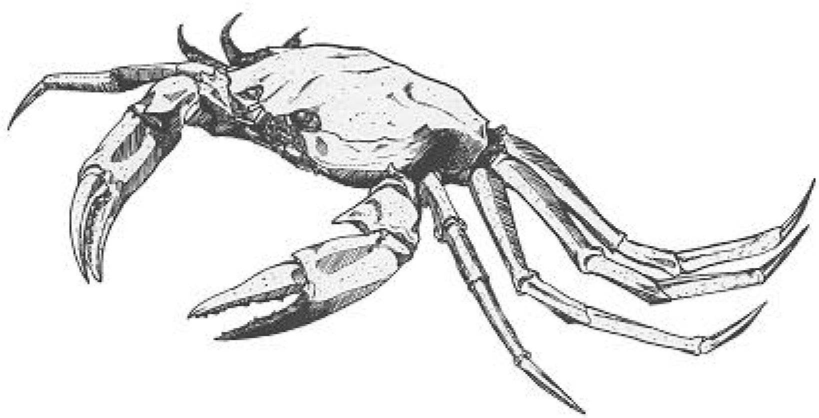
Fishery Management Plan
for
Deep-Sea Red Crab
(*Chaceon quinquedens*)

Including an
Environmental Impact Statement, an
Initial Regulatory Flexibility Act Analysis, and a
Regulatory Impact Review

Volume I



March 2002

Prepared By
New England Fishery Management Council
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Draft EIS Submitted:	**November 13, 2001**
Revised Draft EIS Submitted:	**November 17, 2001**
Final EIS Submitted:	**March 19, 2002**

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Executive Summary

Background and Purpose

Background

On and off since the early 1970's, there has been a small directed fishery off the coast of New England and the Mid-Atlantic for the deep-sea red crab (*Chaceon quinquedens*). The size and intensity of this fishery has varied somewhat over the years, but the fishery has always been small relative to the more prominent New England fisheries such as groundfish, sea scallops, and lobster. This fishery has never been regulated, either under federal or state jurisdiction. No management plan exists for the red crab fishery.

Faced with increasing landings and increased interest in the fishery from potential new entrants around the country, a group of fishermen approached the New England Fishery Management Council (Council) in late 1999 with a request that the Council manage red crab. In November 1999, the Council agreed to begin development of a new fishery management plan (FMP) for the deep-sea red crab fishery. In February 2000, the Council's Notice of Intent to Prepare an Environmental Impact Statement (EIS) was published in the *Federal Register*, officially beginning the Council's FMP scoping process (65 FR 4941). A control date was established for the red crab fishery by publication of the official notice in the *Federal Register* on March 1, 2000 (65 FR 11029). The control date allows the Council and NMFS to implement a controlled or limited entry system or some other program to differentiate historic participants from new entrants.

Faced with an increase in the number of vessels targeting the red crab resource, in January 2001, the Council requested that the Secretary of Commerce take emergency action to prevent overfishing in the red crab fishery while the Council continued to develop an FMP. On May 8, 2001, NMFS announced a set of emergency regulations designed to prevent overfishing, for a 180-day period effective May 18 - November 14, 2001 (66 FR 23182). The emergency regulations were extended for a second 180-day period, effective November 15, 2001 - May 14, 2002.

Statement of the Problem

This FMP is being developed in an attempt to address one primary problem and one secondary problem. All actions considered and proposed in this FMP are intended to be directly or indirectly related to solving one or both of these problems.

Overfishing the Red Crab Resource. The threat of overfishing the red crab resource is the primary problem needing management attention. Based on a comprehensive survey conducted when the fishable stock of this resource was considered to be in virgin condition, maximum sustainable yield (MSY) was originally estimated at 5.5 million pounds (Serchuk 1977). Commercial landings of red crab have exceeded this level several times since the development of the fishery.

Overcapitalization of the Red Crab Fishery. The potential for the directed red crab fishery to become overcapitalized is the secondary problem needing management attention. Determining the appropriate number and fishing power of the vessels in the directed red crab fishery is a problem that must take into account biological, economic, and social concerns.

Purpose and Need for Action

All the current information available on the deep-sea red crab and its fishery indicates that there is a limited MSY of approximately 6.24 million pounds and that four to six vessels fishing at existing levels of capacity represent the likely maximum amount of harvesting effort that can be sustained by the resource. The addition of new vessels, especially catcher-processor vessels with increased capacity, threatens not only the resource, but the viability of the established fishery. Even without any new entrants, overfishing is a potential threat. Anecdotal reports from the industry suggest that five vessels harvested more than seven million pounds of red crab in 2000, roughly 112% of the best current estimate of MSY.

Active management of this fishery is now needed to prevent overfishing and maintain a fishing fleet that is of an appropriate size and capacity for the resource. The New England Council has primary responsibility for managing this resource (NEFMC 1986). An FMP designed to address overfishing and fleet capacity will provide the Council and NMFS with the opportunity to manage this fishery in a sustainable manner that ensures a continuing and productive fishery for this unique resource.

Issues to be Resolved

Development and implementation of a management plan for the red crab fishery is intended to address a number of issues in addition to the problems previously identified.

- Status of the red crab stock
- Availability of data on the resource and the fishery
- Incidental catch and discards of red crabs in other fisheries
- Appropriate levels of fishing power
- Maintenance of consistent supply
- Compliance with marine mammal protection requirements
- Area of management jurisdiction
- Handling mortality

<u>Fishery Management Program</u>

Because this is a new FMP, there are many basic decisions to be made by the Council that affect the type and scope of the management program to be developed. These include decisions on the management unit for the FMP, the start of the regulatory fishing year, considerations related to an estimate of commercial biomass and maximum sustainable yield, an overfishing definition, specification of optimum yield, the identification and description of essential fish habitat, and the extent of reporting requirements on the fishermen and seafood dealers. The Council is also considering establishing a framework adjustment process for this fishery to enable relatively rapid decision-making in response to changing conditions of the resource.

The only species included in the management unit for the Red Crab FMP will be the deep-sea red crab (*Chaceon quinquedens*). Although the range of this species includes the South Atlantic and the Gulf of Mexico, the boundaries of the management unit, also called the management area, will be limited to the waters north of 35º 15.3' north latitude (the latitude of Cape Hatteras Light, North Carolina). The fishing year will start on March 1 of each year and end on the last day of February.

Maximum sustainable yield (MSY) for the portion of the red crab resource within the boundaries of the New England Council's management unit is estimated to be 6.24 million pounds. Consistent with the Magnuson-Stevens Act and the National Standard Guidelines, the overfishing definition for red crab will be as follows: (1) overfishing is defined as any rate of exploitation such that the ratio of current exploitation to an idealized exploitation under MSY conditions exceeds a value of 1.0; and (2) the red crab stock will be considered to be in an overfished condition if one of three conditions are met. Optimum yield (OY) is to be specified based on adjustments to MSY, and currently would be set at 95% of MSY, or 5.928 million pounds. The setting of OY at this level is intended to account for some degree of uncertainty associated with the calculation of MSY and the susceptibility of the resource to overfishing.

The 1996 amendments to the Magnuson-Stevens Fishery Conservation and Management Act, known as the Sustainable Fisheries Act (SFA), changed the focus of the Magnuson-Stevens Act by emphasizing the importance of habitat protection to healthy fisheries and by strengthening the ability of the National Marine Fisheries Service (NMFS) and the Councils to protect and conserve the habitat of marine, estuarine, and anadromous finfish, mollusks, and crustaceans. This habitat is termed "essential fish habitat" and is broadly defined to include "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity." To comply with these provisions of the Magnuson-Stevens Act, the Council must, for each existing and new FMP, identify and describe the essential fish habitat (EFH) for each species managed under its jurisdiction. In addition to a text description of EFH for each major life stage of red crab, the spatial extent of EFH will be designated for each life stage based on known depth zone affinities. There are no habitat areas of particular concern (HAPCs) proposed for red crab at this time.

Federal permits will be required for all vessels who catch, possess, and/or land red crab in the Northeast U.S. EEZ. Two types of permits will be issued: (1) controlled access permits for vessels and operators qualified to participate in the controlled access directed fishery; and (2) open access incidental catch permits for all other vessels and operators who wish to land red crabs up to 500 pounds per fishing trip. Federal permits will also be required for all dealers who purchase red crab product from any vessel.

Reporting requirements will be implemented as follows: (1) interactive voice response (IVR) and vessel trip reports (VTR) will be required of all vessels participating in the controlled access directed fishery; (2) VTRs will be required of all vessels with an incidental catch permit; and (3) dealer weighout reports will be required of all dealers who obtain a Federal dealer permit. Vessel landings must be reported in whole weight of red crab, or its equivalent, utilizing the more appropriate of the two recovery rate conversion formulas if the crab is not landed whole. Dealer weighout reports must report red crab landings in the most appropriate market category. In addition to the required reporting, there will also be a voluntary sub-sampling program for vessels authorized to participate in the controlled access directed red crab fishery.

An annual specifications process for OY, TAC, DAS, etc., will be implemented for this FMP, as well as a framework adjustment process for certain adjustments to the management plan. Stock Assessments and Fishery Evaluation (SAFE) reports will be prepared by the PDT on a biennial basis. The PDT will review the most recent landings and effort data on an annual basis in order to provide the information necessary for the Council to recommend the specifications for the following fishing year.

Description of the Management Measures

The Council developed a range of management measures and alternatives intended to represent the most feasible measures and alternatives that could reasonably be expected to resolve the stated problems and achieve the FMP goals and objectives. Some measures, determined to be impracticable or to not meet the goals and objectives of the FMP, were removed from further consideration and not analyzed in this document. The "no action" alternative is considered to include no management action (i.e., the equivalent of having no FMP for this fishery). The "status quo" alternative is considered to include the management measures implemented through the emergency regulations. The management alternatives under consideration by the Council and described below were developed from a list of potential management measures. The full list of management measures proposed by the Council are identified below.

An incidental catch limit of 500 pounds per trip, in whole weight equivalent, will be implemented for all vessels holding an open access incidental catch permit. There will be a zero possession limit for any fishing vessel that does not have an open access incidental catch permit. There will be no minimum size regulated for this fishery at this time, although the Council reserves the right to implement a minimum size at any point in the future via a framework adjustment to the FMP. The retention and landing of female red crabs will be prohibited in the controlled access directed red crab fishery. For vessels fishing under the controlled access program there will be a small allowance for the incidental retention of female crabs. The allowance for females will be an amount not to exceed one standard U.S. fish tote per vessel per trip.

The FMP will prohibit the full processing of red crabs at sea by catcher-processor vessels, but allow butchering and partial processing at sea. Red crabs may only be landed whole or in half sections with the claws and legs attached. This prohibition will apply to all vessels that land red crab, either through the controlled access fishery or as incidental catch. All vessels with a controlled access permit to fish for red crab will be subject to a pot limit of 600 red crab pots. The FMP will include the following restrictions and requirements for the fishing gear used in the red crab fishery: (1) the maximum allowable size of all traps used in the controlled access red crab fishery will be 18 cubic feet; (2) all buoys used at the end of each red crab trap trawl will be required to be marked as directed in the FMP; the use of parlor traps in the red crab fishery is prohibited; and all non-trap/pot gear will be prohibited in the controlled access red crab fishery.

Each fishing year, the landings in the red crab fishery will be counted against a target total allowable catch (TAC). The target TAC will be set annually through the annual specification process, equal to the most current estimate of optimum yield (OY) for the fishery, and may be readjusted based on any projected overage or underage expected for the current fishing year. All vessels holding a controlled access red crab permit fishing in the directed fishery will be subject to a possession/trip limit of red crab. The baseline possession limit for all controlled access vessels will be 75,000 pounds of whole red crab or their equivalent. If a vessel can show documented proof of a higher trip during the controlled access qualification period, then that vessel will qualify for a trip limit equal to the larger trip, rounded to the nearest 5,000 pounds.

Implementation of the Red Crab FMP will include a controlled access program for vessels that wish to participate in the directed red crab fishery and retain more than the incidental catch limit described above. In order to qualify for the controlled access program and receive a controlled access red crab fishing permit, vessels must demonstrate that their average annual landings of red crabs during the three years prior to the control date (March 1, 1997 - February 29, 2000) were greater than 250,000 pounds. Only red crabs harvested from and landed in the Red Crab FMP management unit will qualify for the controlled access program. Vessel transfer and upgrading restrictions will be implemented consistent with the Council's other FMPs.

Days-at-sea (DAS) will be allocated equally to all vessels authorized to participate in the controlled access fishery, based on the total number of DAS available to the fleet divided by the number of vessels with controlled access permits that have indicated their intent to participate in the fishery for the fishing year. All vessels authorized to receive a controlled access red crab permit must, on an annual basis, declare their intent to participate or not in the directed fishery for the next fishing year at least six months prior to the start of the fishing year. Any DAS allocated to a vessel in one fishing year could be carried over to the next fishing year, up to a maximum of 10 DAS or 10% of the total allocated DAS, whichever is less.

In the first year of FMP implementation (through February 28, 2003), each vessel authorized to participate in the controlled access directed fishery will be allocated a percentage of 130 DAS. For the first full fishing year, March 1, 2003 - February 29, 2004, each vessel authorized to participate in the controlled access directed fishery will be allocated 156 DAS, unless this allocation is changed under the FMP specification process. The target TAC for the first full fishing year will be 5,928,000 pounds of whole red crab or their equivalent. It is the intent of the FMP that DAS will be counted as a whole day (24 hours). Any portion of a day on which a vessel is out of port will count as a full DAS.

<u>Description of the Impacts of the Management Alternatives</u>

Impacts of the Preferred Alternative

<u>Direct and Indirect Impacts</u>

This alternative would implement many of the same measures as other alternatives but the principle mechanism to control effort in the fishery would be the use of vessel days-at-sea (DAS). The objective of the alternative would be to allow the appropriate number of DAS to harvest, but not exceed, the target TAC. The effectiveness of this alternative is not directly dependent on the number of vessels participating, but on the calculation of the total number of days that would allow for the target catch to be landed. If the additional measures (especially trap limits) were not used as limiting factors, this alternative has potential to have one of the higher levels of net benefits, since it allows for the market to control production. As long as other measures are not introduced to effect the behavior of vessels, they will be able to maximize their outputs from a given level of inputs, assuming the biomass increases over time.

Incidental catch limits will prevent excessive red crab landings by vessels from other fisheries. Trap limits can limit catch rates and gear restrictions can allow small red crabs to escape from traps. A target TAC with reporting requirements for each trip will reduce the probability of overfishing. Reporting requirements will also support monitoring and enforcement.

Controlled access will limit the number of vessels harvesting red crab and make it easier to monitor total landings. A trip limit and a limit on days-at-sea per vessel can serve along with the target TAC to control fishing effort, catch per trip, and annual catch. These will tend to spread out the effort, because each vessel in the fishery will be assured of a certain amount of time to fish (days-at-sea) and, assuming the trip limit is low enough, numerous trips will be necessary to land the target TAC. Spreading out the catch over time is probably less of a disturbance to the red crab population, especially to the mating system. From society's point of view, this means there is a reduction in the accumulation of excess capital and lower costs. Those other resources (who are not in the fishery) can be directed elsewhere. This alternative allows greater continuity of effort and supplies to the market and avoids negative responses to short term fluctuations. Historic participants may be able to remain in the fishery, even if they have to operate in a less efficient manner.

Because the calculation of days-at-sea is indirect, the realized catch after one year using all the days-at-sea might over- or under-shoot the target TAC. This is different from a hard TAC, where the fishery closes as soon as the hard TAC is taken. It is expected that if both a target TAC and days-at-sea are implemented, the target TAC will have to be adjusted each year to account for the previous year's difference between the realized and target catch. Choosing the appropriate number of days-at-sea to achieve the target TAC will be more difficult if there are changes over time in fishing gear, hold capacity, or other fishing regulations (e.g., trip limits).

This alternative would prevent a derby fishery if the initial allocation of DAS is set correctly. The continuous annual adjustment in target TAC enables management of the resource to respond to changes in stock condition without a costly and timely management process. A high degree of flexibility is afforded to participants in the fishery concerning when and how long to fish. Processors will be assured of a steady supply of fresh product.

Butchering/processing restrictions are expected to have positive social impacts on the fishermen involved in the directed red crab fishery unless the most restrictive option, a total prohibition on all butchering and processing at sea, is selected. The gear requirement options offer potential social benefits, resulting from the proposed prohibition on all fishing gear other than traps. A controlled access system will provide positive social impacts on the vessels authorized to participate in the directed red crab fishery. Days-at-sea (DAS) limits are expected to provide positive social benefits to the fishermen involved in the directed red crab fishery by preventing a derby fishery and allowing them more flexibility and stability, while reducing uncertainty. Overall, implementing a management program for the red crab fishery that reduces the probability of overfishing and reduces the likelihood of the fishery becoming overcapitalized will have an overall positive effect on the social and cultural aspects of the fishery.

The Council has not developed management alternatives specifically to minimize any adverse effects of fishing on red crab EFH primarily because there are no known adverse effects at this time, and also because at least two of the management measures selected as part of the preferred alternative (trap limits and prohibitions on non-trap gear in the directed red crab fishery) were in part chosen because they minimize the potential for adverse effects in the future. If information is obtained in the future that suggests there are adverse effects on any EFH from the red crab fishery, then the Council will develop and consider management alternatives for minimizing, mitigating, or avoiding these adverse effects.

The only management measures under consideration with any potential relevance to impacts to the EFH of any managed species that may be associated with the directed red crab fishery are the proposed trap limits and the proposed gear restrictions. Both of these measures are proposed in this alternative as well as in Alternative 1, the emergency action baseline. Thus, there are no expected differences between this management alternative and the first baseline. The no action alternative, Alternative 10, by definition would not include any type of trap limit or gear restrictions. This alternative is less likely to result in any impacts to EFH than is the no action alternative, thus this alternative is expected to have a more positive effect on the EFH of managed species than would the no action baseline.

<u>Cumulative Impacts</u>

There are no adverse cumulative impacts to the red crab resource, the directed red crab fishery, or any other fisheries expected as a result of the actions proposed in this FMP. Implementing a management program for the red crab fishery that reduces the probability of overfishing and reduces the likelihood of the fishery becoming overcapitalized will have an overall positive effect on the economic, social and cultural aspects of the fishery, as well as on the resource.

Magnuson-Stevens Act Consistency

Section 301 of the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act) requires that fishery management plans (FMPs) contain conservation and management measures that are consistent with the ten National Standards. The FMP summarizes, in the context of the National Standards, the analyses and discussion of the proposed action that appear in various sections of this document.

Description of the Resource and the Affected Environment

This section of the Red Crab FMP provides a description of the life history characteristics, distribution, abundance, and ecological relationships of the species for which this management plan is being developed, the deep-sea red crab. This section also describes the habitat of the species, including the physical environment, habitat condition, threats to habitat, and habitat conservation recommendations to protect red crab habitat.

In addition to the biological and physical descriptions identified above, this section of the FMP includes a description of the fishery, including the history of exploitation, the fishing gear, and domestic and foreign fishing activities. The FMP identifies and characterizes the baseline conditions of the social and cultural entities involved in the fishery, including vessel owners/operators, vessel crew, processors, fishery-dependent service industries, and fishing communities. This section of the FMP also describes the baseline economic characteristics of the fishery, including that of the harvesting sector, the processing sector, the wholesale and retail sector, fishery-dependent service industries, and the markets for red crab.

This section of the FMP also identifies and describes the protected species (under the Endangered Species Act and the Marine Mammal Protection Act) that may be affected by either the red crab fishery or actions taken under this FMP.

Social Impact Assessment

Consideration of social impacts is a growing concern as fisheries experience increased participation and/or declines in stocks. With an increasing need for management action, the consequences of such changes need to be examined in order to mitigate the negative impacts experienced by the populations concerned. The social impact analysis and assessment conducted for the Red Crab FMP employed the use of specific social impact factors that were evaluated for each management measure and alternative under consideration. The social impact factors were developed based upon identified issues that affect fishermen and their communities (NEFMC 2000a), and included (1) changes in occupational opportunities; (2) changes in community infrastructure; (3) safety; (4) support for the management program; and (5) flexibility, stability, and uncertainty. Overall, implementing any management program for the red crab fishery that reduces the probability of overfishing and reduces the likelihood of the fishery becoming overcapitalized will have a positive effect on the social and cultural aspects of the fishery.

Regulatory Impact Review and Initial Regulatory Flexibility Act Analysis

Uncertainty about the status of the red crab stock, as well as the uncertainty inherent in the data has limited the probability with which we can predict the potential outcomes of the various alternatives. One of the most positive outcomes from this FMP will be the collection of data that will reduce the uncertainty about the future of the resource and its management. The preferred alternative is ranked above most others given that the selection must end likely increases in overcapacity, deal with a control date, have a transition period prior to the implementation of the regulations, and provide an operating environment similar to what has gone on historically.

Relationship to Applicable Law

This draft fishery management plan has been prepared primarily in response to the requirements of the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act). It also addresses requirements of the Marine Mammal Protection Act and the Endangered Species Act. However, these are not the only laws and administrative orders that the Council must consider in developing an FMP. In preparing a fishery management plan, the Council must comply with requirements of the National Environmental Policy Act (NEPA), the Regulatory Flexibility Act (RFA), the Administrative Procedures Act (APA), the Paperwork Reduction Act (PRA), the Coastal Zone Management Act, and Executive Orders 12612 (Federalism), 12630 (Property Rights), 12866 (Regulatory Planning), and 13158 (Marine Protected Areas). These other applicable laws and administrative orders help ensure that, in developing an FMP, the Council considers the full range of alternative actions and their expected impacts on the marine environment, living marine resources, and the human communities that could be affected.

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1.0 Introduction

This fishery management plan (FMP) initiates a management program for the deep-sea red crab fishery located off the coast of the Northeast United States by the New England Fishery Management Council (Council), in partnership with the National Marine Fisheries Service (NMFS). This FMP is being developed according to the Magnuson-Stevens Fishery Conservation and Management Act, the primary domestic legislation governing management of the nation's marine fisheries and resources. In 1996, Congress passed the Sustainable Fisheries Act, which amended and reauthorized the Magnuson-Stevens Act and included a new emphasis on precautionary management in U.S. fishery management policy. New provisions of the Magnuson-Stevens Act require managers to stop overfishing and rebuild overfished fisheries; to minimize bycatch and bycatch mortality to the extent practicable; and to identify and protect essential fish habitat (EFH).

Although this draft fishery management plan has been prepared primarily in response to the requirements of the Magnuson-Stevens Act, it also addresses requirements of the Marine Mammal Protection Act and the Endangered Species Act. However, these are not the only laws and administrative orders that the Council must consider in developing an FMP. In preparing a fishery management plan, the Council must comply with requirements of the National Environmental Policy Act (NEPA), the Regulatory Flexibility Act (RFA), the Administrative Procedures Act (APA), the Paperwork Reduction Act (PRA), the Coastal Zone Management Act, and Executive Orders 12612 (Federalism), 12630 (Property Rights), 12866 (Regulatory Planning), and 13158 (Marine Protected Areas). These other applicable laws and administrative orders help ensure that, in developing an FMP, the Council considers the full range of alternative actions and their expected impacts on the marine environment, living marine resources, and the human communities that could be affected. This integrated Red Crab FMP document contains all elements of the Fishery Management Plan and the Environmental Impact Statement (EIS) (which is required by NEPA).

1.1 Proposed Management Measures

The Council has proposed that the following management measures be implemented for the Red Crab FMP:

1.1.1 Fishery Management Program

a. The only species included in the management unit for the Red Crab FMP will be the deep-sea red crab (*Chaceon quinquedens*). Although the range of this species includes the South Atlantic and the Gulf of Mexico, the boundaries of the management unit, also called the management area, will be limited to the waters north of 35º 15.3' north latitude (the latitude of Cape Hatteras Light, North Carolina), bounded by the coastline of the continental United States in the west and north and the Hague Line and seaward extent of the U.S. exclusive economic zone (EEZ) in the east.

Rationale: This is a single-species fishery with little to no interaction and/or bycatch of other managed or non-managed species; therefore only the target species need be included in the management unit. The proposed boundaries reflect the traditional extent of the red crab fishery in the Northeast U.S., are consistent with prior action taken by the Secretary of Commerce (the Emergency Regulations), incorporate a well-known biogeographic boundary (Cape Hatteras, NC), and are consistent with other New England Council FMPs. The other options considered by the Council would have arbitrarily split the traditional fishing area into a managed area and an area subject to no management.

It would not be practicable to manage this resource throughout its entire range, which would overlap not only the jurisdiction of the South Atlantic Fishery Management Council, but the Gulf of Mexico Council as well. Since what we are actually managing with this FMP is the red crab *fishery*, which in the Northeast is limited to the area north of Cape Hatteras, NC, this is the most appropriate boundary for the management unit. The Gulf of Mexico Council is developing an FMP to manage deep-water crabs including red crab, but this fishery is economically and geographically distinct from the red crab fishery in the Northeast. Red crab is not a major component of the South Atlantic Council's golden crab fishery.

b. The <u>fishing year</u> will start on March 1 of each year and end on the last day of February.

   Rationale: The proposed start of the fishing year reflects traditional fishing practices and is prior to times of relatively higher effort and landings. The timing of the fishing year is anticipated to reduce the margin of error associated with projections made about future fishing years, and is consistent with other Council FMPs (e.g., Sea Scallop FMP) which reduces the administrative burden on NMFS. Although a somewhat arbitrary decision, of all the possible fishing year start dates, March 1 makes the most sense. It is the same start date as for another Council FMP and it reflects the time after which the cumulative landings for the first six months of the fishery are expected to be the highest.

c. <u>Maximum sustainable yield</u> (MSY) for the portion of the red crab resource within the boundaries of the New England Council's management unit is estimated to be 6.24 million pounds, based on the following conditions:

   (a) The biomass of male crabs only was considered in the estimation of MSY.

   (b) Adult red crabs are assumed to recruit to the fishery when they reach 4" in carapace width.

   (c) For the purpose of calculating MSY, the natural mortality rate is assumed to be 0.15.

   Rationale: The red crab fishery traditionally targets, retains, and lands only relatively large male crabs. The Red Crab FMP will prohibit the retention and landing of female crabs in the directed fishery operating under the controlled access program. The traditional fishery only retains and lands large crabs and market constraints limit the acceptance of small crabs. A four inch carapace width is considered to be the smallest crab that would be retained by a vessel and accepted by the market. Although there is very little information on the natural mortality rate of red crabs, scientific information on similar species suggests that 0.15 is a satisfactory estimation. This estimate of MSY reflects the best available information on the biology of this resource species.

d. The overfishing definition for red crab will be as follows:

(a) Overfishing is defined as any rate of exploitation such that the ratio of current exploitation to an idealized exploitation under MSY conditions exceeds a value of 1.0. The actual measure of exploitation used will be determined by the availability of suitable data (CPUE data, landings, etc.).

(b) The red crab stock will be considered to be in an overfished condition if one of the following three conditions are met:

Condition 1 -- The current biomass of red crab is below ½ B_{msy} in the New England Council's management area.

Condition 2 -- The annual fleet average CPUE, measured as marketable crabs landed per trap haul, continues to decline below a baseline level for three or more consecutive years.

Condition 3 -- The annual fleet average CPUE, measured as marketable crabs landed per trap haul, falls below a minimum threshold level in any single year.

Rationale: This overfishing definition allows for the collection of different types of information which may then be used for status determinations (fishery landings, fishing effort and CPUE, survey data, etc.) depending the best information available at the time. The proposed overfishing definition offers the most flexibility to the Council and NMFS and guarantees that some information will be available with which to make a status determination. This overfishing definition incorporates the recommendation of the Council's SSC.

e. Optimum yield (OY) is to be specified based on adjustments to MSY, and currently would be set at 95% of MSY, or 5.928 million pounds. The setting of OY at this level is intended to account for some degree of uncertainty associated with the calculation of MSY and the susceptibility of the resource to overfishing.

Rationale: This alternative was the most representative of the intent of OY as described in the Magnuson-Stevens Act and theoretically accounts for all factors required by the Act. This alternative provides flexibility to the Council to change the specification of OY as new information becomes available, but also accounts for some uncertainty associated with the available information.

f. In addition to a text description of essential fish habitat (EFH) for each major life stage of red crab, the spatial extent of EFH will be designated for each life stage based on known depth zone affinities, as follows:

(1) Egg EFH = the known depth range of egg-bearing adult female red crabs

(2) Larval EFH = the total known depth range for all life stages of red crabs

(3) Juvenile EFH = the known depth range of juvenile red crabs

(4) Adult EFH = the known depth range of adult red crabs

Rationale: The text description of EFH is based on the best available scientific information about the species, as required in the NMFS EFH guidelines (67 FR 2343). The use of depth zone affinities as the principal method of designating EFH incorporates the best available information about the species, in light of the near complete absence of relative abundance data from the NMFS trawl survey (the typical data source for EFH designations). This method can be used to differentiate among the life stages. No habitat areas of particular concern (HAPC) have been proposed for this species. The information currently available to the Council suggests no areas or habitat types identified as EFH for red crabs meet any of the criteria for an HAPC.

g. Federal permits will be required for all vessels who catch, possess, and/or land red crab in the Northeast U.S. EEZ. Two types of permits will be issued:

(a) controlled access permits for vessels and operators qualified to participate in the controlled access directed fishery; and

(b) open access incidental catch permits for all other vessels and operators who wish to land red crabs up to 500 pounds per fishing trip.

Federal permits will also be required for all dealers who purchase red crab product from any vessel. All vessels who qualify and are authorized to participate in the controlled access directed fishery will also be allowed to fish under the open access incidental catch rules when they are not fishing on a directed red crab trip (i.e., on a red crab DAS). All vessels authorized to receive a controlled access red crab permit must, on an annual basis, declare their intent to participate or not in the directed fishery for the next fishing year at least six months prior to the start of the fishing year. The initial issuance of a controlled access permit assumes the intent to fish in the first year; the declaration requirement will only apply to permit renewals. Vessels and operators will have 180 days from the effective date of the regulations to apply for their initial controlled access permits. Vessels who fail to renew their permit for a fishing year will be ineligible to renew their permits in subsequent years.

Rationale: Permits provide a necessary mechanism to track fishery participants, ensure compliance with regulations, and monitor fishing activity. Permits are necessary for the controlled access program to ensure that only those vessels so qualified are engaging in this fishery at more than incidental catch levels. Permits are necessary for the incidental catch fishery to monitor overall effort levels and numbers of participants, and to ensure compliance with reporting requirements. Permits are necessary for dealers to ensure compliance with reporting requirements.

The requirement for vessels to renew their permits on an annual basis or be prohibited from renewing in the future is an important restriction for two reasons. First, all other limited access fisheries are constructed with this requirement and, to be consistent, the red crab fishery should include this as well. Second, strictly speaking, this is intended to be a "controlled access" system, whereby the Council may consider allowing additional or new vessels entry into the fishery at some point in the future. One mechanism for the Council to determine that a new vessel may be allowed into the fishery is if one vessel with a controlled access permit exits the fishery. If a vessel fails to renew their controlled access permit, this would be interpreted by the Council as a signal that they have exited the fishery. The Council would then initiate a process to allow an new vessel into the fishery, but this can only work if the Council is assured that the exiting vessel would not be able to renew their permit at some point in the future when they decide to re-enter the fishery.

The requirement for vessels to declare their intent prior to each fishing year allows the Council, working with NMFS, to adjust the annual allocation of DAS based on the expected number of vessels that will actually participate in the fishery. This is an important consideration due to the small number of vessels that will be involved in this fishery. Because only five vessels may qualify for controlled access permits, each vessel would be allocated 20% of the total available fleet DAS. If one vessel declares out of the fishery for a year, that increases the DAS allocated to each remaining vessel by 25% (e.g., if each of 5 vessels gets would allocated 200 DAS of a total 1000 fleet DAS, and 1 vessel declares out, each of the remaining 4 vessels would get an additional 50 DAS, or 25% of their initial 200 DAS allocation). Although this type of declaration requirement is not standard with other DAS programs, it is important in this fishery in order to achieve OY on a continuing basis.

h. Reporting requirements will be implemented as follows:

(a) Interactive voice response (IVR) and vessel trip reports (VTR) will be required of all vessels participating in the controlled access directed fishery.

(b) VTRs will be required of all vessels with an incidental catch permit.

(c) Dealer weighout reports will be required of all dealers who obtain a Federal dealer permit.

Vessels participating in the controlled access fishery will be required to utilize the IVR call-in system to report their total landings within 24 hours of the termination of each fishing trip during which they land any amount of red crab. Both controlled access vessels and open access incidental catch vessels will be required to complete and submit one or more VTRs for each fishing trip, regardless of whether they land any red crab on that trip. VTRs may be submitted on a monthly basis, postmarked not later than 15 days after the end of each reporting month. All dealers with a red crab dealer permit will be required to complete and submit a weekly dealer report. VTRs and dealer reports must be submitted on forms provided by or approved by the NMFS Regional Administrator. If authorized in writing by the Regional Administrator, the form(s) may be submitted electronically or through other media.

Vessel landings must be reported in whole weight of red crab, or its equivalent, utilizing the more appropriate of the two recovery rate conversion formulas if the crab is not landed whole:

(1) 58% of whole to butchered crab, or 1.72 to 1, for fully cleaned crab sections that have had the gills and other detritus removed; or

(2) 64% of whole to butchered crab, or 1.56 to 1, for crab sections with all or the majority of the gills retained.

Recovery rate #1 applies to red crab that is partially processed at sea, as defined in the FMP, and recovery rate #2 applies to red crab that is butchered at sea, as defined in the FMP. Dealer weighout reports must report red crab landings in the most appropriate market category. The market categories will be as follows:

(1) Whole Red Crab -- red crab is landed whole, either live, on ice, or frozen;

(2) Butchered Red Crab -- red crab is landed in half sections, with the claws and legs retained, with all or the majority of the gills intact; or

(3) Partially Processed Red Crab -- red crab is landed in half sections, with the claws and legs retained, cleaned with the gills removed, and one or more of the following: cooked, frozen, or glazed.

In addition to the required reporting noted above, there will also be a voluntary sub-sampling program for vessels authorized to participate in the controlled access directed red crab fishery. Red crab vessels which choose to participate in the sub-sampling data collection program will be asked to count and record the complete catch, including juveniles of both sexes, of at least one trap per trap trawl hauled on a fishing trip in which they are participating in the voluntary program.

Rationale: Timely reporting of landings is necessary to monitor the fishing effort and the effectiveness of the management measures. The IVR system will be used to track near-real time landings in the fishery to ensure that the Council and NMFS always have the most complete and current data available on the fishery. The VTRs required of the controlled access participants will be used to monitor catch-per-unit-effort (CPUE), monitor areas fished, bycatch and discards, and other information necessary to adequately monitor the effectiveness of the management measures. The VTRs required of the incidental catch fishery participants will be used to monitor this segment of red crab landings. The dealer reports are necessary to verify landings reports. The voluntary sub-sampling program offers the opportunity to collect important information on the overall red crab population and other relevant information about the red crab fishery.

i. An annual specifications process for OY, TAC, DAS, etc., will be implemented for this FMP, as well as a framework adjustment process for certain adjustments to the management plan. Stock Assessments and Fishery Evaluation (SAFE) reports will be prepared by the PDT on a biennial basis. The PDT will review the most recent landings and effort data on an annual basis in order to provide the information necessary for the Council to recommend the specifications for the following fishing year.

   Rationale: The annual specifications process provides the most streamlined and efficient mechanism to make relatively minor adjustments to certain aspects of the management program, specifically the amount of target TAC available to the fishery and the number of DAS to be allocated to each vessel authorized to participate in the controlled access fishery. More significant, but still relatively minor, changes to the management program, such as implementing a minimum size, changing the incidental catch limit, adjusting trap limits or gear requirements, among others as specified in the FMP, can be implemented via a framework adjustment to the FMP. SAFE reports prepared biennially by the Council's Red Crab PDT with the assistance of NMFS will be used by the Council and NMFS to monitor the effectiveness of the FMP and changes in the fishery and its participants that result from the management measures.

1.1.2 Specific Management Measures

a. An incidental catch limit of 500 pounds per trip, in whole weight equivalent, will be implemented for all vessels holding an open access incidental catch permit. There will be a zero possession limit for any fishing vessel that does not have an open access incidental catch permit.

   Rationale: One of the Council's goals for the Red Crab FMP was to allow "all fishermen the continued opportunity to land appropriate amounts of red crab as bycatch." This measure would enable all fishermen who so choose to obtain an open access incidental catch permit and retain up to 500 pounds of red crabs per fishing trip. While this measure may affect some fishermen who occasionally retained more than 500 pounds, this level allows a larger than average incidental catch (the average incidental catch was approximately 400 pounds per trip), and would not have affected nearly 75% of the trips taken during 1998 - 2000. This measure is necessary to ensure that the amount of red crab that may be harvested by an uncontrolled number of incidental catch vessels making an uncontrolled number of fishing trips does not exceed an amount that can be absorbed by the resource while sustaining a directed fishery.

b. The retention and landing of female red crabs will be prohibited in the controlled access directed red crab fishery. For vessels fishing under the controlled access program there will be a small allowance for the incidental retention of female crabs. The allowance for females will be an amount not to exceed one standard U.S. fish tote per vessel per trip.

Rationale: Prohibiting the retention and landing of female crabs in the directed fishery puts into regulation what has been a common fishing practice and is, in fact, already a market requirement. This measure would protect the reproductive capacity of female red crabs. This measure only affects the directed red crab fishery because they have the capability to quickly sort red crabs harvested in their traps and to return female crabs to the water almost immediately. The measure does not affect the incidental catch vessels because the Council does not want to provide any incentive to these fishermen to seek any more than the first 500 pounds of red crab that they harvest. The allowance for the incidental retention of female crabs by the controlled access vessels allows these fishermen to continue current fishing practices and represents a very small fraction of the total crabs retained and landed on each fishing trip (i.e., one standard U.S. fish tote is estimated to equate to roughly 100 pounds, which would be approximately 0.13% of the 75,000 pound trip limit).

c. There will be no <u>minimum size</u> regulated for this fishery at this time, although the Council reserves the right to implement a minimum size at any point in the future via a framework adjustment to the FMP.

   Rationale: The minimum size of crabs currently harvested is approximately 4" carapace width and this size is maintained by market constraints. Implementing a regulated minimum size of 4" carapace width at this time would be redundant with existing market constraints and would significantly complicate enforcement and increase the administrative burden both on NMFS and the fishing industry. The Council intends to monitor the size of crabs landed via a requested port sampling program and retains the ability to implement a minimum size via a framework adjustment if the average size of landed crabs begins to decline and/or if the number of crabs smaller than 4" carapace width increases.

d. The FMP will prohibit the full <u>processing of red crabs at sea</u> by catcher-processor vessels, but allow butchering and partial processing at sea. These are defined as follows:

   (1) *Processing, or to process*, with respect to the Atlantic deep-sea red crab fishery, means:

      (a) For full processing, the removal of meat from the body and/or legs of a red crab and any preparation of the meat that follows, including but not limited to cleaning, freezing, cooking, and/or glazing. (This is prohibited.)

      (b) For partial processing, the splitting or cutting of crabs in half along the length of the carapace, removal of the carapace, and any preparation of the crab that follows, including but not limited to cleaning, freezing, cooking, and/or glazing. (This is allowed.)

(2) *Butchering*, with respect to the Atlantic deep-sea red crab fishery, means the splitting or cutting of crabs in half along the length of the carapace, removal of the carapace, and storing of the crab sections on ice.

Red crabs may only be landed whole or in half sections with the claws and legs attached. This prohibition will apply to all vessels that land red crab, either through the controlled access fishery or as incidental catch. Vessels with an incidental catch of red crabs must have no more than two claws and eight legs per crab on-board their vessel. The maximum allowance for red crab claws and legs separate from crab bodies for vessels participating in the controlled access fishery will be equal to the amount necessary to fill one standard U.S. fish tote per vessel per trip. This is expected to be roughly 100 pounds. This allowance only applies to the controlled access fishery and is only intended to account for incidental and unintended loss of claws and legs during normal fishing and handling operations.

Rationale: These restrictions would allow the current practices of vessels involved in the red crab fishery to continue, while prohibiting any expansion of processing at sea activities. Vessels currently outfitted to butcher and/or partially process crabs at sea would not have to change their fishing practices. This measure should have no impact on the red crab industry, and will allow the male-only restriction to be administered and enforced. The sex of the crabs can be discerned either by the shape of the tail flap on whole crabs, or by the outline of the tail flap on crabs that have been butchered and/or partially processed. The requirement to land crabs either whole or in half sections with the legs and claws intact is intended to remove any incentive and prevent the harvesting of red crab for their claws and/or legs alone. The proposed allowance for the controlled access vessels recognizes that accidental claw and/or leg loss may occur during normal fishing operations and handling.

e. All vessels with a controlled access permit to fish for red crab will be subject to a <u>pot limit</u> of 600 red crab pots. This measure will be managed and enforced via a requirement for each vessel to declare, on their annual permit application, the maximum number of traps they use per string and the maximum number of strings they employ in their fishing operations, such that the product of the maximum number of traps per string and the maximum number of strings declared by the vessel is no more than 600 traps. If on a red crab trip (on a red crab DAS and more than the incidental catch limit of red crab on board) no vessel may haul any fishing gear other than red crab gear, marked as required according to the gear marking requirements.

Rationale: A limit of 600 traps per vessel reflects current fishing practices and is consistent with the NMFS emergency regulations, so this measure should have no impacts to red crab fishing vessels involved in the directed fishery. This measure is intended to prevent an increase in the number of traps used in the red crab fishery. Because the fishery will be managed via effort controls (principally through DAS limits), any method by which a vessel can increase their efficiency per day of fishing has the potential to subvert the effort controls intended to ensure a sustainable fishery. Increasing the number of traps used is one technique that could be used to increase a vessel's efficiency; this measure, in conjunction with the maximum trap size described below, maintains the relative fishing power of all vessels to be roughly equivalent to existing levels. It is not the intent of the Council to limit the ability of red crab vessels to participate in other fisheries; thus, the trap limit is only intended to constrain the gear used in the red crab fishery.

f. The FMP will include the following restrictions and requirements for the fishing gear used in the red crab fishery:

(1) Escape vent. There will be no requirement for an escape vent required at this time. If scientific information is provided indicating that an escape vent is warranted, and sufficient information is available to determine the appropriate size for an escape vent, either the Council or the NMFS Regional Administer may implement measures to require a specified escape vent.

Rationale: The intent of a requirement for an escape vent in a trap fishery is to reduce the probability of undersized crabs being retained in the traps and subject to increased mortality due to handling during fishing operations. Although the Council intends to implement an escape vent requirement for all fishing gear used in the directed red crab fishery, there is not sufficient information available at this time to determine the specific size and dimensions that the escape vent should be. There is also not sufficient information for the Council to determine the need for an escape vent in this fishery. The design of the traps currently used in the fishery may reduce or eliminate the need for an escape vent.

(2) Maximum trap size. The maximum allowable size of all traps used in the controlled access red crab fishery will be 18 cubic feet. All traps used in the controlled access fishery must be either rectangular/trapezoidal or conical, but new trap designs may be approved by the Regional Administrator provided the volume of the new trap design does not exceed the maximum limit established by the Council.

Rationale: Restricting traps used in the red crab fishery to a maximum size prevents any future increase in trap size, constraining trap efficiency to current levels. Eighteen cubic feet was selected as the maximum allowable volume to allow for some margin of error in the traps currently being used and was based on rounding the larger of the two calculated trap volumes to the nearest cubic foot. This measure, in conjunction with the trap limit described above, serves to prevent a potential increase in the per day efficiency of fishing vessels fishing under a DAS limit program.

(3) Gear markings. The following will be required on all buoys used at the end of each red crab trap trawl:

(a) "RC" should be painted on the top of each buoy to clearly indicate red crab fishing gear;

(b) the vessel's permit number should be painted on the side of each buoy to clearly indicate the vessel and to allow for verification that it is authorized to participate in the controlled access fishery;

(c) the number of the trap trawl relative to the total number used by the vessel (i.e., "3 of 6") should be painted on the side of each buoy as well;

(d) all letters and numbers painted on buoys should be at least three inches in height to be clearly visible by U.S. Coast Guard and other vessels; and

(e) high flyers and radar reflectors will be required on each trap trawl.

Rationale: Gear markings are necessary to identify fishing gear being used in the red crab fishery. The proposed gear markings would allow the administration and enforcement of the trap limit. These proposed gear marking requirements are consistent with current marking practices in the red crab fishery.

(4) Parlor traps. The use of parlor traps in the red crab fishery is prohibited. A parlor trap is a trap with two or more compartments within the trap that are intended to make it more difficult for animals to escape from the trap. A red crab trap must therefore have only one compartment within the trap and that compartment must not be divided into sections with barriers that impede the free movement of crabs within the trap. A red crab pot is not to have any form of chamber or partition in the pot which is capable of containing red crabs other than that formed by the external frame of the pot.

Rationale: Parlor traps improve the ability of traps to retain crabs over a longer time. Thus the use of parlor traps could increase fishing effort, particularly if accompanied by a change in fishing strategy, such as longer soak times. Parlor traps would likely increase the productivity of traps when they are left on the fishing grounds between trips. Because the current traps do not prevent the escape of crabs from the trap, many of the crabs that might enter the traps during the period between trips are gone before the vessel returns to haul the traps on the next trip. Parlor traps would create a concern about "ghost" fishing if traps are lost. Lost traps do not present a ghost fishing problem at present because the crabs can escape from the traps. Parlor traps would be more likely to cause handling damage to crabs. This would lower product quality for the marketable crabs that were kept and increase mortality for the crabs that are released alive.

(5) Non-trap gear. All non-trap/pot gear will be prohibited in the controlled access red crab fishery, such that any vessel holding a controlled access red crab permit may only utilize crab pots, subject to the restrictions and requirements identified above, to fish for red crab or on any trip during which they are fishing on a red crab DAS. Vessels holding an open access red crab incidental catch permit may use any type of fishing gear they choose.

Rationale: Prohibiting non-trap fishing gear (principally otter trawl and dredge gear) in the controlled access directed red crab fishery will protect the resource and its habitat from more damaging fishing gear, minimizing the potential for any adverse impacts to red crab EFH. This measure will reduce the potential for increased discard mortality associated with other gear types. This prohibition will also reduce potential gear conflicts between red crab fishermen.

g. Each fishing year, the landings in the red crab fishery will be counted against a target total allowable catch (TAC). The target TAC will be set annually through the annual specification process, equal to the most current estimate of optimum yield (OY) for the fishery, and may be readjusted based on any projected overage or underage expected for the current fishing year.

   Rationale: Setting the annual target TAC based on OY reflects the intent of the OY provisions of the Magnuson-Stevens Act and provides a conservative approach to setting the annual TAC. Since the principal control on the fishery will be an effort-based control on days-at-sea, use of a hard TAC (where the fishery shuts down when the TAC is reached) is not an appropriate mechanism. Any type of hard TAC, in conjunction with a DAS program, would encourage vessels to use as many of their DAS as possible as soon as possible in the fishing year before the hard TAC is reached. This would be inconsistent with the goals and objectives of the FMP, which include maintaining, to the greatest extent possible, a twelve-month fishery and minimizing the potential for a derby fishery.

h. All vessels holding a controlled access red crab permit fishing in the directed fishery will be subject to a possession/trip limit of red crab. The baseline possession limit for all controlled access vessels will be 75,000 pounds of whole red crab or their equivalent. If a vessel can show documented proof of a higher trip during the controlled access qualification period, then that vessel will qualify for a trip limit equal to the larger trip, rounded to the nearest 5,000 pounds. Vessels that butcher and/or partially process the red crabs they harvest (subject to the butchering and processing at sea restrictions identified above) must apply the more appropriate of two recovery rate formulas to their catch in order to determine whether they are within the possession limit. The recovery rate conversion ratios are as follows:

   (1) 58% of whole to partially-processed red crab, or 1.72 to 1, for fully cleaned crab sections that have had the gills and other detritus removed; and

   (2) 64% of whole to butchered red crab, or 1.56 to 1, for crab sections with all or the majority of the gills retained.

   Recovery rate #1 applies to red crab that is partially processed at sea, as defined in the FMP, and recovery rate #2 applies to red crab that is butchered at sea, as defined in the FMP. All persons are prohibited from transferring at sea, either directly or indirectly, or attempting to transfer at sea to any vessel, any red crab, or its equivalent as specified at § 648.13, taken in or from the red crab management unit.

Rationale: The differential trip limit maintains the approximate capacity of fishing vessels as it was prior to the control date, increases the potential for fishing vessels to operate efficiently, and recognizes some of the inherent differences among the fishing operations and capacities of the vessels operating in the fishery prior to the control date. The baseline trip limit of 75,000 pounds serves to establish for any new vessels that qualify to enter the fishery a trip limit equal to the approximate average capacity of vessels engaged in the fishery prior to the control date. The overall intent of the trip limit measure is to maintain the overall capacity of the red crab fleet to be approximately equal what it was prior to the control date, prevent an overall increase or a creep in the capacity of the red crab fleet, and to prevent one or more vessels from subverting the constraints of the DAS program by extending their fishing trips and making fewer but much larger fishing trips. The recovery ratios are necessary to administer the trip limits in the face of different types of fishing operations.

i. Implementation of the Red Crab FMP will include a <u>controlled access program</u> for vessels that wish to participate in the directed red crab fishery and retain more than the incidental catch limit described above. In order to qualify for the controlled access program and receive a controlled access red crab fishing permit, vessels must demonstrate that their average annual landings of red crabs during the three years prior to the control date (March 1, 1997 - February 29, 2000) were greater than 250,000 pounds. Only red crabs harvested from and landed in the Red Crab FMP management unit will qualify for the controlled access program. Vessel transfer and upgrading restrictions will be implemented consistent with the Council's other FMPs.

   Rationale: The proposed qualification criteria for the controlled access program utilize the March 1, 2000 red crab control date, as was intended by the Council, and are consistent with the goals and objectives of the Red Crab FMP. The proposed criteria allow vessels with an established history in this fishery to continue, while preventing an increase in capacity above recent historic levels. This measure is intended to prevent overcapacity in the fishery. The proposed vessel transfer and upgrading restrictions maintain consistency of fleet capacity with current conditions and maintain a consistent basis for the calculation of DAS projections and allocations. This measure also protects the capacity of the fleet for the future, should other controls such as trap limits and trip limits change.

j. <u>Days-at-sea</u> (DAS) will be allocated equally to all vessels authorized to participate in the controlled access fishery, based on the total number of DAS available to the fleet divided by the number of vessels with controlled access permits that have indicated their intent to participate in the fishery for the fishing year. All vessels authorized to receive a controlled access red crab permit must, on an annual basis, declare their intent to participate or not in the directed fishery for the next fishing year at least six months prior to the start of the fishing year.

Any DAS allocated to a vessel in one fishing year could be carried over to the next fishing year, up to a maximum of 10 DAS or 10% of the total allocated DAS, whichever is less.

In the first year of FMP implementation (through February 28, 2003), each vessel authorized to participate in the controlled access directed fishery will be allocated a percentage of 130 DAS. 130 DAS is the baseline allocation for all vessels in the first year of FMP implementation, but this baseline will be adjusted to account for estimated landings that occur between May 15, 2002 and the date the red crab controlled access program is implemented. For the first full fishing year, March 1, 2003 - February 29, 2004, each vessel authorized to participate in the controlled access directed fishery will be allocated 156 DAS, unless this allocation is changed under the FMP specification process. The target TAC for the first full fishing year will be 5,928,000 pounds of whole red crab or their equivalent. The target TAC of 5,928,000 pounds and an allocation of 156 DAS per controlled access vessel will remain the baseline until these amounts are modified through the specification process.

It is the intent of the FMP that DAS will be counted as a whole day (24 hours). Any portion of a day on which a vessel is out of port will count as a full DAS. For example, if a vessel embarks on a fishing trip at 11:00 PM on June 1, then that counts as one DAS. If they return from the trip at 1:00 AM on June 10, that also counts as one DAS, and they would have used 10 DAS on the fishing trip (not the 8.0833 DAS that would be counted if an hourly clock is used).

Rationale: The equal allocation of available DAS treats all vessels authorized to participate in the controlled access red crab fishery equally, regardless of their prior level of effort in the fishery. The requirement for vessels to declare their intent prior to each fishing year allows the Council, working with NMFS, to adjust the annual allocation of DAS based on the expected number of vessels that will actually participate in the fishery. This is an important consideration due to the small number of vessels that will be involved in this fishery. Because only five vessels will likely qualify for controlled access permits, each vessel will be allocated 20% of the total available fleet DAS. If one vessel declares out of the fishery for a year, that increases the DAS allocated to each remaining vessel by 25% (e.g., if each of 5 vessels gets would allocated 200 DAS of a total 1000 fleet DAS, and 1 vessel declares out, each of the remaining 4 vessels would get an additional 50 DAS, or 25% of their initial 200 DAS allocation). Although this type of declaration requirement is not standard with other DAS programs, it is important in this fishery in order to achieve OY on a continuing basis. The partial end of the year DAS carry-over is intended to ensure that at least some unused fishing effort is not wasted, while providing no incentive to hoard DAS. This measure also limits the potential annual fishing capacity to roughly 10% above the baseline.

2.0 Background and Purpose

2.1 Background

On and off since the early 1970's, there has been a small directed fishery off the coast of New England and the Mid-Atlantic for the deep-sea red crab (*Chaceon quinquedens*[1]). The size and intensity of this fishery has varied somewhat over the years, but the fishery has always been small relative to the more prominent New England fisheries for groundfish, sea scallops, and lobster. Prior to the emergency regulations implemented in May 2001, this fishery had never been regulated, either under federal or state jurisdiction. No management plan existed for the red crab fishery prior to this one.

Prior to 1970, there was no known fishery for deep-sea red crab, although there was some incidental catch of red crab in other fisheries. In the early 1970's small markets opened up for the species, spurring one or two vessels to attempt to fish for red crab directly. Markets for this species fluctuated over the next decade or so, as did attempts at new techniques to improve the harvest, preservation, and processing of the crabs.

Throughout the 1980's there appears to have been a fairly consistent fishery for red crab, with known landings averaging over 5.5 million pounds. In the early 1990's landings appear to have fluctuated somewhat, but have been steadily increasing since about 1995. Reported landings were nearly 7 million pounds in 2000.

Faced with increasing landings and increased interest in the fishery from potential new entrants around the country, a group of fishermen approached the New England Fishery Management Council (Council) in late 1999 with a request that the Council develop a fishery management plan (FMP) for red crab. They also asked the Council to consider taking steps to control access to the fishery to help maintain it at sustainable levels. The Council considered the testimony of the red crab fishermen, as well as information on estimates of maximum sustainable yield (MSY) and current capacity in the fishery. In November 1999, the Council agreed to begin development of a new FMP for the deep-sea red crab fishery.

In January of 2000, the Council's Red Crab Committee met to consider available information, to prepare for scoping the proposed Red Crab FMP, and to consider whether to recommend the Council establish a control date for the red crab fishery. The Council considered the recommendations of the committee at its January 2000 meeting and voted to establish a control date for the red crab fishery and to begin the scoping process for the Red Crab FMP. It was the intention of the Council that the control date, once established, would serve as a placeholder in the event the Council wanted the option of differentiating historic participants in the red crab fishery from new speculative entrants.

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[1] The deep-sea red crab, now known as *Chaceon quinquedens*, was previously known as *Geryon quinquedens*. In 1989, Manning and Holthius revised the Geryonidae family to include two new genera and nine new species. The majority of geryonid species were renamed as *Chaceon* spp. Only two species remained in the *Geryon* genus, *G. longipes* and *G. trispinosus*, both from the northeastern Atlantic Ocean.

The Council also hoped that the setting of a control date would serve as a disincentive to any new vessels considering moving to New England to begin fishing for red crab.

In February 2000, the Council's Notice of Intent to Prepare an Environmental Impact Statement (EIS) was published in the *Federal Register*, officially beginning the Council's FMP scoping process (65 FR 4941). The Council hosted two scoping meetings, well attended by the red crab industry and other interested parties. At the scoping meetings, there was general support for the development of a Red Crab FMP, including the consideration of management measures such as a limited entry program, setting a minimum allowable size, restricting the fishery to male crabs only, prohibiting the processing of red crabs at sea, and some type of reasonable trap limits. There was less support at the scoping meetings for measures such as closed areas, closed seasons, and quotas (either trip limits or individual fishing quotas).

A control date was established for the red crab fishery by publication of the official notice in the *Federal Register* on March 1, 2000 (65 FR 11029). The control date allows the Council and NMFS to implement a controlled or limited entry system or some other program to differentiate historic participants from new entrants. The publication of the control date notice did not obligate the Council or NMFS to establish a limited entry system or to constrain access to this fishery in any way.

In November 2000, the Council was notified that at least two new vessels had announced their intention to relocate to New England from other parts of the country and begin fishing for red crab. The existing members of the fishery and the Council became concerned that the additional fishing power and effort represented by these new entrants could jeopardize the sustainability and condition of the resource before an FMP could be developed and implemented.

Faced with an increase in the number of vessels targeting the red crab resource, in January 2001, the Council requested that the Secretary of Commerce take emergency action to prevent overfishing in the red crab fishery while the Council continued to develop an FMP. The Secretary reviewed the available information on the resource and its fishery and determined that the current exploitation and the likelihood of substantive increases in total exploitation, in the area north of Cape Hatteras, North Carolina, constituted an emergency situation presenting serious conservation problems and that emergency action was indeed necessary to prevent overfishing. On May 8, 2001, NMFS announced a set of emergency regulations designed to prevent overfishing, for a 180-day period effective May 18 - November 14, 2001 (66 FR 23182).

The emergency regulations were not intended to limit access to the red crab fishery, but rather to control the overall fishing pressure and prevent or eliminate overfishing while the Council developed the FMP. After analyzing several alternatives to address the emergency and to prevent overfishing, NMFS implemented a set of measures that included: (1) the establishment of a total allowable catch (TAC) of 2.5 million pounds; (2) a trip limit of 65,000 pounds of whole weight red crab or its equivalent; (3) a trap limit of 600 pots; and (4) an incidental catch limit of 100 pounds of red crab per fishing trip (NMFS 2001a). The regulations also established a requirement for any vessel that wished to fish for red crab at more than the incidental catch level to obtain a letter of authorization (LOA). Vessels with an LOA were required to report their landings for each trip via an interactive voice response (IVR) system and to submit vessel trip reports (VTR) documenting each red crab fishing trip. On July 23, 2001, NMFS amended the emergency regulations to revise the conversion factor used to determine the whole weight equivalent of partially-processed or butchered crabs (66 FR 38165).

The emergency regulations included a provision that gave the NMFS Regional Administrator the authority to close the directed red crab fishery if, at any time during the 180-day effectiveness period, she projected that the 2.5 million pound TAC would be harvested. On August 8, NMFS announced that the directed red crab fishery would be closed down on August 17, 2001 (66 FR 41454). Effective August 17 through November 14, 2001, no vessel was allowed to fish for, or possess, red crab harvested from the exclusive economic zone (EEZ) in excess of 100 pounds per trip. There were a total of 52 trips made by 7 vessels during the emergency period and a total of 2,839,931 pounds of red crab landed. This amount is equivalent to 113.6% of the TAC established for the 180-day period. Landings of red crab by vessels without LOAs (these vessels would have been limited to 100 pounds of red crab per trip) were not tracked and were not counted against the TAC.

The emergency regulations were extended for a second 180-day period, effective November 15, 2001 - May 14, 2002. The extension included the same measures as the first emergency period, but reduced the overall TAC to 2.16 million pounds to account for the overage from the first emergency period. On January 15, 2002, NMFS announced that the directed red crab fishery would again be shut down, effective January 18 through May 14, 2002 (67 FR 1908). During the second emergency period, 6 vessels made a total of 36 trips and landed a total of 2,075,457 pounds. This amount is equivalent to 96.1% of the TAC established for the second 180-day emergency period. The combined landings during the two emergency periods equal 4,915,388 pounds, or 98.3% of the total TAC.

2.2 Statement of the Problem

This FMP is being developed in an attempt to address one primary problem and one secondary problem. All actions considered and proposed in this FMP are intended to be directly or indirectly related to solving one or both of these problems.

Overfishing the Red Crab Resource. The threat of overfishing the red crab resource is the primary problem needing management attention. Based on a comprehensive survey conducted when the fishable stock of this resource was considered to be in virgin condition, maximum sustainable yield (MSY) was estimated at 5.5 million pounds of exploitable males (Serchuk 1977). Commercial landings of red crab have exceeded this level several times since the development of the fishery. In 1982, NMFS characterized this resource as “becoming fully exploited” after landings increased from nearly 2.7 million pounds in 1979 (there had been a fairly steady increase in landings since 1974) to just over 5.6 million pounds in 1980 (NMFS 1982). The following year NMFS revised this status to “fully exploited” after landings increased to 6.8 million pounds in 1981 (NMFS 1983).

Although NMFS did not report the status of the red crab resource after 1983[2], available landings data illustrate a continuing increase in landings through 1984 when reported landings peaked at over 8.5 million pounds. Thereafter, reported landings fluctuated around an average of 5.8 million pounds for the 1980's. Landings declined in the 1990's until about 1995. Landings reported in the NMFS vessel logbook and dealer weighout databases are summarized in Table 1 for 1991 - 2001. There were no reporting requirements for red crab prior to 2001, so the landings presented in the table should be considered the minimum estimates of total landings. After May 18, 2001, all vessels landings more than 100 pounds of red crab were required to report their landings, so this may explain the apparent significant increase for 2001. The very low landings reported in 1994 may be a result of less effort, less reporting, an aberration in the NMFS landings database system, or a combination of all three factors.

Overfishing this resource is of particular concern due to the nature of the species. As reported in Steimle et al. (2001), Hastie (1995), and elsewhere, geryonid crabs are typically slow-growing and major recruitment events are believed to occur rarely. Hastie (1995) makes a strong case that deep-water benthic crustacean communities, geryonids especially, are particularly vulnerable to overfishing and the protection of these resources by strict management is important. It is interesting to note that all of the reviewed literature that discusses fishing potential for red crabs and other geryonid crabs are unanimous in their assessment that this resource cannot sustain significant fishing pressure, that this resource is particularly vulnerable to overfishing, and that strict management controls are needed to protect the sustainability of the fishery (Armstrong 1990; Duggan and Lawton 1998; Hastie 1995; Holmsen 1978; Holmsen and McAllister 1974; Meade and Gray 1973; Serchuk 1977).

Year	Reported Landings (in pounds)
1991	3,948,903
1992	2,340,103
1993	3,172,858
1994	2,681
1995	1,655,734
1996	2,283,998
1997	4,487,192
1998	3,891,386
1999	4,019,243
2000	6,956,613
2001	8,798,959

Table 1: Reported landings of red crab by year, 1991 - 2001. Because there were no requirements to report landings of red crab prior to May 2001, the numbers presented here are very likely minimum estimates of actual landings in these years. One explanation for the significant increase in 2001 is that after May 18, 2001, all vessels landing more than 100 pounds of red crab were required to report their landings.

[2] In fact, after 1985 red crab was no longer included in the annual "Status of the Fishery Resources Off the Northeastern U.S." reports developed by NMFS (NMFS 1986).

Overcapitalization of the Red Crab Fishery. The directed red crab fishery is overcapitalized and needs management attention. Determining the appropriate number and fishing power of the vessels in the directed red crab fishery is a problem that must take into account biological, economic, and social concerns. The directed commercial fishery for red crab began in 1973 in response to declines in the offshore lobster fishery and fishery development efforts improved the harvesting, processing, and marketing of the resource (NMFS 1982). When the fishery was initiated, there were only one or two vessels participating (Ganz and Herrmann 1974). Between 1973 and 1981, the number of red crab fishing vessels fluctuated between one and four (Lux et al. 1982), as several vessels attempted the fishery but failed (Holmsen 1978). By 1986, the number of vessels appears to have stabilized at two (Elner 1986). It is not clear how many vessels fished for red crab between 1986 and the early-1990's, but NMFS landings and dealer reporting data only indicate two vessels with significant landings (more than 15,000 pounds annually) between 1991 and 1994. Between 1995 and 2000, there were as many as five vessels apparently directing on red crab.

The number of vessels actively prosecuting this fishery is an important consideration because historically a small number of vessels has been able to fish at or above MSY levels.[3] In fact, in an attempt to frame the ideal capacity of this fishery, Holmsen and McAllister (1974) suggested that "if the NMFS assessment of the size of the resource is correct [MSY of five to six million pounds], there would not be room for more than seven to eight efficient vessels . . . in the red crab fishery." It is important to understand, however, that this estimate of the number of vessels is based upon their description of an "average" crab vessel (for 1974). They describe the average vessel as 85 feet in length, fishing 250 pots, and landing approximately 40,000 pounds of whole crabs per trip. Holmsen and McAllister's estimate of seven to eight efficient vessels supported in the fishery should be revised downward to represent the fact that the vessels in the fishery since 1995 have greater fishing capacity than what they presumed in 1974.

The five vessels participating in the directed red crab fishery prior to 2000 average 96 feet in length, fish an average of 544 pots, and have the capacity to land the equivalent of an average of approximately 78,000 pounds of red crab per trip. The figures suggest that these five vessels alone can exceed the total fishing power suggested by Holmsen and McAllister as an upper bound on this fishery.[4] The problem for the Council to

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[3] Consider that in the early to mid-1980's there were no more than four vessels directing on red crab in any one year (Lux et al. 1982), but reported landings between 1980 and 1982 averaged 5.8 million pounds. It was only two years later, in 1984, that reported landings peaked at 8.5 million pounds.

[4] If we assume the maximum number of vessels suggested by Holmsen and McAllister (1974) and multiply that number of vessels times the estimated number of traps fished and the per trip landings, we get:

8 vessels × 250 pots per vessel = 2,000 pots, and
8 vessels × 40,000 pounds per vessel per trip = 320,000 pounds.

We can then compare these estimates of "fleet fishing power" to those derived for the five vessels in the fishery prior to 2000:

5 vessels × 540 pots per vessel = 2,700 pots, and
5 vessels × 78,000 pounds per vessel per trip = 390,000 pounds.

address is the desire of additional fishing vessels to enter the directed red crab fishery and the increased fishing power they would add to the fleet.

In early 2001, two additional vessels entered the red crab fishery. One vessel relocated from the North Pacific and the other vessel relocated from the Gulf of Mexico. Both are catcher-processor vessels over 150 feet in overall length. Although they may be fishing with fewer pots, both reportedly have the capacity to fish approximately 1,000 crab pots. Vessel hold capacity may be a more important indicator of overall fishing power than either vessel size or the number of pots fished. The hold capacities of the two additional vessels are reported to be in the range of 185,000 to 300,000 pounds of red crab product. The equivalent amount of red crab in whole weight depends on the degree of processing that occurs on-board the vessel. If the crabs are simply butchered (split into half sections with the carapace removed), the whole weight equivalent is approximately 1.56 - 1.72 times the butchered weight (66 FR 23182 and 66 FR 38165). This indicates that the two additional vessels may be able to land the equivalent of 288,000 to 516,000 pounds of red crab per trip, depending on the exact butchering process used by the vessel. Even if we assume the lower bound of this range, each of these new vessels individually possesses the capacity to harvest more per trip than the entire fleet suggested by Holmsen and McAllister (1974).

Given the concerns about overfishing and the vulnerability of the resource identified above, it seems unlikely that such a fleet (the five vessels fishing prior to 2000 and the two additional vessels that entered the fishery in 2001) can be sustained. Even with this concern, there are reports of even more vessels interested in entering the directed red crab fishery.

2.3 Purpose and Need for the Action

All the information available on the deep-sea red crab and its fishery indicates that there is a limited MSY of 6.24 million pounds and that four to six vessels fishing at existing levels of capacity represent the maximum amount of harvesting effort that can be sustained by the resource. The addition of new vessels, especially catcher-processor vessels with increased capacity, threatens not only the resource, but the viability of the existing fishery. Even without any new entrants, overfishing is a potential threat. Anecdotal reports from the industry suggest that the existing five vessels harvested more than seven million pounds of red crab in 2000, roughly 112% of MSY (J. Williams, personal communication).

There has been both an increase in reported landings of red crab over the past few years and an increase in interest among fishing vessels to enter and participate in this fishery. Some of this interest has no doubt been related to the fact that the red crab fishery is one of the few remaining unregulated crab fisheries in the country. Nationally, crab fisheries rank sixth in terms of quantity landed and second in terms of value (NMFS 2000). Crab fisheries such as those for the blue crab, Dungeness crab, king crab, and snow crab are all aggressively managed. Interest in fishing for deep-sea crabs in other regions has been increasing (Waller et al. 1995).

Active management of this fishery is now needed to prevent overfishing and maintain a fishing fleet that is of an appropriate size and capacity for the resource. The New England Council has primary responsibility for managing this resource (NEFMC 1986). An FMP designed to address overfishing and fleet capacity will provide the Council and NMFS with the opportunity to manage this fishery in a sustainable manner that ensures a continuing and productive fishery for this unique resource.

2.4 Issues to be Resolved

In addition to the two main problems of overfishing and overcapitalization identified above, there are several other issues which must be addressed, if not resolved, in this FMP. This section attempts only to identify the issues and offers a brief summary. Each issue is fully explained and addressed later in the FMP, in the appropriate sections.

a. *Status of the stock*. Although survey data exist from the mid-1970's and these data provide a good overview of the size and composition of the resource under virgin stock conditions, no comprehensive recent or current survey data exist with which to facilitate a comparison. This prevents NMFS and the Council from making a determination of the current status of the stock (is it overfished? has the size or sex composition changed? etc.). The FMP must, therefore, develop a management program for this fishery in the absence of a current stock assessment.

   The lack of fishery-independent survey data on the red crab resource presents a real challenge to the Council, as we have no current estimates of red crab biomass. The NMFS bottom trawl survey only occasionally captures any red crabs (Steimle et al. 2001) and only at the shallowest fringe of their habitat. Red crabs are known to occupy depths from 274 - 1800 meters with highest densities and biomass occurring between 320 - 910 meters (Wigley et al. 1975 and Steimle et al. 2001). The NMFS otter trawl survey does not tow deeper than 366 meters (Reid et al. 1999).

   There are plans for a proposed survey to be conducted sometime in the next two to three years. The survey would be conducted independently of NMFS in a joint venture by several area scientists and one or two red crab fishing vessels. Depending on how the survey is designed and implemented, the resulting data may be comparable with the prior survey and therefore useful in developing an index of biomass. Because we have little information on the population dynamics that have taken place between the 1970's and the present, as new information about this fishery is obtained, the management plan could change.

b. *Availability of data.* As noted above, comprehensive recent or current survey data are not available for this resource. Fishery data, including data on landings and effort, are available in some cases but not necessarily for the entire fishery. Until the implementation of the emergency regulations (66 FR 23182), there were no requirements for vessels fishing for red crab to report their landings or their fishing effort unless the vessel also carried a permit for a fishery that required data reporting (such as groundfish).

The nature of this directed fishery -- deep-water, traps only -- led many in the fishery to fish only for red crab. Thus, the majority of participants in the directed fishery were under no obligation to provide any landings information to NMFS or any other government agency. Prior to 2000 most red crab product landed in the U.S. was reportedly sold to a processor based in Canada and therefore exempt from U.S.-based processor dealer reporting requirements. In late 2000 and 2001, a U.S. processor began purchasing and processing red crab products.

c. *Incidental catch and discards*. In addition to the fleet of vessels that target red crab in the directed fishery, there are many vessels which occasionally land varying but much lower amounts of red crab. For all years 1991 through 2000, there were a total of 83 vessels that reported landings of at least one pound of red crab in at least one year. Of these, there were only 7 vessels that reported landings that averaged over 100,000 pounds of red crab per year in the years they fished for red crab.[5] For the vessels with less than 100,000 pounds of red crab landings, the yearly average of landings drops off quickly, with only 7 of the remaining 76 vessels averaging more than 10,000 pounds per year. This analysis indicates that, on average, 92% of the vessels that land red crab only fish occasionally or at what we will call "incidental catch" levels (less than 10,000 pounds per year). Further analysis of these data indicate that although there were a total of 83 vessels that reported some landings of red crab during this ten-year period, the number of vessels reporting landings in any one year averaged only 15 vessels and in no year did the number of vessels reporting landings of red crab exceed 25. Table 2 summarizes the numbers of vessels in each year, 1991 - 2000, within a category of red crab landings.

Landings (pounds)	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	Mean
< 10,000	7	10	9	6	19	18	15	11	6	6	11
10,000 > 100,000	1	0	0	0	4	4	0	1	2	1	1
> 100,000	2	2	2	0	2	2	7	4	4	5	3

Table 2: Numbers of vessels with landings of red crab, 1991-2000. This table provides a summary of the numbers of vessels in each year with reported landings of red crab within one of three categories.

In addition to consideration for vessels to land incidental catch levels of red crab, the Council must also address the potential discards of red crabs that may occur in other fisheries. The monkfish trawl fishery, for example, has been

[5] Data from the NMFS dealer weighout and VTR databases were analyzed to identify all vessels reporting at least one pound of red crab landings. Average landings were calculated for each vessel, but only considered the years in which they actually reported positive landings of red crab. For example, a vessel that reported landings of red crab only in 1991 and 1992 had their average calculated by dividing their total landings by 2 years rather than the full 10 years. This is intended to be a better indication of the number of vessels that landed significant amounts of red crab, *while they were fishing for red crab*.

identified as one in which there may be the potential for bycatch and discarding of red crabs, with high attendant discard mortality. The FMP will address this issue to the extent possible.

d. *Appropriate levels of fishing power*. As discussed above in the problem associated with the potential for overcapitalization in the red crab fishery, the Council must address the issue of identifying the appropriate level of fishing power for this fishery. There are several factors related to fishing power that need to be considered: size of vessels; hold capacity of vessels; number of traps used; number of crew; and on-board processing capability. These factors all combine and interrelate to determine the overall fishing power of the individual vessels and of the fleet.

e. *Maintenance of consistent supply*. Current fishermen and processors have requested that the Council try, to the extent possible, to allow for the maintenance of a consistent supply of red crab product all year long. The Council will attempt to address this issue by selecting management measures more likely to promote and maintain a twelve month fishery.

f. *Compliance with marine mammal protection requirements*. The red crab fishery, as described, falls under the Marine Mammal Protection Act Category I Lobster Trap/Pot Fishery and therefore is required to comply with the applicable gear restrictions for that fishery that are intended to reduce the potential for the entanglement of marine mammals in the gear. The Council must address this potential in the FMP and address any measures which may be required to bring this fishery and the gear they use into compliance with the marine mammal protection requirements.

g. *Council area of jurisdiction*. Historically, most commercial fishing for red crab has occurred off southern New England (Lux et al. 1982; Elner 1986), but commercial fishing operations are also known to target the southern flank of Georges Bank and the Mid-Atlantic as far south as the area off Cape Hatteras, North Carolina. The FMP must specify the management unit for the management program, including the area of jurisdiction. Typically, each FMP manages the fishery for each species throughout the entire range of the species. Red crab, however, occur off the coast of the south Atlantic states, including Florida, occur in the Gulf of Mexico, and may range as far south as northern Brazil (Elner 1986). It would not be practical nor prudent for the New England Council to attempt to manage this resource in the Gulf of Mexico or even as far south as Florida. Instead, the Council must identify a geographic point at which our jurisdiction over the management of the resource will end.

h. *Handling mortality*. "Handling mortality" is the rate of mortality to red crabs that results from being brought to the surface, handled, and returned to the seafloor. In the directed red crab fishery, this is associated with the sorting of the crabs harvested in the traps and the return of females and undersized males. Handling mortality may result from injury to the crabs during handling, being out of the water too long, being subjected to temperature stress from high water temperatures at the surface or rapid temperature changes, predation while in the water column, or settlement to different areas of the bottom where survival is lower. There are no precise estimates of the magnitude of handling mortality, but high handling mortality would indicate that a large percentage of the discarded females and small males would die even though they are returned to the sea and not landed.

Even though the magnitude of handling mortality is unknown, there is evidence to suggest at least some crabs survive being returned to the ocean. Lux et al. (1982) conducted a tagging study of red crabs beginning in 1974. To complete this study, they tagged crabs brought up in commercial pots and simply released them back into the water, similarly to the sorting and discard process employed by the fishermen. If handling mortality was very high, then very few returns would be expected. Tagged crabs were collected for several years, even seven years after the tagging study. In the laboratory, Ganz and Herrmann (1974) subjected red crabs to changes in water temperature to see how they respond to this stress. One test involved subjecting crabs to increasing temperatures to simulate being hauled up through the water column in a trap. All crabs survived all the temperature changes, although while held at temperatures greater than 50ºF the crabs appeared to suffer increasing degrees of sluggishness. The results suggest that crabs subjected to temperature stress as a result of being brought to the surface and returned to the ocean can survive (i.e., there is probably low to zero discard mortality due to temperature change stress).

3.0 Fishery Management Program

3.1 Management Goals and Objectives

The management goals and objectives for the Red Crab FMP are described below.

Goal 1: Consistent with the National Standards and other required provisions of the Magnuson-Stevens Fishery Conservation and Management Act, manage the Atlantic deep-sea red crab fishery at sustainable levels.

Goal 2: Create a management system so that fleet capacity will be commensurate with resource status so as to achieve the dual goals of economic efficiency and biological conservation.

Goal 3: Maintain a directed fishery for Atlantic deep-sea red crab, while at the same time allowing all fishermen the continued opportunity to land appropriate amounts of red crab as bycatch.

Goal 4: Minimize, to the extent practicable, adverse impacts on fishing communities during the transition from an unregulated fishery to a regulated one.

Objective 1: Achieve, on a continuing basis, optimum yield (OY) for the U.S. fishing industry.

Objective 2: Prevent overfishing of the red crab resource.

Objective 3: Develop a definition of overfishing.

Objective 4: Develop biological, economic and social measures of success for the red crab fishery and resource.

Objective 5: Develop a controlled access system to keep fishing capacity matched to the available resource.

Objective 6: Adopt fishery management measures that constrain fishing mortality to levels that are compliant with the Sustainable Fisheries Act.

Objective 7: Promote research and improve the collection of information to better understand red crab population dynamics, biology and ecology, and to improve assessment procedures in cooperation with the industry.

Objective 8: Minimize, to the extent practicable, adverse impacts associated with management of the red crab fishery on other fisheries.

Objective 9: To the maximum extent possible, maintain a twelve month fishery.

3.2 Management Unit

The choice of a management unit depends on the focus of the FMPs objectives, and may be organized around geographic, economic, technical, social, or ecological perspectives. The management unit includes the species of concern, the identification of distinct stocks, if any, and the geographic area subject to management. Although this species has a wide range (published ranges for this species have varied from Nova Scotia to Cuba and also to Brazil) and it also occurs in the Gulf of Mexico, the area of primary concern for the Council most likely ranges from about Norfolk Canyon in the south to the Hague Line in the north. The Council considered information on the geographic range of the species and any known stock structure, as well as the desired regulatory area, and establish geographic limits on the management unit for this FMP. It is considered a rebuttable presumption that any red crab on-board or off-loaded from a vessel in the northwest Atlantic was harvested from the New England / Mid-Atlantic EEZ and therefore subject to the regulations of this FMP.

Historically, most commercial fishing for red crab has occurred off Southern New England (Lux et al. 1982; Elner 1986), but commercial fishing operations are also known to target the southern flank of Georges Bank and the Mid-Atlantic as far south as Cape Hatteras, North Carolina. Typically, an FMP manages the fishery for each species included in the management unit throughout the entire range of the species. Red crabs, however, occur off the coast of the south Atlantic states, including Florida, occur in the Gulf of Mexico, and may range as far south as Argentina (Elner 1986). It would not be practical nor prudent for the New England Council to attempt to manage this resource in the Gulf of Mexico or even as far south as Florida. Thus, the management unit will not be defined by the stock boundaries. Instead, the Council identified a geographic point at which our jurisdiction over the management of the resource will end.

There were several alternatives available to the Council for establishing the management unit for this FMP. The alternatives reflected various southern boundaries for the management jurisdiction of the red crab fishery. Potential alternatives included the southern extent of the Wigley et al. (1975) survey that developed a biomass estimate for the stock (Survey Boundary), Norfolk Canyon (unofficially considered the southern extent of the directed fishery), the Virginia/North Carolina border (the northern extent of the South Atlantic Golden Crab FMP management jurisdiction), and Cape Hatteras, North Carolina (consistent with the Emergency Regulations).

3.2.1 Preferred Alternative: Cape Hatteras, NC

The Council has identified a management unit for this FMP. The only species included in the management unit for the Red Crab FMP will be the deep-sea red crab (*Chaceon quinquedens*). Although the range of this species includes the South Atlantic and the Gulf of Mexico, the boundaries of the management unit, also called the management area, will be limited to the waters north of 35º 15.3’ north latitude (the latitude of Cape Hatteras Light, North Carolina), bounded by the coastline of the continental United States in the west and north and the Hague Line and seaward extent of the U.S. exclusive economic zone (EEZ) in the east (see Figure 1).

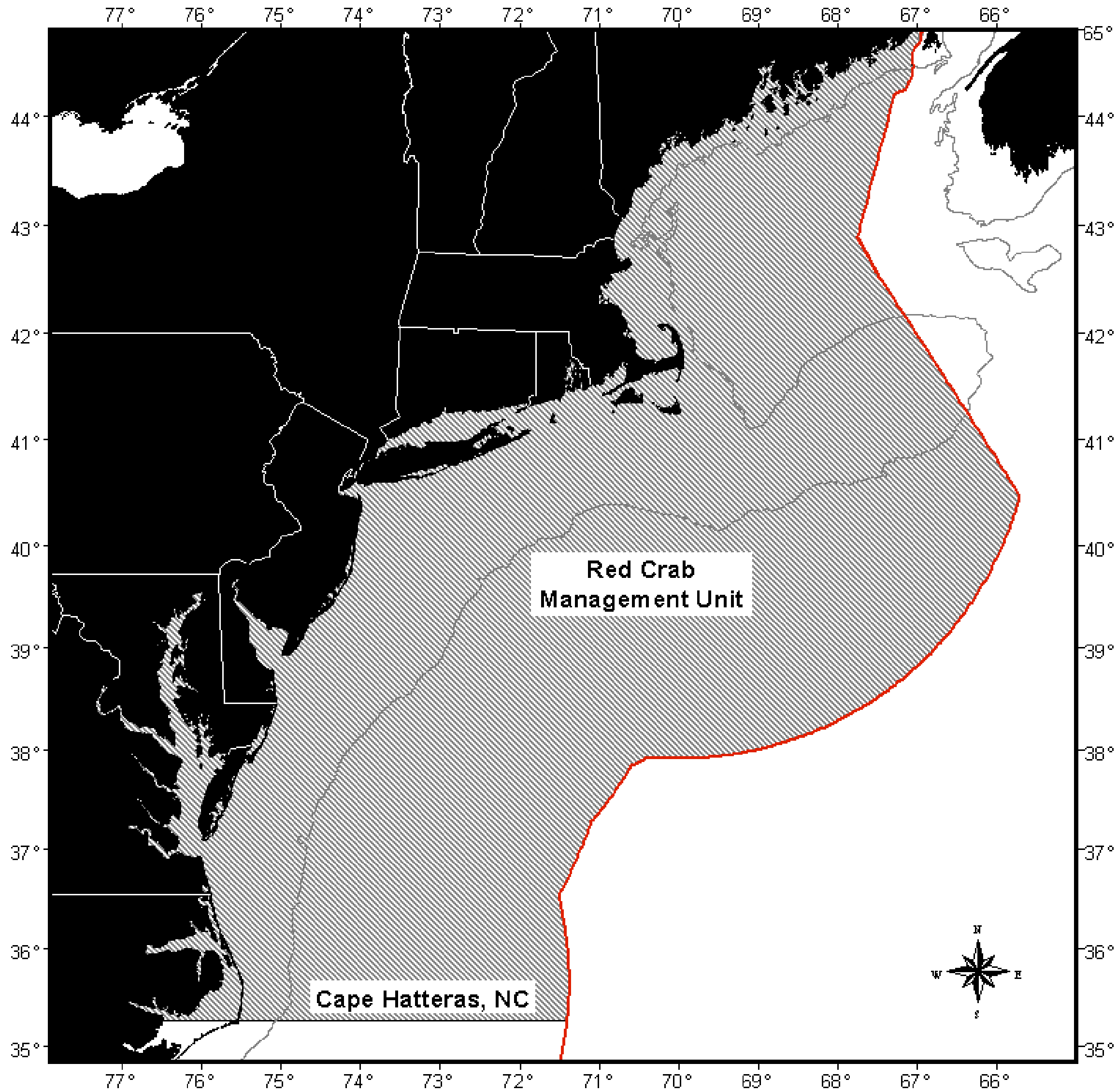

Figure 1: Map of the Red Crab FMP management unit. The shaded area represents the area within which the management measures identified in the Red Crab FMP apply.

Rationale: This is a single-species fishery with little to no interaction and/or bycatch of other managed or non-managed species; therefore only the target species need be included in the management unit. The proposed boundaries reflect the traditional extent of the red crab fishery in the Northeast U.S., are consistent with prior action taken by the Secretary of Commerce (the Emergency Regulations), incorporate a well-known biogeographic boundary (Cape Hatteras, NC), and are consistent with other New England Council FMPs. The other options considered by the Council would have arbitrarily split the traditional fishing area into a managed area and an area subject to no management.

It would not be practicable to manage this resource throughout its entire range, which would overlap not only the jurisdiction of the South Atlantic Fishery Management Council, but the Gulf of Mexico Council as well. Since what we are actually managing with this FMP is the red crab *fishery*, which in the Northeast is limited to the area north of Cape Hatteras, NC, this is the most appropriate boundary for the management unit. The Gulf of Mexico Council is developing an FMP to manage deep-water crabs including red crab, but this fishery is economically and geographically distinct from the red crab fishery in the Northeast. Red crab is not a major component of the South Atlantic Council's golden crab fishery.

3.2.2 Non-Preferred Alternatives

3.2.2.1 Survey Boundary

An area about halfway between Baltimore and Washington Canyons (off the coast of the eastern shore of Virginia) was the southern extent of the 1974 R/V Albatross IV survey of the red crab population conducted by the Northeast Fisheries Science Center (NEFSC) (Wigley et al. 1975). The results of this survey include estimates of total red crab biomass in the survey area, total biomass of commercial-size red crabs in the survey area, and maximum sustainable yield (MSY) for the red crab resource in the survey area. The rationale for delineating the management unit according to the 1974 survey is that we could utilize the biomass and yield estimates derived from the survey data without the need to extrapolate to other areas not included in the survey. Limiting the management unit to the Survey Boundary would, however, leave an area where the fishery is known to be prosecuted without management. Since this is inconsistent with the goals and objectives of the FMP, this alternative was not selected.

3.2.2.2 Norfolk Canyon

Norfolk Canyon (off the coast of Virginia, east of Cape Charles) is just south of Washington Canyon and is believed to represent the southern extent of the directed red crab fishery. Delineating the management unit to just south of Norfolk Canyon would capture the entire known current fishing grounds, but would still leave some traditional and potential fishing areas without management. The South Atlantic Fishery Management Council has an FMP for golden crab (*Chaceon fenneri*) which extends to the Virginia-North Carolina border. Although not specifically included in the management unit for this FMP, red crab are occasionally caught in the golden crab fishery (SAFMC 1995). Because this fishery is related to the red crab fishery (golden crab is a closely related species that is also fished with traps in deep-water along the shelf and slope), if the management unit for the Red Crab FMP ends north of the Golden Crab FMP, there would be an area of the coast subject to deep-water crab fishing that is not under management. The administration and enforcement of regulations would be complicated by this shortfall. Limiting the management unit to Norfolk Canyon would leave an area where the fishery could be prosecuted without management. Since this is inconsistent with the goals and objectives of the FMP, this alternative was not selected.

3.2.2.3 Virginia/North Carolina Border

The Virginia-North Carolina border is the northern extent of the management unit for the South Atlantic Council's Golden Crab FMP. Choosing the Virginia-North Carolina border as the southern extent of the red crab management unit would therefore be consistent with the existing Golden Crab FMP. Although red crab are not currently in the management unit for the Golden Crab FMP, they are included in the fishery. Thus, if at some point in the future landings of red crab in the South Atlantic golden crab fishery increased and some type of management action was required, the South Atlantic Council has a mechanism in place to deal with the issue. Limiting the management unit to the Virginia/North Carolina border would leave an area where the fishery could be prosecuted without management. Since this is inconsistent with the goals and objectives of the FMP, this alternative was not selected.

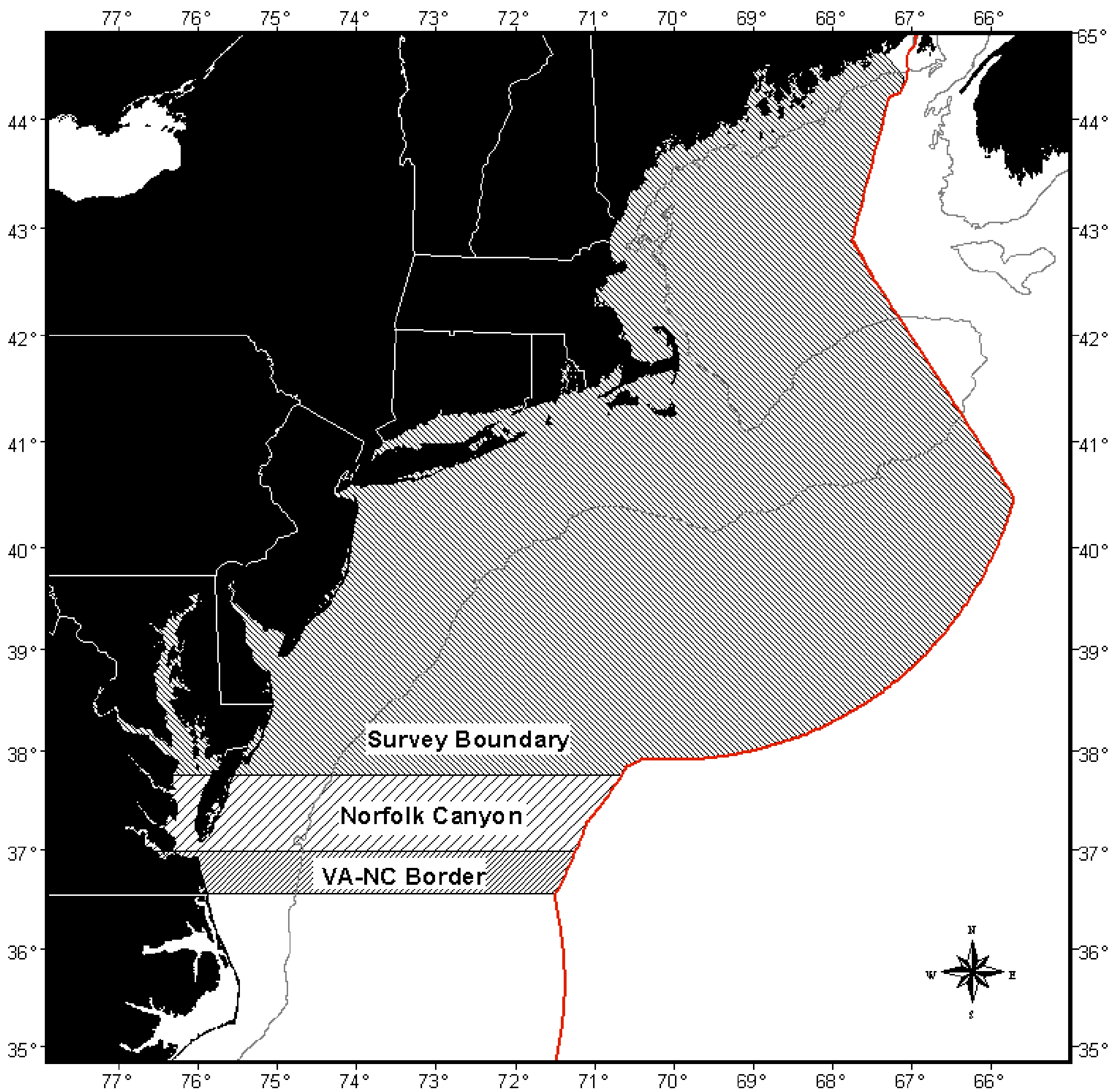

Figure 2: Map of Red Crab FMP management unit non-preferred alternatives. Each shaded area represents the proposed southern extent of a management unit alternative considered by the Council.

3.3 Fishing Year

The intent of establishing a formal fishing year for the Red Crab FMP is to create a clearly indicated start date for all new regulations and other controls or adjustments on the fishery that may take place on an annual schedule. This will also provide a clearly indicated end date for each fishing year for the purposes of management and tracking landings and fishing effort. The Council considered several alternatives for establishing the fishing year for this FMP.

3.3.1 Preferred Alternative: March 1

The red crab fishing year will start on March 1 of each year and end on the last day of February. This sets the fishing year based on times of relatively higher versus relatively lower landings of red crabs. Based on the management scheme selected by the Council (DAS with a target TAC), it appeared necessary or at least prudent to establish a fishing year offset from the calendar year so that the time between when preliminary information on the fishery for the current year and the implementation of adjusted management measures for the following year does not occur during a time of high red crab fishing effort and landings. If this were the case, and the Council were limited to preliminary information from a time of relatively low fishing effort, forecasts of likely future landings would be biased towards lower landings than what is likely to actually occur and the margin of error on all projections would be higher.

Figure 3 represents the cumulative percentage of the total annual landings harvested within six, seven, or eight months of the start month indicated. In this figure, the month is the hypothetical start of the fishing year. For example, the fishing year will begin on March 1, so based on historical landings patterns, we would expect the fishery to land approximately 60% of the total annual landings within six months of the start of the fishing year. Within eight months, we would expect the fishery to land almost 80% of their annual landings. This leaves only slightly more than 20% of the landings remaining to be harvested in the last one-third of the fishing year. If on the other hand, the fishing year began on September 1, six months later we would only expect the fishery to have landed 38% of their annual landings. Eight months after the September start of the fishing year, we would expect them to have landed only 59%.

Since this last one-third of the fishing year is the time in which the Council will be making decisions for any necessary annual adjustments for the fishery, the Council's decision-making will be much better informed if the majority of the fishing effort for the year has already occurred. More information would be available with which to make any necessary projections for landings and DAS usage or other measure of fishing effort, and determine whether an adjustment is needed to increase or decrease the TAC, DAS, or other fishing controls for the following year.

<u>Rationale</u>: The proposed start of the fishing year reflects traditional fishing practices and is prior to times of relatively higher effort and landings. The timing of the fishing year is anticipated to reduce the margin of error associated with projections made about future fishing years, and is consistent with other Council FMPs (e.g., Sea Scallop

FMP) which reduces the administrative burden on NMFS. Although a somewhat arbitrary decision, of all the possible fishing year start dates, March 1 makes the most sense. It is the same start date as for another Council FMP and it reflects the time after which the cumulative landings for the first six months of the fishery are expected to be the highest (see Figure 3).

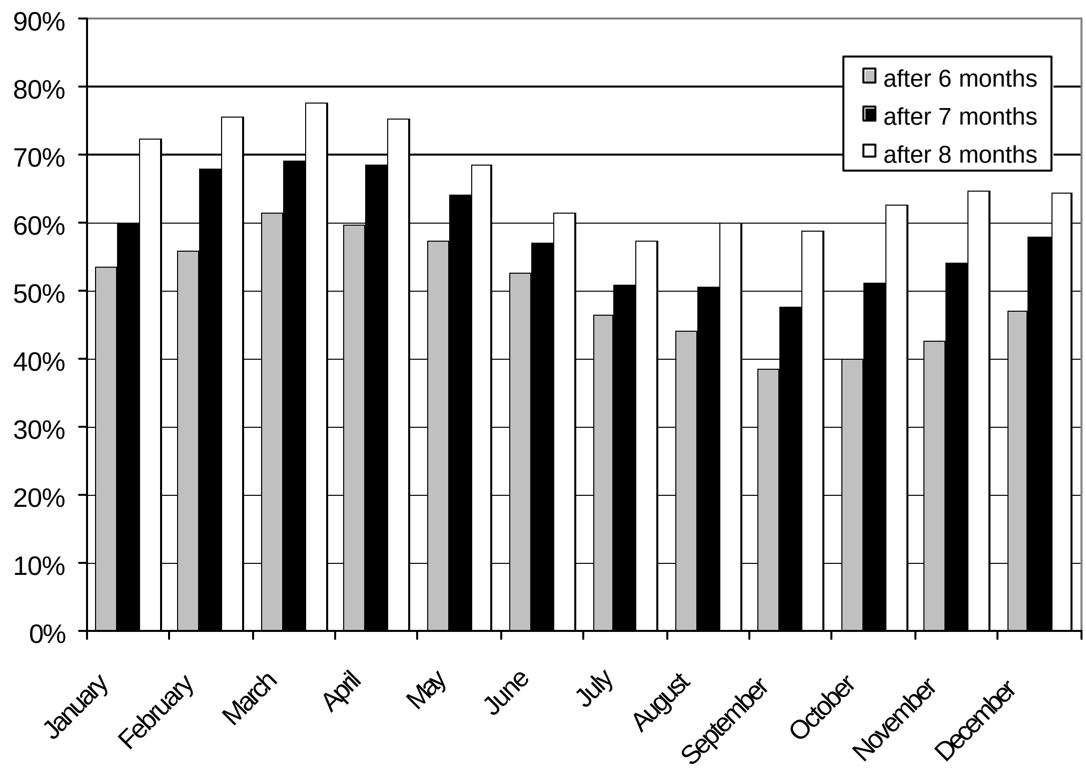

Figure 3: Cumulative percentage of annual landings by fishing year start month. This chart represents the cumulative percentage of the total annual landings harvested within six, seven, or eight months of the month indicated. The data are derived from the NMFS landings database, 1994 - 2000.

3.3.2 Non-Preferred Alternatives

3.3.2.1 Calendar-based Fishing Year

This alternative would set the fishing year equal to the calendar year, January 1 - December 31. All annual adjustment would be expected to be implemented on January 1, and landings and fishing effort would be tracked according to the calendar year.

3.3.2.2 Other FMP-based Fishing Year

This alternative would set the fishing year equal to and consistent with the fishing year of some other FMP (e.g., the Sea Scallop or Multispecies FMPs), for no other reason than to minimize the administrative burden. The Sea Scallop FMP specifies the fishing year as March 1 - February 28. The Northeast Multispecies FMP specifies the fishing year as May 1 - April 30. Other New England FMPs include the Atlantic Herring FMP (January 1 - December 31) and the Monkfish FMP (May 1 - April 30).

3.3.2.3 Quality-based Fishing Year

This alternative would set the fishing year based on times when the quality of red crabs is highest. This option presupposes that we will be able to determine a temporally consistent pattern in quality of red crab product. The Council would ideally be able to track red crab quality similar to what was done in Figure 3 for annual landings. Currently, these data are not available.

3.4 Estimate of Commercial Biomass and MSY

Maximum sustainable yield (MSY) for the portion of the red crab resource within the boundaries of the New England Council's management unit is estimated to be 6.24 million pounds, based on the following conditions:

(a) The biomass of male crabs only was considered in the estimation of MSY.

(b) Adult red crabs are assumed to recruit to the fishery when they reach 4" in carapace width.

(c) For the purpose of calculating MSY, the natural mortality rate is assumed to be 0.15.

Rationale: The red crab fishery traditionally targets, retains, and lands only relatively large male crabs. The Red Crab FMP will prohibit the retention and landing of female crabs in the directed fishery operating under the controlled access program. The traditional fishery only retains and lands large crabs and market constraints limit the acceptance of small crabs. A four inch carapace width is considered to be the smallest crab that would be retained by a vessel and accepted by the market. Although there is very little information on the natural mortality rate of red crabs, scientific information on similar species suggests that 0.15 is a satisfactory estimation. This estimate of MSY reflects the best available information on the biology of this resource species.

3.4.1 Total and Commercial Biomass

In 1974, NMFS conducted a directed survey of the red crab resource using the R/V Albatross IV. The results of this survey are available in a paper written by Wigley, Theroux and Murray (1975). Based on the data collected in this survey Wigley et al. estimated total commercial biomass at 59 million pounds. There was also a NMFS survey conducted in 1980 to test gear. Too few samples were collected and the survey did not cover much of the red crab range. Since this time there have been no further surveys of the red crab resource along the U.S. coast from the mid-Atlantic northward.

The only assessment ever done for this species was by Dr. Fred Serchuk in 1977. In this assessment, Serchuk (1977) utilized the data from the Wigley et al. (1975) survey. Because of the lack of any significant directed fishery for red crab prior to the 1974 Albatross IV survey, Serchuk assumed that the 59 million pound estimate of commercial biomass represented virgin biomass, from which he was able to derive an estimate for maximum sustainable yield (MSY).

It is important to consider the results of the Wigley et al. survey in the correct context. Wigley et al. (1975) assumed a minimum commercial size of 4½ inches (carapace width). Because they assumed this was the size at which an adult red crab would recruit to the fishery, the proportion of crabs smaller than 4½ inches was not included in the estimate of commercial biomass.

Wigley et al. (1975) developed an estimate of total biomass of red crabs (both sexes and all sizes) equal to 116.5 million pounds. The estimate of commercial biomass was based upon the percentage of all red crabs believed to be larger than the assumed minimum commercial size. Wigley et al. (1975) determined that 51% of the total biomass was represented by crabs larger than 4½ inches (59 million pounds). Of these, males represented 93% of the biomass, such that the biomass of commercial-sized males was estimated to be approximately 55 million pounds (Wigley et al. 1975). This is the amount (55 million pounds) that Serchuk used as the basis for his 1977 assessment.

Clearly, the size of red crab assumed to be the minimum commercial size is an important factor in the determination of the overall commercial biomass, which then has an effect on the basis for the estimate of MSY. If the minimum commercial size had been assumed to be smaller than 4½ inches, then the proportion of the total biomass represented by commercial sized crabs would have been more than the 51% determined by Wigley et al. (1975).

If we assume that there may be other sizes of red crabs that could represent the minimum size for the fishery, then by applying these alternative sizes at which red crabs would be considered to recruit to the fishery, we can calculate a range for the commercial biomass of the red crab population. For the purposes of the FMP, we have assumed that the minimum size of crabs harvested in the red crab fishery could be 4", 4 ¼", or 4 ½."[6] Using the size frequency information by area provided in Murray (1974) and Wigley et al. (1975), the PDT was able to calculate the percentage of the overall biomass that is represented by crabs larger than a given size. Table 3 shows the percentage of the total red crab biomass (as estimated by Wigley et al. as a result of the survey data) that would be considered exploitable (males and females) for each alternative minimum size.[7] This table also shows the amount of the red crab biomass that would be considered exploitable under each alternative minimum size.

[6] All reports from members of the red crab fishing industry indicate that the fishery currently retains and lands all male crabs larger than 4". Thus, the range of minimum sizes considered here reflects current fishing practices, but also would reflect an increase in the size of crabs retained.

[7] In this discussion, the term "minimum size" does not necessarily mean a *regulated* minimum size (which would require the Council to implement a minimum size in this fishery and enforce this regulation), but should be considered the size at which red crabs recruit to the fishery. Since two of the three alternatives are larger than the current size crabs taken by the fishery, we have devised the term "*operational* minimum size" which would allow the Council to select a target minimum size for the fishery without establishing regulations to this extent.

Operational Minimum Size Alternatives	Exploitable Biomass as Percentage of Total Biomass	Estimate of Total Exploitable Biomass
4” CW	78.1 %	90.9 million pounds
4 ¼” CW	65.6 %	76.4 million pounds
4 ½” CW	50.5 %	58.8 million pounds

Table 3: Estimates of total exploitable biomass, depending on size. This table provides estimates of total exploitable biomass (both sexes) contained within the area surveyed by Wigley et al. (1975), depending upon the operational minimum size selected for the fishery, based on results of calculations performed by NEFSC using the Wigley et al. data. The Council’s preferred alternative is 4” CW.

Wigley et al. (1975), in addition to calculating the amount of exploitable biomass including males and females, calculated the proportion of this exploitable biomass comprised by males only. Table 4 reproduces the calculations summarized in Table 3, but also determines the proportion of males represented by each alternative. Since the existing fishery retains and lands male crabs only, the *male-only exploitable* biomass is defined as the biomass of male red crabs estimated to be larger than the minimum size (*total exploitable* biomass, then, represents both males and females).

Operational Minimum Size Alternatives	Biomass of Males as Percentage of Exploitable Biomass	Estimate of Male-Only Exploitable Biomass
4” CW	79.8 %	72.5 million pounds
4 ¼” CW	89.0 %	68.1 million pounds
4 ½” CW	94.8 %	55.8 million pounds

Table 4: Estimates of male-only exploitable biomass, depending upon the operational minimum size selected for the fishery, contained within the area surveyed by Wigley et al. (1975) based on results of calculations performed by NEFSC using the Murray (1974) and Wigley et al. (1975) data.

3.4.2 Natural Mortality

The natural mortality rate (M) for the deep-sea red crab is currently unknown (Hastie 1995; Melville-Smith 1988a; Serchuk 1977). However, information is available for an assumed level of natural mortality (ASMFC 2001; Eldridge 1972; Melville-Smith 1988a; Serchuk 1977).

Eldridge (1972) estimated a rate of natural mortality for king crab (*Paralithodes* spp.) of 0.2. Serchuk (1977) applied this rate of M to his assessment of red crab, assuming somewhat similar life histories. In addition, there are other estimates of M which could be used. In a series of papers from 1988 and 1989, Melville-Smith studied a similar species of deep-sea red crab (*Chaceon maritae*) off the coast of southwest Africa and estimated possible values of M for this species. There are several similarities between the African species of red crab and the Atlantic red crab, suggesting rates of natural mortality may be similar, as well:

(1) The species are from the same genus and are closely related. In fact, for many years *C. maritae* was actually considered to be *C. quinquedens*.

(2) Both species appear to utilize the same habitat in terms of depth and water temperature.

(3) The species share similar morphology in terms of overall appearance and carapace width to body weight relationship.

(4) The only evidence of differences between the species appears to be the suggestion that *C. quinquedens* may have a faster growth rate than *C. maritae*, but the evidence for a faster growth rate is not conclusive.

Melville-Smith (1988a) uses a range of estimates for M, equal to 0.05, 0.10, and 0.15. Melville-Smith reports that most studies of cold-water crabs and lobsters use low values (0.1 for *Homarus americanus* and *Jasus edwardsii*, and 0.14 for *Cancer pagurus*) and studies of warmer water crustaceans use higher values (0.14 - 0.52 for *Panulirus argus* and 0.226 for *Panulirus cygnus*). His use of values in the range of 0.05 - 0.15 for *C. maritae* presumed that the true value probably lies somewhere within that range.

For American lobsters, the natural mortality is partitioned into soft shell and hard shell components (ASFMC 2001). Lobsters that do not molt during a particular year have an M=0.10. Lobsters that molt once during a particular year have an M=0.15 and lobsters that molt twice during the year have an M=0.20. The total M for the stock depends on the proportion of lobsters in each molting category, and the average was calculated at between 0.13 - 0.15.

Choosing an appropriate estimate or range of estimates for M for the deep-sea red crab is obviously an important step in the FMP development process. Based on the available information, the Council may have to consider a range of values for M, much like those suggested by Melville-Smith, and proceed accordingly. Table 5 summarizes the range of alternatives for red crab natural mortality.

If we apply Melville-Smith's logic, then the true value of M for deep-sea red crab is probably somewhere in the total range of estimates (0.05 - 0.20). In addition to the four estimates provided by Melville-Smith and Serchuk, we have provided the mean of the estimates, M=0.125.

	Estimate of M	Source
Alternative 1	0.05	Melville-Smith (1988a)
Alternative 2	0.10	Melville-Smith (1988a)
Alternative 3	*0.125*	*Mean rate*
Alternative 4	0.15	Melville-Smith (1988a)
Alternative 5	0.20	Serchuk (1977)

Table 5: List of alternative estimates for natural mortality rate (M) for red crab based on available scientific literature. For the purposes of estimating MSY, the Council assumed that natural mortality is best reflected by Alternative 4, M = 0.15.

3.4.3 Maximum Sustainable Yield

In 1977, Serchuk completed an assessment of the red crab resource in the northwest Atlantic. This assessment provided an MSY estimate of 5.5 million pounds, assuming a male-only fishery targeting crabs 4½ inches and larger. The assessment was based on the data collected in 1974 during a NMFS survey of the red crab population in the Northeast (Wigley et al. 1975). The Wigley et al. survey included the area along the continental slope from eastern Georges Bank south to just south of Baltimore Canyon, east of the border between Maryland and Virginia. There are two issues about this survey and the resulting estimate of MSY related to the geographic range of the 1974 survey:

(1) A portion of the survey area from which the MSY estimate of Serchuk (1977) was developed now lies beyond the U.S.-Canadian border (the Hague Line) so that some of the assumed commercial biomass is not available to U.S. fishermen; and

(2) The likely fishable area extends beyond the Wigley et al. (1975) survey area to Cape Hatteras, North Carolina, but the biomass of red crabs in this area is not reflected in the estimate of MSY by Serchuk (1977).

A question to resolve is whether and how to adjust the estimate of MSY to better reflect the management unit. First, we can consider the portion of the survey area now east of the Hague Line. Wigley et al. (1975) estimated biomass in four geographic zones and within seven depth classes. Using the information in that paper (Figures 7 and 9 and Tables 9 - 12 *in* Wigley et al. 1975), 20.4% of the overall standing stock biomass and 30.5% of the commercial biomass come from the geographic zone intersected by the Hague Line. Plotting the coordinates of the Hague Line on the maps provided in the report demonstrate that approximately 25% of this geographic zone lies to the east of the Hague Line in what is now Canadian territory.

To get an estimate of biomass for the portion of the red crab stock on the U.S. side of the Hague Line, we take 75% of the biomass estimate for this geographic zone (Zone

D) and add it to the estimates for the other zones. The result is an estimate of total biomass (all sizes and sexes) of 110 million pounds and an estimate of total exploitable standing stock biomass (females and males larger than 4.5 inches carapace width) of 54 million pounds. These estimates of the size of the U.S. portion of the stock represent 94.9% and 92.4%, respectively, of the estimates provided in Wigley et al. (1975). Because the Council chose to incorporate this adjustment, the numbers in Table 3 and Table 4 were modified accordingly, as reflected in Table 6.

Operational Minimum Size Alternatives	Total Exploitable Biomass (Table 3)	U.S. Portion of the Stock (Minus Canada)	Adjusted Total Exploitable U.S. Biomass	Adjusted Male-Only Exploitable U.S. Biomass
4“ CW	90.9 M pounds	94.9 %	86.3 M pounds	68.8 M pounds
4 ¼“ CW	76.4 M pounds	94.9 %	72.5 M pounds	64.5 M pounds
4 ½“ CW	58.8 M pounds	94.9 %	55.8 M pounds	52.9 M pounds

Table 6: Exploitable and commercial biomass of red crab, reduced for the Canadian portion of the stock (sample calculations: $86.3 = 90.9 \times .949$ and $68.8 = 72.5 \times .949$).

The second issue to resolve is the portion of the fishing grounds south of the area surveyed by Wigley et al. (1975). All of the biomass estimates were based on the 1974 survey that extended just south of Baltimore Canyon (see Figure 17). The directed fishery routinely extends at least as far south as Norfolk Canyon, and the management unit extends to Cape Hatteras, thus there is some amount of the fishable stock that is not incorporated into the biomass estimates outlined above.

One approach to deal with this issue is to use only the available estimates of biomass, based on the Wigley et al. (1975) survey, but consider these to be conservative estimates of biomass acknowledging that these under-estimate the true biomass. A second approach would entail determining the additional biomass of red crabs included in this additional area. There are a couple of methods that could be used to estimate the additional biomass from this area.

The first method to estimate an additional biomass for the area south of the Wigley et al. (1975) survey is to simply extend the results of the Wigley et al. survey to include this additional area. As described above, the Wigley et al. survey results were differentiated into four geographic zones (A - D, Figures 7 and 9 and Tables 9 - 12 *in* Wigley et al. 1975). Using this information, we can determine that 17.1% of the total biomass is attributed to the southernmost zone. If we assume that the density of red crabs in the additional area south of the survey is approximately the same as the density in this southernmost geographic zone, then we can apply this percentage to the unsampled area given an estimate of its relative area.

The southernmost geographic zone extends from Hudson Canyon to approximately halfway between Baltimore and Washington Canyons. The additional area extends from the survey boundary to as far south as Cape Hatteras (depending on the alternative selected for the management unit). This is approximately 115.3% of the area of the southern survey zone (Zone A). We would assume, therefore, an additional 19.7% of the total biomass may be included to account for this additional area. If Cape Hatteras was not selected as the boundary of the management unit, then the additional biomass would have been adjusted accordingly (see Table 7).

Management Unit Alternatives	Percentage of Additional Biomass	Adjusted Total Biomass	Adjusted Male-Only Exploitable Biomass
Survey Boundary	0 %	116.51 M pounds	72.52 M pounds
Norfolk Canyon	8.65 %	126.59 M pounds	78.79 M pounds
VA - NC Border	11.63 %	130.06 M pounds	80.95 M pounds
Cape Hatteras	19.72 %	139.48 M pounds	86.82 M pounds

Table 7: Total and male-only exploitable biomass of red crab, adjusted for additional fishery area, assuming a 4" operational minimum size.

The second method to estimate the additional biomass would apply the results of other studies of red crab biomass from the additional area. The only known study on the segment of the red crab population located south of the Wigley et al. survey that attempted to estimate biomass or density was conducted by Haefner (1978). This study reported on the distribution and relative abundance of the red crab in the vicinity of the Norfolk Canyon. Haefner (1978) provides densities of red crabs for each of ten depth zones between 200 - 1800 meters. Ideally, we would be able to simply add the Haefner densities to those calculated by Wigley et al. (1975). However, this is not possible for several reasons:

(1) The Haefner survey used a trawl only while the Wigley et al. survey used a trawl and a camera system. Wigley et al. compared the densities calculated from the trawl component of the survey and the camera component and reported that the trawl densities varied considerably from the camera densities, ranging from 19.1% of the camera density to 78.4% of the camera density, depending on depth and location. This suggests that the Haefner densities are underestimates of true density, but the amount of underestimation is not known with sufficient precision to be used.

(2) The Haefner survey used a different and larger trawl than the trawl used by the Wigley et al. survey, and may not have sampled as efficiently as the trawl in the Wigley survey. The differences in trawl size and design further complicate attempts to compare the results of the two studies.

(3) The observed differences in the average densities of red crabs between the two studies could be a result of incomplete or inefficient sampling in the Haefner

survey, or could be a result of real differences in crab abundance.

For these reasons, Haefner himself concluded that the two studies could not be combined to get an overall estimate of stock size. In addition to the above limitations of a comparison between the Haefner and the Wigley et al. surveys, the Haefner study does not develop an estimate of biomass for the red crabs in the Norfolk Canyon area, but stops at reporting observed densities. Also, the Haefner study is limited in its applicability as it only surveyed the red crabs in the direct vicinity of Norfolk Canyon and does not provide any insight into the segment of the red crab population south of Norfolk Canyon. It should be recognized that any attempt to develop an estimate of the additional biomass represented by the area of the management unit south of the boundary of the Wigley et al. (1975) will be an estimate only and will have a fairly high degree of uncertainty associated with it.

The only assessment and estimate of MSY for red crab was done by Serchuk (1977). The basis for this assessment and estimate of MSY was to take the available estimate of commercial biomass and incorporating it into Gulland's equation (Gulland 1971) for virgin stock exploitation. The equation appears as:

$$MSY = 0.5 * M * B_0$$

where M = natural mortality rate, and
B_0 = virgin biomass of commercial sized crabs

The two key elements of this calculation are the rate used for M and the biomass of commercial sized crabs. The above discussion identified the alternatives available for a estimate of M that would result in a different estimate of MSY as well as the alternatives available for how to calculate the commercial biomass. Depending on the combination of natural mortality rate and commercial biomass as described above, there is a wide range of estimates of MSY that would serve as the basis for many management measures. Table 8 provides this range for each of the possible operational minimum sizes, rates of M, and management unit boundaries considered. Based on the decisions of the Council, the MSY for red crab is estimated to be 6.24 million pounds.

The Wigley et al. (1975) survey also did not consider the Gulf of Maine portion of the red crab stock. The red crabs that occur in the Gulf of Maine are smaller than those that occur along the continental slope, the occur there in lower density, and the habitat of the Gulf of Maine is not ideal for the deep-sea red crab. For these reasons, fishermen actively avoid fishing in the Gulf of Maine. For these reasons, any red crabs that occur in the Gulf of Maine are not considered in this FMP.

Operational Minimum Size	Natural Mortality Rate Options	Management Unit Alternatives			
		Survey Boundary MSY	Norfolk Canyon MSY	VA-NC Border MSY	**Cape Hatteras MSY**
4" CW	0.05	1.72 million pounds	1.88 million pounds	1.93 million pounds	2.08 million pounds
	0.10	3.44 million pounds	3.76 million pounds	3.87 million pounds	4.16 million pounds
	0.125	4.31 million pounds	4.70 million pounds	4.83 million pounds	5.20 million pounds
	0.15	5.17 million pounds	5.64 million pounds	5.80 million pounds	**6.24 million pounds**
	0.20	6.89 million pounds	7.52 million pounds	7.74 million pounds	8.32 million pounds
4 ¼" CW	0.05	1.61 million pounds	1.76 million pounds	1.81 million pounds	1.95 million pounds
	0.10	3.23 million pounds	3.52 million pounds	3.62 million pounds	3.90 million pounds
	0.125	4.03 million pounds	4.40 million pounds	4.53 million pounds	4.87 million pounds
	0.15	4.84 million pounds	5.28 million pounds	5.43 million pounds	5.85 million pounds
	0.20	6.45 million pounds	7.04 million pounds	7.25 million pounds	7.80 million pounds
4 ½" CW	0.05	1.32 million pounds	1.44 million pounds	1.48 million pounds	1.60 million pounds
	0.10	2.65 million pounds	2.89 million pounds	2.97 million pounds	3.20 million pounds
	0.125	3.31 million pounds	3.61 million pounds	3.71 million pounds	3.99 million pounds
	0.15	3.97 million pounds	4.33 million pounds	4.46 million pounds	4.79 million pounds
	0.20	5.29 million pounds	5.78 million pounds	5.94 million pounds	6.39 million pounds

Table 8: Summary of the estimates of MSY for the male-only red crab fishery depending upon the selection of an operational minimum size, an estimate of the natural mortality rate, and the southern boundary of the management unit. The overall range of MSY estimates is 1.32 - 8.32 million pounds. Based on the Council's preferred alternatives for the minimum commercial size, the rate of natural mortality, and the southern extent of the management unit, MSY is calculated to be 6.24 million pounds.

3.5 Overfishing Definition[8]

3.5.1 Overview

The Magnuson-Stevens Act includes a requirement that all FMPs "specify *objective and measurable criteria* for identifying when the fishery to which the plan applies is overfished." The National Standard Guidelines (NSGs) require the specification of "status determination criteria" (63 FR 24212). These criteria are to be "expressed in a way that enables the Council and Secretary to monitor the stock or stock complex and determine annually whether overfishing is occurring and whether the stock or stock complex is overfished." To comply with the Magnuson-Stevens Act and the National Standard Guidelines, the Council must develop more than a simple "overfishing definition" for this resource.

The National Standard Guidelines define overfishing, overfished, and other terms and required components of an FMP. According to the NSGs, an *overfished* stock is one "whose size is sufficiently small that a change in management practices is required in order to achieve an appropriate level and rate of rebuilding." A stock is considered overfished when its size falls below the minimum stock size threshold (MSST). The Magnuson-Stevens Act requires a rebuilding plan for stocks that are overfished. According to the NSGs, *overfishing* "occurs whenever a stock or stock complex is subjected to a rate or level of fishing mortality that jeopardizes the capacity of a stock or stock complex to produce MSY on a continuing basis." Overfishing is considered to be occurring if the maximum fishing mortality threshold (MFMT) is exceeded for one year or more.

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[8] This section of the FMP includes many technical terms that may be unfamiliar to some readers. These terms are defined below (as well as in the Glossary):

B. Biomass, measured in terms of total weight, spawning capacity, or other appropriate units of production.

B_0. Virgin stock biomass, i.e., the long-term average biomass value expected for the stock in the absence of fishing. In the FMP, B_0 is used as the biomass of red crabs prior to the onset of commercial fishing for this resource.

B_{msy}. Long term average exploitable biomass of male red crabs that would be achieved if fishing at a constant fishing mortality rate equal to F_{msy}.

CPUE. Catch-per-unit-effort, or in this FMP, the average number of marketable red crabs caught per trap, where a single trap haul is considered the standard unit of fishing effort.

F. Instantaneous fishing mortality rate. Measures the effective fishing intensity for a given partial recruitment pattern.

F_{msy}. Fishing mortality rate which, if applied constantly, would result in MSY.

M. Instantaneous natural mortality rate.

MFMT. Maximum fishing mortality threshold. This is the reference point for determining if overfishing is occurring.

MSST. Minimum stock size threshold. This is the reference point for determining if the stock is in an overfished condition.

MSY. Maximum sustainable yield. The largest long-term average yield (catch) that can be taken from a stock under prevailing ecological and environmental conditions.

The NSGs require that both an MSST and an MFMT be specified. If these specific criteria cannot be specified due to data and information limitations, then reasonable proxies must be specified. In addition, the NSGs suggest the development of a *control rule*. A control rule describes a variable (such as fishing effort) over which management has some direct control, as a function of some other variable(s) related to the status of the stock (such as biomass). The standard, default control rule describes fishing mortality rates and current biomass levels (Restrepo et al. 1998).

The control rule does not have to be cast in these terms, however. The control rule's basic function is to be able to compare an available measure of stock status with some basic biological reference points, as well as to indicate the direction management should take under "bad" or "good" conditions. The following figure represents the "default" control rule as described in Restrepo et al. (1998).

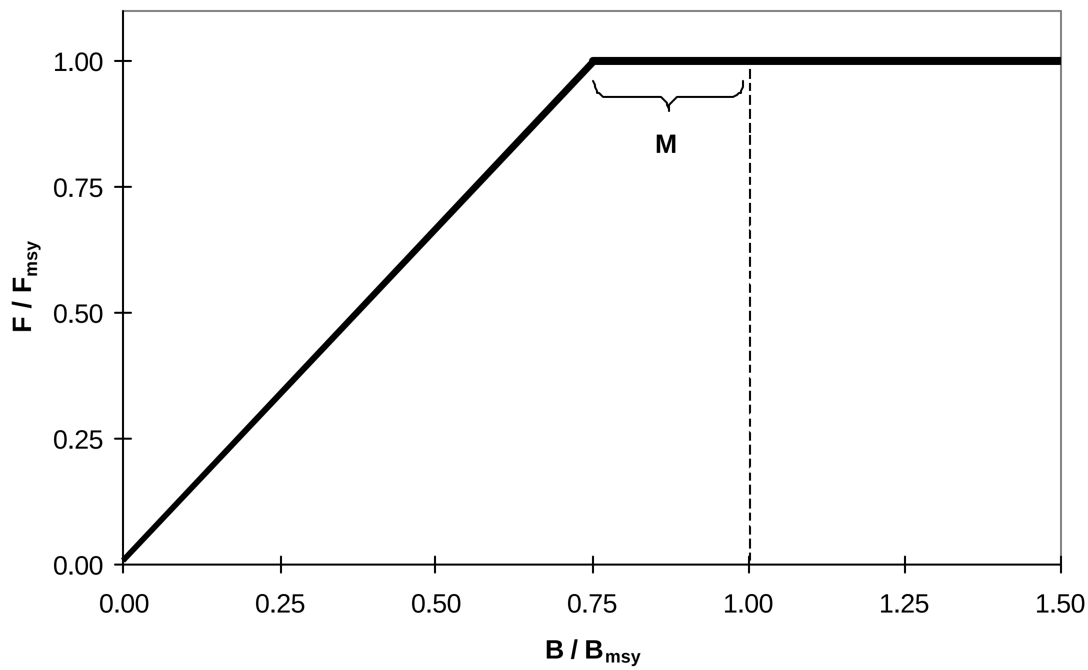

Figure 4: "Default" MSY control rule (Restrepo et al. 1998). "M" is defined as the natural mortality rate, "F" as the fishing mortality rate, and "B" as biomass.

In Figure 4, biomass and fishing mortality are indicated by a ratio of current biomass or fishing mortality compared to the biomass or fishing mortality rate that would occur under MSY conditions. M represents the natural mortality rate, such that fishing mortality rate is not reduced until the biomass reaches a level equivalent to $(1\text{-}M)*B_{msy}$. Use of this control rule requires a good estimate of B_{msy}, a current measure of B, a good estimate of F_{msy} and a current measure of F.

As stated above, the Magnuson-Stevens Act allows for the use of proxies in situations where there is insufficient knowledge to develop the above estimates and measures. Proxies are generally required when the MSY-related parameters (such as B,

B_{msy}, F, and F_{msy}) cannot be estimated from the available data (Restrepo et al. 1998). Proxies are also used when the estimated values for the MSY parameters are deemed to be unreliable. A full discussion of this topic is available in Restrepo et al. (1998). Basically, the use of proxies depends in large part upon the availability of data with which to make status determinations. Data-rich cases would not require proxies, but data-moderate and data-poor cases would (Restrepo et al. 1998).

The following sections describe the Council's preferred and non-preferred alternatives for determining when overfishing may be occurring, when the stock is in an overfished condition, the control rule and reference points to be used in making these determinations.

3.5.2 Overfishing Definition Preferred Alternative

The Council considered several alternatives for an appropriate combination of an overfishing definition, a control rule, and a set of measurable reference points to be used to determine whether the resource is in an overfished condition or whether overfishing is occurring. The Council developed several alternatives for an *overfishing* definition to be used in this FMP. It is important to note that this definition will only indicate when overfishing is occurring, not necessarily when the stock is in an overfished condition. To make a determination as to whether the stock is overfished, we must apply the control rule and utilize the status determination criteria and reference points. Because the control rules and reference points are to some degree tied to the proxies that may be required, and these are in turn somewhat tied to the overfishing definition, all of these elements were bundled together in each of the alternatives considered by the Council.

Definition of Overfishing: Overfishing is defined as any rate of exploitation such that the ratio of current exploitation to an idealized exploitation under MSY conditions exceeds a value of 1.0. The actual measure of exploitation used will be determined by the availability of suitable data (CPUE data, landings, etc.).

This alternative does not establish a fixed measure against which to compare current fishing pressure, or exploitation. Rather, it establishes a ratio value against which several different measures or proxies could be compared. Choice of the particular measure or proxy to be used in an assessment would be left to the assessment team, based on a clearly identified set of criteria and conditions under which each type of measure or proxy may be used. The list of proxies from which to choose and the likely conditions to be specified for each are described below.

Definition of Overfished: The red crab stock will be considered to be in an overfished condition if one of the following three conditions are met:

> Condition 1 -- The current biomass of red crab is below ½ B_{msy} in the New England Council's management area.
>
> Condition 2 -- The annual fleet average CPUE, measured as marketable crabs landed per trap haul, continues to decline below a baseline level for three or more consecutive years.

Condition 3 -- The annual fleet average CPUE, measured as marketable crabs landed per trap haul, falls below a minimum threshold level in any single year.

Reference Points: To implement this alternative, estimates of an exploitation rate and biomass level that would exist under MSY-level conditions are required, as are measures of current exploitation and B. If these estimates and/or measures are not available or are unreliable, reasonable proxies are required. Under this alternative, appropriate proxies for MSY-level exploitation would include either the best estimate of the relationship between MSY and the CPUE that would occur under MSY conditions, or simply a level of landings equal to MSY. To gauge current exploitation, suitable proxies would include either a measure of the relationship between current landings and current CPUE, or simply a measure of current landings. These proxies are further explained below.

Proxy #1: f / f_{msy} -- It is common for data sparse stocks to estimate trends in fishing mortality as an exploitation ratio, i.e., landings or catch divided by an index of abundance, usually from a survey. As a proxy for F_{msy}, Councils in the past have selected an exploitation level that existed during a time with no trend in biomass at an intermediate biomass level. Sometimes this has been augmented by an estimate of absolute MSY from another source of information to determine a suitable index-based proxy for B_{msy}. Thus, the following equations apply:

$$f_{msy} = L_{msy} / I_{msy} \text{ or } MSY / I_{msy} \quad \text{(a)}$$

where: f_{msy} is an MSY exploitation index; L_{msy} are the landings during the period thought to approximate MSY conditions; and I_{msy} is the survey biomass index during the same period. If a suitable sub-fleet can be identified or standardization method can be developed, the commercial CPUE could replace I_{msy} from a fishery independent survey. Care should be taken to ensure that the unit of effort is robust or this method could give misleading results. Using the above equation and substituting standardized CPUE gives:

$$f_{msy} = L_{msy} / CPUE_{msy} \text{ or } MSY / CPUE_{msy} \quad \text{(b)}$$

To create a ratio of current fishing effort compared to idealized fishing effort under MSY conditions, apply the above formula (b) but simply replace the MSY controls with current estimates of the measures. This gives the formula:

$$f = L / CPUE \quad \text{(c)}$$

where L represents the current landings and CPUE represents the current catch rates. The ratio used in this approach could then be defined as follows:

$$f : f_{msy} = \frac{L}{CPUE} : \frac{MSY}{CPUE_{msy}} \quad \text{(d)}$$

The advantage of this approach is it allows for the use of available landings and CPUE data from the fishing industry (assuming these data are reliable and accurate) to determine relative fishing effort. This approach does not rely on calculating an accurate fishing mortality rate. The disadvantage of this approach is that it requires accurate and consistent reporting of catch data. Reliable landings and effort data should be available, using dealer data augmented by records from fishermen. Effort would be defined as the number of marketable crabs landed per trap haul. If we are able to meet the conditions necessary for this approach to work, this index could be suitable indicator of relative fishing effort.

Proxy #2: L / MSY -- If we are not able to implement the above indicators of fishing effort, the data will exist to implement the most crude method. To serve as a ratio of current fishing effort to an idealized fishing effort under MSY conditions, we could simply compare current landings to our best estimate of MSY. When this ratio of L:MSY is greater than one, obviously landings have exceeded MSY and overfishing would be occurring. When the ratio is less than one, then landings are less than MSY and overfishing would not be occurring. Although quite crude, if data availability conditions prevent us from using the previous index, this index would provide at least some indication of current fishing effort relative to MSY conditions.

B_{msy} can be estimated at a variety of percentages of B_0, and 40%B_0 is often recommended (Restrepo et al. 1998). To fully implement this alternative, either a measure of current biomass or a measure of current CPUE are also required. If current biomass is not available, then a measure of CPUE would be used (conditions 2 or 3). Both CPUE conditions require a baseline level of CPUE against which to measure current CPUE. Ideally, the baseline CPUE would be the CPUE that would occur under MSY conditions. Unfortunately, historic CPUE data from the fishery are inconsistent and unreliable. Available data from 1997 suggest an average CPUE of approximately 25 marketable crabs per trap haul. Reported landings in 1997 totaled 4.5 million pounds, approximately 82% of our best estimate of MSY. In this case, $CPUE_{msy}$ becomes the baseline and if current CPUE continues to decline for three years below this level, the resource would be considered as overfished.

Another approach is to calculate a comparable CPUE that occurred under virgin stock conditions. In 1974, several studies on red crabs were conducted by a variety of groups and individuals (Ganz and Herrmann 1974; Lux et al. 1982; Wigley et al. 1975). Ganz and Herrmann (1974) explored several aspects of the developing red crab fishery off southern New England, including observations of commercial fishing trips, the size structure of the population, and responses to changes in water temperature. Lux et al. (1982) began a tagging study on red crabs off southern New England in 1974 in an attempt to study molting frequency and commercial catch rates. Wigley et al. (1975) conducted a comprehensive bottom trawl and photographic survey of the red crab population in an attempt to determine population size, structure and distribution.

Because of the infancy of the directed red crab fishery (it had just begun in 1973, with less than 250,000 pounds of reported landings), the characterization of the population from the 1974 survey is interpreted as representing virgin stock conditions. Thus, we are using the overall commercial biomass calculations from this survey as equal to virgin biomass (B_0). The other studies conducted in this same year offer additional measures which can serve as an indication the stock under virgin conditions. For example, both Ganz and Herrmann (1974) and Lux et al. (1982) calculated CPUEs for the fishing vessels operating at this time.

By combining the information provided in both of these papers, an approximate average CPUE for market-size males can be derived for the stock under virgin conditions. The results of this calculation suggest that a range of 26 - 29 represents an optimal catch of males greater than 4 ½" CW per trap during virgin stock biomass conditions.[9] This range could be called $CPUE_0$, if it can be adjusted to represent the current commercial size crabs (> 4" CW). In order to apply this figure as a baseline against which to compare today's fishery, we have to make a couple of assumptions. First, we have to assume that the fishermen working in 1974 were fishing in areas similar to the locations visited by fishermen today. Second, we have to assume that the gear being used in 1974 was similar in size, design, and catchability as the gear being used by fishermen today.

To address the first assumption, we can compare the locations of the surveys, which both were reported to occur off the coast of southern New England in the depth range from 366 meters to 823 meters. The fishermen today report fishing most frequently within 400 - 800 meters, so this is fairly comparable. Although the fishery today has expanded to target the southern slope of Georges Bank and the Mid-Atlantic as far south as Norfolk Canyon, most of the fishing effort appears to continue to be focused on the southern New England area. To address the gear assumption, it is impossible to know whether the gear used in 1974 is the same as the gear used today. However, we can say that the gear used in 1974 was reported to be a slight modification of the offshore lobster pot (Ganz and Herrmann 1974). Similar gear is appears to be used today, as the most common gear in the fishery remains a rectangular 48" × 30" wood and wire trap with a top entry. Thus, although the gear used today might fish somewhat differently than the gear that would have been used in 1974, the results of this analysis probably provide at least a reasonable approximation of CPUE under virgin stock conditions for comparison with current catch rates.

If the above analysis and assumptions are accepted, then the suggested CPUE baseline is between 26 and 29 market-size crabs per trap, before being adjusted for 4" CW market-size crabs. Incorporating this baseline allows us to develop the following threshold reference points for this alternative:

- $f : f_{msy} > 1$ = This would be overfishing if proxy 1 is used ($MFMT_{ratio} = 1$).
- $\frac{L}{MSY} > 1$ = This would be overfishing if proxy 2 is used ($MFMT_{landings}$ =

[9] Lux et al. (1974) reported observing commercial fishing trips where 224,000 crabs total were harvested and 117,000 of these (52.2%) were market-size males (> 4 ½" CW). Ganz and Herrmann (1974) reported that the optimal soak time for this fishery appeared to be in the range of 18-24 hours, when catch ranged from 50-55 total crabs per trap haul. If we apply Lux et al.'s percentage of market-size males to the total catch per trap from Ganz and Herrmann, we get approximately 26.1 - 28.7 market-size males per trap haul.

MSY).

- $B < ½B_{msy}$ = This is the threshold level for being overfished, if current biomass data are available ($MSST_{Biomass} = ½\ B_{msy}$).

- $CPUE < ½CPUE_0$ = This is the threshold level for being overfished if current CPUE has been continuing to decline below this level for three or more years ($MSST_{CPUE-1} = ½\ CPUE_0$).

- $CPUE < ¼CPUE_0$ = This is the threshold level for being overfished if the current CPUE declines below this level in one any year ($MSST_{CPUE-2} = ¼\ CPUE_0$).

This alternative incorporates the likelihood of available data with a range of possible conditions under which various proxies for stock status and/or fishing effort can be used.

Control Rule: While the form of the control rule will look the same as the default MSY-control rule described in Restrepo et al. (1998) (Figure 4), the measures comprising the x and y axes will obviously be different and will depend upon the availability of data at the time of the assessment.

3.5.3 Non-Preferred Overfishing Definitions

3.5.3.1 Non-Preferred Alternative 1

Definition of Overfishing: Overfishing is defined as any rate of fishing mortality (F) in excess of F_{msy} for deep-sea red crab in the New England Council's management area.

This alternative provides an overfishing definition used in many fisheries; however, this definition assumes a good estimate of F_{msy} and an accurate measure of current F. If a good estimate of F_{msy} is not available then a proxy is needed. Similarly, if an accurate measure of current F is not available then a proxy is needed. Choice of an appropriate proxy is data dependent, and may require changing the overfishing definition to better represent the proxy being used. Depending on the quality of these proxies, the resulting status determination may or may not accurately reflect current fishing pressure on the resource. The degree to which the status determination accurately reflects current conditions in the fishery depends upon the choice of the proxy, the availability of data with which to calculate the proxy, the accuracy and precision of the data used to calculate the proxy, and the timeliness of the data used to calculate the proxy.

Definition of Overfished: The red crab stock will be considered to be in an overfished condition if the biomass of red crab falls below ½ B_{msy} in the New England Council's management area.

This alternative provides a definition for overfished that is used in many fisheries; however, this definition assumes a good estimate of B_{msy} and an accurate measure of current B. If a good estimate of B_{msy} is not available then a proxy is needed. Similarly, if an accurate measure of current B is not available then a proxy is needed. Choice of an appropriate proxy is data dependent, and may require changing the definition of overfished to better represent the proxy being used. Depending on the quality of these proxies, the resulting status determination may or may not accurately reflect current status of the stock. The degree to which the status determination accurately reflects current stock conditions depends upon the choice of the proxy, the availability of data with which to calculate the proxy, the accuracy and precision of the data used to calculate the proxy, and the timeliness of the data used to calculate the proxy.

Reference Points: To implement this alternative, estimates of F_{msy} and B_{msy} are required, as are measures of current F and B. If these estimates and/or measures are not available or are unreliable, reasonable proxies are required. Typical proxies for F_{msy} include F_{max}, $F_{0.1}$, F_{med}, or $F_{\%SPR}$. F_{max} and $F_{0.1}$ both require development of an equilibrium yield per recruit model (YPR) that corresponds to various levels of F. F_{med} and $F_{\%SPR}$ both require development of an equilibrium spawning output per recruit (SPR) model that corresponds to various levels of F. Currently, neither a YPR model or a SPR model are available for deep-sea red crab.

B_{msy} can be estimated as a variety of percentages of B_0, and $40\%B_0$ is often recommended (Restrepo et al. 1998). Threshold reference points at which management action must be taken are often in the form of:

- $F > F_{msy}$ = This is indicated as overfishing (MFMT = F_{msy}).
- $B < ½B_{msy}$ = This is a typical threshold level for being overfished (MSST = ½ B_{msy}).
- $B < ¼B_{msy}$ = This is an alternative biomass threshold for highly resilient stocks (MSST = ¼ B_{msy}).

The main issue with this alternative for the Red Crab FMP is the lack of data with which to estimate current F and the fact that survey data with which to calculate current B are not likely to be consistently available, if they are available at all. This approach, although the standard methodology for many FMPs, appears to be unsupported by the available data and information on this fishery and the resource.

Control Rule: When using the standard approach outlined in this alternative, the form of the control rule can often be a derivation or slight modification of the default MSY-control rule described in Restrepo et al. (1998) (Figure 4). When using this control rule, any of the above described proxies can be substituted for the default measures and the threshold reference points are as described above. Any time current biomass is less than $(1\text{-}M)*B_{msy}$, F should be reduced through some management action to avoid a continued decline in stock biomass. Once biomass declines below the minimum threshold, a rebuilding plan would be required.

3.5.3.2 Non-Preferred Alternative 2

Definition of Overfishing and Overfished: Overfishing and overfished are defined to be occurring at any time that the annual fleet average catch-per-unit-effort (CPUE), measured as marketable crabs landed per trap haul, continues to decline below a baseline level for three or more consecutive years, or if, in any one year, it falls below a minimum threshold level.

This alternative depends entirely upon consistent and accurate reporting of catch data. The concept is that if catch rates have been in decline for a period of time, then fishing effort is probably exceeding sustainable levels. Thus, under this option, if a decline in CPUE below a baseline level is observed to continue for three or more consecutive years, we would consider the fishery to be overfishing the resource. There are several limitations of this approach. First, changes in CPUE (up or down) may occur without any relationship to stock conditions if fishing techniques, technologies, or the number of participants changes. Similarly, real changes in fishing effort could be masked by changes in fishing techniques or technologies that result in the appearance of a flat CPUE trend.

This alternative presumes that a persistent reduction in CPUE is a direct reflection of fishing pressure (i.e., this alternative and measure in effect serve as proxies for an evaluation of fishing mortality rate). Since under ideal conditions we are trying to maintain a balance between an adequate stock size (target $\geq B_{MSY}$) and a reasonable amount of fishing pressure (target $\leq F_{MSY}$), a sustained rate of fishing mortality above F_{MSY} when the stock is at B_{MSY} is considered overfishing because ultimately this level of effort will result in a reduction in stock size to below B_{MSY}. If the stock is at a level less than B_{MSY}, then fishing mortality should also be reduced to below F_{MSY} by a comparable amount to prevent further reductions in stock size. Thus, the level of effort at which overfishing occurs may vary with stock size. Ideally, then, the measure of fishing effort used to determine if overfishing is occurring is independent of stock size, yet the threshold is tied to stock size.

However, the approach suggested in this alternative does not reflect this. In this case, the threshold is independent of stock size, yet the measure is totally dependent upon stock size. Overfishing would only appear to occur when the stock size was reduced to levels such that catch rates declined overall. Theoretically, fishing effort could be dramatically reduced yet because the stock declined, even a minimal amount of fishing effort would appear as overfishing. This alternative, although suggested as a potential overfishing definition, may be more appropriate as an indicator of stock size (and thus a reference point for a fishery-dependent-data based control rule).

Another concern with this alternative is that, because of the considerations identified above, there would be no way to differentiate when overfishing is occurring from when the stock is overfished. Since a rebuilding plan is required (under the Magnuson-Stevens Act) anytime a stock is overfished, as soon as it was indicated that overfishing was occurring according to this alternative, a rebuilding plan would also be required. This eliminates the possibility that the Council could use an overfishing determination to reduce fishing effort before the stock levels decline to the point of requiring a rebuilding plan.

This alternative also locks in place the type of measure and the data required to determine the status of the fishery. If CPUE data are not available, are suspect for one of the reasons outlined above, or if data that would provide a more robust measure of exploitation rate become available, the status determination and overfishing definition can only be changed through a formal change to the FMP.

Reference Points: To implement this alternative, the only measures necessary are a current CPUE and a baseline CPUE against which to compare. The baseline CPUE ($CPUE_0$) is derived as explained in the previous alternative. Threshold reference points at which management action must be taken would be in the form of:

- $CPUE < ½CPUE_0$ = This is the threshold level for overfishing and for being overfished if current CPUE has been continuing to decline below this level for three or more years.

- $CPUE < ¼CPUE_0$ = This is the threshold level for overfishing and for being overfished if the current CPUE declines below this level in one any year.

Control Rule: Due to the nature of this alternative -- the CPUE measure indicates both overfishing and when the stock is in an overfished condition -- there is no control rule appropriate for this alternative.

Table 9 summarizes the above alternatives by displaying the criteria used to assess the status of the fishery and the stock, the threshold reference points, available proxies, and the actions that would be required by the Council if the thresholds are violated.

<table>
<tr><th>Alternative</th><th>Status</th><th>Criteria</th><th>Reference Point</th><th>Proxy</th><th>Remedy if Threshold Exceeded</th></tr>
<tr><td rowspan="5">Preferred Alternative</td><td rowspan="2">Overfishing</td><td rowspan="2">f</td><td rowspan="2">$f:f_{MSY} > 1$</td><td>$\frac{L}{CPUE} : \frac{MSY}{CPUE_{MSY}}$</td><td>Reduce landings.</td></tr>
<tr><td>$\frac{L}{MSY}$</td><td>Reduce landings.</td></tr>
<tr><td rowspan="3">Overfished</td><td>B</td><td>$B < ½ B_{MSY}$</td><td>None.</td><td>Rebuilding plan.</td></tr>
<tr><td rowspan="2">CPUE</td><td>$CPUE < ½ CPUE_0$</td><td>N/A</td><td>Rebuilding plan.</td></tr>
<tr><td>$CPUE < ¼ CPUE_0$</td><td>N/A</td><td>Rebuilding plan.</td></tr>
<tr><td rowspan="2">1</td><td>Overfishing</td><td>F</td><td>$F > F_{MSY}$</td><td>None.</td><td>Reduce F.</td></tr>
<tr><td>Overfished</td><td>B</td><td>$B < ½ B_{MSY}$</td><td>None.</td><td>Rebuilding plan.</td></tr>
<tr><td rowspan="2">2</td><td>Overfishing</td><td rowspan="2">CPUE</td><td>$CPUE < ½ CPUE_0$</td><td>N/A</td><td rowspan="2">Reduce effort and rebuilding plan.</td></tr>
<tr><td>Overfished</td><td>$CPUE < ¼ CPUE_0$</td><td>N/A</td></tr>
</table>

Table 9: Summary of status determination criteria and reference points for Red Crab FMP. "None" indicates that we have not yet identified a suitable proxy for this reference point, and "N/A" indicates that a proxy is not applicable for this reference point.

3.6 Optimum Yield

3.6.1 Overview

> **National Standards [16 U.S.C. 1851 § 301]:**
> (1) Conservation and management measures shall prevent overfishing while achieving, on a continuing basis, the *optimum yield* from each fishery for the United States fishing industry.

As stated in National Standard 1, the Magnuson-Stevens Act requires that the conservation and management measures contained in an FMP achieve optimum yield (OY) from the fishery on a continuing basis. The Act defines OY as follows:

> **Definition of Optimum Yield [16 U.S.C. 1802 § 3]:**
> (28) The term "optimum", with respect to the yield from a fishery, means the amount of fish which --
> (A) will provide the greatest overall benefit to the Nation, particularly with respect to food production and recreational opportunities, and taking into account the protection of marine ecosystems;
> (B) is prescribed as such on the basis of the maximum sustainable yield from the fishery, as reduced by any relevant economic, social, or ecological factor; and
> (C) in the case of an overfished fishery, provides for rebuilding to a level consistent with producing the maximum sustainable yield in such fishery.

Although all FMPs must contain conservation and management measures to achieve OY, OY itself is not a limit criteria. Instead of an absolute ceiling, OY is a target reference point that is the desired result of the management plan. Because it is a target, exceeding OY does not necessarily constitute overfishing. This introduces the concept of *targets* as differentiated from limits.

The maximum fishing mortality threshold (MFMT) and the minimum stock size threshold (MSST) are limits. If fishing effort exceeds the MFMT, then overfishing is occurring and management action must be taken. If the biomass of a stock falls below MSST, then the stock is overfished and a rebuilding plan must be implemented. Targets, on the other hand, define where we would like things to be. Thus, the OY target defines how much yield we would like to see the fishery take. There can be fishing effort targets as well as biomass targets. In addition to the specification of OY for the Red Crab FMP, this section will also address targets for the management program and the fishery.

3.6.2 Specification of Optimum Yield

The Council must specify optimum yield (OY) for this fishery in the FMP. As an example of an OY specification for a similar species and similar fishery, the Council reviewed the South Atlantic Council's Golden Crab FMP. In the Golden Crab FMP, OY is specified as follows:

> Optimum yield (OY) is all golden crab that are harvested legally under the

provisions of the Golden Crab FMP which is equivalent to that level of golden crab harvest that would minimize user conflict among vessels, minimize the cost of fishing, produce a stable level of landings that would maximize returns to the fishermen, provide for a stable supply, and minimize management costs.

In developing this specification for OY, the South Atlantic Council also considered basing OY on a harvest level which ensures the weight of the spawning stock does not decrease below some minimum threshold percentage of the spawning stock that would occur in an unfished fishery. They also considered setting OY as all golden crab harvested while maintaining the fishing mortality rate equal to some objective level (M, F_{msy}, $F_{0.1}$, or F_{max}), or simply setting OY equal to MSY. All of these alternatives were rejected due to a lack of sufficient information.

While we may not have sufficient information to measure spawning stock biomass (SSB) on a yearly basis (because currently there are no plans for an annual fishery independent survey) or to measure the actual fishing mortality rate, we do have an estimate of MSY. Thus, the Council could specify OY based on MSY. According to part (B) of the Magnuson-Stevens Act definition, OY can be interpreted as follows:

$OY = MSY + (C_{ECON} + C_{SOC} + C_{ECOL})$, if $\Sigma C_n < 0$, or
$OY = MSY$, if $\Sigma C_n > 0$, where
MSY = Maximum sustainable yield;
C_{ECON} = Economic Considerations;
C_{SOC} = Social Considerations;
C_{ECOL} = Ecological Considerations; and
each factor can be either negative (a potential *reduction* from MSY) or positive (a potential *increase* from MSY) but the sum of the factors can only be negative or zero (i.e., OY cannot exceed MSY).

To implement this alternative, we would examine each of these factors in turn and determine whether or not there are any relevant considerations that would warrant an adjustment in the target yield. For example, we could examine the known ecological considerations -- including the relationship of red crab to other species, the importance of red crab as a prey source for other species, the impact of the red crab fishery on important marine habitats, and any impacts of the fishery on bycatch or other targeted species -- and identify any reasons to consider reducing or increasing the target yield to account for these issues. If no concerns are identified, then we could conclude that OY does not need to account for any ecological considerations. We would then repeat this process for social and economic considerations. For any factors for which we should adjust the target yield, we would estimate either a quantity of red crab or a percentage of yield for which we need to account.

We would then sum over the three potential yield adjustment factors and compute the total adjustment to yield required to account for the economic, social or ecological considerations. If this total amount is negative (implying a reduction in yield to account for these factors), then this amount would be specified as the reduction in MSY that would provide us with OY. If the total amount is positive (implying an increase in yield to account for these factors), then OY will not be adjusted and will simply be equivalent to MSY (this is because, according to the Magnuson-Stevens Act, OY cannot be *more* than MSY). OY would be specified as that amount of red crab harvested in the directed red crab fishery, subject to all the provisions of the Red Crab FMP, that equals MSY as reduced by economic, social, and/or ecological considerations relevant to this fishery. This approach is intended to incorporate changes to MSY to account for any uncertainty about the status or vulnerability of the resource or the current levels of fishing effort.

Ecological considerations: The first factor examined for red crab as an indication of an adjustment to MSY is ecological. The NSGs suggest several considerations, including: stock size and age composition; the vulnerability of incidental or unregulated stocks in a mixed-stock fishery; predator-prey or competitive interactions; and dependence of marine mammals and birds or endangered species on a stock of fish. Because this is not a mixed-stock fishery, that consideration will not be addressed. There are no current data on stock size and very little is known about the age composition of the red crab population. Accordingly, there is no information on this consideration with which to judge whether an adjustment to yield would be appropriate. Since the adjustment could be positive or negative, assuming a zero adjustment appears justified.

As reported in Steimle et al. (2001), there is little indication that red crab constitute a major prey item for any species. There are few records of predation on red crabs, but these appear only as minor components of prey sources (Steimle et al. 2001). There are few records of red crab prey sources. Gray (1969) and Beyers et al. (1980) both report some observations and suggest a variety of food sources for red crabs. Sea anemones may be a desired prey (Gray 1969), but most likely red crabs are opportunistic omnivores due to the limited availability of food at the water depths common for red crabs (Beyers et al. 1980; Steimle et al. 2001). Based on what is known about red crab predator-prey interactions, no adjustment to yield for this factor appears warranted. Also, although Steimle et al. (2001) describes a few competitive interactions (primarily with Jonah crab, *Cancer borealis*, American lobster, *Homarus americanus*, and golden crab, *Chaceon fenneri*), none of these appears significant enough to warrant an adjustment to yield.

The last ecological consideration identified in the NSGs suggests dependence of any marine mammals, birds, or endangered species. There is no information in any of the available literature reviewed for this FMP that suggests red crabs are a significant, or even a minor, component of the diets of any marine mammals, birds, or endangered species. Overall, it appears that there are no ecological reasons to suggest an adjustment to yield either above or below what would otherwise be the optimum yield.

Social considerations. The second factor examined for red crab as an indication of an adjustment to MSY is social. The NSGs suggest several considerations, including: enjoyment gained from recreational fishing; avoidance of gear conflicts and resolving disputes; preservation of a way of life for fishermen and their families; and dependence of local communities on a fishery. Due to the depths and distances from shore required to fish for red crabs, there are no known recreational fishing activities targeting this species. Also, due to the depths and distances from shore at which the commercial fishery takes place, the potential for gear conflicts or other disputes with other fisheries is minimized. In fact, the Council is unaware of any direct gear conflicts or other disputes between the red crab fishery and any other commercial or recreational fishery.

Preservation of a way of life for fishermen and their families is always an important consideration in the development of an FMP, but this fishery has always been limited to a few fishing vessels and fishermen. Only in the past year has the interest and involvement of fishermen in the red crab fishery grown in response to changing economic conditions and the availability of substitute resources. Thus, any management program developed by the Council which either directly or indirectly protects those fishermen traditionally involved in the red crab fishery would satisfy this condition without the need to adjust the target yield. Because of the small and dispersed nature of this fishery, there are no communities dependent upon the red crab fishery (see Section 8.4.5).

Economic considerations. The third and final factor examined for red crab as an indication of an adjustment to MSY is economic. The NSGs suggest several economic considerations, including: the risk of overharvesting when a stock's size or productive capacity is uncertain; satisfaction of consumer and recreational needs; and development of domestic and export markets for U.S.-harvested fish. Although there is always a risk of overharvesting when management operates with imperfect information, and the current size of the stock is unknown, the productive capacity (MSY) of the resource is known (Serchuk 1977). As stated above, there are no known recreational fishing activities affected by the commercial red crab fishery and consumer needs appear to be satisfied under current conditions of the fishery. It is an objective of the FMP to ensure the continued and consistent harvest and supply of consumer products from this fishery. Lastly, both U.S. and foreign markets appear to exist for the products of this fishery and these opportunities do not appear to be threatened by the current estimates of annual target yield for the fishery.

Another economic consideration which should be factored into the setting of a target yield under this alternative is the difference between MSY and MEY. MEY will always be less than MSY (see the description of Alternative 2 for an explanation). Assuming the MEY estimated for the previous alternative (MEY = 95% of MSY), the difference between MSY and MEY is a valid factor on the consideration of OY. Thus, to address economic considerations, and in the absence of any other economic factors, MSY should be reduced by 5%.

Adjustment to MSY. The 5% reduction to MSY suggested above should account for current uncertainties about the status of the resource, its vulnerability to overfishing, and the levels of fishing effort in the fishery. Returning to the original equation suggested as the basis for this alternative, we use:

MSY (Maximum sustainable yield) = 6.24 million pounds
C_{ECON} (Economic Considerations) = -5% of MSY
C_{SOC} (Social Considerations) = 0
C_{ECOL} (Ecological Considerations) = 0
OY = 6,240,000 + (-312,000 + 0 + 0)
OY = 5,928,000 pounds

3.6.3 Non-Preferred Alternatives

3.6.3.1 Non-Preferred Alternative 1: OY = MSY

The first alternative is a very straightforward application of the statutory limit of OY, and would specify that OY is simply set equal to the best available estimate of MSY for the red crab resource.

This alternative is supportable in that we have an estimate of MSY for this resource, but it is not supported by the definition of OY in the Magnuson-Stevens Act or the further guidance provided in the national standard guidelines (NSGs). OY is intended to represent the amount of yield that best optimizes biological, economic, social, and ecological factors. This alternative only recognizes the biological factors and sets OY equal to the theoretical biological limit for a sustainable fishery, MSY. Economic, social, and ecological factors are not incorporated into this alternative.

3.6.3.2 Non-Preferred Alternative 2: OY = 90% of MSY

This alternative would specify that OY is set equal to the best available estimate of MSY, conservatively reduced by 10% to account for potential economic, social and ecological concerns.

This alternative begins with the theoretical biologic limit for a sustainable fishery, MSY, and, reduces this yield by some amount to account for other non-biological factors. The use of 10% is intended to represent a precautionary approach that should account for these factors without the necessity of quantifying them.

Because so much is unknown about this resource and its fishery, quantitatively specifying proposed adjustments to MSY to account for economic, social, and ecological factors may not be possible at this time. The NSGs suggest that the "Councils should adopt a precautionary approach to specification of OY" (63 FR 24212). Although there are many interpretations of the phrase "precautionary approach" it is essentially a proactive management tenet that urges conservation in the face of scientific uncertainty.

In this application, a lack of scientific certainty on the quantitative amounts that the overall yield should be adjusted to completely account for economic, social, and ecological considerations should not prevent the Council from reducing MSY by some amount. This amount (the 10% reduction suggested in this alternative) is simply an estimate of the amount of yield most likely to fulfill the requirements of the Magnuson-Stevens Act. Although a 10% reduction is somewhat arbitrary, the Council feels that this amount best represents the intent of the NSGs, as explained in the context of a precautionary approach by Restrepo et al. (1998).

3.6.3.3 Non-Preferred Alternative 3: OY = MEY (95% of MSY)

This alternative would specify that OY is set equal to the maximum economic yield (MEY) to account for economic considerations.

In theory, MEY is defined as the point at which profits to the fishery are maximized[10] over time and effort is at the least cost level. MEY occurs at the point where the marginal benefit of effort is equal to the marginal cost of effort. Net benefits for consumers and the seafood sector of the economy could also be included if prices change with landings.

This alternative seeks to recognize the economic aspect of maximizing yield in a fishery and incorporate, if not the social and ecological considerations of OY, the economic considerations. The difficulty with this alternatives lies in the estimation of MEY. In order to estimate the level of effort and landings equivalent to MEY, we need a bioeconomic model that incorporates the influence of fishing effort on sustainable levels of production. Unfortunately, due to the lack of recent information on red crab biology, we cannot estimate the amount of yield that can be sustained over time, for a given amount of fishing effort. A simple Schaefer-type logistic growth model may be acceptable when exploitation rates are low, but can produce errors when extended to higher rates or unknown levels of exploitation. Many alternatives to the logistic growth models have been proposed to describe fish populations, but in this case it is impossible to accurately estimate one.

Since MEY cannot be estimated, setting MEY = 95% of MSY provides a less conservative alternative than Alternative 2, but still has some reduction to account for potential economic concerns.

3.6.3.4 Comparison of OY Alternatives

The following table summarizes the four alternatives for the specification of optimum yield for the Red Crab FMP.

	Calculation of OY	MSY	OY
Preferred Alternative	$OY = MSY + (C_{ECON} + C_{SOC} + C_{ECOL})$	6.24 M pounds	5.928 M pounds
Alternative 1	OY = MSY	6.24 M pounds	6.24 M pounds
Alternative 2	OY = 90% * MSY	6.24 M pounds	5.616 M pounds
Alternative 3	OY = MEY	6.24 M pounds	5.928 M pounds

Table 10: Summary of alternatives for OY, assuming a value of MSY = 6.24 million pounds (based on the discussion in Section 3.4.3). As MSY is adjusted to account for other factors (commercial size of crab, extent of management unit, natural mortality), so to should the specifications of OY under each alternative.

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[10] While the profits of individual fishermen or entities may vary, fisheries economics is concerned primarily with the behavior, costs, and benefits of the fishery as a whole. Thus, while MEY may not represent the point at which all of the fishermen or fishing entities maximize their individual profits, it does represent the idealized point at which the fishery's profits are maximized.

3.6.4 Targets

The guidelines for National Standard 1 state that "target reference points, such as OY, should be set safely below limit reference points." There are two main types of target reference points: a target fishing mortality rate or other indication of fishing effort; and a target stock biomass. These targets provide goals for the management program rather than constraints as are established with the limit reference points.

In the Red Crab FMP, the limit reference points will be determined by the selection of an appropriate overfishing definition. The targets, on the other hand, are largely determined by the selection of an appropriate OY. The alternatives described above suggest four varied approaches for OY. Each of these, in turn, serves as an alternative target level of fishing effort.

Since we are currently unable to determine or estimate fishing mortality rates, a more direct approach such as monitoring of fishing effort is required. At a minimum, the Council will closely monitor landings of red crab as an indicator of relative fishing effort and a proxy for the actual fishing mortality rate. The target reference point for fishing effort will be a proxy for OY, as expressed in pounds of marketable red crabs landed by the directed red crab fishery.

In addition to a target for fishing effort (or, in this case, annual yield), we can also develop a target for stock biomass. Since all of the alternatives for OY (and subsequently the target levels of fishing effort as expressed in terms of annual yield) are set at or below MSY, a target biomass equal to B_{msy} would ensure a stock biomass capable of producing OY on a continuing basis. Thus, under all OY alternatives, the target biomass for the red crab stock will be B_{msy} (male-only) = 26.5 to 41.6 million pounds, depending on the accepted minimum size and the southern extent of the management unit.[11] Based on the factors described in Section 3.4, the target biomass consistent with the calculation of an MSY of 6.24 million pounds is B_{msy} = 41.6 million pounds.

3.7 Essential Fish Habitat

3.7.1 Background

3.7.1.1 Legal Authority and Mandate

The 1996 amendments to the Magnuson-Stevens Fishery Conservation and Management Act, known as the Sustainable Fisheries Act (SFA), expanded the focus of the Magnuson-Stevens Act by emphasizing the importance of habitat protection to healthy fisheries and by strengthening the ability of the National Marine Fisheries Service (NMFS) and the Councils to protect and conserve the habitat of marine, estuarine, and

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[11] Typically, for populations with logistic growth, B_{msy} is assumed to equal to ½ the virgin biomass, B_o. For red crab, based on the adjustments made to the results of the Wigley et al. (1975) survey, B_o (male-only) is estimated to be between 52.8 and 83.2 million pounds. Thus, B_{msy} (male-only) would be between 26.4 and 41.6 million pounds.

anadromous finfish, mollusks, and crustaceans. This habitat is termed "essential fish habitat" and is broadly defined to include "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity."

To improve fish habitat protection, the Magnuson-Stevens Act now requires the Councils, NMFS, and other federal agencies to take specific new actions. The Magnuson-Stevens Act now requires the Council, after receiving recommendations from NMFS, to complete the following for all new FMPs or FMP amendments:

EFH Designation Mandate [16 U.S.C. 1853 § 303]:

(a) Any fishery management plan which is prepared by any Council . . . shall --

(7) describe and identify essential fish habitat for the fishery based on the guidelines established by the Secretary, minimize to the extent practicable adverse effects on such habitat caused by fishing, and identify other actions to encourage the conservation and enhancement of such habitat;

The Magnuson-Stevens Act also now requires all Federal agencies (and other entities funded by Federal sources) engaging in activities that may adversely affect EFH to consult with NMFS regarding those activities. NMFS and the Councils may make suggestions on how to mitigate any potential habitat damage. Once these agencies receive NMFS' comments, they must respond in writing within 30 days, outlining the measures they are proposing to mitigate the impact of the activity on EFH. They must also explain any inconsistencies between the mitigation actions they propose with the recommendations made by NMFS. This is known as the "EFH Consultation Process" and is required and authorized under 16 U.S.C. 1853 § 305 and states:

EFH Consultation Mandate [16 U.S.C. 1853 § 305]:

(2) Each Federal agency shall consult with the Secretary with respect to any action authorized, funded, or undertaken, or proposed to be authorized, funded, or undertaken, by such agency that may adversely affect any essential fish habitat identified under this Act.

(3) Each Council --

(A) may comment on and make recommendations to the Secretary and any Federal or State agency concerning any activity authorized, funded, or undertaken, or proposed to be authorized, funded, or undertaken, by any Federal or State agency that, in the view of the Council, may affect the habitat, including essential fish habitat, of a fishery resource under its authority; and

(B) shall comment on and make recommendations to the Secretary and any Federal or State agency concerning such activity that, in the view of the Council, is likely to substantially affect the habitat, including essential fish habitat, of an anadromous fishery resource under its authority.

3.7.1.2 History

The Magnuson-Stevens Act required the Council to amend its existing FMPs to address the EFH provisions and submit these amendments to the Secretary of Commerce no later than October 11, 1998. To meet this requirement, the Council had to identify and describe essential fish habitat for 18 Council-managed species (sea scallops, monkfish, Atlantic herring, Atlantic salmon, and 14 species of groundfish), identify and, to the extent practicable, take action to minimize fishing-related adverse effects on EFH, identify and propose measures to conserve and enhance EFH, and identify habitat-related research and information needs.

The Council developed a single, stand-alone FMP amendment that addressed the EFH requirements of all 18 Council-managed species. This document, the "omnibus" EFH amendment, was submitted to NMFS on October 7, 1998. Following review by NMFS, the sea scallop, groundfish, and Atlantic salmon portions of the amendment were approved by the Secretary on March 3, 1999. The monkfish portions were approved on April 22, 1999. The portions of the amendment related specifically to Atlantic herring were approved with the Herring FMP. Amendment 12 to the Northeast Multispecies (Groundfish) FMP extended Council management to offshore hake, and included the required EFH designations and review for this species.

Since fishery management plans have been amended with EFH information, NMFS and the Councils are more proactive in protecting habitat areas by alerting other federal and state agencies about areas of concern, and urging them to avoid planning projects that might cause adverse impacts to EFH in these areas. When projects are planned that may adversely affect EFH, the Councils and NMFS can recommend conservation measures.

3.7.1.3 Definitions

The Magnuson-Stevens Act defines essential fish habitat as follows:

Definition of EFH: [16 U.S.C. 1802 § 3]
(10) The term "essential fish habitat" means those waters and substrate necessary to fish for spawning, breeding, feeding or growth to maturity.

For the purposes of interpreting this definition, "waters" includes aquatic areas and their associated physical, chemical, and biological properties that are used by fish, and may include aquatic areas historically used by fish where appropriate; "substrate" includes sediment, hard bottom, structures underlying the waters, and associated biological communities; "necessary" means the habitat required to support a sustainable fishery and the managed species' contribution to a healthy ecosystem; and "spawning, breeding, feeding, or growth to maturity" covers a species' full life cycle (67 FR 2343).

Fish habitat is where a species is found during some or all of its life. Fish habitat is used here both in the traditional sense where structure or substrate delineates its geographic boundaries (e.g., coral reefs, marshes, and kelp beds) and in the less conventional sense where boundaries are more fluid (e.g., turbidity zones, thermoclines, and fronts separating water masses). Historical fish habitat is the geographic area where a species was found at some point in time; this habitat may not be used now if the species distribution has changed or has been reduced, or access has been altered by man or natural events. Fish use habitat for spawning, breeding, migration, feeding and growth, and for shelter to reduce mortality. Most habitats provide only a subset of these functions. Fish habitat can change with life stage, abundance, the presence of other species, and with temporal and spatial variability in the environment. The type of habitat available, its attributes, and its functions are important to the productivity of a species.

3.7.1.4 Guidelines

On January 17, 2002, NMFS published the Final Rule (67 FR 2343) on essential fish habitat. This rule established guidelines to assist the Councils and the Secretary of Commerce in the implementation of the EFH provisions of the Magnuson-Stevens Act, including the description and identification of EFH in fishery management plans (FMPs), the identification of adverse impacts from both fishing and non-fishing activities on EFH, and identification of actions required to conserve and enhance EFH. The regulations also detailed procedures the Secretary (acting through NMFS), other Federal agencies, state agencies, and the Councils will use to coordinate, consult, or provide recommendations on Federal and state activities that may adversely affect EFH.

According to the NMFS EFH Guidelines, EFH must be designated according to the level of information available on the species distribution, abundance, and habitat-productivity relationships. The levels of information, as defined in the Final Rule, are:

- Level 1: Distribution data are available for some or all portions of the geographic range of the species. At this level, only distribution data are available to describe the geographic range of a species (or life stage). Distribution data may be derived from systematic presence/absence sampling and/or may include information on species and life stages collected opportunistically. In the event that distribution data are available only for portions of the geographic area occupied by a particular life stage of a species, habitat use can be inferred on the basis of distributions among habitats where the species has been found and on information about its habitat requirements and behavior. Habitat use may also be inferred, if appropriate, based on information on a similar species or another life stage.

- Level 2: Habitat-related densities of the species are available. At this level, quantitative data (i.e., density or relative abundance) are available for the habitats occupied by a species or life stage. Because the efficiency of sampling methods is often affected by habitat characteristics, strict quality assurance criteria should be used to ensure that density estimates are comparable among methods and habitats. Density data should reflect habitat utilization, and the degree that a habitat is utilized is assumed to be indicative of habitat value. When assessing habitat value on the basis of fish densities in this manner, temporal changes in habitat availability and utilization should be considered.

- Level 3: Growth, reproduction, or survival rates within habitats are available. At this level, data are available on habitat-related growth, reproduction, and/or survival by life stage. The habitats contributing the most to productivity should be those that support the highest growth, reproduction, and survival of the species (or life stage).

- Level 4: Production rates by habitat are available. At this level, data are available that directly relate the production rates of a species or life stage to habitat type, quantity, quality, and location. Essential habitats are those necessary to maintain fish production consistent with a sustainable fishery and the managed species' contribution to a healthy ecosystem.

3.7.2 Identification and Description of EFH for Red Crab

The regulatory text of the Final Rule (67 FR 2343) directs the Council to describe EFH in text that provides information on the biological requirements for each life history stage of the species. Tables are provided in individual species reports and summarize all available information on environmental and habitat variables that control or limit distribution, abundance, reproduction, growth, survival, and productivity of the managed species.

The regulatory text of the Final Rule also directs the Council to present the general distribution and geographic limits of EFH for each life history stage in the form of maps. These maps are presented as fixed in space and time, but they encompass all appropriate known temporal and spatial variability in the distribution of EFH. The EFH maps are a means to visually present the EFH described in the amendment.

There are two distinct but related components of the process to comply with the guidelines of the Final Rule: (1) developing the text description of essential fish habitat; and (2) identifying the geographic extent of essential fish habitat. Together, they provide a picture of the EFH for Council-managed species.

To support the Council, NMFS develops individual species reports for most species managed by the Council. These reports consist of literature reviews documenting the life history and habitat requirements of the species, as well as food habits information and distribution and abundance information by life history stage. The species report for deep-sea red crab was developed by NMFS and is provided in Appendix A. The information presented in the species report was used to develop the EFH text description.

The text descriptions of essential fish habitat define the environmental parameters within the areas represented by the map designations. NMFS regulations within the Final Rule require that the text description take precedence when the text and EFH maps differ. These text descriptions identify the habitat requirements for each species by life history stage. They include the general geographic area(s) preferred by the species, the preferred substrate (if demersal), and ideal ranges of water temperature, depth, and salinity (where known). The descriptions reflect the best available information on the species' habitat requirements collected from the scientific literature and observations made during research surveys. Because this species occurs only offshore in deep water, sources of information on inshore areas (e.g., NOAA's Estuarine Living Marine Resources Program reports) were not considered.

There are two parts to every EFH designation. The first part of the EFH designation for each species includes a text-based description of the habitat characteristics considered essential for that species at each major life history stage. The text descriptions include physical as well as oceanographic parameters. The second part of the EFH designation for each species includes a set of maps indicating the geographical extent of the EFH designation and the range of the species. A unique map is created for each major life history stage. The intent of the two-part EFH designation is for the map to indicate the geographical extent within which the text description applies. Thus, if the map indicates that eastern Georges Bank was EFH for a particular species and the text description indicates that sandy habitats within a depth range of 50 - 100 meters was EFH, then only those portions of eastern Georges Bank that met the physical characteristics would actually be considered EFH.

3.7.3 EFH Designation Methodology

The Council considered a range of alternatives for methods and approaches that could be adopted to identify and describe essential fish habitat for deep-sea red crab. The alternatives presented offer options for how best to determine the areal extent within which the EFH Text Description would apply.

3.7.3.1 Preferred EFH Designation Methodology Alternative

The general distribution of this species has been suggested as tightly correlated to depth along the U.S. continental slope (Wigley et al. 1975; Steimle et al. 2001). Members of the fishing industry report using depth as the primary indicator for where to fish for red crabs (J. Williams, personal communication). There are several scientific papers which discuss and identify depth ranges used by this species both as adults and as juveniles (Wigley et al. 1975; Steimle et al. 2001). Thus, it may be appropriate to use the known depth range affinities of this species as indicators of the extent of essential fish habitat.

For example, in Steimle et al. (2001), the full depth range for juvenile red crabs is indicated as 700 - 1800 meters and the full depth range for adult red crabs is indicated as 200 - 1300 meters. Wigley et al. (1975) support these ranges but also indicate that adults are most abundant between 320 - 914 meters. The full range of the species would be represented by the union of the juvenile and adult depth ranges, or 200 - 1800 meters. The maps in Figure 18 - Figure 21 reflect these depth ranges.

For most life stages, there are at least two options for an appropriate depth range for the EFH designation. For example, juvenile EFH could be designated based on the full depth range occupied by the species, or it could be based on the known depth range for juveniles. Adult EFH could be designated based on the full depth range occupied by the species, the full known depth range for adults, or a more narrow depth band known to contain much higher concentrations of red crab adults. It is a little more complicated for eggs and larvae. Eggs remain attached to adult female red crabs for the duration of this life stage, so there may be no need to designate EFH for red crab eggs. Larvae are the only pelagic life stage for this species, and very little is known about their movement, behavior, and range.

Red crab larvae may cover great distances while pelagic, settling by chance in suitable habitat or they may remain resident in the general area and settle out quickly once they reach the appropriate depths. Because so little is known about this life stage, it is difficult to precisely delineate the essential fish habitat for red crab larvae. In similar situations with other species for which there was very little or no information available on the egg and/or larval life stages, the Council assumed that the union of the adult and the juvenile ranges would serve as an acceptable proxy for the unknown life stage(s). The same can be done for red crab, using the depth range of 200 - 1800 meters as a proxy for the range of optimal larval habitat.

3.7.3.2 Non-Preferred EFH Designation Alternatives

a. Non-Preferred Alternative 1 -- No EFH Designation

Considered the "no action" alternative, this approach would result in there being no EFH designated for red crab. According to the 1996 amendments to the Magnuson-Stevens Act, however, the Regional Fishery Management Councils are mandated to designate EFH for each species managed under an FMP. Thus, this alternative would not be in compliance with the Magnuson-Stevens Act. According to the National Environmental Policy Act (NEPA), the full range of alternatives considered in a proposed action should include the no action alternative. Consideration of this alternative fulfills the requirements and intentions of NEPA. Because selection of this alternative would result in the Red Crab FMP being out of compliance with the Magnuson-Stevens Act, this alternative is not suitable for selection. There would be no EFH Text Description for this alternative.

b. Non-Preferred Alternative 2 -- NMFS Survey Data

In the Council's previous EFH designations (NEFMC 1998), the areal extent of the EFH designations, as reflected in the EFH maps, were based upon an index of catch-per-unit-effort (CPUE) data resulting from the NMFS' Bottom Trawl and MARMAP Ichthyoplankton surveys. All survey catches, on a per tow basis, were binned and averaged for each ten minute square of latitude and longitude. The averaged catch-per-tow data were then ranked from highest average catch-per-tow (per ten minute square) to lowest positive average catch-per-tow. Starting with the ten minute square with the highest average catch-per-tow, the averages for each ten minute square were summed and the cumulative percentage of the total average catch-per-tow was calculated.

The ten minute squares were then categorized, using the cumulative percentages, into 50%, 75%, 90% and 100% groups. The 50% category represented the top two quartiles of ten minute squares, the 75% category the top three quartiles, the 90% the top nine deciles and the 100% category represented the full geographic range of the species within the survey. Because these categories reflect an index of catch, not area, the areal percentage of the range of the species is always less. For example, the 50% category of ten minute square includes the top two quartiles of catches and because the species is therefore more abundant (or concentrated) in these ten minute squares, there will be fewer ten minute squares in this category than in the bottom two quartiles. Thus, the 50%

category might only represent 25-30% of the overall range of the species. The percentages selected as the basis for the EFH designation were determined on a species by species basis.

This approach was developed based on the available data (from the NMFS surveys) and is consistent with the regulations and technical guidance developed by NMFS on how to designate EFH based on the level of information available. NMFS described four levels of information to be used, from basic presence/absence data (Level 1) to habitat-specific production data (Level 4). The availability of relative abundance data from the NMFS surveys provided what were considered Level 2 data for most species managed by the New England Council. As such, the regulations and technical guidance indicated use of relative abundance data to differentiate areas with relatively greater abundance of a species as EFH in contrast to areas with relatively lower abundance. Ecologically, it follows that one can infer that areas of relatively high abundance or density are indicative of more suitable habitats. Research has demonstrated that as populations decline, their range contracts and they focus in on areas of best suited habitat.

The EFH designations included in the omnibus EFH Amendment also utilized a variety of other information considered important in the identification and description of EFH. Because the NMFS surveys focus on offshore waters, several sources of information were needed to identify important areas in inshore areas. One such source of information was the Massachusetts Inshore Trawl Survey. Data from the Connecticut Long Island Sound Survey were also used in some cases. The NOAA Estuarine Living Marine Resources Program (ELMR) provided information on the presence/absence of many Council-managed species in a number of estuaries and embayments along the coast of New England and the Mid-Atlantic. Historical information was also used in some cases, as was information provided by members of the fishing industry.

Unlike most other species managed by the New England Council, red crabs are sampled in the NMFS surveys only rarely (Steimle et al. 2001). The survey only extends to 366 meters in depths (Reid et al. 1999), but the species is known to occur out to 1800 meters, with highest densities occurring between 320 and 910 meters in depth (Wigley et al. 1975). Although some red crabs are caught in the survey (Steimle et al. 2001), they are very few in numbers and probably only represent the shallow fringe of their population. Due to the deep-water nature of the species, red crabs are not captured in any of the nearshore surveys, such as the Massachusetts Inshore Trawl Survey or the Connecticut Long Island Sound Survey, nor are they included in the NOAA ELMR information. The survey data, therefore, provide an insufficient basis to accurately designate EFH in the traditional method (for the New England Council). This option is presented for consideration primarily as a basis for comparison with other alternatives that may provide a more robust approach to accurately represent the marine areas important to this species.

c. Non-Preferred Alternative 3 -- Depth Zones plus Sediment Affinities

A slight variation of the previous alternative would be to incorporate any known sediment type affinities of red crabs into the delineation of essential fish habitat for this species. In addition to mapping the depth zones used by this species, we could overlay the depth zones with sediment maps (Poppe et al. 1989) to further delineate EFH based on habitat descriptions for this species available in the literature. Wigley et al. (1975) and Steimle et al. (2001) both describe some of the primary sediment types in which red crabs appear to occur most frequently.

There are some limitations and weaknesses with this approach, as it assumes that the sediment basemap used to determine areas of EFH is complete and accurate. The best available source of information on the distribution of surficial sediments at the scale appropriate for this task is the map generated by Poppe et al. (1989). This map characterizes the sediment types for the Gulf of Maine, Georges Bank, southern New England shelf, and the Mid-Atlantic Bight, including much of the associated continental slope. Even so, the distribution of sediment types is poorly known and is not adequate for designating EFH in many areas of the Gulf of Maine and southern New England shelf. EFH designated on our current knowledge of sediment distribution would be unreliable and subject to missing many important areas of habitat. Also, this approach may be somewhat redundant with the approach already employed, which is to use the map designations as the areal extent within which the EFH text descriptions apply. If the text descriptions specify the sediment types utilized most often by the species (as they do in all cases where possible), then the combination of the text description and the map designation already includes this sediment-based provision.

d. <u>Non-Preferred Alternative 4</u> -- EFH is Everywhere

At the other end of the extreme from Alternative 1, this alternative would result in all waters from the shoreline to the EEZ designated as EFH for this species, whether red crabs occur in all areas or not. This alternative would indicate the most broad EFH designations possible. If all waters out to the EEZ are EFH for this species, then there is no possibility that the EFH designation would miss any important areas (within U.S. waters). However, this approach is not consistent with the intentions of the Magnuson-Stevens Act, which suggests that EFH should be a subset of all habitat available to a species. The NMFS regulations and technical guidance specify that EFH should be designated within the full range of each species. This approach would actually go beyond this intention and include areas outside of the species' range as EFH.

3.7.4 EFH Text Description and Maps of EFH

3.7.4.1 <u>EFH Text Description</u>

In its *Report to Congress: Status of the Fisheries of the United States* (January 2001), NMFS reported that the status of the resource is currently unknown. EFH for red crab includes those areas of the offshore waters (out to the offshore U.S. boundary of the exclusive economic zone) that are identified on the following figures and described by the following conditions. The text description refers to the maps of the preferred options for EFH designation for each life history stage. If the Council's preferred options change, the EFH text description will be modified to reflect these changes.

Eggs: Red crab eggs are brooded attached to the underside of the female crab until they hatch into larvae and are released into the water column. Egg-bearing females are most commonly found on the shallow continental slope between 200 and 400 meters, where temperatures are typically between 4 - 10° C. The EFH designation for red crab eggs will be the same as the known distribution of egg-bearing females (200 - 400 meters) along the southern flank of Georges Bank and south to Cape Hatteras, North Carolina, as depicted in Figure 5.

Larvae: Essential fish habitat for red crab larvae is described as the water column from the surface to the seafloor across the entire depth range identified for the species, 200 - 1800 meters along the southern flank of Georges Bank and south to Cape Hatteras, North Carolina, as depicted in Figure 6. Generally, the following conditions exist where red crab larvae are most commonly observed: water temperatures between 4 and 25° C, salinities between 29 and 36‰, and dissolved oxygen between 5 and 8 ml/l. Red crab larvae appear to be most common during January through June.

Juveniles: Bottom habitats of the continental slope with a substrate of silts, clays, and all silt-clay-sand composites within the depths of 700 to 1800 meters along the southern flank of Georges Bank and south to Cape Hatteras, North Carolina, as depicted in Figure 7. Generally, the following conditions exist where red crab juveniles are most commonly observed: water temperatures between 4 and 10° C, salinities of approximately 35‰, and dissolved oxygen between 3 and 7 ml/l.

Adults: Bottom habitats of the continental slope with a substrate of silts, clays, and all silt-clay-sand composites within the depths of 200 to 1300 meters along the southern flank of Georges Bank and south to Cape Hatteras, North Carolina, as depicted in Figure 8. Generally, the following conditions exist where red crab adults are most commonly observed: water temperatures between 5 and 14° C, salinities of approximately 35‰, and dissolved oxygen between 3 and 8 ml/l.

Spawning Adults: Bottom habitats of the continental slope with a substrate of silts, clays, and all silt-clay-sand composites within the depths of 200 to 1300 meters along the southern flank of Georges Bank and south to Cape Hatteras, North Carolina, as depicted in Figure 8. Generally, the following conditions exist where red crab adults are most commonly observed: water temperatures between 4 and 12° C, salinities of approximately 35‰, and dissolved oxygen between 3 and 8 ml/l.

A table presenting summary information on the habitat affinities and requirements for each life history stage of red crab is provided in Appendix A, the EFH Source Document. There is no information on the existence or occurrence of deep-sea red crab in any bays or estuaries of the northeastern U.S. The Council acknowledges that there may be potential seasonal and spatial variability of the environmental conditions generally associated with this species.

3.7.4.2 Maps of EFH Designation Options

The following set of maps (Figure 5 - Figure 8) represents the mapping components of the EFH designations for each major life history stage (eggs, larvae, juveniles, and adults) of red crab. Although deep-sea red crabs occur elsewhere in the ocean (in the Gulf of Maine, on the Canadian side of the Hague Line, and south of Cape Hatteras, North Carolina), these areas are not proposed as EFH for red crabs. The abundance of red crabs in the Gulf of Maine is not considered high enough to support a fishery and all of the current and historic fishing effort has been located along the continental slope from the southern side of Georges Bank south to Norfolk Canyon. The EFH regulations require that EFH be designated only in U.S. waters, so while there may be important red crab habitat along the southern flank of Georges Bank on the Canadian side of the Hague Line, this area will not be considered for EFH designation. Also, EFH for this species will not be designated outside the boundary of the management unit, Cape Hatteras, North Carolina. Following the four maps identifying EFH for the four major life stages, there are several maps representing the non-preferred options considered by the Council (Figure 9 - Figure 13).

Essential Fish Habitat
Egg Life Stage

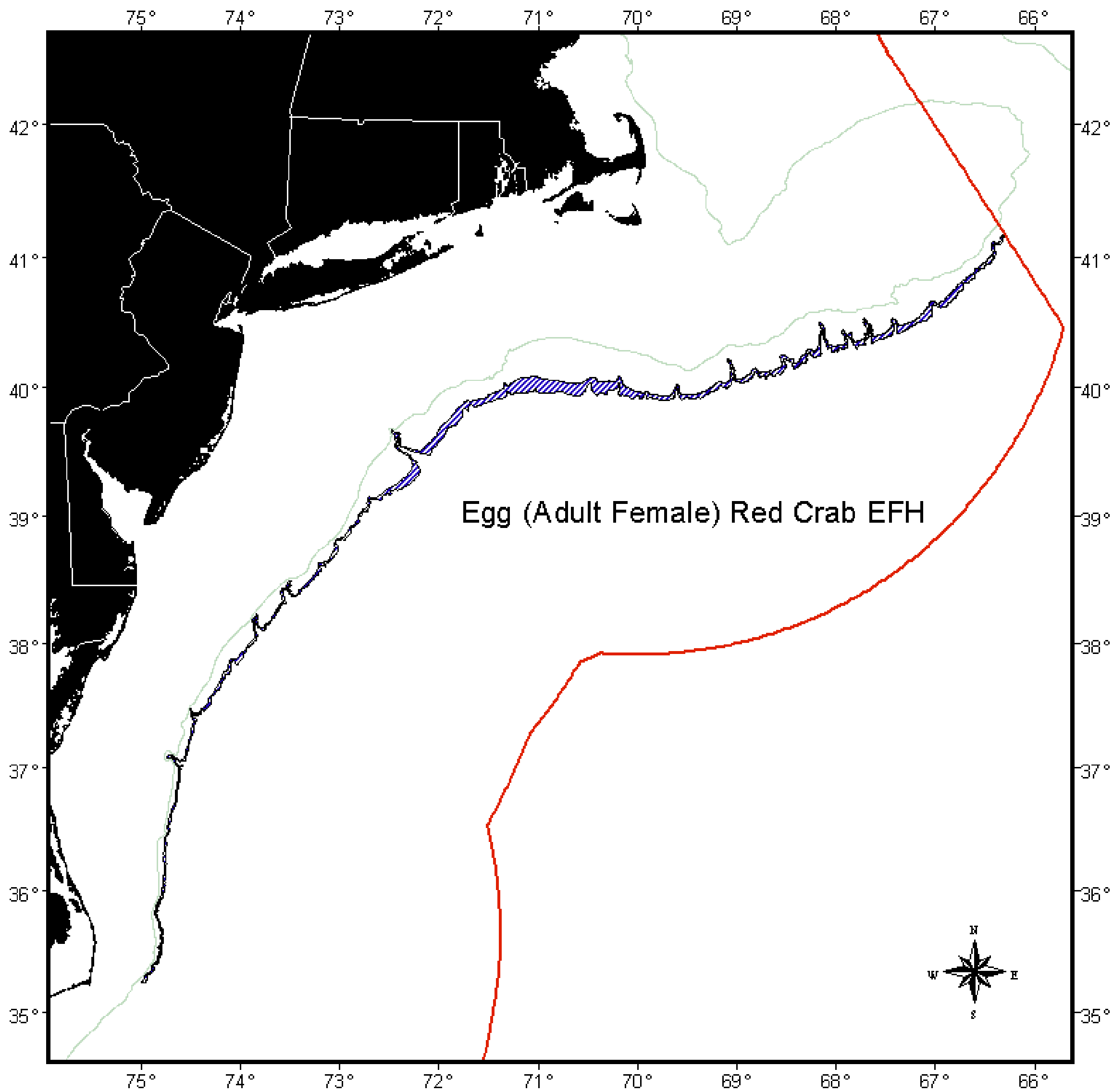

Figure 5: Egg life stage EFH. This map represents the designation of EFH for this life history stage based on known depth zone affinities. This delineates the potential EFH for red crab eggs based on the preferred depth range of adult females (Steimle et al. 2001). This is distinct from the EFH designation for red crab adults, which is much broader to reflect the inclusion of adult males.

Essential Fish Habitat
Larvae Life Stage

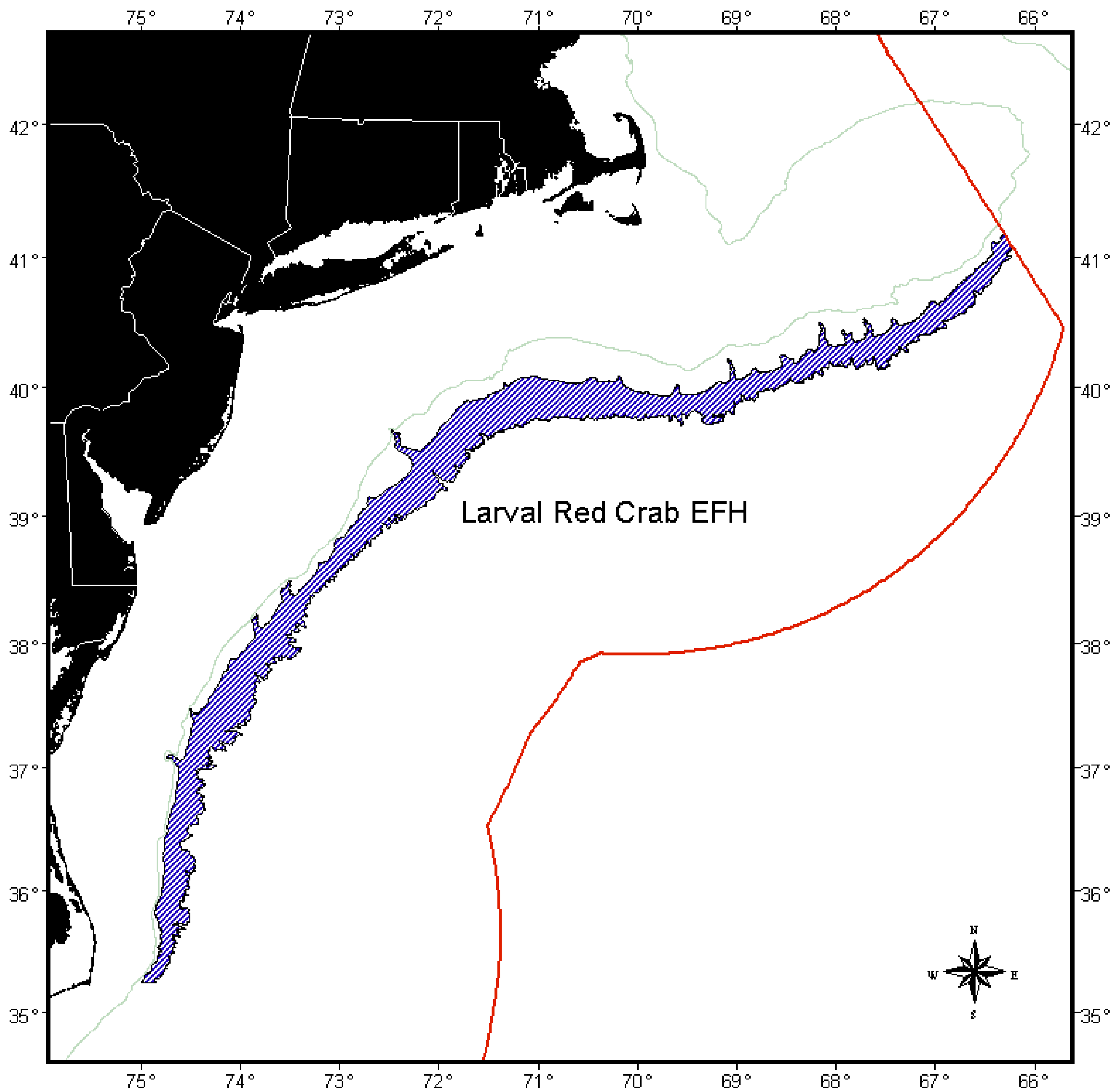

Figure 6: Larval life stage EFH. This map represents the designation of EFH for this life history stage based on known depth zone affinities. This provides the broadest possible delineation based on known depth ranges by utilizing the union of the full adult and juvenile depth ranges, 200 - 1800 meters (Steimle et al. 2001). The union of the juvenile and adult depth ranges is meant to serve as a proxy for the actual range of red crab larvae, which is unknown. This map represents the total area within the preferred depth range for adults and juveniles of this species and thus representative of the area of the water column where red crab larvae are most likely to be found.

Essential Fish Habitat
Juvenile Life Stage

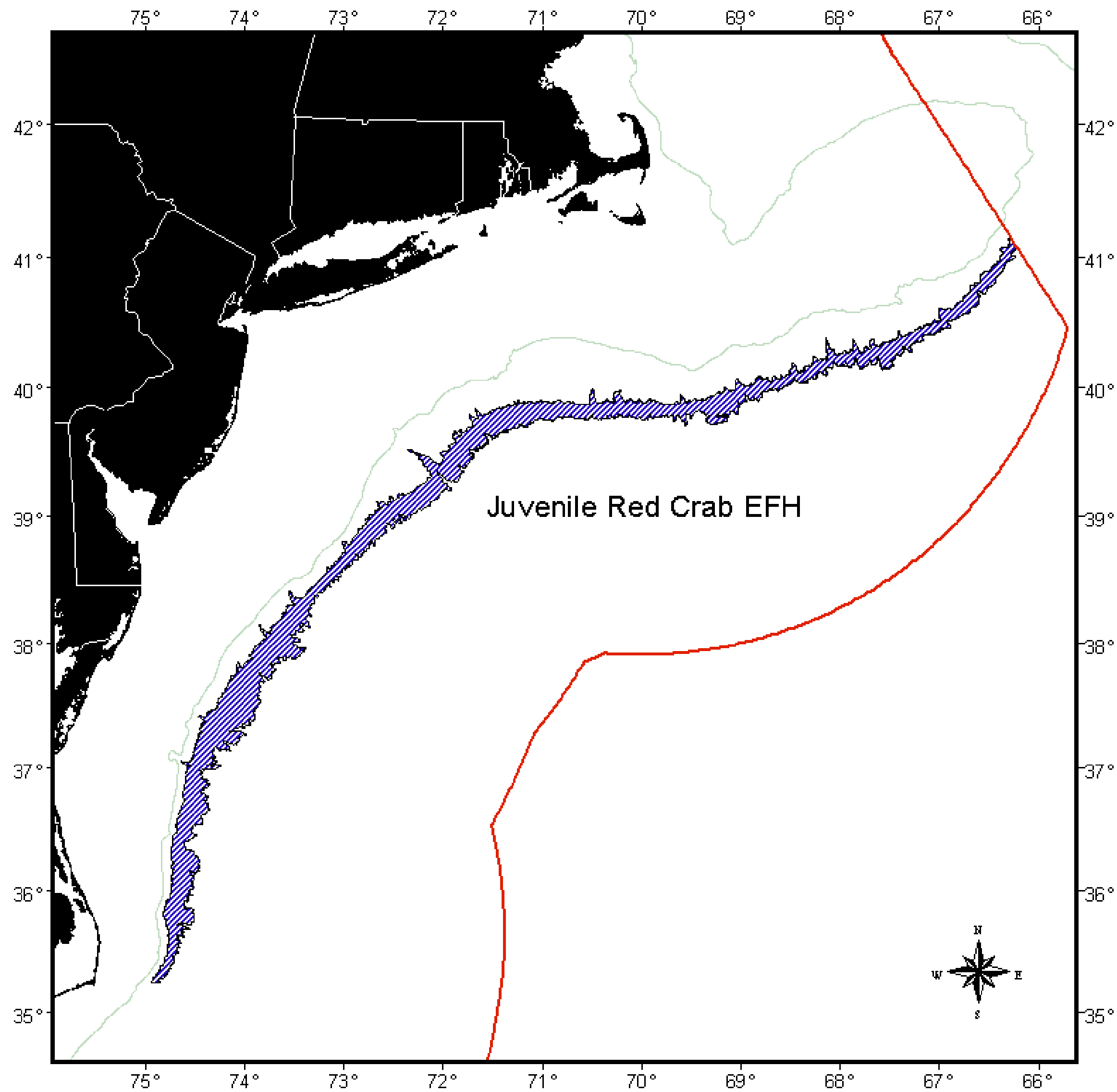

Figure 7: Juvenile life stage EFH. This map represents the designation of EFH for this life history stage based on known depth zone affinities. This includes the total area known to be within the preferred depth range for juveniles of this species. The depth range presented is 700 - 1800 meters (Steimle et al. 2001).

Essential Fish Habitat
Adult Life Stage

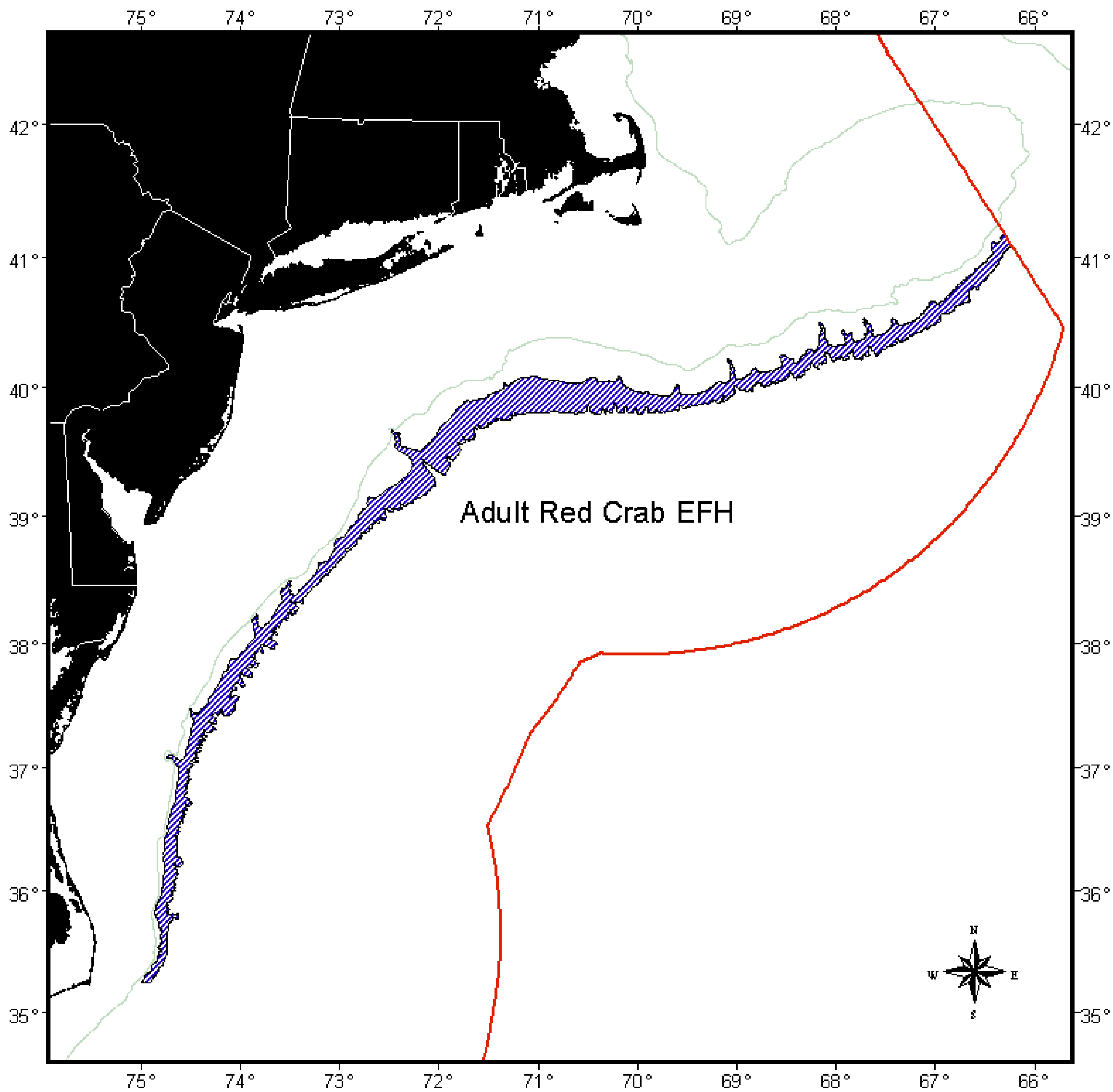

Figure 8: Adult life stage EFH. This map represents the designation of EFH for this life history stage based on known depth zone affinities. This includes the total area known to be within the preferred depth range for adults of this species. The depth range presented is 200 - 1300 meters (Steimle et al. 2001).

Essential Fish Habitat
Egg Life Stage
Non-Preferred Option 1

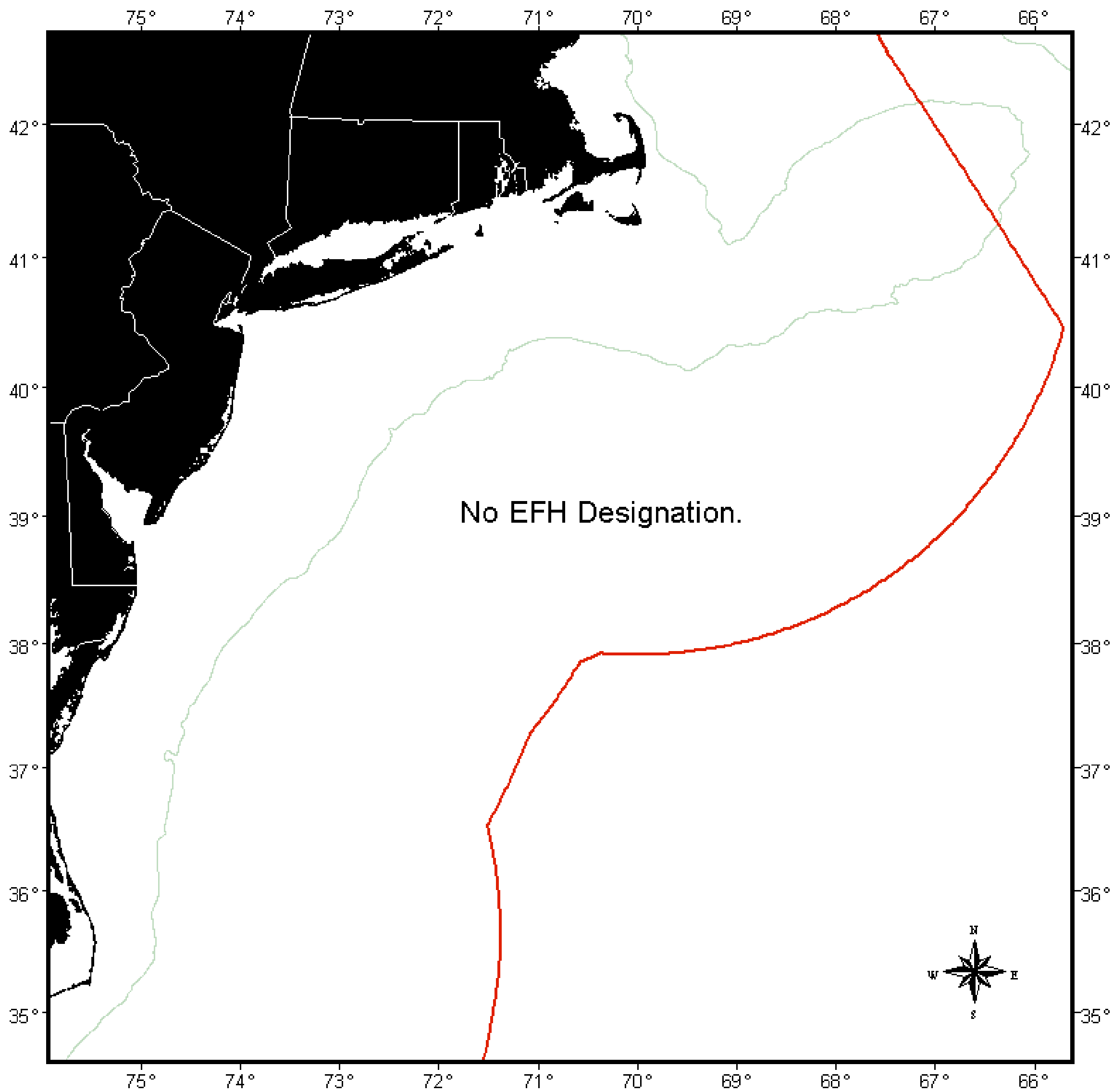

Figure 9: Egg life stage EFH option 1. This map represents an option for the designation of EFH for this life history stage based on known depth zone affinities. This option is actually to have no EFH designation for this life stage of the species, due to the fact that the eggs are not independent of the adult females. Since EFH for adults is determined separately, a distinct EFH designation for eggs may be redundant and unnecessary.

Essential Fish Habitat
Egg Life Stage
Non-Preferred Option 2

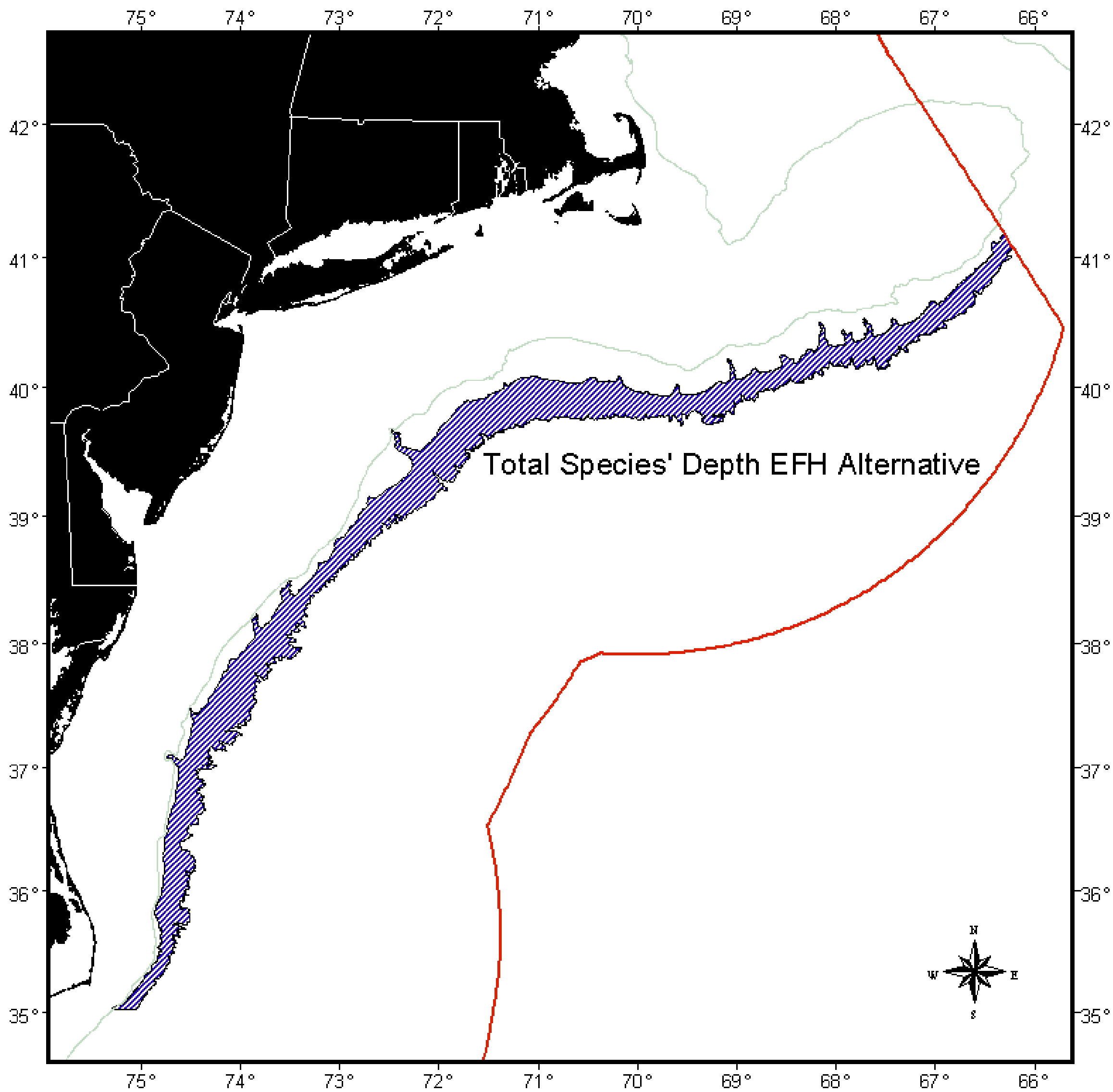

Figure 10: Egg life stage EFH option 2. This map represents an option for the designation of EFH for this life history stage based on known depth zone affinities. This option provides the broadest possible delineation based on known depth ranges by utilizing the union of the full adult and juvenile depth ranges, 200 - 1800 meters (Steimle et al. 2001).

Essential Fish Habitat
Juvenile Life Stage
Non-Preferred Option 1

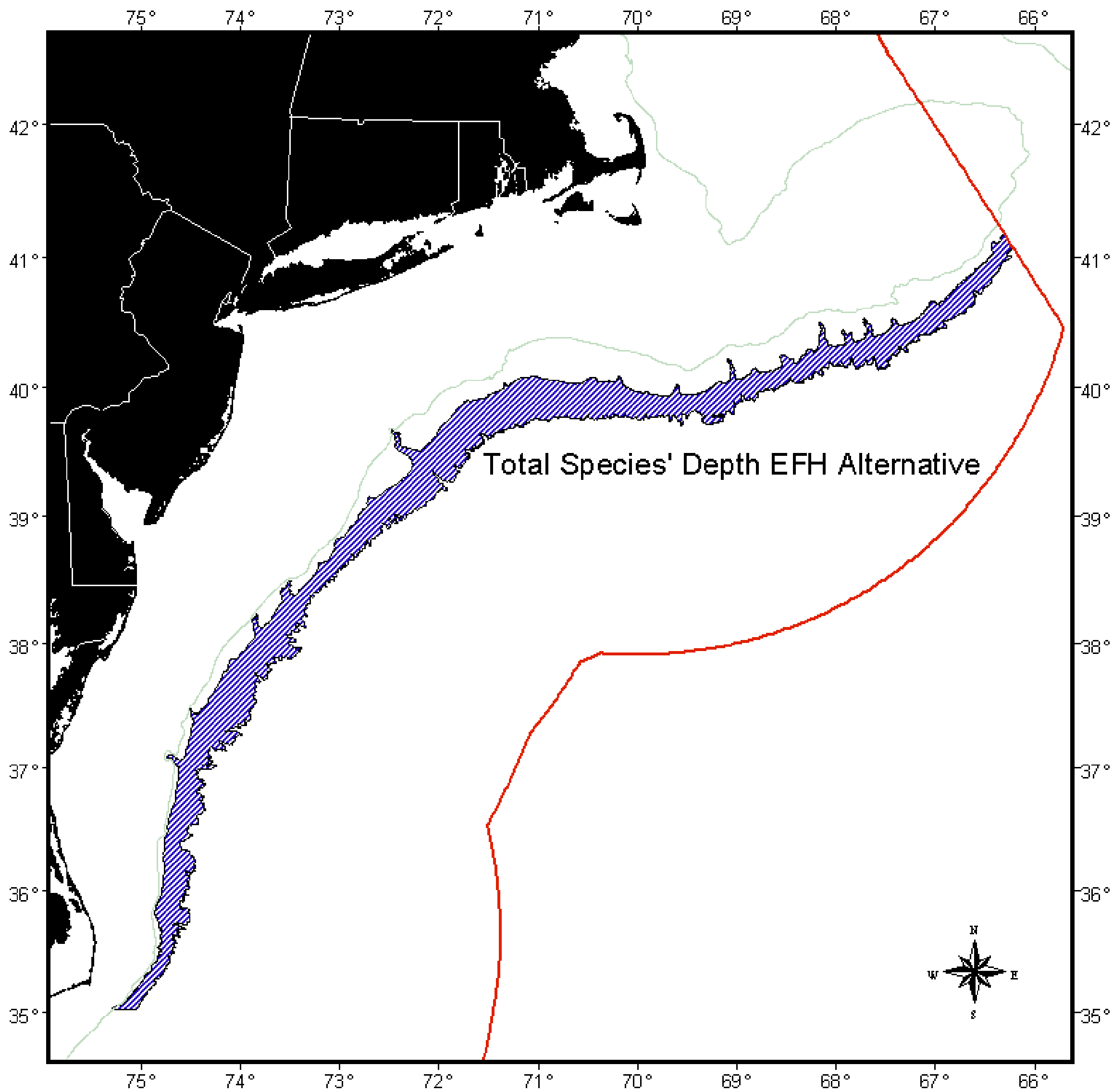

Figure 11: Juvenile life stage EFH option 1. This map represents an option for the designation of EFH for this life history stage based on known depth zone affinities. This option provides the broadest possible delineation based on known depth ranges by utilizing the union of the full adult and juvenile depth ranges, 200 - 1800 meters (Steimle et al. 2001).

Essential Fish Habitat
Adult Life Stage
Non-Preferred Option 1

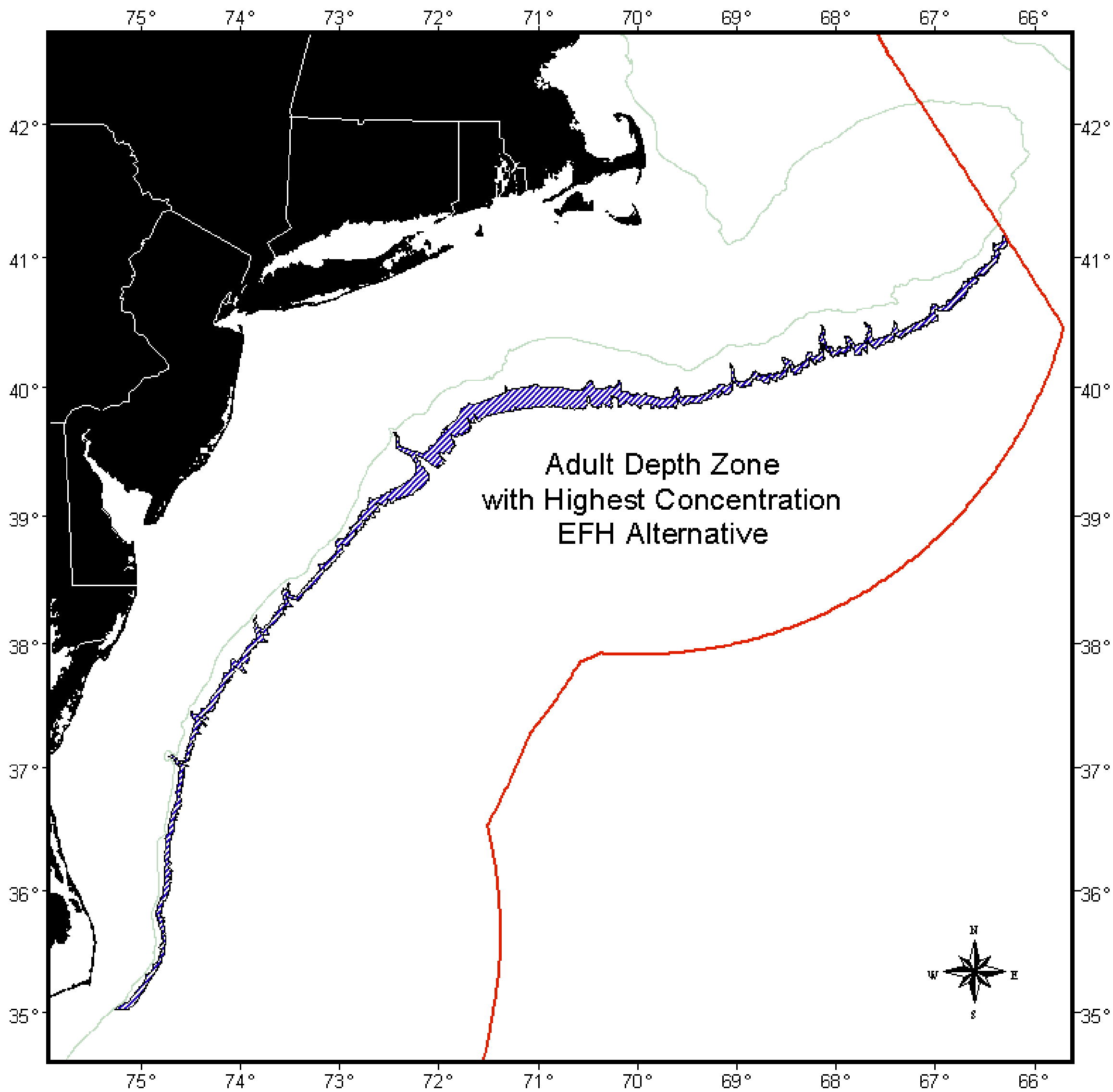

Figure 12: Adult life stage EFH option 1. This map represents an option for the designation of EFH for this life history stage based on known depth zone affinities. This option includes the total area known to be within the depth range containing the highest concentrations of adults of this species. The depth range presented is 320 - 914 meters (Wigley et al. 1975).

Essential Fish Habitat
Adult Life Stage
Non-Preferred Option 2

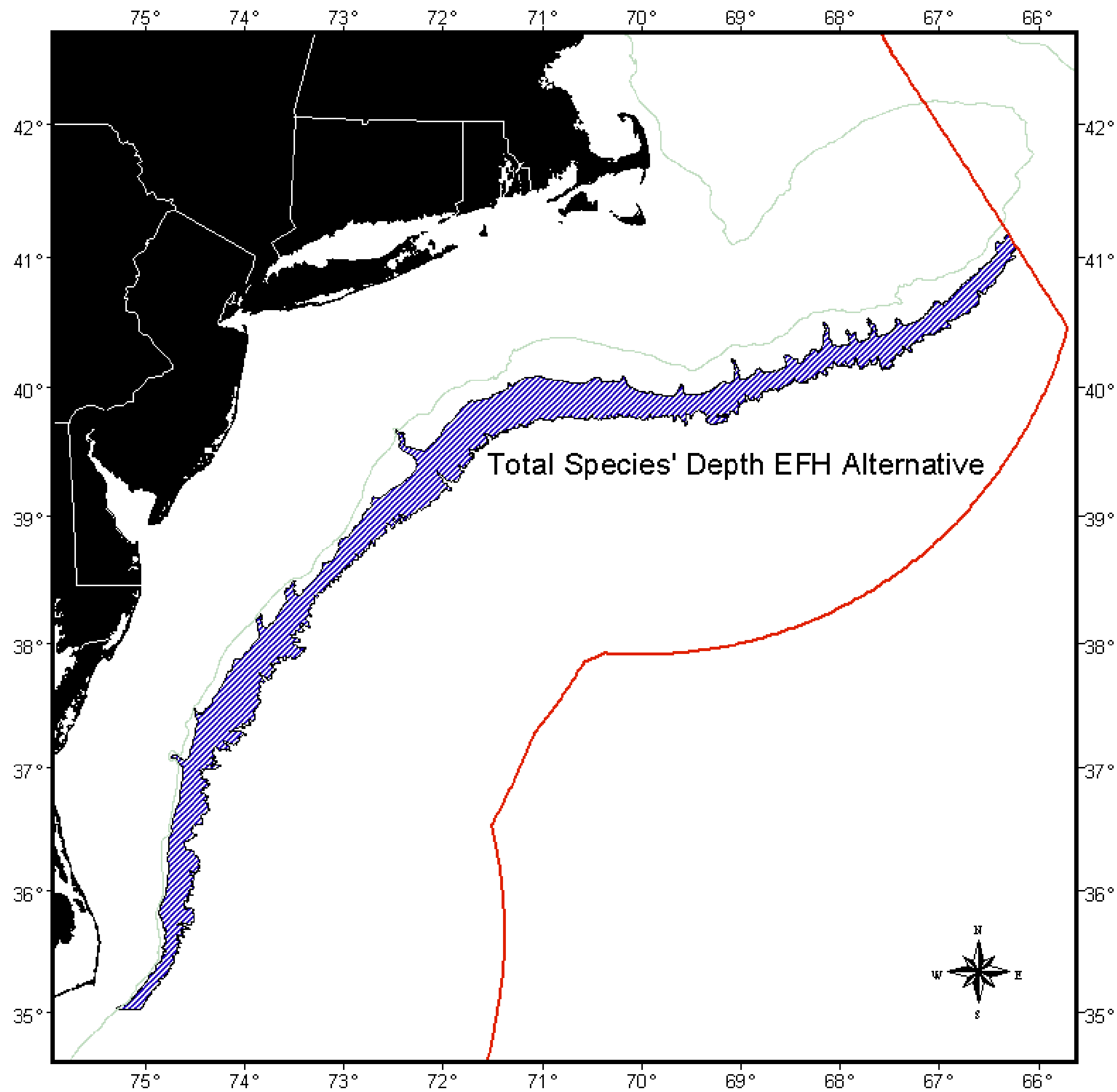

Figure 13: Adult life stage EFH option 2. This map represents an option for the designation of EFH for this life history stage based on known depth zone affinities. This option provides the broadest possible delineation based on known depth ranges by utilizing the union of the full adult and juvenile depth ranges, 200 - 1800 meters (Steimle et al. 2001).

3.7.5 Habitat Areas of Particular Concern

According to the language of the NMFS EFH Final Rule (67 FR 2343), EFH that is judged to be particularly important to the long-term productivity of populations of one or more managed species, to be particularly vulnerable to degradation, or to be particularly rare should be identified as a "habitat area of particular concern" (HAPC) to help provide additional focus for conservation efforts. The rule provides the four basic criteria for consideration of an area for HAPC designation. The four criteria are:

(1) the importance of the ecological function provided by the habitat;

(2) the extent to which the habitat is sensitive to human-induced environmental degradation;

(3) whether, and to what extent, development activities are, or will be, stressing the habitat type; and

(4) the rarity of the habitat type.

The Final Rule also specifies that habitats that are particularly vulnerable to specific fishing equipment types should be identified for possible designation as habitat areas of particular concern. The intent of the HAPC designation is to identify those areas that are known to be important to species which are in need of additional levels of protection from adverse impacts (fishing or non-fishing). Designation of habitat areas of particular concern is intended to determine what areas within EFH should receive more of the Council's and NMFS' attention when providing comments on federal and state actions, and in establishing higher standards to protect and/or restore such habitat.

For the purposes of the Council's HAPC designation process, the criteria identified by NMFS in the EFH Final Rule are considered to be defined as follows:

Importance of *Historic* Ecological Function - The area or habitat feature proposed for HAPC designation at one time provided an important ecological function to a currently managed species, but no longer provides that function due to some form of degradation. An important ecological function could include, but is not limited to, protection from predation, increased food supply, appropriate spawning sites, egg beds, etc. The importance of the ecological function should be documented in scientific literature and based on either field studies, laboratory experiments, or a combination of the two.

Importance of *Current* Ecological Function - The area or habitat feature proposed for HAPC designation currently provides an important ecological function to a managed species. An important ecological function could include, but is not limited to, protection from predation, increased food supply, appropriate spawning sites, egg beds, etc. The importance of the ecological function should be documented in scientific literature and based on either field studies, laboratory experiments, or a combination of the two.

Sensitivity to Anthropogenic Stresses – The area or habitat feature proposed for HAPC designation is particularly sensitive (either in absolute terms or relative to other areas and/or habitat features used by the target species) to the adverse effects associated with anthropogenic activities. These activities may be fishing or non-fishing related. The stress or activity must be a recognizable threat to the area of the proposed HAPC.

Extent of Current or Future Development Stresses – The area or habitat feature proposed for HAPC designation faces either an existing and on-going development-related threat or a planned or foreseeable development-related threat. Development-related threats may result from, but are not limited to, activities such as sand mining for beach nourishment, gravel mining for construction or other purposes, the filling of wetlands, salt marsh, or tidal pools, shoreline alteration, channel dredging (but not including routine maintenance dredging), dock construction, marina construction, etc.

Rarity of the Habitat Type – The habitat feature proposed for HAPC designation is considered "rare" either at the scale of the New England region or at the scale of the range of at least one life history stage of one or more Council-managed species. A "rare" habitat feature is that which is considered to occur infrequently, is uncommon, unusual, or highly valued owing to its uniqueness. Keep in mind that the term "rare" usually implies unusual quality and value enhanced by permanent infrequency. We may usually think of rare habitats or features as those that are spatially or temporally very limited in extent, but it could also be applied to a unique combination of common features that occur only in a very few places.

The Council has reviewed the available information on deep-sea red crabs and their habitat (see Section 8.2 and Appendix A), and is not proposing any HAPCs for red crab at this time. The current information suggests no areas or habitat types identified as EFH for red crab that meet any of the above criteria specified for the consideration of an HAPC. If new or additional information on red crabs and their habitat is obtained by the Council that indicates there are specific areas or habitat types designated as EFH for red crab that meet one or more of the above HAPC criteria, the Council would consider designating an HAPC at the appropriate time.

The Council has developed a formal process for the solicitation, preparation, review and designation of potential HAPCs based on the best available information. This process is described in the Council's 2000 Habitat Annual Review Report (NEFMC 2000b). This process will apply to the future consideration of HAPCs for deep-sea red crab.

3.7.6 EFH Assessment

This EFH Assessment is provided pursuant to 50 CFR 600.920.

3.7.6.1 Description of the Proposed Action

See Section 4.2 for a description of the proposed action, to implement management measures for the deep-sea red crab fishery. The activity managed by this proposed action, fishing for deep-sea red crab, occurs in a limited area and narrow depth band along the continental slope of the United States, from the southern flank of Georges Bank south to Cape Hatteras, North Carolina, in depths between 400 and 800 meters (see Figure 23). The range of this activity occurs across the designated EFH of eleven species managed by the New England, Mid-Atlantic, and South Atlantic Fishery Management Councils. These species are identified in Table 11. Managed species not listed in Table 11 either do not have EFH designated within the area of the red crab fishery (e.g., Atlantic herring eggs) or are not demersal species (e.g., Atlantic herring juveniles and adults, bluefish, Atlantic billfish) and would not be expected to be impacted by this activity. Please refer to the New England Council's Omnibus EFH Amendment, the Summer Flounder, Scup and Black Sea Bass FMP, the Tilefish FMP, and the Golden Crab FMP for relevant information on the characteristics and distribution of EFH designated for these species. EFH designated for species managed under the Secretarial Highly Migratory Species FMPs is not affected by this action, nor is EFH designated for any other species managed by the South Atlantic Council as all of the relevant species are pelagic and not directly affected by benthic habitat impacts.

Species	Council
Monkfish	New England
Offshore Hake	New England
Red Hake	New England
Redfish	New England
White Hake	New England
Whiting	New England
Witch Flounder	New England
Black Sea Bass	Mid-Atlantic
Scup	Mid-Atlantic
Tilefish	Mid-Atlantic
Golden Crab	South Atlantic

Table 11: List of demersal species for which EFH is designated in the area of the red crab fishery.

3.7.6.2 Analysis of the Effects of the Proposed Action

The most likely result of this proposed action is to decrease the level of red crab fishing occurring in the U.S. EEZ to below current levels, or at least below the levels of red crab fishing that (a) were occurring prior to the implementation of the emergency regulations; and (b) would occur in the absence of this management plan. This action is expected to limit the capacity of the red crab fishery and prevent expansion of the fishery above levels that existed prior to March of 2000. This action prohibits the use of any type of fishing gear other than a red crab trap/pot in the directed fishery, including otter trawls and dredges, and limits all vessels in the directed fishery to no more than 600 traps/pots. This action does not propose to alter where fishing for red crab is prosecuted. The allowable fishing gear utilized to harvest red crab in the directed fishery has not been shown to have an adverse impact to the EFH of any species (see Section 8.2.3). Due to the size of this fishery (a very small fishery with only five vessels expected to qualify for the controlled access directed fishery), the limited amount of gear allowed for each vessel (600 pots per vessel), the prohibition on other gear types and the prevention of an expansion of fishing effort, this action is not expected to contribute impacts to the EFH of any managed species. Potential impacts to EFH associated with this fishery would be expected to decrease as a result of this action based on the overall controls on the fishery, the trap/pot limit, the non-trap/pot gear prohibition, and the controlled access program which will limit the number of participants.

3.7.6.3 Conclusions

The red crab fishery has been determined to have no identifiable adverse effects on EFH, therefore no specific management alternatives for minimizing the adverse effects of fishing are necessary. Several management measures intended to serve multiple purposes (resource conservation, effort control, etc.) also provide direct benefits to habitat. These measures include trap limits (Section 4.2.5), controlled access (Section 4.2.9), and a prohibition on non-trap gear (Section 4.2.6).

The action proposed under this Fishery Management Plan should have at most a minimal adverse effect on the EFH of species managed by the New England, Mid-Atlantic or South Atlantic Fishery Management Councils (although no adverse impacts are expected). This FMP minimizes to the extent practicable adverse effects on EFH caused by fishing pursuant to 50 CFR Part 600.815(a)(2)(ii). Because there are less than substantial adverse impacts associated with this action, an abbreviated consultation should be all that is required.

3.7.6.4 Proposed Mitigation

A description of the alternatives considered but not selected by the Council is provided in Section 4.0. No further mitigation is practicable or necessary.

3.8 Permits and Reporting and Record-Keeping Requirements

Prior to the implementation of the emergency regulations on May 18, 2001, there was no requirement for any type of permit in order to fish for deep-sea red crab in the U.S. EEZ. In order to control and track the fishing effort for red crabs within the Council's management area, federal permits will be required for all vessels, operators and dealers engaged in any aspect of the red crab fishery.

Throughout the development of the FMP, the Council stressed the need for the collection of information on the red crab fishery, including fishery-dependent data on harvests and landings of red crabs. The FMP therefore includes several requirements for record-keeping and reporting, at both the fishing vessel and dealer/processor level. The Council considered the components of the Atlantic Coastal Cooperative Statistics Program (ACCSP) to ensure that they are addressed in the Red Crab FMP and that the reporting requirements implemented in the FMP are consistent with the ACCSP program.

3.8.1 Vessel Permits

3.8.1.1 Controlled Access Permit

For a person aboard a fishing vessel to fish for, possess, off-load, or sell more than the incidental catch limit of deep-sea red crab in or from the EEZ within the Council's management area for this FMP, a valid controlled access vessel permit for red crab must be issued to the vessel and be on board. The FMP will require that annual controlled access permits be renewed at least 180 days prior to the start of the fishing year, and that the permit renewal application include a binding declaration either into or out of the fishery for the following fishing year. If a vessel does not explicitly indicate whether they will be in or out of the fishery for the coming year, they will be considered to have declared into the fishery for administrative purposes. If a vessel declares into the fishery, they of course retain the ability to determine their own level of appropriate participation. If a vessel declares out of the fishery for the following year, this decision is binding and they will have to wait until the next year's permit renewal application process to declare back into the fishery for the next full fishing year.

There is no fee for these permits at this time; however, this does not preclude the Regional Administrator from charging a fee at some time in the future to recover administrative expenses of issuing a permit required under this section. The amount of the fee will be calculated in accordance with the procedures of the NOAA Finance Handbook, available from the Regional Administrator, for determining administrative costs of each special product or service. The fee may not exceed such costs and is specified with each application form. Red crabs taken from the EEZ by any vessel issued a Federal red crab permit may only be sold to Federally-permitted dealers. Because all catches occur in the EEZ (red crabs are not harvested in state waters), it is considered a rebuttable presumption that a vessel with red crab aboard harvested the crabs from the EEZ.

Vessel permits will enable the universe of participants to be known and, if necessary, control their access to the resource. Requiring permits is a necessary component to meet the objective of collecting the data and information necessary to monitor and assess the fishery. These data are necessary for the long-term productivity and sustainability of the red crab resource and for the Council to increase enforcement compliance and achieve optimum yield.

3.8.1.2 Open Access Incidental Catch Permit

For a person aboard a fishing vessel to fish for, possess, off-load, or sell less than the incidental catch limit of deep-sea red crab in or from the EEZ within the Council's management area for this FMP, a valid open access incidental catch vessel permit for red crab must be issued to the vessel and be on board. The FMP requires an open access incidental catch permit for all vessels who do not qualify to participate in the directed red crab fishery but still wish to land small amounts of red crab, up to the incidental catch limit (see Section 4.2.1).

There is no fee for these permits at this time; however, this does not preclude the Regional Administrator from charging a fee at some time in the future to recover administrative expenses of issuing a permit required under this section. The amount of the fee will be calculated in accordance with the procedures of the NOAA Finance Handbook, available from the Regional Administrator, for determining administrative costs of each special product or service. The fee may not exceed such costs and is specified with each application form. Red crabs taken from the EEZ by any vessel issued a Federal red crab permit may only be sold to Federally-permitted dealers. Because all catches occur in the EEZ (red crabs are not harvested in state waters), it is considered a rebuttable presumption that a vessel with red crab aboard harvested the crabs from the EEZ.

Vessel permits will enable the universe of participants to be known and, if necessary, control their access to the resource. Requiring permits is a necessary component to meet the objective of collecting the data and information necessary to monitor and assess the fishery. These data are necessary for the long-term productivity and sustainability of the red crab resource and for the Council to increase enforcement compliance and achieve optimum yield.

3.8.2 Operator Permit

Operators of commercial vessels permitted to harvest deep-sea red crab will be required to obtain and make available for inspection a valid operator permit. No performance or competency tests will be required to obtain a permit. The permit may be revoked for violation of fishing regulations.

Any operator of a vessel fishing for red crab must have an operator's permit issued by the NMFS Regional Administrator. An operator is defined as the master or other individual on board a vessel who is in charge of the vessel. (Note: This definition is specified in the Code of Federal Regulations, 50 CFR 648.5.) The operator will be required to submit an application, supplied by the Regional Administrator, for an

Operator's Permit. The permit will be issued for up to three years. The applicant will provide his/her name, mailing address, telephone number, date of birth and physical characteristics (height, weight, hair and eye color, etc.) on the application, and will be requested to provide his/her social security number. In addition to this information, the applicant will be required to provide two passport-size color photos.

Permit holders will be required to carry their permit aboard the fishing vessel during fishing and off-loading operations. It must be available for inspection upon request by an authorized officer. There is no fee for this permit at this time; however, this does not preclude the Regional Administrator from charging a fee at some time in the future to recover administrative expenses of issuing a permit required under this section. The amount of the fee will be calculated in accordance with the procedures of the NOAA Finance Handbook, available from the Regional Administrator, for determining administrative costs of each special product or service. The fee may not exceed such costs and is specified with each application form.

Requiring permits is a necessary component to meet the objectives of enforcement and collecting the data and information necessary to monitor and assess the fishery. These data are necessary for the long-term productivity and sustainability of the red crab resource and for the Council to increase enforcement compliance and achieve optimum yield.

3.8.3 Dealer Permit

A dealer who receives red crab must obtain an annual dealer permit for red crab. To be eligible for such permit, an applicant must have a valid state wholesaler's license in the state where he or she operates.

There is no fee for this permit at this time; however, this does not preclude the Regional Administrator from charging a fee at some time in the future to recover administrative expenses of issuing a permit required under this section. The amount of the fee will be calculated in accordance with the procedures of the NOAA Finance Handbook, available from the Regional Administrator, for determining administrative costs of each special product or service. The fee may not exceed such costs and is specified with each application form. To purchase red crab harvested in the EEZ from a fisherman, a person or business (including a restaurant) must have a Federal dealer permit. Red crabs taken from the EEZ may only be sold to Federally permitted dealers, and Federally permitted dealers may only purchase red crab from Federally permitted vessels. Because all catches occur in the EEZ (red crabs are not harvested in state waters), it is considered a rebuttable presumption that a vessel with red crab aboard harvested the crabs from the EEZ.

Requiring permits is a necessary component to meet the objective of collecting the data and information necessary to monitor and assess the fishery. These data are necessary for the long-term productivity and sustainability of the red crab resource and for the Council to increase enforcement compliance and achieve optimum yield.

3.8.4 Observers and Sea Sampling

The NMFS Regional Administrator may request any vessel holding a red crab permit to carry a NMFS-approved sea sampler/observer. If requested by the Regional Administrator to carry an observer or sea sampler, a vessel may not engage in any fishing operations in the red crab fishery unless an observer or sea sampler is on board, or unless the requirement is waived.

If requested by the Regional Administrator to carry an observer or sea sampler, it is the responsibility of the vessel owner to arrange for and facilitate observer or sea sampler placement. Owners of vessels selected for sea sampler/observer coverage must notify the appropriate Regional or Science and Research Director, as specified by the Regional Administrator, before commencing any fishing trip that may result in the harvest of resources of the red crab fishery. Notification procedures will be specified in selection letters to vessel owners.

For domestic vessels, observers will normally be funded through the NMFS observer program. In the future, innovative methods of funding observers may include industry sponsored initiatives.

3.8.5 Vessel Reporting

3.8.5.1 Interactive Voice Response

Fishing vessels permitted to participate in the controlled access directed red crab fishery will be required to utilize the Interactive Voice Reporting (IVR) system, as was required during the emergency regulatory period, to report the total red crab landings of each trip as well as other information deemed necessary within 24 hours after returning to port and off-loading, as required by the Regional Administrator. The IVR system employs an automated toll-free telephone call-in program.

The use of the IVR system will enable NMFS and the Council to track landings on a near-real time basis. The Council will propose annual adjustments to DAS allocations and changes to the target TAC based on information about landings and DAS use. IVR reporting does not exempt the owner or operator from other applicable reporting requirements of §648.7. This requirement applies only to vessels holding a controlled access permit for the red crab fishery and applies to all fishing trips during which they land any amount of red crab (not necessarily only those trips on which they land more than the incidental catch limit). The IVR requirement does not apply to vessels holding an open access incidental catch red crab permit.

3.8.5.2 Vessel Trip Reports

The owner or operator of a vessel for which either a controlled access or an open access permit for red crab has been issued must maintain a logbook form for each fishing trip on a form supplied by or approved by the Regional Administrator. Among other things, the logbook forms provide a record of fishing locations, time fished, fishing effort, and bycatch information. The forms should also provide for the recording of economic data such as variable costs and prices paid. Logbook forms must be submitted to the Regional Administrator postmarked or received within 15 days after the end of the reporting month. If no fishing occurred during a month, a report so stating must be submitted in accordance provided with the forms.

This requirement applies to all vessels permitted to fish for red crab under either a controlled access permit or an open access incidental catch permit. The owner or operator of a vessel must provide data and must comply with any requirements regarding landing red crab and any associated bycatch. The Council is requiring 100% logbook coverage due to the lack of data and the importance of this information. Also, the owner or operator of a vessel must make their catch available for biological sampling (including port sampling) and, if required, must carry an observer.

If the Council and the Regional Administrator agree that a suitable electronic data recording and submission technology exists for implementation on red crab fishing vessels, the owner or operator of a vessel may choose, as an alternative to the logbook, to submit the required data electronically. Vessels would be allowed to provide the required data to NMFS (or have the required data provided to NMFS on their behalf) in either hardcopy or electronic format. If on hardcopy, the appropriate Vessel Trip Report (VTR) form would be used. If electronic, the format and content of the data would have to meet any and all criteria established by the Council in consultation with NMFS.

Vessels licensed to participate in the directed red crab fishery would also be subject to the reporting requirements of the Marine Mammal Protection Act (MMPA). Under these provisions of the MMPA, vessels must report any incidental mortality or injury to a marine mammal during commercial fishing activities. This report is required within 48 hours after the end of the fishing trip. A reporting form can be provided by the NMFS Northeast Regional Office.

The owner or operator of any vessel issued a valid controlled access or open access incidental catch permit for red crab must maintain on board the vessel and submit an accurate fishing log report for each fishing trip, regardless of whether red crab was fished for or taken, on forms supplied by or approved by the NMFS Regional Administrator. If authorized in writing by the Regional Administrator, a vessel owner or operator may submit reports electronically, for example by using a VMS or other media (as noted above). At a minimum, the following information and any other information required by the Regional Administrator, must be provided:

a. vessel name;

b. USCG documentation number (or state registration number, if undocumented);

c. permit number;

d. date/time sailed;

e. date/time landed;

f. trip type;

g. number of crew;

h. type of gear fished;

i. quantity and size of gear (this is intended to represent the total number of pots employed by a vessel in their fishing operations);

j. mesh/ring size, if non-trap gear (in the open access incidental catch fishery);

k. chart area fished;

l. average depth fished;

m. latitude/longitude (or loran station and bearings);

n. total hauls per area fished (this is intended to represent the total number of pots hauled in the area during the trip, such that the quotient of the total landings from the area divided by the total number of pots hauled is equal to the average catch per trap);

o. average tow time duration;

p. hail weight, in pounds, by species, of all species, or parts of species, such as monkfish livers, landed or discarded (weight of red crab landed must reflect the appropriate recovery rate conversion formulas);

q. dealer permit number;

r. dealer name;

s. date sold, port and state landed; and

t. vessel operator's name, signature, and operator's permit number.

3.8.5.3 Voluntary Subsampling Protocol

The owner of any vessel issued a controlled access permit for red crab may volunteer to participate in a data collection program for the purpose of counting and recording the complete catch, including juveniles of both sexes, of at least one trap per trap trawl on the fishing trip on which they are participating in this program. The report, to be submitted on specially designed forms that can be obtained from the Regional Administrator, shall be separate and apart from other record-keeping and reporting requirements of the FMP. Vessels choosing to participate in this data collection program will count and record the complete catch (including females and juvenile males) of at least one trap per trap trawl on a fishing trip. The following would be recorded for each trap haul:

a. date, time, and location (in latitude and longitude) of trap haul;

b. the number of males;

c. the number of females;

d. the size of each crab noted above, in millimeters of carapace width, by sex; and

e. the species, numbers, and sizes of all other organisms brought up in the trap.

3.8.6 Dealer Reporting

A dealer who has been issued an annual dealer permit for red crab must provide, on forms supplied by or approved by the Regional Administrator, all red crab purchases and prices paid to the Regional Administrator. This information must be provided weekly, and must be postmarked and received within 16 days after the end of each reporting week. The following information would be provided by all seafood dealers licensed to participate in the red crab fishery. All seafood dealers, whether U.S.-based or foreign-based, if they are Federally-permitted to participate in the red crab fishery, will be required to provide this information. If authorized in writing by the Regional Administrator, dealers may submit reports electronically or through other media. The following information, and any other information required by the Regional Administrator, must be provided in the report:

a. dealer name and mailing address;

b. dealer permit number;

c. name and permit number or name and hull number (USCG documentation number or state registration number, whichever is applicable) of vessels from which red crabs are landed or received;

d. trip identifier for a trip from which red crabs are landed or received;

e. dates of purchases;

f. pounds of red crab received, by market category;

g. price per pound, by market category, or total value, by market category;

h. port landed;

i. signature of person supplying the information; and

j. any other information deemed necessary by the Regional Administrator.

The dealer or other authorized individual must sign all report forms. If no red crabs are purchased during a reporting week, no written report is required to be submitted. If no red crabs are purchased during an entire reporting month, a report so stating on the required form must be submitted.

3.8.7 Vessel Monitoring System (VMS)

The Council considered requiring all vessels with a controlled access red crab permit to maintain VMS on their vessel for monitoring and enforcing fishing effort. VMS will not be required for red crab vessels at this time, but the Council may consider in a future action requiring VMS on all vessels fishing for red crab in the directed red crab fishery. VMS can be used to accurately track fishing effort and locations.

3.9 Council Review and Monitoring of the FMP

The Council, its Red Crab Plan Development Team (PDT), and its Advisory Panel, plan to monitor the status of the fishery and its resource following implementation of the FMP and review, on a regular basis, the need to make adjustments to the regulatory framework. The Council, working with its partners in the National Marine Fisheries Service (NMFS), will prepare a biennial Stock Assessment and Fishery Evaluation (SAFE) Report for the red crab fishery and its resource. The SAFE Report will be the primary vehicle for the presentation of all biological and socio-economic information relevant to the red crab fishery. The SAFE Reports will be intended to expand and update (where possible) the information contained in the FMP. Based on the continued monitoring of the fishery and review of the effectiveness of the measures in the FMP, if the Council determines that an adjustment to the measures is needed to continue to meet the goals and objectives of the FMP, it will implement either an annual specification process or a framework adjustment process (described below).

Although the SAFE will be completed every other year, the Council's Red Crab PDT will meet at least annually to review the status of the stock and the fishery. Based on this review, the PDT will report to the Council's Red Crab Committee, no later than five months prior to the start of the next fishing year, any necessary adjustments to the management measures adopted and recommendations for the specifications and TACs. The PDT will specifically recommend TACs for the following year and an estimated TAC for the year after. In developing these recommendations the PDT will review the following data, if they are available: commercial catch data; current estimates of fishing mortality and catch-per-unit-effort (CPUE); stock status; recent estimates of recruitment; virtual population analysis results and other estimates of stock size; sea sampling, port sampling, and survey data or, if sea sampling data are unavailable, length frequency information from port sampling and/or surveys; impact of other fisheries on the mortality of red crabs, and any other relevant information.

Based on recommendations from the Council's Red Crab PDT or other appropriate technical group which has reviewed the available information on the status of the stock and the fishery, the Red Crab Committee may recommend to the Council changes to the appropriate specifications and/or the annual TAC, as well as any measures necessary to assure that the specifications will not be exceeded. The Council shall review these recommendations and any public comment received and will recommend appropriate specifications to the Regional Administrator. Any suggested revisions to Federal management measures may be implemented through the framework process or an amendment to the FMP.

For example, under a target TAC and DAS program, the number of DAS allocated to each vessel participating in the directed red crab fishery may be revised on an annual basis. This allocation would be based on a monitoring of the landings and comparison of these landings against the target TAC. If, in any year, it appears that the fishery will not harvest the total target TAC by the time they have used all allocated DAS, the Council may recommend increasing the number of DAS allocated to the fishery for the following year. If, on the other hand, is appears that the fishery will exceed the target TAC before they have used all allocated DAS, the Council may recommend decreasing the number of DAS allocated to the fishery for the following year.

Specifications and/or TACs will be implemented by the Regional Administrator, and may include the specification of optimum yield (OY), the setting of any hard or target TACs, allocation of days-at-sea (DAS), and/or adjustments to trip/possession limits. The annual specifications process will mimic the framework adjustment process that allows changes to be made to regulations in a timely manner without going through the full plan amendment process. To implement changes to the specifications and/or TACs, the Council will develop and analyze the proposed specifications over the span of at least two Council meetings, and provide advance public notice of the availability of both the proposals and the analyses. Opportunity to provide written and oral comments on the proposed specifications and/or TACs will be provided throughout the process before the Council submits any recommendations to the Regional Administrator.

The purpose of this process is to provide a formal opportunity for public comment that substitutes for the customary public comment period provided when publishing the proposed changes as a proposed rule in the *Federal Register*. Based on the significance of the proposed changes to the specifications and/or TACs, the Secretary of Commerce may waive the need for additional public comment that would otherwise occur through publication of a proposed rule. In these cases, the changes to the specifications and/or TACs will be published only in the form of a final rule in the *Federal Register*. The previous year's specifications will remain effective unless changed by the Regional Administrator. If the specifications will not be changed, this will be announced through a notice action.

The specifications and TACs established pursuant to the FMP may be adjusted by NMFS, after consulting with the Council, during the fishing year by publishing notification in the *Federal Register* stating the reasons for such action and providing an opportunity for prior public comment. Any adjustments must be consistent with the Red Crab FMP objectives and other FMP provisions. For example, adjustments may be made to correct for errors in estimating any of the specifications, to provide for increased opportunities for U.S. fishermen to use the resource, or to address conservation concerns.

Based on the starting date for the fishing year selected for this fishery (March 1), the FMP will be implemented mid-year. As such, the first annual review and adjustment will be proposed for the start of the 2004 fishing year (March 1, 2004 - February 28, 2005). This ensures that the measures to be implemented in the FMP will be in place for at least one year prior to review and possible adjustment. Also, because this FMP will be implemented in the middle of the fishing year, the allowable TAC, allocations of DAS, or other measures may be prorated to account for the partial first fishing year.

The amount of the proration will be based on the percentage of the target TAC remaining when the FMP or measures proposed in the FMP are to be implemented. The first year the Red Crab FMP is implemented (the time between when the FMP is implemented after the final rule is published in the *Federal Register* and when the next fishing year begins on March 1, 2003) presents a unique situation related to the specification of a target TAC and the allocation of DAS to all vessels who receive a controlled access red crab permit. Rather than determine the total fleet DAS available based on the target TAC and an estimated average per DAS landing efficiency, a baseline of 130 DAS per vessel will be used in the first year of implementation. The calculation of 130 DAS per vessel is based on a conservative estimate of per day landing efficiency and an assumption that six vessels may qualify for the controlled access fishery.

The Regional Administrator will have to estimate the amount of landings from any hiatus period based upon the best available data and projections. The Regional Administrator will also have to calculate the amount of red crab landed (based on reporting requirements) during the initial implementation period of the FMP before the controlled access program and DAS are implemented. These two landings totals should be combined and deducted from the target TAC of 5.928 million pounds. The result will represent the amount of the target TAC available for the remainder of the first fishing year, to be fished under the DAS program. The Regional Administrator should calculate the percentage of the target TAC that remains available to the fishery. Vessels that qualify to fish for red crab under the controlled access/DAS program should be allocated this percentage of the initial baseline of DAS (i.e., a percentage of 130 DAS).

For example, if there is a two week hiatus period between the expiration of the emergency regulations and the implementation of the FMP, we may be able to estimate that 580,000 pounds of red crab would be landed in that time period (this is based on the landings from the first four weeks of the second emergency period, when 290,000 pounds were landed per week, on average). If there is a one-month delay between the initial implementation of the FMP and the implementation of the DAS program, we may record additional landings on the order of 1.16 million pounds (based on an extension of the above estimate). This would result in a total landings estimate of 1.740 million pounds prior to the implementation of the DAS program. This amount would be deducted from the 5.928 million pound target TAC to determine that there are approximately 4.187 million pounds of the TAC remaining for the fishery. This is 70.6% of the original TAC, so each vessel would be allocated 70.6% of the initial DAS baseline for the remainder of the fishing year, or $70.6\% \times 130 = 91.8 \approx 92$ DAS. While this may seem a low allocation, this would be for, in this example, the period from July 1, 2002 - February 28, 2003. This period of time represents 242 days, or 66.3% of the year. Extrapolating out from this amount, an allocation of 92 DAS for the partial year is equivalent to an allocation of 139 DAS for a full fishing year, just over what was determined to be a reasonable baseline in the above steps. It should also be remembered and taken into account that the red crab vessels allocated DAS as described above will have been able to fish during the time between when the emergency regulations expire (May 15, 2002) and when the controlled access/DAS program is implemented.

For the first full fishing year, March 1, 2003 - February 29, 2004, each vessel authorized to participate in the controlled access directed fishery will be allocated 156 DAS, unless this allocation is changed under the FMP specification process described above. The target TAC for the first full fishing year will be 5,928,000 pounds of whole red crab or their equivalent. The target TAC of 5,928,000 pounds and an allocation of 156 DAS per controlled access vessel will remain the baseline until these amounts are modified through the specification process.

3.10 Framework Adjustments

Many management measures in the Red Crab FMP can be changed or adjusted via a "framework" action. The effectiveness of the management program depends somewhat on uncertain factors that may change over time. Achieving the FMPs goals and objectives may require at least annual adjustments to the management measures. It is therefore necessary to have an administrative mechanism in place that fulfills the Council's public input and notification requirements while maximizing flexibility and responsiveness.

The framework adjustment process allows changes to be made in regulations in a timely manner without going through the full plan amendment process. The purpose is to provide a formal opportunity for public comment that substitutes for the customary public comment period provided when publishing a proposed rule. If changes to the management measures were contemplated in the FMP, there was sufficient opportunity for public comment on the framework action, and the changes are not highly controversial, the Secretary of Commerce may waive the need for additional public comment that would otherwise occur through publication of a proposed rule in the *Federal Register*. In these cases, the changes to the regulations are published only in the form of a final rule in the *Federal Register*.

Framework actions must be given the same consideration as to the potential impacts of the action as are FMPs and FMP amendments. The essence of the framework concept is the adjustment of management measures within the scope and criteria established by the FMP and implementing regulations to provide real-time management of fisheries. Framework measures may be "open" measures that provide the Council with a given set or limit of options to apply to a fishery through a regulatory amendment process, or more traditional "closed" measures such as closures, seasons, or gear restrictions. Closed measures are implemented through in-season rule related notices. Analysis for FMPs, FMP amendments, and regulatory amendments that establish a framework process should, to the extent possible, assess the full range of impacts that would likely result from the options considered under any future framework action. This will reduce the scope of analysis required for subsequent actions established under the framework process.

3.10.1 Framework Adjustment Process

To implement a framework adjustment for the Red Crab FMP, the Council will develop and analyze proposed actions over the span of at least two Council meetings, and provide advanced public notice of the availability of both the proposals and the analyses. Opportunity to provide written and oral comments will be provided throughout the process before the Council submits any recommendations to the Regional Administrator.

In response to an annual review of the status of the fishery or the resource by the Red Crab PDT or at any other time, the Council may recommend adjustments to any of the measures proposed by this FMP. The Red Crab Oversight Committee may request that the Council initiate a framework adjustment. Framework adjustments will require one initial meeting (the agenda must include notification of the impending proposal for a framework adjustment) and one final Council meeting.

After a management action has been initiated, the Council will develop and analyze appropriate management actions within the scope identified below. The Council may refer the proposed adjustments to the Red Crab Committee for further deliberation and review. Upon receiving the recommendations of the oversight committee, the Council will publish notice of its intent to take action and provide the public with any relevant analyses and opportunity to comment on any possible actions. After receiving public comment, the Councils must take action (to approve, modify, disapprove, or table) on the recommendation at the Council meeting following the meeting at which it first received the recommendations. The Council's recommendation for adjustments or additions to management measures must come from one or more of the categories listed below. Documentation and analyses for the framework adjustment will be available at least two weeks before the final meeting.

After developing management actions and receiving public testimony, the Council may make a recommendation to the Regional Administrator. The Council's recommendation will include supporting rationale and, if management measures are proposed, an analysis of impacts and a recommendation to the Regional Administrator on whether to issue the management measures as a final rule. If the Council recommends that the management measures should be issued directly as a final rule, the Council will consider at least the following four factors and provide support and analysis for each factor considered:

1. Whether the availability of data on which the recommended management measures are based allows for adequate time to publish a proposed rule, and whether regulations have to be in place for an entire harvest/fishing season;

2. Whether there has been adequate notice and opportunity for participation by the public and members of the affected industry in the development of the Council's recommended management measures;

3. Whether there is an immediate need to protect the resource or to impose management measures to resolve gear conflicts; and

4. Whether there will be a continuing evaluation of management measures adopted following their implementation as a final rule.

If the Regional Administrator concurs with the Council's recommended management measures they will be published as either a final rule based on the factors specified above or as a proposed rule in the *Federal Register*. If the Council's recommendation is first published as a proposed rule and the Regional Administrator concurs with the Council's recommendation after receiving additional public comment, the measures will then be published as a final rule in the *Federal Register*.

If the Regional Administrator approves the Councils' recommendations, the Secretary may, for good cause, waive the requirement for a proposed rule and opportunity for public comment in the *Federal Register*. The Secretary, in so doing, will publish only the final rule. Submission of recommendations does not preclude the Secretary from deciding to provide additional opportunity for prior notice and comment in the *Federal Register*, but it contemplates that the Council process will adequately satisfy that requirement.

The Regional Administrator may approve, disapprove, or partially disapprove the Council's recommendation. If the Regional Administrator does not approve the Council's specific recommendation, she must notify the Council in writing the reasons for her action prior to the first Council meeting following publication of her decision. Nothing in this proposal prevents the Secretary of Commerce from soliciting additional comment, but it is contemplated that the Council's process will adequately satisfy that requirement.

3.10.2 Management Measures That Can Be Adjusted Via Framework

The management measures described below are contemplated for future framework adjustment. The impacts of changes in these measures have not been fully analyzed but fall within the scope of possible management restrictions contemplated by this FMP.

3.10.2.1 Optimum Yield

Changes to the specification of optimum yield (OY) may be implemented by the annual specifications process or by framework action. As new information becomes available on the appropriate level for MSY, on ecological, social, or economic factors that are related to OY, or other information on the stock or its fishery that may affect the specification of OY, the Council may adjust OY to better reflect and account for this new information. This adjustment may be necessary to incorporate specific data about the fishery or the resource, or may be necessary to account for a better understanding of the vulnerability of the resource to fishing pressure.

3.10.2.2 Management Unit

The management area boundaries adopted in this FMP account for the current best understanding of stock structure as well as existing fishing patterns. Additional information on the red crab resource may suggest changes in the management area. In a similar fashion, as the directed red crab fishery adjusts to direct management, there may be a need to adjust the management area to reflect new fishing patterns.

3.10.2.3 Technical Parameters for MSY

There are several parameters used to develop an estimate of MSY. An estimate of commercial biomass depends upon the size at which adult crabs are considered to recruit to the fishery (be of commercial size), whether crabs landed are males only or include female crabs of the appropriate size, the size of the management area, and the best estimate of the total biomass of red crabs contained within the management area under virgin stock conditions (B_0). Until a robust estimate of the MSY-level fishing mortality rate (F_{msy}) is available, the natural mortality rate (M) is used as a proxy. The current estimate of M used by the Council to determine MSY is based on a range of possible rates of natural mortality available for this species. As the science improves and more detailed information becomes available on this species, better estimates of M may be developed. If the Council receives new or improved information relevant to these parameters, a revision to the estimate of MSY may be warranted.

3.10.2.4 Description and Identification of EFH

Changes to the boundaries of EFH designated for any life stage of red crab may be changed via a framework adjustment if the Council receives new or improved information relevant to the EFH designations and such a change is warranted. Changes to the EFH Text Description may also be made via a framework adjustment.

3.10.2.5 Description and Identification of HAPCs

Changes to the boundaries of any HAPCs designated for any life stage of red crab may be changed via a framework adjustment if the Council receives new or improved information relevant to the HAPC designations and such a change is warranted. New HAPCs may be designated via a framework adjustment for any life stage of red crab if the Council receives relevant information that indicates an HAPC should be considered and the Council approves the proposed HAPC designation.

3.10.2.6 Incidental Catch Limits

Changes to the incidental catch limits established for those fishermen not participating in the directed red crab fishery may be implemented by framework action. This may be necessary if the number of vessels taking incidental catch levels of red crabs changes, or other conditions in the incidental catch fishery change such that the catch limit implemented via this FMP is no longer deemed appropriate. Changes to the overall stock status may indicate that the incidental catch limit should be changed. Better information about the incidental catch fishery and its interactions with the resource and the directed fishery may also indicate appropriate changes to the incidental catch limit. If changes are made through a framework adjustment, they will be within the range identified in this FMP (50 - 1,000 pounds of red crab per trip).

3.10.2.7 Minimum Size of Landed Crabs

If the FMP does not implement a minimum size regulation for the directed red crab fishery, this measure may be implemented by a framework action if it is determined that a regulatory minimum size is necessary. This would most likely occur if the number or proportion of small crabs (females and/or juvenile males) being landed in the directed fishery increases over time and threatens the sustainability of the resource. If the FMP does implement a minimum size regulation, changes to this regulated minimum size may be implemented by a framework action if it is determined that the current minimum size is no longer appropriate. If changes are made through a framework adjustment, they will be within the range identified in this FMP (4” - 5” carapace width).

3.10.2.8 Male Crabs Only

If the FMP does not implement a males-only regulation for the directed red crab fishery, this measure may be implemented by a framework action if it is determined that a males-only regulation is necessary. This would most likely occur if the number or proportion of female crabs being landed in the directed fishery increases over time and threatens the sustainability of the resource. If the FMP does implement a males-only regulation, changes to this regulation may be implemented by a framework action if it is determined that it is no longer appropriate.

3.10.2.9 Butchering/Processing Restrictions

If the FMP does not implement butchering/processing at sea restrictions for the directed red crab fishery, this measure may be implemented by a framework action if it is determined that such restrictions are necessary. This would most likely occur if the number or proportion of undersized and/or female crabs being landed in the directed fishery increases over time and threatens the sustainability of the resource as a result of the butchering and/or processing at sea operations in the directed fishery. If the FMP does implement some form of butchering and/or processing at sea restrictions, changes to these restrictions may be implemented by a framework action if it is determined that the level of restrictions implemented in the FMP is no longer appropriate and either more or less stringent restrictions should be put in place. If changes are made through a framework adjustment, they will be within the range identified in this FMP.

3.10.2.10 Trap Limits

If the FMP does not implement a trap limit for the directed red crab fishery, this measure may be implemented by a framework action if it is determined that trap limits are necessary. This would most likely occur if the number of traps being used in the directed fishery increases over time and threatens the sustainability of the resource or the fishery. If the FMP does implement a trap limit, changes to this regulation may be implemented by a framework action if it is determined that the current limit is no longer appropriate. If changes are made through a framework adjustment, they will be within the range identified in this FMP (400 - 1,000 traps per vessel).

3.10.2.11 Gear Requirements/Restrictions

Escape vents

If the FMP does not implement a requirement for escape vents in the traps used in the directed red crab fishery, this measure may be implemented by a framework action if it is determined that escape vents are necessary. This would most likely occur once sufficient information becomes available to determine the most appropriate dimensions for an escape vent to meet the needs of this FMP. If the FMP does implement an escape vent, changes to this regulation may be implemented by a framework action if it is determined that the current dimensions are no longer appropriate.

Trap size

If the FMP does not implement a maximum trap size restriction for the traps used in the directed red crab fishery, this measure may be implemented by a framework action if it is determined that a maximum trap size is necessary. This would most likely occur if it is determined that members of the directed fishery are increasing their trap size or volume in an attempt to increase their per-trap fishing power. If the FMP does implement a maximum trap size or volume restriction, changes to this regulation may be implemented by a framework action if it is determined that the current dimensions are no longer appropriate.

Trap materials

If the FMP does not implement a restriction on the use of certain materials in the traps used in the directed red crab fishery, this measure may be implemented by a framework action if it is determined that trap materials restrictions are necessary. This would most likely occur if it is determined that the traps being used in the fishery have the potential to cause adverse effects on the habitat of the region or on other species and/or their associated biological communities. If the FMP does implement trap materials restrictions, changes to this regulation may be implemented by a framework action if it is determined that the current restrictions are no longer appropriate.

Trap tags and/or gear markings

If the FMP does not implement requirements for trap tags and/or gear markings in the directed red crab fishery, this measure may be implemented by a framework action if it is determined that trap tags and/or gear markings are necessary. This would most likely occur if trap limits are implemented for the first time in the same framework action, as some form of trap tags and/or gear markings will be a necessary component of any trap limit system. If the FMP does implement trap tags and/or gear marking requirements, changes to this regulation may be implemented by a framework action if it is determined that the current requirements are no longer appropriate, or some modification is necessary to better meet the intent of the regulation.

Trap configuration and deployment

If the FMP does not implement a trap configuration and/or deployment restrictions for the traps used in the directed red crab fishery, this measure may be implemented by a framework action if it is determined that trap configuration and/or deployment restrictions are necessary. This would most likely occur if it is determined that members of the directed fishery are changing their trap configurations in an attempt to increase their per-trap fishing power. If the FMP does implement a trap configuration and/or deployment restriction, changes to this regulation may be implemented by a framework action if it is determined that the current restrictions are no longer appropriate.

Ghost panel

If the FMP does not implement a requirement for ghost panels in the traps used in the directed red crab fishery, this measure may be implemented by a framework action if it is determined that ghost panels are necessary. This would most likely occur once sufficient information becomes available to determine whether or not the current practices in the fishery and current trap designs are sufficient to prevent undue levels of ghost fishing from lost or broken traps. If the FMP does implement a ghost panel requirement, changes to this regulation may be implemented by a framework adjustment if it is determined that the current dimensions or specifications are no longer appropriate.

Marine mammal requirements

Most changes to gear requirements intended to comply with marine mammal requirements are implemented through the Atlantic Large Whale Take Reduction Plan (ALWTRP). If specific measures that only apply to the directed red crab fishery are deemed necessary or appropriate, these measures may be implemented by a framework adjustment to the Red Crab FMP.

Prohibition on the use of parlor traps

If the FMP does not implement a prohibition on the use of parlor traps in the directed red crab fishery, this measure may be implemented by a framework action if it is determined that this prohibition is necessary. This would most likely occur if it is determined that members of the directed red crab fishery are using redesigned crab traps that employ parlors, and the new gear has the potential to cause adverse effects on the red crab resource. If the FMP does implement a prohibition on the use of parlor traps in the directed red crab fishery, changes to this regulation may be implemented by a framework action if it is determined that the current restrictions are no longer appropriate.

Prohibition on the use of other gear types

If the FMP does not implement a prohibition on the use of fishing gear types other than traps in the directed red crab fishery, this measure may be implemented by a framework action if it is determined that this prohibition is necessary. This would most likely occur if it is determined that members of the directed red crab fishery are migrating to other gear types, such as otter trawls or dredges, that have the potential to cause adverse effects on the red crab resource, the habitat of the region, or on other species and/or their associated biological communities. If the FMP does implement a prohibition on the use of fishing gear types other than traps in the directed red crab fishery, changes to this regulation may be implemented by a framework action if it is determined that the current restrictions are no longer appropriate.

3.10.2.12 Total Allowable Catch

Most management alternatives under consideration by the Council in the development of this FMP include some form of TAC established for the directed red crab fishery, either a hard TAC that establishes the upper limit of landings for the year, or a target TAC that serves as a guide for other effort-based controls on the fishery. Changes to the annual TAC may be implemented by framework adjustment or through an annual specifications process. These changes are likely to occur on an annual basis as part of the "annual adjustment" for this fishery. Each year, the Council will monitor landings and determine if the current year's landings are likely to exceed the TAC, as well as whether the TAC established remains appropriate as we learn more about the resource and the stock status.

In any year that the fishery exceeds a hard TAC, the amount of the overage will be deducted from the following year's TAC. In any year that the fishery is projected to exceed a target TAC, the amount of the projected overage will be deducted from the following year's target TAC. New information on the status of the stock may indicate that previous or current TACs are either too high or too low. Such information would be used to adjust the following year's TAC.

Depending on the information available to the Council, it may be appropriate or necessary to modify the method used to determine the annual TAC. If changes are made to this process through a framework adjustment, they will be within the range identified in this FMP. If the FMP does not implement a TAC for the directed red crab fishery, this measure may be implemented by a framework adjustment if it is determined that a TAC is necessary. This would most likely occur if it is determined that the current controls on the fishery are insufficient to adequately control landings to a sustainable level and a more direct control on landings is necessary to prevent overfishing.

3.10.2.13 Possession/Trip Limits

If the FMP does not implement trip limits for the directed red crab fishery, this measure may be implemented by a framework action if it is determined that some form of trip limits are necessary. This would most likely occur if the per trip fishing power of vessels participating in the directed fishery increases out of proportion with the other effort controls in the fishery, such as if vessels convert to butchering or processing at sea to improve their overall per trip landings. If the FMP does implement some form of trip limits in the directed red crab fishery, changes to or elimination of these limits may be implemented by a framework action if it is determined that the existing trip limits are no longer appropriate and either more or less stringent restrictions should be put in place.

If the trip limit is not eliminated, but changes are made through a framework adjustment, they will be within the range identified in this FMP (10,000 - 200,000 pounds per vessel per trip). Following sufficient time during which detailed and complete information on the directed red crab fishery has been collected, it may be appropriate to implement new methods for setting the trip limits to which each vessel participating in the fishery is subject. For example, the Council could use vessel average per trip landings or maximum per trip landings to establish trip limit categories for the vessels in the directed fishery.

3.10.2.14 Controlled Access System

Most management alternatives under consideration by the Council for the Red Crab FMP include some form of controlled access system to determine participation in the directed fishery. Changes to this controlled access system may be implemented by a framework adjustment if these changes are warranted. Most likely, changes to the controlled access system would be used to increase the number of vessels authorized to participate in the directed fishery if new information indicates that this increase is appropriate and would not threaten the sustainability of the resource or the existing fishery. If the FMP does not implement some form of controlled access system for the directed red crab fishery, a framework adjustment will not be the appropriate mechanism to implement a new controlled access system should the Council determine that such a system is necessary and appropriate.

3.10.2.15 Days-at-Sea Limits

If the FMP does implement some form of days-at-sea limits in the directed red crab fishery, changes to these limits may be implemented by a framework action if it is determined that the existing DAS limits are no longer appropriate and either fewer or additional DAS should be allocated to either the fleet or to individual fishing vessels. For example, each vessel will be allocated a percentage of the overall fleet DAS, which are determined based on the annual target yield (or target TAC) and an assumed fleet average catch per day-at-sea. If the target yield changes, either as a result of new or updated information on the status of the resource or as a result of the projected utilization of previous years' or current year's target TACs.

As we collect more information on the operations of the directed red crab fishery, we may be able to calculate a more robust estimate of the fleet average landings per day-at-sea. As our estimate of this estimate changes, the fleet DAS will also be adjusted. One last way in which the vessels' allocation of DAS may change is if the number of vessels participating in the directed fishery changes, either through attrition or through a change in the controlled access system. If changes are made through a framework adjustment, they will be within the range identified in this FMP (11 - 296 DAS per vessel per year). If the FMP does not implement some DAS program for the directed red crab fishery, a framework adjustment will not be the appropriate mechanism to implement a new DAS program should the Council determine that such a system is necessary and appropriate.

4.0 Description of the Management Alternatives

4.1 Overview

The Council developed a range of management measures and alternatives intended to represent the most feasible measures and alternatives that could reasonably be expected to resolve the stated problems and achieve the FMP goals and objectives. Some measures, determined to be impracticable or to not meet the goals and objectives of the FMP, were removed from further consideration and not analyzed in this document. The "no action" alternative is considered to include no management action (i.e., the equivalent of having no FMP for this fishery). The "status quo" alternative is considered to include the management measures implemented through the emergency regulations.

This section identifies and describes both the *management measures* and the *management alternatives* considered for this FMP. Each alternative includes a unique set of measures. The measures are the actual actions being considered to meet the goals and objectives of the plan. For example, a controlled access program is a specific type of management measure that may be used to address some of the problems in this fishery. Several of the management alternatives being considered include a controlled access program as one of the measures. The concept of management alternatives is distinct from that of measures because the alternatives represent specific combinations of measures which together would comprise the overall management program. For example, providing only a long list of potential measures does not inform the public as to what the actual management program may be, especially if some measures cannot work in combination with others (e.g., minimum sizes and allowing processing-at-sea) while others require certain combinations of measures to be effective (e.g., hard TAC and reporting requirements).

4.2 Description of the Proposed Management Measures and Options

The following describes the management measures included in the preferred alternative for the Red Crab FMP. Within the description of each proposed management measure is a range of options that the Council considered. The specific option selected by the Council is described first, followed by the non-preferred options.

The options described below for each potential management measure were intended to represent a broad range of possible options for each management measure considered under the Red Crab FMP. Following the public review and comment period for the draft FMP and draft EIS, the Council considered any additional information received on this species and its fishery. If the additional information received had suggested that an option not specified below, but within the range of options considered, was more appropriate for this fishery, the Council may have selected a new option. For example, following discussions with the fishing industry and analysis of additional data, we may have determined that a trap limit of 550 traps is more appropriate than the current suggested option of 600 traps. Since 550 is only a slight adjustment to the proposed 600 trap limit and is well within the overall range suggested (400 - 1000 traps), we could have made this change in the final document.

4.2.1 Incidental Catch Limit (allowance for other fisheries)

The FMP will establish an incidental catch limit as an allowance for fishing vessels not participating in the directed fishery to harvest and retain some amount of red crab. The FMP included several options for setting incidental catch levels and allowances for all fisheries not targeting red crab. This would ensure that the offshore lobster fishery, as well as other fisheries, would be able to continue to land relatively small amounts of red crab as an incidental catch in their primary fisheries.

The following options were intended to represent a range of possible incidental catch allowance limits. Red crabs landed under the incidental catch allowance may be subject to any minimum size and/or sex restrictions implemented under the plan. Evaluation of the following options was done based both on the incidental catch vessels being subject to other regulations as well as not subject to other regulations.

The following table summarizes data retrieved from the 1998, 1999 and 2000 VTR and dealer weighout databases for trips reporting some amount of red crab landed as incidental catch. Nearly 40% of all trips reporting incidental catch levels of red crab reported 100 pounds or less. Half of all trips reported 200 pounds or less. Setting an incidental catch limit of 1,000 pounds would account for most trips (88.6%) reporting some landings of red crab.

Incidental Catch Limit Options	Cumulative Percentage of Trips
50 pounds per trip	26.6%
100 pounds per trip	38.4%
500 pounds per trip	72.6%
1,000 pounds per trip	88.6%

Table 12. Cumulative percentage of number of fishing trips with incidental catch limit or less of red crab, 1998 - 2000 data.

4.2.1.1 Preferred Option: 500 pounds per trip

This is the Council's preferred alternative. This option allows all vessels who obtain an open access incidental catch permit, or vessels holding a controlled access permit but are not on a red crab day-at-sea, to retain and land up to a maximum of 500 pounds of red crab, potentially subject to any other regulations, per fishing trip. The incidental catch limit will be measured as the weight of whole red crabs, or the whole weight equivalent.

4.2.1.2 Non-Preferred Option 1: 50 pounds per trip

This option would allow all vessels not fishing on a directed red crab trip to retain and land up to a maximum of 50 pounds of red crab, potentially subject to any other regulations, per fishing trip. The incidental catch limit will be measured as the weight of whole red crabs, or the whole weight equivalent.

4.2.1.3 Non-Preferred Option 2: 100 pounds per trip

This option would allow all vessels not fishing on a directed red crab trip to retain and land up to a maximum of 100 pounds of red crab, potentially subject to any other regulations, per fishing trip. The incidental catch limit will be measured as the weight of whole red crabs, or the whole weight equivalent.

4.2.1.4 Non-Preferred Option 3: 1000 pounds per trip

This option would allow all vessels not fishing on a directed red crab trip to retain and land up to a maximum of 1000 pounds of red crab, potentially subject to any other regulations, per fishing trip. The incidental catch limit will be measured as the weight of whole red crabs, or the whole weight equivalent.

4.2.1.5 Non-Preferred Option 4: Tiered incidental catch limits

This option would provide for an additional level of allowable incidental catch for certain vessels participating in a fishery with an informal tradition of higher red crab landings during winter months. Vessels holding a valid Area 3 Lobster Permit would be allowed to retain and land up to a maximum of 1,000 pounds of red crab per fishing trip during the months of December, January, and February only. The rest of the year, these vessels, as well as all other vessels not fishing on a directed red crab trip, would be allowed to retain and land up to a maximum of 100 pounds of red crab per fishing trip. Both levels of incidental catch limits under this option are potentially subject to other regulations. The incidental catch limit will be measured as the weight of whole red crabs, or the whole weight equivalent.

4.2.2 Minimum Size Limit

The Council considered establishing a minimum size limit for the red crab fishery. There are several issues related to the implementation and enforcement of this type of measure. For example, the Council debated how a minimum size limit (usually based on carapace width) might be established if butchering or processing at sea is allowed.

The following options for minimum size all refer to carapace width, based on the maximum width including the spines. Gray (1970) indicated methods for measuring red crabs both by width and by length and suggested that the length measurements may be less variable than the width. If there is concern that width measurements may be too uncertain, the Council could adopt Gray's length-width relationships and set a minimum size based on the carapace length, although this measurement may not be a very efficient technique for use in the field. Depending on whether and the degree to which the Council allows or restricts processing and/or butchering at sea, weight-based minimum size restrictions may have to be developed. If the crabs are sectioned (with the carapace removed) the minimum "size" will have to be indicated by a minimum section weight. For a minimum size to be effectively monitored, the Council will have to specify an section weight that is equivalent to the minimum size for each possible method of butchering crabs (e.g., with gills or without gills). Also, although all the following options are specified in carapace width, conversions to carapace length could be used if this measurement is determined to be more appropriate for this fishery.

A minimum size restriction may apply to all vessels in possession of red crabs, whether from the directed fishery or as part of a incidental catch allowance. A significant issue for the Council was the utility of a minimum size limit relative to the difficulty of enforcement and actual conservation necessity of this type of measure. The market largely controls the size of the crab that is efficient to process and sell, and so far this seems to be about a minimum of a one pound crab. If we accept that the market will control the size of the crabs landed, implementation of a regulated minimum size may be unnecessary, especially given the enforcement concerns. If market conditions changed, or small crabs were being landed in increasing numbers, the Council could adopt a minimum size limit in the future via a framework adjustment to the FMP.

4.2.2.1 Preferred Option: Non-regulated minimum size

As discussed above, it does not appear to be practicable to implement a regulatory minimum size in this fishery if any type of butchering and/or processing of red crabs at sea is permitted. The nature of the butchering process (removal of the carapace and the cutting of the crab in half laterally) makes it all but impossible to administer and enforce a minimum size regulation. With full processing at sea (removal of the meat from the body of the crab), it would be completely impossible to enforce this type of regulation.

Also, as discussed above, it does not appear to be necessary to regulate a minimum size for red crabs at this time. The market for red crabs is currently fairly restrictive in demanding only male crabs larger than four inches in carapace width. As long as these market conditions remain, a complicated and difficult to enforce regulatory minimum size may be superfluous and unnecessary.

However, there remains the concern that market conditions or other factors could change that would result in smaller crabs being landed and/or processed. Any downward trend in the size of the crabs landed could have significant implications for the sustainability of the resource as male crabs could start being harvested before they have an adequate opportunity to reproduce.

An option available to the Council to deal with this situation was to establish an "operational minimum size" that represents the smallest size crab that should be harvested. Although it would not be a violation to land crabs smaller than this size, self-reporting, port sampling and observer coverage would be used to track the sizes of red crabs being landed. If the proportion of crabs smaller than the operational minimum size begins to increase, the Council will consider taking appropriate action at that time to regulate a minimum size and ensure the enforceability of such an action.

For the purposes of this measure, the operational minimum size is four inches in carapace width, measured as noted above, consistent with the minimum size at which red crabs are considered to recruit to the fishery. There will be no regulations associated with this measure, but the fishing industry is put on notice that a minimum size could be implemented in the regulations in the future if the Council and/or NMFS determine that there is an increase in the number of percentage of undersized crabs being retained and landed.

Because this action would likely entail very strict controls on the handling of red crabs, including butchering and/or processing at sea, and strict controls on the allowable size composition of all red crab catches, it would be in the best interest of the fishing industry to ensure that landed red crabs remain sufficiently above the operational minimum size. This option essentially serves as a placeholder for possible future action by the Council to address any increases in the amount of undersized crabs harvested in the fishery.

4.2.2.2 Non-Preferred Option 1: 4" minimum size (carapace width)

This option would establish the minimum allowable size for red crabs retained and landed of four inches, measured as the width of the crab's carapace at the spines. This size was identified during the scoping process as the minimum size acceptable to the market and the minimum size currently targeted by the industry.

4.2.2.3 Non-Preferred Option 2: 4 ½" minimum size (carapace width)

This option would establish the minimum allowable size for red crabs retained and landed of four and a half inches, measured as the width of the crab's carapace at the spines. Reportedly, the market seeks red crabs at least one pound in weight. Both Serchuk (1977) and Meade (1973) suggest 4 ½" as being "of commercial size." Meade includes some size-weight data from harvested crabs that supports a minimum size of 4 ½" as equivalent to a one pound crab. A size-weight relationship developed by Farlow (1980) also indicates that a minimum size of 4 ½" would be consistent with a one pound male crab.

4.2.2.4 Non-Preferred Option 3: 5" minimum size (carapace width)

This option would establish the minimum allowable size for red crabs retained and landed of five inches, measured as the width of the crab's carapace at spines. At the high end of the range of options, the Council could consider setting the maximum size at five inches. This would ensure that only large crabs at least one and a half pounds in weight are retained and landed.

4.2.2.5 Non-Preferred Option 4: Allowances

Because of the potential for measurement and human error, if a regulated minimum size is selected, it may be necessary to add in an allowance for some percentage of crabs below the minimum size. The percentage should be low, no more than 1% by weight, and based on common fishing practices and constraints.

4.2.3 Males-Only

In addition to a minimum size restriction for the red crab fishery, the Council considered whether the fishery should be constrained to retain and land only male red crabs or whether females as well as males should be allowed to be landed. The Council also considered whether this restriction should apply to all vessels that land any amount of red crab (i.e., including the open access incidental catch vessels) or only to those vessels that qualify for a controlled access permit to fish in the directed fishery.

4.2.3.1 Preferred Option: Male only restriction for the controlled access fishery

The preferred option restricts the harvest and landing of red crabs to male crabs only for those vessels holding a controlled access permit to participate in the directed red crab fishery. All female crabs captured in traps are required to be returned to the ocean. If the crabs are landed whole, the abdomen will remain intact and can be used to differentiate females from males. If the crabs are landed in sections, either the abdomen itself or the outline of the abdomen will be used to differentiate females from males. The male-only restriction will apply only to vessels that possess a controlled access permit for the directed fishery. These vessels will be granted a small allowance for the incidental retention of female crabs. The allowance for females will be an amount not to exceed one standard U.S. fish tote per vessel per trip.

Prohibiting the retention and landing of female crabs in the directed fishery puts into regulation what has been a common fishing practice and is, in fact, already a market requirement. Female red crabs are slow-growing and may only reproduce once every few years. Protecting females from all harvesting may serve to maintain and protect the reproductive potential of the species. This measure only affects the directed red crab fishery because they have the capability to quickly sort red crabs harvested in their traps and to return female crabs to the water almost immediately. The measure does not affect the incidental catch vessels because the Council does not want to provide any incentive to these fishermen to seek any more than the first 500 pounds of red crab that they harvest. The allowance for the incidental retention of female crabs by the controlled access vessels allows these fishermen to continue current fishing practices and represents a very small fraction of the total crabs retained and landed on each fishing trip (i.e., one standard U.S. fish tote is estimated to equate to roughly 100 pounds, which would be approximately 0.13% of the 75,000 pound trip limit).

4.2.3.2 Non-Preferred Option 1: Male only restriction for all vessels

This option would restrict the harvest and landing of red crabs to male crabs only for all vessels that retain and land any amount of red crab, including those with controlled access permits to participate in the directed red crab fishery and those with open access incidental catch permits. All female crabs captured in traps or other fishing gear would be required to be returned to the ocean.

4.2.3.3 Non-Preferred Option 2: No restriction on sex of crabs

This option would not restrict sex of the red crabs that may be retained and landed in either the controlled access fishery or the incidental catch fishery. Male and female red crabs could be retained and landed by all vessels authorized to land red crabs.

4.2.4 Butchering/Processing-at-Sea Restrictions

The FMP will establish butchering and/or processing at sea restrictions for the directed red crab fishery. Butchering and/or processing red crabs at sea (versus landing crabs whole) expands the vessels' capacity to harvest red crab on a per trip basis. The FMP includes several options to set restrictions and/or prohibitions on the butchering and/or processing at sea of red crabs. These measures are balanced against the other measures considered in the FMP, such as minimum size limits and sex restrictions. Processing and butchering are defined as follows:

- *Processing, or to process*, with respect to the Atlantic deep-sea red crab fishery, means:
  - For full processing, the removal of meat from the body and/or legs of a red crab and any preparation of the meat that follows, including but not limited to cleaning, freezing, cooking, and/or glazing.
  - For partial processing, the splitting or cutting of crabs in half along the length of the carapace, removal of the carapace, and any preparation of the crab that follows, including but not limited to cleaning, freezing, cooking, and/or glazing.
- *Butchering*, with respect to the Atlantic deep-sea red crab fishery, means the splitting or cutting of crabs in half along the length of the carapace, removal of the carapace, and storing of the crab sections on ice.

The more butchering and processing activities that are allowed under the FMP, the more difficult it will be to control the number of small crabs being landed. The FMP will also establish tolerances for incidental separation of crab bodies, legs, and/or claws.

4.2.4.1 <u>Preferred Option: Partial processing and butchering allowed</u>

This is the Council's preferred option. This option allows all at-sea butchering and process activities short of full-processing, defined as above to include extraction of meat from the crab. Any activity short of removing the crab meat (including splitting, sectioning, freezing, cooking, and/or glazing of crab sections) would be considered butchering or partial processing and allowed under this option. Retaining and landing whole crabs would, of course, be allowed.

Appropriate recovery rates were developed to determine the whole weight equivalent from the weight of the butchered crabs. The recovery rate conversion formulas are as follows:

  - 58% of whole to partially-processed red crab, or 1.72 to 1, for fully cleaned crab sections that have had the gills and other viscera removed;

and

- 64% of whole to butchered red crab, or 1.56 to 1, for crab sections with all or the majority of the gills retained.

The first recovery rate applies to red crab that is partially processed at sea, as defined in the FMP, and the second recovery rate applies to red crab that is butchered at sea, as defined in the FMP. The second recovery rate is higher because the individual crab sections that retain the gills, mandibles and other viscera weigh more (closer to the weight of a whole crab) than do crab sections without this material still attached. All persons are prohibited from transferring at sea, either directly or indirectly, or attempting to transfer at sea to any vessel, any red crab, or its equivalent as specified at § 648.13, taken in or from the red crab management unit.

Red crabs may only be landed whole or in half sections with the claws and legs attached. This prohibition will apply to all vessels that land red crab, either through the controlled access fishery or as incidental catch. Vessels with an incidental catch of red crabs must have no more than two claws and eight legs per crab on-board their vessel. The maximum allowance for red crab claws and legs separate from crab bodies for vessels participating in the controlled access fishery will be equal to the amount necessary to fill one standard U.S. fish tote per vessel per trip. This is expected to be roughly 100 pounds. This allowance only applies to the controlled access fishery and is only intended to account for incidental and unintended loss of claws and/or legs during normal fishing and handling operations.

These restrictions would allow the current practices of vessels involved in the red crab fishery to continue, while prohibiting any expansion of processing at sea activities. Vessels currently outfitted to butcher and/or partially process crabs at sea would not have to change their fishing practices. This measure should have no impact on the red crab industry, and will allow the male-only restriction to be administered and enforced. The sex of the crabs can be discerned either by the shape of the tail flap on whole crabs, or by the outline of the tail flap on crabs that have been butchered and/or partially processed. The requirement to land crabs either whole or in half sections with the legs and claws intact is intended to remove any incentive and prevent the harvesting of red crab for their claws and/or legs alone. The proposed allowance for the controlled access vessels recognizes that accidental claw and/or leg loss may occur during normal fishing operations and handling.

4.2.4.2 Non-Preferred Option 1: No processing or butchering at sea

This option would prohibit the landing of red crabs in any form except whole. This would prohibit all forms of processing and butchering at sea. This would be the most restrictive option considered under this measure. No recovery rates would need to be established, as all crabs landed will be in whole weight. Existing vessels that butcher and/or process at sea (within reasonable limits) may be given an exemption to this option -- grandfathered -- in order to allow them to continue to fish for red crab in the method for which their vessel is best suited. Existing vessels that do not butcher and/or process at sea would not be allowed to convert, and any new vessels entering the fishery would not be allowed to butcher/process at sea but would have to enter the fishery prepared to land their crabs whole.

4.2.4.3 Non-Preferred Option 2: No processing at sea (butchering allowed)

This option would allow the butchering of crabs at sea, but prohibit all forms of processing. Crabs could be landed either whole or sectioned, but not frozen, cooked, cleaned, and/or glazed.

Appropriate recovery rates would be established to determine the whole weight equivalent from the weight of the butchered crabs. In the 2001 emergency regulations, NMFS identified two recovery rates to be used by vessels that butcher crabs at sea. The first recovery rate applies to vessels that remove the gills and/or fully clean the crab sections. This recovery rate is 58% of whole to butchered crabs, or 1.72 to 1, and is called the “cleaned” recovery rate (66 FR 23182). The second recovery rate applies to vessels that do not remove the gills and mandibles and only partially clean the associated viscera off the crab sections. This recovery rate is 64%, or 1.56 to 1, and is called the “gills-on” recovery rate (66 FR 38165). This recovery rate is higher because the individual crab sections that retain the gills, mandibles and other viscera weight more (closer to the weight of a whole crab) than do crab sections without this material still attached.

4.2.4.4 Non-Preferred Option 3: All processing and butchering allowed

This option would use the original definitions of processing and butchering at sea, and allow all of these activities to occur. Under this option, vessels could separate crab meat from the body and clean, cook, glaze, and/or freeze, etc. at sea with no restrictions. This would be the least restrictive option considered under this measure. Appropriate recovery rates would need to be established for all contingencies under this option to accurately determine the whole weight equivalent from the weight of the butchered crabs. The recovery rates used would be dependent upon the specific process used (e.g., crab meat picked, cooked, and frozen would be considered separately from crab sections with the carapace removed). If centrifuge or other meat separation technology is used on board a red crab fishing vessel, it would become impossible to control the size of crabs harvested, processed and landed.

Appropriate recovery rates would be established to determine the whole weight equivalent from the weight of the butchered or processed crabs. The recovery rates used would be dependent upon the specific process used (e.g., crab meat picked, cooked, and frozen would be considered separately from crab sections with the carapace removed). In the 2001 emergency regulations, NMFS identified two recovery rates to be used by vessels that butcher crabs at sea and one for use by vessels that process crabs at sea. The first recovery rate applies to vessels that remove the gills and/or fully clean the crab sections. This recovery rate is 58% of whole to butchered crabs, or 1.72 to 1, and is called the “cleaned” recovery rate (66 FR 23182). The second recovery rate applies to vessels that do not remove the gills and mandibles and only partially clean the associated viscera off the crab sections. This recovery rate is 64%, or 1.56 to 1, and is called the "gills-on" recovery rate (66 FR 38165). This recovery rate is higher because the individual crab sections that retain the gills, mandibles and other viscera weight more (closer to the weight of a whole crab) than do crab sections without this material still attached. The third recovery rate applied to vessels that fully process crabs at sea and land meat-only. This recovery rate is 25%, or 4 to 1, and is called the "meat-only" recovery rate (66 FR 23182).

4.2.5 Trap/Pot Limits

The FMP will establish trap/pot limits for the directed red crab fishery. The setting of trap limits (number of traps allowed) was identified as a potential measure for the FMP during the initial scoping process. These limits and restrictions only pertain to vessels with controlled access permits to participate in the directed red crab fishery. Vessels fishing primarily for lobsters may employ significantly more traps than the trap limits specified below, but these vessels would only be subject to the red crab incidental catch limit, not the trap limit. Consideration of these options depend also upon the gear requirements implemented in the FMP. For instance, limiting the number of traps would have much less utility if trap size was not also controlled. The Council determined the enforceability of trap restrictions and developed a procedure for administering the trap limit to ease the enforcement burden associated with this measure. The administration and enforcement of this measure may be complicated by the proximity of the offshore lobster fishery and red crab vessels that are permitted to also fish for lobsters.

As a partial solution to improve the enforceability of this measure, rather than manage the trap limit by counting individual traps, the Council intends to require each vessel to declare, in a formal statement attached to their permit, the maximum number of traps per string that they employ. They would then be allowed a maximum number of strings based on the proposed trap limit (e.g., 600) divided by their declared traps per string. All fractions will be rounded down to the lowest whole number (i.e., if they are allowed 600 traps and they declare 125 traps per string -- which divides to 4.8 strings -- they would be allowed a maximum of 4 strings).

4.2.5.1 <u>Preferred Option: 600 traps per vessel</u>

This is the Council's preferred option. This option allows all vessels holding a controlled access permit and fishing on a directed red crab trip to employ a maximum of 600 red crab traps in the harvesting of red crabs. This amount has been reported to the Council as the "industry standard" used by most vessels, although individual vessels may vary slightly from this number. This limit is not expected to represent a significant reduction for any vessel currently directing on red crab, although it may be a slight to moderate reduction for some. Most importantly, this option would prevent any vessel from *increasing* the number of traps they employ, either in an attempt at increasing their effort or in an attempt at "holding bottom."

This measure will be managed and enforced via a requirement for each vessel to declare, on their annual permit application, the maximum number of traps they use per string and the maximum number of strings they employ in their fishing operations, such that the product of the maximum number of traps per string and the maximum number of strings declared by the vessel is no more than 600 traps. If on a red crab trip (on a red crab DAS and more than the incidental catch limit of red crab on board) no vessel may haul any fishing gear other than red crab gear, marked as required according to the gear marking requirements.

A limit of 600 traps per vessel reflects current fishing practices and is consistent with the NMFS emergency regulations, so this measure should have no impacts to red crab fishing vessels involved in the directed fishery. This measure is intended to prevent an increase in the number of traps used in the red crab fishery. Because the fishery will be managed via effort controls (principally through DAS limits), any method by which a vessel can increase their efficiency per day of fishing has the potential to subvert the effort controls intended to ensure a sustainable fishery. Increasing the number of traps used is one technique that could be used to increase a vessel's efficiency; this measure, in conjunction with the maximum trap size described below, maintains the relative fishing power of all vessels to be roughly equivalent to existing levels. It is not the intent of the Council to limit the ability of red crab vessels to participate in other fisheries; thus, the trap limit is only intended to constrain the gear used in the red crab fishery.

4.2.5.2 Non-Preferred Option 1: 400 traps per vessel

This option would allow all vessels fishing on a directed red crab trip to employ a maximum of 400 traps in the harvesting of red crabs. In most, if not all, cases this would be a reduction in the number of traps currently employed by vessels. The Council may want to consider a wholesale reduction in the number of traps used by each vessel in the fishery as a conservation measure to control effort.

4.2.5.3 Non-Preferred Option 2: 1,000 traps per vessel

This option would allow all vessels fishing on a directed red crab trip to employ a maximum of 1,000 traps in the harvesting of red crabs. This amount is most likely more than is being used by any vessel currently directing on red crab, but the option is intended to represent the upper bound on the reasonable range of options considered in the development of the FMP.

4.2.5.4 Non-Preferred Option 3: Overage Allowance

Because all vessels may suffer some gear damage or loss, a small allowance should be made for vessels to have spare traps available for use as replacements. This allowance should probably be indicated by a percentage of the trap limit and should be based on typical per trip gear loss. For instance, if a vessel fishing 500 traps typically has to replace around 25 per trip, the allowance should be 5%. The advisors report replacing an average of approximately 10 traps per trip, and as many as 50 traps on a trip, so these numbers could be used to establish an appropriate overage allowance. If the option is implemented to set a maximum number of traps allowed per string and a maximum number of strings per vessel, an overage allowance would not be necessary.

4.2.6 Gear Requirements and Restrictions

The FMP will establish gear requirements and restrictions for the directed red crab fishery. The Council considered the utility of requiring escape vents (of a size to be determined to allow for the escapement of small crabs and possibly females) on all traps used in the directed red crab fishery. Other gear requirements considered as options in the FMP include size and materiel restrictions for traps used in the directed fishery. Gear marking or trap tag requirements were also considered. Gear modifications may be necessary to comply with marine mammal and protected species requirements. The Council considered prohibiting all fishing gear types except pots and traps in the directed red crab fishery.

Vessels fishing for red crab under either a controlled access permit or an open access incidental catch permit will be required to comply with all relevant gear requirements and restrictions as indicated in the Atlantic Large Whale Take Reduction Plan, pursuant to 50 CFR § 229.32.

4.2.6.1 Preferred Option 1: Maximum trap size

The FMP will establish limits on the size of traps that may be used by a vessel with a controlled access permit in the directed red crab fishery. The Council considered several ways to set a maximum allowable size for red crab traps, including based on specific maximum allowable dimensions (e.g., 48" by 30" by 18"), maximum allowable trap foot print area (e.g., 10 $feet^2$), maximum trap girth measured in two directions (e.g., 250 inches), or by maximum allowable trap volume (e.g., 18 $feet^3$). The latter three options allow for different trap designs (e.g., square, circular, or conical) that are still constrained by the overall size restrictions, but allow some degree of flexibility.

The maximum allowable size of all traps used in the controlled access red crab fishery will be 18 cubic feet. All traps used in the controlled access fishery must be either rectangular/trapezoidal or conical, but new trap designs may be approved by the Regional Administrator provided the volume of the new trap design does not exceed the maximum limit established by the Council.

Restricting traps used in the red crab fishery to a maximum size prevents any future increase in trap size, constraining trap efficiency to current levels. Eighteen cubic feet was selected as the maximum allowable volume to allow for some margin of error in the traps currently being used and was based on rounding the larger of the two calculated trap volumes to the nearest cubic foot. This measure, in conjunction with the trap limit described above, serves to prevent a potential increase in the per day efficiency of fishing vessels fishing under a DAS limit program.

4.2.6.2 Preferred Option 2: Gear markings

The Council considered requiring that all traps used in the directed red crab fishery be marked in such a way as to identify them as red crab traps, the vessel from which they are deployed, and any other information the Council or the Regional Administrator deems necessary. In order to clearly identify red crab fishing gear as such, the vessel to which it belongs, and other information necessary to enforce the provisions of the FMP, the following will be required on all buoys used at the end of each red crab trap trawl:

- "RC" should be painted on the top of each buoy to clearly indicate red crab fishing gear;
- the vessel's permit number should be painted on the side of each buoy to clearly indicate the vessel and to allow for verification that it is authorized to participate in the controlled access fishery;
- the number of the trap trawl relative to the total number used by the vessel (i.e., "3 of 6") should be painted on the side of each buoy as well;
- all letters and numbers painted on buoys should be at least three inches in height to be clearly visible by U.S. Coast Guard and other vessels; and
- high flyers and radar reflectors will be required on each trap trawl.

Gear markings are necessary to identify fishing gear being used in the red crab fishery. The proposed gear markings would allow the administration and enforcement of the trap limit. These proposed gear marking requirements are consistent with current marking practices in the red crab fishery.

4.2.6.3 Preferred Option 3: Prohibition on the use of parlor traps

The use of parlor traps in the red crab fishery is prohibited. A parlor trap is a trap with two or more compartments within the trap that are intended to make it more difficult for animals to escape from the trap. A red crab trap must therefore have only one compartment within the trap and that compartment must not be divided into sections with barriers that impede the free movement of crabs within the trap. A red crab pot is not to have any form of chamber or partition in the pot which is capable of containing red crabs other than that formed by the external frame of the pot.

Parlor traps improve the ability of traps to retain crabs over a longer time. Thus the use of parlor traps could increase fishing effort, particularly if accompanied by a change in fishing strategy, such as longer soak times. Parlor traps would likely increase the productivity of traps when they are left on the fishing grounds between trips. Because the current traps do not prevent the escape of crabs from the trap, many of the crabs that might enter the traps during the period between trips are gone before the vessel returns to haul the traps on the next trip. Parlor traps would create a concern about "ghost" fishing if traps are lost. Lost traps do not present a ghost fishing problem at present because the crabs can escape from the traps. Parlor traps would be more likely to cause handling damage to crabs. This would lower product quality for the marketable crabs that were kept and increase mortality for the crabs that are released alive.

4.2.6.4 Preferred Option 4: Prohibition on the use of other gear types

The FMP will require that only traps meeting the above specifications, restrictions, and requirements be used in the directed red crab fishery. Other gear types, such as otter trawls, dredges, nets, etc., would be prohibited from use by vessels holding a controlled access permit for the red crab fishery and operating on a red crab DAS. This prohibition would not apply to those vessels retaining incidental catch-level amounts of red crab harvested while participating in other fisheries, even if they hold a controlled access permit for the red crab fishery.

Prohibiting non-trap fishing gear (principally otter trawl and dredge gear) in the controlled access directed red crab fishery will protect the resource and its habitat from more damaging fishing gear, minimizing the potential for any adverse impacts to red crab EFH. This measure will reduce the potential for increased discard mortality associated with other gear types. This prohibition will also reduce potential gear conflicts between red crab fishermen.

4.2.6.5 Non-Preferred Option 1: Escape vents

This option suggests that escape vents be required on all traps used in the directed red crab fishery. The escape vents would be used to facilitate the escapement of small crabs and possibly females if the fishery is regulated as male-only. The most appropriate size for the escape vent will be determined based on an analysis of size-weight relationships for male and female red crabs, as well as on information from the fishing industry on common fishing practices. The most appropriate size for the escape vent also depends upon the minimum size adopted by the Council, if such a measure is adopted. If the Council adopts a minimum size of five inches, the escape vent would need to be larger than if the Council adopts a minimum size of four inches. We should consult with the industry on this issue to determine whether current trap design incorporates enough spacing to be considered a sufficient escape vent. Depending on the operation of this fishery and the trap designs used, escape vents may not be necessary, although the Council could reserve the right to require escape vents if trap design or fishing operations change.

4.2.6.6 Non-Preferred Option 2: Trap materials

This option would establish controls on the materials allowed to be used in the directed red crab fishery. As stated above, comments received during the scoping process indicated that the industry standard trap is constructed of wood and wire mesh. The Council could control trap design materials, although this may prevent the industry from developing new designs and materials which may be better suited to this fishery. This option is probably not necessary, but the Council may want to restrict the use of toxic materials (including wood treatments) in the construction of red crab traps.

4.2.6.7 Non-Preferred Option 3: Trap configuration and deployment

Whether or not the Council chooses to adopt any other gear controls or restrictions, it may consider establishing certain minimum and/or maximum standards for the configuration and deployment of trap trawls. Items to consider include a minimum and/or maximum number of traps per trawl allowed (e.g., no less than 20 and no more than 100) and a minimum and/or maximum lengths for trap trawls (e.g., no less than 100 yards and no more than 1 mile in length). This option is probably unnecessary as the fishermen will have determined the most efficient trap and string configuration for their fishery.

4.2.6.8 Non-Preferred Option 4: Ghost panel

The Council may consider requiring some form of "ghost panel" or other mechanism designed to allow for escapement after a period of time if the trap has been abandoned or lost. The Council concluded that this measure is not necessary at this time. Current trap designs employ a circular opening on the top of the trap, approximately eight inches in diameter, that allows for both the ingress and egress of animals to and from the trap. Sufficient information exists to suggest that animals only remain in the trap as long as there is bait available; once the bait is exhausted, the animals leave the trap (Ganz and Herrmann 1975). This option may become necessary if trap designs change to prevent the free egress of animals from the traps. The necessity of this option may also depend, in part, on whether the Council adopts or changes other gear controls, such as trap design requirements and prohibitions.

4.2.7 Total Allowable Catch

The FMP will establish a target total allowable catch (TAC) for the red crab fishery. The establishment of a hard TAC was identified as a potential measure for the FMP and considered by the Council. A hard TAC would operate by establishing an upper limit for annual landings in the fishery, and once this limit was reached, the fishery would be shut down for the remainder of the year. The Council expressed concern over the likelihood of creating conditions leading to a "derby"-type fishery. The Council agreed with the need to take precautions against creating a derby fishery and created a suite of management measures intended to maintain fishing effort and mortality low enough to obviate the need for a shutdown early in the year.

Each of the following options for specifying an annual TAC could be implemented using either a hard TAC or a target TAC. Under the hard TAC option, the Council would need to specify a data collection system for determining when the TAC has been reached and notification procedures for shutting down the fishery. Some allowances for data variability and timing issues would need to be established and addressed. Under the preferred target TAC option, the Council will specify a data collection system and protocols for establishing the following year's TAC based on current year harvest levels. Besides the options listed below, there may be other options for specifying a TAC that require more information than is currently available. The Council will retain the flexibility (through the framework adjustment process) to change the approach as new information is collected.

At the end of this section, Table 13 summarizes the five options and indicates possible amounts for an annual TAC under each option. The actual amount of a TAC in any given year under several of these option depends upon the MSY set for the resource. If the calculated MSY of 6.24 million pounds is changed, either through better information on which to base the calculations or changes in the assumptions selected by the Council, the amount of TAC under non-preferred options 1 and 3 would also change. The preferred option depends upon the selection of a target yield (OY). Non-preferred option 4 depends upon both the amount of target yield and the number of vessels allowed access to the directed fishery.

4.2.7.1 Preferred Option: Target Yield

This is the Council's preferred option. Each fishing year, the landings in the red crab fishery will be counted against a target total allowable catch (TAC). The target TAC will be set annually through the annual specification process, equal to the most current estimate of optimum yield (OY) for the fishery, and may be readjusted based on any projected overage or underage expected for the current fishing year. For example, when the Council is setting the annual specifications for the following fishing year, if OY is 5.928 million pounds and the Council projects that 6.75 million pounds will be harvested in the current fishing year (a 822,000 pound overage), then the target TAC for the following year could be set at 5.106 million pounds. If, on the other hand, the Council projects that only 5.25 million pounds will be harvested in the current fishing year (a 678,000 pound overage), then the target TAC could be set at 6.606 million pounds.

These calculations will have to take past years' landings into account as well as projections for the current year, and this may affect whether and the degree to which the Council adjusts the TAC for the following year based on current year projections. The methods used to project current year landings will be developed by the Council's Red Crab PDT and will be adjusted as data collection improves.

Setting the annual target TAC based on OY reflects the intent of the OY provisions of the Magnuson-Stevens Act and provides a conservative approach to setting the annual TAC. Since the principal control on the fishery will be an effort-based control on days-at-sea, use of a hard TAC (where the fishery shuts down when the TAC is reached) is not an appropriate mechanism. Any type of hard TAC, in conjunction with a DAS program, would encourage vessels to use as many of their DAS as possible as soon as possible in the fishing year before the hard TAC is reached. This would be inconsistent with the goals and objectives of the FMP, which include maintaining, to the greatest extent possible, a twelve-month fishery and minimizing the potential for a derby fishery. The target yield could vary with the condition of the stock.

4.2.7.2 Non-Preferred Option 1: Maximum sustainable yield (MSY)

The hard or target TAC would be set equal to the best available estimate of MSY for the red crab resource, as adjusted for the management unit. In each year, the TAC would be set at the adjusted MSY. Please see Section 3.4.3 for a full discussion on methods of estimating MSY and current best estimates. When new information becomes available that allows a revision of the estimate of MSY, the TAC would also be adjusted.

4.2.7.3 Non-Preferred Option 2: Average landings

The TAC could be based not on an estimate of MSY, but on the average landings reported in the red crab fishery over the last ten years or so. Since we believe the fishery to be sustainable at the levels of fishing activity involved in the last ten years, the average landings could be used as a proxy for a reasonable annual TAC. This method would be considered precautionary in the face of imperfect data on the true MSY and could be considered an approach that would allow the fishery to continue as it has been for the past several years. This approach may underestimate the available resource, especially if MSY is revised upward following collection of additional data. This approach could be used either as a hard TAC or as a target TAC, but given its conservative nature would probably be better used as a hard TAC.

4.2.7.4 Non-Preferred Option 3: Economic considerations

The TAC could be based on economic considerations. Biological limits would establish the upper constraint for the annual TAC, but this amount would be reduced downward to better incorporate economic considerations (e.g., optimizing per unit costs, maximizing economic rents, etc.). This approach could be used either as a hard TAC or as a target TAC. In this case, the most direct approach to setting a TAC that best incorporates economic considerations would be to set the TAC equal to the maximum economic yield (MEY). The concept of MEY is explained in Section 3.6.3.3.

4.2.7.5 Non-Preferred Option 4: Vessel-based cap on landings

Rather than establish an overall TAC for the entire fishery, the target yield could be divided and assigned to individual vessels or categories of vessels (e.g., large catcher-processors and small catcher vessels). Each vessel or category of vessels would be allocated a certain amount of landings for the year and when they reached this amount of landings, would have to stop fishing for the remainder of the year. Because this option, if used to allocate a portion of the overall TAC to each vessel in the fishery, is essentially an individual vessel quota (IVQ) allocation, this is not a viable alternative at this time.

	Measure of TAC	**Amount of TAC**
Preferred Option	target (OY)	5.928 M pounds*
Option 1	MSY	6.24 M pounds*
Option 2	Average Landings	3.21 M pounds
Option 3	MEY	5.925 M pounds*
Option 4	Vessel-Based	5.928 M pounds*

Table 13: Summary of alternatives for setting a TAC for the red crab fishery.
*The actual amount of a TAC under several of these option depends upon the MSY set for the resource. If the calculated MSY of 6.24 million pounds is adjusted, so too will the amount of TAC under options 1 and 3. The preferred option depends upon the selection of a target yield (OY). Option 4 depends upon both the amount of target yield and the number of vessels allowed access to the directed fishery.

4.2.8 Trip Limits

The FMP will establish trip limits for these vessels holding a controlled access permit for the directed red crab fishery. In order to minimize the potential for a derby fishery that may be associated with the setting of a TAC, the Council considered trip limits as a potential measure for the FMP. The balancing of enforcement concerns versus conservation rationale for trip limits was considered. For each option considered under this measure, the trip limit would be considered to be in whole weight equivalent (i.e., a vessel that partially processes or butchers crabs at sea, if the practice is allowed under the FMP, would use a specified recovery rate conversion formula and determine the whole weight equivalent of the weight of their crab product). For example, if a vessel butchers at sea and uses a 50% recovery rate, under the 10,000 pound limit they would be limited to landing 5,000 pounds of butchered red crab per trip. The specification of reasonable and straight-forward conversion rates will be critical to the success of this potential measure.

4.2.8.1 <u>Preferred Option: Differential Trip Limit</u>

This is the Council's preferred option. Instead of implementing a one-size-fits-all trip limit, the Council considered several methods to apply differential trip limits to the red crab fishery in an attempt to recognize differences in vessel size, fishing efficiency, and history in the fishery. The first method considered allows vessels to declare into a trip limit category and allocates vessels a specific number of fishing trips. The second method considered would establish some number of vessel trip limit categories and use vessel landings history to determine the category in which to place each vessel. The third method considered would establish a separate trip limit for each vessel, based on the vessel's highest trip on record, by landings of red crab.

All vessels holding a controlled access red crab permit fishing in the directed fishery will be subject to a possession/trip limit of red crab. The baseline possession limit for all controlled access vessels will be 75,000 pounds of whole red crab or their equivalent. If a vessel can show documented proof of a higher trip during the controlled access qualification period, then that vessel will qualify for a trip limit equal to the larger trip, rounded to the nearest 5,000 pounds. Vessels that butcher and/or partially process the red crabs they harvest (subject to the butchering and processing at sea restrictions identified above) must apply the more appropriate of the two recovery rate formulas to their catch in order to determine whether they are within the possession limit.

This approach to the differential trip limit maintains the approximate capacity of fishing vessels as it was prior to the control date, increases the potential for fishing vessels to operate efficiently, and recognizes some of the inherent differences among the fishing operations and capacities of the vessels operating in the fishery prior to the control date. The baseline trip limit of 75,000 pounds serves to establish for any new vessels that qualify to enter the fishery a trip limit equal to the approximate average capacity of vessels engaged in the fishery prior to the control date. The overall intent of the trip limit measure is to maintain the overall capacity of the red crab fleet to be approximately equal what it was prior to the control date, prevent an overall increase or a creep in the capacity of the red crab fleet, and to prevent one or more vessels from subverting the constraints of the DAS program by extending their fishing trips and making fewer but much larger fishing trips. The recovery ratios are necessary to administer the trip limits in the face of different types of fishing operations.

Using the first method considered, the Council would be able to offer differential trip limits for different vessels, based on the vessel's choice, and allocate a maximum number of trips per year to each vessel depending on the category of trip limit they choose. This program would be modeled on the scallop fishery closed area exemption program, wherein each scallop vessel was allocated a certain number of fishing trips and a maximum trip limit. The chief difference is that this program would include the entire red crab directed fishery and this concept provides a tiered approach to vessel trip limits, such that a vessel might declare into a 60,000 pound trip limit category, a 120,000 pound trip limit category, or a 180,000 pound trip limit category, depending on which amount of landings is most economical for their vessel. Each vessel would then be allocated a certain number of trips such that the ratio of landings to trip limit category would be the same. For example, under the above categories of trip limits, vessels declaring into the 60,000 pound category would be allocated twice as many trips as vessels in the 120,000 pound category and three times as many trips as the vessels in the 180,000 pound category. Vessels declaring into the 120,000 pound category would be allocated three trips for every two allocated to the vessels in the 180,000 pound category.

Once a vessel declared into a category, they would be committed to that category for at least the remainder of the fishing year. The Council and NMFS would have to establish an appeals process for broken trips, but in general once the maximum number of trips is reached, a vessel would not be able to continue fishing, even if they harvested less than their trip limit on one or more trips. As with the sea scallop closed area exemption program, the Regional Administer could retain the right to increase the number of trips allocated to all vessels if it becomes clear during the fishing year that the overall TAC will not be reached.

The second method considered for a differential trip limit establishes some number of trip limit categories (e.g., two categories equal to 60,000 pounds and 100,000 pounds). Under this example scenario, all vessels participating in the directed fishery would be subject to the 60,000 pound trip limit unless they can show evidence of a past trip with landings of 100,000 pounds or greater prior to the control date. If they have evidence of such a previous trip, they would be allowed to fish at the higher trip limit. This would allow vessels with a history of higher than average per trip landings (which may be necessary to remain economically viable in the fishery) to continue fishing at that level. Other vessels without the history of higher than average per trip landings would not be allowed to increase their effort but would be constrained to a lower level of per trip landings more in line with the rest of the fleet. This type of differential trip limit, based in part on vessel history, would not necessarily be combined with an allocated number of trips, but could be implemented on its own as a variation of any of the above trip limit options. The number of categories and the trip limits would be based on the most appropriate natural breaks in vessel landings.

The third differential trip limit method considered would establish a different trip limit for each vessel, based solely on their highest trip on record. This could be considered an extension of the second method, with the number of trip limit categories being equal to the number of vessels in the directed fishery and the trip limits themselves based on the largest reported trip of each vessel.

4.2.8.2 Non-Preferred Option 1: 10,000 pounds

This option represents the low end of the range and would indicate that any vessel on a directed red crab trip could land no more than 10,000 pounds (whole weight equivalent) of red crabs, subject to any other restrictions (such as minimum sizes, male only, etc.).

4.2.8.3 Non-Preferred Option 2: 50,000 pounds

This option represents a mid-range trip limit, as a more likely limit than the options at either end of the range. Under this option, all vessels fishing on a directed red crab trip would be limited to landing 50,000 pounds (whole weight equivalent) of red crabs, subject to all other restrictions.

4.2.8.4 Non-Preferred Option 3: 65,000 pounds

This option represents another mid-range trip limit, and is based on the average hold capacity of the traditional red crab vessels. Under this option, all vessels fishing on a directed red crab trip would be limited to landing 65,000 pounds (whole weight equivalent) of red crabs, subject to all other restrictions. This option may be implemented for all vessels participating in the directed red crab fishery until such time as the differential trip limits can be implemented.

4.2.8.5 Non-Preferred Option 4: 200,000 pounds

This option represents the most likely upper bound on trip limits the Council would reasonably consider under this FMP. Under this option, all vessels fishing on a directed red crab trip would be limited to landing 200,000 pounds (whole weight equivalent) of red crabs, subject to all other restrictions. Although the Council may consider this as an option for purposes of establishing an upper extreme, it should not be construed as a likely outcome of the FMP development process.

4.2.9 Controlled Access Program

The Council identified the development of a controlled access program as a specific objective for the FMP. The Council intends the controlled access system to establish qualification criteria based on history in the red crab fishery, including criteria to clearly differentiates history in the Atlantic red crab fishery (within the management unit) from history in other areas such as the Gulf of Mexico and South Atlantic. The intent of this system is to ensure that participation in the red crab fishery is maintained at sustainable levels. Although "limited entry" was discussed during the scoping process and supported by several industry members, the various options considered under proposed controlled access system include components of a limited entry program. Thus, a limited entry program did not appear as a stand-alone measure.

As an alternative to a straight in-or-out access program (where vessels either get total access or no access to the directed fishery), the Council considered a program of differentiated access for vessels to qualify for different levels of participation based on their history in the fishery. Under this system the Council would develop categories (e.g., occasional, part-time, and full-time as in the scallop fishery, or seasonal access to the directed fishery as well as full-time access) and allow vessels different levels of participation according to the category qualification criteria. Only landings from the New England Council's management area for the red crab fishery may be used to qualify for the controlled access program.

4.2.9.1 Preferred Option: Control date cut-off

This is the Council's preferred option. Implementation of the Red Crab FMP will include a controlled access program for vessels that wish to participate in the directed red crab fishery and retain more than the incidental catch limit described above. This option limits the vessels qualified to participate in the directed red crab fishery to only those vessels with a history of verifiable landings prior to the March 1, 2000 control date. In order to qualify for the controlled access program and receive a controlled access red crab fishing permit, vessels must demonstrate that their average annual landings of red crabs during the three years prior to the control date (March 1, 1997 - February 29, 2000) were greater than 250,000 pounds. Only red crabs harvested from and landed in the Red Crab FMP management unit will qualify for the controlled access program.

Prior to selecting the specific criteria, the Council considered a range of options for qualification criteria under the control date cut-off. The following options were intended to represent a range of qualification criteria, some of which were considered too restrictive and others which were considered not restrictive enough.

a. At least 10,000 pounds of verifiable annual landings in one or more years of up to the three years prior to the control date. The intention of this option would be to differentiate vessels targeting red crabs from those landing small amounts of red crab as incidental catch in their primary fisheries.

b. At least 300,000 pounds of verifiable annual landings in one or more years of up to the three years prior to the control date. The intention of this option would be to differentiate full-time directed red crab vessels from those vessels occasionally targeting red crabs.

The proposed qualification criteria for the controlled access program utilize the March 1, 2000 red crab control date, as was intended by the Council, and are consistent with the goals and objectives of the Red Crab FMP. The proposed criteria allow vessels with an established history in this fishery to continue, while preventing an increase in capacity above recent historic levels. This measure is intended to prevent overcapacity in the fishery. The proposed vessel transfer and upgrading restrictions maintain consistency of fleet capacity with current conditions and maintain a consistent basis for the calculation of DAS projections and allocations. This measure also protects the capacity of the fleet for the future, should other controls such as trap limits and trip limits change.

4.2.9.2 Non-Preferred Option 1: Control date priority

This option would give those vessels with a history of verifiable red crab landings priority access in the directed red crab fishery under the FMP. This would not prohibit additional vessels from qualifying to participate in the directed fishery, but would not guarantee them access either. Access qualification would be based on the capacity of the resource and the total capacity of the vessels. First, the total capacities of the vessels with a history prior to the control date (based on a set of minimum qualification criteria -- see Option 1) would be summed and compared against the capacity of the resource. If there is additional resource capacity remaining, additional vessels would be added until the capacity of the fishery matched that of the resource.

It may be difficult to determine vessel capacity and this option may require more information than we have currently. The vessel capacity will be linked strongly to the other management measures implemented under the FMP. This could also be considered in the future as a way to tweak the control date cut-off option -- initially, we could establish access based on qualification relative to the control date, but as additional information becomes available we could conduct an interim review and allow additional vessels access to the fishery. This could be done every three years, or some other reasonable interval, especially after a new stock assessment is conducted and available. New vessels may be given access in one of several ways: (1) attrition of existing vessels; (2) revised resource capacity; or (3) reduction in fishing effort of existing vessels.

4.2.9.3 Non-Preferred Option 2: Vessels with landings after control date

This option would limit the vessels qualified to participate in the directed red crab fishery to only those vessels with a verifiable history of some minimum amount of landings in the one year subsequent to the control date (March 1, 2000 - February 28, 2001). The qualification criteria for this option could be the same range as the control date cut-off option.

a. At least 10,000 pounds of verifiable landings.

b. At least 300,000 pounds of verifiable landings.

4.2.9.4 Non-Preferred Option 3: All currently active vessels

This option would give those vessels currently and actively fishing for red crab access to the directed red crab fishery under the FMP. New vessels not currently in the fishery would not necessarily be given access to the fishery unless there was capacity remaining. New vessels may be given access in one of several ways: (1) attrition of existing vessels; (2) revised resource capacity; or (3) reduction in fishing effort of existing vessels. The difficulty with this option will be to define “currently.” One method for determining the number of vessels in the fishery is to use the number of vessels that requested letters of authorization (LOA) from the Regional Administrator during implementation of the red crab emergency regulations (17 vessels requested LOAs during the May 18 - November 14, 2001 emergency period). Although 17 vessels had LOAs, fewer actually fished for red crab using the LOA, so there will be an additional level of difficulty determining (1) the number of current vessels and (2) the number of active vessels. We may be able to use the implementation date of the FMP as a cut-off, but that could result in a rush of vessels entering the fishery while the FMP is in development or NMFS' review. Another option is for the Council to consider an additional control date that would be established during the development of the FMP. Any analysis of this option would have to allow for the entry of additional vessels above those currently engaged in the red crab fishery.

4.2.9.5 Non-Preferred Option 4: Vessel size restrictions

This option would establish an upper limit on the size of vessels that may participate in the directed red crab fishery. The size restriction could be based solely on registered length (e.g., a maximum of 120 feet), on hold capacity (e.g., a maximum of 100,000 pounds) or on some combination of vessel specifications. This option would be less relevant if controlled access is implemented as part of this FMP.

4.2.10 Vessel Transfer / Vessel Upgrading Restrictions

The FMP will implement vessel transfer and upgrading restrictions on vessels authorized to hold a controlled access permit for the directed red crab fishery. The Council's intention was to develop this measure to be as consistent as possible to the Council's other FMPs (Northeast Multispecies, Sea Scallop, etc.). This measure would restrict the ability of vessel owners to transfer their controlled access eligibility to another vessel and to upgrade or replace their own vessels to within certain limits. This measure would be irrelevant if no controlled access was implemented as part of the FMP.

4.2.10.1 Preferred Option: Implement vessel transfer/upgrade restrictions

Vessels will be restricted from transferring their red crab eligibility to another vessel if that vessel was more than 10% larger in length, gross registered tonnage, and/or net tonnage than the original vessel's baseline specifications. The intention of this option is to prevent transferring eligibility in the directed red crab fishery from a relatively small vessel to a much larger vessel. Vessels also would be restricted from replacing and/or upgrading their red crab eligible vessel if the upgrade or replacement would increase the length, gross registered tonnage, and/or net tonnage by more than 10% of the original vessel's baseline specifications. This measure only applies directly to vessels with a controlled access permit for the directed red crab fishery, but all fishing vessels are subject to the more restrictive of the regulations that pertain to any permits which they hold. For example, if a vessel holds both a limited entry northeast multispecies permit and a controlled access red crab permit, that vessel is subject to the more restrictive of the vessel transfer/upgrading restrictions.

4.2.10.2 Non-Preferred Option: Do not implement vessel transfer/upgrade restrictions

There would be no restrictions or limits placed on vessels participating in the red crab fishery regarding vessel transfers and/or upgrading.

4.2.11 Days-at-Sea Limits

The FMP will establish days-at-sea (DAS) limits for the directed red crab fishery. Days-at-sea will be used in conjunction with a target TAC to mitigate the potential for creating a derby fishery as a result of implementing new management measures. The days-at-sea program could be adjusted annually depending on how the fishery is doing against the annual TAC. The initial total DAS available to the fishery depends upon several factors, including the initial TAC and other effort controls implemented through the FMP, such as trap limits and/or trip limits.

Vessels will be required to declare, on an annual basis as part of their permit renewal application, into or out of the directed red crab fishery for the following fishing year. The Council may utilize this information to adjust the number of DAS allocated to each vessel declaring into the fishery. For example, if based on the target TAC established for the coming fishing year, the fleet DAS are calculated to be 600 and there are six vessels normally authorized to participate in the directed fishery, each vessel would be allocated 100 DAS. If, however, two vessel opt out of the fishery for the coming fishing year, the remaining four vessels may each be allocated 150 DAS.

It is the intent of the FMP that DAS will be counted as a whole day (24 hours). Any portion of a day on which a vessel is out of port will count as a full DAS. For example, if a vessel embarks on a fishing trip at 11:00 PM on June 1, then that counts as one DAS. If they return from the trip at 1:00 AM on June 10, that also counts as one DAS, and they would have used 10 DAS on the fishing trip (not the 8.0833 DAS that would be counted if an hourly clock is used).

Part 1 -- DAS Allocations

4.2.11.1 Preferred Option: Equal allocation of DAS

This is the Council's preferred option. Under this option, DAS will be initially allocated to all vessels that qualify to fish in the controlled access directed red crab fishery on an equal basis, without regard to the vessel's history in the fishery or past landings. Vessel qualification criteria should be considered distinct from this measure and subject to the options considered under the controlled access program measure. Adjustments to DAS would be made evenly to all vessels in the program and increases/decreases will be specified in whole numbers. Allocation of DAS may be to all vessels equally, or equally to all vessels within certain categories. For example, vessels that butcher crabs at sea could all receive the same number of DAS, this category may be allocated more or less than a category of vessels that land crabs whole. This allocation would be based on the relative efficiency and productivity of the vessels within each category, once sufficient data are available with which to make a determination of their relative efficiency.

The equal allocation of available DAS treats all vessels authorized to participate in the controlled access red crab fishery equally, regardless of their prior level of effort in the fishery. The requirement for vessels to declare their intent prior to each fishing year allows the Council, working with NMFS, to adjust the annual allocation of DAS based on the expected number of vessels that will actually participate in the fishery. This is an important consideration due to the small number of vessels that will be involved in this fishery. Because only five vessels will likely qualify for controlled access permits, each vessel will be allocated 20% of the total available fleet DAS. If one vessel declares out of the fishery for a year, that increases the DAS allocated to each remaining vessel by 25% (e.g., if each of 5 vessels gets would allocated 200 DAS of a total 1000 fleet DAS, and 1 vessel declares out, each of the remaining 4 vessels would get an additional 50 DAS, or 25% of their initial 200 DAS allocation). Although this type of declaration requirement is not standard with other DAS programs, it is important in this fishery in order to achieve OY on a continuing basis.

Upon implementation of the FMP, the Council will be required to make annual recommendations to NMFS regarding the target TAC and allocations of DAS for subsequent fishing years. Changes to either the target TAC or the DAS allocations will be implemented through the annual specifications process described in Section 3.9. There are three variables necessary to specify the DAS allocated to each vessel participating in the controlled access red crab fishery: (1) the target TAC for the fishing year; (2) the number of vessels that will be allocated DAS; and (3) a measure of central tendency representing the per day efficiency of the vessels in the red crab fleet.

The target TAC will be determined based upon the specification of OY, adjusted according to the projected landings for the current fishing year (see Section 4.2.7.1). The number of vessels will be equal to the number of vessels authorized to participate in the directed red crab fishery under the controlled access program, adjusted if one or more of these vessels declares out of the fishery for the coming fishing year (see Section 3.8.1.1). The measure of central tendency for the per day efficiency is a more complicated matter that will vary according to the available data.

As described in Section 5.3.10, there are several measures of central tendency that may be appropriate in this situation: (1) median landings per day of trip; (2) arithmetic mean landings per day of trip; (3) trimmed mean landings per day of trip; (4) mean of vessels per day of trip; and (5) upper or lower bounds on a confidence interval. There are other measurements possible, including but not limited to: (1) geometric mean; (2) harmonic mean; and (3) mode. Selection of the most appropriate statistical measure often depends upon the available data, in particular, the proper scale of measurement and the distribution of the data.

Each year, the Council's Red Crab PDT will examine the available data on vessel landings and trip length (available from the VTRs and/or from the IVR call-in program combined with the DAS accounting program). The PDT will select the most appropriate statistical measure and estimate a per day vessel efficiency that can be applied to the controlled access fleet. This per day efficiency will represent the "average" amount of landings a vessel could be expected to harvest on each day that they are on a fishing trip.

Because as more time goes by during which the fishery is operating under the FMP and therefore subject to the reporting requirements of the FMP, the availability of data should improve and the distribution of available may change, the choice of the most appropriate statistical measure should be expected to change from year to year.

Dividing the target TAC by the best estimate of per day efficiency provides the overall fleet allocation of DAS. The fleet DAS allocation would then be divided by the number of vessels to be participating in the controlled access directed red crab fishery to determine the DAS allocated to each vessel. For example, if the target TAC is set at 5.928 million pounds and the median landings per day of a fishing trip are estimated to be 6,671 pounds (see Table 19), then the fleet DAS would be 888. If five vessel are authorized and declare their intent to participate in the controlled access fishery, each vessel would be allocated 178 DAS (see Table 20). For the first year of FMP implementation, the upper 95% confidence interval was used, six vessels were assumed to be in the directed fishery, and a baseline of 130 DAS were allocated to each vessel as a conservative allocation to accommodate the many uncertainties associated with the initial allocation of DAS. As the uncertainties associated with this program decrease, less conservative approaches can be used to allocate DAS.

4.2.11.2 Non-Preferred Option 1: Allocation based on history

This option would initially allocate DAS to all vessels qualified to fish in the directed red crab fishery on a sliding scale based on the history of the vessel in the fishery. Vessels with a long history in the red crab fishery would be allocated more DAS than recent entrants to the fishery. Vessel qualification criteria should be considered distinct from this measure and subject to options considered under the controlled access option. Adjustments to DAS would be made proportional for all vessels in the program and increases/decreases could be specified in a percentage of existing DAS (for instance, if the DAS adjustment is for a 10% increase, then a vessel initially allocated 100 DAS would have 110 while a vessel initially allocated 50 DAS would have 55).

4.2.11.3 Non-Preferred Option 2: Allocation based on landings

This option would initially allocate DAS to all vessel qualified to fish in the directed red crab fishery on a sliding scale based on landings of red crab reported over a specified time period (e.g., the one year prior to implementation of the FMP; the one year prior to the control date; the highest amount of landings in one of the previous three years; the average amount of landings from the previous three years, etc.). Vessels with higher landings would be allocated proportionally more DAS than vessels with lower landings. Vessel qualification criteria should be considered distinct from this measure and subject to options considered under the controlled access option. Adjustments to DAS would be made proportional for all vessels in the program and increases/decreases could be specified as a percentage of existing DAS (for instance, if the DAS adjustment is for a 10% increase, then a vessel initially allocated 100 DAS would have 110 while a vessel initially allocated 50 DAS would have 55).

Part 2 -- End of Year DAS Carry-Over

4.2.11.4 Preferred Option: Partial end-of-year carry over

This is a preferred option of the Council. Any red crab DAS allocated to a vessel with a controlled access permit to participate in the directed red crab fishery in one fishing year may be carried over to the next fishing year, up to a maximum of 10 DAS or 10% of the total allocated DAS, whichever is less. The partial end of the year DAS carry-over is intended to ensure that at least some unused fishing effort is not wasted, while providing no incentive to hoard DAS. This measure also limits the potential annual fishing capacity to roughly 10% above the baseline. DAS sanctioned vessels will be credited with unused DAS based on their DAS allocation minus total DAS sanctioned. The maximum partial carry-over could be based on a whole number (e.g., 10 DAS) or could be based on a percentage of their total DAS (e.g., 10% of DAS), whichever is less. Any carry-over of unused DAS from one year to the next will expire at the end of that year; the carry-over of unused DAS is not cumulative. For example, if a vessel is allocated 100 DAS in year 1, but used only 90, then that vessel would be able to carry-over 10 DAS into year 2. If that vessel is also allocated 100 DAS for year 2, it would have a total of 110 DAS available. However, if that vessel only fished 105 DAS in year 2, it would not be able to carry over 5 DAS into year 3. It would only be able to carry DAS into year 3 if it fished less than 100 DAS in year 2, and then only carry-over 100 minus the number of DAS it fished (up to a maximum of 10 DAS).

4.2.11.5 Non-Preferred Option 1: No end-of-year carry-over

Controlled access vessels qualified to participate in the directed red crab fishery that have unused DAS on the last day of the fishing year in any year may not carry over any unused DAS into the following year.

4.2.11.6 Non-Preferred Option 2: Complete end-of-year carry-over

Controlled access vessels qualified to participate in the directed red crab fishery that have unused DAS on the last day of the fishing year in any year may carry over all of their unused DAS into the following year. DAS sanctioned vessels will be credited with unused DAS based on their DAS allocation minus total DAS sanctioned.

4.3 Description of the Proposed Management Alternatives

The management alternatives identified below list specific measures that would be included in each alternative, but in most cases, the specific option within that measure is not necessarily related to the alternative selected. For example, all but the “no action” alternative include incidental catch limits as one measure. There exists a range of options for how to implement incidental catch limits (50 pounds per trip, 100 pounds, 500 pounds, etc.) and these are not dependent upon the alternative that may be selected. Descriptions of each type of measure and the relevant options are provided in the previous section.

4.3.1 Preferred Alternative (#5): Target TAC, Days-at-Sea and Trip Limits

This is the Council's preferred alternative. This alternative is the same as alternative #4, with the addition of trip limits. Trip limits would be used to ensure that each trip taken by a red crab vessel is roughly equivalent. The objective of the alternative is to determine the appropriate number of DAS appropriate to harvest, but not exceed, the target TAC. DAS can be adjusted on an annual basis in response to changing stock conditions and to better estimate the amount of fish likely to be harvested. A trap limit will be used to control the potential fishing power of individual vessels. A differential trip limit will be used to maintain differences among fishing vessels, but still maintain the overall fishing fleet at levels approximating those during the time prior to the control date.

a. Incidental catch limits

b. Males only

c. Butchering/processing-at-sea restrictions

d. Trap limits

e. Gear requirements/restrictions

f. Total allowable catch

g. Trip limits

h. Controlled access system

i. Days-at-sea limits

4.3.2 Non-Preferred Alternative 1: "Emergency Rule"

This alternative would implement a set of measures most similar to those implemented under the emergency regulations. The emergency regulations implemented a hard TAC (based on an estimate of MSY), a trip limit, a trap limit, incidental catch limits for vessels not operating in the directed red crab fishery, and reporting requirements for all participants in the fishery. In addition to these measures, this alternative also includes gear requirements and restrictions to maintain the directed fishery as trap only and to assure compliance with marine mammal requirements. Although an express objective of the FMP, this alternative does not include a controlled access system so as to be as consistent as possible with the emergency regulations.

a. Incidental catch limits

b. Trap limits

c. Gear requirements/restrictions

d. Total allowable catch

e. Trip limits

4.3.3 Non-Preferred Alternative 2: Hard TAC with Trap Limits

This alternative would control total fishing effort and landings primarily through the use of a hard TAC. The primary mechanism to make fishing effort equivalent among vessels and to prevent expansion of effort would be a trap limit. A controlled access system would be implemented to limit the number of vessels participating in the directed fishery to an appropriate number. Supplemental measures such as requiring landed crabs to be males only, some form of butchering or processing-at-sea restrictions, and gear requirements and restrictions would be used to control certain aspects of the fishery. Incidental catch limits and reporting requirements would also be implemented.

a. Incidental catch limits

b. Males only

c. Butchering/processing-at-sea restrictions

d. Trap limits

e. Gear requirements/restrictions

f. Total allowable catch

g. Controlled access system

4.3.4 Non-Preferred Alternative 3: Hard TAC, Trap Limits and Trip Limits

In an effort to spread out the landings of red crab and reduce the potential for creating a derby-type fishery, this alternative includes all the measures from the previous alternative with the addition of trip limits. This alternative is also very similar to the "Emergency Rule" alternative with the addition of the male only restriction and some form of butchering and/or processing-at-sea restriction.

a. Incidental catch limits

b. Males only

c. Butchering/processing-at-sea restrictions

d. Trap limits

e. Gear requirements/restrictions

f. Total allowable catch

g. Trip limits

h. Controlled access system

4.3.5 Non-Preferred Alternative 4: Target TAC with Days-at-Sea

This alternative would implement many of the same measures as previous alternatives (incidental catch limits, males only, butchering/processing-at-sea restrictions, gear requirements/restrictions, and a controlled access system), but the principle mechanism to control effort in the fishery would be the use of vessel days-at-sea (DAS). Rather than a hard TAC at which point the fishery would be shut down, a target TAC would be established for the year and DAS would be allocated among the vessels participating in the directed fishery. The objective of the alternative would be to determine the appropriate number of DAS to harvest, but not exceed, the target TAC. DAS can be adjusted on an annual basis in response to changing stock conditions and to better estimate the amount of red crab likely to be harvested. Some form of trap limit would be used to control the potential fishing power of individual vessels.

a. Incidental catch limits

b. Males only

c. Butchering/processing-at-sea restrictions

d. Trap limits

e. Gear requirements/restrictions

f. Total allowable catch

g. Controlled access system

h. Days-at-sea limits

4.3.6 Non-Preferred Alternative 6: Trip Limits and Set Number of Trips

This alternative would also implement many of the same measures as previous alternatives (incidental catch limits, males only, butchering/processing-at-sea restrictions, trap limits, gear requirements/restrictions, and a controlled access system), but the principle mechanism to control effort in the fishery would be the use of a specified trip limit and an authorized number of potential fishing trips. The trip limit could be set equal for all vessels, in which case all vessels participating in the directed fishery would be authorized the same number of potential trips. Another option would be to establish differential trip limits and allow vessels to declare into a certain category of trip limit. Vessels would be authorized different numbers of potential trips depending on the trip limit category into which they declare.

a. Incidental catch limits

b. Males only

c. Butchering/processing-at-sea

d. Trap limits

e. Gear requirements/restrictions

f. Trip limits

g. Controlled access system

4.3.7 Non-Preferred Alternative 7: All Possible Measures

This alternative includes all possible management measures except for an IVQ system (which would relegate most of the measures contained in this alternative as unnecessary). This alternative would provide the most flexibility to the Council to make slight changes to a variety of measures in order to achieve either a change in fishing effort or the amount and type of red crabs landed.

a. Incidental catch limits

b. Minimum size restrictions

c. Males only

d. Butchering/processing-at-sea

e. Trap limits

f. Gear requirements/restrictions

g. Total allowable catch

h. Trip limits

i. Controlled access system

j. Days-at-sea limits

4.3.8 Non-Preferred Alternative 8: IVQ with Controlled Access

As noted in the management measures section, there is currently a federal moratorium that prevents the implementation of any form of individual fishing quota (IFQ). However, this alternative was considered for the purposes of the DEIS. This management alternative, and the next alternative, represent options for a form of an IFQ system called an individual vessel quota (IVQ). Assuming that the current moratorium is lifted at some point in the future, and should the Council decide to fully develop and implement an IVQ system for the red crab fishery, it will develop a full FMP

Amendment. This process will involve an extended period of development and review, including a full scoping process and public review and comment process.

This alternative and the one following are not intended to represent the only types of IVQ programs that the Council may eventually consider. These alternatives are intended to indicate that the Council considers an IVQ system as one possible management strategy that may be appropriate for the red crab fishery and to suggest two basic alternatives for how this type of program could be designed.

This alternative would implement both a controlled access system to limit the number of vessels participating in the directed fishery and an individual vessel quota to allocate each vessel an individual percentage-based share of the TAC. As the TAC changed from year to year in response to changing stock conditions, the percentage of quota allocated to each vessel would not change, but the amount of quota would change accordingly. Other measures (incidental catch limits and gear requirements/restrictions) would also be implemented to address their relevant concerns. Measures such as trap limits, trip limits, DAS, etc., would not be necessary under this alternative.

a. Incidental catch limits

b. Gear requirements/restrictions

c. Controlled access system

d. Individual vessel quotas

4.3.9 Non-Preferred Alternative 9: IVQ Only

This alternative is very similar to the previous alternative, except that it would rely entirely upon an individual vessel quota system to control the harvest of red crabs in the directed fishery. A controlled access system intended to restrict the number of vessels participating in the directed fishery would not be used. Instead, any vessel with a history of red crab landings prior to the implementation of the FMP would be able to continue fishing for red crab, albeit at the same relative rate at which they previously fished. As the TAC changed from year to year in response to changing stock conditions, the percentage of quota allocated to each vessel would not change, but the amount of quota would change accordingly. Other measures (incidental catch limits, gear requirements and/or restrictions) would also be implemented to address their relevant concerns. Measures such as trap limits, trip limits, DAS, etc., would not be necessary.

a. Incidental catch limits

b. Gear requirements/restrictions

c. Individual vessel quotas

4.3.10 Non-Preferred Alternative 10: No action

This alternative would preserve the status quo, whereby vessels fishing for red crab would not be subject to any restrictions. The no action alternative would likely assure that overfishing would occur in the red crab fishery. As a result, the sustainability of the red crab resource would be severely compromised; the red crab fishery would likely be unsustainable; historic participants could be eliminated from the fishery or at least become marginally viable; and the status of the stock would likely be degraded.

	Management Alternatives									
	Emergency Rule	Hard TAC and Trap Limits	Hard TAC, Trap and Trip Limits	Target TAC with DAS	Target TAC with DAS & Trip Limits	Trip Limits with # of Trips	All Possible Measures	IVQ with Controlled Access	IVQ Only	No Action
Measures	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Incidental catch limits[12]	X	X	X	X	X	X	X	X	X	*No Action Alternative*
Minimum size							X			
Males only		X	X	X	X	X	X			
Butchering/processing restrictions		X	X	X	X	X	X			
Trap limits	X	X	X	X	X	X	X			
Gear requirements/restrictions[13]	X	X	X	X	X	X	X	X	X	
Total allowable catch	X	X	X	X	X		X			
Trip limits	X		X		X	X	X			
Controlled access system[14]		X	X	X	X	X	X	X		
Days-at-sea limits				X	X		X			
Individual vessel quotas								X	X	

Table 14: Cross-reference of management measures included in proposed management alternatives for Red Crab FMP. Alternative 5 is the preferred alternative selected by the Council.

[12] All management alternatives (except "no action") include some level of incidental catch limits, based on the FMP goal to "allow all fishermen the continued opportunity to land appropriate amounts of red crab as bycatch."

[13] All management alternatives (except "no action") include some degree of gear requirements and/or restrictions to deal implement gear markings, at a minimum, and to ensure that the directed fishery is regulated as trap only.

[14] Most management alternatives include a provision for a controlled access system, consistent with Objective 5 of the FMP, which states "develop a controlled access system to keep fishing capacity matched to the available resource."

4.4 Other Measures and Alternatives Considered but Rejected

4.4.1 Individual Vessel Quotas

Although there is currently a federal moratorium that prevents the implementation of any form of individual fishing quota (IFQ), for the purposes of the DEIS, the Council considered options for a form of an IFQ system called an individual vessel quota (IVQ). Under this system, each vessel would be allocated a portion of the overall quota available to the fishery.

Assuming that the current moratorium is lifted at some point in the future, and should the Council decide to fully develop and implement an IVQ system for the red crab fishery, it will develop a full FMP amendment. This process will involve an extended period of development and review, including a full scoping process and public review and comment process.

The options outlined below are not intended to represent the only types of IVQ programs that the Council may eventually consider. The options outlined below are intended to indicate that the Council considers an IVQ system as one possible management strategy that may be appropriate for the red crab fishery and to suggest two basic ways to allocate quota should an IVQ system be fully developed.

Once allocated, the vessel would be free to land as much of or as little of their quota as they deem appropriate, but they may not exceed their IVQ. Under the system considered by the Council, quota or quota shares may not be bought, sold, traded, or otherwise transferred from one vessel to another. Any quota not used by a vessel will not be added to their quota allocation for a following year. Any landings by a vessel in excess of their quota will be deducted from their quota allocation for the following year. The allocation of quota in the red crab fishery does not directly or indirectly confer or imply any rights or real value to the vessel so allocated.

4.4.1.1 <u>Option 1: Quota based on history</u>

An IVQ system would assign an annual quota to each vessel qualified to fish in the directed red crab fishery based on their annual landings during some qualification time period (for instance the year prior to the control date). Thus, if a vessel landed 100,000 pounds of red crab in the year prior to the control date, they would be allocated an annual quota of 100,000 pounds. This type of program would allow vessels to continue to fish at previous levels but not expand their effort in the fishery.

4.4.1.2 <u>Option 2: Equal share of quota</u>

A variation of this measure would be to first qualify the vessels that may participate in the directed fishery (via a controlled access program) and then to allocate quota to all qualified vessels equally, regardless of differences in history in the fishery or prior landings. Thus, if five vessels qualify to participate in the controlled access directed fishery, each vessel would be allocated 20% of the annual quota.

4.4.2 Fishing Seasons (seasonal closures)

The Council specified maintaining a twelve month fishery as an objective of the FMP (due to concerns over adverse impacts to fishing communities and market/economic constraints), thus consideration of fishing seasons would be inconsistent with this FMP objective. The PDT reviewed available scientific information on red crab biology, and determined that there is currently no evidence of strong seasonality for either molting or mating. Both molting and mating appear to occur year-round. At this point, there are no known reasons to implement fishing seasons, but as more information on this resource becomes available and if it becomes clear that there are distinct mating seasons, the Council may want to reconsider this type of measure. Market concerns also suggest that seasonal closures would be inefficient and not desirable. Current markets require a consistent supply of red crab product, year-round, to be maintained.

4.5 Relationship of the Recommended Measures to Existing Applicable Laws

There are four types of existing laws and policies which may be applicable to this FMP and the measures and alternatives recommended by the Council. These include: other fishery management plans; treaties or international agreements; Federal law and policies; and state, local, and other applicable laws and policies. These will each be addressed in turn.

4.5.1 Fishery Management Plans

There are many FMPs implemented for the U.S. EEZ within the same general geographic area as the Council's management area for the Red Crab FMP. The following list identifies all known approved FMPs developed for the U.S. EEZ along the Atlantic coast:

New England Council: Atlantic Herring FMP; Atlantic Salmon FMP; Monkfish FMP; Northeast Multispecies FMP; Sea Scallop FMP.

Mid-Atlantic Council: Atlantic Mackerel, Squid and Butterfish FMP; Bluefish FMP; Dogfish FMP; Summer Flounder, Scup and Black Sea Bass FMP; Surfclam and Ocean Quahog FMP; Tilefish FMP.

South Atlantic Council: Atlantic Coast Red Drum FMP; Coastal Migratory Pelagics FMP; Coral, Coral Reef and Live/Hard Bottom Habitats FMP; Golden Crab FMP; Shrimp FMP; Snapper Grouper FMP; Spiny Lobster FMP.

Secretarial Plans (NMFS): American Lobster FMP; Atlantic Billfish FMP; Atlantic Tunas, Swordfish and Sharks FMP.

Due to the limited geographic distribution of the red crab fishery (approximately 400 - 800 meters in depth from the Hague Line south to Norfolk Canyon), there are actually very few interactions between this fishery and any fisheries managed under the above FMPs. For the New England Council, only the monkfish fishery has been identified as one with a potential interaction with the red crab fishery. For the Mid-Atlantic Council, all fisheries with the possible exception of the tilefish fishery occur in water shallower than the red crab fishery. The only South Atlantic Council-managed fishery with some potential interactions is the golden crab fishery. Of the Secretarial FMPs, only the American lobster fishery has been identified as one with potential interactions with the red crab fishery. Thus there are four management plans with the potential for some interaction with the red crab fishery: the FMPs for monkfish, tilefish, golden crab, and American lobster.

The monkfish fishery is largely a trawl fishery with some dredge fishing also occurring. Most of the monkfish fishery occurs over the continental shelf in conjunction with the groundfish and/or sea scallop fisheries. Some monkfish fishing occurs in deep water where red crabs may occur. The principle interaction between these two fisheries is that there may be some degree of bycatch and discard mortality of red crabs in the monkfish fishery. The Red Crab FMP identifies this potential interaction as a research and information need and a potential management concern. Should future research and data collection provide information confirming this interaction and its severity, the Council may consider taking appropriate action to reduce the bycatch of red crabs in the monkfish fishery. This action may take the form of fishing restrictions on the monkfish fishery.

The tilefish fishery occurs in relatively deep water (100 - 300 meters) but is prosecuted almost entirely with bottom longlines (approximately 93% of all landings) (MAFMC 1999). It appears that the red crab and tilefish fisheries may abut one another, but there is probably little interaction between the two with the possible exception of some of the deep-water canyons (Hudson, Block and Veatch Canyons). Because both fisheries primarily use static fishing gear (pots in the case of the red crab fishery and longlines in the case of tilefish), any interactions are expected to be negligible. It is not foreseen that the Red Crab FMP will have any effect on the tilefish fishery, nor vice versa.

The golden crab fishery is identified as occasionally including red crab, but the South Atlantic Council concluded that the populations of golden and red crabs are sufficiently separated from one another to be managed separately (SAFMC 1995). Thus there are very few interactions likely between these two FMPs. Depending on the management unit selected by the Council, there may be a geographic area of overlap between the two Council's areas of management jurisdiction. This could be a cause for concern if there were significant landings of red crabs aboard golden crab vessels and/or significant landings of golden crab aboard red crab vessels fishing in this intersection zone. However, based on the South Atlantic Council assessment, this seems unlikely.

The offshore lobster fishery, managed under the NMFS' American Lobster FMP, is a fishery with some history of direct interaction with the red crab fishery. It has been reported that some offshore lobster vessels occasionally target red crab and may land higher than "incidental catch" levels of red crab. Under normal operating conditions, these two fisheries appear to be segregated according to depth, with the lobster fishery occurring in more shallow water. The Red Crab FMP will establish limits on the incidental catch of red crab by any vessel not authorized to participate in the directed red crab fishery. These limits may affect the operations of some vessels in the offshore lobster fishery if they are prohibited from harvesting and landing as much red crab as they otherwise would. In order to ensure the enforceability of some management measures such as gear restrictions that limit the number of traps that can be fished for red crab, the Council may establish a lobster-red crab fishery demarcation line such that only red crab traps would be allowed to be set deeper than the demarcation line.

4.5.2 Treaties or International Agreements

Foreign fishing is prohibited within the U.S. EEZ for anadromous species and continental shelf fishery resources beyond the EEZ out to the limit of U.S. jurisdiction under the Convention of the Continental Shelf unless authorized by an international agreement which existed prior to passage of the Magnuson-Stevens Act and is still in force and effect or authorized by a Governing International Fishery Agreement which has been issued subsequent to the Magnuson-Stevens Act. There are no pre- or post-Magnuson-Stevens Act agreements affecting deep-sea red crab.

4.5.3 Federal Law and Policies

All applicable Federal laws and policies, including the National Environmental Policy Act (NEPA), the Endangered Species Act (ESA), and the Marine Mammal Protection Act (MMPA) are identified and discussed in Section 12.0 of the FMP.

4.5.4 State and Local Laws, Regulations and Policies

There are no state or local laws, regulations, or policies that apply to the deep-sea red crab fishery.

5.0 Description of the Environmental Impacts of the Management Alternatives

5.1 Introduction and Background

5.1.1 Organizational Structure of Impacts Assessment

There are two principal ways to organize the discussion of the environmental impacts of the management alternatives. The first structure organizes the discussion by impact type (biological impacts, economic impacts, social impacts, etc.) and includes the relevant analyses of all measures and alternatives under each type of impact. The discussion of each measure and each alternative would be repeated for each type of impact. This structure is usually most appropriate for Environmental Impact Statements (EIS) or lengthy Environmental Assessments (EA) when fairly well-developed technical analyses of the probable consequences are available.

The second organizational structure organizes the discussion by alternatives and includes the relevant biological, economic, social, etc., analyses under each alternative. This structure is usually most appropriate for a relatively short EA, but is useful when the availability of technical information on which to base the analyses is limited. This structure is also useful when we want to emphasize the distinctions between the alternatives. In the case of the Red Crab FMP, there were many management measures and alternatives to be analyzed. It is the intention of the Council to illustrate as clearly as possible the differences between the management alternatives under consideration. For most resource types (especially economic, social, and habitat), there is little technical information on which to base our analyses and our assessment of potential impacts will be largely qualitative. For these reasons (the desire to emphasize the alternatives and the limited technical information), this section is organized by alternatives and the analyses of the potential impacts on each resource type will be included in the discussion of each proposed measure and each potential management alternative.

In its consideration of a new management program for the red crab fishery, the Council intended to present a variety of ways the fishery could be managed (the management alternatives), each with a variety of specific tools to achieve the FMP goals and objectives (the management measures). Because each measure was developed with a range of options for the Council to consider, it would have been overly complicated to present only the analysis of impacts for the alternatives with the analysis of the impacts associated with the proposed measures and options within each alternative. Instead, the potential impacts associated with each proposed measure are provided first, and this analysis differentiates between the options within each measure. Then, the measures that constitute each alternative are discussed as a package and compared and contrasted with the two baselines identified for this FMP.

5.1.2 Biological and Ecological Impacts on Red Crab

The measures and alternatives considered in this FMP address a wide range of management issues. The potential biological and ecological impacts on the resource that may result from these measures and alternatives will vary depending on the type of measure, the specific option selected, and the combination of measures that constitute the preferred alternative. This assessment will identify, to the extent possible, the potential biological and ecologic impacts to the red crab population comprising the management unit. The assessment will examine, where appropriate, whether the measures and alternatives are likely to contribute to or diminish the sustainability of the resource, whether the measures and alternatives are likely to alter the size structure of the population, changes in mortality expected as a result of the measures and alternatives, and whether the measures and alternatives are likely to have an affect on reproductive yield.

5.1.3 Ecological Impacts on Other Species and Communities

This section of the impacts assessment is intended to address any changes to the interactions of the deep-sea red crab with other species and their associated communities that may result from the implementation of this FMP. This section is also intended to identify and assess potential changes to the interactions of the directed red crab fishery with other species or their associated communities, usually reflected as bycatch in the primary fishery.

5.1.4 Impacts to Essential Fish Habitat

A description of the physical environment in which red crabs live and an assessment of the impacts to this habitat from fishing practices is provided in Section 8.2.3, the description of the resource and affected environment. All the alternatives and actions proposed in this FMP are intended to control and, in some cases, reduce the amount of fishing effort targeting deep-sea red crabs. The alternatives and actions proposed in this FMP, therefore, are unlikely to increase any adverse impacts to the EFH of any managed species that may be associated with the directed red crab fishery. This section of the impacts assessment will address the specific effects on habitat expected as a result of the particular measures and alternatives proposed for the FMP.

5.1.5 Economic Impacts on the Fishery

This section describes the economic impacts of the management measures that were considered for this FMP. The management alternatives represent the possible combinations of individual measures that together constitute a potential management program for the fishery. Each alternative includes a unique set of measures. The measures are the actual actions being considered to meet the goals and objectives of the plan. For example, a controlled access program is a specific type of management measure that may be used to address some of the problems in this fishery. Several of the management alternatives considered included a controlled access program as one of the measures.

The measures and alternatives considered in this FMP address a wide range of management issues. The potential economic impacts that may result from these measures and alternatives will vary depending on the type of measure, the specific option selected, and the combination of measures that constitute the preferred alternative. The economic impacts of the proposed management measures can be felt by various sectors of the red crab fishing industry. These include harvesters, processors, fishery-dependent services, international trade, markets and fishing communities. The majority of the comments here will apply to either the harvesting or processing sector as they are the sectors that will be most influenced.

Few of these management measures would be effective alone. This section attempts to describe the economic impact of these individual measures. However, it is sometimes hard to think of one measure without thinking about its interaction with other measures that would either improve or decrease its effectiveness. Unfortunately, there are few economic data available with which to evaluate the potential economic impacts of the proposed management measures and alternatives to those individual and entities involved in the directed red crab fishery. As a result, the following discussion, at least as it pertains to economic impacts, is primarily a qualitative assessment of the likely impacts of the various measures and alternatives. A description of the affected human environment (red crab fishermen and fishing communities) is presented in Sections 8.4 and 8.5 of this FMP. A description of the available baseline social and economic information on the red crab fishery is provided in Appendix B.

5.1.6 Social/Cultural Impacts

This assessment characterizes to the extent possible the magnitude and extent of the social impacts likely to result from the proposed management action as well as from the other alternatives considered by the Council during the development of the Red Crab FMP. A description of the affected human environment (fishermen and communities) is presented in Sections 8.4 and 8.6 of this FMP. A description of the available baseline social and economic information on the red crab fishery is provided in Appendix B.

To the extent possible, the social impact factors described in the following subsections were considered relative to the management alternatives considered and were used as a basis for comparison between alternatives. While this assessment cannot quantify the impacts of the management alternatives on the following factors, discussion of the potential changes in the variables as a result of management actions provides information useful for better decision-making. The following factors were developed based in part upon the issues of concern identified by groundfish fishermen and their communities (NEFMC 2000a), tailored to represent the most significant issues of concern to red crab fishermen and their communities. While it is understood that there are differences among fisheries in what are perceived to be social impacts, there are some issues that are considered universal to all fisheries (i.e., safety at sea). These are not the only factors that could or should be considered, but they are largely indicative of the types of social issues that should be considered in the decision-making process. There may be other social issues which may affect fishermen and their communities, but they are even more difficult to define.

5.1.6.1 Social Impact Factor 1 -- Changes in Occupational Opportunities

This factor reflects the degree to which the implementation of the alternatives in this FMP could alter the occupational profile of the affected fishing communities

Changes in occupational opportunities can lead to changes in household/family income, classes, and lifestyles; in assessing this factor, both short-and long-term shifts in job opportunities should be considered. This includes changes to year-round and seasonal fishing opportunities, short-term and long-term dislocation from the fishery, employment opportunities, and the ability to find and keep experienced crew.

Emphasis should be placed on identifying potential changes in the unique social and family arrangements that characterize the communities under consideration, particularly on changes in household employment patterns, trends in family-run fishing businesses, and participation in job retraining programs. Special consideration should also be given to social and cultural values and norms that may be affected by changes in opportunity, such as long-term family involvement in the fishery, job satisfaction, and respect for fishing as an occupation and a way of life.

5.1.6.2 Social Impact Factor 2 -- Changes in Community Infrastructure

This factor reflects the increase or decrease in the demand and supply of basic infrastructure services and facilities essential to fishing in the affected communities, including processors, seafood markets, boat and equipment repair shops, bait and ice providers, display auctions, cooperatives, creditors, legal services, etc.

The cost, quality, availability, and location of fishing-related services can affect fishing community members' business practices, satisfaction with their community, and overall well-being. Additionally, these service industries provide alternative, fishing-related employment opportunities in port communities and contribute significant revenues to the county or city in which the fishing community is located. Impacts on this factor are directly connected to changes in industrial diversification and occupational opportunities. They are also more long-term in nature.

5.1.6.3 Social Impact Factor 3 -- Safety

This factor is related to the ability of fishermen to maintain safe operations at sea; safety can be compromised by various adaptations to increased regulations and decreased opportunity

The safety of fishermen and fishing operations at sea is an extremely important social impact issue, as decreased safety often increases stress at the individual and family level, which can exacerbate many other family and social problems. In addition, the impacts of fishing-related casualties can be felt throughout fishing communities, many of which are close-knit groups with longstanding family and social networks.

5.1.6.4 Social Impact Factor 4 -- Support for Management Program

This factor reflects the degree to which the participants of the fishery subject to the proposed regulations support the measures being proposed

Management measures that are more preferred or supported by the fishing industry sometimes encounter more success than measures that are opposed or that the industry feels are forced upon them. Some people believe that compliance with regulations is directly related to the degree of support for the regulations or faith that they will be effective in achieving their objectives.

5.1.6.5 Social Impact Factor 5 -- Flexibility/Stability/Uncertainty

This factor reflects the amount of flexibility retained by the participants of the fishery for making the day-to-day decisions that affect how, where, and when they fish. This factor also reflects the amount of stability the participants feel is provided by the fishery, or as the inverse, the amount of uncertainty they feel about their future participation in the fishery. These factors are considered together because they are often tightly interrelated.

Flexibility for the members of the fishing fleet and the ability to plan business ventures over the short-term and long-term is an important factor, as is the sense of control over their fishing activity. In an unregulated fishery, the vessel owners and operators have total control to determine when to fish and for how long, where to fish, and how they fish. Some of the measures proposed in this FMP may reduce the flexibility of the participants in the directed red crab fishery. Decreases in flexibility may result in increased stress levels felt by the fishermen and their families.

Having a sense of stability in their fishing activities and business is an important factor for all participants in the fishery. For vessel owners and operators, this is reflected in the desire to be able to plan their fishing year, including when to fish and when to service their vessel, the ability to retain trained crew members, and the ability to get an adequate price for their product. For crew members, stability is reflected in the desire to continue their employment and count on some basic level of earnings. For processors, this is reflected in the desire to have a steady supply of fresh product and the ability to maintain markets for their products. Most fishermen already face less stability in their jobs than do most other people; their income is determined largely by the amount of fish they catch and the prices they get for their fish. Any measures that reduce this sense of stability increases the uncertainty felt by the participants of the fishery.

5.1.7 Impacts on Protected Species

The description of the resource and affected environment section of this FMP (Section 8.7) provides a complete and comprehensive identification and description of all marine mammals and other protected species that may be found in the environment utilized by the red crab fishery. The following sections assessing the potential impacts of the proposed measures and alternatives focus on whether the proposed measures would be expected to provide benefits or have adverse impacts on the populations of marine mammals and other protected species identified in Section 8.7.

5.2 Analysis of the Impacts of the Red Crab Management Program

This section will identify and describe the potential impacts associated with the elements of the fishery management program (management unit, fishing year, overfishing definition, etc.). This analysis will include a brief assessment of the most likely impacts that will result from the alternatives and options selected by the Council for implementation in the Red Crab FMP contrasted with the non-preferred alternatives. For those elements where there was not a range of alternatives considered by the Council (e.g., permitting and reporting requirements), only the potential impacts of the proposed program are included.

5.2.1 Fishery Management Unit

In general, selection of a management unit is not expected to have any direct biological, economic, or social impacts on the resource species or its fishery. The management unit establishes the boundaries within which the measures in the management plan will be implemented. The proposed boundary for the management unit (Cape Hatteras, North Carolina) includes the full extent of the directed fishery for deep-sea red crab in the northeastern U.S. This is expected to minimize all potential economic and social impacts that may affect the members of the directed fishery that will qualify for the controlled access program, as they will be assured that the red crab resource in the area of the traditional fishery will be protected from uncontrolled exploitation. The proposed boundary may have economic and/or social impacts on the incidental catch fishery as all vessels that retain red crab as incidental catch in other fisheries will be subject to the incidental catch restrictions in the FMP. Fishermen regulated under the South Atlantic Council's Golden Crab FMP may be affected by this management unit as it creates an overlap between the two management plans that could cause some confusion among these fishermen. Gear conflicts may arise between these two fishing groups, although even without the overlap in management units gear conflicts could arise. Without the force of the FMP, however, there would be no way for the Council to address any potential gear conflicts between the user groups.

There are no direct biological or ecological impacts expected as a result of the management unit set at Cape Hatteras, North Carolina, relative to the other alternatives considered by the Council. The primary indirect impact is the establishment of the area within which the management measures intended to protect and conserve the red crab resource will be implemented. A smaller management unit (i.e., one of the non-preferred alternatives) would result in more of the red crab resource outside the management jurisdiction and therefore subject to overexploitation. The only habitat issue related to the identification of the management unit is to establish the range within which essential fish habitat (EFH) may be designated for red crab. Selecting the broadest management unit results in larger EFH designations relative to what the designations would have been under one of the non-preferred alternatives. There are no impacts expected to any protected species as a result of the identification of a management unit.

5.2.2 Fishing Year

In general, selection of a fishing year start date is not expected to have any direct biological, economic, or social impacts on the resource species or its fishery. There may have been indirect economic and/or social impacts on the participants of the fishery if the start date was chosen to occur at a time of low productivity, poor conditions, and/or low demand and, due to the nature of the management scheme (e.g., a program that encouraged a derby-style fishery), fishing effort increased to levels above those which would occur if the fishing year began at another time. These potential concerns should be mitigated in two ways. First, the overall management scheme was selected as an attempt to minimize the potential for creating a derby-style fishery. The use of a days-at-sea program with a target TAC provides no incentive for a fisherman to fish during time of poor conditions, reduced product quality or decreased demand. Fishermen will be able to hold their DAS to fish during the best times without any concern over losing the ability to fish for red crab. Second, the fishing year will begin at a time of traditionally increasing rather than decreasing landings (see Figure 3). Available data suggest that absent any management controls, landings of red crab increase after March 1 relative to other times of the year; thus, red crab fishermen will be allocated their annual DAS at a time when they would normally increase their fishing effort.

There are no reasons to believe that the selection of a fishing year start date would have any biological or ecological impacts on the red crab resource or associated species. The intent of the overall management plan is to maintain a directed red crab fishery for all twelve months of the year. Fishing effort should therefore be evenly distributed throughout the year and not directly linked to a particular fishing year start date. There are no impacts expected to essential fish habitat or any protected species as a result of the identification of a start date for the fishing year.

5.2.3 Commercial Biomass and MSY

The biological impacts to red crab associated with the estimation of commercial biomass and the calculation of MSY are described in Section 3.4. Economic and/or social impacts associated with this element of the FMP may stem from the results (e.g., the more conservatively biomass and MSY are estimated, the less red crab will be available to the fishery for harvest), but the Magnuson-Stevens Act requires that commercial biomass and MSY be determined solely on biological factors and the limits of the resource, not on potential economic and/or social impacts that may result from a more or less conservative estimate of MSY. There are no impacts expected to essential fish habitat or any protected species as a result of the estimation of commercial biomass and the calculation of MSY for the red crab resource.

5.2.4 Overfishing Definition

The biological impacts to red crab associated with the development of an overfishing definition are discussed in Section 3.5. Economic and/or social impacts associated with this element of the FMP may stem from the results (e.g., if a stock is determined to be overfished or if overfishing is occurring, fishing effort will have to be reduced), but the Magnuson-Stevens Act requires that the overfishing definition be determined solely on biological factors, the limits of the resource and on the available information, not on potential economic and/or social impacts that may result. There are no impacts expected to essential fish habitat or any protected species as a result of the selection of an overfishing definition for the red crab resource.

5.2.5 Optimum Yield

According to the Magnuson-Stevens Act, the specification of optimum yield (OY) is intended to incorporate economic, social and ecological factors, yet never exceed MSY. These are described in Section 3.6. The preferred alternative selected by the Council is intended to best incorporate these factors into the specification of OY for the red crab fishery. There are no direct impacts expected to essential fish habitat or any protected species as a result of the specification of OY for the red crab fishery.

5.2.6 Essential Fish Habitat

In general, the identification and description of essential fish habitat (EFH) is not expected to have any direct biological, economic, or social impacts on the resource species or its fishery. There may be impacts associated with any management measures that may be implemented to conserve and protect EFH, but these impacts are more appropriately identified and analyzed under the particular management measures themselves. The only impacts expected as a result of the proposed EFH designations are to the habitat itself. The designation of EFH provides an explicit mechanism to be used to facilitate the protection of EFH, from either fishing or non-fishing related activities. Without this designation, this protection is not possible. There are no impacts expected to any protected species as a result of the designation of EFH for red crabs.

5.2.7 Permits and Reporting Requirements

The development of a permitting program and reporting requirements for the red crab fishery is not expected to have any biological or ecological impacts on the red crab resource or associated species. The proposed permitting program and reporting requirements will have economic impacts on the participants of the red crab fishery who must comply with these new requirements in order to continue their participation. Direct economic impacts are expected associated with the time needed by fishery participants to apply for the required permits and maintain and submit the required reports on catch, landings, and purchases of red crab and associated species (all fishermen permitted under the Red Crab FMP are required to report discards and bycatch as well as red crab landings). Based on the information provided to comply with the requirements of the Paperwork Reduction Act (PRA), the following estimated annual costs are expected to be borne by the participants of the red crab fishery:

Controlled Access Directed Red Crab Fishery

1. Permitting = $45.00 per participant to apply for all required permits.
2. Reporting = $40.00 per participant to comply with reporting requirements.

Open Access Incidental Catch Fishery

1. Permitting = $16.00 per participant to apply for all required permits.

2. Reporting = $15.00 per participant to comply with reporting requirements.

Red Crab Dealers and Processors

1. Permitting = $2.00 per participant to apply for all required permits.

2. Reporting = $130.00 per participant to comply with reporting requirements.

Considering that the average annual expenses for members of the directed fishery are estimated at $397,000 (see Section 8.5.1 on the baseline economic characteristics of the fishery), the direct economic impacts on fishery participants as a result of the proposed permit program and reporting requirements are relatively insignificant. The social impacts are similarly expected to be relatively insignificant to the participants of the red crab fishery, and all social and economic impacts are offset by the benefits of being able to continue their participation in the red crab fishery by complying with these requirements. There are no impacts expected to essential fish habitat or any protected species as a result of the permitting program and reporting requirements proposed for the red crab fishery.

5.3 Analysis of the Impacts of the Management Measures and Options

This section will identify and describe the potential impacts associated with each management measure considered in the Red Crab FMP. The analysis of impacts will consider each potential measure separately and independently of the other potential management measures, except in the case of measures that can only work in concert with one another. In this limited case, the set of measures that can only work in concert with one another will be considered as a group. The analysis in this section will serve as a baseline for the analysis in the following section, which will compare and contrast the potential impacts of the ten proposed management alternatives. Please see Section 4.2 for a full description of all proposed management measures, the options contained within each measure, and the sets of management measures comprising the alternatives considered by the Council.

5.3.1 Incidental Catch Limit

This measure will establish limits on the amount of deep-sea red crab that may be landed by any vessel not authorized to participate in the controlled access directed red crab fishery.

5.3.1.1 Biological and Ecological Impacts of the Measure on Red Crab

Directed red crab trips frequently land over 40,000 pounds per trip. Other trips land relatively small amounts of red crab (100 pounds to a few thousand pounds) as incidental catch. A measure to allow incidental catch will allow fishermen from other fisheries to retain a fixed amount of red crabs per trip. If the limit is set low enough, incidental catches will not have a significant impact on the red crab stock. If the incidental catch limit per trip is set high, then the quota for the directed fishery could be reduced to result in no net additional impact on the red crabs. Based on the NMFS database, total reported incidental catches from 1998, 1999 and 2000 were 13,619, 35,517 and 56,187 pounds, respectively. These are likely to be underestimates, given the limited quality of this database for historical red crab landings. Figure 14 displays the frequency distribution of non-directed red crab fishing trips with some amount of red crab landings during 1998 - 2000. Dealer weigh-out and VTR data provided by NMFS on incidental catch of red crab from 1998 to 2000 were analyzed to determine the percentage of trips that would likely be affected by the options under consideration.

Between 1998 and 2000, there were a total of 263 reported trips that landed an annual average of 35,108 pounds of red crab. Table 15 reports the percentage of these trips that would be accounted for by each of the options under consideration for an incidental catch limit and the expected percentage of trips that would be affected by each option. The lowest incidental catch limit option (50 pounds per trip) would be expected to account for approximately 25% of all trips (26.6% in 1998 - 2000) and would be expected to affect approximately 75% of all non-directed fishing trips. Setting the incidental catch limit at 100 pounds per trip would be expected to account for approximately 40% of all trips (38.4% in 1998 - 2000) and therefore affect about 60% of all trips. Increasing the incidental catch limit to the 500 pounds per trip option would be expected to account for nearly 75% of all trips (72.6% in 1998 - 2000) and would be expected to affect approximately 25% of trips. Setting an incidental catch limit of 1,000 pounds per trip would account for most (88.6% in 1998 - 2000) trips reporting some landings of red crab and would only affect approximately 10 - 12% of all trips.

Incidental catch can be monitored and the effect it has on the fishing mortality rate can be measured. Discarding of red crabs, which are neither targeted nor landed, is distinct from incidental catch. The impact of discarding red crabs is more difficult to estimate, but could be larger than that of incidental catches. The magnitude of discarding has not been measured, and the fraction of discarded red crabs that survive and reproduce is not known. The way they are captured, handled and released at the surface is certain to affect their survival rate. Red crabs are very sensitive to injury (Gray 1970), which raises concern about discard mortality. Almost any damage, such as a crushed periopod or cracked claw, will cause mortality. Fishing with crab traps causes much less injury to crabs than using otter trawls. It is difficult to return crabs to the sea floor after they have been exposed to air for an extended period (Ganz and Herrmann 1975) because they float on the surface rather than sinking back to the bottom.

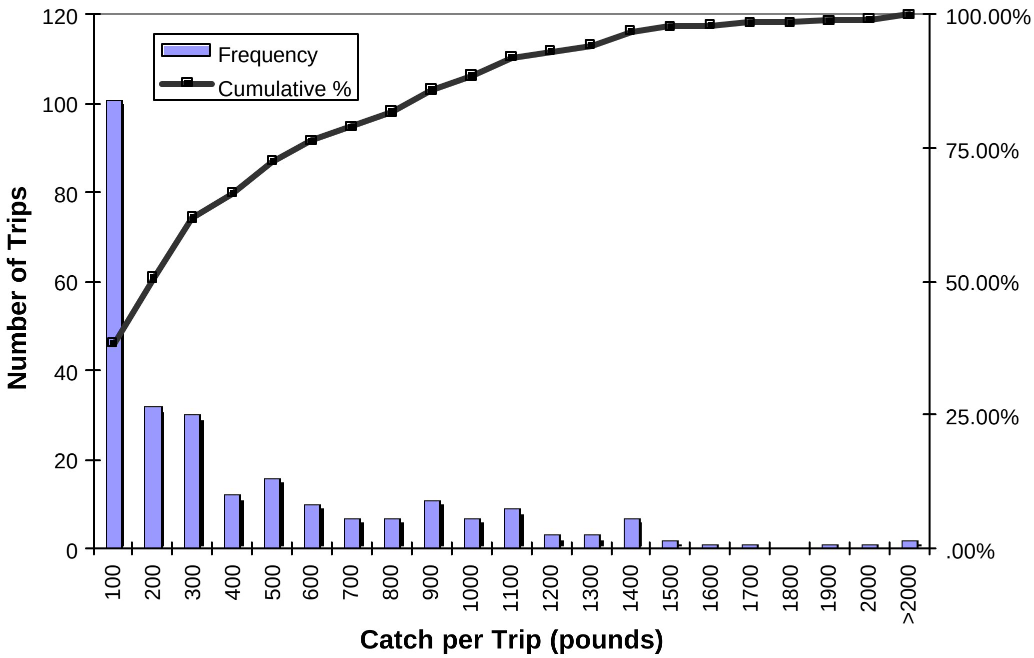

Figure 14: Incidental catch of red crab on non-directed fishing trips, 1998 - 2000.

Incidental Catch Limit Options	Cumulative Percentage of Trips Taken	Percentage of Trips Affected
50 pounds per trip	26.6%	73.4%
100 pounds per trip	38.4%	61.6%
500 pounds per trip	72.6%	27.4%
1,000 pounds per trip	88.6%	11.4%

Table 15: Cumulative percentage of number of fishing trips with proposed incidental catch limit or less of red crab, based on 1998 - 2000 data.

5.3.1.2 Ecological Impacts of the Measure on Other Species and Communities

Because this measure does not apply to the controlled access directed red crab fishery, and only applies to participants of other fisheries that may have some incidental catch of red crab, this measure would not be expected to have any direct effect on other species or their communities. There are no beneficial effects possible unless the limit selected would reduce the level of non-red crab vessel fishing effort. Adverse impacts are possible if the incidental catch limit selected would significantly increase the participation level of non-red crab vessels.

5.3.1.3 Impacts of the Measure to Essential Fish Habitat

This measure proposes to restrict the landings of red crab by vessels not authorized to participate in the controlled access directed red crab fishery that have incidental catch of red crabs. Because this measure only affects the amount of red crab landings by vessels not participating in the directed red crab fishery, it will have no effect on the essential fish habitat (EFH) of any resource species managed by the New England, Mid-Atlantic, or South Atlantic Fishery Management Councils, or NMFS under the highly migratory species FMPs.

Generally, the implementation of trip limits of any kind (including incidental catch limits) would not be expected to have a direct effect on the habitat of the region. Trip limits could have an indirect effect on the habitat of the Northeast by controlling the amount of fishing effort associated with the fishery, assuming that fishing effort ceases as soon as the trip limit is reached and does not continue with the intent of "high-grading." However, in the case of an incidental catch limit where the targeted species is not managed under this FMP nor is affected by this action, indirect effects on the habitat are also unlikely.

5.3.1.4 Economic Impacts of the Measure on the Fishery

This measure only applies to participants of other fisheries not authorized to participate in the controlled access directed red crab fishery that may have some incidental catch of red crab; therefore, this measure will not affect the harvesting sector of the directed red crab fishery. All of the alternatives include some allowance for incidental catch, so this measure would not be one that would be the deciding factor for one alternative over another.

This measure may have an effect on harvesters participating in other fisheries who sometimes land red crabs, but the extent of the impact depends entirely upon the incidental catch limit that is selected. The FMP includes several options for setting incidental catch levels. The preferred alternative recognizes an incidental catch of 500 pounds per trip, consistently over the course of the year. This would ensure that the offshore lobster fishery, as well as other fisheries, would be able to continue to land relatively small amounts of red crab as an incidental catch in their primary fisheries.

Figure 14 displays the frequency distribution of non-directed red crab fishing trips with some amount of red crab landings during 1998 through 2000. Dealer weigh-out and VTR data provided by NMFS on incidental catch of red crab from 1998 - 2000 were analyzed to determine the percentage of trips that would likely be affected by the options under consideration.

For non-red crab directed trips (n=263 trips; VTR and weighout database) that landed red crabs between 1998 and 2000, the average catch was 400 pounds and the median catch was 200 pounds. Thirty-eight percent of the trips took less than 100 pounds, fifty percent took less than 200 pounds, seventy-six percent of the trips took less than 600 pounds, and eighty-eight percent of the trips took less than 1,000 pounds. Total incidental catch of red crab in 1998 (13,619 pounds), 1999 (35,517 pounds) and 2000 (56,187 pounds) average to 35,108 pounds per year. Given the poor quality of the database, this is very likely to be an underestimate. It is also interesting to note the incremental increase that occurred in total incidental catch during the three years.

Table 15 reports the percentage of these trips that would be accounted for by each of the options under consideration for an incidental catch limit and the expected percentage of trips that would be affected by each option. The economic impacts of the proposed incidental catch limit options will only be felt by those vessels no longer able to retain as much red crab as they previously would have, and then only to the degree that their landings are reduced. For example, the proposed catch limit of 500 pounds per trip (the preferred alternative), would have affected 27.4% of the trips taken in 1998-2000 (there were 72 individual trips taken in 1998-2000 with more than 500 pounds of red crab as incidental catch). The average red crab landings of these trips were approximately 1,040 pounds. Since these trips would have been allowed to retain 500 pounds of red crab, this results in an average loss of 540 pounds of red crabs per trip. Assuming that one third of these trips were taken in each year, there would have been 24 trips per year with an average loss of 540 pounds per trip. Assuming the red crabs could be sold for as much as $1.00 per pound (this is likely to be an overestimate), there would have been a total loss of potential revenue of approximately $12,960 per year for all vessels combined.

This analysis assumes that all the red crab landed as incidental catch is sold for additional revenue. However, in many cases, it is likely that the retained red crabs are not sold but are distributed among the crew of the fishing vessels for their personal consumption. In these cases, the direct economic impacts will be less. Thus, overall it appears that the economic impacts of the proposed incidental catch limit will be minimal.

Tiered incidental catch limits would provide for a different level of incidental catch for certain vessels that participate in a fishery with a tradition of higher red crab landings during winter months. Those vessels holding a valid Area 3 Lobster Permit would be allowed to retain and land up to a maximum of 1,000 pounds of red crab per fishing trip during the months of December, January, and February only. The rest of the year, these vessels, as well as all other vessels not fishing on a directed red crab trip, would be allowed to retain and land up to a maximum of 100 pounds of red crab per fishing trip. Both levels of incidental catch limits under this option are potentially subject to other regulations. In public comment, it was suggested that 6 months from November through April represent the time when red crab is typically caught by offshore lobstermen.

In calendar year 2000, December, January and February accounted for 11%, 3% and 7% of red crab revenue, as recorded in NMFS dealer data. September, October, and November accounted for the largest revenue per month from red crab, with 13%, 14% and 12%, respectively.

The degree to which the incidental catch of red crabs by vessels not participating in the controlled access directed red crab fishery contributes to the annual revenues of the processing sector is unknown, but is unlikely to be significant. According to both dealer and VTR reports, there were a total of 139 trips in calendar year 2000 that landed an average of 404 pounds of red crab per trip. Approximately 56,200 total pounds were landed in 2000 by those not in the directed fishery. This breaks down to roughly 4,700 pounds per month and, if we assume an equal split of the landings among the four known processors of red crab product, just under 1,200 pounds per month per processor.

Given that the vessels participating in the directed red crab fishery routinely land an average of 60,000 pounds of red crab per trip, the potential loss to the processors of some portion of approximately 1,200 pounds per month would not be significant (remember that we will not be eliminating the incidental catch, simply capping the amount of incidental catch that may be landed on each trip, so some amount of incidental catch would still be coming in from the non-directed component of the fishery).

There are no economic impacts to fishery-dependent service industries, such as fuel, ice, bait, and gear suppliers expected as a result of this proposed measure. This measure does not affect the directed red crab fishery and only affects the non-directed component of the red crab fishery to a minor degree. Because of this, the primary fishing activities of the non-directed component of the fishery would continue and it is anticipated that their use of the fishery-dependent service industries would continue unchanged.

There are no economic impacts to markets for red crab expected as a result of this proposed measure. This measure does not affect the directed red crab fishery and only affects the non-directed component of the fishery to the extent of placing per trip limits on the amount of red crab they may land as incidental catch. The relatively small amount of red crab landed by those vessels with landings of red crab as incidental catch is insignificant compared to the landings of the directed red crab fishery. For example, in 2000, all vessels with incidental catch of red crab landed a total of 56,187 pounds of red crab. This equates to approximately what one vessel in the directed red crab fishery lands on each trip.

There are no known economic impacts to fishing communities expected as a result of this proposed measure. There are no communities dependent upon either the directed red crab fishery or the non-directed component of the fishery. While the survey concentrated solely on the directed red crab fishery, the analysis of National Standard 8 (see Section 7.1) deals with both the directed and the non-directed component of the fishery.

More information on the non-directed fleet, consisting of both lobster vessels and otter trawlers can be found in Section 5.3.6.4 under gear restrictions. The analysis done on incidental catch of red crab (Section 5.3.1) was done using both weigh-out and VTR data from the years 1998 to 2000.

5.3.1.5 Social/Cultural Impacts of the Measure

This measure only applies to participants of other fisheries not authorized to participate in the controlled access directed red crab fishery that may have some incidental catch of red crab; therefore, this measure will not affect the harvesting sector of the directed red crab fishery or their communities. It is unlikely, given the relatively minor economic impacts to fisherman harvesting incidental catch levels of red crab expected from this measure (see above), that this measure would have any noticeable social impacts on these fishermen or their communities.

This proposed measure is not expected to have any effect on the occupational opportunities of any participants of the directed or non-directed components of the red crab fishery. The proposed measure is not expected to have any effects on community infrastructure, or the safety of any fishery participants. There appears to be general support for this type of measure among the participants in the fishery, and this measure is not expected to decrease the flexibility or stability, or increase the uncertainty, of any participants in the fishery.

5.3.1.6 Impacts of the Measure on Protected Species

There are no beneficial effects to protected species expected with proposed 500 pound incidental catch limit, due to the fact that a significant reduction in the level of non-red crab vessel fishing effort is not anticipated at that level of incidental catch. However, any limitation in the incidental catch will serve to minimize the participation level of non-red crab vessels. Approximately 25% of non-red crab vessel trips will be affected by the 500 pound limit, thus restricting expansion of fixed gear in the red crab fishing areas that may result from vessels not participating in the red crab fishery.

5.3.2 Minimum Size Limit

This measure proposed establishing a regulatory minimum size for all red crabs landed in the directed red crab fishery.

5.3.2.1 Biological and Ecological Impacts of the Measure on Red Crab

This measure proposed limiting the harvest of red crabs to individuals greater than or equal to a certain carapace width (CW). According to the early NMFS stock assessment for the Northeast U.S. fishery (Serchuk 1977), "Landings consist only of male crabs with a minimum carapace width of 4 ½ inches (114 mm)." Size limits considered at this time were 4 inches (102 mm), 4 ¼ inches (108 mm), and 4 ½ inches (114 mm) CW. The carapace width is the distance between the tips of spine number five on the carapace.

Wigley et al. (1975) carried out a survey of red crabs between Georges Bank and Virginia in 1974, and estimated a total red crab biomass of 116,512,000 pounds (52,864,000 kg). The survey included a part of Georges Bank now in Canadian waters, and excluded a region between Virginia and Cape Hatteras, North Carolina. Data from the Wigley survey were reanalyzed to compute the percent of total biomass above particular size limits, for both sexes and for males only (see Table 16). Harvesting crabs above 4 ½ inches (114 mm) would ensure that the majority of the landed crabs are males, thus preserving female spawning crabs (see Figure 15).

Male Carapace Width Minimum Size Limit	Female Carapace Width Minimum Size Limit	Percent of Total Biomass Greater Than/Equal To Minimum Size Limit
4"	4"	78.1%
4 ¼"	4 ¼"	65.6%
4 ½"	4 ½"	50.5%
4"	Male-only	62.3%
4 ¼"	Male-only	58.4%
4 ½"	Male-only	47.8%

Table 16: Percent of total red crab biomass that is exploitable under the different options associated with this measure.

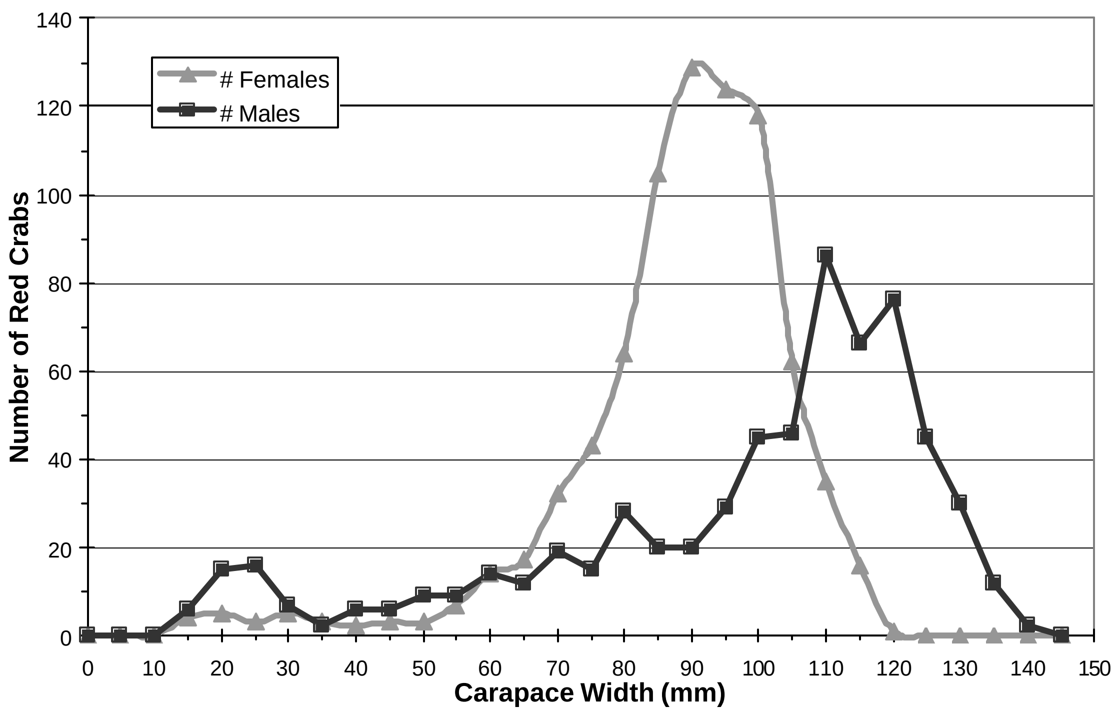

Figure 15: Male and female red crab length frequency from Wigley et al. survey (1975), showing that in this survey there were more but smaller females than males.

Due to market constraints, the traditional vessels reportedly retain only large male crabs, so they are already practicing this measure to some degree. The traditional market is for crabs averaging over one pound, and this is best met by large male crabs. For a given carapace width, females are less desirable because they generally do not weigh as much as males (see Figure 16). Because catcher-processor vessels may be able to process crabs on-board, they may not be restricted in the same way as other vessels by these market forces, and may have some incentive to retain and process smaller crabs, including females. This type of measure would be difficult to enforce at sea, as it would be nearly impossible to determine the make-up of the crab harvest (i.e., the size and sex of the crabs that are processed at sea) of processing vessels. Butchering crabs at sea, where the carapace is removed and the crab is cut in half laterally, will also make any proposed regulatory minimum size very difficult, if not impossible, to enforce.

Regardless of whether or not it can be enforced, a minimum body size limit for landing red crab could be advantageous to the fishery and to the red crab stock. From a yield perspective, crab biomass increases non-linearly with CW. Thus, yield per crab is much greater if that individual is large. For example, 4 inch (102 mm) and 4 ½ inch (114 mm) CW crabs from Nova Scotia weigh only 0.8 pounds (370 grams) and 1.0 pounds (450 grams) on average, respectively (Meade and Gray 1973). By comparison, crabs of 5 inch (127 mm) and 5 ½ inch (140 mm) CW weigh 1.3 pounds (600 grams) and 2.0 pounds (900 grams) on average, respectively. These red crab weights are similar to those from male red crabs of comparable CWs collected in deep water off southern New England in the 1970s (Farlow 1980, see Figure 16) and in 2001 by NMFS.

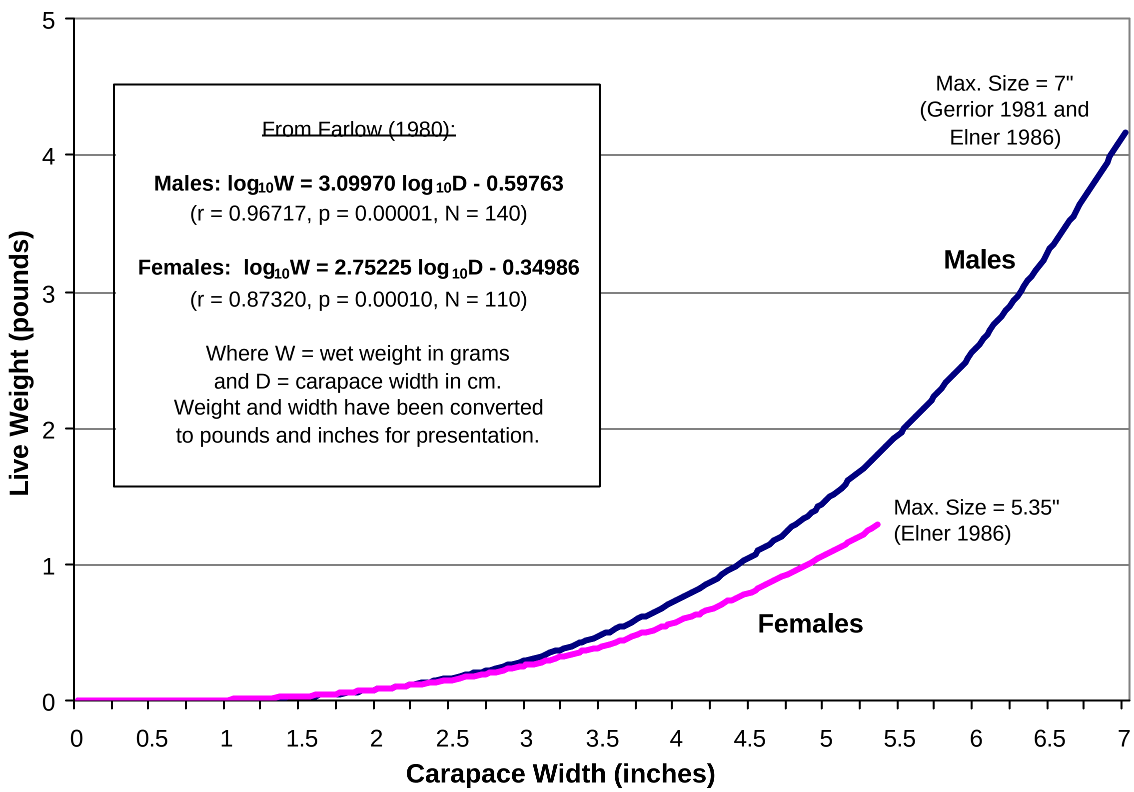

Figure 16: Widths and weights of red crabs (males and females), based on size-weight relationships derived by Farlow (1980).

An advantage of a minimum size in the range of 4 to 4 ½ inches (102 - 114 mm) CW is that it would allow both male and female crabs to mature and reproduce at least once. As with most decapods, the eggs of the female red crab are attached to the pleopods under the abdominal flap until the eggs hatch and larvae are released into the water column. The minimum carapace width for females carrying eggs is 87 mm in southern New England, 64 mm in the Gulf of Maine (Ganz and Herman 1975), and 80 – 91 mm in Norfolk Canyon (Haefner 1977). Several studies found ovigerous females ranging in size between 80 – 130 mm (Wigley et al. 1975; Haefner 1977; Hines 1988; Steimle et al. 2001). Male red crabs have distinguishing reproductive structures when they are quite small (~70 mm), but the size when they can mate successfully may be considerably larger (Lawton and Duggan 1998; Fernandez-Vergaz 2000). Because males and females are often segregated by depth (Stone and Bailey 1980), and because males tend to grow larger than females, it should be possible to target the large males with little impact on the smaller females.

There are some possible disadvantages to a size limit. A fishery directed on the largest individuals in a population might alter the life history of the species over time (e.g., eliminating faster growers). It can also truncate the age and size structure (Barry and Tegner 1989; Kruse et al. 2000); thus, increasing the percentage of first-time breeders (see discussion below in section on Male-Only Fishery). Due to a lack of biological information, it is difficult to say whether either of these effects is likely to occur if a 4 ½ inch (114 mm) size limit were imposed on red crabs. Finally, discard mortality on small or marginal-sized female crabs could increase under a minimum size limit (although since these crabs are currently not landed, fishing practices would not be expected to change and there should be no change in mortality).

These issues were considered in a recent analysis of the male-only, red king crab (*Paralithodes camtschaticus*) fishery in Alaska (Kruse et al. 2000). Specifically, they examined whether to reduce the size limit from 165 mm to 152 mm CW. The 165 mm size limit was originally set based on market controls and to allow males at least one mating opportunity (although the sizes of red king crabs are larger than those of red crabs, this situation is similar to the traditional red crab fishery in the Atlantic which has had a self-imposed rule to take only large males). Kruse et al. (2000) concluded that it is better to maintain the higher (165 mm) size limit for red king crab. The results of the analysis were sensitive to the assumed mortality caused by handling and returning of crabs to the ocean, which Kruse et al. (2000) assumed to be 20% in their base case.

Some of the *advantages* of switching to a smaller size limit would have included: lower discard mortality of red king crabs; increased proportion of legal crabs in the catch; and increased catch in numbers of legal crabs per haul in the short-term. Some *disadvantages* of switching to a smaller size limit would have included: decreased yield per legal crab; decreased steady-state (equilibrium) yield from the stock; the population would have a higher percentage of first-time breeders; and an economic break-even analysis showed that it would take several decades for cumulative catch under the smaller size limit to exceed the cumulative catch under the larger size limit. Importantly, the authors noted that net benefits of the reduced size limit would accrue more quickly if the true handling mortality was greater than the assumed value (20%).

There are no definitive estimates of "handling" mortality for the deep-sea red crab in the Atlantic. This is problematic for managers because, as shown by Kruse et al. (2000), this parameter is of major importance in determining the appropriate size limit. It is known that red crabs are often damaged in fishing nets, but are less likely to be damaged in pots. They are very sensitive to damage, which may cause them to die. Capturing and releasing red crabs exposes them to a number of additional risks and stresses. These include physiological stress from exposure to air, changes in temperature and pressure, predators in the water column, and displacement from the original home range to a new location which may not be as suitable for survival, feeding and/or mating. To get an accurate estimate of the migration patterns of deep-sea red crab off the coast of Africa, Melville-Smith (1987) developed a special cage to safely lower the crabs to the bottom after they had been tagged. This extra precaution appeared to increase survival, as indicated by the greater rate of recovery of tagged crabs in years when the special cage was used. Other factors, such as greater awareness by fishermen to return tagged crabs, may have also caused the recovery rate to go up.

It should be stressed that removing too many large males from the population could disturb courtship and mating (Elner et al. 1987), which may reduce female fecundity. Imposing a minimum size limit would be the most direct way to maintain males that are capable of mating with the largest females in the population.

5.3.2.2 Ecological Impacts of the Measure on Other Species and Communities

Very little is known about the interactions of the deep-sea red crab with other species and their associated communities. The directed red crab fishery has no known interactions with other species or their associated communities, as the bycatch of other species in the red crab fishery is minimal. The impacts of this fishery on other species or their communities are expected to be minimal to non-existent. This proposed measure would not affect this conclusion.

If new information becomes available that suggests this conclusion may be incorrect, the Council will review the information and consider whether or not additional action may be necessary. Future assessments of this type will consider all new information regarding the interactions of the red crab fishery with other species and their communities and consider mitigation, if necessary, at the appropriate time.

5.3.2.3 Impacts of the Measure to Essential Fish Habitat

Measures that do not directly reduce fishing effort by a gear type associated with adverse impacts to EFH, but rather manage the sex or size class of fish or invertebrates targeted by the industry, such as with the minimum size limits proposed in this measure, would not be expected to have a direct effect on the habitat of the region.

5.3.2.4 Economic Impacts of the Measure on the Fishery

The preferred alternative of this FMP would not enforce a minimum size in the red crab fishery. Other alternatives considered different limits and restrictions. There are several issues related to the implementation and enforcement of these types of measures. For instance, how to establish a minimum size limit (usually based on carapace width) if butchering or processing at sea is allowed. Depending on whether and the degree to which the Council allows or restricts processing and/or butchering at sea, weight-based minimum size restrictions would be developed, based on conversion factors. A significant issue for the Council will be the utility of a minimum size limit relative to the difficulty of enforcement and actual conservation benefit. The market largely controls the size of the crab that is efficient to process and sell, and so far this seems to be about a minimum of a one pound crab. There is evidence that a one pound red crab is equivalent to a 4.2" carapace width (Meade 1973, Farlow 1980). Other studies have specified a 4" CW crab as the minimum required for the market. Obviously, this difference between a 4" and a 4.2" market size has repercussions for this measure.

If we accept that the market will control the size of the crabs landed, implementation of a regulated minimum size may be unnecessary, especially given the enforcement concerns. If market conditions changed, or small crabs were being landed and/or processed in increasing numbers, the Council could adopt a minimum size limit in the future via a framework adjustment to the FMP. A minimum carapace width restriction (and thus the male only restriction) would appear to have minimal economic impact on the vessels that bring back live crabs.

It may not be practical to implement a regulatory minimum size in this fishery if any type of butchering and/or processing of red crabs at sea is permitted. The nature of the butchering process (removal of the carapace and the cutting of the crab in half laterally) makes it all but impossible to administer and enforce a minimum size regulation. With full processing at sea (removal of the meat from the body of the crab), it would be completely impossible to enforce this type of regulation. It may not be necessary to regulate a minimum size for red crabs at this time since the market for red crabs is fairly restrictive. As long as these market conditions remains, a complicated and difficult to enforce regulatory minimum size may be superfluous and unnecessary.

Because the catcher-processor vessels may have processing capability on-board, they may not be restricted in the same way by market forces, and may have some incentive to retain and process smaller crabs, including females. Nevertheless, none of the freezer-processors fishing for red crab at present reportedly has a centrifuge on board which is used to separate meat from shell and that could provide an incentive to process small crabs. There is some concern that these vessels could obtain a centrifuge in the future. If this did occur, there would be no incentive by these vessels to avoid smaller crabs. Currently, there is no reason for these vessels to take any size crab other than large crabs consistent with those taken by vessels that have fished historically. Furthermore, this type of measure would be difficult to enforce at sea, since it would be nearly impossible to determine the make-up of the crab harvest (i.e., the size and sex of the crabs that are processed at sea) of processing vessels.

There would be no economic benefits to offset the additional cost of enforcing a minimum size restriction. There would be no economic impacts to the shore-based processing sector due to the minimum size, since the sector is currently already self regulated to accept only a certain size crab. Because of the difficulty for enforcement posed by the relationship between processing at sea and minimum size requirements, the processor portion of the catcher/processor vessels may be affected by this measure. If there is a minimum size requirement, there may also be corresponding prohibitions of processing at sea that may have adverse effects on the larger catcher/processor vessels and their crews.

The minimum size restriction alone would not cause economic impacts to fishery-dependent service industries. The minimum size restriction used with other measures may cause impacts, but they would be caused by the other measures, and not solely due to this measure. Since the markets tend to enforce a minimum size, there would be no impacts to markets for red crab expected as a result of this proposed measure. There are no known economic impacts to fishing communities expected as a result of this proposed measure, as the measure itself is expected to be self-enforcing.

5.3.2.5 Social/Cultural Impacts of the Measure

There are no data available with which to evaluate the potential impacts of this measure on the social and cultural aspects of New England and Mid-Atlantic fishing communities. The small size, few participants, and distributed nature of this fishery, however, suggests that any social or cultural impacts to these fishing communities will be negligible. For example, there is one red crab vessel based in Gloucester, Massachusetts. Relative to the other fishing activities based in Gloucester, any impacts to this red crab vessel, its owners and operators, crew, fishing-related support services, and their families, that arise as a result of the measures proposed in this FMP are unlikely to significantly affect the community of Gloucester.

Based on information provided by members of the red crab fishing industry in response to a survey collecting baseline information on the fishery, few consider the communities in which they live to be fishing communities, and fewer still consider their communities to be significantly dependent upon fishing activities (see Appendix B). The implementation of new management programs for the red crab fishery, therefore, would not be expected to significantly disrupt the social frameworks of these communities.

This measure is unlikely to change current fishing practices in the directed red crab fishery. This fishery, although currently not subject to an FMP, already operates by harvesting only male crabs larger than four inches carapace width. Assuming that this measure will not substantially alter that practice, which arose as a result of market demands and common practices in crustacean fisheries, then no social or cultural impacts to fishing communities will result.

Also, because this measure is not expected to substantially alter current fishing practices, this proposed measure will not have any social impacts on the participants in the directed red crab fishery. This proposed measure is not expected to have any effect on the occupational opportunities of any participants of the directed fishery. The proposed measure is not expected to have any effects on community infrastructure, or the safety of any fishery participants. There appears to be general support for this type of measure among the participants in the directed fishery, and this measure is not expected to decrease the flexibility or stability, or increase the uncertainty, of the participants in the directed fishery.

5.3.2.6 Impacts of the Measure on Protected Species

The proposed option for no regulated minimum allowable size for the red crabs that are retained and landed in the controlled access directed red crab fishery will not change the current trip lengths in the fishery and therefore have no beneficial effect to protected species.

5.3.3 Male Only Fishery

This measure will establish a sex restriction (males only) for all red crabs landed in the controlled access directed red crab fishery.

5.3.3.1 Biological and Ecological Impacts of the Measure on Red Crab

This option would limit the landings of deep-sea red crabs in the directed fishery to males only. The landing of female red crabs would be prohibited, except as an allowance for accidental retention. Many of the points covered in the previous section on "Minimum Size Limit" apply here as well. These two measures are intertwined because males grow larger and weigh more than females. Thus, taking "males only" is equivalent in many respects to taking crabs with a minimum size limit.

The section on minimum size included a table listing the percentage of the total red crab biomass from the 1974 Wigley survey that consists of both sexes as well as males only, for three potential size limits from 4 inches to 4 ½ inches (Table 16). For example, if the Council selects a "male only" fishery with a minimum size of 4 ½ inches, then 47.8% of the total biomass is considered exploitable.

The minimum size section showed that, for a given carapace width, males weigh more than females (Figure 16). Thus, assuming an equal number of crabs were landed, fishing for males-only would increase the short term yield but could decrease the biomass of the stock more rapidly. In addition to these short term effects, there could be more subtle, long term impacts depending on the level of harvests on males and whether or not a size limit was in effect. Harvesting only males could alter the sex ratio and reduce the frequency of large males in the stock. In several species of crabs (blue, stone, and snow) and lobsters, large males are the most successful breeders (Paul and Paul 1996; Jivoff 1997; MacDiarmid and Butler 1999; Sainte-Marie et al. 1999; Kendall et al. 2001). Mating by crabs typically involves courtship, defense and guarding of mates. Sex ratio and size structure of the population can affect mating success and population growth in crabs (see the discussion in the previous section).

5.3.3.2 Ecological Impacts of the Measure on Other Species and Communities

Very little is known about the interactions of the deep-sea red crab with other species and their associated communities. The directed red crab fishery has no known interactions with other species or their associated communities, as the bycatch of other species in the red crab fishery is minimal. The impacts of this fishery on other species or their communities are expected to be minimal to non-existent. This proposed measure would not affect this conclusion.

If new information becomes available that suggests this conclusion may be incorrect, the Council will review the information and consider whether or not additional action may be necessary. Future assessments of this type will consider all new information regarding the interactions of the red crab fishery with other species and their communities and consider mitigation, if necessary, at the appropriate time.

5.3.3.3 Impacts of the Measure to Essential Fish Habitat

Measures that do not directly reduce fishing effort by a gear type associated with adverse impacts to EFH, but rather manage the sex or size class of fish or invertebrates targeted by the industry, such as with the sex restrictions proposed in this measure, would not be expected to have a direct effect on the habitat of the region.

5.3.3.4 Economic Impacts of the Measure on the Fishery

The preferred alternative of this FMP establishes a male only fishery. It may be more difficult to enforce a sex restriction if butchering or processing at sea is allowed. There will be no economic impacts to the harvesting sector due to the male only requirement because it is currently self-regulated to retain and land only male crabs.

There would be no economic impacts to the shore-based processing sector due to the male only requirement, since the sector is currently already self regulated to accept only a certain size of male crab. Because of the difficulty for enforcement posed by the relationship between processing at sea and male only requirements, the processor portion of the catcher/processor vessels may be affected by this measure.

The male only requirement alone would not cause economic impacts to fishery-dependent service industries. The male only requirement used with other measures may cause impacts, but they would be caused by the other measures, and not solely due to this measure. Since the markets tend to enforce male only requirement, there would be no impacts to markets for red crab expected as a result of this proposed measure. There are no known economic impacts to fishing communities expected as a result of this proposed measure, as the measure itself is expected to be self-enforcing.

5.3.3.5 Social/Cultural Impacts of the Measure

There are no data available with which to evaluate the potential impacts of this measure on the social and cultural aspects of New England and Mid-Atlantic fishing communities. The small size, few participants, and distributed nature of this fishery, however, suggests that any social or cultural impacts to these fishing communities will be negligible. For example, there is one red crab vessel based in Gloucester, Massachusetts. Relative to the other fishing activities based in Gloucester, any impacts to this red crab vessel, its owners and operators, crew, fishing-related support services, and their families, that arise as a result of the measures proposed in this FMP are unlikely to significantly affect the community of Gloucester.

Based on information provided by members of the red crab fishing industry in response to a survey collecting baseline information on the fishery, few consider the communities in which they live to be fishing communities, and fewer still consider their communities to be significantly dependent upon fishing activities (see Appendix B). The implementation of new management programs for the red crab fishery, therefore, would not be expected to significantly disrupt the social frameworks of these communities.

This measure is unlikely to change current fishing practices in the directed red crab fishery. This fishery, although currently not subject to an FMP, already operates by harvesting only male crabs larger than four inches carapace width. Assuming that this measure will not substantially alter that practice, which arose as a result of market demands and common practices in crustacean fisheries, then no social or cultural impacts to fishing communities will result.

Also, because this measure is not expected to substantially alter current fishing practices, this proposed measure will not have any social impacts on the participants in the directed red crab fishery. This proposed measure is not expected to have any effect on the occupational opportunities of any participants of the directed fishery. The proposed measure is not expected to have any effects on community infrastructure, or the safety of any fishery participants. There appears to be general support for this type of measure among the participants in the directed fishery, and this measure is not expected to decrease the flexibility or stability, or increase the uncertainty, of the participants in the directed fishery.

5.3.3.6 Impacts of the Measure on Protected Species

The proposed option for a male-only fishery will have no beneficial effect to protected species. This measure may result in increased trip length (and a decrease in CPUE) if high-grading occurs, meaning that red crab fishing gear would be in the water for a longer period of time, potentially increasing the chances of interactions between the fishing gear used in the red crab fishery and marine mammals or other protected species. However, since this is currently an industry-wide practice, very little increase in trip length is expected.

5.3.4 Butchering/Processing at Sea Restrictions

This measure will place restrictions on the level of butchering and/or processing that may be employed at sea by vessels participating in the directed red crab fishery.

5.3.4.1 Biological and Ecological Impacts of the Measure on Red Crab

If processing at sea were prohibited, this would reduce the maximum number of crabs that could be landed per trip, and this would reduce the risk of overfishing. If processing at sea were allowed, then recovery ratios (the ratio of the weight of the processed product to the weight of whole, unprocessed crab) could be used to make all trips equivalent in terms of number of crab deaths. Recently published (Department of Commerce 2001) recovery ratios for red crab are:

- 25% if the crab is reduced to finished meat product that has been picked, cleaned, and frozen (that is, meat only);

- 58% if the crabs are partially-processed and fully-cleaned (i.e., the gills, mandibles and tail flap are removed), and the meat is not picked;

- 64% if crabs are butchered but not fully-cleaned (i.e., the gills, mandibles and tail flap are still present), and the meat is not picked.

Butchering and partial processing at sea might result increase the number of small crabs (< 4" CW) being retained in the catch. This would be difficult to monitor because butchering and processing break the carapace and crab parts become separated. The long term effect of taking smaller crabs as well as large crabs would be fewer large and old animals in the equilibrium population (Barry and Tegner 1989; Kruse et al. 2000).

Without an overall TAC, as well as trip and trap limits, a simple prohibition on processing at sea may not effectively constrain total harvest.

5.3.4.2 Ecological Impacts of the Measure on Other Species and Communities

Very little is known about the interactions of the deep-sea red crab with other species and their associated communities. The directed red crab fishery has no known interactions with other species or their associated communities, as the bycatch of other species in the red crab fishery is minimal. The impacts of this fishery on other species or their communities are expected to be minimal to non-existent. This proposed measure would not affect this conclusion.

If new information becomes available that suggests this conclusion may be incorrect, the Council will review the information and consider whether or not additional action may be necessary. Future assessments of this type will consider all new information regarding the interactions of the red crab fishery with other species and their communities and consider mitigation, if necessary, at the appropriate time.

5.3.4.3 Impacts of the Measure to Essential Fish Habitat

This measure restricts the amount and type of butchering and/or processing of red crabs at sea by vessels participating in the controlled access red crab fishery. This type of management measure, which controls how the fishermen treat the crabs once they are harvested but does not affect their harvesting techniques, would not have any direct effect on the habitat of the Northeast region. There may be an indirect effect by potentially restricting some vessels from continuing their current practices. If these restrictions reduced the fishing power of these affected vessels (by limiting the amount of red crabs they can harvest before reaching their vessel's capacity), overall fishing effort in the fishery may be reduced. However, because the directed red crab fishery is not believed to be associated with any adverse impacts to the EFH of any managed species, any indirect reduction of fishing effort would not have an impact on the habitat of the region.

5.3.4.4 Economic Impacts of the Measure on the Fishery

The FMP will establish processing-at-sea restrictions for the controlled access directed red crab fishery. Butchering and/or processing red crabs at sea (versus landing crabs whole) expands the vessels' capacity to harvest red crab on a per trip basis. The FMP includes several options to set restrictions and/or prohibitions on the butchering and/or processing at sea of red crabs. These types of measures will be balanced against the other potential measures included in the FMP, such as minimum size limits and sex restrictions. The more butchering and processing activities that are allowed under the FMP, the more difficult it will be to control as well as enforce the number of small crabs being landed.

A prohibition on processing or butchering at sea would reduce the maximum number of crabs that could be landed per trip for those vessels which do not currently land live crabs, depending on the vessels' hold capacity. Existing vessels that butcher and/or process at sea (within reasonable limits) may be given an exemption to this option -- in order to allow them to continue to fish for red crab in the method for which their vessel is best suited. Existing vessels that do not butcher and/or process at sea would not be allowed to convert, and any new vessels entering the fishery (if allowed) would have to land their crabs whole. If existing vessels were granted the exemption, those that currently process on board may be seen to have an advantage over those that do not. They, in fact, would be able to continue to fish in the manner that was most efficient for them in the past. This would be closely tied to the option of limited access and what vessels are allowed to fish, and especially under any possible exemption of restrictions.

The preferred option will allow all activities except the removal of meat from the body and/or legs of the crab. Any activity short of removing the meat (including splitting, sectioning, freezing, cooking, and/or glazing of crab sections) will be allowed under this option. At the other end of the spectrum, one of the non-preferred options would allow all processing and butchering activities. Under this option, vessels could separate meat from the crab body and clean, cook, glaze, and/or freeze, etc. at sea with no restrictions. If centrifuge or other meat separation technology were to be used on board a red crab fishing vessel in the future, it would become impossible to control the size of crabs harvested, processed and landed.

Appropriate recovery rates will be used for all contingencies to accurately determine the whole weight equivalent from the weight of the butchered crabs. The recovery rates used will be dependent upon the specific process used (e.g., crabs simply split with the carapace removed would be converted differently than sections glazed and frozen).

As a stand-alone measure, a simple prohibition on processing at sea would not control effort in the fishery sufficiently to constrain total harvest. Only one of the historical participants processes at sea, which butchers its crabs (as opposed to full processing). New entrants to the fishery are capable of processing red crab at sea. Prohibiting all forms of processing at sea would greatly reduce a vessels ability to increase its fishing capacity because the effective capacity would be constrained by the vessels ability to maintain its crabs alive, as well as by its hold capacity. If processing at sea is allowed, in the absence of other measures, a catcher-processor vessel that has a large hold capacity for processed product would likely harvest more than the traditional vessels on any one trip. The hold capacity of red crab vessels is variable, ranging from

60,000 pounds to approximately 320,000 pounds, and averaging just over 122,000 pounds whole weight equivalent.

A prohibition on all forms of processing at sea would prevent some vessels from operating as they currently are designed to do, as well as curtailing these same vessels from supplying the processed product market that has been established. While some controls are needed to prevent overfishing, this can be accomplished through a combination of other measures (e.g., TAC, DAS) that allow more flexibility as to which vessels can fish and what product these vessels choose to land.

Under some options considered by the Council, a vessel that is currently processing at sea may be prohibited from doing so, and may potentially no longer be profitable and may cease fishing. The potential capacity and fishing patterns of those vessels capable of processing at sea is not clear at this time, given the short time frame some vessels have reportedly been in the fishery. However, the capacity of any vessel that processes at sea is greater than one that does not, everything else being equal. Not allowing processing at sea would certainly be dissuasive to the freezer/processor vessel owners, given the presumably higher fixed and variable costs associated with operation of larger vessels, processing facilities and the employment of additional crew.

The preferred alternative (to allow butchering and partial processing of red crabs at sea) will minimize the enforcement costs and difficulty while allowing vessels to continue to operate in a manner that is most familiar and efficient for them. It will provide for minimum disruption (and costs) to those now in the fishery. To date, no crab vessel has removed meat from the crab, so a prohibition on this type of processing will have minimal economic impact on the fishery.

The degree of processing allowed and the corresponding definitions accepted will influence the degree of impact on the red crab vessels, and especially on the processing sector. Processing on board restrictions would appear to have minimal impact on most of the vessels that have been in the fishery prior to 2000. There is one vessel that has fished before the control date that would be impacted, and others that have fished after the control date. A complete prohibition on processing at sea may have disproportionate effects by vessel size class with the largest vessels the most negatively impacted.

Since processing at sea is more labor-intensive than landing live crab, there would be some employment effects to such a prohibition. Any vessel that does complete processing at sea and that has a corresponding larger crew would be the most affected. Other vessels that do partial processing would be affected by the prohibition, as well. On the other hand, if live whole crabs were landed, the processing would still be done somewhere, whether it is in one of the ports in which it is landed or exported to Canada.

There is very little information available directly on any fishery-dependent service industries that may be influenced by changes in the processing at sea practices in the red crab fishery. The type of service industries used by the red crab fishery and their general locations was reported by some vessel owners and operators in the survey given to red crab advisors. The types of services used include: fuel, ice, food and groceries, bait, gear, oil/lubrication, water, hull maintenance, engine maintenance, electronics, insurance, accounting, legal advice, and dockage. These needs are met by services provided in Lower Mid-Coast Maine, Gloucester and the Massachusetts North Shore, Boston and the Massachusetts South Shore, Cape Cod and the Islands, the New Bedford, MA area, Rhode Island, some non-coastal areas of New England, and some areas outside of New England. Of these, the fishery-related service industries in the New Bedford, MA area provide more support to the red crab fishery than the other locations combined. Due to the small size of the fishery, and the small number of fishing vessels involved, however, it is unlikely that providing these services to red crab vessels accounts for more than a very minor component of any service industry's overall fishery-related revenue.

There may be implications to the markets for red crab expected as a result of processing at sea restrictions. Depending on what level of processing is allowed, certain vessels may not be operating in the future which could affect the product supply, or the product mixes that are available to the wholesaling and retailing sector. Since one intent of the FMP is to limit the supply of red crab to an optimal level, there may be slightly less red crab provided to the markets.

There are no known economic impacts to fishing communities expected as a result of this proposed measure. There are no communities dependent upon the directed red crab fishery. Since the size of the fishery is so small, and so few vessels participate, the impact of any change in the red crab fishery is overwhelmed by the influence of larger fisheries, which generate greater revenue.

5.3.4.5 Social/Cultural Impacts of the Measure

There are no data available with which to evaluate the potential impacts of this measure on the social and cultural aspects of New England and Mid-Atlantic fishing communities. The small size, few participants, and distributed nature of this fishery, however, suggests that any social or cultural impacts to these fishing communities will be negligible. Based on information provided by members of the red crab fishing industry in response to a survey collecting baseline information on the fishery, few consider the communities in which they live to be fishing communities, and fewer still consider their communities to be significantly dependent upon fishing activities (see Appendix B). The implementation of new management programs for the red crab fishery, therefore, would not be expected to significantly disrupt the social frameworks of these communities.

The different options considered for this measure are associated with different levels of impacts to the fishermen currently involved in the directed red crab fishery. The most restrictive option would require that all crabs harvested in the directed red crab fishery be landed whole. The majority of vessels currently involved in the directed red crab fishery maintain the crabs whole and alive in refrigerated sea water (RSW) tanks and these participants would not be affected by any of the options under consideration. One traditional participant and at least one new entrant in the directed fishery employ some form of butchering on-board their vessels while at sea. These participants may be affected by some of the options under consideration.

If the most restrictive option is selected, these participants would be forced to either alter their current fishing practices to comply with the new regulations or, if they are unable to adapt, leave the fishery. If they leave the fishery, this could have an effect on their occupational opportunities if they are unable to find employment elsewhere. Leaving the fishery would also decrease their flexibility and the stability they have in the fishery, increasing the uncertainty they feel about their future in the fishing industry.

If they can remain in the red crab fishery, but must alter their fishing practices, this could also affect the occupational opportunities of these participants if the vessels would use fewer crew under the new regulations. Changing their vessel's fishing practices could have an effect on safety if any aspect of their new fishing practices increases the likelihood of injury or other incident. This adaptation to the new regulation, while not as severe as being forced to leave the fishery, would nonetheless decrease their flexibility and stability and increase their level of uncertainty for the future. The more restrictive options under this measure are not supported by the current participants of the directed red crab fishery.

The preferred option, prohibiting the full processing of red crabs at sea (removing the meat from the shell) but allowing butchering of crabs at sea, is supported by the current participants of the fishery and would not be expected to have any adverse social impacts on these participants. No current participant in the directed red crab fishery is known to fully process red crabs on board their vessel while at sea. Adoption of this option, as opposed to the least restrictive option -- no restrictions on butchering or processing at sea -- would be expected to have beneficial social impacts for the participants as they have voiced support for this measure and it would provide them an increased sense of stability in the fishery. These members of the industry have indicated concern over the potential for vessels to fully process red crabs at sea and the potential impacts that would occur to the resource. Thus, not restricting processing at sea could actually increase the level of uncertainty in the fishery and have greater adverse social impacts than a more restrictive option.

5.3.4.6 Impacts of the Measure on Protected Species

The prohibition on full processing of red crab at sea will have no effect (beneficial or adverse) to protected species as it does not modify active fishing operations such as deployment or retrieval of gear or the physical characteristics of the gear used. Partial processing and butchering at sea may extend trip lengths, but is not expected to increase the total amount of fixed gear that may be set in the red crab fishing areas.

5.3.5 Trap/Pot Limits

This measure will establish trap/pot limits for the controlled access directed red crab fishery, capping the maximum number of traps that may be used.

5.3.5.1 Biological and Ecological Impacts of the Measure on Red Crab

Capping the number of pots per vessel, the number of pots per string and the number of strings per vessel would cause vessels in the fleet to have similar efficiencies.

Currently, vessels are reportedly fishing with 500-600 pots. Without considering the entire fishing process, it is unclear what specific effect capping the number of pots would have on the red crab stock. The catch from a trip is determined not only by the total number of pots being fished, but by the number of pots per string (trawl), the number of trawls, the number of times each trawl is set and hauled during a trip, the time required to set and haul a trawl, and whether the vessel lands live, sectioned, or totally processed crab product. For example, without a trip limit or a rule limiting processing at sea, then catcher-processing vessels could continually reset their traps, process the resource on-board, and quit only when their vessel's hold capacity was reached. To better enforce a trap limit, some form of trap tag or buoy marking system should be employed.

5.3.5.2 Ecological Impacts of the Measure on Other Species and Communities

Very little is known about the interactions of the deep-sea red crab with other species and their associated communities. The directed red crab fishery has no known interactions with other species or their associated communities, as the bycatch of other species in the red crab fishery is minimal. The impacts of this fishery on other species or their communities are expected to be minimal to non-existent. This proposed measure would not affect this conclusion.

If new information becomes available that suggests this conclusion may be incorrect, the Council will review the information and consider whether or not additional action may be necessary. Future assessments of this type will consider all new information regarding the interactions of the red crab fishery with other species and their communities and consider mitigation, if necessary, at the appropriate time.

5.3.5.3 Impacts of the Measure to Essential Fish Habitat

Although crab traps are not considered to contribute any adverse impacts to the types of habitat found within the area of the directed red crab fishery (based on the results of studies on the effects of lobster and crab traps on a variety of habitat types by Eno et al. 1999), the limited available information suggests that if there were any impacts associated with this fishery, limiting the number of traps used in the fishery, and thus in contact with the bottom, may serve to reduce any potential risk.

Current reports from the fishing industry suggests that the industry average number of traps employed by each vessel is 560. Only the proposed limit of 400 traps per vessel would result in an overall reduction in traps being used in the fishery. The other two options (the preferred option of 600 and the option for1000 traps allowed per vessel) would not result in any reduction of the number of traps used in the fishery.

If no reduction in the overall number of traps used in the fishery results from this measure, then there would be no potential immediate benefits to any habitat within the range of the red crab fishery that may be impacted by this gear. If the trap limit of 400 traps per vessel is selected and the overall number of traps employed in this fishery is decreased, then there may be a benefit to habitat implied by this reduction of gear in contact with the bottom.

It should be clearly recognized, however, that there is no information available to the Council that suggests the amount of fishing gear used in the red crab fishery should in any way be restricted in order to protect the EFH of any managed species.

5.3.5.4 Economic Impacts of the Measure on the Fishery

The FMP will establish gear or trap limits for the directed red crab fishery. This measure will limit the number of pots that a vessel could fish on a per trip basis, and will serve to control the effort of the fishery in conjunction with a trip limit. It is unclear what effect, if any, capping the number of pots alone would have on the fishery, or if it would be redundant with the use of trip limits. Vessels fishing primarily for lobsters may employ more traps than the trap limits specified, but these vessels would only be subject to the red crab incidental catch limit, not the trap limit. The administration and enforcement of this potential measure may be complicated by the proximity of the offshore lobster fishery and red crab vessels that are permitted to also fish for lobsters. As a partial solution to improve the enforceability of this measure, rather than manage the trap limit by counting individual traps, the preferred alternative will implement a maximum traps per string equivalent rule.

Capping the number of pots per vessel, the number of pots per string and the number of strings per vessel would force vessels in the fleet to behave similarly. However, larger vessels may be forced to operate in a less efficient manner due to constraints equally imposed. Without considering the entire fishing process, it is unclear what specific effect capping the number of pots would have on the red crab fishery. The catch from a trip is determined not only by the total number of pots being fished, but by the number of pots per line (trawl), the number of trawls, the number of times each trawl is set and hauled during a trip, the time required to set and haul a trawl, and whether the vessel lands live, sectioned, or totally processed crab product. If there is not a corresponding trip limit or a rule limiting processing at sea, catcher-processing vessels could continually reset their traps, process the resource on-board, and quit only when their vessels hold capacity was reached. To better enforce a trap limit, a trap tag or buoy marking system should be employed.

If the non-preferred option of 400 traps per vessel were chosen, this would severely limit all red crab directed vessels. The preferred alternative, 600 traps per vessel, has been reported as the "industry standard" used by most vessels, although individual vessels may vary slightly from this number. This limit would prevent any vessel from increasing the number of traps it actively fishes, either in an attempt at increasing their effort or in an attempt at "holding bottom." A trap limit of 600 pots would have minimal effect on the fishery as currently prosecuted. The vessels operating as of the control date all report fishing between 500 and 600 pots, and at least one of the new entrants is reportedly fishing 600 pots. A 600-pot limit may not be a reduction for any vessels currently fishing red crab, and is consistent with the NMFS emergency regulations.

The most common method of red crab fishing is to set traps or pots for a short time (< 24 hours), haul and then reset all traps, repeating this process until the vessel's hold is full or it becomes uneconomical to remain on the fishing grounds (e.g., because catch rates are declining or mortality and/or product quality of the crabs on board is declining). Traditionally, most of the vessels in the fishery make eight to ten day trips where seven to eight days are spent on the fishing grounds. They haul, on average, 500-600 traps per day, working about sixteen hours, although new entrants may be able to haul significantly more traps per day, especially if they work 24 hours a day due to larger crew size.

With a very low trap limit (e.g., 100 - 200 traps per vessel), each vessel would likely be restricted to fishing only six to eight hours per day, and, in order to reach their hold capacity, vessels would have to extend the length of their fishing trips. This would diminish the profitability of each trip, as fuel and food costs increase in proportion to trip revenue. With a higher trip limit or no trip limit, the larger vessels could potentially land significantly more trips, thereby creating a derby-type fishery. Also, for the vessels that land live crabs, increasing the length of the trips would increase the proportion of crabs that die before being landed. Reportedly, with any trip over eight days, increasing percentages of "dead loss" occur. The vessels that butcher/partially process and freeze the resulting product would not be affected in this way, so they could continue fishing without concern over dead loss.

The processing sector (shore-based) is dependent upon a steady supply of red crab product from the vessels. Any change in the number of pots which has an effect on the amount of red crab product landed will in turn have an effect on those that process it. There are no economic impacts to fishery-dependent service industries expected as a result of proposed gear or trap limits. Any change in the number of pots which has an effect on the amount of red crab product landed will in turn have an effect on the markets. Any change in the amount of product landed as a result of gear limits will be quite small.

There are no economic impacts to fishing communities expected as a result of this proposed measure. Since the size of the fishery is so small, and so few vessels participate, the impact on any change in the red crab fishery is overwhelmed by the influence of larger fisheries that generate greater revenue.

5.3.5.5 Social/Cultural Impacts of the Measure

There are no data available with which to evaluate the potential impacts of this measure on the social and cultural aspects of New England and Mid-Atlantic fishing communities. The small size, few participants, and distributed nature of this fishery, however, suggests that any social or cultural impacts to these fishing communities will be negligible. Based on information provided by members of the red crab fishing industry in response to a survey collecting baseline information on the fishery, few consider the communities in which they live to be fishing communities, and fewer still consider their communities to be significantly dependent upon fishing activities (see Appendix B). The implementation of new management programs for the red crab fishery, therefore, would not be expected to significantly disrupt the social frameworks of these communities.

Two of the three options under consideration, including the preferred option, for this measure would not affect the fishing practices of any current participants in the directed red crab fishery. The current fleet average number of pots used per vessel is 560 and no vessel reports using more than 600 pots. The options to set a pot limit of 600 or 1000 pots per vessel would have no impacts, social or otherwise, on the current practices of the fishery. The third option, to set a pot limit of 400 pots per vessel, may have an effect on any participants who currently use more than 400 pots.

The effects of this new limit could result in vessels remaining at sea for longer periods of time (assuming they do not change their average soak time and remain at sea long enough to obtain the same amount of landings as they previously had). Remaining at sea for longer periods of time could cause adverse social impacts reflected in additional time away from home and their families, and increase safety risks associated with longer fishing trips. This option could also decrease the flexibility of many participants in the fishery and increase uncertainty on several fronts. While there is general support in the industry for a trap limit of 600 pots per vessel, there would not be support for a measure that limited gear to 400 pots per vessel.

5.3.5.6 Impacts of the Measure on Protected Species

Reduced fishing effort may be seen as having a direct beneficial effect on marine mammals and other protected species if the average trap trawl length remains the same. The current average trap usage by vessel is 560. The proposed limit of 600 traps represents no real change from present practice. This measure will prevent any expansion of trap trawl length in the future. For marine mammals and other protected species, a beneficial impact could be expected at 400, no change at 600, and an adverse impact at 1000 (assuming that the fishing vessels actually increased their trap usage up to the limit[15]). The current fleet practice of leaving the gear at sea between fishing trips has a potential adverse impact for protected species, although the Atlantic Large Whale Take Reduction Plan (ALWTRP) prohibits this practice as “wet storage” if it occurs for more than 30 days.

5.3.6 Gear Requirements/Restrictions

The preferred options for this measure propose to implement several types of restrictions and limits on the type, size and design of fishing gear used in the directed red crab fishery, including prohibiting all fishing gear types except crab pots in the directed red crab fishery. This proposed measure is different from the others considered in this FMP in that the specific options are really sub-measures that are not mutually exclusive. Unlike measures such as the incidental catch limit, where the options are mutually exclusive variations that specify the particular catch limit to be implemented in the FMP, this measure is really a catch-all for gear-type regulations considered under this FMP. All of the following options could be implemented for this fishery, or none could be implemented. Also, there are no specific variations identified for most of these options.

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[15] It should not be a foregone conclusion that the red crab vessels would increase their trap usage up to the level of the new maximum, should the Council select a 1000 trap per vessel limit. Prior to the emergency regulations, the red crab fishery was unregulated and yet the fishery naturally settled on an industry average of less than 600 traps per vessel. This level of trap usage is most likely the most efficient for this fishery and is unlikely to change significantly unless *reduced* by regulation.

For example, there are no specific sizes proposed for the escape vent option, although if the escape vent was selected, a particular size would have to be determined.

5.3.6.1 Biological and Ecological Impacts of the Measure on Red Crab

The biological and ecological impacts of the options proposed in this measure vary according to each option (these options are not variations on a theme, but are actually distinct options which are not mutually exclusive) and will be assessed separately.

Escape Vents

This non-preferred option proposed requiring escape vents on all traps used in the directed red crab fishery to ensure the adequate escapement of undersized crabs. This type of option has obvious benefits to the resource by reducing the potential for discard mortality of females and juvenile males that are brought to the surface in the traps, sorted, and then released back into the water. While the actual discard mortality is unknown, it is assumed that at least some of these crabs suffer mortality as a result.

Unfortunately, although this option would have benefits to the red crab resource, no selectivity studies have been done to determine the appropriate size escape vents needed in this fishery. If the required escape vents were too small, then undersized crabs would be retained and much of the anticipated benefits would be lost. If the required escape vent was too big, then market-sized crabs would also escape and the yield of the fishery would decline.

It would be impossible, with the available information, to suggest a biologically-based escape vent size. This may not be immediately necessary, as fishermen have reported that a mechanism already exists for the escapement of undersized crabs. The trap design most commonly used in the directed red crab fishery is a rectangular wood and wire trap, and the wood lathes are spaced approximately two inches apart. The fishermen report that this lathe spacing allows small crabs to escape.

Given the paucity of scientific information on this issue on which to base a management decision, the FMP is intended to encourage the fishermen to continue their current practices and to continue to use a gear design that allows some degree of escapement. Meanwhile, the FMP will request that NMFS, or another appropriate scientific group (possibly working in conjunction with the fishing industry), conduct selectivity studies on a variety of escape vent sizes (see Section 9.0). Upon completion of these studies and the data being made available, the Council would be able to consider whether additional action is necessary to require a minimum escape vent size and would have the information with which to determine the appropriate size for the escape vent.

Trap Size

In theory, larger traps can result in higher catches. This assumes, however, that all other variables remain the same: number of traps, number of trap hauls, soak time between hauls, number of traps per string, etc. The principal potential impact on the resource from an increase in trap size above what is currently being used would be increased catch rates. Increased catch *rates* are not necessarily a problem if the overall catch does not change (e.g., whether a vessel takes 50,000 pounds of crab on a trip hauling 3,000 traps of the current size or 2,000 larger traps is of little overall consequence to the resource).

Thus, assuming that the FMP will implement some form of overall catch controls on the directed red crab fishery (hard TAC, IVQ, trip limits with a set number of trips, etc.), establishing a maximum trap size will not have a biological impact. If, however, effort is controlled in such a way that catch rates per unit of effort could vary, then a trap size restriction would have an important role in providing protection for the resource. For example, if the measure to implement a DAS program is the primary effort control mechanism selected for this fishery, so it will be very important to understand the relative fishing power of each individual DAS. Given a constant allocation of days, increasing trap size (and thus increasing the catch rates per trap haul) could be one mechanism used by the industry to increase the efficiency of their allocated DAS.

In order to effectively manage the fishery using this type of effort control and not have unintended negative consequences on the resource, a maximum trap size is being proposed for the directed red crab fishery. Without a maximum trap size, increased catch rates per DAS could result in overexploitation of the resource.

Trap Materials

This non-preferred option would be unlikely to result in any direct impacts to the resource. The option was primarily intended to offer the Council a mechanism to "freeze" trap design so that different trap technologies cannot be used to alter the efficiencies of the traps. It is impossible at this time, however, to speculate on what those trap technologies might be and what their effects would be on trap efficiency.

Gear Markings

This preferred option is purely administrative in nature, intended to aid in the identification of fishing gear being used in the directed red crab fishery and to aid in the enforcement of management measures implemented via this FMP, and will have no biological or ecological impacts on the resource.

Trap Configuration and Deployment

This non-preferred option would be purely administrative in nature, intended to aid in the enforcement of any trap limits implemented via this FMP, and would have no biological or ecological impacts on the resource.

Ghost Panel

It is common for fishermen, especially trap fishermen, to lose some amount of their fishing gear throughout the year. Members of the red crab industry have reported losing an average of 10.5 traps per fishing trip. Fishing gear that is lost and remains on the bottom often continues to function for some time to come. This is called "ghost fishing" and is believed to have potentially significant impacts on resources trapped in the "ghost gear." The management of trap fisheries often require the installation of a biodegradable panel in the trap of such a size that should the gear become lost to the fisherman and the panel opens, all animals trapped in the gear would be able to escape.

This has obvious potential benefits to the resource, as individuals that remain trapped in ghost gear will die and cannot contribute either to the fishery or to the reproductive potential of the resource. Implementation of this option would require that all participants in the directed red crab fishery either install some type of biodegradable panel or element to their trap gear to allow for the escapement of all animals should the gear remain on the bottom for a significant period of time, or that the trap design itself be constructed of biodegradable materials. The most common trap design currently used in the fishery consists of a wood, wire, and twine gear that should be sufficiently biodegradable to meet the objectives of this option. Fishermen using any other gear type that is not biodegradable should be required to install some type of ghost panel in order to minimize the potential for unintended ghost fishing mortality on the resource.

Marine Mammal Requirements

This option is intended solely to meet the requirements of the Atlantic Large Whale Take Reduction Plan (ALWTRP) and will have no affects on the resource.

Prohibition on the Use of Parlor Traps

This preferred option will prohibit the use of parlor traps in the controlled access directed red crab fishery. Parlor traps improve the ability of traps to retain crabs over a longer time. Thus the use of parlor traps could increase fishing effort, particularly if accompanied by a change in fishing strategy, such as longer soak times. Parlor traps would likely increase the productivity of traps when they are left on the fishing grounds between trips. Because the current traps do not prevent the escape of crabs from the trap, many of the crabs that might enter the traps during the period between trips are gone before the vessel returns to haul the traps on the next trip. Parlor traps would increase the concern about "ghost" fishing if traps are lost. Lost traps do not present a ghost fishing problem at present because the crabs can escape from the traps. Parlor traps would be more likely to cause handling damage to crabs, lower product quality for the marketable crabs that were kept, and increase mortality for the crabs that are released alive.

Prohibition on the Use of Other Gear Types

This preferred option will require that all participants in the directed red crab fishery employ trap gear only in this fishery. The use of trawls, dredges, nets, or other types of fishing gear will be prohibited in the directed fishery. The effect of this measure on the resource will be primarily determined by the reduction in any potential discard mortality associated with non-trap gear, especially in the bottom-tending mobile gears such as trawls and dredges. All current participants in the directed fishery use traps as their sole gear type, so implementation of this option will not have a direct affect on the resource except as a mechanism to prevent a future *increase* in discard mortality associated with the directed fishery should a participant desire to change their gear type.

5.3.6.2 Ecological Impacts of the Measure on Other Species and Communities

Very little is known about the interactions of the deep-sea red crab with other species and their associated communities. The directed red crab fishery has no known interactions with other species or their associated communities, as the bycatch of other species in the red crab fishery is minimal. The impacts of this fishery on other species or their communities are expected to be minimal to non-existent. This proposed measure would not affect this conclusion.

The trap-only restriction proposed in this measure would prevent an increase in adverse impacts to other species and their associated communities that would result from an increase in dragging for red crabs. If new information becomes available that suggests this conclusion may be incorrect, the Council will consider whether or not additional action may be necessary. Future assessments of this type will consider all new information regarding the interactions of the red crab fishery with other species and their communities and consider mitigation, if necessary, at the appropriate time.

5.3.6.3 Impacts of the Measure to Essential Fish Habitat

The majority of options proposed in this measure affect only the design and size of the fishing gear to be used in the directed red crab fishery. Options such as escape vents, ghost panels, trap tags and gear markings, and marine mammal requirements would not have any direct or indirect effect on the habitat of the region.

The option to restrict the size of the traps used in the directed red crab fishery could have an effect on habitat if the option reduced the overall size (particularly the footprint) of the gear; however, this option only proposes to establish limits that would maintain the current size of the gear and prevent any increase in the size of the gear. This could have an indirect effect on the habitat of the region by preventing the development or use of much larger and/or heavier trap gear in the future (such as the 7’ by 7’ steel traps commonly used in the West coast crab fisheries). Larger and/or heavier trap gear may have more of an impact on the habitat of the region than the currently used gear is believed to have.

The option to control the materials allowable in the construction of the traps used in the directed red crab fishery could have an effect on the habitat of the region if this option prevented the use of toxic materials in the traps that could have an adverse impact on habitat. The materials currently used in the construction of the traps used in this fishery are not known to be or to contain any toxic materials, therefore this option would not provide any immediate benefits to habitat.

The most significant option within this measure that could contribute to the protection of EFH is the option to prohibit the use of all gears types except traps in the directed red crab fishery. Although this fishery is currently trap-only and there would be no immediate benefits to habitat associated with this option, without this option the participants of the fishery could switch to other gear types, such as otter trawls and dredges, that are often associated with adverse impacts to certain types of habitat. This option will prevent this from occurring, thus ensuring a continued trap-only fishery and minimal, if any, impacts to habitat.

5.3.6.4 Economic Impacts of the Measure on the Fishery

The FMP will establish some form of gear requirements and/or restrictions for the directed red crab fishery. The Council considered the need/utility for requiring escape vents (of a size to be determined to allow for the escapement of small crabs and possibly females), size and material restrictions, gear marking or trap tag requirements on all traps used in the directed red crab fishery. Depending on the modifications that are necessary to the traps or other gear used in the directed red crab fishery, the costs of those changes must be taken into account. The preferred alternative does not have a requirement for an escape vent, so there will be no additional costs for that modification.

The preferred alternative requires gear markings on all buoys used at the end of each red crab trap trawl. Under the preferred alternative, gear types other than red crab traps, such as otter trawls, dredges, nets, etc., will be prohibited from use in the directed red crab fishery. This prohibition would not apply to those vessels retaining incidental catch-level amounts of red crab harvested while participating in other fisheries. Vessels holding an open access red crab incidental catch permit may use any type of fishing gear they choose. Public opinion was expressed by otter trawl owners who are concerned about the level of incidental catch that would be allowed under the preferred alternative for non-trap gear types.

In calendar year 2000, according to NMFS dealer data, there were three vessels who reportedly used a gear other than crab pots to land red crab, but those other gears were either offshore lobster pots or a unknown type of pot or trap. This may indicate that this gear restriction may have some adverse impacts on these three vessels (by encouraging them to switch gears to red crab traps only) or it may simply be an anomaly in the recording system. In calendar year 2001, NMFS dealer data indicates additional non crab-pot effort, reporting seven vessels using other than crab pots/traps. Four of these were otter trawlers.

In the VTR data in 2000, there were two otter trawlers and five types of lobster pot gear identified. In 2000, there was only one vessel that reported using crab pots, another reminder of the poor data. In the VTR data in 2001 (as of 2/15/2002), there were three otter trawlers, four vessels using lobster pots, and three red crab vessels. Even though 2001 data are not complete, there is a trend for additional vessels and dealers to report their red crab landings. Because of the emergency action and its requirement to report landings and effort, we are collecting more data than in the past. We know from the survey that most respondents (all in the directed fishery) report 100% dependence on the red crab fishery for their annual income.

Gear requirements would be primarily non-controversial modifications that would be good for the red crab resource and would not reduce the amount of the resource available to be processed. Thus, this would not have an impact on the processing component of the red crab fishery.

There are no economic impacts to fishery-dependent service industries expected as a result of proposed gear restrictions. The types of services used include: fuel, ice, food and groceries, bait, gear, oil/lubrication, water, hull maintenance, engine maintenance, electronics, insurance, accounting, legal advice, and dockage. The current suppliers of these types of services would easily handle any modifications needed to the gear. Given the small number of fishing vessels involved, it is unlikely that providing a change in services to red crab vessels would account for much of a change to any service industry's fishery-related revenue.

Any change in gear restrictions which has an effect on the amount of red crab product landed, will in turn have an effect on the markets. In this case, the amount of red crab landed will not be changed significantly by the gear requirements considered here. Any change in the amount of product landed as a result of gear restrictions will be quite small. There are no economic impacts to fishing communities expected as a result of this proposed measure. Since the size of the fishery is so small, and so few vessels participate, the impact of any change in the red crab fishery is overwhelmed by the influence of larger fisheries, which generate greater revenue.

5.3.6.5 Social/Cultural Impacts of the Measure

There are no data available with which to evaluate the potential impacts of this measure on the social and cultural aspects of New England and Mid-Atlantic fishing communities. The small size, few participants, and distributed nature of this fishery, however, suggests that any social or cultural impacts to these fishing communities will be negligible. Based on information provided by members of the red crab fishing industry in response to a survey collecting baseline information on the fishery, few consider the communities in which they live to be fishing communities, and fewer still consider their communities to be significantly dependent upon fishing activities (see Appendix B). The implementation of new management programs for the red crab fishery, therefore, would not be expected to significantly disrupt the social frameworks of these communities.

Most of the options considered under this measure are largely administrative in nature and would not substantively change current fishing practices. Options such as those requiring escape vents, limiting trap construction materials, trap tags and gear marking requirements, ghost panels, and even the marine mammal requirements, would not be expected to cause any social impacts to the participants of the fishery. The only potential social impact associated with these options may be an increase in the stress levels of vessel owners and operators if they are concerned about their ability to comply with any new gear-related requirements.

Because these options are not expected to substantially alter current fishing practices, these aspects of this proposed measure will not have any social impacts on the participants in the directed red crab fishery. This proposed measure is not expected to have any effect on the occupational opportunities of any participants of the directed fishery. The proposed measure is not expected to have any effects on community infrastructure, or the safety of any fishery participants. There appears to be general support for this type of measure among the participants in the directed fishery, and this measure is not expected to decrease the flexibility or stability, or increase the uncertainty, of the participants in the directed fishery.

The only option that may be associated with any potential social impacts to the participants of the directed red crab fishery is the proposed requirement that the directed fishery be regulated as a trap-only fishery. No one in the fishery currently uses any type of fishing gear other than traps, but there is some concern among the members of the fishery that potential future participants may use mobile gear such as trawls and dredges. The members of the industry are opposed to the use of such gear and so they support this option. In spite of the concerns of members of the red crab industry over the potential use of otter trawls and dredges, the actual potential for these gears being used at directed levels is fairly small. Implementation of this option may also result in an increased sense of stability and a reduction in any uncertainty (knowing that trawl and dredge gear will not be allowed in the fishery).

5.3.6.6 Impacts of the Measure on Protected Species

Most of the gear requirements being proposed under this measure are for the protection of the red crab resource and have no impact on protected species. The ALWTRP currently requires a suite of gear modifications for the red crab fishery. There will be no additional beneficial effect on marine mammals and other protected species associated with these measures except for the buoy marking requirement. Buoy marking will provide the potential for the identification of red crab gear found on an entangled whale. The prohibition on all non-trap gear for use in the directed red crab fishery is not beneficial to marine mammals and other protected species as alternatives to traditional trap gear may reduce the likelihood of interactions between protected species and red crab fishing gear.

5.3.7 Total Allowable Catch

This measures establishes a target total allowable catch (TAC) for the directed red crab fishery. Option 5, the Vessel-Based TAC, cannot be implemented as an actual vessel-based TAC, as that is in essence an individual vessel quota, which is prohibited under current law. This type of system could be done as a vessel-category-based TAC, where the overall TAC is split into two or more TACs allocated to different categories of vessels (e.g., a catcher-processor TAC and a whole crab TAC).

5.3.7.1 Biological and Ecological Impacts of the Measure on Red Crab

In many of the proposed measures, the overall allowable level of red crab catch is the primary control on the fishery. The level of the TAC determines the expected effects on the resource. A TAC set at or very close to the best estimate of MSY for the resource incurs higher levels of risk to the resource than a TAC set at a precautionary percentage of the MSY level. The higher the TAC, the higher the probability that the resource may be subject to overfishing and become overfished.

An issue related to the actual size of the TAC (and, therefore, the amount of the red crab stock likely to be removed from the population during the fishing year) is the timing of the fishing effort. If there are no other controls on the fishery, then a derby-type fishery is likely to develop. This could end up as a fishery that opens at the start of the fishing year and closes a few months later when the TAC is reached. This type of management program would constrain all the year's fishing effort into a much shorter timeframe. This could have either adverse or beneficial effects on the resource, depending on several factors.

If the fishing effort is concentrated during times of heavy molting and reproduction, more females may be caught and damaged than normal. This could limit successful reproduction. If the fishing effort is concentrated just prior to any annual cycle of molting, then the loss of a significant portion of the large males could reduce the number of males available for mating, also limiting successful reproduction. There may be times of the year, however, when concentrated fishing effort does not have any deleterious effects on the resource.

If the use of an overall TAC for the fishery is combined with other measures intended to reduce the likelihood of a derby fishery and spread the landings out over the entire year, then there are unlikely to be any significant impacts to the resource above and beyond the impacts expected due to the level of the TAC.

5.3.7.2 Ecological Impacts of the Measure on Other Species and Communities

Very little is known about the interactions of the deep-sea red crab with other species and their associated communities. The directed red crab fishery has no known interactions with other species or their associated communities, as the bycatch of other species in the red crab fishery is minimal. The impacts of this fishery on other species or their communities are expected to be minimal to non-existent. This proposed measure would not affect this conclusion.

If new information becomes available that suggests this conclusion may be incorrect, the Council will review the information and consider whether or not additional action may be necessary. Future assessments of this type will consider all new information regarding the interactions of the red crab fishery with other species and their communities and consider mitigation, if necessary, at the appropriate time.

5.3.7.3 Impacts of the Measure to Essential Fish Habitat

This measure may have an indirect effect on the habitat of the region by establishing an upper limit on the amount of fishing effort allowed in the directed red crab fishery. A hard TAC, where the fishery is closed upon landings reaching the TAC, would constrain the overall fishing effort for the year, whether that effort is allocated via some number of trips, DAS, IVQ, etc., or is not allocated at all. Limiting the total amount of allowable fishing effort could have an effect on habitat if there were any adverse impacts to this habitat associated with the directed red crab fishery. Since there are no known adverse impacts associated with this fishery as it is currently prosecuted, it is unlikely that this measure would have any effect on the EFH of any managed species. The use of a target TAC, where fishing effort is not controlled directly, would have no effect on habitat, even indirectly.

5.3.7.4 Economic Impacts of the Measure on the Fishery

The FMP will establish a target TAC for the red crab fishery. The hard TAC option would establish an upper limit for annual landings in the fishery, and once this limit was reached, the fishery would be shut down for the remainder of the year. Used alone, this would create conditions leading to a “derby”-type fishery. Because this is generally known, it would have to be paired with a suite of management measures that keeps fishing effort and mortality low enough to obviate the need for a shutdown early in the year. Under the hard TAC option, in a manner similar to the emergency action, there would need to be a data collection system for determining when the TAC has been reached and notification procedures for shutting down the fishery. Under the preferred target TAC option, the Council will need to specify a data collection system and protocols for establishing the following year's TAC based on current year harvest levels.

A hard TAC alone would traditionally bring about a derby style of fishing activity. It would favor the vessels that could harvest the greatest volume of red crab in the shortest time. The larger vessels or particularly those with the largest hold capacity would have disproportionate benefits. A trip limit combined with a TAC would allow for spreading out the TAC over a specified time frame, but would still create a derby type situation. The purpose of a trip limit, in combination with a TAC, is to spread out the TAC so that the landings do not occur solely at the beginning, or solely by the vessels capable of landing the most efficiently. If trip limits were used in addition to a TAC, the number of trips allowed per vessel would have to be considered. If the resulting number of trips was very restrictive, it could exclude a whole class of vessels -- those that are capable of landing far more to stay within the TAC than the trip limit.

Rather than establish an overall TAC for the entire fishery, the target yield could be divided and assigned to individual vessels or categories of vessels (e.g., large catcher-processors and small catcher vessels). Each vessel or category of vessels would be allocated a certain amount of landings for the year and when they reached this amount of landings, would have to stop fishing for the remainder of the year. In order for this option to be considered, it must be used with a category of vessels. If a TAC were assigned to individual vessels, it would be an IVQ which is already a separate alternative. See Section 5.3.11 for a discussion of this option. Considered as a sole measure, a TAC assigned to categories of vessels may have some economic benefits, especially given the small number of participants that would be in each category. In other fisheries, situations such as this have prompted successful use of producer co-ops, where vessel owners within a category can negotiate and agree on their share of a group allocation.

The preferred alternative chosen was the creation of a target TAC equal to the most current estimate of optimum yield for the fishery, adjusted annually. This would minimize the potential for a derby fishery, and have the best chance of maintaining a twelve-month fishery.

A race to fish for the harvesters causes a race to process for the processors, since red crab is a perishable product. Placing an upper limit on total landings would place a limit on the amount of red crab available to be processed and would influence whether or not there was a steady supply of product. This may affect the quality of red crab available, if processors are forced to deal with supply fluctuations. All of the processors report relying on some other products in addition to red crab so that their revenue is not completely dependent on the continuous supply of red crab. On average, red crab accounts for 11.5% of their fishery-related processing operations. Most processing employees also work on other fishery-related products or at least do not work exclusively on red crab. See Appendix B for a further discussion of the processing sector.

There are no economic impacts to fishery-dependent service industries expected as a result of a total allowable catch measure. The current suppliers of these types of services would easily handle any change in services needed. Given the small number of fishing vessels involved, it is unlikely that providing a change in services to red crab vessels would account for a change to any service industry's fishery-related revenue.

Any change which has an effect on the amount of red crab product landed will in turn have an effect on the markets. In this case, the amount of red crab landed will be reduced to a level that may be consistent with prior years. In the absence of a demand function for red crab, it is hard to predict what effect a lower quantity of product would have on price. There are no known economic impacts to fishing communities expected as a result of this proposed measure. Since the size of the fishery is so small, and so few vessels participate, the impact on any change in the red crab fishery is overwhelmed in the community by the influence of larger fisheries, which generate greater revenue.

5.3.7.5 Social/Cultural Impacts of the Measure

There are no data available with which to evaluate the potential impacts of this measure on the social and cultural aspects of New England and Mid-Atlantic fishing communities. The small size, few participants, and distributed nature of this fishery, however, suggests that any social or cultural impacts to these fishing communities will be negligible. Based on information provided by members of the red crab fishing industry in response to a survey collecting baseline information on the fishery, few consider the communities in which they live to be fishing communities, and fewer still consider their communities to be significantly dependent upon fishing activities (see Appendix B). The implementation of new management programs for the red crab fishery, therefore, would not be expected to significantly disrupt the social frameworks of these communities.

The proposed measure to manage the directed red crab fishery through the use of a target TAC could result in adverse social impacts on the current participants of the fishery. There are two aspects of this proposed measure that are related to potential social impacts. First, the TAC may have to be set significantly lower than the level of landings to which the current fishery participants are accustomed. This would in turn reduce their revenues, with a potential reduction in occupational opportunities for some fishermen, and a general decrease in flexibility and stability associated with this fishery, in turn increasing the uncertainty felt by the participants.

Second, without other complementary controls, the simple establishment of an overall TAC for the fishery could create a derby-type fishery, where the participants fish much harder and more frequently than they would under other conditions in an attempt to harvest as much of the available TAC as they can before the TAC is reached and the fishery is closed down. Depending on the number of participants in the fishery and the level of the TAC, this "race to fish" could result in significant decreases in flexibility and stability in the fishery, as well as significant increases in the uncertainty associated with the fishery and the availability of the resource (e.g., "I better fish hard today, because the TAC might be gone tomorrow.").

Derby-type fishing is also associated with decreases in safety levels in most fisheries where they occur, as participants fish harder, more frequently, for longer durations, and are less likely to adjust their fishing practices to account for changes in weather or potential mechanical difficulties. Lastly, derby fishing is also associated with labor problems from the view of the vessel owners and operators who may be forced to lay off crew members once the annual TAC is reached, possibly for significant portions of the year, and then may have trouble finding qualified crew when the fishery starts up again for the next year. Derby fishing is also associated with labor problems from the perspective of the crew members, who may find themselves facing unemployment for significant periods of time while the fishery is closed.

Although there is general support within the industry for some sort of TAC as an upper limit on the overall fishing effort allowed in the directed red crab fishery, the TAC must be implemented in conjunction with other measures that would serve to prevent a derby-type fishery.

5.3.7.6 Impacts of the Measure on Protected Species

Any overall TAC set lower than current fishing levels would reduce the overall fishing effort and be beneficial to protected species. The target TAC will be set at 5,928,000 pounds of whole red crab or their equivalent. This TAC level is equivalent to the total catch reported in 1999 and represents a 25% decrease from 2001 levels. Therefore, an overall benefit to protected species can be expected.

There is concern that a derby fishery would result from some of the options that were proposed unless specific measures were adopted to mitigate this concern. However, a derby fishery would not necessarily be adverse for marine mammals and other protected species if the fishery is timed to occur during periods when the fishing grounds are little used by protected species. The beginning of the fishing year has been set at March 1 when most large whales have moved north into the Gulf of Maine and before other odontocetes arrive at the shelf edge. The DAS limits should also mitigate against development of a derby fishery. Therefore the overall impact of the selected TAC level and fishing year is beneficial to protected species.

5.3.8 Trip Limits

This measure will establish limits on the amount of red crab that may be landed on each fishing trip taken by a vessel participating in the directed red crab fishery.

5.3.8.1 Biological and Ecological Impacts of the Measure on Red Crab

Trip limits alone are unlikely to have any direct effects on the red crab resource. The options proposed in this measure potentially constrain the fishing power of individual vessels on a per-trip basis, but do not necessarily constrain the fishing power of the entire fleet over the entire fishing year. For example, a trip limit of 50,000 pounds coupled with no overall limit on catch and no control on the number of trips taken could allow for significant overfishing is all vessels made many trips at the trip limit (e.g., 7 vessels each making 30 trips at 50,000 pounds per trip = 10.5 million pounds of landings). A much higher trip limit, on the other hand, coupled with a strict limit on overall catch or the number of trips each vessel may make, would constrain the fishing power of the fleet (e.g., a trip limit of 200,000 pounds would likely not result in overfishing if the overall TAC was set equal to MSY).

5.3.8.2 Ecological Impacts of the Measure on Other Species and Communities

Very little is known about the interactions of the deep-sea red crab with other species and their associated communities. The directed red crab fishery has no known interactions with other species or their associated communities, as the bycatch of other species in the red crab fishery is minimal. The impacts of this fishery on other species or their communities are expected to be minimal to non-existent. This proposed measure would not affect this conclusion.

If new information becomes available that suggests this conclusion may be incorrect, the Council will review the information and consider whether or not additional action may be necessary. Future assessments of this type will consider all new information regarding the interactions of the red crab fishery with other species and their communities and consider mitigation, if necessary, at the appropriate time.

5.3.8.3 Impacts of the Measure to Essential Fish Habitat

This measure was considered primarily as a mechanism to spread out the overall fishing effort throughout the year and to avoid creation of a derby-type fishery. It is expected that the overall fishing effort, on an annual basis, would not change as a result of this measure. Generally, the implementation of trip limits of any kind would not be expected to have a direct effect on the habitat of the region. Trip limits could have an indirect effect on the habitat of the Northeast by controlling the amount of fishing effort associated with the fishery, assuming that fishing effort ceases as soon as the trip limit is reached and does not continue with the intent of "high-grading." However, this fishery is not considered to contribute any adverse impacts to the habitat of the region under any circumstances and this measure does nothing to alter this conclusion.

5.3.8.4 Economic Impacts of the Measure on the Fishery

From an economic point of view, this measure has a drawback compared to a limitation of effort. Trip limits act by reducing the efficiency of the fishing activity, by forcing fishermen to come back to port before they would otherwise. They reduce catches without any associated reduction of costs, and therefore result in reduced profitability at least in the short term.

However, trip limits have been used in conjunction with a TAC to minimize the potential for a derby fishery (although certainly not eliminating it) that may be associated with the setting of a TAC alone. In a quota fishery, trip limits provide a way to spread out the catch over the year, providing for a more orderly fishery and limiting market gluts. The balancing of enforcement concerns versus conservation rationale for trip limits will need to be considered. For each option specified under this measure, the trip limit would be considered to be in whole weight equivalent (i.e., a vessel that partially processes or butchers crabs at sea would use a specified recovery rate conversion formula and determine the whole weight equivalent of the weight of their crab product). The specification of reasonable and straightforward conversion rates will be critical to the success of this potential measure.

The non-preferred trip limit option of 65,000 pounds was based on the average trips taken by the traditional red crab vessels. Another non-preferred option would offer differential trip limits for different vessels (of the vessel's choice) and allocate a maximum number of trips per year to each vessel depending on the category of trip limit they choose. Each directed red crab vessel would be allocated a certain number of fishing trips and a maximum trip limit, providing a tiered approach to vessel trip limits, such that a vessel might declare into a 60,000 pound trip limit category, a 120,000 pound trip limit category, or a 180,000 pound trip limit category, depending on which amount of landings is most economical for their vessel. Each vessel would then be allocated a certain number of trips such that the ratio of landings to trip limit category would be the same. For example, under the above categories of trip limits, vessels declaring into the 60,000 pound category would be allocated twice as many trips as vessels in the 120,000 pound category and three times as many trips as the vessels in the 180,000 pound category. Smaller vessels may opt for more trips at higher trip limits while larger vessels may opt for fewer trips at lower trip limits. This method would offer vessels the ability to operate their vessel in a more efficient manner than if there was one trip limit that applied to every size vessel.

A differential trip limit and authorized number of trips would provide trip allocations to vessels in the red crab fishery similar to what is occurring in the controlled access fishery for scallops in re-opened management areas. Vessels would be able to know, up front, what they could land with no further restrictions. This would force vessels to be efficient in two ways. The individual vessels would be allowed to utilize their full holding capacity; it would allow larger vessels to participate at a higher level of landings. Because this measure would ultimately be combined with a hard TAC, it is not known how much of the TAC that each participating vessel would ultimately receive.

The benefits of this option would be determined by several factors: the number of vessels, the corresponding number of trips, and the trip limit criteria. We know that the final number of trips allowed per year would be significantly less than vessels in this fishery have historically taken. This would mean that these vessels would have to do other things to remain profitable, either fish for red crabs on a part-time basis or fish in other regions outside of the Northeast. The red crab resource is widespread and it is very possible that vessels would fish for red crab elsewhere. This option would severely limit the number of trips that vessels could take. Given our limited data, it is clear that this would limit vessels that have been in the fishery, and presumably would limit vessels that have recently entered or were planning on entering the fishery. However, they would have the flexibility to plan their fishing activities such that they use the trips to their advantage and plan other revenue-generating activity, from fishing or other activities.

Another non-preferred variety of differential trip limit could also be used that establishes trip limit categories (e.g., 60,000 pounds and 100,000 pounds). All vessels participating in the directed fishery would be subject to the 60,000 pound trip limit unless they could show evidence of a past trip with landings of 100,000 pounds or greater prior to the control date. This would allow vessels with a history of higher than average per trip landings, which may be necessary to remain economically viable in the fishery, to continue fishing at that level. Other vessels without the history of higher than average per trip landings would not be allowed to increase their effort but would be constrained to a lower level of per trip landings more in line with the rest of the fleet.

The catch per trip and the number of trips must be considered concurrently to determine the impact on the red crab fishery. Trip limits will tend to increase the number of trips taken and spread the harvest out during the year. If trip limits are constraining to a vessel, it will raise the cost per crab harvested. Assuming an annual TAC of 5 million pounds, a trip limit of 75,000 pounds of live crab would imply a total of 67 trips per year for all participants. According to the social and economic survey that was voluntarily completed by members of industry, the average number of red crab trips taken was just under 32. Clearly, if more than two vessels were participating in the fishery and they were allocated an equal number of trips, they would all have to cut back from their prior activity level. The decrease in revenue that vessels would experience would depend on the specific trip limit and corresponding number of trips allotted.

In the past, most boats landed whole crabs and the average catch per trip ranged from 38,000 to 100,000. Therefore, setting a trip limit below 100,000 would not affect all boats equally. Vessels that have recently entered the fishery reportedly have higher harvesting capacity than the other boats, and could be most restricted by a trip limit. A trip limit of 65,000 pounds equates to the average landings of the red crab vessels fishing in this fishery prior to the March 1, 2000, control date. Vessels that land whole crabs and that have a hold capacity of approximately 65,000 pounds would be able to continue fishing trips at historical levels, but in a safer manner than under a TAC without trip limits. Vessels that butcher or process crabs at sea and that have hold capacities of greater than 65,000 pounds could still fish, but would likely be constrained by this trip limit over what they could have harvested and landed based on their hold capacities.

A derby fishery not only is economically inefficient, but creates safety concerns as vessels may feel pressure to take more risk and fish in poor weather conditions so that they do not lose their opportunities before the TAC is reached and the fishery closed. Without a trip limit, a vessel that can process at sea and land finished product, especially those vessels with hold capacities in excess of 100,000 pounds, could remain at sea for as long as necessary to harvest as much red crab as possible and may harvest a significant portion of the overall TAC on each trip. This could also create an incentive for the rest of the red crab vessels to fish as hard and as fast as possible in an effort to secure as large a share of the TAC as possible.

Under this FMP, vessels will be prohibited from transferring red crab at sea. A prohibition against transfers at sea prevents vessels from transferring red crab at sea in excess of the trip limit and, thereby, circumventing the red crab trip limit restriction. This may be an important factor.

The preferred alternative will allow for a baseline possession limit for all controlled access vessels of 75,000 pounds of whole red crab (or the equivalent). Based upon public comments, the preferred option was selected that would allow vessels to operate at their best historical level. If a vessel can show proof of a trip higher than 75,000 pounds during the controlled access qualification period, then that vessel will qualify for a trip limit equal to the larger trip, rounded to the nearest 5,000 pounds. It is not always possible for a vessel to duplicate their highest level of landings, so that their average will be less then their individual trip limit. This form of differential trip limit will enable vessels to operate at their peak efficiency, in the most economical way possible, within the constraints necessary for the resource.

Placing an upper limit on landings per trip will place a limit on the amount of red crab available to be processed at any one time. This will limit the amount of red crab available to processors to a lesser quantity than processors may currently have available to them. This may also influence whether or not there was a steady supply of product. This may affect the quality of red crab available, if processors are forced to deal with supply fluctuations. All of the processors report relying on some other products in addition to red crab so that their revenue is not completely dependent on the continuous supply of red crab. On average, red crab accounts for 11.5% of their fishery-related processing operations. Most processing employees work either on other fishery-related products or at least do not work exclusively on red crab. See Appendix B for a further discussion of the processing sector.

There are no known economic impacts to fishery-dependent service industries expected as a result of a trip limit. The current suppliers of these types of services would easily handle any change in services needed. Given the small number of fishing vessels involved, it is unlikely that providing a change in services to red crab vessels would account for much of a change to any service industry's fishery-related revenue.

Trip limits may force some vessels to operate in an inefficient manner and raise their costs. Any change which has an effect on the efficiency of red crab vessels will in turn have an effect on the markets. It is unknown how great an impact this forced inefficiency may have on the markets.

There are no known economic impacts to fishing communities expected as a result of this proposed measure. Since the size of the fishery is so small, and so few vessels participate, the impact on any change in the red crab fishery is overwhelmed in the community by the influence of larger fisheries, which generate greater revenue.

5.3.8.5 Social/Cultural Impacts of the Measure

There are no data available with which to evaluate the potential impacts of this measure on the social and cultural aspects of New England and Mid-Atlantic fishing communities. The small size, few participants, and distributed nature of this fishery, however, suggests that any social or cultural impacts to these fishing communities will be negligible. Based on information provided by members of the red crab fishing industry in response to a survey collecting baseline information on the fishery, few consider the communities in which they live to be fishing communities, and fewer still consider their communities to be significantly dependent upon fishing activities (see Appendix B). The implementation of new management programs for the red crab fishery, therefore, would not be expected to significantly disrupt the social frameworks of these communities.

The use of trip limits is primarily intended to reduce the likelihood of a derby-type fishery developing in response to an established TAC, largely by limiting the amount of red crab that could be landed on a per trip basis and spreading out the effort into more fishing trips than would otherwise be necessary to harvest the TAC. Thus, implementation of this measure may mitigate some of the impacts identified for the previous measure. However, that does not mean that there may not be any social impacts potentially associated with proposed options under this measure.

Any option that significantly changes the fishing practices of a vessel participating in the directed red crab fishery could increase the level of adverse social impacts. It may be possible to establish a trip limit so low that vessels cannot break even on any fishing trips. This would increase the general levels of stress in the fishery and may force some participants out of the fishery. This level of trip limit would be expected to decrease flexibility and stability and significantly increase uncertainty. Occupational opportunities may be decreased if owners are forced to reduce their crew to accommodate the lower trip limits. Fewer crew on a vessel may have safety implications, as will any other "cost-cutting" measure adopted by the vessel owner in attempt to work within the trip limit.

Also, while trip limits set too low will increase the level of social impacts in the fishery, if the trip limits are set too high, then nothing will be achieved in the attempt to prevent a derby fishery. For example, a trip limit that allows the participants to continue to land red crabs to their vessels' capacities will not affect fishing practices and will do nothing to abate the potential "race to fish." Thus, any trip limits selected for the red crab fishery must be low enough to be effective in the prevention of a derby fishery, but not too low to cause other unintended consequences.

The option that allows vessels to choose a differential trip limit (one that matches or is close to their vessel's capacity) would mitigate the concern over unintended consequences if the trip limit is set too low, and the specific number of allocated trips per vessel would mitigate the concern over the potential for creating a derby fishery. All vessels would be able to fish at a level appropriate for their vessel and by having a specific number of fishing trips allowed each year, all incentives to race to fish are removed. This option would be expected to contribute beneficial social impacts to the participants of the fishery.

Under the differential trip limit option, flexibility of when and where to fish is retained, stability is increased as the number of annual trips is known, and uncertainty would be decreased as there is no question as to when and how quickly will the fishery be closed down if the TAC is reached. The safety and occupational concerns identified previously will be mitigated.

5.3.8.6 Impacts of the Measure on Protected Species

The proposed trip limit of 75,000 pounds does not, by itself, constrain the overall fishing effort. The overall TAC and subsequent DAS allocation system under which vessels will be operating will provide adequate control on fishing effort. Trip limits may serve to control the size of vessels that participate in the fishery, thus serving to limit the amount of gear used by each vessel. Therefore, the overall effect of the proposed measure on marine mammals and other protected species can be stated as not likely to increase the existing entanglement threat to those species.

5.3.9 Controlled Access Program

This measure proposes a variety of qualification criteria to be used to determine the vessels authorized to participate in the directed red crab fishery.

5.3.9.1 Explanation of Analysis

Background

The Magnuson-Stevens Act allows for the development of a limited (or controlled) access system for a fishery, but to do so requires the Council to take several issues into account, as follows:

> **Discretionary Provisions [16 U.S.C. 1853 § 303]:**
> Any fishery management plan which is prepared by any Council, or by the Secretary, with respect to any fishery, may --
> (6) establish a limited access system for the fishery in order to achieve optimum yield if, in developing such system, the Council and the Secretary take into account --
> (A) present participation in the fishery,
> (B) historical fishing practices in, and dependence on, the fishery,
> (C) the economics of the fishery,
> (D) the capability of fishing vessels used in the fishery to engage in other fisheries,
> (E) the cultural and social framework relevant to the fishery and any affected fishing communities, and
> (F) any other relevant considerations.

The analyses and descriptions of potential impacts that follow, primarily in the economic and social impacts sections, are intended to address each of these points

Overview

Data were available from the vessel trip report (VTR) and dealer weighout (Dealer) databases on reported landings of deep-sea red crab. Because the reporting of red crab was not required prior to the implementation of the NMFS emergency regulations, all landings data reported in this analysis should not be considered as absolute landings but only as the minimum landings. Vessels without federal permits that required landing reports or dealers not federally licensed would not be required to report their landings of red crab and may not have done so. Thus it is important to understand that the number of vessels identified below is the minimum number of vessels as other vessels not reporting may also have had similar landings.

The VTR and Dealer databases were used to identify all individual vessels with more than one pound of reported red crab landings during the years 1991 - 2001, inclusive. Where there was a discrepancy between the amount of landings in the VTR data and the amount in the Dealer data, the greater of the two was used. There were 86 individual vessels that reported some landings of red crab during this period. Of these, 47 reported less than 1,000 pounds of landings total over the eleven year period. Of the remaining vessels, 22 had total landings of more than 1,000 pounds but less than 10,000 pounds. Only one of these 22 vessels had less than 1,000 pounds of landings in each of the eleven years, but only two vessels had 5,000 pounds or more in any one year.

There were four vessels that reported between 10,000 and 100,000 pounds of landings during this period. Three of these vessels only reported landings in a single year and the fourth vessel reported landings in only two of the years. There were another six vessels with reported landings between 100,000 and 1,000,000 pounds. None of these vessels reported any landings prior to 1995. Of these, two vessels reported landings only in 2001. Seven vessels reported landings greater than 1,000,000 pounds. Of the seven, two vessels have not reported any landings since 1993. The remaining five vessels reported landings greater than 1,000,000 pounds, and have a current reporting history.

These data can be used to get an indication of how many vessels would be likely to qualify for the controlled access program depending on the criteria selected by the Council. The Council developed a wide range of potential criteria to be used to establish the red crab controlled access program.

Landings Prior to the Control Date

The first question we attempted to answer was based on the range of criteria developed by the Council to determine access to the fishery based on some minimum amount of landings during some time period prior to the control date. The specific language of this option reads as follows:

> *Control date cut-off -- This option would limit the vessels qualified to participate in the directed red crab fishery to only those vessels with a history of verifiable*

landings prior to the March 1, 2000 control date. There could be a couple options for qualification criteria under the control date cut-off. The following options are intended to represent a range of qualification criteria, some of which may be considered too restrictive and others which may be considered not restrictive enough.

a. At least 10,000 pounds of verifiable annual landings in one or more years of up to the three years prior to the control date. The intention of this option would be to differentiate vessels targeting red crabs from those landing small amounts of red crab as incidental catch in their primary fisheries.

b. At least 300,000 pounds of verifiable annual landings in one or more years of up to the three years prior to the control date. The intention of this option would be to differentiate full-time directed red crab vessels from those vessels occasionally targeting red crabs.

In this option the amounts of 10,000 and 300,000 pounds are intended to reflect a *range* of potential criteria rather than a single binary choice. The language requiring landings "in one or more of up to three years" was also intended to reflect a range such that the Council would have the flexibility to choose one year prior, two years prior, or three years prior to the control date as the timeframe. The Council would also have the flexibility to determine how landings would be compared against the timeframe, such that the Council could choose to use:

a. an *average of the landings for the time period*, if the time period selected is two or three years;

b. the *total landings for the entire time period*, be it one, two or three years;

c. the *minimum landings required in each year* of the time period, be it one, two or three years; or

d. the *minimum landings required in at least one year* of the time period, if the time period selected is two or three years.

For example, suppose that a hypothetical fishing vessel reported landings of red crabs in the amounts of 25,000 pounds, 15,000 pounds, and 65,000 pounds in each of the one, two and three years prior to the control date, respectively. If the minimum required landings weight selected was 50,000 pounds and the time period selected was the three years prior, this vessel would:

a. NOT QUALIFY using the *average* landings for the time period (which would be 35,000 pounds);

b. QUALIFY using the *total* landings for the time period (which would be 105,000 pounds);

c. NOT QUALIFY using the minimum landings in each year of the time period (they had a year with only 15,000 pounds and one with 35,000 pounds -- both less than the 50,000 pound requirement); and

d. QUALIFY using the minimum landings in at least one year of the time period (one year with 65,000 pounds -- more than the 50,000 pound requirement).

The first step in answering this question was to pare down the number of vessels to only those with one or more pounds of landings of red crab during the three year period prior to the control date. There were 29 vessels with landings during this time frame. Of those, 18 vessels had less than 1,000 pounds total and 21 had less than 10,000 pounds. Of the remaining eight vessels, different numbers of vessels could potentially qualify for the controlled access program depending on the exact nature of the criteria. Refer to Table 17 to see the minimum number of vessels that would be able to qualify under each possible set of controlled access criteria.

For example, if the minimum landings criterion was 250,000 pounds and the time period was the two years prior to the control date, starting from the upper left and working clockwise, the following numbers of vessels would be expected to qualify:

a. <u>three vessels</u> would qualify with 250,000 pounds of landings in each of the two years prior to the control date;

b. <u>four vessels</u> would qualify with an average of 250,000 pounds of landings in each of the two years prior to the control date;

c. <u>five vessels</u> would qualify with a total of 250,000 pounds of landings for the two years prior to the control date combined; and

d. <u>five vessels</u> would also qualify with 250,000 pounds of landings in at least one of the two years prior to the control date.

One thing to notice in reviewing this table is that many of the results are the same and do not change as the criteria change. For example, it makes no apparent difference whether the minimum landings criterion is anywhere between 50,000 pounds and 300,000 pounds for the year prior to the control date: four vessels would be expected to qualify. Under these circumstances, the Council considered selecting the most conservative approach (300,000 pounds) to minimize the potential for unknown vessels meeting the qualification criteria and gaining access to the fishery.

The Council's preferred alternative is to establish criteria requiring that a vessel demonstrate at least 250,000 pounds of red crab landings, on average, per year during the three years prior to the control date. Under this criterion, five fishing vessels would be expected to qualify for the red crab controlled access program.

Minimum Criteria	1 Year Prior		2 Years Prior		3 Years Prior	
10,000 pounds	5	5	4	6	4	8
	5	5	6	6	8	8
20,000 pounds	5	5	4	6	4	7
	5	5	6	6	8	8
30,000 pounds	5	5	4	5	4	7
	5	5	6	6	8	8
40,000 pounds	5	5	4	5	4	5
	5	5	6	6	8	8
50,000 pounds	4	4	4	5	4	5
	4	4	5	5	7	8
100,000 pounds	4	4	4	5	4	5
	4	4	5	5	6	6
150,000 pounds	4	4	4	5	4	5
	4	4	5	5	5	5
200,000 pounds	4	4	3	4	3	5
	4	4	5	5	5	5
250,000 pounds	4	4	3	4	3	5
	4	4	5	5	5	5
300,000 pounds	4	4	3	4	3	4
	4	4	5	5	5	5

Each cell represents the minimum number of vessels that would be expected to qualify for the controlled access program under the specific set of criteria defined by the minimum reported landings over some number of years prior to the Control Date. The four cells for each combination of time and landings represent:

# of vessels with at least the minimum weight in each of the years prior to the control date	# of vessels with at least the minimum weight on average in the years prior to the control date
# of vessels with at least the minimum weight in at least one of the years prior to the control date	# of vessels with at least the minimum weight total for the years prior to the control date

Table 17: Numbers of qualifying vessels (option 1). This table reports the minimum number of fishing vessels that would be expected to qualify for a red crab controlled access program based on the range of options developed by the Council for the period prior to the control date. The numbers reported are based on an analysis of both VTR and dealer weighout data from 1997-2000.

Landings After the Control Date

The second question we attempted to answer was based on the range of criteria developed by the Red Crab Committee to determine access to the fishery based on some minimum amount of landings during the one year immediately following the control date. The specific language of this option reads as follows:

> *This option would limit the vessels qualified to participate in the directed red crab fishery to only those vessels with a verifiable history of some minimum amount of landings in the one year subsequent to the control date (March 1, 2000 - February 28, 2001). The qualification criteria for this option could be the same range as the control date cut-off option.*
>
> *a.* *At least 10,000 pounds of verifiable landings.*
>
> *b.* *At least 300,000 pounds of verifiable landings.*

Minimum Criteria	1 Year After
10,000 pounds	7
20,000 pounds	7
30,000 pounds	7
40,000 pounds	7
50,000 pounds	7
100,000 pounds	6
150,000 pounds	6
200,000 pounds	5
250,000 pounds	5
300,000 pounds	4

Table 18: Numbers of qualifying vessels (option 2). This table reports the minimum number of fishing vessels that would be expected to qualify for a red crab controlled access program based on the range of options developed by the Council for the year subsequent to the control date. The numbers reported are based on an analysis of both VTR and dealer weighout data from 2000-2001.

As before the amounts of 10,000 and 300,000 pounds are intended to reflect a range of potential criteria rather than a single binary choice. The nature of this option does, however, limit the consideration of landings to only the one year period. The first step in answering this question was to determine the number of vessels with at least one pound of red crab landings during the qualification period. There were fourteen vessels with landings during this time frame. Of these fourteen vessels, four had less than 1,000 pounds of red crab landings and seven had less than 10,000 pounds. Of the remaining seven vessels, different numbers of vessels could potentially qualify for the controlled access program depending on the specific criteria selected. Refer to Table 18 to see the minimum number of vessels that would be expected to be able to qualify under each of the controlled access criteria for the one year following the control date.

Although potentially less restrictive than the options for the criteria for landings prior to the control date, this option is at least more straight forward. Only one year's worth of landings would be considered, so there are no contingencies for a multi-year average or looking at the maximum or minimum landings during a multi-year time period. Depending on the minimum landings weight criterion selected, between four and seven vessels would be expected to qualify. As noted above, these numbers represent the *minimum* numbers of vessels only, as additional vessels may be able to present information on landings not currently reflected in the NMFS VTR and/or dealer weighout databases. Again, as noted above, the Council considered adopting the most restrictive criterion that provides the same number of vessels (e.g., 250,000 pounds instead of 200,000 pounds -- both of which would allow at least five vessels to qualify).

5.3.9.2 Biological and Ecological Impacts of the Measure on Red Crab

The direct biological and ecological impacts on the red crab resource expected as a result of this potential measure are limited to the potential affects associated with the number of vessels prosecuting the directed fishery. This measure is solely concerned with the number of vessels qualified to participate in the directed red crab fishery. From biological and ecological perspectives, the number of vessels prosecuting the fishery may be irrelevant. Other measures, such as those that control overall landings, would be expected to more directly affect the resource. For example, if the controlled access program had been devised to allow 17 vessels access to the directed fishery, but each vessel is limited to an annual harvest of 320,000 pounds, then the total harvest would be less than 5.5 million pounds. If, on the other hand, the controlled access program was devised to limit the fishery to four vessels, but those vessels have no TAC or trip limit or other effort control, and each of the four vessels makes 30 trips at an average of 65,000 pounds per trip, then the fleet would be expected to harvest 7.8 million pounds.

However, there may be indirect impacts associated with this measure related to the timing of the harvest activity. Mating and reproduction could be affected by the number of vessels participating in the fishery if their fishing effort is condensed in time. For example, the more vessels participating in the fishery, the more likely that a majority of the overall target yield will be harvested early in the fishing year (this would be exacerbated under any conditions which fail to prevent derby-type fishing, such as a hard TAC alone). If the fishery is constrained to landing only large male red crabs, the removal of a significant portion of this segment of the population during a short time could have repercussions for the whole population. Under a scenario of a large fleet operating under a hard TAC, most of the large males could be removed from the population *before* they have had a chance to mate that year. Thus, the reproductive cycle for that year would be wholly dependent upon small males, who may be less successful.

5.3.9.3 Ecological Impacts of the Measure on Other Species and Communities

Very little is known about the interactions of the deep-sea red crab with other species and their associated communities. The directed red crab fishery has no known interactions with other species or their associated communities, as the bycatch of other species in the red crab fishery is minimal. The impacts of this fishery on other species or their communities are expected to be minimal to non-existent. This proposed measure would not affect this conclusion.

If new information becomes available that suggests this conclusion may be incorrect, the Council will review the information and consider whether or not additional action may be necessary. Future assessments of this type will consider all new information regarding the interactions of the red crab fishery with other species and their communities and consider mitigation, if necessary, at the appropriate time.

5.3.9.4 Impacts of the Measure to Essential Fish Habitat

Overall, this fishery is not considered to contribute any adverse impacts to the habitat of the region and this measure does nothing to alter this conclusion. This measure will be used to determine the number and which fishing vessels qualify to participate in the controlled access directed red crab fishery. Limiting the number of vessels participating in the fishery does have an impact on the level of fishing effort, but since the fishing activities associated with this fishery do not have any known adverse impacts to the EFH of any managed species, constraining overall fishing effort, as represented by the number of participating vessels, does not decrease or increase any impacts to habitat.

5.3.9.5 Economic Impacts of the Measure on the Fishery

A controlled access program limits the participation of vessels in the fishery; it does not directly limit the catch of fish. Limited access alone is not sufficient to provide the incentives for proper management of the red crab stock. The controlled access system establishes qualification criteria based on history in the red crab fishery. The intent of this system is to ensure that participation in the red crab fishery is maintained at sustainable levels.

As an alternative to a straight in-or-out access program (where vessels either get total access or no access to the directed fishery), the Council considered adopting a program of differentiated access for vessels to qualify for different levels of participation based on their history in the fishery. The Council would develop categories (e.g., occasional, part-time, and full-time, or seasonal access to the directed fishery as well as full-time access) and allow vessels different levels of participation according to the category qualification criteria. Many options could be used to either establish the criteria just for access to the fishery (without categories) or to determine in which category each qualified vessel would fit.

This measure was written with a high degree of flexibility and a wide range of potential criteria to establish a controlled access program. The factors to be decided included whether or not to use the control date established, the time period prior to or after the control date, the amount of qualifying landings, as well as how landings would be compared against the time frame. Refer to Table 17 to see the minimum number of vessels that would qualify under each set of controlled access criteria, if using landings prior to the control date of March 1, 2000. Refer to Table 18 to see the minimum number of vessels that would qualify under each set of controlled access criteria, if using landings for one year subsequent to the control date (March 1, 2000 - February 28, 2001). In reviewing Table 17 and Table 18, it can be seen that many of the possible options have an overlapping number of vessels that would qualify. The number of qualifying vessels range from three (most restrictive) to eight (least restrictive). These numbers, again, represent the minimum number of vessels only, as additional vessels may be able to prove participation in the fishery according to the established criteria.

The preferred alternative includes a controlled access program where vessels must demonstrate that their average annual landings of red crabs during the three years prior to the control date (March 1, 1997 – February 29, 2000) were greater than 250,000 pounds. This option would allow for five vessels to participate in the directed fishery (see Table 17). During that three year period, eight out of 30 vessels could have qualified under less restrictive criteria. This means that there are three vessels that are not expected to qualify for the controlled access program that would have qualified had other criteria been preferred. For example, if the criteria, using that same three years prior to the control date, had been that vessels must have a total of at least 40,000 pounds for the three years, eight vessels would have qualified. Clearly, a total of 40,000 pounds for three years is a significantly different criterion than an average of 250,000 pounds over three years. More attention will be given to a description of these vessels and what was done to mitigate the impact on them.

The preferred alternative implements the March 1, 2000 control date. Without the control date, additional vessels may have qualified under different criteria. As an indication of interest in the fishery, 17 vessels requested letters of authorization (LOAs) from the NMFS Regional Administrator to allow them to harvest more than 100 pounds of red crab per trip during the first emergency rule period, May 18 - November 14, 2001. However, out of seven vessels that landed red crab, only six made multiple trips during the emergency period and consistently landed at or near the trip limit. The 17 vessels that requested LOAs could be taken as an upper limit when calculating those vessels that did not qualify for controlled access. This would imply a potential of 12 vessels that will not qualify had other criteria been selected (such as under the no action alternative).

Using the control date as a mechanism to establish history in the fishery requires the development of qualification criteria that are fair and equitable, the development of a mechanism to demonstrate that these criteria are met, and the establishment of an appeal and resolution process for those vessels denied access to the fishery.

This measure is solely concerned with the number of vessels qualified to participate in the directed red crab fishery. If this were the only measure included in the plan, it would not limit the total harvest enough to protect the resource for the future. The intention of this option would be to differentiate full-time directed red crab vessels from those vessels occasionally targeting red crabs.

One option of controlled access would give those vessels currently and actively fishing for red crab access to the directed red crab fishery under the FMP. New vessels not currently in the fishery would not necessarily be given access to the fishery unless there was capacity remaining. The difficulty with this option will be to define "currently." One method for determining the number of vessels in the fishery is to use the number of vessels that requested LOAs from the Regional Administrator during implementation of the red crab emergency regulations. Alternatively, the six vessels that made multiple trips under the first emergency action period may be thought to be those currently and actively fishing. This would imply that the preferred alternative would omit only one vessel from the directed fishery. From the public comments, there is clearly at least one vessel on record that would be eliminated from the future fishery.

A vessel size restriction was considered to establish an upper limit on the size of vessels that may participate in the directed red crab fishery. The size restriction could be based solely on registered length (e.g., a maximum of 120 feet), on hold capacity (e.g., a maximum of 100,000 pounds) or on some combination of vessel specifications. The hold capacity of a vessel would be the determining factor in how many pounds of red crab it could land before returning to port. Vessel lengths vary from 72 feet to 150 feet with an average of 105 feet. The hold capacity varies from 60,000 pounds to 320,000 with a mean of 122,000 pounds.

The most significant factor contributing to the immediate threat of overfishing the red crab resource derives from the addition of several new vessels into this fishery in late 2000 and early 2001. The capacity of the additional vessels, in combination with the capacity of the existing vessels, likely exceeds the capacity needed to harvest this resource at sustainable levels. One potential argument is that controlled access will discriminate against potential new entrants. In reality, their only loss is the opportunity to share capital gains accruing to those that were grand-fathered (or allowed in because of the control date) into the fishery.

Depending on the degree of controlled access allowed in the FMP, it is possible some processors may be affected. If a vessel were not allowed into the fishery under the FMP, then the processor(s) that had purchased product from that vessel would no longer be able to buy that product, unless they bought product from another vessel. All processors remain free to purchase from another source under all of the alternatives considered for the FMP. The loyalty between vessels and processors may make that somewhat difficult although still possible. Respondents to the survey indicate that most vessels use only a single processor, although one respondent did report occasionally using a second. Most respondents indicated that they choose to sell their red crab to a particular processor in large part out of loyalty to that processor. If a processing plant were to lose business because of a vessel's absence in the fishery, their profits would suffer. However, all of the processors report relying on some other products in addition to red crab. On average, red crab accounts for 11.5% of their fishery-related processing operations. Most processing employees work either on other fishery-related products or at least do not work exclusively on red crab. See Appendix B for a further discussion of the processing sector.

There are no measurable economic impacts to fishery-dependent service industries expected as a result of controlled access. If a current vessel is prohibited from entering the fishery, the supplier of services to that vessel would be impacted. It is unknown to what extent, because we do not know to how many vessels the suppliers sell. The current suppliers of these types of services presumably would not experience any change in their service level when selling to vessels qualified under the controlled access program.

There are no known economic impacts to fishing communities expected as a result of this proposed measure. Since the size of the fishery is so small, and so few vessels participate, the impact of any change in the number of vessels in the red crab fishery is overwhelmed in the community by the influence of larger fisheries, which generate greater revenue.

5.3.9.6 Social/Cultural Impacts of the Measure

The specific issues identified in the Magnuson-Stevens Act for consideration when developing any form of limited or controlled access relevant to an assessment of potential social and/or cultural impacts include: the cultural and social framework of the fishery and the fishing communities; the present and historical participation in and dependence on the fishery; and the capability of vessels in the fishery to engage in other fisheries.

There are no data available with which to evaluate the potential impacts of this measure on the social and cultural aspects of New England and Mid-Atlantic fishing communities. The small size, few participants, and distributed nature of this fishery, however, suggests that any social or cultural impacts to these fishing communities will be negligible. Based on information provided by members of the red crab fishing industry in response to a survey collecting baseline information on the fishery, few consider the communities in which they live to be fishing communities, and fewer still consider their communities to be significantly dependent upon fishing activities (see Appendix B). The implementation of new management programs for the red crab fishery, therefore, would not be expected to significantly disrupt the social or cultural frameworks of these communities.

As discussed elsewhere in the this FMP (see the Background and Purpose section for an overview), the historical and present participation in this fishery are markedly different. The present participation can probably best be characterized by the levels of participation during the emergency rule period, May 18 - November 14, 2001. Seventeen vessel requested letters of authorization (LOAs) from the NMFS Regional Administrator, allowing these vessels the ability to harvest and retain more than 100 pounds of red crab per trip. This number of vessels could be considered as representative of the current level of interest in the fishery. Another approach to defining the present participation in the fishery is to identify the number of vessels that participated in the emergency rule fishery at a level consistent with a directed fishery. There were six vessels that made multiple trips during the emergency period and consistently landed at or near the trip limit.

Historically, fewer vessels have been involved in the fishery at significant levels. As indicated in the above analysis, there were only five vessels that averaged more than

250,000 pounds per year in the three years prior to the control date, and only two vessels that had at least 300,000 pounds in each of the three years prior to the control date. At least two of the vessels that participated in the emergency period red crab fishery at directed fishery levels had not participated in the fishery prior to 2001.

The social impacts associated with participation levels derive from a vessel's ability (and the people associated with and dependent upon that vessel) to continue to participate in the fishery, or to find other suitable alternatives that are not disruptive to their social networks. In the case of the directed red crab fishery, implementation of a controlled access program is likely to primarily affect the vessels that entered the fishery in 2001. The qualification criteria proposed by the Council (see Table 17) would allow at least five vessels to continue to participate.

The two recent entrants, and other vessels that have not participated in the directed fishery at significant levels, may not be authorized to participate in the directed fishery following implementation of this FMP. However, the impacts to these vessels are expected to be much less significant than they would be on the vessels that have participated in this fishery at significant levels for longer periods of time. The two new entrants had been participating in other fisheries in other parts of the country prior to entering the red crab fishery in 2001. They entered the red crab fishery after the publication of the control date and the notice that the Council would be considering a limited entry program and would consider landings after the control date differently from landings prior to the control date; thus, they entered this fishery fully aware that they may not be allowed to continue to participate once an FMP was developed.

The vessels that have not traditionally participated in the red crab fishery at directed levels appear to either be part-time fishing vessels or they have other primary fisheries. These vessels may be prohibited from participating in the red crab fishery at directed levels, but they will be allowed to continue to land red crab at the level of the incidental catch limit. For some of these vessels, this will result in no change to their current fishing practices, but others may be required to cut back on some amount of their landings. Please see the analysis under the proposed incidental catch limit measure (Section 5.3.1.5) for a full description of the potential social impacts of this action.

Once the vessels authorized to participate in the directed red crab fishery are known, this should improve the stability felt by the fishermen associated with these vessels and their families. Similarly, the uncertainty should decrease as these fishermen will know that they can continue to participate in the directed fishery. The flexibility of these vessels will remain unchanged. For the vessels who would otherwise wish to participate in the directed fishery, but will not qualify under the selected options, the stability and flexibility would be expected to decrease and uncertainties would increase. These variables would reflect increased levels of social impacts to these fishermen.

One issue to note is that there is general support for a controlled access program in the directed fishery, so this measure should be well-supported by the industry. Of course, those vessels that may be excluded from the fishery will most likely no longer support the measure. It must also be recognized that the Council announced its intent to consider a controlled access program early in 2000, with the publication of a control date to differentiate new entrants in the fishery from established ones. Anyone entering the fishery after this control date should have recognized the possibility that they would not be allowed to participate in the directed fishery once an FMP was implemented. This knowledge may not eliminate potential social impacts to the fishermen associated with these vessels, but it should have prepared them to appropriately mitigate the impacts.

This proposed measure is not expected to have any effect on the occupational opportunities of any participants of the directed fishery, except as identified above. The proposed measure is not expected to have any effects on community infrastructure, or the safety of any fishery participants.

5.3.9.7 Impacts of the Measure on Protected Species

Controlling participation in the fishery to sustainable levels would be expected to have a direct beneficial effect on marine mammals and other protected species. The proposed criteria for past participation in the red crab fishery to qualify for a controlled access permit under the Red Crab FMP will restrict the fishery to a level of vessel participation that can be expected to maintain effort at historic levels. Therefore, the proposed measure is not likely to increase the existing entanglement threat to protected species.

5.3.10 Days-at-Sea Limits

Overview

This measure establishes a days-at-sea (DAS) program for the controlled access directed red crab fishery, constraining vessels participating in the directed fishery from fishing for red crab to the allocated number of annual DAS. The DAS program will serve as the principle fishing effort control mechanism by limiting the amount of time (i.e., the number of days) that an authorized red crab fishing vessel may spend at sea each year in the directed harvest of red crabs. All time away from port would be counted against each vessel's annual DAS allocation, so steaming time is included and counted as a day-at-sea.

Calculation of DAS

There were several steps necessary to develop and analyze this potential measure. One of the first steps was to determine how many total days the fleet should be allocated. This amount will later be distributed among the authorized fishing vessels in a manner that will determine the per vessel DAS allocation. The total fleet DAS should be calculated to reflect the total amount of fishing effort that would equate to an annual harvest equal to the target yield.

In order to determine how many DAS the entire fleet should be allocated, the approximate "value" of each average fishing day should be calculated. This should be based on records of actual landings on trips of known duration. If there are enough records of landings and trip lengths for the vessels in the fleet, a relatively robust fleet average can be calculated.

Using data collected by NMFS during the emergency period, we should be able to calculate an average catch per day that can be attributed to the fleet overall. Dividing the target annual yield by this average catch per day results in the total number of DAS that should be available to the fleet. Out of a total of 52 trips made during the emergency period (as reported in the IVR database), only 22 were represented in the VTR database as of the time this document was prepared. Table 19 provides a summary of the trip landings, length, and landings per day of trip from the red crab emergency period for these 22 trips (the VTR data are required for this analysis in order to calculate trip length).

Emergency Period Landings (n = 22, as of 1/03/02)	
Average landings per trip	53,271 pounds
Average length of trip	8.14 days
Median landings per day of trip	6,671 pounds
Mean landings per day of trip	6,798 pounds
95% CI minimum	6,001 pounds
95% CI maximum	7,594 pounds
20%Trimmed Mean landings per day	6,782 pounds
Mean of vessels per day of trip	6,488 pounds

Table 19: Analysis of vessel trip report data from red crab emergency period, May 18 - November 14, 2001 (data available as of 1/03/02).

This suggests that each day that a red crab fishing vessel is at sea (including steaming time) they can catch an average of approximately 6,800 pounds of marketable red crabs, or at least that the range is between approximately 6,000 pounds and 7,600 pounds of landings per day. Of course, this information is fairly limiting due to the small sample size. As more data from this fishery become available, these figures can be recalculated with larger sample sizes.

When more data are available in the VTR database (or at least a more significant percentage), there are several variations of this analysis that can be done. First we can compare the catch per day of the larger vessels compared to the smaller vessels. We can also compare the catch per day of the vessels that process or butcher compared to the vessels that land whole crabs. Differences in productivity can be identified for individual vessels, size category of vessel, and product category of vessels.

Once the Council decided on a target yield, these amounts were compared to the best estimates of landings per day to determine the fleet annual DAS. For example, if we assume that the range of MSY estimates provided in Table 8 represents the extremes of the target yield for the fishery, we can calculate an estimated fleet DAS for each endpoint of this range. Then, for each controlled access scenario used in the FMP analysis, we can specify how many DAS each vessel would be allocated, assuming equal allocation of days.

Target Yield = OY (OY = 95% of MSY)			
Estimates of OY (in pounds)	1.254 million	5.928 million	7.904 million
Total Fleet Annual DAS	188	888	1,185
Per Vessel DAS with 4 Vessels	47	222	296
Per Vessel DAS with 5 Vessels	38	178	237
Per Vessel DAS with 6 Vessels	31	148	197
Per Vessel DAS with 17 Vessels	11	52	70

Table 20: Speculative number of potential DAS to be allocated to red crab fishing vessels, based on preliminary analysis and using the median landings per day-at-sea.

This suggests that under this scenario (target yield = OY), if there are five vessels authorized to fish for red crab in the directed fishery, each vessel would be allocated between 38 and 237 DAS for the year; assuming the MSY calculated for the red crab resource (6.24 million pounds, such that OY=5.928 million pounds), each of the five vessels would be allocated 178 DAS. All vessels would be required to notify NMFS when they embark on a fishing trip and when they return. They would also be required to report all landings to NMFS. Once they have used their allocation of DAS, they would not be allowed to fish for or possess more than the incidental catch level of red crab. At the end of each year, the total landings would be calculated and compared against the target yield. If the target yield was exceeded, each vessel would be allocated fewer DAS the following year. If the landings were less than the target yield, each vessel could be allocated additional DAS for the following year.

Once we have additional data on which to base these analyses, including an analysis of productivity by categories of vessels, we should have enough information to determine the appropriate number of DAS to be allocated to the fleet. Depending on the outcome of these additional analyses, it may be appropriate to allocate different numbers of DAS to different categories of vessels.

In the first year of FMP implementation (through February 28, 2003), each vessel authorized to participate in the controlled access directed fishery will be allocated a percentage of 130 DAS. 130 DAS is the baseline allocation for all vessels in the first year of FMP implementation, but this baseline will be adjusted to account for estimated landings that occur between May 15, 2002 and the date the red crab controlled access program is implemented. For the first full fishing year, March 1, 2003 - February 29, 2004, each vessel authorized to participate in the controlled access directed fishery will be allocated 156 DAS, unless this allocation is changed under the FMP specification process. The target TAC for the first full fishing year will be 5,928,000 pounds of whole red crab or their equivalent. The target TAC of 5,928,000 pounds and an allocation of 156 DAS per controlled access vessel will remain the baseline until these amounts are modified through the specification process.

Allocated DAS in Year 1

The first year the Red Crab FMP is implemented (the time between when the FMP is implemented after the final rule is published in the *Federal Register* and when the next fishing year begins on March 1, 2003) presents a unique situation related to the specification of a target TAC and the allocation of DAS to all vessels who receive a controlled access red crab permit. Rather than determine the total fleet DAS available based on the target TAC and an estimated average per DAS landing efficiency, a baseline of 130 DAS per vessel will be used in the first year of implementation. The calculation of 130 DAS per vessel is based on a conservative estimate of per day landing efficiency and an assumption that six vessels may qualify for the controlled access fishery.

The Regional Administrator will estimate the amount of landings from any hiatus period based upon the best available data and projections. The Regional Administrator will also calculate the amount of red crab landed (based on reporting requirements) during the initial implementation period of the FMP before the controlled access program and DAS are implemented. These two landings totals should be combined and deducted from the target TAC of 5.928 million pounds. The result will represent the amount of the target TAC available for the remainder of the first fishing year, to be fished under the DAS program. The Regional Administrator will calculate the percentage of the target TAC that remains available to the fishery. Vessels that qualify to fish for red crab under the controlled access/DAS program will be allocated this percentage of the initial baseline of DAS (i.e., a percentage of 130 DAS).

For example, if there is a two week hiatus period between the expiration of the emergency regulations and the implementation of the FMP, we may be able to estimate that 580,000 pounds of red crab would be landed in that time period (this is based on the landings from the first four weeks of the second emergency period, when 290,000 pounds were landed per week, on average). If there is a one-month delay between the initial implementation of the FMP and the implementation of the DAS program, we may record additional landings on the order of 1.16 million pounds (based on an extension of the above estimate). This would result in a total landings estimate of 1.740 million pounds prior to the implementation of the DAS program. This amount would be deducted from the 5.928 million pound target TAC to determine that there are approximately 4.187 million pounds of the TAC remaining for the fishery. This is 70.6% of the original TAC, so each vessel would be allocated 70.6% of the initial DAS baseline for the remainder of the fishing year, or $70.6\% \times 130 = 91.8 \approx 92$ DAS. While this may seem a low allocation, in this example this would be for the period from July 1, 2002 - February 28, 2003. This period of time represents 242 days, or 66.3% of the year. Extrapolating out from this amount, an allocation of 92 DAS for the partial year is equivalent to an allocation of 139 DAS for a full fishing year, just over what was determined to be a reasonable baseline in the above steps. It should also be remembered and taken into account that the red crab vessels allocated DAS as described above will have been able to fish during the time between when the emergency regulations expire (May 15, 2002) and when the controlled access/DAS program is implemented.

5.3.10.1 Biological and Ecological Impacts of the Measure on Red Crab

A days-at-sea allocation alone is unlikely to have any direct effects on the red crab resource. The options proposed in this measure constrain the fishing power of individual vessels to a certain number of fishing days per year, but do not necessarily constrain the fishing power of the entire fleet, which will be dependent upon the specifics of the controlled access program and the number of vessels authorized to participate in the directed fishery.

For example, assuming an average landings of 6,500 per day at sea, if there are 10 vessels each authorized 200 DAS per year, the fleet would be expected to harvest on the order of 13 million pounds of red crab. If, however, five vessels are each authorized 170 DAS per year, this fleet would be expected to harvest on the order of 5.5 million pounds. The DAS program is intended to be based on the overall yield expected from the resource (see the discussion under the TAC measure) and the number of vessels authorized to participate in the directed fishery (see the discussion under the controlled access measure), assuming some average landings per DAS.

5.3.10.2 Ecological Impacts of the Measure on Other Species and Communities

Very little is known about the interactions of the deep-sea red crab with other species and their associated communities. The directed red crab fishery has no known interactions with other species or their associated communities, as the bycatch of other species in the red crab fishery is minimal. The impacts of this fishery on other species or their communities are expected to be minimal to non-existent. This proposed measure would not affect this conclusion.

If new information becomes available that suggests this conclusion may be incorrect, the Council will review the information and consider whether or not additional action may be necessary. Future assessments of this type will consider all new information regarding the interactions of the red crab fishery with other species and their communities and consider mitigation, if necessary, at the appropriate time.

5.3.10.3 Impacts of the Measure to Essential Fish Habitat

This measure, which proposes to allocate a certain number of days during which a red crab vessel may fish for red crab, would have no direct effect on the level of fishing effort in the directed red crab fishery. The acceptable level of fishing effort will be determined by the establishment of an allowable level of catch. The DAS options simply provide a mechanism to allocate the allowable fishing effort amongst the participating fishing vessels. In addition, overall this fishery is not considered to contribute any adverse impacts to the habitat of the region and this measure does nothing to alter this conclusion.

5.3.10.4 Economic Impacts of the Measure on the Fishery

A decrease in effort always results in a short-term decrease in catch rate, but importantly, may lead to an increase in the long term. In standard yield-effort relationships, the short-term catch rate will always increase with increasing levels of effort. It is only over the long term, when the process of population dynamics has resulted in decreased fish stock, that yield will ultimately decline. The use of days-at-sea as a management option would allow more continuity of effort and supplies to the market, and avoids any response to short term fluctuations.

Days-at-sea (DAS) limits as a sole measure may be effective if the days are allocated to individual vessels and not to the fleet. Also, the initial allocation of DAS must be significantly low to allow for recovery of the stock. DAS limits for the directed red crab fishery would be used in conjunction with a target TAC to prevent a derby fishery. The days-at-sea program will be adjusted annually depending on how the fishery is doing against the annual TAC. The initial total DAS available to the fishery will depend upon many factors, including the initial TAC, the number of vessels, and other effort controls implemented through the FMP, such as trap limits and/or trip limits. One of the benefits to the fishermen of the DAS program is that they have greater flexibility in decisions about when and how long to fish. This would help them to operate each trip as efficiently as possible, and to space their landings optimally to take advantage of market conditions.

The DAS measure is written with a high degree of flexibility and a wide range of potential criteria to allocate DAS. The potential flexibility would allow a choice between equal allocation of DAS without regard to the vessel's history in the fishery or past landings, allocation of DAS on a sliding scale based on the history of the vessel in the fishery, or allocation of DAS on a sliding scale based on landings of red crab reported over a specified time period. Vessels with higher landings could be allocated proportionally more DAS than vessels with lower landings. There may be various degrees of end-of-year carry-over of unused DAS or none at all allowed.

The preferred alternative selected by the Council would allocate DAS equally to all vessels authorized to participate in the controlled access fishery. All vessels authorized to receive a controlled access red crab permit must, on an annual basis, declare their intent to participate or not in the directed fishery for the next fishing year at least six months prior to the start of the fishing year. This will allow the annual allocation of DAS to be calculated based on the actual number of participants in the fishery. The small number of vessels in the fishery means that each vessel's participation has a large impact on the appropriate number of DAS that the fleet will utilize in catching the target TAC. The advance knowledge and planning for efficient harvest will have economic benefits from harvesting to processing to marketing. Public comments supported this declaration of intent.

Depending on the total number of days at sea allocated, and the manner in which they are allocated in the FMP, it is possible some processors may be affected. If the DAS allocated per vessel is significantly less than the vessel's usual pattern (which appears likely, as would be the case under the preferred alternative), the short term supply to their processor(s) may be affected. However, since a DAS program promotes a twelve month fishery, the processors supply should be steady, if limited. If a vessel were not allowed into the fishery under the FMP, then the processor(s) that that vessel has sold to would no longer have that product available for purchase. Respondents to the survey indicate that most vessels use only a single processor, although one respondent did report occasionally using a second. However, all of the processors report relying on some other products in addition to red crab. On average, red crab accounts for 11.5% of their fishery-related processing operations. Most processing employees work either on other fishery-related products or at least do not work exclusively on red crab. See Appendix B for a further discussion of the processing sector.

There may be minimal economic impacts to fishery-dependent service industries expected as a result of a days at sea measure. If a vessel were not allowed into the fishery under the FMP, then the service industries that provided that vessel with services, would no longer be getting the same business from that vessel. It is impossible to speculate on what that vessel may do under those circumstances, and whether or not he would still need those same service industries.

There are no known economic impacts to fishing communities expected as a result of this proposed measure. Since the size of the fishery is so small, and so few vessels participate, the impact on any change in the red crab fishery is overwhelmed in the community by the influence of larger fisheries, which generate greater revenue.

5.3.10.5 Social/Cultural Impacts of the Measure

There are no data available with which to evaluate the potential impacts of this measure on the social and cultural aspects of New England and Mid-Atlantic fishing communities. The small size, few participants, and distributed nature of this fishery, however, suggests that any social or cultural impacts to these fishing communities will be negligible. Based on information provided by members of the red crab fishing industry in response to a survey collecting baseline information on the fishery, few consider the communities in which they live to be fishing communities, and fewer still consider their communities to be significantly dependent upon fishing activities (see Appendix B). The implementation of new management programs for the red crab fishery, therefore, would not be expected to significantly disrupt the social frameworks of these communities.

The DAS measure is proposed primarily as a way to control the overall amount of fishing effort (as in the TAC options), but with a much higher level of certainty and flexibility afforded the individual fishermen. The DAS measure will be paired with a target TAC, as opposed to a hard TAC where the fishery is closed upon the TAC being reached. The target TAC will be used to measure how closely the allocated number of DAS matches the anticipated overall catch level. Total landings may vary, but should vary around a mean very close to the target yield for the fishery.

The increased flexibility to the fishermen results from the ability of the fishermen to choose when and for how long to fish, depending on weather, market considerations, availability of crew, etc. The fishermen will be allocated a certain number of DAS, which they can use at any time during the fishing year. Increases in stability would be expected as the fishermen can plan their use of their DAS, and they will know exactly how many days they can fish each year. Both of these factors will reduce the uncertainty normally felt by fishermen unsure of when the fishery may close due to harvest levels.

There would be no reason to anticipate any derby-type fishing occurring, as there is no incentive to "race to fish." Occupational opportunities would not be expected to change as a result of this measure, and may, in fact be improved from those associated with the simple hard TAC measure. Any reduction in occupational opportunities would result from an overall reduction in target yield from current landings levels, but this cannot be linked to this measure, which is proposed as a mechanism to match fishing effort with the available yield.

The proposed measure is not expected to have any effects on community infrastructure, or the safety of any fishery participants. There appears to be general support for this type of measure among the participants in the directed fishery, although most are somewhat hesitant until they known the actual number of DAS they are likely to be allocated.

5.3.10.6 Impacts of the Measure on Protected Species

Days-at-sea limits will not by themselves reduce red crab fixed gear effort. However, the proposed TAC level described above will cut the total landings back to 1999 levels. This represents a 25% reduction in landings (and presumably overall fishing effort) from 2001 levels. DAS limits set between 130 and 160 will allow the small number of vessels that will qualify for controlled access permits to fish for most of the fishing season. The proposed measure is not likely to increase the existing entanglement threat to protected species.

5.3.11 Individual Vessel Quotas

This non-preferred measure proposed managing the directed red crab fishery by allocating a portion of the overall available quota to each vessel authorized to participate in the directed red crab fishery. Although this measure cannot currently be adopted by the Council due to a Congressional moratorium against all new individual fishing quota programs, it is presented here for the sake of comparison.

5.3.11.1 Biological and Ecological Impacts of the Measure on Red Crab

The potential biological and ecological impacts of this proposed measure are exactly the same as in the measure proposing an overall TAC for the fishery. The principal difference between these two measures is that this measure proposed to allocate a specific amount or percentage of the overall TAC to each vessels participating in the directed red crab fishery, whereas the TAC measure simply dictated what the overall yield for the fishery should be. As long as the vessel quotas are adhered to and the overall quota is set appropriately, the risk to the resource of overfishing will be minimized. As in the TAC measure, the risk to the resource increases as the amount of the overall quota increases. The risk to the resource also increases if all the vessels harvest more than their allotted share of the quota and the overall quota is exceeded.

5.3.11.2 Ecological Impacts of the Measure on Other Species and Communities

Very little is known about the interactions of the deep-sea red crab with other species and their associated communities. The directed red crab fishery has no known interactions with other species or their associated communities, as the bycatch of other species in the red crab fishery is minimal. The impacts of this fishery on other species or their communities are expected to be minimal to non-existent. This proposed measure would not affect this conclusion.

If new information becomes available that suggests this conclusion may be incorrect, the Council will review the information and consider whether or not additional action may be necessary. Future assessments of this type will consider all new information regarding the interactions of the red crab fishery with other species and their communities and consider mitigation, if necessary, at the appropriate time.

5.3.11.3 Impacts of the Measure to Essential Fish Habitat

This measure, which simply proposes to allocate portions of the overall allowable catch of red crabs to particular participants in the directed red crab fishery, would have no effect on the habitat of the region. This measure would not change the overall level of fishing effort, nor would it affect the distribution of fishing effort. In addition, overall this fishery is not considered to contribute any adverse impacts to the habitat of the region and this measure does nothing to alter this conclusion.

5.3.11.4 Economic Impacts of the Measure on the Fishery

Assuming that the current moratorium is lifted at some point in the future, an IVQ system should be considered.

In addition to granting the right to be in the fishery, individual quotas also convey the right to harvest a specified quantity to fish (or proportion of TAC). Since it works back from a predetermined TAC to the amount available to the individual vessel, it provides much tighter control over each year's catch than would control of inputs (such as DAS or trip limits). They would also allow a greater degree of freedom to the individual fisherman. His choice of area or fishing time would be his own. There is no incentive to over invest in the vessel and gear, or to select anything but the least cost combination of inputs. An IVQ system could be developed that would assign an annual quota to each vessel qualified to fish in the directed red crab fishery based on their annual landings during some qualification time period (for instance the year prior to the control date). Thus, if a vessel landed 100,000 pounds of red crab in the year prior to the control date, they would be allocated an annual quota of 100,000 pounds or else a percentage based on their vessel history. Depending on the number of vessels granted the right to be in the fishery, this program may allow vessels to continue to fish at previous levels but perhaps not to expand their effort in the fishery.

A variation of this measure would be to first qualify the vessels that may participate in the directed fishery (via a controlled access program) and then to allocate quota to all qualified vessels equally, regardless of differences in history in the fishery or prior landings. Thus, if five vessels qualify to participate in the controlled access directed fishery, each vessel would be allocated 20% of the annual quota. This would have equity implications and would not reward anyone for their prior fishing activity.

To be an effective tool, IVQs must be tailored to the circumstances that exist in the red crab fishery and the goals to be achieved. Given the dynamic nature of fishing activities, it is likely that management of IVQs will require flexibility to stay abreast of social and economic changes. A quota-based management system may be able to achieve the goals of the FMP in a consistent basis because it directly limits the amount of catch. As with other quota systems, the success of the program would depend on the appropriate level of the catch limit. Some argue that the incentives built into an IVQ system make them effective because the value of the IVQ depends upon the health of the stock. Some potential negative impacts of an IVQ system are the high management requirements and behavior among participants that may not be in the best interest of the stock (such as high-grading). These problems would appear to exist in whatever manner fisheries are managed. IVQs are well suited to shellfisheries where the problems of multi-species fisheries do not exist. There is also not much bycatch to create a problem.

The use of IVQs would allow the most flexibility for harvesters as well as the processors to which the vessels choose to sell. Respondents to the survey indicate that most vessels use only a single processor, although one respondent did report occasionally using a second. Most respondents indicated that they choose to sell their red crab to a particular processor in large part out of loyalty to that processor. Since IVQs may be paired with a controlled access system, the comments made in that section would apply in this case. See Appendix B for a further discussion of the processing sector.

There are no known economic impacts to fishery-dependent service industries expected as a result of IVQs. Again, if a controlled access system is paired with an IVQ, those comments will also apply. The current suppliers of these types of services would handle any change in services needed, but it is the absence of vessels that may affect the business of these suppliers. If vessels are eliminated under a controlled access program, the suppliers of those vessels may or may not be able to still supply them with their product, depending on what the vessel did as an alternative.

An IVQ program would enable vessels to operate in an efficient manner. They would essentially be able to fish in a manner that they are used to fishing, with full knowledge of what lies ahead. Any change, which has an effect on the efficiency of red crab vessels, will in turn have an effect on the markets. It is unknown what impact this efficiency would have on the markets.

There are no known economic impacts to fishing communities expected as a result of this proposed measure. Since the size of the fishery is so small, and so few vessels participate, the impact on any change in the red crab fishery is overwhelmed in the community by the influence of larger fisheries, which generate greater revenue.

5.3.11.5 Social/Cultural Impacts of the Measure

There are no data available with which to evaluate the potential impacts of this measure on the social and cultural aspects of New England and Mid-Atlantic fishing communities. The small size, few participants, and distributed nature of this fishery, however, suggests that any social or cultural impacts to these fishing communities will be negligible. Based on information provided by members of the red crab fishing industry in response to a survey collecting baseline information on the fishery, few consider the communities in which they live to be fishing communities, and fewer still consider their communities to be significantly dependent upon fishing activities (see Appendix B). The implementation of new management programs for the red crab fishery, therefore, would not be expected to significantly disrupt the social frameworks of these communities.

The IVQ measure is proposed primarily as a way to control the overall amount of fishing effort (as in the TAC options), but with a much higher level of certainty and flexibility afforded the individual fishermen. The proposed IVQ system would be based on an overall TAC for the fishery, but rather than creating incentives for a race to fish, each vessel would know a priori the amount of the overall TAC they are authorized to harvest. Total landings should never exceed the target yield for the fishery.

The increased flexibility to the fishermen results from the ability of the fishermen to choose when and for how long to fish, depending on weather, market considerations, availability of crew, etc. The fishermen would be allocated a discrete amount of catch they may harvest in the year, which they can harvest at any time during the fishing year. Increases in stability would be expected as the fishermen can plan their use of IVQ, and they will know exactly how much red crab they can land each year. Both of these factors will reduce the uncertainty normally felt by fishermen unsure of when the fishery may close due to harvest levels.

There would be no reason to anticipate any derby-type fishing occurring, as there is no incentive to "race to fish." Occupational opportunities would not be expected to change as a result of this measure, and may, in fact be improved from those associated with the simple hard TAC measure. Any reduction in occupational opportunities would result from an overall reduction in target yield from current landings levels or from the decisions made by individual fishermen (for instance, to take all of their available quota in a very short time in the beginning of the fishing year).

The proposed measure is not expected to have any effects on community infrastructure or the safety of fishery participants. There appears to be general support for this type of measure among the participants in the directed fishery, although most are somewhat hesitant until they know the amount of quota they are likely to be allocated.

5.3.11.6 Impacts of the Measure on Protected Species

Individual vessel quotas would not by themselves reduce red crab trap effort. Setting the overall TAC at 1999 levels would provide beneficial effects to protected species no matter how the TAC is managed, i.e., by DAS or IVQ.

5.4 Comparison of the Impacts of the Management Alternatives

5.4.1 Introduction

This section will compare and contrast the potential impacts of the ten proposed management alternatives under consideration in the Red Crab FMP. Please see Section 4.3 for an identification and description of the alternatives and the specific management measures included in each. Table 22 indicates the measures contained within each management alternative under consideration. Each alternative, including the preferred alternative, presented in this section will be compared against two baselines: (1) the Emergency Rule alternative and (2) the no action alternative. The baseline for comparison is the regulatory environment which would exist if the Red Crab FMP is not implemented. The reason for two baselines in this case is that it is conceivable for one of two things to occur should this proposed FMP not be implemented.

Under one scenario, the red crab fishery would remain unregulated (as it was prior to the implementation of the emergency regulations) and there would be no further action to manage this fishery and protect the resource. This is equivalent to the "no action" alternative. Under the second scenario, rather than allow the fishery to remain unregulated with the inherent threat to the resource that that situation would present, NMFS, acting on behalf of the Secretary of Commerce, could implement interim management measures or some other safeguards, while they develop a Secretarial management plan for this fishery. Based on the measures developed and implemented by NMFS as emergency regulations, it seems reasonable to assume that the resulting management measures would appear very similar to the Emergency Rule.

5.4.1.1 Biological and Ecological Impacts of the Alternatives on Red Crab

While the alternatives differ from each other in their combinations of management measures, each one has at least some potential to create a derby-type fishery, which is undesirable. This could happen if the harvestable part of the resource is concentrated in a narrow depth zone and the large males are, or are perceived by fishermen to be, limited in number and have slow growth rates. Effort control measures like trip limits, days-at-sea, trap limits, gear restrictions, a controlled access system and individual vessel quotas will tend to spread out the catch over time and make the fishery less like a derby-type fishery. Because it would be concentrated into a short period of time, a derby-type fishery would increase the risk of causing a major disturbance to the mating process and to recruitment. Female red crabs with eggs have been seen throughout much of the year, but there is considerable uncertainty about when mating takes place.

Handling mortality is defined here as death from all factors related to red crabs being brought to the surface, handled, and returned to the bottom (because they cannot be sold). Handling mortality is distinct from fishing mortality (i.e., deaths of crabs that are landed and sold). There are no precise estimates of the magnitude of handling mortality for red crab. Furthermore, handling mortality is not addressed directly by any of the measures or alternatives being considered. If handling mortality is low, then these Alternatives have the potential to conserve the resource. However, if handling mortality is high, then many females and the smaller males die even when they are not landed (i.e., brought to the port). If handling mortality is high, then additional measures that reduce handling mortality could be warranted. It should be noted that it will not be possible to estimate the magnitude of handling mortality from the data that will be obtained under standard reporting requirements.

5.4.1.2 Ecological Impacts of the Alternatives on Other Species and Communities

Very little is known about the interactions of the deep-sea red crab with other species and their associated communities. The directed red crab fishery has no known interactions with other species or their associated communities, as the bycatch of other species in the red crab fishery is minimal. The impacts of this fishery on other species or their communities are expected to be minimal to non-existent. None of the management alternatives under consideration would be expected to change this conclusion and none of the management alternatives would result in more or less expected impact to other species or their communities.

5.4.1.3 Impacts of the Alternatives to Essential Fish Habitat

The only management measures under consideration with any potential relevance to impacts to the EFH of any managed species that may be associated with the directed red crab fishery are the proposed trap limits and the proposed gear restrictions. Both of these measures are proposed in Alternatives 2 through 7 as well as in Alternative 1, the emergency action baseline. Thus, there are no expected differences between these management alternatives and the first baseline. The no action alternative, Alternative 10, by definition would not include any type of trap limit or gear restrictions. Alternatives 2 through 7 all are less likely to result in any impacts to EFH than is the no action alternative, thus these alternatives are expected to have a more positive effect on the EFH of managed species than would the second baseline.

5.4.1.4 Economic Impacts of the Alternatives on the Fishery

In the strictest terms, alternatives are defined as a definitive set of measures. In this case, all of the alternatives to be considered compose a suite of possible measures, which are themselves open to debate, so that many different outcomes are possible under any one alternative. The preferred alternative has been defined as a suite of preferred options under many different measures. Descriptions of the impacts of each type of measure and the relevant options are provided in the previous section. The preferred option for each measure was identified and discussed.

In general, several different concepts of fishery management are being combined in the various alternatives. Many of these regulations have advantages and disadvantages, and some are only useful when used in combination with others. There are various tradeoffs between the regulations that determine what class of vessel may experience the greatest impacts. The “no action” alternative (Alternative 10) is considered to include no management action (i.e., the equivalent of having no FMP for this fishery). The “status quo” alternative (Alternative 1) is considered to include the management measures implemented through the emergency regulations. When comparisons are made, these are the two baselines to be compared with all other alternatives. Since the preferred alternative has been chosen, special emphasis will be given to the comparison of this versus all other alternatives. The assessment of the alternatives is done from the perspective of the nation rather than from that of private firms or individual vessels.

The economic impacts analyzed refer to the impacts of the alternatives on landings, revenues, ex-vessel prices, employment, and distributive effects. We can attempt to determine the direction of change in net benefits from the baseline levels, but it is difficult to determine the comparable net benefits of all alternatives. Because of the wide range of possibilities within each alternative, even the ranking of alternatives compared to the baselines is difficult. An attempt was made to outline the economic principles that should be considered when making comparisons of the alternatives to the two different baselines (Table 23 and Table 24). The degree of uncertainty in the direction of change from the baselines becomes clear. This table can also allow for some type of comparison between all of the alternatives, as cells which are different can point out positive or negative impacts. Landing projections over time for each alternative is what is needed before we can determine economic impacts to the nation.

Table 21 provides a comparison of the expected economic impact of all alternatives compared to the preferred alternative. Since there are very few positive impacts (+ characters) in Table 21, this implies that the preferred alternative compares favorably with all others. Notice the no action alternative generates almost all negative impacts (-) when compared to the preferred alternative.

The comparisons made between the baselines and the alternatives will be made using a long term time horizon, a sufficient period of time to allow a consideration of all expected effects. There will be short term benefits from some of the alternatives, but they may not be sustainable. In restrictive management alternatives, costs are incurred in the short-term and benefits are realized later.

There are some comments which would apply to all alternatives. All management alternatives (except "no action") will include some level of incidental catch limits, based on the goal of FMP to "allow all fishermen the continued opportunity to land appropriate amounts of red crab as bycatch." While they may have economic impacts for those vessels from the non-directed fishery, the impacts would be felt equally across all alternatives. All management alternatives (except "no action") must include some degree of gear requirements and/or restrictions to, at a minimum, deal with marine mammal requirements, gear markings, and to ensure that the directed fishery is regulated as trap only. Any economic impacts from this measure would be felt equally among all alternatives. With the exception of the two baselines, all management alternatives include a provision for a controlled access system, consistent with an objective of the FMP, which states "develop a controlled access system to keep fishing capacity matched to the available resource." Although there are economic impacts from the selection of the preferred option for controlled access, this measure would not be the cause of differing distributive impacts between the alternatives.

	Management Alternatives									
	Emergency Rule	Hard TAC and Trap Limits	Hard TAC, Trap and Trip Limits	Target TAC with DAS	Target TAC with DAS & Trip Limits	Trip Limits with # of Trips	All Possible Measures	IVQ with Controlled Access	IVQ Only	No Action
Economic elements[16]	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Harvest level	0	0	0	0	Preferred Alternative	0	0	0	0	-
Employment	-	-	-	0		-	-	0	0	-
Price	-	-	-	0		-	-	0	0	-
Revenue[17]	0	0	0	0		0	0	0	0	-
Vessel efficiency	-	-	-	0		-	-	0	0	-
Fishing season length	-	-	-	0		0	-	0	0	0
Industry output level										-
Harvesting/processing costs										-
Fleet size	-	0	0	0		0	0	0	0	-
Fleet composition										
Management costs, difficulty	0	0	0	+		+	-	+	+	++

Table 21: Expected economic impacts of all alternatives compared to the preferred alternative (#5).

All management alternatives (except "no action") will include some level of reporting requirement to ensure that information is collected that is necessary for the continued management of the resource. There would be additional costs due to enforcement (which may include observers) and reporting but these appear to be non-controversial and would impact all alternatives equally.

While the alternatives differ in their combinations of management measures, many have the potential to promote a derby-type fishery. Effort control measures like trip

[16] Economic impacts include market effects, profit effects, and fleet effect; They are rated positive (+), negative (-), neutral (0). Empty cells represent unknown effects or direction of change from baseline.

[17] Assumes prices are held constant.

limits, days-at-sea, trap limits, and individual vessel quotas will tend to spread out the catch over time and make the fishery less like a derby-type fishery. These effort control measures differ in the efficiency and flexibility within which vessels can operate. An issue with economic significance is the disproportionate effects, by vessel size, for every alternative. A second significant issue is the share of the catch to be allocated among vessels with a history in the fishery and recent or new entrants. This is related to the interpretation of the control date of March 1, 2000, in qualifying recent or new entrants.

Red Crab Vessels

There are four characteristics of red crab vessels that are relevant to making a comparison between efficiency of the different vessels and how they would each be impacted under each of the alternatives: (1) fishing capacity; (2) hold capacity; (3) finished product and recovery rates; and (4) harvesting capacity. Fishing capacity refers to the number of pots that red crab vessels carry or use. The maximum hold capacity of a vessel indicates how much product (live or processed) the vessel can carry. The recovery rate depends on the degree of processing, if any, that occurs on board. Harvesting capacity refers to the amount of red crab that any one vessel could take on one trip. These issues are controversial and influence the impact of new vessels entering the fishery, as well as the impact of these alternatives on vessels in the fishery. Vessels impacted under any of the alternatives may have to do other things to remain profitable, either fish for red crabs on a part-time basis or fish in other regions outside the Northeast.

Red Crab Price

The ex-vessel price of red crab, according to the dealer weighout database, which is the only source of revenue information available, ranged, in 2000, from $.55 to $.94 per pound for individual vessels. This range in ex-vessel price among vessels is partly due to the different methods of processing and marketing, whether landed whole or with some degree of processing. The ex-vessel price of red crab by month ranged from $.63 to $.81. Average prices for each month were $.69, $.64, $.71, $.63, $.63, $.66, $.67, $.73, $.74, $.80, $.81, $.76 from January to December 2000, respectively. The ex-vessel price by port ($.55 to $.92) was very similar to the price received by vessels, reinforcing the fact that vessels land predominately in only one port.

Red Crab Revenue and Costs

The gross revenue per day required to break even ranges from $4,000 to $5,000. Based on the prices listed above, this would require minimum landings ranging from 2,200 pounds to 4,700 pounds per day. An average trip lasting 8 days means vessels would have to land between 17,600 pounds and 37,600 pounds to break even. The preferred alternative which includes a trip limit of 75,000 pounds would enable red crab vessels to break even, that is, cover their variable costs. The average variable cost/trip is approximately $15,000. Vessels must cover their variable costs in the short run in order to continue fishing.

In the long term, vessels must cover their fixed costs to remain profitable. It appears from the available information that red crab vessels would be able to allocate some of their trip revenue to cover their fixed costs. See Appendix B for a complete discussion of the revenues and costs of red crab vessels. There were no data on red crab imports or exports available from the U.S. Bureau of the Census. When compared to the no action alternative, all of these alternatives have a positive economic effect on the level of harvest. Since taking no action would drive the stock level down, any action at all would be an improvement over what harvest levels would become without management.

5.4.1.5 Social/Cultural Impacts of the Alternatives

The relative social and cultural impacts to fishermen and their communities of each management alternative under consideration are compared against those of two baselines: Alternative 1, the emergency action alternative, and Alternative 10, the no action alternative. The social and cultural impacts associated with the management measures proposed in the alternatives under consideration in many cases are dependent upon the specific options selected. In some cases, a single option may have positive social benefits for some members of the red crab fishery and negative social impacts for other members. For the purposes of this comparison of the potential impacts of the management alternatives under consideration, it is assumed that the same options would be selected under each alternative.

5.4.1.6 Impacts of the Alternatives on Protected Species

The protected species discussion in this section expands on the positive, negative, or, in some cases, lack of impacts of the management alternatives on protected resources, and provides comments on these packages relative to the two baselines described earlier. There is a focus on sperm whales as the protected species most likely to be affected by the operations of the red crab fishery, followed by a conclusion that no species inhabiting the waters of the management unit are expected to be adversely affected by any of the ten alternatives. All of the proposed alternatives, however, provide more positive benefits than the no action alternative.

	Management Alternatives									
	Emergency Rule	Hard TAC and Trap Limits	Hard TAC, Trap and Trip Limits	Target TAC with DAS	Target TAC with DAS & Trip Limits	Trip Limits with # of Trips	All Possible Measures	IVQ with Controlled Access	IVQ Only	No Action
Measures	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Incidental catch limits	X	X	X	X	X	X	X	X	X	*No Action Alternative*
Minimum size							X			
Males only		X	X	X	X	X	X			
Butchering/processing restrictions		X	X	X	X	X	X			
Trap limits	X	X	X	X	X	X	X			
Gear requirements/restrictions	X	X	X	X	X	X	X	X	X	
Total allowable catch	X	X	X	X	X		X			
Trip limits	X		X		X	X	X			
Controlled access system		X	X	X	X	X	X	X		
Days-at-sea limits				X	X		X			
Individual vessel quotas								X	X	

Table 22: Identification of measures contained within each management alternative under consideration in the Red Crab FMP.

5.4.2 Alternative 1: "Emergency Rule"

This non-preferred alternative proposed to implement the set of management measures that most closely resembles those implemented by NMFS in the Emergency Regulations. Alternative 1 differs from Alternative 10 (the "no action" baseline) by including measures for incidental catch limits, trap limits, some gear requirements, a hard TAC, and trip limits.

5.4.2.1 Biological and Ecological Impacts of the Alternative on Red Crab

Compared to Alternative #10, in what ways might this Alternative have a more positive effect on red crabs?

Incidental catch limits will prevent excessive red crab landings by vessels from other fisheries. Trap limits can limit catch rates and gear restrictions can allow small red crabs to escape from traps. A hard TAC with reporting requirements for each trip will reduce the probability of overfishing.

Compared to Alternative #10, in what ways might this Alternative have a more negative effect on red crabs?

There are no conditions under which this alternative would be expected to have more negative effects on red crabs than Alternative 10.

5.4.2.2 Ecological Impacts of the Alternative on Other Species and Communities

There are no expected differences in the ecological impacts on other species or their communities between this management alternative and Alternative 10.

5.4.2.3 Impacts of the Alternative to Essential Fish Habitat

The no action alternative, Alternative 10, by definition would not include any type of trap limit or gear restrictions. This alternative is less likely to result in any impacts to EFH than is the no action alternative, thus this alternative is expected to have a more positive effect on the EFH of managed species than would the second baseline.

5.4.2.4 Economic Impacts of the Alternative on the Fishery

Alternative 1 would implement a set of measures most similar to those implemented under the emergency regulations. The emergency regulations implemented a hard TAC (based on an estimate of MSY), a trip limit, and a trap limit. This alternative does not include a controlled access system.

Alternative 1 would not preclude the continuation of all vessels in the red crab fishery. Although this alternative does not restrict any degree of processing at sea, it may do so indirectly by imposing a trip limit. So, even though processing would be allowed, it is not clear whether vessels would choose to process on board under this alternative.

The trip limit, in combination with the hard TAC, could still promote a derby fishery but would allow for a more equitable distribution of landings in time and space than would a TAC used alone. However, the vessels capable of landings far greater than the trip limit may be forced to operate in an inefficient manner or not participate in the fishery at all. It is quite possible that they may not cover their variable costs on these limited trips. This one measure, if set low, may force some vessels out of the fishery or preclude them from entering the fishery. Larger vessels presumably have greater expenses and the trip limit may not allow them to earn enough revenue to justify making such a trip.

It is impossible to estimate how many vessels, if any, might be eliminated by this alternative. While some impacted vessels might continue to make trips and land only up to the trip limit, some vessels might cease making trips, because the trip limit would not provide for profitable trips. It is possible that the effort from the eliminated trips could move into other areas where vessels could make up for lost revenue. However, it is not clear at what level this would occur, or how much additional revenue this would create for vessels. Revenue would essentially be capped under this alternative. It is difficult to determine what effect this alternative would have on the variable costs of the vessels involved.

From what we understand about the vessel length and gross registered tonnage of vessels in this fishery, we can say that there are likely to be some disproportionate effects by vessel size class. The larger vessels would be more likely to be impacted than the smaller vessels, through a reduction in total gross revenues. Most of the smaller vessels would presumably be able to continue fishing in the manner that was closer to their past behavior.

The trip limits could have a differential impact on vessels with different levels of productivity (which would be indicated by their landings-per-unit-efforts (LPUE) if these were known). Higher productivity vessels will be constrained more by the trip limits compared to the vessels that have a lower LPUE. On the other hand, the actual trip length would likely be shorter for the high productivity vessels; thus their trip costs may be less (everything else being equal) compared to smaller vessels that have to fish longer to land the trip limit. The trip limit would require the more productive vessels to take more trips than their ability requires. Their trip costs are lower than their counterparts, but higher than necessary to harvest their effective allocation.

Trip limits and pot limits may be somewhat redundant. The use of pot limits is questionable, given that the vessels haul pots multiple times on a trip and that a pot limit is difficult to enforce at sea. Some vessels may be able to use the combination of a pot limit and a trip limit to their advantage. For example, some may be able to increase the number of pots per trawl, catch their trip limit quicker, resulting in a shorter trip, with the possibility of making a greater number of trips. The implementation of pot limits may prove to be somewhat problematic, as well.

A few positive economic effects can be felt from Alternative 1, if compared with no action at all. Incidental catch is regulated under Alternative 1, preventing those vessels from directing on red crab. Restrictions on number of entrants will prevent additional vessels from entering the fishery and leaving it overcapitalized. Historic participants are less likely to be eliminated from the fishery or become marginally viable. Required reporting would improve the data availability for this fishery.

5.4.2.5 Social/Cultural Impacts of the Alternative

There are no specific measures within this alternative that would be expected to provide social and/or cultural benefits to the red crab fishery compared with Alternative 10, but, overall, implementing a management program for the red crab fishery that reduces the probability of overfishing and reduces the likelihood of the fishery becoming overcapitalized will have an overall positive effect on the social and cultural aspects of the fishery.

5.4.2.6 Impacts of the Alternative on Protected Species

The emergency regulations implemented a 180-day hard TAC of 2.5 million pounds, a 65,000 pound trip limit, a 600-trap limit, a 100 pound incidental catch limits for vessels not participating in the direct red crab fishery, and reporting requirements for all participants. The TAC level equals the estimated MSY for the fishery, but is higher than the historical annual landings, although it is reported that the 2000 landings exceeded the MSY level. The trip limit is the average size for the historic fleet, and the trap limit is less than 100 traps higher than the historic fleet level. The incidental catch limit may reduce participation from other fisheries. The gear requirements proposed would not provide any additional protection beyond what is already provided under the MMPA regulations that implement the ALWTRP. The reporting requirement will provide additional information regarding the seasonal and area distribution of red crab fishing effort to allow managers to better assess the actual overlap of the fishery with protected species. However, implementation of an effort-capping scheme will provide more protection than the No Action alternative.

The effort control/reduction measures (TAC, trip and trap limits, and incidental catch limits) all serve to control the growth of the fishery that would result in more fixed gear being set in high use waters for protected species, namely the endangered sperm whale and other odontocetes protected under the MMPA; as well as migratory or occasional foraging habitat for the endangered right, humpback, fin, blue and sei whales and the endangered leatherback sea turtle. However, Alternative 1 would not provide any additional protection to the endangered large whales and leatherback sea turtle during their high use period along the continental shelf edge (Spring months of April - June).

5.4.3 Alternative 2: Hard TAC with Trap Limits

This non-preferred alternative proposed to implement a set of management measures to control total fishing effort and landings primarily through the use of a hard TAC. Alternative 2 differs from Alternative 1 by including options for a male-only fishery, butchering and processing restrictions, and a controlled access system, but does not include the option for a trip limit. Alternative 10, the no action alternative, includes no management measures, so all the measures proposed in Alternative 2 differ from Alternative 10.

5.4.3.1 Biological and Ecological Impacts of the Alternative on Red Crab

Compared to Alternative #1, in what ways might this Alternative have a more positive effect on red crabs?

By limiting the landings to males, females will be protected from direct fishing mortality. Females still might incur high handling mortality. We do not know how high handling mortality is, so traps should be designed to reduce the capture of crabs that must be returned or that are too small to have much meat yield. Protecting the females will promote population growth, but this will occur only if sufficient numbers of large males are left in the population.

The amount of processing allowed will affect whether this alternative can be put into practice successfully. The most extreme hypothetical case would be if at-sea processing was eliminated, and only whole, male crabs could be landed. Resulting positive effects would include the ability to monitor compliance with the male-only measure and protection of females and small males. In addition, this might limit the number of crabs taken per trip because the ships' storage areas would fill more quickly per capita of crab landed. In contrast, if processing at sea were allowed with only minor restrictions, then it would not be possible to monitor what was being landed or to protect females or smaller males.

Controlled access will limit the number of vessels harvesting red crab and make it easier to monitor and enforce a hard TAC. Reporting requirements will also support monitoring and enforcement.

Compared to Alternative #1, in what ways might this Alternative have a more negative effect on red crabs?

The TAC will limit the overall catch, but without trip limits (or some other measure which causes trips to end) this could become a derby-type fishery whereby most of the annual catch is taken in a short period of time. If all of the catch was removed during a critical time for red crab reproduction, this could reduce future recruitment. Female red crabs with eggs have been seen throughout much of the year, but there is considerable uncertainty about when mating takes place. Avoiding a derby fishery would lower the risk of causing a major disturbance to the mating process.

Without trip limits, recovery ratios cannot be used to constrain each trip to have roughly the same maximum number of crabs (i.e., no upper limit on mortality per trip).

Compared to Alternative #10, in what ways might this Alternative have a more positive effect on red crabs?

By limiting the landings to males, females will be protected from direct fishing mortality. Females still might incur high handling mortality. We do not know how high handling mortality is, so traps should be designed to reduce the capture of crabs that must be returned or that are too small to have much meat yield. Protecting the females will promote population growth, but this will occur only if sufficient numbers of large males are left in the population.

The amount of processing allowed will affect whether this alternative can be put into practice successfully. The most extreme hypothetical case would be if at-sea processing was eliminated, and only whole, male crabs could be landed. Resulting positive effects would include ability to monitor compliance with the male-only measure and protection of females and small males. In addition, this might limit the number of crabs taken per trip because the ships' storage areas would fill more quickly per capita of crab landed. In contrast, if processing at sea were allowed with only minor restrictions, then it would not be possible to monitor what was being landed or to protect females or smaller males.

Controlled access will limit the number of vessels harvesting red crab and make it easier to monitor and enforce the hard TAC. Reporting requirements will also support this. Incidental catch limits will prevent excessive red crab landings by vessels from other fisheries. Trap limits can limit catch rates and gear restrictions can allow small red crabs to escape from traps. A hard TAC with reporting requirements for each trip will reduce the probability of overfishing.

Compared to Alternative #10, in what ways might this Alternative have a more negative effect on red crabs?

There are no conditions under which this alternative would be expected to have more negative effects on red crabs than Alternative 10.

5.4.3.2 Ecological Impacts of the Alternative on Other Species and Communities

There are no expected differences in the ecological impacts on other species or their communities between this management alternative and the first baseline, Alternative 1, the emergency action alternative. The only difference in the ecological impacts on other species or their communities expected between this management alternative and the second baseline, Alternative 10, the no action alternative, is that associated with the prohibition on all fishing gear types other than traps in the directed red crab fishery, which would be expected to confer benefits to other species and their communities by preventing the use of mobile gear such as otter trawls and dredges.

5.4.3.3 Impacts of the Alternative to Essential Fish Habitat

The relative impacts to essential fish habitat (EFH) of each management alternative under consideration are compared against those of two baselines: Alternative 1, the emergency action alternative, and Alternative 10, the no action alternative.

The only management measures under consideration with any potential relevance to impacts to the EFH of any managed species that may be associated with the directed red crab fishery are the proposed trap limits and the proposed gear restrictions. Both of these measures are proposed in this alternative as well as in Alternative 1, the emergency action baseline. Thus, there are no expected differences between this management alternative and the first baseline. The no action alternative, Alternative 10, by definition would not include any type of trap limit or gear restrictions. This alternative is less likely to result in any impacts to EFH than is the no action alternative, thus this alternative is expected to have a more positive effect on the EFH of managed species than would the second baseline.

5.4.3.4 Economic Impacts of the Alternative on the Fishery

Alternative 2 would control total fishing effort and landings primarily through the use of a hard TAC. The primary mechanism to make fishing effort equivalent among vessels and to prevent expansion of effort would be a trap limit. A controlled access system would be implemented to limit the number of vessels participating in the directed fishery to an appropriate number.

Trap limits work by reducing the efficiency of the fishing activity, by forcing fishermen to use a smaller number of traps that they may be accustomed to. A lesser number of traps would reduce the catch, without any associated reduction of costs, resulting in reduced profitability. Since this alternative relies exclusively on trap limits to help spread the landings out over the year, to do so effectively the limit would have to be set so low that it would affect all vessels revenue.

Controlled access will limit the participation of vessels harvesting red crab. From society's point of view, this means there is a reduction in the accumulation of excess capital and lower costs. Alternative 2 would force participating vessels to be very inefficient (affecting some vessels more than others) because the primary mechanism to control effort is through a trap limit. Cost per crab harvested would be higher; to utilize their full vessel capacity, they may try to extend the length of their trip.

Vessels are operating inefficiently, not due to a trip limit (as in Alternative 1), but due to restrictive trap limits instead. Trap limits in conjunction with TAC prevent a complete derby, but almost certainly would have the fishery shut down prior to the end of the fishing year. Employment in the processing sector would have to adjust to fluctuating supply; even though processors are only 11.5% dependent on red crab on average, they would still have to adjust to unsteady levels, assuming the fishery would be shut down early.

The degree of processing allowed will affect whether vessels would have to change their current fishing behavior. If they were forced to modify their method of harvesting, it would add to their costs, and some vessels may no longer be profitable. Some may be forced out of the fishery. Not allowing processing at sea would certainly be dissuasive to the freezer/processor vessel owners, given the presumably higher fixed and variable costs associated with operation of larger vessels, processing facilities and the employment of additional crew. In contrast, if processing at sea were allowed with only minor restrictions, vessels would have the flexibility to continue their fishing, not affecting their costs. Other measures would have to be restrictive. Instability of supply would cause fluctuations in availability and price.

Compared to no action, the only positive aspect of Alternative 2 is that data would be gathered which would enable future management actions to use more comprehensive, reliable, and timely information on the fishery.

5.4.3.5 Social/Cultural Impacts of the Alternative

Compared to Alternative 1, in what ways might this alternative have a more positive social/cultural impact?

Butchering/processing restrictions are expected to have positive social impacts on the fishermen involved in the directed red crab fishery unless the most restrictive option, a total prohibition on all butchering and processing at sea, is selected. A controlled access system will provide positive social impacts on the vessels authorized to participate in the directed red crab fishery.

Compared to Alternative 1, in what ways might this alternative have a more negative social/cultural impact?

If the most restrictive option for butchering/processing restrictions is selected, this alternative has the potential to cause negative social impacts on some members of the directed red crab fishery. The controlled access system may have negative social impacts on the vessels excluded from participating in the directed red crab fishery. Depending upon the option selected and the level of the trip limit set for the directed red crab fishery, trip limits may be expected to have a positive social impact on members of the red crab fishery by mitigating some of the potential negative social impacts associated with a hard TAC. These potential negative social impacts will not be mitigated in Alternative 2, so it may have a more negative social impact than Alternative 1.

Compared to Alternative 10, in what ways might this alternative have a more positive social/cultural impact?

Butchering/processing restrictions are expected to have positive social impacts on the fishermen involved in the directed red crab fishery unless the most restrictive option, a total prohibition on all butchering and processing at sea, is selected. The gear requirements options offer potential social benefits, resulting from the proposed prohibition on all fishing gear other than traps. A controlled access system will provide positive social impacts on the vessels authorized to participate in the directed red crab fishery. Overall, implementing a management program for the red crab fishery that reduces the probability of overfishing and reduces the likelihood of the fishery becoming overcapitalized will have an overall positive effect on the social and cultural aspects of the fishery.

Compared to Alternative 10, in what ways might this alternative have a more negative social/cultural impact?

If the most restrictive option for butchering/processing restrictions is selected, this alternative has the potential to cause negative social impacts on some members of the directed red crab fishery. The controlled access system may have negative social impacts on the vessels excluded from participating in the directed red crab fishery.

5.4.3.6 Impacts of the Alternative on Protected Species

A hard TAC set at MSY would represent a somewhat higher catch than historic levels, but would serve to set an appropriate limit for future growth. Trap limits are also beneficial for protected species as it caps the amount of gear that can be set for each vessel. Trap limits below the current average level of 560 may not reduce the number of strings used, although trap limits above the current level may increase the number of strings and accompanying vertical buoy lines. We note that TAC alone does not control the timing of the effort. Derby fishing for a hard TAC may bring the bulk of the effort into direct conflict with the spring high use of the continental shelf edge by endangered large whales and the leatherback sea turtle. Incidental catch limits will serve to limit growth of non-directed red crab fisheries such as offshore lobster along the continental shelf edge provided the level chosen is at/or below the current landings. The reporting requirement will provide additional information regarding the seasonal and area distribution of red crab fishing effort to allow managers to better assess the actual overlap of the fishery with protected species. The gear requirements proposed would not provide any additional protection beyond what is already provided under the MMPA regulations that implement the ALWTRP. The requirement for males only and the butchering/processing at-sea will not provide any protection for protected species.

Using only TAC to control the fishery is an adequate effort control on the growth of the fishery, thus curbing uncontrolled growth that would result in more fixed gear being set in high use waters for protected species, namely the endangered sperm whale and other odontocetes protected under the MMPA; as well as migratory or occasional foraging habitat for the endangered right, humpback, fin, blue and sei whales and the endangered leatherback sea turtle. Since the level of TAC, trap limits, and incidental catch limits are not yet chosen, we cannot assess the protected species effects with respect to Alternative 1. However, implementation of an effort-capping scheme will provide more protection than Alternative 10.

5.4.4 Alternative 3: Hard TAC, Trap Limits and Trip Limits

This non-preferred alternative proposed to implement a set of management measures to control total fishing effort and landings primarily through the use of a hard TAC, but would also implement trip limits as a tool to reduce the likelihood of creating a derby fishery. Alternative 3 differs from Alternative 1 by including options for a male-only fishery, butchering/processing restrictions, and a controlled access system. Alternative 10, the no action alternative, includes no management measures, so all the measures proposed in Alternative 3 differ from Alternative 10.

5.4.4.1 Biological and Ecological Impacts of the Alternative on Red Crab

Compared to Alternative #1, in what ways might this Alternative have a more positive effect on red crabs?

This alternative has all the advantages of Alternative 2, plus the trip limit can work along with the butchering/processing restriction and the male-only requirement to limit the size range, sex and number of red crabs that are landed per trip. This combination of measures may serve to spread the catch out to some degree across seasons (reduce, but not eliminate the potential for a derby-type fishery), limit the catch to large males (which should allow females to continue reproducing), and allow the catch to be monitored for stock assessment.

Compared to Alternative #1, in what ways might this Alternative have a more negative effect on red crabs?

There are no conditions under which this alternative would have a more negative effect on red crabs than Alternative 1.

Compared to Alternative #10, in what ways might this Alternative have a more

positive effect on red crabs?

This has all the advantages of Alternative 2, plus the trip limit can work along with the butchering/processing restriction and the male-only requirement to limit the size range, sex and number of red crabs that are landed per trip. This combination of measures will spread the catch out across seasons (reduce the derby-type fishery), limit the catch to large males (which should allow females to continue reproducing), and allow the catch to be monitored for stock assessment.

Compared to Alternative #10, in what ways might this Alternative have a more negative effect on red crabs?

There are no conditions under which this alternative would be expected to have more negative effects on red crabs than Alternative 10.

5.4.4.2 Ecological Impacts of the Alternative on Other Species and Communities

There are no expected differences in the ecological impacts on other species or their communities between this management alternative and the first baseline, Alternative 1, the emergency action alternative. The only difference in the ecological impacts on other species or their communities expected between this management alternative and the second baseline, Alternative 10, the no action alternative, is that associated with the prohibition on all fishing gear types other than traps in the directed red crab fishery, which would be expected to confer benefits to other species and their communities by preventing the use of mobile gear such as otter trawls and dredges.

5.4.4.3 Impacts of the Alternative to Essential Fish Habitat

The relative impacts to essential fish habitat (EFH) of each management alternative under consideration are compared against those of two baselines: Alternative 1, the emergency action alternative, and Alternative 10, the no action alternative.

The only management measures under consideration with any potential relevance to impacts to the EFH of any managed species that may be associated with the directed red crab fishery are the proposed trap limits and the proposed gear restrictions. Both of these measures are proposed in this alternative as well as in Alternative 1, the emergency action baseline. Thus, there are no expected differences between this management alternative and the first baseline. The no action alternative, Alternative 10, by definition would not include any type of trap limit or gear restrictions. This alternative is less likely to result in any impacts to EFH than is the no action alternative, thus this alternative is expected to have a more positive effect on the EFH of managed species than would the second baseline.

5.4.4.4 Economic Impacts of the Alternative on the Fishery

In an effort to spread out the landings of red crab and reduce the potential for creating a derby-style fishery, Alternative 3 includes all the measures from the previous alternative with the addition of trip limits. This alternative is also very similar to the

"Emergency Rule" alternative with the addition of the male-only restriction and some form of butchering or processing at sea restriction.

The trip limit, in combination with the hard TAC, would help prevent (although certainly not eliminate) a derby fishery and allow for a more equitable distribution of landings in time and space. However, the vessels capable of landings far greater than the trip limit may be forced to operate in an inefficient manner or not participate in the fishery at all. It is quite possible that they may not cover their variable costs on these limited trips. This one measure may possibly force some vessels out of the fishery or preclude them from entering the fishery. Larger vessels presumably have greater expenses and the trip limit may not allow them to earn enough revenue to justify making such a trip.

It is impossible to estimate how many vessels, if any, might be eliminated by this alternative. While some impacted vessels might continue to make trips and land only up to the trip limit, some vessels might cease making trips, because the trip limit would not provide for profitable trips. It is possible that the effort from the eliminated trips could move into other areas where vessels could make up for lost revenue. However, it is not clear at what level this would occur, or how much additional revenue this would create for vessels. The trip limit would require the more productive vessels to take more trips than their ability requires. Their trip costs are lower than their counterparts, but higher than necessary to harvest their effective allocation.

Compared to the two baselines, Alternative 3 would limit the number of vessels harvesting red crab through controlled access. From society's point of view, this means there is a reduction in the accumulation of excess capital and lower costs. Those other resources (who are not in the fishery) can be directed elsewhere. This combination of measures will spread the catch out across seasons (reduce the derby-type fishery).

Compared to the preferred alternative (Alternative 5), increased inefficiency of vessel operations due to both trap limits and trip limits would raise vessels costs without a corresponding increase in revenue. Both trap and trip limits strive to control effort by forcing vessels to operate at less than their full capacity. Additional controls would increase enforcement costs.

As with Alternative 1, the degree of processing allowed will affect whether vessels would have to change their current fishing behavior. If they were forced to modify their method of harvesting, it would add to their costs, and some vessels may no longer be profitable. Some may be forced out of the fishery. Not allowing processing at sea would certainly be dissuasive to the freezer/processor vessel owners, given the presumably higher fixed and variable costs associated with operation of larger vessels, processing facilities and the employment of additional crew. In contrast, if processing at sea were allowed with only minor restrictions, vessels would have the flexibility to continue their fishing, not affecting their costs. Other measures would have to be restrictive.

In all but the no action alternative, data would be gathered which would enable future management actions to use more comprehensive, reliable, and timely information on the fishery. Historic participants may be able to remain in the fishery, even if they have to operate in a less efficient manner.

5.4.4.5 Social/Cultural Impacts of the Alternative

Compared to Alternative 1, in what ways might this alternative have a more positive social/cultural impact?

The positive effects of this alternative compared to Alternative 1 are the same as for Alternative 2.

Compared to Alternative 1, in what ways might this alternative have a more negative social/cultural impact?

The negative effects of this alternative compared to Alternative 1 are the same as for Alternative 2, with the exception of those impacts associated with trip limits.

Compared to Alternative 10, in what ways might this alternative have a more positive social/cultural impact?

The positive effects of this alternative compared to Alternative 10 are the same as for Alternative 2 with the addition of trip limits which may be expected to have a positive social impact on members of the red crab fishery by mitigating some of the potential negative social impacts associated with a hard TAC.

Compared to Alternative 10, in what ways might this alternative have a more negative social/cultural impact?

The negative effects of this alternative compared to Alternative 10 are the same as for Alternative 2.

5.4.4.6 Impacts of the Alternative on Protected Species

A hard TAC set at MSY would represent a somewhat higher catch than historic levels, but would serve to set an appropriate limit for future growth. Trap limits are also beneficial for protected species as it caps the amount of gear that can be set for each vessel. Trap limits below the current average level of 560 may not reduce the number of strings used, although trap limits above the current level may increase the number of strings and accompanying vertical buoy lines. Adding trip limits to a TAC does not change the protected species effects from Alternative 2, as vessels may still make quick turn-around trips, maintaining the possible adverse effects of a derby fishery occurring during the spring high use of the continental shelf edge by endangered large whales and the leatherback sea turtle. Incidental catch limits will serve to limit growth of non-directed red crab fisheries such as offshore lobster along the continental shelf edge provided the level chosen is at/or below the current landings. The reporting requirement will provide additional information regarding the seasonal and area distribution of red crab fishing effort to allow managers to better assess the actual overlap of the fishery with protected species. The gear requirements proposed would not provide any additional protection beyond what is already provided under the MMPA regulations that implement the ALWTRP. The requirement for males only and the butchering/processing at-sea will not provide any protection for protected species.

An alternative with hard TAC, trap limits, and trip limits will provide adequate control on the growth of the fishery, thus curbing uncontrolled growth that would result in more fixed gear being set in high use waters for protected species, namely the endangered sperm whale and other odontocetes protected under the MMPA; as well as migratory or occasional foraging habitat for the endangered right, humpback, fin, blue and sei whales and the endangered leatherback sea turtle. Since the level of TAC, trap limits, and incidental catch limits are not yet chosen, we cannot assess the protected species effects with respect to Alternative 1. However, implementation of an effort-capping scheme will provide more protection than Alternative 10.

5.4.5 Alternative 4: Target TAC with Days-at-Sea

This non-preferred alternative proposed to implement a set of management measures to control effort in the fishery primarily through the allocation of DAS to all vessels authorized to participate in the directed red crab fishery. Alternative 4 differs from Alternative 1 by including options for a male-only fishery, butchering/processing restrictions, a controlled access system and days-at-sea limits, but does not include the option for trip limits and would use a target TAC rather than a hard TAC. Alternative 10, the no action alternative, includes no management measures, so all the measures proposed in Alternative 4 differ from Alternative 10. Alternative 4 differs from the preferred alternative only in that it does not include trip limits.

5.4.5.1 Biological and Ecological Impacts of the Alternative on Red Crab

Compared to Alternative #1, in what ways might this Alternative have a more positive effect on red crabs?

By limiting the landings to males, females will be protected from direct fishing mortality. Females still might incur high handling mortality. We do not know how high handling mortality is, so traps should be designed to reduce the capture of crabs that must be returned or that are too small to have much meat yield. Protecting the females will promote population growth, but this will occur only if sufficient numbers of large males are left in the population.

The amount of processing allowed will affect whether this alternative can be put into practice successfully. The most extreme hypothetical case would be if at-sea processing was eliminated, and only whole, male crabs could be landed. Resulting positive effects would include the ability to monitor compliance with the male-only measure and protection of females and small males. In addition, this might limit the number of crabs taken per trip because the ships' storage areas would fill more quickly per capita of crab landed. In contrast, if processing at sea were allowed with only minor restrictions, then it would not be possible to monitor what was being landed or to protect females or smaller males.

Controlled access will limit the number of vessels harvesting red crab and make it easier to monitor total landings. Reporting requirements will also support monitoring and enforcement.

A limit on days-at-sea per vessel serves as the primary method of controlling fishing effort and catch. This will tend to spread out the effort, because each vessel in the fishery will be assured of a certain amount of time to fish. Spreading out the catch over time is probably less of a disturbance to the red crab population, especially to the mating system.

Compared to Alternative #1, in what ways might this Alternative have a more negative effect on red crabs?

The "days-at-sea" measure is a way of managing fishing effort to try to achieve the target TAC. The calculation of days-at-sea per vessel must be completed before the fishing year, and the calculation requires assumptions about the number of vessels, their average catch per trip, and the average days per trip. A further complication is that the days-at-sea for each red crab vessel might have to be estimated taking into account different types of vessels with different amounts of crab processing. Because the calculation of days-at-sea is indirect, the realized catch after one year using all the days-at-sea might over- or under-shoot the target TAC. This is different from a hard TAC, where the fishery closes as soon as the hard TAC is taken. It should be expected that if both a target TAC and days-at-sea are implemented, the target TAC will have to be adjusted each year to account for the previous year's difference between the realized and target catch. Choosing the right number of days-at-sea to achieve the target TAC is more difficult if there are changes over time in fishing gear, hold capacity, or other fishing regulations (e.g., trip limits).

As an alternative to a simple equal allocation of DAS among all participating vessels, or a category-based allocation, recovery ratios could be used to adjust days-at-sea for vessels planning different amounts of processing, but the formula for doing this would be more difficult to derive (and probably less accurate at correctly assigning days-at-sea) than applying recovery ratios to an alternative with trip limits.

Compared to Alternative #10, in what ways might this Alternative have a more positive effect on red crabs?

By limiting the landings to males, females will be protected from direct fishing mortality. Females still might incur high handling mortality. We do not know how high handling mortality is, so traps should be designed to reduce the capture of crabs that must be returned or that are too small to have much meat yield. Protecting the females will promote population growth, but this will occur only if sufficient numbers of large males are left in the population.

The amount of processing allowed will affect whether this alternative can be put into practice successfully. The most extreme hypothetical case would be if at-sea processing was eliminated, and only whole, male crabs could be landed. Resulting positive effects would include ability to monitor compliance with the male-only measure and protection of females and small males. In addition, this might limit the number of crabs taken per trip because the ships' storage areas would fill more quickly per capita of crab landed. In contrast, if processing at sea were allowed with only minor restrictions, then it would not be possible to monitor what was being landed or to protect females or smaller males.

Controlled access will limit the number of vessels harvesting red crab and make it easier to monitor total landings. Reporting requirements will also support this.

A limit on days-at-sea per vessel serves as the primary method of controlling fishing effort and catch. This will tend to spread out the effort, because each vessel in the fishery will be assured of a certain amount of time to fish. Spreading out the catch over time is probably less of a disturbance to the red crab population, especially to the mating system.

Incidental catch limits will prevent excessive red crab landings by vessels from other fisheries. Trap limits can limit catch rates and gear restrictions can allow small red crabs to escape from traps. A target TAC with reporting requirements for each trip will reduce the probability of overfishing.

Compared to Alternative #10, in what ways might this Alternative have a more negative effect on red crabs?

There are no conditions under which this alternative would be expected to have more negative effects on red crabs than Alternative 10.

5.4.5.2 Ecological Impacts of the Alternative on Other Species and Communities

There are no expected differences in the ecological impacts on other species or their communities between this management alternative and the first baseline, Alternative 1, the emergency action alternative. The only difference in the ecological impacts on other species or their communities expected between this management alternative and the second baseline, Alternative 10, the no action alternative, is that associated with the prohibition on all fishing gear types other than traps in the directed red crab fishery, which would be expected to confer benefits to other species and their communities by preventing the use of mobile gear such as otter trawls and dredges.

5.4.5.3 Impacts of the Alternative to Essential Fish Habitat

The relative impacts to essential fish habitat (EFH) of each management alternative under consideration are compared against those of two baselines: Alternative 1, the emergency action alternative, and Alternative 10, the no action alternative.

The only management measures under consideration with any potential relevance to impacts to the EFH of any managed species that may be associated with the directed red crab fishery are the proposed trap limits and the proposed gear restrictions. Both of these measures are proposed in this alternative as well as in Alternative 1, the emergency action baseline. Thus, there are no expected differences between this management alternative and the first baseline. The no action alternative, Alternative 10, by definition would not include any type of trap limit or gear restrictions. This alternative is less likely to result in any impacts to EFH than is the no action alternative, thus this alternative is expected to have a more positive effect on the EFH of managed species than would the second baseline.

5.4.5.4 Economic Impacts of the Alternative on the Fishery

Alternative 4 would implement many of the same measures as previous alternatives but the principle mechanism to control effort in the fishery would be the use of vessel days-at-sea (DAS). The objective of the alternative would be to allow the appropriate number of DAS to harvest, but not exceed, the target TAC. The effectiveness of this alternative is not directly dependent on the number of vessels participating, but on the calculation of the total number of days that would allow for the target catch to be landed. If the additional measures (especially trap limits) were not used as limiting factors, this alternative has potential to have one of the higher levels of net benefits, since it allows for the market to control production. As long as other measures are not introduced to effect the behavior of vessels, they will be able to maximize their outputs from a given level of inputs, assuming the biomass increases over time.

The potential OY for the fishery that would determine the TAC ranges from 1.254 to 7.904 million pounds. Using this range, we can calculate a range of possible DAS allocations, depending on MSY and fleet size. This range is 11 DAS per vessel if 17 vessels are fishing on a TAC of 1.254 million pounds, up to 296 DAS per vessel if only four vessels are fishing on a TAC of 7.904 million pounds. Given the uncertainty in the parameters, this range from 11 to 296 DAS illustrates the degree of flexibility that exists in the individual measures. We can assume that the actual DAS would be somewhere in the middle of the range.

The preferred alternative specifies an OY for the fishery of 5.928 million pounds. This would translate into 52 DAS per vessel if 17 vessels were fishing up to 222 DAS per vessel if only four vessels were fishing. If five vessels (or six) were fishing, the individual DAS allotted would be 178 (or 148). Given that the reported number of days absent among the red crab vessels varies from 200 to 300, we can assume that they would all have to cut back on their effort. Since DAS will be restrictive, they can make adjustments to their behavior to accommodate this change, by planning for other sources of income.

Controlled access will limit the participation of vessels harvesting red crab. From society's point of view, this means there is a reduction in the accumulation of excess capital and lower costs. Those other resources (who are not in the fishery) can be directed elsewhere. This alternative would allow greater continuity of effort and supplies to the market and avoids a negative response to short term fluctuations.

This alternative would prevent a derby fishery if the initial allocation of DAS is set correctly. The continuous annual adjustment in target TAC enables management of the resource to respond to changes in stock condition without a costly and timely management process. A high degree of flexibility is afforded to participants in the fishery concerning when and how long to fish. Processors will be assured of a steady supply of fresh product.

Since the calculation of DAS works from a target TAC, it provides less tight control over the level of catch than a hard TAC. Choosing the right number of days-at-sea to achieve the target TAC is more difficult if there are changes over time in fishing gear, hold capacity, or other fishing regulations (e.g., trip limits). The success of this alternative would depend on allowing the DAS to be the principle restriction, and on the careful calculation, and adjustment of the effort restriction.

The degree of processing allowed will affect whether vessels would have to change their current fishing behavior. If they were forced to modify their method of harvesting, it would add to their costs, and some vessels may no longer be profitable. Some may be forced out of the fishery. Not allowing processing at sea would certainly be dissuasive to the freezer/processor vessel owners, given the presumably higher fixed and variable costs associated with operation of larger vessels, processing facilities and the employment of additional crew. In contrast, if processing at sea were allowed with only minor restrictions, vessels would have the flexibility to continue their fishing, not affecting their costs. Other measures would have to be restrictive.

This alternative would prevent a rush to catch all remaining large males. Alternative 4 allows a more predictable level of supplies to market (retailers and consumers) and to the processors. The continuous annual adjustment in target TAC enables management of the resource to respond to changes in stock condition without costly and timely management process. A high degree of flexibility is afforded to participants in the fishery concerning when and how long to fish.

5.4.5.5 Social/Cultural Impacts of the Alternative

Compared to Alternative 1, in what ways might this alternative have a more positive social/cultural impact?

Butchering/processing restrictions are expected to have positive social impacts on the fishermen involved in the directed red crab fishery unless the most restrictive option, a total prohibition on all butchering and processing at sea, is selected. A controlled access system will provide positive social impacts on the vessels authorized to participate in the directed red crab fishery. Days-at-sea (DAS) limits are expected to provide positive social benefits to the fishermen involved in the directed red crab fishery by preventing a derby fishery and allowing them more flexibility and stability, while reducing uncertainty.

Compared to Alternative 1, in what ways might this alternative have a more negative social/cultural impact?

If the most restrictive option for butchering/processing restrictions is selected, this alternative has the potential to cause negative social impacts on some members of the directed red crab fishery. The controlled access system may have negative social impacts on the vessels excluded from participating in the directed red crab fishery. Depending upon the option selected and the level of the trip limit set for the directed red crab fishery, trip limits may be expected to have a positive social impact on members of the red crab fishery by mitigating some of the potential negative social impacts associated with a hard TAC. These potential negative social impacts will not be mitigated in Alternative 4, so it may have a more negative social impact than Alternative 1.

Compared to Alternative 10, in what ways might this alternative have a more positive social/cultural impact?

Butchering/processing restrictions are expected to have positive social impacts on the fishermen involved in the directed red crab fishery unless the most restrictive option, a total prohibition on all butchering and processing at sea, is selected. The gear requirements options offer potential social benefits, resulting from the proposed prohibition on all fishing gear other than traps. A controlled access system will provide positive social impacts on the vessels authorized to participate in the directed red crab fishery. Days-at-sea (DAS) limits are expected to provide positive social benefits to the fishermen involved in the directed red crab fishery by preventing a derby fishery and allowing them more flexibility and stability, while reducing uncertainty. Overall, implementing a management program for the red crab fishery that reduces the probability of overfishing and reduces the likelihood of the fishery becoming overcapitalized will have an overall positive effect on the social and cultural aspects of the fishery.

Compared to Alternative 10, in what ways might this alternative have a more negative social/cultural impact?

If the most restrictive option for butchering/processing restrictions is selected, this alternative has the potential to cause negative social impacts on some members of the directed red crab fishery. The controlled access system may have negative social impacts on the vessels excluded from participating in the directed red crab fishery.

5.4.5.6 Impacts of the Alternative on Protected Species

DAS has the benefit of reducing the possibility of derby fishing as vessels can spread out their effort through the season, although there is no limit on the amount of effort during the spring high use of the continental shelf edge by endangered large whales and the leatherback sea turtle. Trap limits are also beneficial for protected species as it caps the amount of gear that can be set for each vessel. Incidental catch limits will serve to limit growth of non-directed red crab fisheries such as offshore lobster along the continental shelf edge. The reporting requirement will provide additional information regarding the seasonal and area distribution of red crab fishing effort to allow managers to better assess the actual overlap of the fishery with protected species. The gear requirements proposed would not provide any additional protection beyond what is already provided under the MMPA regulations that implement the ALWTRP. The requirement for males only and the butchering/processing at-sea will not provide any protection for protected species.

Using DAS with a target TAC limits will provide adequate control on the growth of the fishery, thus curbing uncontrolled growth that would result in more fixed gear being set in high use waters for protected species, namely the endangered sperm whale and other odontocetes protected under the MMPA; as well as migratory or occasional foraging habitat for the endangered right, humpback, fin, blue and sei whales and the endangered leatherback sea turtle. Since the level of TAC, trap limits, and incidental catch limits are not yet chosen, we cannot assess the protected species effects with respect to Alternative 1. However, implementation of an effort-capping scheme will provide more protection than Alternative 10.

5.4.6 Alternative 5: Target TAC with Days-at-Sea and Trip Limits

This is the Council's preferred alternative. The preferred alternative (like Alternative 4) proposes to implement a set of management measures to control effort in the fishery primarily through the allocation of DAS to all vessels authorized to participate in the directed red crab fishery, with the addition of trip limits. Alternative 5 differs from Alternative 1 by including options for a male-only fishery, butchering/processing restrictions, a controlled access system and days-at-sea limits. Alternative 5 has a target TAC instead of the hard TAC in Alternative 1. Trip limits and days-at-sea are two measures for controlling fishing effort and fishing mortality. Alternative 10, the no action alternative, includes no management measures, so all the measures proposed in Alternative 5 differ from Alternative 10.

5.4.6.1 <u>Biological and Ecological Impacts of the Alternative on Red Crab</u>

Compared to Alternative #1, in what ways might this Alternative have a more positive effect on red crabs?

This has all the advantages of Alternative 4, plus with trip limits in place, recovery ratios associated with different amounts of processing can be used to constrain each trip to have roughly the same maximum number of crabs (i.e., place an upper limit on mortality per trip).

A trip limit and a limit on days-at-sea per vessel can serve along with the target TAC to control fishing effort, catch per trip, and annual catch. These will tend to spread out the effort, because each vessel in the fishery will be assured of a certain amount of time to fish (days-at-sea) and, assuming the trip limit is low enough, numerous trips will be necessary to land the target TAC. Spreading out the catch over time is probably less of a disturbance to the red crab population, especially to the mating system.

Compared to Alternative #1, in what ways might this Alternative have a more negative effect on red crabs?

The days-at-sea measure is a way of managing fishing effort to try to achieve the target TAC. The calculation of days-at-sea per vessel must be completed before the fishing year, and the calculation requires assumptions about the number of vessels, their average catch per trip, and the average days per trip. A further complication is that the days-at-sea for each red crab vessel might have to be estimated taking into account different types of vessels with different amounts of crab processing. Because the calculation of days-at-sea is indirect, the realized catch after one year using all the days-at-sea might over- or under-shoot the target TAC. This is different from a hard TAC, where the fishery closes as soon as the hard TAC is taken. It should be expected that if both a target TAC and days-at-sea are implemented, the target TAC will have to be adjusted each year to account for the previous year's difference between the realized and target catch. Choosing the right number of days-at-sea to achieve the target TAC is more difficult if there are changes over time in fishing gear, hold capacity, or other fishing regulations (e.g., trip limits).

Compared to Alternative #10, in what ways might this Alternative have a more positive effect on red crabs?

This has all the advantages of Alternative 4, plus with trip limits in place, recovery ratios associated with different amounts of processing can be used to constrain each trip to have roughly the same maximum number of crabs (i.e., place an upper limit on mortality per trip).

A trip limit and a limit on days-at-sea per vessel can serve along with the target TAC to control fishing effort, catch per trip, and annual catch. These will tend to spread out the effort, because each vessel in the fishery will be assured of a certain amount of time to fish (days-at-sea) and, assuming the trip limit is low enough, numerous trips will be necessary to land the target TAC. Spreading out the catch over time is probably less of a disturbance to the red crab population, especially to the mating system.

Compared to Alternative #10, in what ways might this Alternative have a more negative effect on red crabs?

There are no conditions under which this alternative would be expected to have more negative effects on red crabs than Alternative 10.

5.4.6.2 Ecological Impacts of the Alternative on Other Species and Communities

There are no expected differences in the ecological impacts on other species or their communities between this management alternative and the first baseline, Alternative 1, the emergency action alternative. The only difference in the ecological impacts on other species or their communities expected between this management alternative and the second baseline, Alternative 10, the no action alternative, is that associated with the prohibition on all fishing gear types other than traps in the directed red crab fishery, which would be expected to confer benefits to other species and their communities by preventing the use of mobile gear such as otter trawls and dredges.

5.4.6.3 Impacts of the Alternative to Essential Fish Habitat

The relative impacts to essential fish habitat (EFH) of each management alternative under consideration are compared against those of two baselines: Alternative 1, the emergency action alternative, and Alternative 10, the no action alternative.

The only management measures under consideration with any potential relevance to impacts to the EFH of any managed species that may be associated with the directed red crab fishery are the proposed trap limits and the proposed gear restrictions. Both of these measures are proposed in this alternative as well as in Alternative 1, the emergency action baseline. Thus, there are no expected differences between this management alternative and the first baseline. The no action alternative, Alternative 10, by definition would not include any type of trap limit or gear restrictions. This alternative is less likely to result in any impacts to EFH than is the no action alternative, thus this alternative is expected to have a more positive effect on the EFH of managed species than would the second baseline.

5.4.6.4 Economic Impacts of the Alternative on the Fishery

The preferred alternative would be exactly the same as the previous alternative, with the addition of differential trip limits. It trip limits were equal across all vessels, it would force each trip taken by a red crab vessel to be roughly equivalent. Equal trip limits would again contribute to inefficiency in the red crab fleet, restricting some vessels more than others. This could lead to dissatisfaction and disruption of the relationship that exists among members of the red crab fleet. If the calculation of days at sea is accurate, this measure should not be necessary. Because there is likely to be some unknown margin of error in the calculation of DAS to be allocated to each vessel, a trip limit can serve as an additional control on fishing effort. One justification for inclusion of the trip limits into the preferred alternative was so that the transition between the emergency action period and the implementation of the final FMP would be smooth. Due to the administrative burden of implementing a DAS program, there would be a short lapse in time before the complete FMP was implemented, whereas the trip limit could take effect with the initial implementation of the FMP. A target TAC should not promote a derby fishery. The calculation of DAS can be adjusted on an annual basis in response to changing stock conditions and better data. This will result in better estimates of the amount of fish likely to be harvested and more accurate allocation of DAS to meet the objectives.

Differential trip limits will be based on each vessel's highest trip on record prior to the control date. This form of trip limit constitutes a limit on fleet capacity, without creating vessel safety concerns. It also allows each vessel to operate in the most economical way, while still enforcing restraint. Under the preferred alternative, each qualifying vessel will maintain their same competitive position relative to each other, and the total fleet will be constrained to meet the conservation objectives.

Since the calculation of DAS works from a target TAC, it provides less tight control over the level of catch than a hard TAC. Choosing the right number of days-at-sea to achieve the target TAC is more difficult if there are changes over time in fishing gear, hold capacity, or other fishing regulations (e.g., trip limits). Under the preferred alternative, the use of differential trip limits, versus equal trip limits, will allow for the benefits of an effort reduction program to occur.

Data would be gathered which would enable future management actions to use more comprehensive, reliable, and timely information on the fishery. This alternative would prevent a derby fishery, and allows a more predictable level of supplies to market (retailers and consumers) and to the processors.

5.4.6.5 Social/Cultural Impacts of the Alternative

Compared to Alternative 1, in what ways might this alternative have a more positive social/cultural impact?

The positive effects of this alternative compared to Alternative 1 are the same as for Alternative 4.

Compared to Alternative 1, in what ways might this alternative have a more negative social/cultural impact?

The negative effects of this alternative compared to Alternative 1 are the same as for Alternative 4, with the exception of those impacts associated with trip limits.

Compared to Alternative 10, in what ways might this alternative have a more positive social/cultural impact?

The positive effects of this alternative compared to Alternative 10 are the same as for Alternative 4 with the addition of trip limits which may be expected to have a positive social impact on members of the red crab fishery by mitigating some of the potential negative social impacts associated with a hard TAC.

Compared to Alternative 10, in what ways might this alternative have a more negative social/cultural impact?

The negative effects of this alternative compared to Alternative 10 are the same as for Alternative 4.

5.4.6.6 Impacts of the Alternative on Protected Species

DAS and trip limits have the benefit of reducing the possibility of derby fishing as vessels can spread out their effort through the season, although there is no limit on the amount of effort during the spring high use of the continental shelf edge by endangered large whales and the leatherback sea turtle. The incidental catch limit set at 500 pounds will serve to limit growth of non-directed red crab fisheries such as the offshore lobster fishery along the continental shelf edge. Establishing a limit of 600 traps is also beneficial for protected species as it caps the amount of gear that can be set for each vessel at current levels. The reporting requirement will provide additional information regarding the seasonal and area distribution of red crab fishing effort to allow managers to better assess the actual overlap of the fishery with protected species. The gear requirements proposed would not provide any additional protection beyond what is already provided under the MMPA regulations that implement the ALWTRP, except for the buoy marking requirement that will assist in identification of gear retrieved in an entanglement. The requirement for males only and the prohibition on processing at-sea will not provide any additional protection for protected species.

Adding the combination of a 75,000 pound trip limit to a DAS allocation between 130 and 160, with a target TAC of 5,928,000 pounds (1999 level), should provide adequate control on the growth of the fishery. Uncontrolled growth that would result in more fixed gear being set in high use waters for protected species was seen as detrimental to the endangered sperm whale and other odontocetes protected under the MMPA, as well as migratory or occasional foraging habitat for the endangered right, humpback, fin, blue and sei whales and the endangered leatherback sea turtle.

The level of TAC will vary depending on resource status and previous landings, and the trap limits will be set at the same level as the emergency regulations. Although the incidental catch limit will be higher than in the emergency regulations, the overall benefit to protected species should be the same or greater than Alternative 1 due to the effect of DAS mitigating the derby fishing affect upon the season opening on March 1. Implementation of the preferred alternative will provide more protection than Alternative 10.

5.4.7 Alternative 6: Trip Limits with Authorized Number of Trips

This non-preferred alternative proposed to implement a set of management measures to control effort in the fishery through the use of a selective trip limit program and an authorized number of annual fishing trips for each vessel authorized to participate in the directed red crab fishery. Alternative 6 differs from Alternative 1 by including options for a male-only fishery, butchering/processing restrictions, and a controlled access system, but does not include options for a TAC. Alternative 10, the no action alternative, includes no management measures, so all the measures proposed in Alternative 6 differ from Alternative 10.

5.4.7.1 Biological and Ecological Impacts of the Alternative on Red Crab

Compared to Alternative #1, in what ways might this Alternative have a more positive effect on red crabs?

By limiting the landings to males, females will be protected from direct fishing mortality. Females still might incur high handling mortality. We do not know how high handling mortality is, so traps should be designed to reduce the capture of crabs that must be returned or that are too small to have much meat yield. Protecting the females will promote population growth, but this will occur only if sufficient numbers of large males are left in the population.

The amount of processing allowed will affect whether this alternative can be put into practice successfully. The most extreme hypothetical case would be if at-sea processing was eliminated, and only whole, male crabs could be landed. Resulting positive effects would include the ability to monitor compliance with the male-only measure and protection of females and small males. In addition, this might limit the number of crabs taken per trip because the ships' storage areas would fill more quickly per capita of crab landed. In contrast, if processing at sea were allowed with only minor restrictions, then it would not be possible to monitor what was being landed or to protect females or smaller males.

Controlled access will limit the number of vessels harvesting red crab and make it easier to monitor landings. Reporting requirements will also support monitoring and enforcement. If the number of trips allowed is computed correctly, then the annual catch should not exceed the annual catch that would be achieved with a hard TAC. In fact, the total catch under this option is likely to be less than what would occur with a hard TAC. Using the regulations under the emergency period as an example, the fishery operated under a trip limit and a hard TAC. NMFS tracked per trip landings using the required interactive voice reporting (IVR) system and developed projections as to when the fishery was likely to reach the TAC based on current landings. Using this process, NMFS determined that the fishery would reach the emergency period TAC on or shortly after August 17, 2001. On August 8, NMFS announced that the fishery would be closed as of August 17 (the earliest the projections indicated the TAC would be reached). By the time the fishery closed on August 17, however, the red crab fishery had landed 2.84 million pounds, a 13.6% overage.

Under the allocated number of trips program, vessels would have a trip limit and a limited number of fishing trips to take during the fishing year. The full target yield would only be reached if all vessels landed 100% of the trip limit on all trips and took all trips allocated to them. Again, using the emergency period as an example to suggest why this may be unlikely, the results of the per trip landings indicate that 21% of all trips landed less than 75% of the trip limit, 36.5% of the trips landed less than 90% of the trip limit, and over half (54%) landed less than 95% of the trip limit. If we assume that the total number of trips made (52) had been the total allocated and that this number of trips in conjunction with the 65,000 pound trip limit combined to represent the target yield for the fishery (3.38 million pounds), then the fishery would only have landed 84% of the target yield. This suggests that this management approach (trip limits and an allocated number of trips per vessel) is a more conservative approach to managing the fishery at or near target yield levels than a hard TAC approach (total landings = 16% *under* the TAC versus 13.6% *over* the TAC).

With trip limits in place, recovery ratios associated with different amounts of processing can be used to constrain each trip to have roughly the same maximum number of crabs (i.e., place an upper limit on mortality per trip). The trip limit can work along with the butchering/processing restriction and the male-only requirement to limit the size range, sex and number of red crabs that are landed per trip. This combination of measures will spread the catch out across seasons (reduce the derby-type fishery), limit the catch to large males which should allow females to continue reproducing, and allow the catch to be monitored for stock assessment.

Compared to Alternative #1, in what ways might this Alternative have a more negative effect on red crabs?

Without a hard TAC there will be no direct way to stop harvesting if the landings exceed the estimated long term annual yield (MSY). This alternative relies on other measures (e.g., number of trips, trip limits, males only, processing restrictions) to slow down the landings taken during the year. It may be difficult to correctly estimate the number of trips per vessel, especially if there are different classes of vessels with different amounts of processing.

Compared to Alternative #10, in what ways might this Alternative have a more positive effect on red crabs?

By limiting the landings to males, females will be protected from direct fishing mortality. Females still might incur high handling mortality. We do not know how high handling mortality is, so traps should be designed to reduce the capture of crabs that must be returned or that are too small to have much meat yield. Protecting the females will promote population growth, but this will occur only if sufficient numbers of large males are left in the population.

The amount of processing allowed will affect whether this alternative can be put into practice successfully. The most extreme hypothetical case would be if at-sea processing was eliminated, and only whole, male crabs could be landed. Resulting positive effects would include the ability to monitor compliance with the male-only measure and protection of females and small males. In addition, this might limit the number of crabs taken per trip because the ships' storage areas would fill more quickly per capita of crab landed. In contrast, if processing at sea were allowed with only minor restrictions, then it would not be possible to monitor what was being landed or to protect females or smaller males.

With trip limits in place, recovery ratios associated with different amounts of processing can be used to constrain each trip to have roughly the same maximum number of crabs (i.e., place an upper limit on mortality per trip).

Controlled access will limit the number of vessels harvesting red crab and make it easier to monitor landings. Reporting requirements will also support this. If the number of trips allowed is computed correctly, then the annual catch should not exceed the annual catch that would be achieved with a hard TAC.

The trip limit can work along with the butchering/processing restriction and the male-only requirement to limit the size range, sex and number of red crabs that are landed per trip. This combination of measures will spread the catch out across seasons (reduce the derby-type fishery), limit the catch to large males which should allow females to continue reproducing, and allow the catch to be monitored for stock assessment.

Incidental catch limits will prevent excessive red crab landings by vessels from other fisheries. Trap limits can limit catch rates and gear restrictions can allow small red crabs to escape from traps. Reporting requirements for each trip will allow the catch to be monitored accurately during the year.

Compared to Alternative #10, in what ways might this Alternative have a more negative effect on red crabs?

There are no conditions under which this alternative would be expected to have more negative effects on red crabs than Alternative 10.

5.4.7.2 Ecological Impacts of the Alternative on Other Species and Communities

There are no expected differences in the ecological impacts on other species or their communities between this management alternative and the first baseline, Alternative 1, the emergency action alternative. The only difference in the ecological impacts on other species or their communities expected between this management alternative and the second baseline, Alternative 10, the no action alternative, is that associated with the prohibition on all fishing gear types other than traps in the directed red crab fishery, which would be expected to confer benefits to other species and their communities by preventing the use of mobile gear such as otter trawls and dredges.

5.4.7.3 Impacts of the Alternative to Essential Fish Habitat

The relative impacts to essential fish habitat (EFH) of each management alternative under consideration are compared against those of two baselines: Alternative 1, the emergency action alternative, and Alternative 10, the no action alternative.

The only management measures under consideration with any potential relevance to impacts to the EFH of any managed species that may be associated with the directed red crab fishery are the proposed trap limits and the proposed gear restrictions. Both of these measures are proposed in this alternative as well as in Alternative 1, the emergency action baseline. Thus, there are no expected differences between this management alternative and the first baseline. The no action alternative, Alternative 10, by definition would not include any type of trap limit or gear restrictions. This alternative is less likely to result in any impacts to EFH than is the no action alternative, thus this alternative is expected to have a more positive effect on the EFH of managed species than would the second baseline.

5.4.7.4 Economic Impacts of the Alternative on the Fishery

Alternative 6 would also implement many of the same measures as previous alternatives, but the principle mechanism to control effort in the fishery would be the use of a specified trip limit and an authorized number of potential fishing trips. The trip limit could be set equal for all vessels, or could allow vessels to declare into a certain category of trip limit. Vessels would be authorized different numbers of potential trips depending on the trip limit category into which they declare.

Vessels would be able to know, up front, what they could land per trip and how many trips they could take. Individual vessels would have the opportunity to plan for alternative sources of revenue. Even though a TAC is not specified for this alternative, the calculation of number of trips and a trip limit would have to take the total catch into account. Depending on the level of the trip limit, it could restrict vessels to operate in a very inefficient manner. Slightly better, differential trip limits may allow one class of vessels to take advantage of their increased hold capacity. It would allow larger vessels to participate at a higher level of landings. Depending on the number of vessels allowed to participate, each vessel could end up with a trip limit and number of trips that may make it unprofitable to participate in the fishery. Individual vessel revenues would be dependent on these factors.

Controlled access will limit the participation of vessels harvesting red crab. From society's point of view, this means there is a reduction in the accumulation of excess capital and lower costs. Those other resources (who are not in the fishery) can be directed elsewhere.

Trip limits would not be as restrictive as under Alternative 1 for some vessels under the differential trip limit option. This alternative would allow different size classes of vessels to participate at levels more appropriate for them. Vessels would know up front how many trips they could take and could plan their fishing activity accordingly.

There may be administrative problems associated with the implementation of this alternative. It will be difficult to correctly estimate the number of trips per vessel, especially if there are different classes of vessels with different amounts of processing.

5.4.7.5 Social/Cultural Impacts of the Alternative

Compared to Alternative 1, in what ways might this alternative have a more positive social/cultural impact?

Butchering/processing restrictions are expected to have positive social impacts on the fishermen involved in the directed red crab fishery unless the most restrictive option, a total prohibition on all butchering and processing at sea, is selected. A controlled access system will provide positive social impacts on the vessels authorized to participate in the directed red crab fishery. The lack of a TAC for this alternative eliminates the potential negative social impacts associated with this type of measure, principally the creation of a derby-style fishery.

Compared to Alternative 1, in what ways might this alternative have a more negative social/cultural impact?

If the most restrictive option for butchering/processing restrictions is selected, this alternative has the potential to cause negative social impacts on some members of the directed red crab fishery. The controlled access system may have negative social impacts on the vessels excluded from participating in the directed red crab fishery. There are no other conditions under which Alternative 6 would be expected to have more negative social or cultural impacts than Alternative 1.

Compared to Alternative 10, in what ways might this alternative have a more positive social/cultural impact?

Butchering/processing restrictions are expected to have positive social impacts on the fishermen involved in the directed red crab fishery unless the most restrictive option, a total prohibition on all butchering and processing at sea, is selected. The gear requirements options offer potential social benefits, resulting from the proposed prohibition on all fishing gear other than traps. A controlled access system will provide positive social impacts on the vessels authorized to participate in the directed red crab fishery. Overall, implementing a management program for the red crab fishery that reduces the probability of overfishing and reduces the likelihood of the fishery becoming overcapitalized will have an overall positive effect on the social and cultural aspects of the fishery.

Compared to Alternative 10, in what ways might this alternative have a more negative social/cultural impact?

If the most restrictive option for butchering/processing restrictions is selected, this alternative has the potential to cause negative social impacts on some members of the directed red crab fishery. The controlled access system may have negative social impacts on the vessels excluded from participating in the directed red crab fishery.

5.4.7.6 <u>Impacts of the Alternative on Protected Species</u>

Controlling both the number of trips and the amount of catch per trip would cap the effort, but does not limit the amount of effort during the spring high use of the continental shelf edge by endangered large whales and the leatherback sea turtle. Trap limits are also beneficial for protected species as it caps the amount of gear that can be set for each vessel. Incidental catch limits will serve to limit growth of non-directed red crab fisheries such as offshore lobster along the continental shelf edge. The reporting requirement will provide additional information regarding the seasonal and area distribution of red crab fishing effort to allow managers to better assess the actual overlap of the fishery with protected species. The gear requirements proposed would not provide any additional protection beyond what is already provided under the MMPA regulations that implement the ALWTRP. The requirement for males only and the processing at sea restrictions will not provide any protection for protected species.

Trip limits by themselves will provide adequate control on the growth of the fishery, thus curbing uncontrolled growth that would result in more fixed gear being set in high use waters for protected species, namely the endangered sperm whale and other odontocetes protected under the MMPA; as well as migratory or occasional foraging habitat for the endangered right, humpback, fin, blue and sei whales and the endangered leatherback sea turtle. Since the level of TAC, trip limits, trap limits, and incidental catch limits are not yet chosen, we cannot assess the protected species effects with respect to Alternative 1. However, implementation of an effort-capping scheme will provide more protection than Alternative 10.

5.4.8 Alternative 7: All Possible Measures

This non-preferred alternative proposed to implement a set of management measures to control effort in the fishery by including all possible management measures with the exception of an IVQ system. Alternative 7 differs from Alternative 1 by including options for a minimum size, a male-only fishery, butchering/processing restrictions, a controlled access system and days-at-sea limits. Trip limits and days-at-sea are two measures for controlling fishing effort and fishing mortality. Minimum size and males-only are ways of controlling what segment of the population is exposed to fishing mortality. Alternative 10, the no action alternative, includes no management measures, so all the measures proposed in Alternative 7 differ from Alternative 10.

5.4.8.1 Biological and Ecological Impacts of the Alternative on Red Crab

Compared to Alternative #1, in what ways might this Alternative have a more positive effect on red crabs?

By limiting the landings to large males, females and small males will be protected from direct fishing mortality. Females and small males still might incur high handling mortality. We do not know how high handling mortality is, so traps should be designed to reduce the capture of crabs that must be returned or that are too small to have much meat yield. Protecting the females will promote population growth, but this will occur only if sufficient numbers of reproductive males are left in the population.

The amount of processing allowed will affect whether this alternative can be put into practice successfully. The most extreme hypothetical case would be if at-sea processing was eliminated, and only whole, large, male crabs could be landed. Resulting positive effects would include the ability to monitor compliance with the size and male-only measure and protection of females and small males. In addition, this might limit the number of crabs taken per trip because the ships' storage areas would fill more quickly per capita of crab landed. In contrast, if processing at sea were allowed with only minor restrictions, then it would not be possible to monitor what was being landed or to protect females or smaller males.

With trip limits in place, recovery ratios associated with different amounts of processing could be used to constrain each trip to have roughly the same maximum number of large, male crabs (i.e., place an upper limit on mortality per trip). Controlled access will limit the number of vessels harvesting red crab and make it easier to monitor and enforce the TAC. Reporting requirements will also support this.

A trip limit and a limit on days-at-sea per vessel can serve along with the hard TAC to control fishing effort, catch per trip, and annual catch. These will tend to spread out the effort, because each vessel in the fishery will be assured of a certain amount of time to fish (days-at-sea) and, assuming the trip limit is low enough, numerous trips will be necessary to land the TAC. Spreading out the catch over time is probably less of a disturbance to the red crab population, especially to the mating system.

If a hard TAC were in place along with days-at-sea and trip limits, then there would be little chance that the actual landings would overshoot the TAC. Without a minimum size limit, as is included in this alternative, removing too many large males from the population could disturb courtship and mating (Elner et al. 1987), which may reduce female fecundity. Imposing a minimum size limit would be the most direct way to maintain males that are capable of mating with the largest females.

Compared to Alternative #1, in what ways might this Alternative have a more

negative effect on red crabs?

There are no conditions under which this alternative would have a more negative effect on red crabs than Alternative 1.

Compared to Alternative #10, in what ways might this Alternative have a more positive effect on red crabs?

By limiting the landings to large males, females and small males will be protected from direct fishing mortality. Females and small males still might incur high handling mortality. We do not know how high handling mortality is, so traps should be designed to reduce the capture of crabs that must be returned or that are too small to have much meat yield. Protecting the females will promote population growth, but this will occur only if sufficient numbers of reproductive males are left in the population.

The amount of processing allowed will affect whether this alternative can be put into practice successfully. The most extreme hypothetical case would be if at-sea processing was eliminated, and only whole, large, male crabs could be landed. Resulting positive effects would include ability to monitor compliance with the size and male-only measure and protection of females and small males. In addition, this might limit the number of crabs taken per trip because the ships' storage areas would fill more quickly per capita of crab landed. In contrast, if processing at sea were allowed with only minor restrictions, then it would not be possible to monitor what was being landed or to protect females or smaller males.

With trip limits in place, recovery ratios associated with different amounts of processing could be used to constrain each trip to have roughly the same maximum number of large, male crabs (i.e., place an upper limit on mortality per trip). Controlled access will limit the number of vessels harvesting red crab and make it easier to monitor and enforce the TAC. Reporting requirements will also support this.

A trip limit and a limit on days-at-sea per vessel can serve along with the hard TAC to control fishing effort, catch per trip, and annual catch. These will tend to spread out the effort, because each vessel in the fishery will be assured of a certain amount of time to fish (days-at-sea) and, assuming the trip limit is low enough, numerous trips will be necessary to land the TAC. Spreading out the catch over time is probably less of a disturbance to the red crab population, especially to the mating system.

If a hard TAC were in place along with days-at-sea and trip limits, then there would be little chance that the actual landings would overshoot the TAC. Incidental catch limits will prevent excessive red crab landings by vessels from other fisheries. Trap limits can limit catch rates and gear restrictions can allow small red crabs to escape from traps. A TAC with reporting requirements for each trip will reduce the probability of overfishing.

Compared to Alternative #10, in what ways might this Alternative have a more negative effect on red crabs?

There are no conditions under which this alternative would be expected to have more negative effects on red crabs than Alternative 10.

5.4.8.2 Ecological Impacts of the Alternative on Other Species and Communities

There are no expected differences in the ecological impacts on other species or their communities between this management alternative and the first baseline, Alternative 1, the emergency action alternative. The only difference in the ecological impacts on other species or their communities expected between this management alternative and the second baseline, Alternative 10, the no action alternative, is that associated with the prohibition on all fishing gear types other than traps in the directed red crab fishery, which would be expected to confer benefits to other species and their communities by preventing the use of mobile gear such as otter trawls and dredges.

5.4.8.3 Impacts of the Alternative to Essential Fish Habitat

The relative impacts to essential fish habitat (EFH) of each management alternative under consideration are compared against those of two baselines: Alternative 1, the emergency action alternative, and Alternative 10, the no action alternative.

The only management measures under consideration with any potential relevance to impacts to the EFH of any managed species that may be associated with the directed red crab fishery are the proposed trap limits and the proposed gear restrictions. Both of these measures are proposed in this alternative as well as in Alternative 1, the emergency action baseline. Thus, there are no expected differences between this management alternative and the first baseline. The no action alternative, Alternative 10, by definition would not include any type of trap limit or gear restrictions. This alternative is less likely to result in any impacts to EFH than is the no action alternative, thus this alternative is expected to have a more positive effect on the EFH of managed species than would the second baseline.

5.4.8.4 Economic Impacts of the Alternative on the Fishery

Alternative 7 includes all possible management measures except for an IVQ system. This alternative relies on so many different measures, it is difficult to determine the degree of impact from any one measure and therefore be difficult to adjust to changing stock conditions. The effectiveness of a days-at-sea program is greater if other measures are not also used to undermine its effectiveness. Many of these measures would make it inefficient to operate in the fishery, raising costs, without the benefit of additional revenue. If all measures are used as a way to limit catch or effort, the entire fleet would operate inefficiently; the increased costs would be passed on to the consumer and no one would benefit. If all of the measures of Alternative 7 are not constraining to the behavior of the fleet, then this alternative would have economic benefits similar to those of the preferred alternative. With all options constraining, this alternative would be very difficult to enforce, as well as costly and difficult to administer.

Compared to Alternatives 1 and 10, the only positive economic effect is due to controlled access. From society's point of view, this means there is a reduction in the accumulation of excess capital and lower costs. Those other resources (who are not in the fishery) can be directed elsewhere. Alternative 1 would also gather data which would enable future management actions to use more comprehensive, reliable, and timely information on the fishery. Historic participants may be able to remain in the fishery, even if they have to operate in a less efficient manner.

Alternative 7 includes all options from the preferred alternative with the addition of a minimum size. Public comments supported the idea that market control over the minimum size of red crabs is adequate to prevent the landings of small crabs. If that situation is believed to change, then future frameworks can implement a minimum size.

5.4.8.5 Social/Cultural Impacts of the Alternative

Compared to Alternative 1, in what ways might this alternative have a more positive social/cultural impact?

Butchering/processing restrictions are expected to have positive social impacts on the fishermen involved in the directed red crab fishery unless the most restrictive option, a total prohibition on all butchering and processing at sea, is selected. A controlled access system will provide positive social impacts on the vessels authorized to participate in the directed red crab fishery. Days-at-sea (DAS) limits are expected to provide positive social benefits to the fishermen involved in the directed red crab fishery by preventing a derby fishery and allowing them more flexibility and stability, while reducing uncertainty.

Compared to Alternative 1, in what ways might this alternative have a more negative social/cultural impact?

If the most restrictive option for butchering/processing restrictions is selected, this alternative has the potential to cause negative social impacts on some members of the directed red crab fishery. The controlled access system may have negative social impacts on the vessels excluded from participating in the directed red crab fishery. There are no other conditions under which Alternative 7 would be expected to have more negative social or cultural impacts than Alternative 1.

Compared to Alternative 10, in what ways might this alternative have a more positive social/cultural impact?

Butchering/processing restrictions are expected to have positive social impacts on the fishermen involved in the directed red crab fishery unless the most restrictive option, a total prohibition on all butchering and processing at sea, is selected. The gear requirements options offer potential social benefits, resulting from the proposed prohibition on all fishing gear other than traps. A controlled access system will provide positive social impacts on the vessels authorized to participate in the directed red crab fishery. DAS limits are expected to provide positive social benefits to the fishermen involved in the directed red crab fishery by preventing a derby fishery and allowing them more flexibility and stability, while reducing uncertainty. Overall, implementing a management program for the red crab fishery that reduces the probability of overfishing and reduces the likelihood of the fishery becoming overcapitalized will have an overall positive effect on the social and cultural aspects of the fishery.

Compared to Alternative 10, in what ways might this alternative have a more negative social/cultural impact?

If the most restrictive option for butchering/processing restrictions is selected, this alternative has the potential to cause negative social impacts on some members of the directed red crab fishery. The controlled access system may have negative social impacts on the vessels excluded from participating in the directed red crab fishery.

5.4.8.6 Impacts of the Alternative on Protected Species

Using all the possible measures will provide adequate control on the growth of the fishery, thus curbing uncontrolled growth that would result in more fixed gear being set in high use waters for protected species, namely the endangered sperm whale and other odontocetes protected under the MMPA; as well as migratory or occasional foraging habitat for the endangered right, humpback, fin, blue and sei whales and the endangered leatherback sea turtle. Trap limits are also beneficial for protected species as it caps the amount of gear that can be set for each vessel. However, these measures do not limit the amount of effort during the spring high use of the continental shelf edge by endangered large whales and the leatherback sea turtle. Incidental catch limits will serve to limit growth of non-directed red crab fisheries such as offshore lobster along the continental shelf edge. The reporting requirement will provide additional information regarding the seasonal and area distribution of red crab fishing effort to allow managers to better assess the actual overlap of the fishery with protected species. The gear requirements proposed would not provide any additional protection beyond what is already provided under the MMPA regulations that implement the ALWTRP. The requirement for males only and the butchering/processing at-sea will not provide any protection for protected species.

Since the level of TAC, DAS scheme to be used, trip limits, trap limits, and incidental catch limits are not yet chosen, we cannot assess the protected species effects with respect to Alternative 1. However, implementation of an effort-capping scheme will provide more protection than Alternative 10.

5.4.9 Alternative 8: IVQ with Controlled Access

This non-preferred alternative proposed to implement a set of management measures to control effort in the fishery primarily through a specific allocation of quota to each vessel authorized to participate in the directed red crab fishery through the controlled access program. Alternative 8 differs from Alternative 1 by including options for a controlled access system and an individual vessel quota (IVQ) system, but does not include options for trap limits, a TAC, or trip limits. Unlike previous alternatives, this one has no restrictions about crab size or gender, trip limits or days-at-sea. Alternative 10, the no action alternative, includes no management measures, so all the measures proposed in Alternative 8 differ from Alternative 10.

5.4.9.1 Biological and Ecological Impacts of the Alternative on Red Crab

Compared to Alternative #1, in what ways might this Alternative have a more positive effect on red crabs?

Controlled access will limit the number of vessels harvesting red crab and make it easier to monitor and enforce the individual vessel quotas, whose sum would be equivalent to a hard TAC. Reporting requirements will also support this. With individual quotas, vessels are less likely to harvest in the manner of a fishing derby. This could reduce the risk that the fishery would disturb the red crab mating process.

Compared to Alternative #1, in what ways might this Alternative have a more negative effect on red crabs?

Any size or gender may be harvested. Without measures to limit what types of crabs may be harvested, the population sex ratio and mating system could become perturbed, which could reduce mating success. Imposing a minimum size limit would be the most direct way to maintain males that are capable of mating with the largest females in the population.

There are no restrictions on processing, but it would be consistent with the other alternatives to utilize recovery ratios to convert processed weights into whole weights. If extensive processing were allowed at sea, it would not be possible to monitor what was being landed or to protect females or smaller males.

Without trip limits, vessels could potentially make much larger catches during a single trip. Removal of a large number of large crabs at a single time might reduce population growth rate more than if the catch was more spread out over time and space.

Compared to Alternative #10, in what ways might this Alternative have a more positive effect on red crabs?

Controlled access will limit the number of vessels harvesting red crab and make it easier to monitor and enforce the individual vessel quotas, whose sum would be equivalent to a hard TAC. Reporting requirements will also support this. With individual quotas, vessels are less likely to harvest in the manner of a fishing derby. This could reduce the risk that the fishery would disturb the red crab mating process.

Incidental catch limits will prevent excessive red crab landings by vessels from other fisheries. Gear restrictions can allow small red crabs to escape from traps. Reporting requirements for each trip will allow total landings to be monitored.

Compared to Alternative #10, in what ways might this Alternative have a more negative effect on red crabs?

There are no conditions under which this alternative would be expected to have more negative effects on red crabs than Alternative 10.

5.4.9.2 Ecological Impacts of the Alternative on Other Species and Communities

There are no expected differences in the ecological impacts on other species or their communities between this management alternative and the first baseline, Alternative 1, the emergency action alternative. The only difference in the ecological impacts on other species or their communities expected between this management alternative and the second baseline, Alternative 10, the no action alternative, is that associated with the prohibition on all fishing gear types other than traps in the directed red crab fishery, which would be expected to confer benefits to other species and their communities by preventing the use of mobile gear such as otter trawls and dredges.

5.4.9.3 Impacts of the Alternative to Essential Fish Habitat

The relative impacts to essential fish habitat (EFH) of each management alternative under consideration are compared against those of two baselines: Alternative 1, the emergency action alternative, and Alternative 10, the no action alternative.

The only management measures under consideration with any potential relevance to impacts to the EFH of any managed species that may be associated with the directed red crab fishery are the proposed trap limits and the proposed gear restrictions. Both of these measures would be proposed in the first baseline, Alternative 1, the emergency action alternative, but only the gear restrictions are proposed in this alternative. Due to the nature of the proposed IVQ system, there is no need to implement any type of trap limit in the red crab fishery. This difference could result in an increase in the number of traps employed in the fishery under this alternative compared to the number of traps that would be employed if trip limits were also implemented. Thus, from the perspective of potential impacts to EFH, this alternative would be expected to have potentially more impact than the first baseline.

The no action alternative, Alternative 10, by definition would not include any type of trap limit or gear restrictions. Because it proposes to implement some form of gear restrictions, including a prohibition on the use of non-trap gear in the directed red crab fishery, this alternative is less likely to result in any impacts to EFH than is the no action alternative. This alternative is expected to have a more positive effect on the EFH of managed species than would the second baseline.

5.4.9.4 Economic Impacts of the Alternative on the Fishery

The next two management alternatives represent options for a form of an IFQ system called an individual vessel quota (IVQ). Alternative 8 would implement both a controlled access system to limit the number of vessels participating in the directed fishery and an individual vessel quota to allocate each vessel an individual percentage based share of the TAC. As the TAC changed from year to year in response to changing stock conditions, the percentage of quota allocated to each vessel would not change, but the amount of quota would change accordingly.

This alternative would provide tighter control over each year's catch than would the control of inputs. Vessels would be able to operate at their peak efficiency, selecting the least cost combination of inputs. A great degree of freedom and flexibility would be granted to the individual vessel. The supply of red crabs would be consistent throughout the year, maintaining a constant supply to processors, retailers, and consumers.

Controlled access will limit the number of vessels harvesting red crab and make it easier to monitor and enforce the individual vessel quotas, whose sum would be equivalent to a hard TAC. From society's point of view, this means there is a reduction in the accumulation of excess capital and lower costs. Those other resources (who are not in the fishery) can be directed elsewhere. Trip revenue would increase as there would be no limits on the amount of crab landed per trip. Vessels could operate to their full potential and utilize their hold capacity. With individual quotas, vessels are not likely to harvest in the manner of a fishing derby. Data would be gathered which would enable future management actions to use more comprehensive, reliable, and timely information on the fishery.

This alternative would shift a substantial part of the management to a market mechanism, since it eliminates some of the gear, vessels, and processing restrictions that are a greater burden to enforce. This alternative should encourage technological development and innovation. Vessels participating in the directed fishery would have the freedom to choose the most appropriate fishing methods (aside from gear restrictions), fishing times, and strategies.

High-grading could be a problem, although this would be expected to be minimal given the market constraints that already exist in the fishery. The creation of use rights means that some gain and some lose; this creates a redistribution of wealth and has equity implications.

5.4.9.5 Social/Cultural Impacts of the Alternative

Compared to Alternative 1, in what ways might this alternative have a more positive social/cultural impact?

There are some cases of trap limits that may have an adverse social impact on the red crab fishery, and since this alternative does not include trap limits, this potential negative impact is eliminated. A controlled access system will provide positive social impacts on the vessels authorized to participate in the directed red crab fishery. The lack of a TAC for this alternative eliminates the potential negative social impacts associated with this type of measure. The IVQ system is expected to create positive social benefits for the fishermen authorized to participate in the directed red crab fishery due to increased stability and flexibility and reduced uncertainty associated.

Compared to Alternative 1, in what ways might this alternative have a more negative social/cultural impact?

The controlled access system may have negative social impacts on the vessels excluded from participating in the directed red crab fishery. There are no other conditions under which Alternative 8 would be expected to have more negative social or cultural impacts than Alternative 1.

Compared to Alternative 10, in what ways might this alternative have a more positive social/cultural impact?

The gear requirements options offer potential social benefits, resulting from the proposed prohibition on all fishing gear other than traps. A controlled access system will provide positive social impacts on the vessels authorized to participate in the directed red crab fishery. The IVQ system is expected to result in positive social benefits for the fishermen authorized to participate in the directed red crab fishery due to the increased stability and flexibility and reduced uncertainty associated with this type of measure. Implementing a management program for the red crab fishery that reduces the probability of overfishing and reduces the likelihood of an overcapitalized fishery will have an overall positive effect on the social and cultural aspects of the fishery.

Compared to Alternative 10, in what ways might this alternative have a more negative social/cultural impact?

The controlled access system may have negative social impacts on the vessels excluded from participating in the directed red crab fishery. There are no other conditions under which Alternative 8 would be expected to have more negative social or cultural impacts than Alternative 10.

5.4.9.6 Impacts of the Alternative on Protected Species

IVQs used in concert with a controlled access system will reduce the amount of total red crab trap effort. However, there is no limit on the amount of effort during the spring high use of the continental shelf edge by endangered large whales and the leatherback sea turtle. Incidental catch limits will serve to limit growth of non-directed red crab fisheries such as offshore lobster along the continental shelf edge. The reporting requirement will provide additional information regarding the seasonal and area distribution of red crab fishing effort to allow managers to better assess the actual overlap of the fishery with protected species. The gear requirements proposed would not provide any additional protection beyond what is already provided under the MMPA regulations that implement the ALWTRP.

IVQs with the use of a controlled access system to limit the number of vessels participating in the fishery will provide adequate control on the growth of the fishery, thus curbing uncontrolled growth that would result in more fixed gear being set in high use waters for protected species, namely the endangered sperm whale and other odontocetes protected under the MMPA; as well as migratory or occasional foraging habitat for the endangered right, humpback, fin, blue and sei whales and the endangered leatherback sea turtle. Since neither the level of TAC to be applied to the IVQ system, or the controlled access program have not yet been chosen, we cannot assess the protected species effects with respect to Alternative 1. However, implementation of an effort-capping scheme will provide more protection than Alternative 10.

5.4.10 Alternative 9: IVQ Only

This non-preferred alternative proposed to implement a set of management measures to control effort in the fishery primarily through a specific allocation of quota to all vessels with any history of landing red crabs. Alternative 9 differs from Alternative 1 by including options for an individual vessel quota (IVQ) system, but does not include options for trap limits, a TAC, or trip limits. This alternative has no restrictions about crab size or gender, trip limits or days-at-sea. Alternative 10, the no action alternative, includes no management measures, so all the measures proposed in Alternative 9 differ from Alternative 10.

5.4.10.1 Biological and Ecological Impacts of the Alternative on Red Crab

Compared to Alternative #1, in what ways might this Alternative have a more positive effect on red crabs?

Individual vessel quotas, which sum to the TAC, are easy to track and enforce. Reporting requirements will also support this. Thus, the realized landings will be very close to the TAC. With individual quotas, vessels are less likely to harvest in the manner of a fishing derby. This could reduce the risk that the fishery would disturb the red crab mating process.

Compared to Alternative #1, in what ways might this Alternative have a more negative effect on red crabs?

Any size or gender may be harvested. Without measures to limit what types of crabs may be harvested the population sex ratio and mating system could become perturbed, which could reduce mating success. There are no restrictions on processing, but it would be consistent with the other alternatives to utilize recovery ratios to convert processed weights into whole weights. If processing were allowed at sea, it would not be possible to monitor what was being landed or to protect females or smaller males.

Without trip limits, vessels could potentially make much larger catches during a single trip. Removal of a large number of large crabs at a single time might reduce population growth rate more than if the catch was more spread out over time and space. Without a controlled access system, it would be very difficult to assign individual vessel quotas. Managers would be uncertain about which vessels were going to participate in the fishery each year. This could lead to a total catch that did not equal the target.

Compared to Alternative #10, in what ways might this Alternative have a more positive effect on red crabs?

Individual vessel quotas, which sum to the TAC, are easy to track and enforce. Reporting requirements will also support this. Thus, the realized landings will be very close to the TAC. With individual quotas, vessels are less likely to harvest in the manner of a fishing derby. This could reduce the risk that the fishery would disturb the red crab mating process. Incidental catch limits will prevent excessive red crab landings by vessels from other fisheries. Gear restrictions may allow small red crabs to escape from traps. Reporting requirements for each trip will allow total landings to be monitored.

Compared to Alternative #10, in what ways might this Alternative have a more

negative effect on red crabs?

There are no conditions under which this alternative would be expected to have more negative effects on red crabs than Alternative 10.

5.4.10.2 Ecological Impacts of the Alternative on Other Species and Communities

There are no expected differences in the ecological impacts on other species or their communities between this management alternative and the first baseline, Alternative 1, the emergency action alternative. The only difference in the ecological impacts on other species or their communities expected between this management alternative and the second baseline, Alternative 10, the no action alternative, is that associated with the prohibition on all fishing gear types other than traps in the directed red crab fishery, which would be expected to confer benefits to other species and their communities by preventing the use of mobile gear such as otter trawls and dredges.

5.4.10.3 Impacts of the Alternative to Essential Fish Habitat

The relative impacts to essential fish habitat (EFH) of each management alternative under consideration are compared against those of two baselines: Alternative 1, the emergency action alternative, and Alternative 10, the no action alternative.

The only management measures under consideration with any potential relevance to impacts to the EFH of any managed species that may be associated with the directed red crab fishery are the proposed trap limits and the proposed gear restrictions. Both of these measures would be proposed in the first baseline, Alternative 1, the emergency action alternative, but only the gear restrictions are proposed in this alternative. Due to the nature of the proposed IVQ system, there is no need to implement any type of trap limit in the red crab fishery. This difference could result in an increase in the number of traps employed in the fishery under this alternative compared to the number of traps that would be employed if trip limits were also implemented. Thus, from the perspective of potential impacts to EFH, this alternative would be expected to have potentially more impact than the first baseline.

The no action alternative, Alternative 10, by definition would not include any type of trap limit or gear restrictions. Because it proposes to implement some form of gear restrictions, including a prohibition on the use of non-trap gear in the directed red crab fishery, this alternative is less likely to result in any impacts to EFH than is the no action alternative. This alternative is expected to have a more positive effect on the EFH of managed species than would the second baseline.

5.4.10.4 Economic Impacts of the Alternative on the Fishery

This alternative is very similar to the previous alternative, except that it would rely entirely upon an individual vessel quota system to control the harvest of red crabs in the directed red crab fishery. Any vessel with a history of red crab landings prior to the implementation of the FMP would be able to continue fishing for red crab, albeit at the same relative rate at which they previously fished.

The composition of the fleet would remain as it is now. Without controlled access, a greater number of vessels would be participating in the fishery, but because of this, each vessel would have a lesser quota than the previous alternative. It would not preclude any vessel now operating in the fishery from participating but would still provide an upper limit on the quantity of labor and capital in the fishery.

With individual quotas, vessels are less likely to harvest in the manner of a fishing derby. Trip revenue would increase as there would be no limits on the amount of crab landed per trip. Vessels could operate to their full potential and utilize their hold capacity. This alternative would shift a substantial part of the management to a market mechanism, since it eliminates some of the gear, vessels, and processing restrictions that are a greater burden to enforce. This alternative should encourage technological development and innovation. Vessels participating in the directed fishery would have the freedom to choose the most appropriate fishing methods (aside from gear restrictions), fishing times, and strategies.

There are a couple of potential negative economic impacts. High-grading could be a problem, although this would be expected to be minimal given the market constraints that already exist in the fishery. Second, the creation of use rights means that some gain and some lose; this creates a redistribution of wealth and has equity implications.

This alternative should encourage technological development and innovation. Vessels participating in the fishery would have the freedom to choose the most appropriate fishing methods (aside from gear restrictions), fishing times, and strategies. Data would be gathered which would enable future management actions to use more comprehensive, reliable, and timely information on the fishery.

5.4.10.5 Social/Cultural Impacts of the Alternative

Compared to Alternative 1, in what ways might this alternative have a more positive social/cultural impact?

The positive effects of this alternative compared to Alternative 1 are the same as for Alternative 8, with the exception of those benefits associated with controlled access.

Compared to Alternative 1, in what ways might this alternative have a more negative social/cultural impact?

There are no conditions under which Alternative 9 would be expected to have more negative social or cultural impacts than Alternative 1.

Compared to Alternative 10, in what ways might this alternative have a more positive social/cultural impact?

The positive effects of this alternative compared to Alternative 10 are the same as for Alternative 8, with the exception of those benefits associated with a controlled access system.

Compared to Alternative 10, in what ways might this alternative have a more negative social/cultural impact?

There are no conditions under which Alternative 9 would be expected to have more negative social or cultural impacts than Alternative 10.

5.4.10.6 Impacts of the Alternative on Protected Species

IVQs will not provide adequate control on the growth of the fishery and may result in more fixed gear being set in high use waters for protected species. Although a TAC will control the amount of landings, the amount of gear allowed to be used will not be controlled, nor is the timing of the gear controlled during the spring high use of the continental shelf edge by endangered large whales and leatherback sea turtles. Incidental catch limits will serve to limit growth of non-directed red crab fisheries such as offshore lobster along the continental shelf edge. The reporting requirements will provide information regarding the seasonal and spatial distribution of red crab fishing effort to allow managers to better assess the actual overlap of the fishery with protected species. The gear requirements proposed would not provide any additional protection beyond what is already provided under the MMPA regulations that implement the ALWTRP.

IVQs will not provide adequate control on the growth of the fishery and may result in more fixed gear being set in high use waters for protected species, namely the endangered sperm whale and other odontocetes protected under the MMPA; as well as migratory or occasional foraging habitat for the endangered right, humpback, fin, blue and sei whales and the endangered leatherback sea turtle. Since the level of TAC to be applied to the IVQ system has not yet been chosen, we cannot assess the protected species effects with respect to Alternative 1. However, the fact that an unlimited number of vessels may participate in the fishery will likely result in an increase in the amount gear that will be used over Alternative 1, although it may be less than the complete lack of effort under Alternative 10.

5.4.11 Alternative 10: No Action

This non-preferred alternative proposed to implement no management measures for the red crab fishery. With no management measures, Alternative 10 represents an unregulated fishery. It does not have the six management measures in Alternative 1 (incidental catch limits, trap limits, gear requirements, total allowable catch, trip limits and reporting requirements).

5.4.11.1 Biological and Ecological Impacts of the Alternative on Red Crab

Compared to Alternative #1, in what ways might this Alternative have a more positive effect on red crabs?

There are no conditions under which this alternative would have a more positive effect on red crabs than Alternative 1, or any of the other alternatives.

Compared to Alternative #1, in what ways might this Alternative have a more

negative effect on red crabs?

Under this alternative, incidental catch would not be regulated and could cause significant red crab mortality. With no restrictions on number of traps or type of gear, the stock could easily be overfished given the power of the red crab fleet. With no restrictions on total allowable catch, trip limits, or reporting requirements, the stock could easily be overfished and it would not be possible to monitor accurately the degree of overfishing. Without some form of management program in this fishery, the resource will be subject to overfishing and could be rapidly depleted.

5.4.11.2 Ecological Impacts of the Alternative on Other Species and Communities

There are no conditions under which this alternative would have a more positive ecological effect on other species and their associated communities than Alternative 1, or any of the other alternatives. Without some form of management program for this fishery, uncontrolled and potentially escalating fishing effort for red crabs could have negative ecological impacts on other species and their communities.

5.4.11.3 Impacts of the Alternative to Essential Fish Habitat

There are no conditions under which this alternative would have a more positive effect on the EFH of any Federally-managed species than Alternative 1, or any of the other alternatives. Without some form of management program for this fishery, such as the trap limits proposed in Alternative 1 and the gear restrictions and controlled access system proposed in the other alternatives, uncontrolled and potentially escalating fishing effort for red crabs could have adverse impacts on some areas designated as EFH for Federally-managed species.

5.4.11.4 Economic Impacts of the Alternative on the Fishery

Alternative 10 would have the greatest economic impact of all alternatives. The no action alternative is one of the baselines against which all other alternatives actions are compared. This can be defined as what is likely to occur in the absence of any of the proposed actions. We will attempt to assess the incremental economic effects relative to this baseline.

With no restrictions, additional entrants would be allowed into the fishery; based on recent occurrences, this would be expected to occur. In the short term, landings may increase, but because they are not sustainable, the long term economic effect will be negative. Since there are no biological projections for landings or LPUE available for any of the alternatives, it is impossible to estimate quantitatively the magnitude of the expected change in revenue that would occur. With the entry of additional vessels, and vessels of increasing size, the catch per vessel would decrease. Historic participants could be eliminated from the fishery or at least become marginally viable.

With no action, the most likely outcome would be that overfishing will occur and a future FMP would need to implement measures that would end and prevent future overfishing. Worse, if appropriate exploitation rates are greatly exceeded or, if it is determined that the red crab stock is overfished, the FMP will need to include a number of restrictive measures to eliminate overfishing and/or rebuild the resource under a statutory time schedule. Therefore, the no-action alternative would likely reduce long-term economic benefits to the fishery. Depending on the amount of fishing that would occur in the absence of any action, a future FMP may have to be more restrictive in order to effectively manage the stock.

In the absence of regulation, there would be an increased supply of red crabs to consumers initially, but the long term effect would be decreased supply and presumably higher prices. In the same manner, an initial increase in processing requirements may occur, depending on the quantity that is processed at sea and the quantity that is processed on shore. Since most of the red crab product is processed, increased supply may not have as large of an effect on price, since processed products have a longer shelf life and are not perishable. A demand equation to determine the impacts of supply on the market cannot be estimated at this time.

In the absence of regulation, there would likely continue to be significant under-reporting, since there would be no incentive for the vessels or dealers to report their landings. Also, the uncontrolled and potentially escalating effort could have negative economic impacts on those businesses who depend on the red crab fishery.

5.4.11.5 Social/Cultural Impacts of the Alternative

There are no conditions under which this alternative would have a more positive social and/or cultural effect on the red crab fishery than Alternative 1, or any of the other alternatives. Without some form of management program for this fishery, such as the trap limits proposed in Alternative 1 and the effort controls and controlled access system proposed in the other alternatives, uncontrolled and potentially escalating fishing effort for red crabs could have negative social and/or cultural impacts on the current members of the red crab fishery and those that depend upon them.

5.4.11.6 Impacts of the Alternative on Protected Species

Alternative 10 will not provide adequate control on the growth of the fishery that would result in more fixed gear being set in high use waters for protected species, namely the endangered sperm whale and other odontocetes protected under the MMPA; as well as migratory or occasional foraging habitat for the endangered right, humpback, fin, blue and sei whales and the endangered leatherback sea turtle. The amount of gear allowed to be used would not be controlled, nor would the timing of the gear be controlled during the spring high use of the continental shelf edge by endangered large whales and the leatherback sea turtle. Non-directed red crab fisheries such as offshore lobster could also expand along the continental shelf edge to harvest red crab. There would be no reporting requirement to provide additional information regarding the seasonal and area distribution of red crab fishing effort.

	Management Alternatives									
	Emergency Rule	Hard TAC and Trap Limits	Hard TAC, Trap and Trip Limits	Target TAC with DAS	Target TAC with DAS & Trip Limits	Trip Limits with # of Trips	All Possible Measures	IVQ with Controlled Access	IVQ Only	No Action
Economic elements[18]	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Harvest level										
Employment										
Price										
Revenue										
Vessel efficiency				+					+	+
Fishing season length		0	0	+	+	0	0	+	+	
Industry output level										
Harvesting/processing costs										
Fleet size		+	+	+	+	+	+	+	0	0
Fleet composition										
Management costs, difficulty		-	-			-	-			+

Table 23: Expected economic impacts of all alternatives compared to Alternative 1 (emergency rule).

[18] Economic impacts include market effects, profit effects, and fleet effect; They are rated positive (+), negative (-), neutral (0). Empty cells represent unknown effects or direction of change from baseline.

	Management Alternatives									
	Emergency Rule	**Hard TAC and Trap Limits**	**Hard TAC, Trap and Trip Limits**	**Target TAC with DAS**	**Target TAC with DAS & Trip Limits**	**Trip Limits with # of Trips**	**All Possible Measures**	**IVQ with Controlled Access**	**IVQ Only**	**No Action**
Economic elements[19]	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Harvest level	+	+	+	+	+	+	+	+	+	*No Action Alternative*
Employment										
Price										
Revenue[20]	+	+	+	+	+	+	+	+	+	
Vessel efficiency	-	-	-	+		-	-	+	+	
Fishing season length	-	-	-	+	+	-	-	+	+	
Industry output level										
Harvesting/processing costs								+	+	
Fleet size	0	+	+	+	+	+	+	+	0	
Fleet composition										
Management costs, difficulty	-	-	- -	-	-	-	- -	-	-	

Table 24: Expected economic impacts of all alternatives compared to Alternative 10 (no action).

[19] Economic impacts include market effects, profit effects, and fleet effect; They are rated positive (+), negative (-), neutral (0). Empty cells represent unknown effects or direction of change from baseline.

[20] Assumes prices are held constant

6.0 Fishery Impact Statement

6.1 Overview

The implementation of a new fishery management plan and its associated regulations changes the environment for fishermen that target the regulated resource, but it can also result in changes for those in fisheries for other species. In many instances, the imposition of regulations to restrict effort and reduce fishing mortality forces fishing effort onto other species. In the complex fishing environment of the northeast region, where there are thousands of vessels participating in a wide variety of fisheries, the impacts of new regulations can have unexpected consequences that complicate fisheries management overall. This section takes a broad overview of fisheries in the region and attempts to gauge the interactions between red crab management and other fisheries.

Obviously, the vessels that will be most affected by the management measures in this plan are those vessels that have been fishing for red crab in recent years. The vast majority of reported landings in recent years have been by a small group of less than ten vessels.[21] Under the proposed measures, many of these vessels will be able to continue participating in the red crab fishery at directed levels, but some vessels will be excluded. Another 76 vessels landed lesser amounts of red crab in recent years and may also be impacted by these regulations.[22] Adoption of this plan may constrain their fishing activity. The impacts of the management plan on the directed and incidental catch level red crab fisheries are described in Section 5.0. Important parts of the fishery are the communities that it supports. The ports that are associated with the red crab fishery are identified in Section 7.1.8. A discussion of the impacts of the proposed management measures and the alternatives on these fishing communities is included in Section 7.1.8. The impacts on other fisheries in the northeast region that the plan may have are described below.

6.2 American Lobster Fishery

The offshore lobster fishery, managed under the NMFS' American Lobster FMP, is a fishery with some history of direct interaction with the red crab fishery. It has been reported that some offshore lobster vessels occasionally target red crab and may land higher than "incidental catch" levels of red crab. Under normal operating conditions, these two fisheries appear to be segregated according to depth, with the lobster fishery occurring in more shallow water. The Red Crab FMP will establish limits on the incidental catch of red crab by any vessel not authorized to participate in the directed red crab fishery. These limits may affect the operations of some vessels in the offshore

[21] There were seven vessels identified in the NMFS VTR and dealer weighout databases that reported landings of more than 100,000 pounds of red crab in at least one year between 1991 and 2000. There were at least two additional vessels that entered the red crab fishery in 2001 and fished at directed levels under the emergency regulations.

[22] These are vessels that reported landing at least one pound, but less than 100,000 pounds, of red crab in at least one year during the years 1991 - 2000 (NMFS VTR and dealer weighout report databases).

lobster fishery if they are prohibited from harvesting and landing as much red crab as they otherwise would. In order to ensure the enforceability of some management measures such as gear restrictions that limit the number of traps that can be fished for red crab, in the future the Council may establish a lobster-red crab fishery demarcation line such that only red crab traps would be allowed to be set deeper than the demarcation line.

6.3 Monkfish Fishery

The monkfish fishery is largely a trawl fishery with some dredge and gillnet fishing also occurring. Most of the monkfish fishery occurs over the continental shelf in conjunction with the groundfish and/or sea scallop fisheries. Some monkfish fishing occurs in deep water where red crabs may occur. The principle interaction between these two fisheries is that there may be some degree of bycatch and discard mortality of red crabs in the monkfish fishery. The Red Crab FMP identifies this potential interaction as a research and information need and a potential management concern. Should future research and data collection provide information confirming this interaction and its severity, the Council may consider taking appropriate action to reduce the bycatch of red crabs in the monkfish fishery. This action may take the form of fishing restrictions on the monkfish fishery.

6.4 Tilefish Fishery

The tilefish fishery occurs in relatively deep water (100 - 300 meters) but is prosecuted almost entirely with bottom longlines (approximately 93% of all landings) (MAFMC 1999). It appears that the red crab and tilefish fisheries may abut one another, but there is probably little interaction between the two with the possible exception of some of the deep-water canyons (Hudson, Block and Veatch Canyons). Because both fisheries primarily use static fishing gear (pots in the case of the red crab fishery and longlines in the case of tilefish), any interactions are expected to be negligible. It is not foreseen that the Red Crab FMP will have any effect on the tilefish fishery, nor vice versa.

6.5 Golden Crab Fishery

The golden crab fishery is identified as occasionally including red crab, but the South Atlantic Council concluded that the populations of golden and red crabs are sufficiently separated from one another to be managed separately (SAFMC 1995). Thus there are very few interactions likely between these two FMPs. Based on the management unit selected by the Council, there will be a geographic area of overlap between the two Council's areas of management jurisdiction. This could be a cause for concern if there were significant landings of red crabs aboard golden crab vessels and/or significant landings of golden crab aboard red crab vessels fishing in this intersection zone. However, based on the South Atlantic Council assessment, this seems unlikely. None of the golden crab vessels are currently fishing in the "northern" management zone (north of 29º 25' North latitude), so there would be no overlap in the fishing activities managed under the two plans.

The Council is aware that up to two golden crab vessels may shift into the northern zone, which includes the waters off the coast of Florida (north of approximately Daytona Beach, Florida), Georgia, South Carolina, and North Carolina so there may be some overlap if these golden crab vessels begin fishing north of Cape Hatteras and red crab vessels fish south of the Virginia-North Carolina border. These interactions, however, should be minimal due to the relatively small number of vessels involved. The golden crab vessels operating north of Cape Hatteras will be subject to the regulations in this FMP, including the incidental catch limits and the requirement to obtain an open access incidental catch permit.

6.6 Conclusions

Due to the offshore, deep water nature of this fishery, there are very few known interactions between the fishery and other fisheries. This also results in very few interactions expected between this FMP and other fisheries, with the exception of the specific cases identified above. None of these interactions, however, are expected to be significant.

7.0 Magnuson-Stevens Act Consistency

7.1 Compliance with the National Standards

Section 301 of the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act) requires that fishery management plans (FMPs) contain conservation and management measures that are consistent with the ten National Standards.

National Standards [16 U.S.C. 1851 § 301]

(a) In General. -- Any fishery management plan prepared, and any regulation promulgated to implement any such plan, pursuant to this title shall be consistent with the . . . national standards for fishery conservation and management.

The following section summarizes, in the context of the National Standards, the analyses and discussion of the proposed action that appear in various sections of this document.

7.1.1 National Standard 1 -- Optimum Yield

Conservation and management measures shall prevent overfishing while achieving, on a continuing basis, the optimum yield from each fishery for the United States fishing industry.

Alternatives for a definition of overfishing and the specification of optimum yield (OY) are provided in Sections 3.5 and 3.6 of this FMP. OY is specified such that it cannot exceed MSY and will account, to the highest degree possible, for the relevant economic, social, and ecological factors.

All of the proposed measures and management alternatives developed for this FMP are intended to prevent overfishing in the directed red crab fishery and achieve OY on a continuing basis. Because this resource is not considered overfished, this FMP does not include a rebuilding plan or schedule.

7.1.2 National Standard 2 -- Scientific Information

Conservation and management measures shall be based upon the best scientific information available.

Section 2.4 of this FMP identifies several issues to be resolved, including the status of the stock, the availability of data, and incidental catch and discards. Throughout the FMP document, note is made of the limited information on the biology, ecology, and population dynamics of the resource. It is also noted throughout the document that information on the fishery is somewhat limited and that landings data on red crabs were not required prior to the implementation of the emergency regulations. Compounding these information gaps is the lack of current comprehensive survey data on the stock.

Despite these limitations, however, the conservation and management measures proposed in this FMP are based on the best *available* scientific information. Baseline social and economic information was collected from representative members of the fishing industry (see Appendix B), and this information was utilized in the development of the FMP. Much, if not all, of the available scientific literature on the biology and ecology of the deep-sea red crab was utilized in the development of the FMP (see Appendix A). Historical information was also used where appropriate to characterize changes in fishing operations and to indicate trends. Landings information from the NMFS vessel trip report (VTR) and dealer weigh-out (WO) databases was used to the maximum extent possible and include data through 2000 as well as partial year data from 2001.

Implementation of the emergency regulations on May 17, 2001 included reporting requirements and these data were fully utilized in the development of the FMP. In some cases, however, data on fishing activity during the emergency period remain incomplete. For example, although the interactive voice response (IVR) data indicates 52 fishing trips were made during the first emergency period, the VTR database includes data on only 22 of these trips (as of January 3, 2001) and the WO database includes only 18 trips (also as of January 3, 2002).

7.1.3 National Standard 3 -- Management Unit

> *To the extent practicable, an individual stock of fish shall be managed as a unit throughout its range, and interrelated stocks of fish shall be managed as a unit or in close coordination.*

For a discussion of the management unit and a description of the alternatives considered by the Council, see Section 3.2 of the FMP.

7.1.4 National Standard 4 -- Allocations

> *Conservation and management measures shall not discriminate between residents of different States. If it becomes necessary to allocate or assign fishing privileges among various United States fishermen, such allocation shall be (A) fair and equitable to all such fishermen; (B) reasonably calculated to promote conservation; and (C) carried out in such manner that no particular individual, corporation, or other entity acquires an excessive share of such privileges.*

The measures and management alternatives proposed in this FMP do not discriminate between residents of different states. Specifically, the proposed controlled access qualification criteria are not based on state residency and the measures themselves do not change the way fishing privileges are allocated among red crab fishermen. However, fishermen in some areas may be affected by the management measures more than others, depending on their specific fishing operations (such as steaming time to the fishing grounds). Vessels based in the Gulf of Maine, for example, may be more affected by alternatives that utilize an allocation of days-at-sea, if they spend relatively more time traveling to and from the fishing grounds than vessels from other areas.

7.1.5 National Standard 5 -- Efficiency

Conservation and management measures shall, where practicable, consider efficiency in the utilization of fishery resources; except that no such measure shall have economic allocation as its sole purpose.

This FMP proposes to promote overall efficiency in the red crab fishery by constraining fishing effort to long term sustainable levels and preventing an increase in capitalization in the directed red crab fishery above the levels that existed prior to the control date. The Council considered efficiency in the utilization of fishery resources when developing the proposed management alternatives. The selection of a DAS program with a differential trip limit was specifically designed to account for potential differences in fishing efficiencies between vessels (see Sections 4.2.11 and 4.2.8). Although a trap limit is proposed to be implemented, the level selected is intended to prevent an *expansion* of gear rather than to constrain existing gear use, which could affect efficiency.

The proposed incidental catch limits may reduce the efficiency of some vessels accustomed to landing more than the limit of red crab. All of these vessels will be able to continue to land some amount of red crab, but the amount of red crab landed by non-controlled access vessels needed to be constrained in order to ensure adequate conservation for the resource and prevent overfishing.

None of the proposed measures have economic allocation as its sole purpose. Economic considerations were incorporated into the assessment of the potential impacts associated with all proposed measures, but the primary rationale for selecting the proposed measures was to prevent overfishing and overcapitalization in the fishery.

7.1.6 National Standard 6 -- Variations and Contingencies

Conservation and management measures shall take into account and allow for variations among, and contingencies in, fisheries, fishery resources, and catches.

The Council accounted for variations in fisheries, fishery resources, and catches by developing a variety of management alternatives, measures, and options that may have been proposed in this FMP (see Section 4.0). Measures such as differentiated trip limits propose to allow vessels to fish under a trip limit most appropriate for their fishing operations, based on past levels of involvement in the red crab fishery. Measures such as the proposed trap limits include options for vessels to continue to fish the most efficient number of traps per string, while maintaining adequate enforcement of this measure. Other measures take similar differences in fishing operations and catches. This approach maximizes opportunities in the fishery and flexibility for the fleet while controlling overall fishing effort and landings. Changes in fisheries occur continuously, both as the result of human activity (for example, new technologies or shifting market demand) and natural variation (for example, oceanographic perturbations). With this FMP, the Council proposes to establish a process to facilitate periodic review of conditions in the fishery and adjust the management measures according to such variations.

7.1.7 National Standard 7 -- Costs and Benefits

Conservation and management measures shall, where practicable, minimize costs and avoid unnecessary duplication.

The Council considered the costs and benefits of a range of alternatives to achieve the conservation goals of this FMP. It considered the potential costs of management action to the industry relative to the costs associated with maintaining the status quo. Short term costs associated with the management action will be compensated by long term sustainability of yield and revenue. The Council also considered administrative and enforcement costs associated with the management alternatives and chose what it believes to be the least complex alternative that achieves the objectives of the management plan with minimal costs to administration or enforcement.

7.1.8 National Standard 8 -- Communities

Conservation and management measures shall, consistent with the conservation requirements of this Act (including the prevention of overfishing and rebuilding of overfished stocks), take into account the importance of fishery resources to fishing communities in order to (A) provide for the sustained participation of such communities, and (B) to the extent practicable, minimize adverse economic impacts on such communities.

National Standard 8 requires that impacts on fishing communities be taken into account to provide for these communities' sustained participation in fisheries and, to the extent practicable, minimize any adverse impacts on fishing communities. Fishing communities are defined as communities that are substantially dependent on or substantially engaged in the harvest or processing of fishery resources to meet social and/or economic needs. National Standard 8 includes consideration of vessel owners, operators, crew, and processors that are based in the community.

By creating a definition of a fishing community, National Standard 8 creates a distinction between communities that are substantially dependent or engaged in fishing or processing and those that are not. National Standard 8 does not, however, provide guidance on what it means to be "substantially" dependent or engaged nor does it provide guidance on what community is contemplated. NMFS guidance provides that community is to be a place-based concept but there remain open questions as to the spatial aspects or dimensions of "place." Clearly, both fishing and non-fishing social and economic activities that occur within the boundaries of a particular place are to be considered, but establishing the perimeter of the "place" can be problematic. In fact, recent work by Hall-Arber et al. (2001) proposed that fishing communities be considered in the context of a regional network of social and economic resource flows that link several geographically distinct locations together as a "natural resource region."

Definitional issues of community and measurement of substantial involvement in fisheries aside, practical data limitations for fisheries in general and red crab in particular make a formal designation of community involvement in fisheries difficult. Since the red crab fishery has been an unregulated fishery until the emergency regulations implemented in 2001, vessels or processors were not required to have Federal fishing permits. Reporting for both Federally permitted dealers and vessels is not required unless the dealer or vessel holds at least one other permit for which mandatory reporting is required. However, through voluntary reporting and through a survey that was conducted of the red crab industry, we can attribute some proportion of red crab fishing activity to particular communities.

Another complicating factor in identifying fishing communities and assessing community engagement is the large geographic area over which the red crab fishery, and most Northeast region fisheries, take place. To date, the most comprehensive examinations of fishing communities have been undertaken by Hall-Arber et al. (2001) and McCay and Cieri (2000). The former study covered ports from Connecticut to Maine while the latter covered ports from New York to North Carolina. Of these studies, Hall-Arber provided detailed port profiles and preliminary assessments of fishing dependence for 38 communities. The McCay study was designed to develop detailed profiles of fishing involvement at the county level and focused on fisheries managed by the Mid-Atlantic Fishery Management Council. This means that the places selected for site visits may not reflect places of concern for red crabs.

Due to the small size of the red crab fishery, there is a limited number of participants that have been involved in this fishery, and consequently a limited number of communities that may be affected. These two studies, mentioned above, provide some information about the social and economic importance of fishing to the locations that can be identified as related to the red crab fishery.

Procedures

The focus of an assessment of the communities affected by the proposed FMP will be primarily on locations where red crab are landed, or where industry participants define as their home or principal port.

Given the difficulties in defining communities and establishing engagement in fishing, no attempt is made here to distinguish between locations on the basis of dependence on fishing in general or the red crab fishery in particular. Rather, all locations where there is some level of engagement in the red crab fishery are identified. From among these locations, available information is reported to characterize the level of engagement in red crab harvesting as compared to other Federal fisheries in the Northeast region.

To the extent that certain vessels may not qualify for future participation in the red crab fishery, these vessels and the communities they are based in would be affected. For this reason, the ensuing analysis attempts to identify whether and where specific locations have vessels that will not qualify under any of the alternatives. Of particular interest is what alternative fisheries may be available to the non-qualifiers.

Data

The data on the red crab fishery are unique in some ways. First, because there were no regulations prior to the emergency action in 2001, there was no mandatory reporting of data prior to that time. Second, there are a small number of participants who are very involved in the management aspects of red crab. Because of this, it was possible to conduct a social and economic survey to gather baseline information on the operations of the fishery and on the people involved in the harvesting, processing, and marketing of red crabs. The survey is believed to represent a significant portion of the industry. It should be noted that while the information reflects a significant portion of the industry, it reports only on those in the directed red crab fleet. This is an important distinction. It also is believed to include all known processors dealing with product from the New England-based red crab fishery. For the non-directed segment of the red crab fleet, we have to rely on NMFS databases.

The survey also provided the only data available on red crab vessel crew, such as how many are working in the red crab fishery. The survey was unable to address where the crew live. This is an important consideration as historical participation affects more than vessel owners. In many cases, crew will live and work out of the same communities or ports as the owner, but this is not always the case. The number of crew employed on each vessel ranges from six to almost twenty, with an average of just over eight crew per vessel.

Much of the information from the survey is summarized in a report on social and economic baseline information for the deep-sea red crab fishery. This report is provided in its entirety as Appendix B. Much of what is discussed here in regards to communities is provided only as a summary of the information provided in the report

NMFS data were used to supplement what we have found out from the industry surveys. NMFS dealer data were used to identify locations where red crab are landed. Total value of landings of red crab and all other species combined for calendar year 2000 are reported as is the number of vessels contributing to landings. As discussed previously, these data may underestimate the level of engagement in fishing for any given location.

NMFS permit application data for permit year 2000 were used to identify the home port, primary port and mailing address locations for those vessels which landed red crab. Data from permit applications are recorded essentially as provided by the applicant. Even though vessels landing red crab do not require a permit, we think most vessels landing red crab have a permit to fish in other fisheries. If there are vessels landing red crab who do not report voluntarily, and who do not have a permit, we would not be able to know anything about their fishing community.

Communities where owners and operators live

The vessel owners and operators participating in the survey identified ten communities in which they live, including Windsor Locks, CT; Fall River, Gloucester, Hamilton, New Bedford, and South Dartmouth, MA; Westport, ME; Adamsville and Tiverton, RI; and Seattle, WA. Red crab fishermen have lived in these communities for over 17 years, on average, and some fishermen have lived in their communities for as long as 44 years.

When asked whether they considered these communities to be fishing communities, it was interesting to find that the majority do not consider them to be fishing communities and even fewer consider them to be significantly dependent on commercial fishing. Only three vessel owners or operators consider their communities to be significantly dependent on fishing. Those reporting that their towns were not fishing communities suggested this was due to few fishermen living there, the town being located inshore, or the town being a bedroom community. Of those who consider their towns to be fishing communities, they suggested this was due to the amount of fishing activities based there.

The permit database identified additional communities where owners may live, particularly those who did not participate in the survey or those who are not part of the directed red crab fleet. These communities are Edgartown and Nantucket, MA; Deer Isle, Stonington, and Harpswell, ME; and Lakewood, NJ.

Communities engaged in red crab harvesting

A community may be said to be engaged in the red crab fishery by virtue of the exchange of red crabs between a vessel and a dealer; if it is a place where harvesters moor their vessel; or if it is a place where harvesters live. To determine which Northeast region communities may be engaged in the red crab fishery, the dealer and permit application data bases were queried to identify places/ports of landings or where red crab harvesters reside. Specifically, port of landing from the 2000 dealer data, and designated home port, principal port, and home mailing address from the fishing year 2000 permit application data were all used to identify communities that may be engaged in one way or another in the red crab fishery. These queries resulted in a total of 19 different named places where an individual may have either landed red crab, tied up his/her vessel, lived in, or received mail (Table 25).

The survey completed by those in the red crab industry was considered as well. The fishing vessels currently operating in the commercial red crab fishery come from a variety of areas and fishing ports in New England and the Mid-Atlantic. The places identified in the survey as serving as the primary ports of operation and mooring for red crab vessels were Fall River, Gloucester, and New Bedford, MA; Bristol, ME; Portsmouth and Tiverton, RI; and Norfolk, VA. Massachusetts had the largest number of locations with three, while Rhode Island, Virginia and Maine were also listed.

Locations that were profiled in the Hall-Arber et al. study and are included here are New Bedford and Gloucester, MA and Tiverton, RI. None of these locations were visited in the McCay and Cieri study.

Boston, MA	Cundys Harbor, ME	Lakewood, NJ	Portsmouth, RI
Chilmark, MA	Deer Isle, ME	Point Pleasant, NJ	Tiverton, RI
Edgartown, MA	Harpswell, ME		
Fairhaven, MA	Portland, ME		
Fall River, MA	Stonington, ME		
Gloucester, MA	Westport, ME		
Hamilton, MA			
Nantucket, MA			
New Bedford, MA			

Table 25: Places where an individual may have landed red crab, or called their homeport, primary port, or address.

Communities engaged in red crab processing

The small size of the harvesting sector of this fishery is carried over to the processing sector which is also relatively small. There are four wholesale and/or processing entities reportedly involved with the red crab fishery. The surveys described above that were completed by the vessel owners and operators were also completed by the owners and/or presidents of the four wholesale and/or processing companies. These companies are based in New Bedford and Fall River, MA; Portland, ME; and Warren, RI.

None of the respondents identified as processors report processing red crab exclusively. Other commercial fishery products processed include: clams, dogfish, Jonah crab, lobster, monkfish, mussels, rock crab, scallops, skates, snow crab, and squid. Processors report that they obtain red crab product from vessels from a variety of ports, including Fall River and New Bedford, Massachusetts, as well as other ports in Massachusetts and Rhode Island. The processors report obtaining red crab product from between one and four vessels each, with an average of two vessels per processor. One respondent indicates that they purchase the red crabs from the vessels and then contract with a third party to actually process red crab, although they do process other fishery-related products.

The number of employees currently employed by the processors varies significantly, from 5 to 1000 with an average of over 300 employees per processor. According to the respondents, the majority of these employees are seasonal in nature, with an average of 146.5 year-round employees per processor. As would be expected given the responses summarized above, most processing employees work either on other fishery-related products or at least do not work exclusively on red crab. On average, less than 13% of processing employees work exclusively on red crab.

Although we have reported four wholesale and/or processing entities, based on the survey and on what we know from contact with industry, we cannot substantiate that from dealer data. For calendar year 2000, there are four dealers that appear in the weighout reports, but they account for only 12% of the pounds and 15% of the revenue from red crabs. The remaining 88% of the pounds and 85% of the revenue is listed in the data as unknown dealer. Thus, there is a possibility that there are additional unpermitted dealers that are buying red crab. Since there is not mandatory reporting for lobster dealers (if that is the only permit they have), dealers that specialize in shellfish may also be buying red crab.

Communities engaged in fishery-dependent services

There is no information available directly on any fishery-dependent service industries that may be involved with the red crab fishery. The types of service industries used by the red crab fishery and their general locations were reported by some vessel owners and operators. The types of services used include fuel, ice, food and groceries, bait, gear, oil/lubrication, water, hull maintenance, engine maintenance, electronics, insurance, accounting, legal advice, and dockage.

The communities identified as providing fishing-related support services include Lower Mid-Coast Maine, Gloucester and the Massachusetts North Shore, Boston and the Massachusetts South Shore, Cape Cod and the Islands, the New Bedford, MA area, Rhode Island, some non-coastal areas of New England, and some areas outside of New England. Of these, the fishery-related service industries in the New Bedford, MA area provide more support to the red crab fishery than the other locations combined.

Communities where products were sold

The people and businesses that sell red crab product at the wholesale or retail level are an important component of the fishing industry and of fishing communities. These people and businesses may also be affected by regulations or by changing conditions in the fishery. The questions in this section of the survey were an attempt to collect information on the dependence on the red crab fishery of the people and businesses in this sector of the industry. These questions focused on the dependence of wholesalers and retailers on the red crab fishery, their employment, and the products they sell.

The only information available on the communities which buy red crab product from wholesalers and retailers was provided in the survey. Three respondents report selling between 60 and 100% of their red crab product to companies in the U.S. but not in New England; three report selling between 5 and 100% of their red crab product to companies in New England; and two report selling between 10 and 15% or their red crab product to foreign enterprises.

Red crab landings

According to NMFS dealer and VTR data, there were a total of twelve different ports where red crab were landed in calendar year 2000 where unique vessels were identified. Activity data for any port where the number of vessels was less than three are confidential. Since there were no ports where greater than three vessels landed, there are no port level data that can be revealed. It is interesting to note that the increase in vessel activity suspected in 2001 is spread out to additional ports, as the preliminary data indicates a greater number of different ports where red crab was landed. Of the twelve vessels that we know landed red crab in 2000, eleven had permits to land additional species. Of the seven vessels that directed on red crab under the emergency action in 2001, five had permits to land other species in the Northeast region.

The use of mailing addresses may have a tendency to disperse fishing activity. All subsequent analysis will be based on either home port or principal port designations since they are assumed to be a more reliable indicator of locations where fishing activity may be based.

Communities with vessels that may qualify

Several different qualification criteria were considered for the Red Crab FMP. The number of vessels which may qualify for fishing under the limited access portion of the FMP varies depending on the criteria used. Table 17 reports the minimum number of fishing vessels that would be expected to qualify for a red crab controlled access program based on the range of options developed by the Council for the period prior to the control date. This minimum number varies from three to eight. Table 18 reports the minimum number of fishing vessels that would be expected to qualify for a red crab controlled access program based on the range of options developed by the Council for the one year following the control date. This number varies from four to seven. The potential number of communities that may be affected by this FMP in one manner or another is based on an upper and lower bound estimate of the number of qualifiers and non-qualifiers.

Although it seems likely that the Council will allow at least five vessels to qualify, the lower limit as listed in Table 17 is for three vessels. Based on the lower bound estimate of qualifiers, a total of three vessels would qualify. Only one of these vessels had a Northeast region permit and had filled out a 2000 permit application. Thus, there were no ports with at least four qualifiers by home or principal port, so the results cannot be shown.

An upper bound of 17 vessels has been estimated to qualify for participation in the red crab fishery, since that is the number that applied for a LOA under the emergency action. These vessels listed 12 different home ports and different principal ports on their 2000 permit application. Again, there were no ports with at least four qualifiers by home or principal port, so the results cannot be shown. Compared to the lower bound estimate of three vessels, an total of 11 additional home or principal ports may have at least one qualifying vessel.

Communities with vessels that may not qualify

The number of potential vessels which may qualify to fish for red crab under this FMP range from three to more than 17. Clearly, it is quite possible that some of those vessels who would like to fish for red crab may not be able to under the proposed regulations. The upper bound number includes vessels which have recently entered the fishery, and also, perhaps, those that indicated an interest in possibly entering the fishery. Given that, the community impacts realized by these newer entrants or possible future entrants would be limited to changes that have been made to the community in the most recent past. The lower bound estimate of qualifiers provides an upper bound or "worst-case" assessment of potential non-qualifiers and the associated port or community impacts. For this reason, the analysis of impacts will be based on the lower bound estimate of qualifiers.

Based on the lower bound estimate of qualifiers, there would be 12 ports with a number of non-qualifiers. There are three out of the 17 vessels for which we have no homeport information. Again, activity data for any port where the number of vessels is less than three is confidential.

These 12 ports with vessels that may not qualify include New Bedford, Nantucket, Westport, Boston, Sandwich, and Swampscott, MA; Lubec, and Tenants Harbor, ME; Tangier, Norfolk and Posquoson, VA; and Seattle, WA.

Some of the ports with non-qualifiers were profiled in either McCay and Cieri (2000) or Hall-Arber et al. (2001). The following provides a brief summary of the importance of fishing in general and red crab fishing in particular.

<u>New Bedford, MA</u>

New Bedford, MA is important to the fishing industry and is consistently numbered among the top ports in the U.S. for the value of its commercial fishing landings. This is a community that is characterized by its involvement in the fishing industry. Since it is such a large fishing community, the importance of red crab relative to other fisheries is negligible.

<u>Nantucket, MA</u>

An island off New England, the local catch of fish and shellfish is quite diverse. While summer is a boom time for seafood production due to the tourist industry, the resident population maintains demand throughout the year. The importance of red crab relative to other fisheries is very minimal.

<u>Westport, MA</u>

Westport is a small estuarine port in southeastern Massachusetts. It is bordered by Fall River on the north and west, Dartmouth on the east, the Atlantic Ocean on the south, and Tiverton and Little Compton, RI, on the west. The town is home to approximately 30 fishing vessels, all of them being lobster vessels, who may supplement their income by dredging clams and quahogs. The importance of red crab to the town of Westport relative to other fisheries is very minimal.

Boston, MA

Boston, MA is an essential provider of fishing-related support services. Boston has a large number of seafood brokers as well as large seafood companies with fleets of trucks and major facilities. The fishing related business of red crab would be dwarfed by some of the other fishing activity that occurs in Boston. The importance of red crab relative to other fisheries is very minimal.

Sandwich, MA

A small fleet of commercial fishermen follow a long tradition of small-scale pursuit of lobster, shellfish, and finfish in Sandwich. Sandwich has a long history of fishing, due in part to the proximity of the Cape Cod canal which allows boats to bring in fish caught off the Cape to be processed and shipped to New Bedford, or sold in nearby fish markets. The importance of red crab relative to other fisheries is very minimal.

Swampscott, MA

Swampscott is located near Gloucester, MA, a major fishing port in the Northeast. There is no evidence that fishing is that important to the town of Swampscott, or that red crab has any significance to the town.

Lubec, ME

Lubec is the easternmost town in the United States. The most common species landed are scallops, sea urchins and lobster. According to state records, Lubec shows 53 lobster/crab licenses, 57 commercial shellfish licenses in addition to 43 scallop permits, 32 commercial fishing licenses, 42 urchin licenses, and a few minor species. Lobster fishing is a year-round fishery here, but is slower and more difficult in winter. The importance of red crab relative to other fisheries is very minimal.

Tenants Harbor, ME

Tenants Harbor is in Knox County, Maine. Lobster and herring are the dominant fisheries now, supplemented by shrimping, scalloping and urchin fishing in the winter. The importance of red crab relative to other fisheries is very minimal.

Tangier, VA

There is no information available on Tangier, VA.

Norfolk, VA

The commercial fishery of Norfolk, VA is a small inshore and bay fishery. Principal gears used are crab pots (55% of value), crab dredges (10%), clam tongs and rakes (4%), handlines (10%) and sink gill-nets (12%). Blue crabs make up nearly two-thirds of the value of Norfolk's catch (64%). Because red crab is a deep water, offshore species, it contributes little to this inshore fishing community.

Posquoson, VA

There is no information available on Posquoson, VA.

Seattle, WA

Since Seattle is not in the Northeast region, we have no information on the importance of fishing to this port in general. Because red crab is a species not found in the Northwest region, the importance of red crab fishing in particular to Seattle would be minimal.

These non-qualifiers had a total of 160 alternative permits. Lobster was the most frequent permit issued, with 22 permits issued. Bear in mind that any one vessel may have several different categories of lobster permits, such as trap area 1, trap area 2, or trap area 3. They also had permits for squid mackerel and butterfish, multispecies, dogfish, ocean quahog, sea scallop, herring, surf clam, bluefish, monkfish, black sea bass, summer flounder, tilefish, scup, and limited access scallop in decreasing order of magnitude.

Summary

There were a total of 19 names of places where some evidence of engagement in the red crab fishery was found. Unfortunately, due to a lack of mandatory reporting, it is not possible to reliably determine the level of engagement of these locations with respect to fishing in general or the red crab fishery in particular.

The controlled assess portion of the FMP may, due to the criteria established, exclude anyone that would like to enter the fishery in the future as well as exclude current participants that may not meet the qualification criteria. Non-qualifiers will not be able to land red crab in this region above the levels allowed under the proposed incidental catch limit, but may be able to fish for red crab in other regions of the country. Excluded vessels and the communities within which they are based may be affected by this restriction.

7.1.9 National Standard 9 -- Bycatch

Conservation and management measures shall, to the extent practicable, (A) minimize bycatch and (B) to the extent bycatch cannot be avoided, minimize the mortality of such bycatch.

Based on reports from members of the fishing industry, there is little bycatch of other species in the directed red crab fishery due to the nature of the fishing gear and operations of the directed fishery. The fishery operates in very deep water, distinct from the fishing grounds of most other managed species, is prosecuted using only selective red crab pots (these traps have the opening on the top and do not provide any barriers to egress by animals that enter the trap), and the catch is quickly sorted on the deck of the vessel, with all unwanted catch immediately returned to the sea with minimal handling. The Council intends to monitor any bycatch associated with the directed red crab fishery and will consider management action to address bycatch if, at any time in the future, available information indicates that such action is warranted.

This FMP proposes to establish controls on the amount of red crab that can be landed as incidental catch by participants of other fisheries. The amount of allowable incidental catch is not currently believed to be significant, but the Council will monitor these landings and may adjust the incidental catch limit in the future if necessary. The Council also intends to monitor the bycatch of red crabs in other fisheries, most notably the deep-water monkfish fishery, to determine whether bycatch of red crabs and the associated bycatch mortality is significant. Depending on the amount and significance of red crab bycatch in other fisheries, the Council may consider taking appropriate actions to minimize this bycatch.

7.1.10 National Standard 10 -- Safety of Life at Sea

Conservation and management measures shall, to the extent practicable, promote the safety of human life at sea.

To the extent possible, this FMP is intended to minimize the dangers to human life at sea while achieving the conservation and management objectives of the plan. Fishing is an inherently dangerous occupation; participants must constantly balance the risks imposed by weather and other natural conditions against the potential economic benefits. A management plan should be designed to that it does not encourage dangerous behavior by the participants. Certain measures, such as the hard TAC, that could result in a "race to fish" (a derby-type fishery), could have had an adverse effect on the safety of human life at sea but were not selected by the Council, which decided instead to use a target TAC approach. Other measures proposed in this FMP, such as trip limits, trap limits, and DAS, are intended to reduce the potential for a derby-type fishery and, thus promote the safety of human life at sea. The potential impacts to the safety of human life at sea are discussed as part of the social impacts of each proposed management measure and alternative in Sections 5.3 and 5.4 of this FMP.

The conclusion of this analysis is that the management measures do not pose additional safety risks. No specific comments were received during public hearings on this issue, and no written comments were received that identified concern for the impact of the proposed measures on vessel safety.

7.2 Other Required Provisions

Section 303 of the Magnuson-Stevens Act contains 14 additional required provisions for FMPs, which are discussed below. Any FMP prepared by any Council, or by the Secretary, with respect to any fishery, must comply with these provisions.

(1) contain the conservation and management measures, applicable to foreign fishing and fishing by vessels of the United States, which are-- (A) necessary and appropriate for the conservation and management of the fishery to prevent overfishing and rebuild overfished stocks, and to protect, restore, and promote the long-term health and stability of the fishery; (B) described in this subsection or subsection (b), or both;

and (C) consistent with the National Standards, the other provisions of this Act, regulations implementing recommendations by international organizations in which the United States participates (including but not limited to closed areas, quotas, and size limits), and any other applicable law.

For a description of the proposed measures and management alternatives intended to conserve and manage the red crab fishery, including the prevention of overfishing, please see Section 4.0. Because this resource is not considered overfished, this FMP does not include a rebuilding plan or schedule. For a discussion of consistency with the National Standards, please see Section 7.1. For a discussion of the consistency of this FMP with other applicable law, please see Section 12.0.

(2) contain a description of the fishery, including, but not limited to, the number of vessels involved, the type and quantity of fishing gear used, the species of fish involved and their location, the cost likely to be incurred in management, actual and potential revenues from the fishery, any recreational interest in the fishery, and the nature and extent of foreign fishing and Indian treaty fishing rights, if any.

For a description of the fishery, including the number and type of fishing vessels involved in the fishery, the type and quantity of fishing gear used, the resource species and its location and environment, and the other relevant issues, please see Section 8.3.

(3) assess and specify the present and probable future condition of, and the maximum sustainable yield and optimum yield from, the fishery, and include a summary of the information utilized in making such specification.

For a discussion of the maximum sustainable yield and optimum yield for this fishery, please see Sections 3.4 and 3.6. For a discussion of the probable future condition of the fishery, please see Section 8.1.5.

(4) assess and specify-- (A) the capacity and the extent to which fishing vessels of the United States, on an annual basis, will harvest the optimum yield specified under paragraph (3); (B) the portion of such optimum yield which, on an annual basis, will not be harvested by fishing vessels of the United States and can be made available for foreign fishing; and (C) the capacity and extent to which United States fish processors, on an annual basis, will process that portion of such optimum yield that will be harvested by fishing vessels of the United States.

For a discussion of the capacity and extent to which U.S. fishing vessels are likely to harvest the annual optimum yield, the potential for foreign fishing to harvest a portion of OY, and the capacity of U.S. fishing processors to process OY, please see Section 8.3.3.

(5) specify the pertinent data which shall be submitted to the Secretary with respect to commercial, recreational, and charter fishing in the fishery, including, but not limited to, information regarding the type and quantity of fishing gear used, catch by species in numbers of fish or weight thereof, areas in which fishing was engaged in, time of fishing, number of hauls, and the estimated processing capacity of, and the actual

processing capacity utilized by, United States fish processors.

For a discussion of the reporting requirements proposed in the FMP, see Section 3.8.

(6) *consider and provide for temporary adjustments, after consultation with the Coast Guard and persons utilizing the fishery, regarding access to the fishery for vessels otherwise prevented from harvesting because of weather or other ocean conditions affecting the safe conduct of the fishery; except that the adjustment shall not adversely affect conservation efforts in other fisheries or discriminate among participants in the affected fishery.*

The proposed framework adjustment process is intended to allow for temporary and/or real-time adjustments to management measures to address these issues as they arise. Section 3.10 describes the proposed framework adjustment process and identifies the types of management measures that may be implemented through a framework adjustment to the Red Crab FMP.

(7) *describe and identify essential fish habitat for the fishery based on the guidelines established by the Secretary under section 305(b)(1)(A), minimize to the extent practicable adverse effects on such habitat caused by fishing, and identify other actions to encourage the conservation and enhancement of such habitat.*

Section 3.7 describes the alternatives considered by the Council to identify essential fish habitat (EFH) for the red crab fishery. Section 8.2.3 describes the effects of the red crab fishery on EFH and the effects of other fisheries on the EFH of deep-sea red crab. Section 8.2.4 identifies red crab habitat conservation recommendations suggested by the Council. The Council did not developed management alternatives specifically to minimize any adverse effects of fishing on red crab EFH primarily because there are no known adverse effects at this time, and also because at least two of the management measures selected as part of the preferred alternative (trap limits and prohibitions on non-trap gear in the directed red crab fishery) were chosen in part because they minimize the potential for adverse effects in the future. If additional information is obtained in the future that suggests there are adverse effects on any EFH from the red crab fishery, then the Council will develop and consider management alternatives for minimizing, mitigating, or avoiding these adverse effects.

(8) *in the case of a fishery management plan that, after January 1, 1991, is submitted to the Secretary for review under section 304(a) (including any plan for which an amendment is submitted to the Secretary for such review) or is prepared by the Secretary, assess and specify the nature and extent of scientific data which is needed for effective implementation of the plan.*

Section 2.4 identifies several important management issues related to the need for scientific data with which to effectively implement and monitor the effectiveness of the FMP. Section 9.0 identifies several specific research and information needs which would improve the Council's and NMFS' ability to effectively manage the red crab fishery and ensure the sustainability of the resource.

(9) include a fishery impact statement for the plan or amendment (in the case of a plan or amendment thereto submitted to or prepared by the Secretary after October 1, 1990) which shall assess, specify, and describe the likely effects, if any, of the conservation and management measures on-- (A) participants in the fisheries and fishing communities affected by the plan or amendment; and (B) participants in the fisheries conducted in adjacent areas under the authority of another Council, after consultation with such Council and representatives of those participants.

The analyses contained in the Environmental Impact Statement assess the potential biological impacts of the proposed management measures as well as the potential economic and social impacts on the human environment. This includes impacts on current fishery participants, impacts participants in other fisheries, impacts on small commercial fishing entities, impacts on seafood dealers, and impacts on relevant fishing ports. The fishery impact statement is included in Section 6.0 of this combined FMP document.

(10) specify objective and measurable criteria for identifying when the fishery to which the plan applies is overfished (with an analysis of how the criteria were determined and the relationship of the criteria to the reproductive potential of stocks of fish in that fishery) and, in the case of a fishery which the Council or the Secretary has determined is approaching an overfished condition or is overfished, contain conservation and management measures to prevent overfishing or end overfishing and rebuild the fishery.

For a discussion of the proposed overfishing definitions and the criteria for identifying when the red crab fishery is overfished, see Section 3.5.

(11) establish a standardized reporting methodology to assess the amount and type of bycatch occurring in the fishery, and include conservation and management measures that, to the extent practicable and in the following priority-- (A) minimize bycatch; and (B) minimize the mortality of bycatch which cannot be avoided.

For a discussion of the reporting requirements proposed in the FMP, including requirements to report bycatch using the VTR forms and a proposed subsampling program, see Section 3.8.

(12) assess the type and amount of fish caught and released alive during recreational fishing under catch and release fishery management programs and the mortality of such fish, and include conservation and management measures that, to the extent practicable, minimize mortality and ensure the extended survival of such fish.

This amendment proposes no recreational fishery management measures. There is no recreational fishery for deep-sea red crabs due to the depth of the water (greater than 320 meters) where red crabs occur and the gear necessary to harvest red crabs (e.g., red crab pots and large hydraulic pot haulers).

(13) include a description of the commercial, recreational, and charter fishing sectors which participate in the fishery and, to the extent practicable, quantify trends in landings of the managed fishery resource by the commercial, recreational, and charter fishing sectors.

Sections 8.3 and 8.4 describe the various sectors which participate in the red crab fishery. Where possible, these sections also identify any trends evident in the landings of red crab by the fishery.

(14) to the extent that rebuilding plans or other conservation and management measures which reduce the overall harvest in a fishery are necessary, allocate any harvest restrictions or recovery benefits fairly and equitably among the commercial, recreational, and charter fishing sectors in the fishery.

There are no known recreational or charter fishing enterprises involved in the red crab fishery. The commercial sector is the only sector involved in this fishery, therefore, all allocations, restrictions, and/or benefits are anticipated to be borne solely by the commercial sector. If it becomes necessary in the future, the Council may develop management measures to address the recreational and/or charter fishing sectors of the fishery, should these sectors develop.

8.0 Description of the Resource and the Affected Environment

8.1 Description of the Species

The deep-sea red crab (*Chaceon quinquedens*) is a deep-water species of brachyuran crab (Family *Geryonidae*) that inhabits deep waters of the continental shelf and slope off the Atlantic coast of the U.S. Geryonid crabs are true deep-water species found in all oceans. Geryonid crabs occur from approximately 100 meters to more than 2800 meters in depth. The family contains three genera: *Geryon* proper; *Chaceon*; and *Zariquieyon*. *Chaceon* contains 11 species previously placed in *Geryon* (including *C. quinquedens*). Most species in this genus are either red or tan (the South Atlantic "golden" crab is actually of the tan variety) (Manning 1990). Generally, red species live in deeper water than tan ones, young crabs live in considerably deeper waters than adults, and the geographic ranges for these species tend to be limited rather than cosmopolitan (Manning 1990).

8.1.1 Life History Characteristics

The following description of the life history of the deep-sea red crab is in part excerpted from the essential fish habitat (EFH) source document for red crab (Steimle et al. 2001). The EFH source document is provided as Appendix A and contains a comprehensive description of the red crab life history, as well as a detailed description of the environment in which red crabs occur and the habitat characteristics of the red crab.

The red crab, like most deep-sea organisms, is slow growing but reaches a maximum size of about 180 mm carapace width (CW), and may live for 15 years or more, although precise information on growth rate and life span are lacking (Serchuk and Wigley 1982).

As for most decapod crustaceans, red crab eggs are ovipositioned and held *en masse* on the female pleopods under their abdominal flap for up to nine months until the eggs hatch and the larvae are released into the water column (Haefner 1978). Mature eggs are large and yolky for crustaceans and range in diameter from 484 to 846 μm, and are thought to be the largest eggs known for crabs with planktonic development (Haefner 1977, 1978; Hines 1982, 1988).

Much of what we know about the development of the larval stage of red crabs comes from eggs that were collected from captured females and then hatched and raised in laboratories. Larval development was observed to consist of four zoeal stages and a final megalopa. The zoea is typical in appearance to most brachyurans, i.e., with a large dorsal spine, and the megalopa is also of a typical crab form (Perkins 1973). The larval stages of this species are relatively large in size compared to other brachyuran crabs (Sulkin and Van Heukelem 1980). Kelly et al. (1982) estimated that, depending upon the water temperatures and food encountered during development, the red crab larvae require about 23 - 125 days from hatching until the megalopa settle. Red crab larvae appear more nutritionally flexible than more shallow-water crab species, and appear to have no difference in survival when presented with different diets in the lab (Sulkin and Van Heukelem 1980). Sulkin and Van Heukelem (1980) suggest that nutritional flexibility may be an evolutionary adaptation for survival in deep waters.

Settlement of juvenile red crabs is reported at a relatively large first post-megalop instar stage, about 4 mm CW (Van Heukelem et al. 1983). This large size at settlement may be an adaptation to slow post-settlement growth, in that a large size at settlement will reduce the time and number of instars required to reach maturity (Hines 1986, 1990). Growth of juveniles is also partially temperature dependent, as Van Heukelem et al. (1983) reported that juvenile crabs maintained at 9 - 15° C grew six times faster than those maintained at 6° C, and at least five molts are required to grow to about 20 mm CW. Juvenile red crabs are most abundant from 700 - 1800 meters in depth (Hastie 1995; Steimle et al. 2001; Wigley et al. 1975). It is interesting to note that although juvenile red crabs appear to grow much faster at higher temperature (Van Heukelem et al. 1983), the actual bottom temperature where juvenile crabs are found is less than 5° C[23].

Haefner (1978) and Van Heukelem et al. (1983) suggest that the red crab requires 18 - 20 molts before it reaches its maximum size of about 180 mm CW. Based on tagging studies, older crabs might molt infrequently, and intermolt periods can be 6 - 7 years for larger crabs, > 100 mm CW (Gerrior 1981; Lux et al. 1982). After a molt, carapace size may be increased by about 7 - 12% and body weight by about 33% (Serchuk and Wigley 1982). Adults are largely segregated by sex, with females shallower than males. Overall, adult red crabs occupy depths ranging from 200 - 1300 meters and occur in the highest concentrations between 320 - 914 meters (Wigley et al. 1975).

Because of the long intermolt period for adult females (5 - 7 years), and the assumption that like most other brachyurans fertilization only occurs at molting, it has been speculated that red crabs may not spawn annually. It is possible that sperm could be stored for intermolt spawning efforts; thus there can be annual brooding within the population, although not for every mature individual (Hines 1982; Lux et al. 1982; Erdman et al. 1991; Biesiot and Perry 1995). Haefner (1977) reports the size at maturity of red crabs off Virginia was between 80 - 91 mm CW. Several studies reported ovigerous crabs between 80 - 130 mm CW (Wigley et al. 1975; Haefner 1977; Hines 1988), although some egg-bearing red crabs were observed as small as 61 mm CW (Elner et al. 1987).

Mating behavior is considered typical of other crabs (Hastie 1995). Elner et al. (1987) studied the mating behavior of the red crab. Male crabs form a protective pre-copulatory “cage” around the female until she molts. Copulation takes place once the female molts and the male continues to hold onto and protect the female for an extended period (1 - 2 weeks) until the female’s shell hardens. Males do not actually carry females prior to their molt, but they do carry females afterward. Prolonged protection of the female serves to ensure the survival of the female during her fragile molt period and

[23] In fact, Wigley et al. (1975) found no juvenile red crabs in temperatures greater than 6° C.

ensures the male's paternity. Both males and females can apparently mate more than once; males by repeating the mating process with multiple partners and females if they are released by the first male while they are still in a soft shell state (Elner et al. 1987).

Eggs of the red crab are the largest known among brachyuran crabs with planktonic development (Hines 1988). Hines (1988) studied the fecundity and reproductive output of red crabs. The body size of female brachyuran crabs is the primary determinant of fecundity. Larger females produce larger brood masses and have greater fecundity per brood than smaller crabs. For most brachyurans, brood weight, on average, is constrained to approximately 10% of female body weight by the space available for yolk accumulation. Red crabs have larger brood masses as a percentage of body weight than most other brachyurans, with brood masses equaling as much as 22% of body weight (Hines 1988). Red crabs also have larger eggs than other crab species, but have relatively low fecundity (160 - 275 thousand eggs per red crab female compared with 1 - 3 million eggs per female for similarly sized crabs) (Hines 1988). The large eggs of this species may help provide nutritional flexibility to the larvae hatched in the deep-sea.

8.1.2 Distribution

Deep-sea red crabs are patchily distributed along the continental shelf edge and slope of the western Atlantic, occurring mostly between 200 and 1800 meters from Emerald Bank, Nova Scotia (and into the Gulf of Maine) and along the continental slope of the east coast of the U.S. into the Gulf of Mexico (Pequegnat 1970; Williams and Wigley 1977; Elner et al. 1987). Previous reports of the occurrence of *Geryon (Chaceon) quinquedens* off West Africa and elsewhere outside of the western North Atlantic continental shelf edge and slope (including Bermuda, Brazil, and Argentina) were found to involve several new geryonid species or mis-identifications (Manning and Holthuis 1981, 1986, 1989). The species' distribution in the depths of the Caribbean Sea, around the West Indies Islands, and off northeastern South America remains uncertain (R. Manning, National Museum of Natural History, Smithsonian Institution, Washington DC, personal communication, January 2000).

As noted above, deep-sea red crabs are distributed along the edge of the continental shelf and on the continental slope from the Scotian Shelf and the Gulf of Maine to at least the coast of Florida and into the Gulf of Mexico. The species is also reported to occur in the deep-water canyons along the coast, such as Norfolk, Hudson, Hydrographer, and Oceanographer Canyons (see Figure 17). The species appears constrained by depth to a fairly narrow band from about 200 meters in depth to as deep as 1800 meters. Density is not known across this depth range (Wigley et al. 1975). The maps on the following pages display the variety of depth ranges known to be occupied by red crabs (Figure 18 - Figure 21).

The larvae of this species are pelagic and occur in warmer and lower salinity surface waters above the continental slope habitat frequented by adult females (Steimle et al. 2001). Post-larval red crabs are primarily inhabitants of the silty seabed of the deep cold water on the outer continental shelf and mid to upper continental slope of the western North Atlantic, south of the Gulf of Saint Lawrence (Canada), into the partially rocky Gulf of Maine, and along the continental shelf edge and slope into the Gulf of Mexico, and possibly the northwestern South Atlantic. These crabs are considered part of an assemblage of deep-water crustaceans that inhabit the mid to upper continental slope of the northwest Atlantic, and this assemblage includes a number of smaller shrimp and crabs (Wenner and Boesch 1979). Salinities on the upper slope where benthic red crabs occur tend to be stable and oceanic at about 35-36 ppt (Schmitz et al. 1987). The thermal regime can be more variable, ~ 4-10ºC, and include the temporary warming effects of the passage of an inshore loop of the Gulf Stream along the upper slope and shelf edge.

The NEFSC bottom trawl surveys collect small quantities of benthic red crabs; these surveys are typically restricted to depths less than 366 meters on the upper slope, although they occasionally trawl in deeper canyons (Reid et al. 1999). Fishery independent information of red crab distributions below this NEFSC bottom trawl survey depth limit are only available from infrequent, special surveys, such as those reported by McRae (1961), Haefner and Musick (1974), Wigley et al. (1975) or Hecker (1983).

In the Northeast, adult red crabs occur along the continental shelf edge and upper slope from the Scotian Shelf and the Gulf of Maine to Cape Hatteras (Serchuk and Wigley 1982). The species also occurs south of Cape Hatteras into at least the Gulf of Mexico at similar depths. The NEFSC bottom trawl survey data (1964 - 1999) were examined for the occurrence of red crabs above the 366 meter depth limitation of the survey. Adult red crabs were segregated into two groups for analysis: below harvestable-size (small) adults (8-11 cm CW) and large adults at or above the commonly used harvestable size of 11 cm CW (see Figures 6 and 7 in Appendix A). The small adults were not collected during the winter bottom trawl surveys and only a few were collected in the summer surveys within and around the perimeter of the Gulf of Maine, but during the spring and fall surveys, they were collected in minor to moderate numbers both within the western Gulf of Maine and along the outer continental shelf between southern Georges Bank and Norfolk Canyon. The larger, harvestable adults were collected in a similar pattern, although fewer of the larger crabs were collected within the Gulf of Maine during the spring and fall trawl surveys.

As previously noted, there may be an inverse relationship between body size and depth for adults (Wigley et al. 1975). Stone and Bailey (1980) reported that large crabs were only collected at 180-360 meter depths on the Scotian Shelf. In the Gulf of Mexico, red crabs were not commonly collected above the 677 meter depth zone; temperature or bottom sediment type could be prime factors controlling their distribution in the Gulf of Mexico (Lindberg et al. 1990; Lockhart et al. 1990). From around Cape Hatteras into the Gulf of Mexico, red crabs may partially overlap the distribution of a larger congenetic species, the golden crab (*C. fenneri*, previously called *Geryon affinis*), that was noted to occur uncommonly off southern New England as well (Wigley et al. 1975).

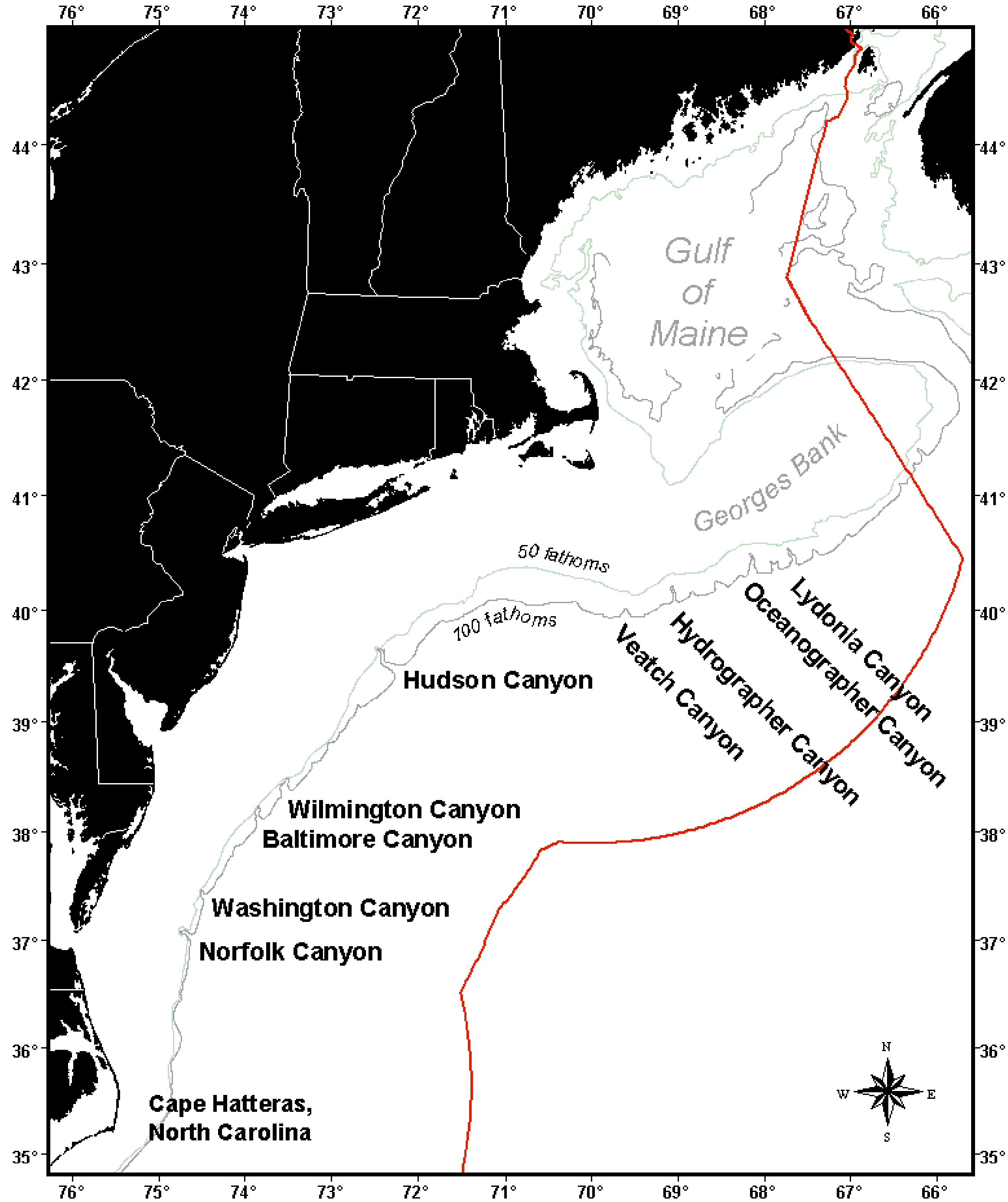

Figure 17: Map of the major offshore canyons in the area of the red crab fishery.

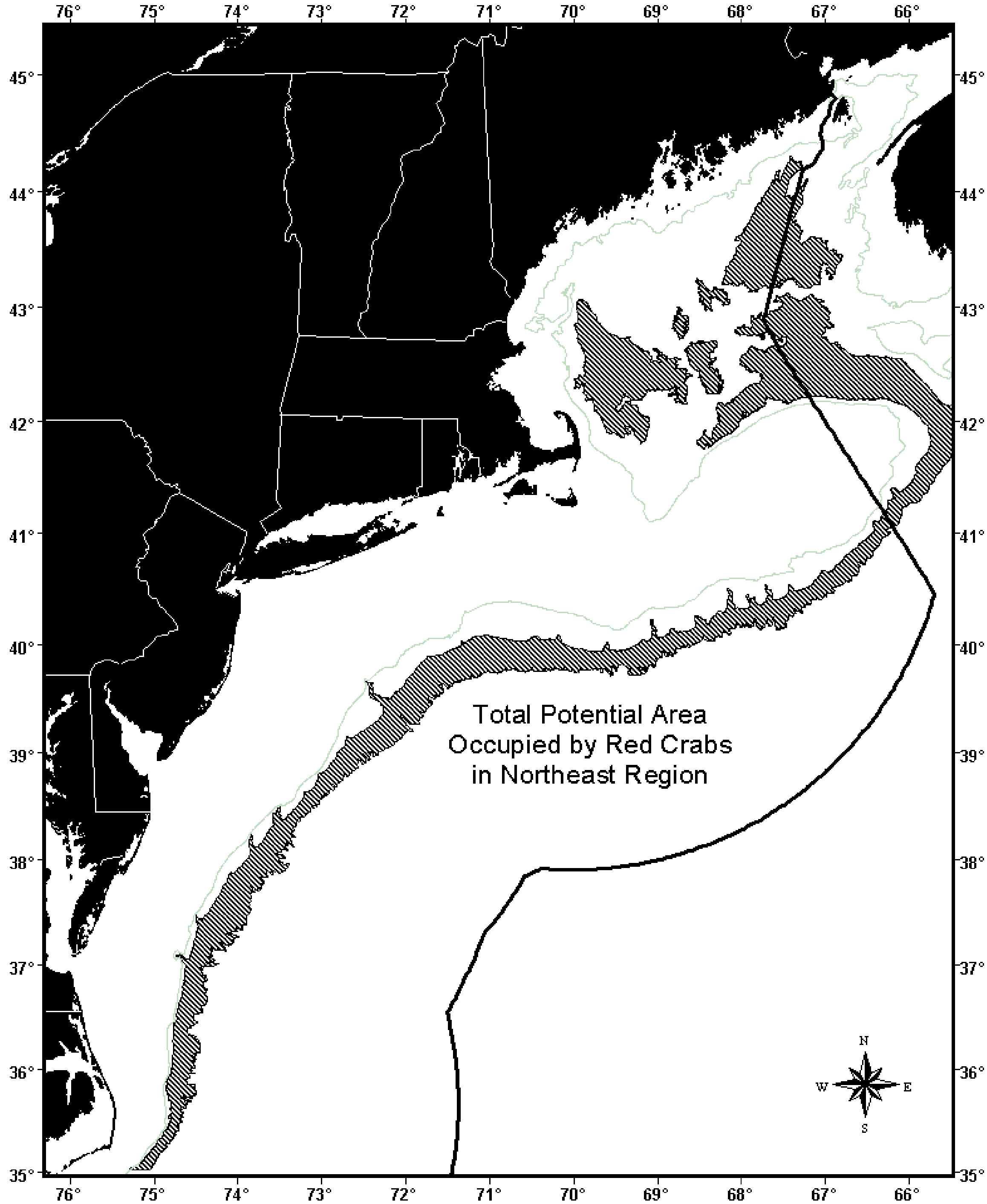

Figure 18: Map of total area (based on depth, 200 - 1800 meters) where red crabs may occur in the Northeast Region.

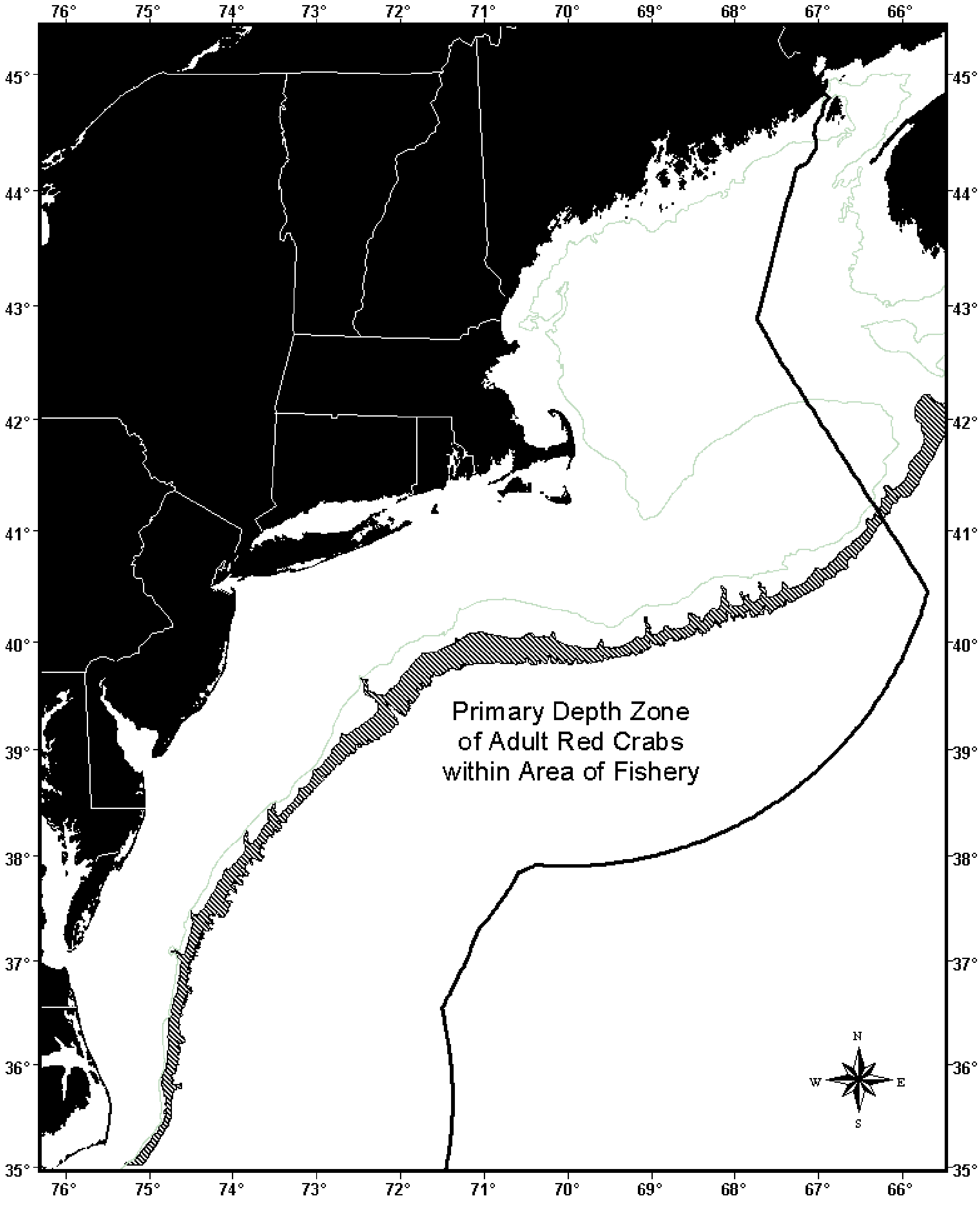

Figure 19: Map of the primary depth zone (200 - 1300 meters) for adult red crabs within the area of the red crab fishery.

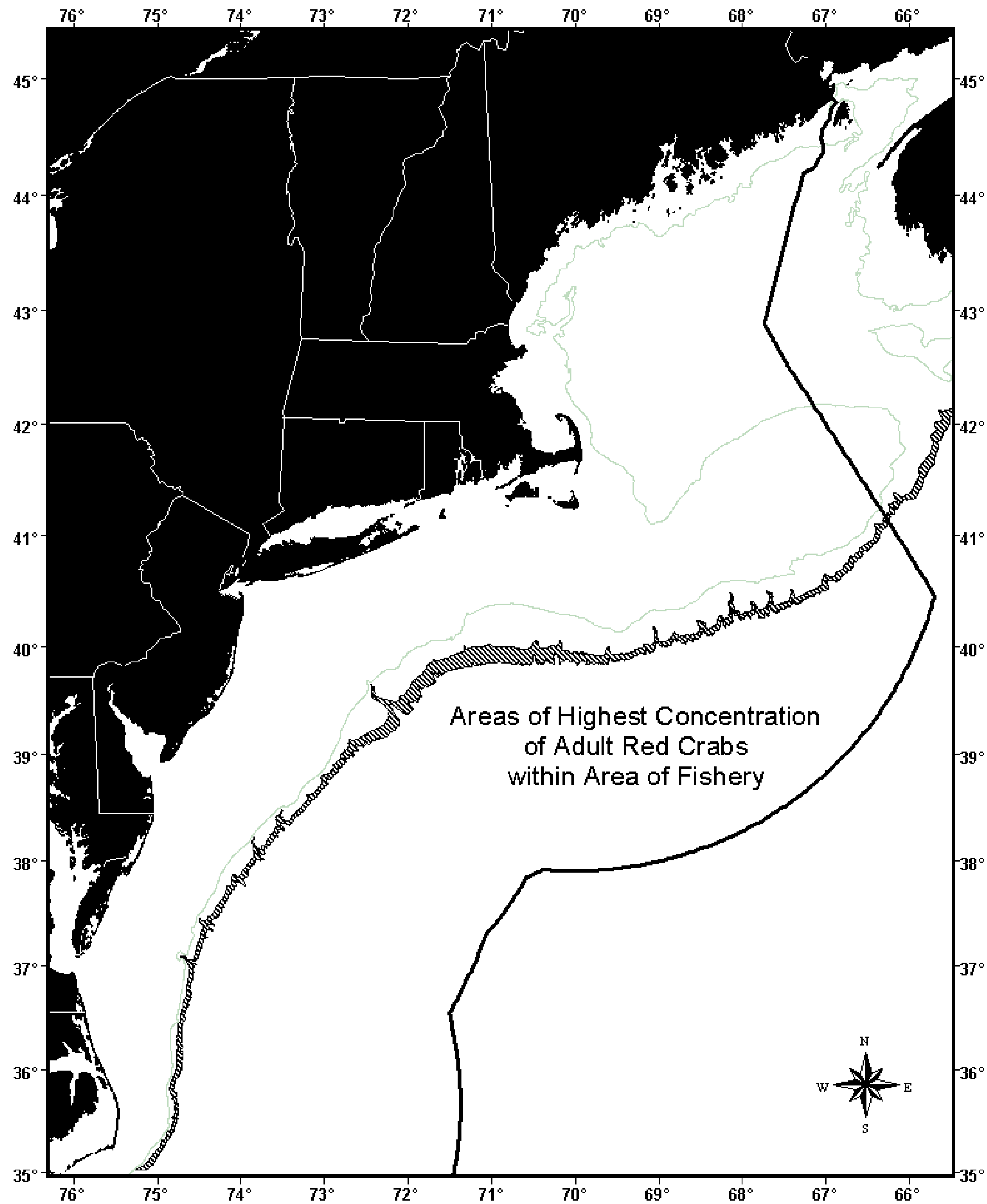

Figure 20: Map of the area of highest concentration (320 - 914 meters) for adult red crabs within the area of the red crab fishery.

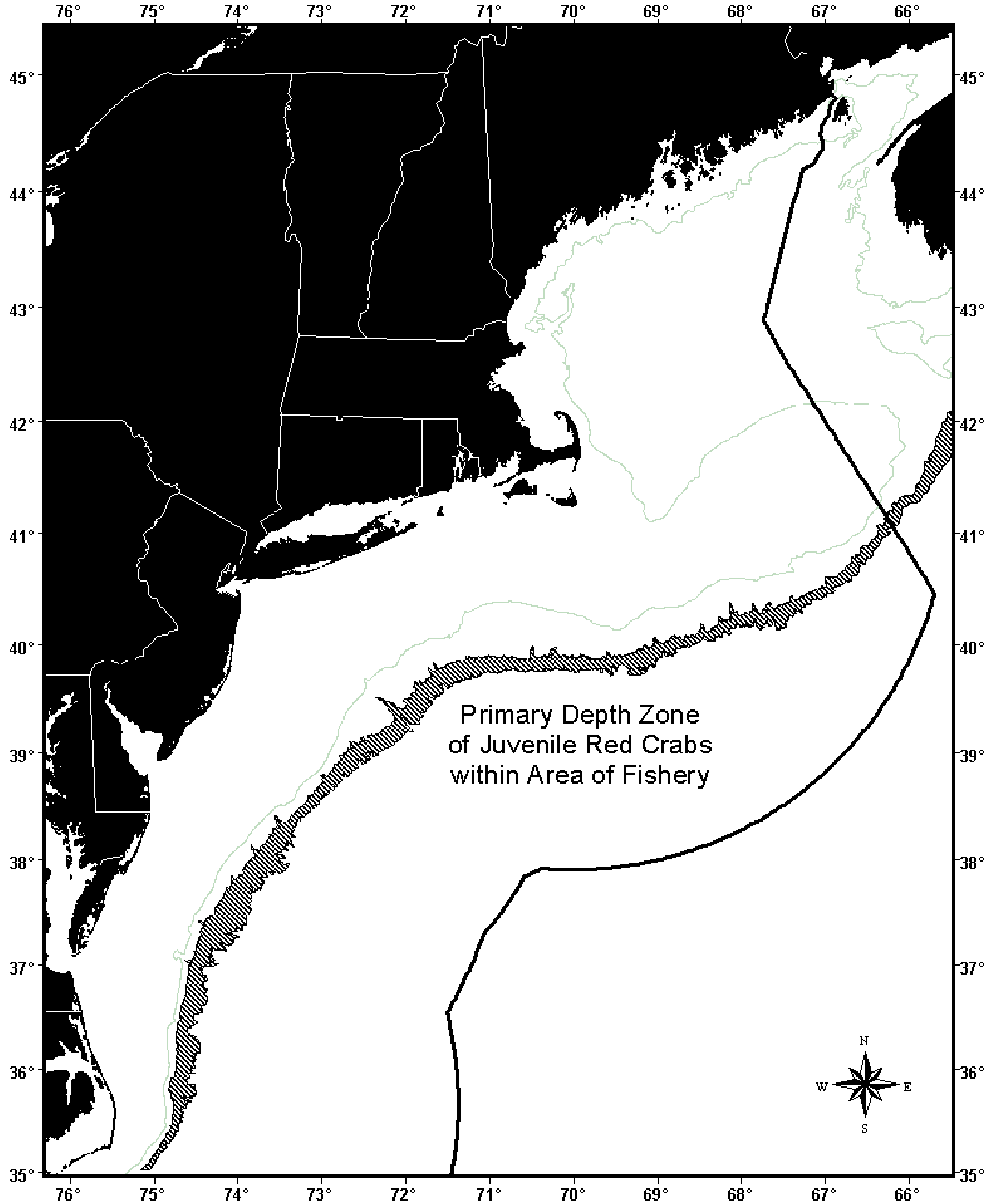

Figure 21: Map of the primary depth zone (700 - 1800 meters) for juvenile red crabs within the area of the red crab fishery.

8.1.3 Abundance and Present Stock Condition

8.1.3.1 Total and Commercial Biomass

See Section 3.4 for a discussion of estimates for total and commercial biomass for the red crab stock to be managed under this FMP.

8.1.3.2 Present Stock Condition

The lack of fishery-independent data on the red crab resource presents a real challenge to the Council, as we have no current estimates of red crab biomass to be used to determine the present stock condition. The NMFS bottom trawl survey only occasionally captures any red crabs (Steimle et al. 2001) and these appear to occur at the shallowest fringe of their habitat. Red crabs are known to occupy depths from 200 - 1800 meters, but the highest densities and biomass occur between 320 - 910 meters (Wigley et al. 1975 and Steimle et al. 2001). The NMFS otter trawl survey does not tow deeper than 366 meters (Reid et al. 1999).

There are plans for a survey to be conducted sometime in the next two to three years. The proposed survey would be conducted independently of NMFS in a joint venture by several area scientists and members of the red crab fishing industry. Depending on how the survey is designed and implemented, the resulting data may be comparable with the 1974 Albatross IV survey and therefore useful in developing an index of biomass. Unfortunately, the timing of the proposed survey is such that the earliest at which we could assess the current stock condition using biomass data would be 2004 - 2005.

8.1.4 Ecological Relationships

8.1.4.1 Predator-Prey Relationships

As reported in Steimle et al. (2001), there is little indication that red crab constitute a major prey item for any species. There are a few records of predation on red crabs, but these appear only as minor components of prey sources (Steimle et al. 2001). Also, there are few records of red crab prey sources. Gray (1969) and Beyers et al. (1980) both report some observations and suggest a variety of food sources eaten by red crabs. Sea anemones may be a desired prey (Gray 1969), but most likely red crabs are opportunistic omnivores due to the limited availability of food at the water depths common for this species (Beyers et al. 1980; Steimle et al. 2001).

8.1.4.2 Other Affected Fishery Resources

Steimle et al. (2001) describes few competitive interactions between red crab and any other fishery resources. The primary competitive interactions involve Jonah crab, *Cancer borealis*, American lobster, *Homarus americanus*, and golden crab, *Chaceon fenneri*, but none of these appears significant.

8.1.4.3 Marine Mammals and Protected Species

There is no information in any of the available literature reviewed for this FMP that suggests red crabs are a significant, or even a minor, component of the diets of any marine mammals or endangered species.

8.1.5 Probable Future Condition

Deep-sea red crabs are a long-lived and slow-growing species with delayed maturity (Steimle et al. 2001). Their reproductive biology is likely to result in infrequent and periodic recruitment. The current biomass of red crabs in the management area is unknown. Given these life history characteristics and the data poor situation, conservative management is appropriate to guard against overfishing.

The number of vessels interested in fishing for red crabs full-time has increased 100% in the last two years and is likely to continue to increase in the near future without conservative management that controls access to the fishery. Without some form of management action that constrains fishing effort and harvests of red crab in this fishery, it is likely that overfishing will occur. During the first emergency period (May 18 - November 14, 2001), 2.825 million pounds were harvested and the fishery shut down on August 17, 2001. If this level of effort was sustained year-round, expected landings would equal 11.3 million pounds -- more than twice the baseline estimate of MSY.

This species is not likely to be able to sustain the high fishing mortality that would result from a fleet as large as is likely to engage in the directed fishery; however, if the management measures proposed in this FMP are adopted and implemented in a timely manner, the fishing effort would be expected to stabilize at a sustainable level and the stock would be less likely to be overfished or subject to overfishing.

8.1.6 Life History Information and Research Needs

The essential fish habitat source document describing the red crab life history and habitat characteristics provided in Appendix A (Steimle et al. 2001), includes a description of information and research needs for this species. As this document suggests, there is a lot more that needs to be learned about the distribution of the species at all life history stages, the variability and trends in population abundance and dynamics, and a way to adequately sample larval stages. The most important information and research needs for this species includes:

- age-size relationships;
- durations of intermolt periods for all size classes;
- fishing mortality rates and natural mortality rates for all size classes;
- mortality of discarded crabs caught in the directed fishery;
- yield per recruit information;

- upslope and lateral migrations (including spawning or size-related);
- larval dispersal patterns and testing of larval dispersal models;
- genetic comparison of the Northwest Atlantic and the Florida/Gulf of Mexico populations;
- when and where females primarily spawn and the possibility of sperm storage by intermolt females;
- role of sex ratio and male size on fertilization success;
- a cost-effective approach to conducting stock assessment surveys for this species; and
- standardized size measurements.

8.2 Description of the Habitat

8.2.1 Description of the Physical Environment

8.2.1.1 Description of the Geological Environment

The deep-sea red crabs are most often associated with the continental slope of the Atlantic coast of North America, from 200 - 1800 meters of depth, between Emerald Bank, Nova Scotia (and into the Gulf of Maine) and in the Gulf of Mexico. The continental slope extends from the shelf break to water depths of about 2000 meters. The slope is the most prominent and complex physiographic feature along the Atlantic coast (Tucholke 1987). The continental slope has a low gradient (3 - 6º) but is steeper than other provinces of the continental margin. The slope is divided into three segments, each different in character: Georges Bank to Cape Hatteras; Florida-Hatteras Slope south of Cape Hatteras; and the Blake Escarpment. For the purposes of this FMP, we will focus on a description of the Georges Bank to Cape Hatteras segment, which comports with the red crab management unit.

The morphology of the present continental slope largely appears to be a result of sedimentary processes that occurred during the Pleistocene, including:

(1) slope upbuilding and progradation by deltaic sedimentation principally during sea-level low-stands;

(2) canyon-cutting by sediment mass movements (slides, debris flows, turbidity currents) during and following low-stands; and

(3) sediment slumping (Tucholke 1987).

The top of the continental slope in the Georges Bank and Cape Hatteras region is the shelf break, which occurs at depths between 40 and 160 meters. The shelf break includes old shorelines developed during the Pleistocene Era when the sea levels reached their lowest levels (Tucholke 1987). These old shorelines are most clearly defined in the areas between Hudson Canyon and Norfolk Canyon.

The base of the slope is defined by a marked change in seafloor gradient where the continental rise begins. This occurs near 2000 meters in depth, but can actually vary 200-300 meters either way (Tucholke 1987). The gradient of the seafloor on the continental slope along its entire range averages between 3° and 6°, and averages 8° on the steepest segments (Tucholke 1987).

North of Cape Hatteras, the continental slope contains many submarine canyons. There are at least 70 large canyons and many smaller gullies between Cape Hatteras and the northeast peak of Georges Bank (Figure 17 displays some of the major named canyons in this area). The canyons are not spaced evenly along the slope, but tend to decrease in areas of increasing slope gradient. Canyons are typically "V"-shaped in cross section and often have steep walls and outcroppings of bedrock. The canyons are continuous from the canyon heads to the base of the continental slope. Some canyons stop at the base of the slope, but some continue as channels onto the continental rise. Larger and more deeply incised canyons are generally significantly older than smaller ones, but there is also evidence that some older canyons have experienced several episodes of filling and re-excavation (Tucholke 1987). Many, if not all, of the submarine canyons may first form by mass-wasting processes on the continental slope, although there is evidence that some canyons formed as a result of fluvial drainage (i.e., Hudson Canyon).

8.2.1.2 Description of the Biological Environment

The fauna of the deep-sea are generally divided into three classes, based on size and taxonomy: megafauna, macrofauna, and meiofauna. Megafauna are the largest class and are defined as animals visible in photographs; macrofauna are an intermediate size class; and meiofauna are the smallest animals, including copepods and nematodes. Polychaetes represent the most important deep-sea group in terms of numbers of individuals and species. Gastropods do not appear to be very abundant in the deep sea, but past studies have not collected enough individuals for large-scale community and population studies (Wiebe et al. 1987).

Ophiuroids are considered to be among the most abundant deep-sea organisms, but there are actually only a few species of this group. The taxonomic group with the highest species diversity includes the peracarid crustaceans represented by Amphipoda, Cumacea, Isopoda, and the Tanaidacea (Wiebe et al. 1987). Some species in the deep-sea are widely distributed and others appear to be restricted to particular ocean basins. The ophuiroids and bivalves appear to have the broadest distributions, while the peracarid crustaceans mentioned above appear to be highly restricted because they brood their young and lack a planktonic stage of development (Wiebe et al. 1987).

There is evidence that Cape Hatteras may be a geographic boundary for upper slope fauna along the east coast of the U.S. (Cutler and Doble 1979). This may provide additional rationale for using Cape Hatteras as the southern boundary of the red crab management unit.

In general, fauna occupying hard-surface sediments in the deep-sea are not as dense as in comparable habitats in shallow water (Wiebe et al. 1987). The canyons, however, may develop a lush epifauna. Hecker et al. (1983) found faunal differences between the canyons and the slope environments, due at least in part to increased environmental heterogeneity. At depths of less than 800 meters, the fauna are extremely variable and the relationships between faunal distribution and substrate, depth, and geography are less obvious (Wiebe 1987). Hecker et al. (1983) found highly patchy faunal assemblages in the canyons and that there are additional faunal groups located in the canyons that do not appear to occur on the slope environment (mainly associated with hard substrates).

Prior to studies conducted in the late 1960's, the species diversity of the deep-sea was believed to be low (Wiebe et al. 1987). Several studies conducted in the late 1960's indicated greater diversity of the entire fauna of the continental slope compared with the continental shelf (Sanders 1968; Sanders and Hessler 1969; Grassle 1967, 1972). It is now known that the species diversity of most groups increases from the shelf to the intermediate depths of the slope and then declines in the deeper waters of the continental rise and plain (Rex 1981; Wiebe 1987). Diversity of megafauna also appears greatest at intermediate depths (1000 - 3000 m) (Haedrich et al. 1975, 1980).

Haedrich et al. (1980) studied the benthic megafauna in the deep waters of the continental slope off southern New England. The authors identified several distinct faunal assemblages according to depth zone, and ranked the top ten species by weight and by number in each depth zone. The results of the Haedrich et al. (1980) study as they apply to red crabs can be summarized as follows:

- Shallower than 254 meters, red crabs were not in the top ten by either weight or number.
- Between 283 - 650 meters, red crabs were eighth in number (0.3% of the total number of organisms observed) and first in weight (biomass of red crab = 43% of the total biomass of benthic megafauna).
- Between 653 - 1290 meters, red crabs were second in number (17% of the total number of organisms) and first in weight (51% of the total biomass).
- Deeper than 1290 meters, red crabs were not in the top ten in numbers and ranked tenth in weight in the 1380 - 1947 meter depth zone (2% of the total biomass).

8.2.1.3 Description of the Oceanographic Environment

There are several elements of the oceanographic environment that affect the continental slope where deep-sea red crabs live. From the coast seaward, there is coastal water, the Western Boundary Undercurrent,[24] slope water, the Gulf Stream, warm and cold core rings, and the Sargasso Sea (see Figure 22). The oceanographic environment over the continental slope and rise changes dramatically at Cape Hatteras, North Carolina, where the Gulf Stream diverges from the coast.

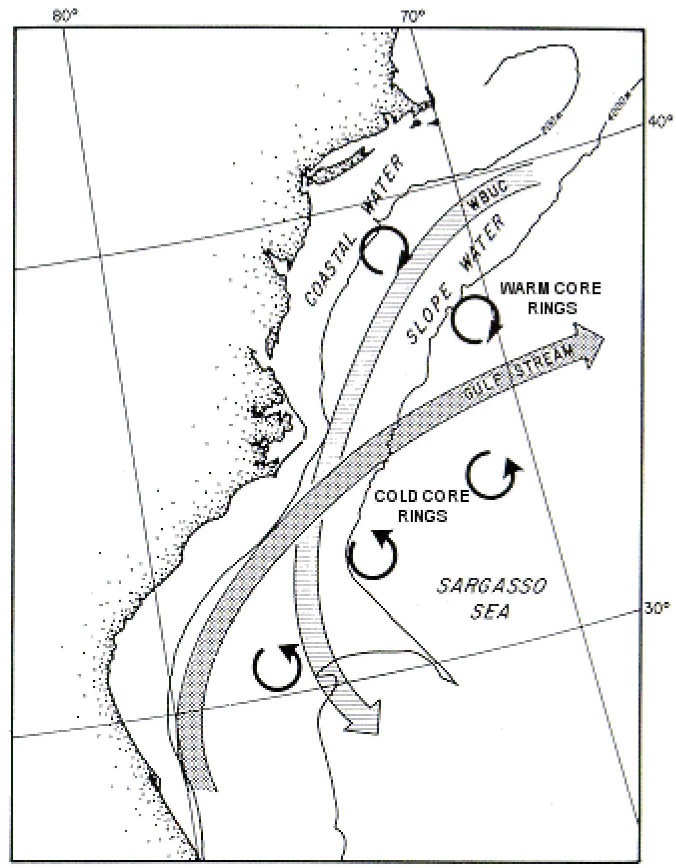

Figure 22: Principal hydrographic regimes of the Atlantic continental slope and rise (from Schmitz et al. 1987).

Southwest of Cape Hatteras, the Gulf Stream flows north and runs directly over the slope, but northeast of Cape Hatteras, the Gulf Stream takes a turn to the east and moves well off the shelf edge and slope. Northeast of Cape Hatteras, the space between the Gulf Stream and the shelf is occupied by slope water. The Western Boundary Undercurrent flows to the southwest along the continental rise (opposite the Gulf Stream). The Gulf Stream and the Western Boundary Undercurrent together represent one of the strongest low frequency horizontal flow systems in the world. Warm and cold core rings spin off from the Gulf Stream, either north or south of the Gulf Stream. The Sargasso Sea is located southeast of Cape Hatteras and does not have a direct affect on the area included in the management unit of this FMP, except to contribute warm water for the formation

[24] North of Cape Hatteras, the Western Boundary Undercurrent (WBUC) is located landward of the Gulf Stream, but south of Cape Hatteras, the WBUC crosses the Gulf Stream and is located seaward of the Gulf Stream.

of warm core rings.

The water column is comprised of three vertical layers: deep water (colder than 4°C), the thermocline (4° - 17°C), and warm water (warmer than 17°C) (Worthington 1976). The water masses of the Atlantic continental slope and rise are essentially the same as those of the North Atlantic Basin (defined in Wright and Worthington 1970). In the North American Basin the deep water accounts for two-thirds of all the water, the thermocline for about one quarter, and the warm water the remainder (Schmitz et al. 1987). In the slope water north of Cape Hatteras, there is no water warmer than 17°C except seasonally in the summer.

The principal cold water mass in the region is the North Atlantic Deep Water, which contributes almost all water colder than 4°C overlying the U.S. continental slope (Schmitz et al. 1987). North Atlantic Deep Water is comprised of a mixture from five sources: Antarctic Bottom Water; Labrador Sea Water; Mediterranean Water; Denmark Strait Overflow Water; and Iceland-Scotland Overflow Water (Schmitz et al. 1987).

The thermocline represents a fairly straightforward water mass compared with either the deep water or the surface water. Nearly 90% of all thermocline water comes from the water mass called the Western North Atlantic Water (Schmitz et al. 1987). This water mass is slightly less saline northeast of Cape Hatteras due to the influx of southward flowing Labrador Coastal Water. In the slope water, the upper thermocline water and the warm water layer appear only during the summer months.

In the winter months, cold temperatures and storm activity create a well-mixed layer down to about 100 - 150 meters, but summer warming creates a seasonal thermocline overlain by a surface layer of low-density water (Schmitz et al. 1987). The seasonal thermocline, in combination with reduced storm activity in the summer, inhibits vertical mixing and reduces the upward transfer of nutrients into the photic zone (Schmitz et al. 1987).

The boundary that separates the warmer, saltier slope water from the colder, less saline shelf water is not vertical; there is a wedge of shelf water extending from about the 100 meter isobath to the sea surface 30 - 80 kilometers seaward (Schmitz et al. 1987). Part of this bulge of shelf water is water that has been cooled by convection in the winter and storms so that it is colder than the underlying slope water (the salinity of the shelf water is lower than the slope water, so there is no density inversion) (Schmitz et al. 1987). Because of the shelf water bulge, there is a temperature maximum zone that is approximately 40 - 80 meters thick, centered at about 120 meters in depth, and usually associated with a salinity maximum. This feature creates a band of warmer water in the range of 9° - 12°C on the seafloor at the shelf break. Below this band of warm water, the temperature steadily decreases and seasonal influences are absent (Schmitz et al. 1987).

Warm and cold core rings are a persistent and ubiquitous feature of the Northwest Atlantic Ocean. Rings which form south of the Gulf Stream usually contain a core of colder slope water and are found only south of Cape Hatteras. Rings which form to the north of the Gulf Stream usually contain a core of warm water from the Sargasso Sea.

Warm core rings are found only in the slope water region northeast of Cape Hatteras and provide the strongest currents in this area (Schmitz et al. 1987). These rings are usually 100 - 200 kilometers in diameter and result from a “pinching off” of a northward Gulf Stream meander. In addition to being a source of strong clockwise currents, these rings can also affect the circulation of water along the shelf/slope front and near the submarine canyons (Schmitz et al. 1987). There is little evidence of ring currents extending deeper than 1000 meters (Saunders 1971).

The numerous submarine canyons along the continental slope between Nova Scotia and Cape Hatteras can alter the physical processes from those in the surrounding slope waters. Fluctuations in the velocities of the surface and internal tides can be large near the heads of the canyons, leading to enhanced mixing and sediment transport (Schmitz et al. 1987). Shepard et al. (1979) concluded that the strong turbidity currents initiated in the canyons were responsible for enough sediment erosion and transport to maintain and modify those canyons. Since surface and internal tides are ubiquitous over the continental shelf and slope, it can be anticipated that these fluctuations are important for sedimentation processes in all the canyons along the eastern continental margin of the U.S. (Schmitz et al. 1987).

A full and detailed description of the habitats utilized by the deep-sea red crab is provided in Appendix A. The EFH source document contains a comprehensive description of the environment in which red crabs occur, as well as a detailed description of the life history and habitat characteristics of the red crab.

8.2.2 Habitat Condition

Due to the lack of current survey information and recent studies done in these areas, we have very little or no information on the current conditions that exist in the habitats utilized by deep-sea red crabs. The Council will request that NMFS, USGS, and NURC conduct or support surveys and studies in the near future that can provide information on the current conditions that exist in the habitats utilized by red crabs.

8.2.3 Threats to Habitat

The regulatory text of the Final Rule (67 FR 2343) directs the Council to assess the potential adverse effects of all fishing equipment types used in waters described as EFH. This assessment is to consider the relative impacts of all fishing equipment types used in EFH on different types of habitat found within EFH. The regulatory text of the Final Rule also directs the Council to identify non-fishing related activities that may adversely affect EFH. The FMP is to describe the EFH most likely to be adversely affected by these activities.

8.2.3.1 Fishing-Related Threats

The Council is required to identify and assess fishing activities that may adversely affect EFH. The Magnuson-Stevens Act defines fishing as:

Definition of Fishing [16 U.S.C. 1802 § 3]:

(15) The term “fishing” means -- any activity, other than scientific research conducted by a scientific research vessel, that involves

(1) the catching, taking, or harvesting of fish;
(2) the attempted catching, taking, or harvesting of fish;
(3) any other activity that can reasonably be expected to result in the catching, taking, or harvesting of fish; or
(4) any operations at sea in support of, or in preparation for, any activity described in subparagraphs (A) through (C).

Such term does not include any scientific research activity which is conducted by a scientific research vessel.

Adverse effects from fishing may include physical, chemical, or biological alterations of the substrate, and loss of, or injury to, benthic organisms, prey species and their habitat, and other components of the ecosystem.

The effects of fishing, such as the direct effects of gear on seafloor habitats (e.g., direct removal of epifauna, smoothed bedforms) and the indirect effects of fishing (e.g., producing shifts in the benthic community because of initial removals of fauna), and other habitat related fishing activities that can be controlled by the Council are considered in this assessment. NMFS recommends that the assessment include, if known: a description of the mechanisms or processes of fishing gear causing adverse effects on habitat; the particular portion of EFH that is affected; a description of known or potential habitat functions disturbed or disrupted by these effects and the extent of such disturbance or disruption; options the Council will consider to minimize adverse effects from fishing practices; and mitigation measures to conserve and enhance EFH adversely affected by fishing activities, if appropriate. According to NMFS, a gear assessment should consider the relative impact of the gear and rate gear types according to their relative impact on different types of EFH, and the Council should consider the severity of the effect, the amount of EFH affected, and the duration/lasting impact of the adverse effect. NMFS suggests the Council also take into account the sensitivity, rarity, resistance, and resilience of different habitat types.

The first fishing activity to assess is the effect the red crab fishery may have on those habitats identified as EFH for red crabs. Since the directed red crab fishery (that which is being directly regulated through this FMP) currently uses only traps, this is the only fishing gear type we need to examine.[25] There is very little information on the effects of pots and traps on benthic habitats. The primary source of information on the effects of this gear type are found in Eno et al. (1999).

Eno et al. (1999) described very few direct impacts to benthic habitats associated with the use of traps. They conducted several studies on the effects of lobster and crab pots on different types of habitat. Observations of pots being hauled from a variety of

[25] The FMP proposes to restrict the directed fishery for red crab to be a trap-only fishery. If, at some time in the future, this should change, we will have to examine additional gear types.

habitat types revealed that the habitats and their communities "appeared relatively unaffected by the fishing activity" (Eno et al. 1999). A review of the potential impacts to habitat from a variety of fishing gear types found that the only indications of adverse impacts to habitat resulting from the use of pots and traps were associated with corals and hard-bottom habitats (Barnette 2001). The hardbottom habitats in the canyons may be affected by the red crab fishery, although there is no information to determine one way or another whether these effects may be occurring.

While based on the Eno et al. report and other information it does not appear that the use of pots in the red crab fishery has an adverse effect on red crab EFH, there is little direct information on the subject and no data or direct research to determine the impacts to benthic habitats from deep-water pot fisheries. If new information becomes available that would change the conclusions reached for this gear type, additional action may be appropriate. It is also important to examine the potential impacts of the red crab fishery to the habitats of the deep-water canyons and determine whether this is a concern, especially in the hardbottom habitats.

The second aspect of the gear assessment is to assess the potential impacts of the red crab fishery on all EFH (for species besides red crab). First, we can extend the conclusions of the above paragraphs summarizing recent work on this issue. We can also develop a working context for the fishing gear used by the red crab fishery to determine the total area covered by the gear used in the fishery. The total area covered reflects the total area subject to any potential impacts. This is a much smaller fishery than most others in the New England and Mid-Atlantic areas.

Unlike mobile gear fisheries, where the total area covered depends upon many variables including the size of the gear (e.g., the sweep of a trawl net), the total area covered by a fixed gear trap fishery can be simply derived from the size of the trap and the number of traps used in the fishery. The fishery uses a fairly standard trap design, and the traps are wood-based, 48" by 30" in size. Currently, the fleet average for traps fished per vessel is approximately 550. The FMP contains a trap limit that caps the traps used per vessel at 600.

The FMP proposes to implement a controlled access program for the directed red crab fishery that will limit the number of participants. The Council's proposed criteria (see Section 4.2.9) are expected to limit the number of qualified participants to five fishing vessels with a relatively significant history in the fishery prior to the March 1, 2000 control date. Thus, it is reasonable to assume that under the FMP, there will be no more than five vessels participating in the directed fishery (although it must be recognized that additional vessels may qualify). Based on this information, we can derive the following: (1) each trap has a 48" $\times$ 30" footprint, for a total area of 1,440 square inches or 10 feet square; (2) each vessel uses a maximum of 600 traps, for a total area per vessel of 6,000 square feet; (3) if we assume a maximum of 5 vessels active in the directed red crab fishery, then we can calculate that the total area for the fleet is 5 times 6,000 square feet, or 30,000 square feet. This suggests that the total area impacted by the red crab fishing fleet is 30,000 square feet. This can be represented by an area 300 feet in length by 100 feet in width. Or, put another way, the total area impacted by the fishing gear at any one time is only 62.5% of the size of a football field (a football field is 300' × 160' = 48,000 square feet).

Even if we assume that the direct area impacted by each trap (in setting and hauling) equates to three times its footprint (Auster and Langton 1999), then the total area impacted by the red crab fishery is 90,000 square feet = 1 ? football fields. This area represents the amount of area potentially affected by each complete set of red crab gear. The total number of complete sets made each year will depend upon many factors associated with the decisions made in this FMP, including: the number of vessels authorized to participate in the controlled access directed red crab fishery; the maximum number of traps allowed per vessel; and the overall effort or landings control implemented (such as the DAS or number of fishing trips allocated to each vessel, or the overall TAC established for the fishery). There may also be impacts associated with the groundlines between pots. The amount of impact may depend upon the length of the line between pots and whether sinking line is employed.

The third issue to consider is whether there are adverse impacts to habitats identified as EFH for red crab from any other fisheries. The Council's Omnibus EFH Amendment (1998) describes the primary fishing gears used in the New England and Mid-Atlantic areas. This Amendment also provides an assessment of the potential adverse impacts to a variety of habitat types. The description of fishing gears and the assessment contained in the EFH Amendment are incorporated here by reference (NEFMC 1998). Because primary red crab habitat is so deep, the only fisheries that appear to intersect red crab habitat are for tilefish and for monkfish. Tilefish is primarily a longline fishery, and longlines are a gear type generally not associated with adverse impacts to benthic habitats, so this should not be a problem. Monkfish is a trawl and gillnet fishery, so there could be some adverse impacts associated with the trawl sector, but very little is known about the interactions between the monkfish fishery and red crab habitat. It will be a primary research and information need of this FMP to gain as much information as possible on any potential impacts to red crab habitat that may be associated with the monkfish fishery.

8.2.3.2 Non-Fishing-Related Threats

The Magnuson-Stevens Act requires the Council to identify and characterize activities other than fishing that potentially reduce the quantity and/or quality of essential fish habitat. This section of the FMP will serve as a reference of non-fishing related threats and activities for the Council, NMFS, habitat management action agencies, and other interested parties. Once EFH for red crab is designated, federal agencies must consult with NMFS regarding any proposed activities that may adversely affect its EFH. NMFS must provide federal and state agencies with conservation recommendations regarding any agency action that would adversely affect the EFH. The Council is also empowered to comment on any federal or state agency action that would affect the habitat, including EFH, of a species under the Council's authority. To assist with these consultation and commenting activities, this section of the FMP addresses those activities most likely to reduce the quantity and/or quality of essential fish habitat for deep-sea red crab. This document is not meant to serve as an exhaustive review and analysis of the impacts of all potentially detrimental activities; yet, it should highlight notable threats and provide enough information to determine if further examination or monitoring of a proposed activity is necessary.

Habitats within the offshore region of New England and the Mid-Atlantic are found, generally, in deep waters with stable biological communities. There are also many high energy offshore habitats in which environmental conditions are continuously changing. Benthic and pelagic marine life may be disrupted by a number of threats within offshore waters. Contamination migrates away from the coast and potentially endangers the health of offshore habitats. Offshore waters are being looked to more frequently to supply new resources or resources that have been eliminated from coastal environments. Deep, stable waters and high energy offshore habitats may be disturbed by increasing amounts of non-fishing threats that may disrupt environmental conditions. Low levels of disturbance in deep, stable habitats may present serious implications on finfish and shellfish populations. Chemical, biological, and physical threats continue to grow in areas important for fishery resources in the offshore region.

Chemical Threats

Oil can have severe detrimental impacts on offshore habitat. Spills or blowouts can produce an oil slick on surface waters which can disrupt the entire pelagic community (i.e., phytoplankton, zooplankton, ichthyoplankton). Oil can interfere with reproduction, development, growth and behavior (e.g., feeding) of fishes, especially in early ontogenetic stages. Carcinogenic and mutagenic properties of oil compounds are receiving increasing attention around the world (Larsen 1992). Contaminated sediments may degrade benthic communities. Non-point and point sources of oil in offshore habitats originate from industrial shipping, recreational boating, marine transportation, energy and mineral exploration and transportation, and ocean disposal of contaminated dredged material.

Marine organisms can be contaminated or killed directly and indirectly from the stress of heavy metals discharged into offshore waters. Sediment accumulates the toxic metals, and fishes bioaccumulate contaminants which can cause health problems in human consumers of fish. Industrial and recreational shipping and atmospheric deposition are non-point sources of heavy metals. Ocean disposal of contaminated dredged material, energy and mineral exploration (e.g., drilling muds), and marine transportation (e.g., hull paint containing lead) introduce heavy metals into the environment (Larsen 1992; Buchholtz ten Brink 1996).

Localized eutrophic conditions, characterized by phytoplankton and filamentous algal blooms (HABs), high turbidity, low dissolved oxygen, and low denitrification rates, can occur in offshore habitats with unnaturally high concentrations of nutrients. Any increase in the nutrient levels of the open ocean will markedly effect the productivity of phytoplankton communities (Omori et al. 1994). Increasing the surface productivity may increase the flux of material from the sea surface to the deep sea benthos (Omori et al. 1994). The stable, deep sea environment is trophically linked to the surface waters and an increase flux of organic matter may have notable impacts on bottom habitats (Omori et al. 1994). Other toxic organisms may be implicated with the blooms of noxious algae causing outbreaks of disease or fish kills. Nutrients enter offshore waters from non-point sources such as industrial shipping, recreational boating, and atmospheric deposition, and point sources, including ocean disposal of contaminated dredged material, and energy and mineral exploration and transportation.

Fish and invertebrate populations may be impacted by the input of pesticides into offshore habitats. Contaminated sediments can accumulate in the benthos providing a potential source of stress through trophic levels. Pesticides enter offshore habitats through atmospheric deposition illustrating a potential non-point source, and ocean disposal of dredged material illustrating a point source. Herbicides and fungicides can alter marine habitats by hindering phytoplankton growth and possibly leading to lasting community structure change. Alteration of the photosynthetic plankton community can alter fishery dynamics by replacing natural plankton species composition with new species. The change in the planktonic community may change the lower trophic structure so cascade effects may hinder fish populations (e.g., bottom-up process). Herbicides can be released into offshore habitats from atmospheric deposition and disposal of dredged material.

Unnatural levels of suspended particles in offshore habitats can increase turbidity, smother benthic habitat, hinder respiration, disrupt water transport rates, and reduce filtering efficiency of organisms. Other problems associated with suspended solids include sorption of toxic metals and organic materials, reduction of egg buoyancy, disruption of ichthyoplankton development, reduction of growth and survival of filter feeders, and decreased foraging efficiency of sight-feeders (Barr 1993). The functions (e.g., photosynthesis) and properties (e.g., dissolved oxygen) of the entire water column may be frequently disrupted. Long-term flux of suspended sediments to offshore waters may provide a source of nutrients that stimulate primary production and contribute to increased turbidity and altered nutrient cycles. Continued high levels of suspended material within offshore waters can lead to fragmentation and alteration of localized community of benthic and pelagic organisms. Suspended particles enter the offshore environment from ocean disposal of dredged material and mining practices.

Biological Threats

Nonindigenous species and reared species potentially impact natural populations by transmitting diseases (exotic or natural), increasing competition with indigenous species, increasing predation on natural organisms, and altering the natural genetic pool (e.g., less genetic heterogeneity). These deleterious impacts can potentially lead to lower fitness of stocks and change the natural community structure and dynamics. Human activities are closely associated with exotic introductions. Shipping (e.g., ballast water), aquariums, and biotechnology are potential sources of nonindigenous species in offshore waters. Dredged material disposal may introduce algal species that degrade habitat conditions.

An increase in natural levels of nutrients induced by human activities can stimulate population explosions of nuisance and toxic algae [harmful algal blooms (HABs)] which have detrimental impacts to habitat and toxic effects on organisms and humans (see

O'Reilly 1994; Boesch et al. 1997). Organisms responsible for HABs have occurred naturally in the environment for a long time, so an apparent increase in bloom events may simply reflect better detection of natural phenomena (NSF and NOAA 1998). However, the current increased intensity and frequency of HABs compared to the past appears to indicate more toxic algal species, more algal toxins, more areas affected, more fishery resources affected, and higher economic losses (Boesch et al. 1997; NSF and NOAA 1998). Nonindigenous algal species may be introduced to the environment from ballast water of commercial vessels, recreational boating, shellfish transfer (e.g., seeding), dredging, and disposal of sediments (Boesch et al. 1997), adding to the potential problem of blooms. HABs can indicate eutrophic conditions, alter, impair, or kill plankton and fish communities, and lower dissolved oxygen (NOAA 1997). Certain toxic organisms (e.g., *Pfiesteria* spp.) are associated with HABs and have caused major outbreaks of disease and fish kills within inshore waters (NCSU 1998); however, these outbreaks may spread to offshore habitats. These short-term impacts can eventually cause a change in the natural processes of habitat reducing viable fish and shellfish populations.

Pathogens can be a serious problem in offshore waters by spreading disease and possibly impacting the long-term success, health, and fitness of fish and invertebrate populations. Shellfish area closures may be required as a result of the spread of diseases (i.e., paralytic, amnesic, and neurotoxic shellfish poisoning) which have impacts on human health. For example, paralytic shellfish toxins have been detected in Atlantic surfclams (*Spisula solidissima*), Atlantic sea scallops (*Placopecten magellanicus*), northern horse mussels (*Modilus modiolus*), and ocean quahogs (*Arctica islandica*) within areas of Georges Bank at levels exceeding the public health safety threshold (White et al. 1993). Potential origins for pathogens in the environment include non-point sources of discharge such as industrial shipping, recreational boating, and point sources of discharges such as aquariums and biotechnology (NOAA 1994). Localized regions of high nutrients may trigger outbreaks in harmful organisms that may hinder the health and success of fish and shellfish populations.

Red crabs may also be susceptible to shell disease, which may be caused by pathogens in the environment (Young 1989). These disease-causing pathogens, if present in the environment, would degrade the quality of the habitat for red crabs and increase red crab mortality.

Physical Threats

There is an increasing demand for good-quality sand and gravel aggregate and an increasing exploration for oil, and offshore habitats are being seen as a possible source (Messieh et al. 1991). Mining presents potential direct and indirect problems to habitat of the mining site and surrounding regions such as issues related to toxicity of operational chemicals, accidental discharge of wastes, removal of benthic flora and fauna, changes in substrate character, and the suspension of sediments (ICES 1991). Structures are also built within habitats to assist in mining and transporting materials. In a review by Pearce (1994), the effects of mining have been listed as: (1) "destruction" of existing benthic biotic community; (2) resuspension of sediments with negative impacts on fishes; (3) changes in bottom topography and sediment composition; and (4) consequences related to the sediment transport from the site by currents. Gravel, mineral, and oil mining occur in marine environments which are essential for fisheries, and operational and accidental discharges are an environmental concern (Messieh et al. 1991).

Gravel aggregates are abundant throughout the Gulf of Maine and are a potential source for mining (Messieh et al. 1991). Gravel/mineral mining is associated with an increase in stress to the surrounding habitat and removal and disturbance of substrate (Scarrat 1987). The alteration to the mining site can fragment habitat, negatively impacting fish and shellfish populations. Long-term mining sites potentially can change natural habitats and associated fish and shellfish populations (Wilk and Barr 1994).

Oil mining has similar impacts as gravel/mineral mining with more risk associated with accidental spills and blow-outs which can disrupt habitat (Wilk and Barr 1994). Oil wells are in the initial stage of exploration in offshore New England waters. Drilling muds and well cuttings are potential wastes of oil exploration. Drilling muds (either water-based or oil-based muds) are complex and variable mixture of fluids, suspended solids, and chemical additives (Messieh et al. 1991). If exploration results in notable amounts of resources, industrial development may occur in offshore waters; leading to larger amounts of drilling wastes and discharge (Messieh et al. 1991)

Debris discharged or transported offshore may degrade and disrupt benthic and pelagic habitats (see Coe and Rogers 1997). Debris within offshore habitat can smother benthic communities or be ingested by fish (Hoagland and Kite-Powell 1997). Reduction of habitat by destroying the benthos can alter community structure and hinder the sustainability of fisheries. Debris non-point sources include industrial shipping and recreational boating, and a point source includes ocean disposal of garbage and mineral exploration (USEPA 1994).

Disposal of dredged material can disrupt and degrade natural habitat and biotic communities. The associated stresses of dredged material (i.e., oil, heavy metals, nutrients, suspended particles, etc.) potentially threaten the habitat of the dump site and adjacent areas. Providing a flux of nutrients to offshore habitats from dredged material may be a notable source contributing to algal blooms. Along with contaminating the habitat, direct disturbance of the benthic and pelagic communities occurs with disposal. Benthic communities are smothered, associated physicochemical conditions are altered, and increased turbidity may hinder pelagic processes (e.g., photosynthesis of algae) by material settling to the bottom. The potential deleterious impacts of dredged material disposal can alter local and surrounding community structure.

In spite of the many potential threats to offshore habitats, in general, due to the very deep nature of red crab habitat, there are very few, if any, direct threats from non-fishing related activities expected to cause an adverse impacts to red crab EFH. The only non-fishing activities identified as potential significant concerns are offshore oil and mineral exploration and extraction, the installation of fiber optic and electrical cables, and contamination by toxic chemicals. There are no known plans or proposals for any offshore oil and mineral exploration and/or extraction that would have an effect on red crab habitat. Should this status change, the Council would examine the information and participate in the project review to the extent allowed under the Magnuson-Stevens Act. On a case-by-case basis, the installation of any fiber optic and/or electrical cables would not be expected to have a significant effect, but the cumulative effects of multiple projects should be tracked and considered in the future. Toxic chemical contaminants are not currently known to be an issue effecting red crab habitat, but this issue bears attention, should the distribution and/or concentration of chemicals of concern change.

8.2.4 Habitat Conservation Recommendations

The Magnuson-Stevens Act requires all FMPs to identify actions to promote the conservation and management of fishery resources. Prior to the concept of EFH, conservation primarily involved management measures to reduce overfishing and rebuild overfished stocks. Such measures embraced the need to minimize and avoid the mortality of bycatch. While these issues remain very important in fishery management, the EFH provisions of the Magnuson-Stevens Act will strengthen the role of the Council and NMFS to further conserve and enhance EFH and related fishery resources.

The regulatory text of the Final Rule directs the Council to describe options to avoid, minimize, or compensate for the adverse effects of activities identified in the non-fishing threats section of this amendment. The Final Rule also directs the Council to promote the conservation and enhancement of EFH, especially in habitat areas of particular concern. The Council has the discretion to provide comments on non-fishing activities authorized by federal and state agencies which impact the EFH of non-anadromous fish species. The conservation and enhancement options promoted by the Council include, as directed in the Final Rule: the enhancement of rivers, streams, and coastal areas; improving water quality and quantity; watershed analysis and planning; and habitat creation.

The enhancement of rivers, streams, and coastal areas may include reestablishing endemic trees or other appropriate native vegetation on riparian areas adjacent to EFH, restoring natural bottom characteristics, removing unsuitable materials from areas affected by human activities, or adding gravel or substrate to stream areas to promote spawning. Improving water quality and quantity may include the use of best land management practices, improved treatment of sewage, proper disposal of waste materials, and providing appropriate in-stream flows. Watershed analysis and planning may include encouraging local and state efforts to minimize destruction/degradation of wetlands, restore and maintain the ecological health of watersheds, and encourage the restoration of native species. Habitat creation may be considered as a means of replacing lost or degraded EFH. Any future ocean dumping or dredge disposal sites should avoid impacting areas designated as EFH.

Specific to red crab habitat, there are few conservation recommendations necessary due to the lack of information and the lack of activities with direct impacts occurring in or around red crab habitat. The only specific recommendations appropriate for this FMP are the following:

- continue all existing prohibitions on oil, gas and mineral exploration and extraction that may be proposed on or near red crab EFH; and

- carefully monitor all projects related to the installation of fiber optic and/or electrical cables that may be associated with red crab habitat and to track any potential cumulative effects of such projects.

8.2.5 Habitat Information and Research Needs

The regulatory text of the Final Rule directs the Council to include recommendations, preferably in priority order, for research efforts that the Council and NMFS view as necessary for carrying out their EFH management mandate. The need for additional research is to make available sufficient information to support a higher level of description and identification of EFH. Additional research may also be necessary to identify and evaluate actual and potential adverse effects on EFH including, but not limited to, direct physical alteration, impaired habitat quality/functions, cumulative impacts from fishing, or indirect adverse effects such as sea level rise, global warming and climate shifts, and non-equipment related fishery impacts. The need for additional research on the effects of fishing equipment on EFH is also included. The research needed to quantify and mitigate adverse effects on EFH identified in this amendment and determined to be an impediment to maintaining a sustainable fishery and the contribution of the managed species to a healthy ecosystem is identified.

The habitat research recommendations include expanded life history information that will result in the comprehensive identification of the habitat requirements of the species or species assemblages, including all life history stages, as well as habitat-related information that defines the interrelationship between the species, the environment and the food web. The identified research needs also include information on adverse impacts from both non-fishing and fishing activities. Fishing activities include both recreational and commercial fishing equipment or practices.

One specific issue requiring more information is the interaction of the monkfish trawl fishery with red crabs and their habitat. This requires the collection of observer data from the monkfish trawl fishery to document any bycatch of red crabs. Significant bycatch of red crabs could be used as a proxy indicator of interactions between the monkfish gear and red crab habitat. A second component of this need is for information on the sex and mortality of red crabs caught in the monkfish trawl fishery.

Another specific research and information need associated with this FMP is to identify the potential impacts of a deep-water trap fishery on a variety of benthic habitats, including the habitats contained in the deep-water canyons. This would essentially be an extension of the Eno et al. (1999) report, but focused on deep-water habitats most likely subjected to fishing by the red crab fishery.

A third specific research and information need to assist the Council and NMFS better understand the habitat requirements of red crabs requires expanded survey data to include more of the range of this species to assist with the identification and description of EFH. Information is also required on the relationships between red crabs and water temperatures and explore the use of bottom water temperature data as a tool to delineate and identify EFH for this species. Lastly, studies are needed to determine the trajectories of red crab larvae, from release into the water column to settlement as juveniles. This may be suitable for a modeling project. It will be very important to determine the length of time red crabs remain as larvae and how long they stay in the plankton.

8.3 Description of the Fishery

8.3.1 History of Exploitation

In the 1950's, commercial concentrations of American lobsters were found in offshore waters south of New England and whenever these lobsters were targeted in waters deeper than 200 fathoms, red crabs were caught as by-catch (Holmsen 1978). Throughout the 1960's and into the 1970's, red crabs were considered an under-utilized species and several studies and reports were conducted to explore the potential for developing a directed red crab fishery (Holmsen 1978; Holmsen and McAllister 1974; Meade and Gray 1973). Success in efforts to create a directed red crab fishery were limited initially by two factors: (1) high harvest-related mortality of the crabs, the meat quality of which degraded soon after death; and (2) lack of economical processing (Holmsen 1978; Meade and Gray 1973).

In the early 1970's, there were several new developments that allowed the directed fishing for red crab to become economical. First, the use of traps and pots became the preferred harvesting technique, and vessels began experimenting with different refrigeration and butchering techniques to preserve the quality of the red crab meat prior to shore-side processing. Second, several processing firms entered the market and provided opportunities for fishermen to sell red crabs at a good price. Coincidentally, these developments occurred at about the same time as declines in the blue crab and king crab fisheries (Hastie 1995).

In New England, red crab has been the target of a directed fishery since the 1970's, although the landings have not been consistent and have varied considerably through the years. In 1973, the first lobster vessel changed over to fish red crab exclusively and another vessel entered in 1976. There were another three to four vessels which landed minor quantities of red crab on an experimental basis during the 1970's. Throughout the 1980's there appears to have been a fairly consistent fishery for red crab, with reported landings averaging over 5.5 million pounds per year. In the early 1990's landings appear to have fluctuated somewhat, but have been steadily increasing since about 1995.

Red crab was harvested commercially in significant volume in the mid and late-1970's, with reported landings reaching 1.1 million pounds in 1974 and increasing to approximately 2.7 million pounds in each year between 1977 and 1979. Documented landings increased significantly in 1980, remaining high throughout much of the 1980's, averaging 5.8 million pounds per year. Reported landings in any one year varied from a high of 8.5 million pounds in 1984 to a low of 2.7 million pounds in 1986.

In 1990, reported landings decreased to 3.36 million pounds, and throughout the

1990's the landings were less than reported in the 1980's, averaging 2.7 million pounds per year (less than half of what was landed in the 1980's). In the late 1990's, reported landings increased from 1.26 million pounds in 1995 to 4.1 million pounds in 1999. Anecdotal industry reports suggest that landings exceeded 7 million pounds in 2000. Since the mid-1990's, and until late 2000, there were between four and five vessels fishing exclusively for red crab.

Prior to the March 1, 2000 control date for the red crab fishery, the largest vessel in the fishery was 120 feet in length overall and the average hold capacity of the fleet was 70,000 pounds of whole crab product. As of the control date, no vessel fished more than 600 pots and none had the ability to completely process crabs on-board. All but one of these vessels landed their crabs whole and alive. The remaining vessel butchered the crabs on board, which means they cut the crab in half and removed the carapace. The principal method of fishing is to steam to the fishing grounds, set and haul baited traps, and return to port quickly in order to ensure fresh product. Trips are limited in length principally by the hold capacity of the vessel and the need to keep the product fresh and, for most vessels, alive.

In early 2001, two additional vessels entered the red crab fishery. One vessel relocated from the North Pacific and the other vessel relocated from the Gulf of Mexico. Both were catcher-processor vessels over 150 feet in overall length. Although they may fish with fewer pots, both reportedly have the capacity to fish approximately 1,000 crab pots. Vessel hold capacity may be a more important indicator of overall fishing power than either vessel size or the number of pots fished. The hold capacities of the two additional vessels are reported to be in the range of 185,000 to 300,000 pounds of red crab product. The equivalent amount of red crab in whole weight depends on the degree of processing that occurs on-board the vessel. If the crabs are simply butchered (split into half sections with the carapace removed), the whole weight equivalent is approximately 1.76 times the butchered weight (Lux et al. 1982). This indicates that the two additional vessels may be able to land the equivalent of 325,000 to 528,000 pounds of red crab per trip. Even if we assume the lower bound of this range, each of these new vessels individually possesses the capacity to harvest more per trip than the entire fleet suggested by Holmsen and McAllister (1974).

8.3.2 Description of the Fishing Gear

The directed fishery is currently entirely a trap fishery. There are a variety of crab pot/trap technologies available, but most of the gear used in this fishery is fairly uniform. In 1974, Holmsen and McAllister (1974) suggested that a large 4' by 4' square pot with upward pointing funnel eyes to be a "good red crab pot" but this trap design was never used in the deep-sea red crab fishery. Holmsen and McAllister (1974) also suggest that it would be economically prohibitive to fish single traps in deep water, and that trap trawls containing 40 to 70 traps would be the most efficient solution. Pots used in the offshore lobster fishery also work well to catch red crab, but likely need at least some minor modifications to improve their efficiency (Holmsen and McAllister 1974).

In a report to the New England Fishery Management Council, Holmsen (1978) describes the evolution of the red crab pot design, including trying igloo shaped pots, large pots similar to the West Coast king crab pot, and modifications to the offshore lobster pot. His report indicates that in the late 1970's, the most prevalent pots used in the fishery were 47" by 32" by 28" and that 60-75 pots were fished per trawl (Holmsen 1978). In 2000, several red crab fishermen reported that the most common trap used was a wood and wire trap 48" by 30" with top entry. Currently, trawls with 90 - 120 traps per trawl are the most common. Escape vents are reportedly used when fishing in areas with relatively high concentrations of females and spacing the wooden laths two inches apart in the construction of the traps allows for the escapement of juveniles. Other traps being used may vary the configuration or materials, but are approximately the same size and weight. These traps may include a wire base construction rather than wood and other than rectangular shapes, including a conical-type trap sometimes used. The large 7' by 7' king crab traps are currently not used in the northeast red crab fishery.

There is an unspecified amount of bycatch of red crab in the offshore lobster fishery, and these crabs are obviously harvested with standard offshore lobster pot technology. The types and numbers of lobster pots used in this fishery are described in the Final Environmental Impact Statement and Regulatory Impact Review for Federal Lobster Management in the Exclusive Economic Zone (EEZ), prepared by NMFS (1999).

There is also an unspecified amount of bycatch of red crab in other offshore fisheries, such as the northeast multispecies fishery. The principle gear types believed to be capable of catching red crab in the multispecies fishery (as well as other fisheries such as that for monkfish) include otter trawls and scallop dredges. The types and configurations of otter trawls and scallop dredges are described in the Northeast Multispecies and Sea Scallop Fishery Management Plans, respectively.

Because this was an unregulated fishery, prior to implementation of the emergency regulations in May 2001, there were no restrictions on the fishing gear that may be used to harvest red crab. Although the directed fishery currently uses very similar traps and harvesting techniques, prior to this FMP there were no regulations preventing new trap designs or configurations, including the use of much larger and heavier traps or the use of more traps per trawl. There were also no regulations preventing the use of otter trawls, dredges, or other bottom-tending mobile gear for the directed red crab fishery.

8.3.3 Domestic Activities

8.3.3.1 Recreational and Subsistence Fishery

There is no recreational or subsistence fishery for deep-sea red crabs due to the depth of the water (greater than 320 meters) where red crabs occur and the gear necessary to harvest red crabs (red crab pots and large hydraulic pot haulers).

8.3.3.2 Commercial Fishery

The red crab commercial fishery is a relatively small fishery (traditionally less than six vessels) of medium to large fishing vessels (90 - 150 feet in length) that fish in deep water (400 - 800 meters, see Figure 23). The nature and extent of the current commercial fishery for deep-sea red crab has been described in previous sections of this FMP (see Background and Purpose), so this section will focus on the operational aspects of the commercial fishery. Much of the following description of the operational aspects of the red crab fishery is taken from a report on social and economic baseline information for the red crab fishery. This report in its entirety is provided as Appendix B.

Most commercial red crab fishing vessels currently spend a significant amount of time on the water engaged in the red crab fishery (up to 300 days per year). Barring mechanical problems or weather-related issues, vessels traditionally take anywhere from 28 to 35 fishing trips per year. If the red crab vessels participate in any other fisheries, they appear to do so only while also on a red crab trip. Red crab fishing trips are reported to last at least a week, ranging from seven to ten days and averaging just over eight days per trip. While on a red crab fishing trip, work days range from 17 to 20 hours per day.

Red crab fishing vessels employ between 480 and 600 crab pots in their fishing operations, with an industry average of 560 pots. All vessels arrange their crab pots in strings (also called pot trawls), with 75 to 180 pots on each string. Each vessel uses approximately the same number of pots on each string and sets the number of pots per string based on vessel characteristics and fishing technique. Once baited and set on the bottom, the pots are allowed to soak between 18 and 36 hours before being hauled (the average soak time reported is 22 ½ hours). The pots are hauled on-board the vessel one at a time and the crabs removed. The crabs are sorted for size and sex immediately and the females and undersized males are returned to the water, usually through a return chute built into the sorting tray.

The retained crabs are then either deposited in the vessel's live wells or are butchered and processed (depending on the individual vessel's capabilities and practice). Vessels that land their product whole maintain tanks of refrigerated sea water (RSW) where the crabs are kept alive for processing on land. The duration of each fishing trip is constrained by the time the crabs can be kept alive in the RSW tanks. Mortality of red crabs will start to increase after approximately seven days. Upon landing, the crabs are removed from the RSW tanks and packed on ice for transport to the processing facility.

Crabs that are butchered first have the carapace removed and then are cut in half laterally. Some vessels leave the remaining crab carcass intact, while others further process the carcass by cleaning off the gills and other viscera. Next, one of two processes is employed on the vessels: (1) the crab sections are placed in mesh bags, dipped in a mild preservative solution, and stored on ice (but not frozen); or (2) the crab sections are quick frozen, boxed for shipping, and stored in an on-board freezer.

On a given fishing trip, each vessel may haul between 1,600 and 4,200 pots (the average is reported to be 2,900 pots hauled per trip). The wide range is a result of the combination of the number of traps used and the soak time favored by each vessel. There is some amount of gear loss or damage on almost every fishing trip, as many as 50 pots per trip. The reported average for pot loss or damage is just over ten pots per trip.

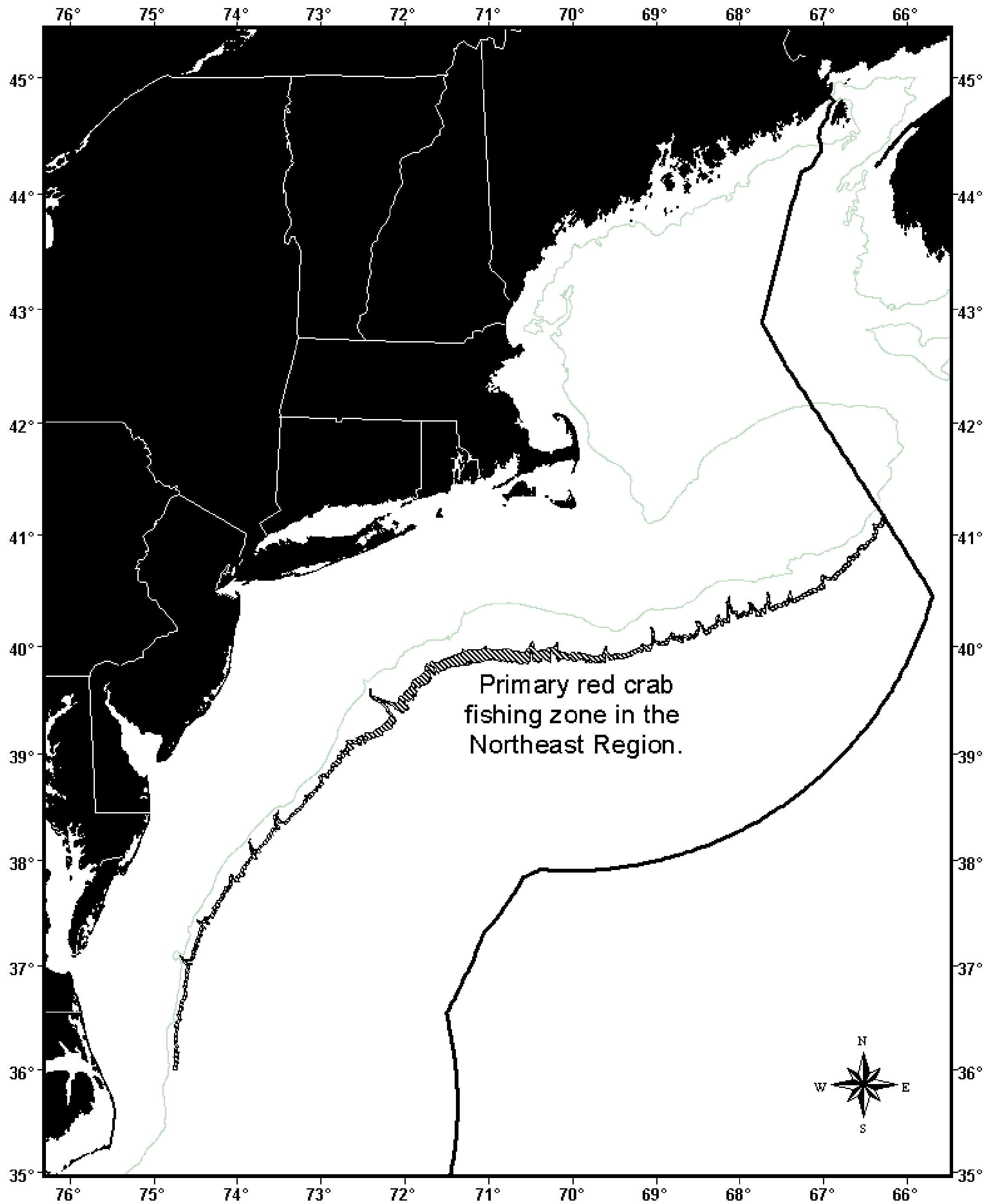

Figure 23: Map of the primary fishing zone for red crab. The area is delineated by the minimum and maximum depths of the fishery as reported by members of the fishing industry (400 - 800 meters).

All pots fished in the red crab fishery are baited before being set. The most common bait used in the fishery includes herring and pogies, and as much as 10,000 pounds of bait may be used in a single fishing trip. Most fishing trips in the red crab fishery target different areas. Vessels will move their gear up and down the coast rather than resetting in the same place again. Many factors are used to determine where to fish on a given trip, including current and recent effort in an area, the movement of other vessels, the time of year, areas with typically the best fishing, and the traditional fishing grounds of the vessel.

The fishing vessels currently operating in the commercial red crab fishery come from a variety of areas and fishing ports in New England and the Mid-Atlantic. Table 26 lists those ports reported to serve as the primary ports of operation and mooring for red crab vessels participating in the commercial fishery.

Port	State
Fall River	MA
Gloucester	MA
New Bedford	MA
Bristol	ME
Portsmouth	RI
Tiverton	RI
Norfolk	VA

Table 26: Primary ports of operations and mooring.

8.3.3.3 Conflict and Competition

As described above, red crab pots are set in strings of 75 - 180 pots per string and are set in very deep water. Red crab habitat is very limited, especially in some areas (see Figure 23), and when combined with increasing fishing effort, the potential for conflict and competition increases. Reports of limited gear conflicts have surfaced since the number of fishing vessels prosecuting the directed red crab fishery increased in early 2001.

8.3.3.4 Domestic Annual Harvesting Capacity

As described in previous sections of the FMP, the current capacity of the domestic harvesting sector greatly exceeds all estimates of MSY. The Council concluded that the capacity of the domestic fleet exceeds the amount of the available resource and is proposing to control access to the directed red crab fishery to better match the capacity of the domestic fishing fleet and the resource.

8.3.3.5 U.S. Harvest of Optimum Yield

Given that the Council has identified the need to control access to the fishery in order to match the capacity of the domestic fishing fleet and the amount of the available resource and reduce the likelihood of overfishing, the domestic fleet will harvest all of the optimum yield.

8.3.3.6 Domestic Annual Processing Capacity

Based on information provided by representatives of the processing companies, there are four U.S.-based wholesale and processing companies involved in the red crab fishery and red crab product delivered by the domestic red crab fishing fleet is sold to these domestic processors and/or wholesalers. The processing capacity represented by these companies exceeds all estimates of MSY for this resource. Representatives of these companies report processing between 100,000 and 400,000 pounds of red crab each month, for an industry-wide total of as much as 700,000 pounds per month. This alone would exceed MSY, (12 months $\times$ 700,000 pounds/month = 8.4 million pounds per year), and all processors report having additional processing capacity that could be utilized. If the reported full capacities of the red crab processors were utilized, they would be able to process more than 1.3 million pounds per month, which would equate to an annual processing capacity of 15.6 million pounds (250% of the current estimate of MSY). None of these companies are solely dependent upon red crab, as they all process other fishery products in addition to red crab. On average, red crab accounts for 11.5% of the total fishery-related processing operations of these companies, with no one company depending upon red crab for more than 25% of their processing operations.

8.3.4 Foreign Activities

There is no foreign fishing activity for deep-sea red crab within the U.S EEZ. There has been a commercial fishery for red crabs in Canadian waters from eastern Georges Bank along the Scotian Shelf. The Canadian fishery began in the late 1960's, but historical catch records are sparse and probably do not accurately reflect actual landings (Lawton and Duggan 1998). In 1998, there were five exploratory licenses being used to harvest red crabs, but reported landings had never exceeded 1.6 million pounds, despite an annual TAC of over 2.8 million pounds (Lawton and Duggan 1998). Even with this limited amount of fishing effort, a Canadian stock status report suggests that the Canadian fishery is not viable.

8.3.5 Interactions Between Domestic and Foreign Participants in the Fishery

There are no foreign fishermen using the U.S. stock of the deep-sea red crab, therefore there are no interactions between domestic and foreign fishermen. There are no reports of foreign fishermen taking any red crab as incidental catch in another fishery, but if there is such incidental catch, the foreign fishermen will be subject to the incidental catch restrictions of this FMP. There are no existing joint ventures involving red crab, and due to the capacities of the domestic harvesting sector and the domestic-based processing sector, there are unlikely to be any joint ventures in the future.

8.4 Identification of the Social and Cultural Entities Involved in the Fishery

Much of the following information is taken from a report on social and economic baseline information for the deep-sea red crab fishery. This report is provided in its entirety as Appendix B. The following is provided only as a summary of the information provided in the report.

8.4.1 Fishing Vessel Owners and Operators

The directed commercial fishery for deep-sea red crab is a small fishery with relatively few participants. There are only five vessels that have been involved full-time in the fishery for more than four years, although with the addition of new entrants over in 2001, the number of full-time vessels has increased to seven. With so few vessels participating in the fishery, the number of vessel owners and/or operators is also very few.

All participants in the fishery surveyed (see Appendix B for background) identified themselves as being white or Caucasian and all are male. Almost all are married and most have at least one child. Level of education is varied, but the majority have some college or are college graduates. They range in age from 39 to 56 years old, with an average of just over 47 years old. All have been involved in commercial fishing of some type for a significant period of time, ranging from 14 to 40 years and an average of over 27 years. Their involvement in the red crab fishery is more variable, ranging from just two years to more than 20, and an average of almost 9 years.

8.4.2 Fishing Vessel Crew

The individuals who serve as crew on commercial fishing vessels are often an overlooked component when analyzing potential impacts on the fishing industry and fishing communities, but they can be affected by regulations and/or changing conditions. The number of crew members involved in the red crab fishery is relatively few, based largely on the size of the fishery and its few participants. The number of crew employed on each vessel ranges from six to almost twenty, with an average of just over eight crew per vessel. There is no direct information on the crew members of red crab fishing vessels, but some information was provided by the vessel owners and operators.

Almost all crew members of red crab vessels are male, but one vessel reported having at least one female crew member. Most are or have been married, but a moderate percentage (38%) have never been married. Most crew are reported to have children, with an average of just under two children per crew member with children. Level of education is somewhat varied, but the vast majority are reported to be high school graduates (over 70%). A significant, but smaller, percentage are reported to have attended some college, and a small percentage have completed college.

The ethnicity and racial make-up of red crab crew members is much more diverse than the owners and operators. Almost all vessels report having at least one minority crew member, and these include African-Americans, Hispanics, and Native Alaskans. The ethnicity of the crew members varies and includes Hondurans, Irish, Mexicans, and Portuguese, as well as other unspecified (by the vessel owners and operators) ethnic groups.

The age of vessel crew is reported to range from 18 years old to 56 years old, with an average for all vessel crew members reported to be just over 28 years old. All vessel crew members are reported to have been involved in commercial fishing for several years, averaging over 10 years per crew member. Not all of this time has been in the red crab fishery, however, as the average time that vessel crew have been involved in the red crab fishery is reported to be only 3 ½ years. Most of the time these crew members have been involved in the red crab fishery has apparently been on the same vessels, as the average time that crew have been employed on their vessels is over 3 years (only slightly less time than they would have been involved in the red crab fishery).

8.4.3 Processors

The small size of the harvesting sector of this fishery is carried over to the processing sector which is also relatively small. There are four wholesale and/or processing entities reportedly involved with the red crab fishery. The surveys described above that were completed by the vessel owners and operators were also completed by the owners and/or presidents of the four wholesale and/or processing companies. These companies are based in New Bedford and Fall River, MA, Portland, ME, and Warren, RI.

No information is available on the employees of these companies, but some demographic information is available on the executives who participated in the survey. All are male and all identify themselves as white or Caucasian and they average just under 48 years old. All report having at least one child and most are married. Most have been involved in commercial fishing-related activities for more than 30 years; their average involvement in the red crab fishery is less than 10 years, although one individual reports being involved in the red crab industry for 30 years.

8.4.4 Fishery-Dependent Service Industries

There is no information available directly on any fishery-dependent service industries that may be involved with the red crab fishery. The type of service industries used by the red crab fishery and their general locations was reported by some vessel owners and operators. The types of services used include: fuel, ice, food and groceries, bait, gear, oil/lubrication, water, hull maintenance, engine maintenance, electronics, insurance, accounting, legal advice, and dockage. These needs are met by services provided in Lower Mid-Coast Maine, Gloucester and the Massachusetts North Shore, Boston and the Massachusetts South Shore, Cape Cod and the Islands, the New Bedford, MA area, Rhode Island, some non-coastal areas of New England, and some areas outside of New England. Of these, the fishery-related service industries in the New Bedford, MA area provide more support to the red crab fishery than the other locations combined. Due to the small size of the fishery, and the small number of fishing vessels involved, however, it is unlikely that providing these services to red crab vessels accounts for more than a very minor component of any service industry's overall fishery-related revenue.

8.4.5 Fishing Communities

There are several ways to consider the communities related to the red crab fishery: (1) the communities in which the vessel owners and operators live; (2) the communities which serve as the primary ports of vessel operations and mooring; and (3) the communities in which the fishing-related support services are obtained.

The vessel owners and operators participating in the survey identified ten communities in which they live, including: Windsor Locks, CT; Fall River, Gloucester, Hamilton, New Bedford, and South Dartmouth, MA; Westport, ME; Adamsville and Tiverton, RI; and Seattle, WA. Red crab fishermen have lived in these communities for over 17 years, on average, and some fishermen report having lived in their communities for as long as 44 years.

When asked whether they considered these communities to be fishing communities, it was interesting to find that the majority do not consider them to be fishing communities and even fewer consider them to be significantly dependent on commercial fishing. Only three vessel owners or operators consider their communities to be significantly dependent on fishing. Those reporting that their towns were not fishing communities suggested this was due to few fishermen living there, the town being located inshore, or the town being a bedroom community. Of those who consider their towns to be fishing communities, they suggested this was due to the amount of fishing activities based in them.

Six ports were identified as the primary ports of vessel operations and mooring, including: Fall River, Gloucester, and New Bedford, MA; Bristol, ME; and Portsmouth and Tiverton, RI. The communities identified as providing fishing-related support services were identified in the previous section and include: Lower Mid-Coast Maine; Gloucester and the Massachusetts North Shore; Boston and the Massachusetts South Shore; Cape Cod and the Islands; the New Bedford, MA area; Rhode Island; some non-coastal areas of New England; and some areas outside of New England.

8.5 Description of the Baseline Economic Characteristics of the Fishery

Much of the following information is taken from a report on social and economic baseline information for the deep-sea red crab fishery. This report is provided in its entirety as Appendix B. The following is provided only as a summary of the information provided in the report.

8.5.1 Harvesting Sector

8.5.1.1 Dependence on the Fishery

Owners and operators of red crab fishing vessels provided information on their dependence on commercial fishing, and the red crab fishery in particular, for their annual household income (see Table 27). Note that on average the respondents report greater than 90% reliance on commercial fishing-related income to support themselves and their families. The red crab fishery is less important on average, but still most respondents report 100% dependence on the red crab fishery for their annual income.

Question	Minimum	Maximum	Average	Median	*n*
Percent income from commercial fishing	75%	100%	93.3%	100%	9
Percent income from red crab fishery	25%	100%	76.1%	100%	9

Table 27: Harvesters' economic dependence upon commercial fishing and red crab fishery for annual household income.

The majority of harvesters surveyed report being actively involved with no other commercial fisheries. The respondents that are involved in other fisheries report being involved with groundfishing, Alaskan crab, king crab, tanner crab, cod, black cod, halibut and salmon. In spite of a majority reporting to be involved with no other fisheries, only one respondent reports having no state or federal fishing permits. Permits listed for the others include tuna, lobster, groundfish, surfclam, squid, and Gulf of Mexico red crab.

When asked if the fishermen in their households have ever worked outside of the fishing industry, a slight majority report that the fishermen in their households have worked outside the fishing industry and the rest report that they have not. When asked how much they could earn if they were not fishing, one respondent reports that they would expect to earn the same, but the rest all report that they would expect to earn less or much less, with most expecting to earn less. The majority of respondents did not know what type of job they might have if they were not fishing. Some non-fishing-related jobs they might pursue include consulting, sales, technology, or some other marine-related employment.

8.5.1.2 Vessel characteristics

Owners and operators of red crab fishing vessels provided basic information on the characteristics of red crab fishing vessels (see Table 28). The average length of vessels in the red crab fishery is 105 feet, ranging from 72 to 150 feet in length. The hold capacity of these vessels is variable, ranging from 60,000 pounds to approximately 320,000 pounds, and averaging just over 122,000 pounds whole weight equivalent. For some vessels, hold capacity was reported in whole weight, but for other vessels the hold capacity was reported in section weight. To convert the section weight data into whole weight equivalents in order to average the hold capacities of all vessels, the fully-cleaned recovery rate conversion formula of 58% (1.72 to 1) provided by NMFS in the emergency regulations was used (66 FR 23182).

Vessels in the red crab fishery range in age from 9 to 36 years old and average 23 years old. The number of crew reported to be employed by each vessel ranged from 5 to 20 and averaged 8.2 crew per vessel. At least two vessels reported the total number of crewmen employed by them, but a portion of the crew rotates their time off (i.e., one vessel reports employing 9 crewmen but only takes 6 out on each fishing trip, allowing 3 a trip off). Most vessels report no seasonal differences in the number of crew they employ, although one respondent indicated that the number of crew varies with catch.

Question	Minimum	Maximum	Average	Median	*n*
Vessel Length (feet)	72	150	105.0	95	8
Hold Capacity (pounds)	60,000	320,000	122,312	70,000	8
Age of Vessel (years)	9	36	23.0	19	7
Number of Crew	5	20	8.2	7	8

Table 28: Vessel characteristics for red crab fishing vessels. Vessel hold capacity is provided in pounds of whole weight equivalent, converted where necessary from section weight into whole weight equivalent using the fully-cleaned recovery rate formula provided in the Secretarial Emergency Action for the Red Crab Fishery (66 FR 23182).

Other information collected on the characteristics of the red crab fishing vessels includes the construction and overall condition of the vessels participating in the red crab fishery. All but one vessel is reported to be constructed of a steel hull, the other constructed of a fiberglass hull. Half the vessels are reported to be in "good" condition (described in the survey as a vessel needing very little attention with a recent overhaul). One vessel was reported in "excellent" condition (described in the survey as a vessel new or very recently overhauled needing no attention). Three vessels were reported in "fair" condition (described in the survey as a vessel needing some attention and needing to be overhauled soon). No vessels were reported in "poor" condition (described in the survey as a vessel needing immediate attention including an overhaul).

Vessel owners and operators were also questioned about some economic aspects of their businesses, focusing on the fixed and variable costs associated with the red crab fishery. Owners and operators of four vessels responded to survey questions on the economics of the red crab fishery, and the results of these questions are summarized here. To protect the confidentiality of the responses to the maximum extent possible, only the mean of the responses to each question will be provided.

8.5.1.3 Catch and Revenue

Vessel owners and operators were asked to provide an average red crab catch and gross revenue per trip for the years 1998 - 2000, inclusive. On average, red crab vessels landed approximately 63,000 pounds of red crab per trip during these years. On average during this time, red crab vessels received an average of approximately $42,000 per trip in gross revenue. Vessel owners and operators also reported their minimum gross revenue needed to break-even, with an average of approximately $4,600 per day of fishing.

8.5.1.4 Trip Expenses

Vessel owners and operators were asked to provide information on their trip expenses for each fishing trip. Information was requested on costs of fuel, oil and lubrication, water, ice, bait, food and groceries, gear expenses and repairs, and any other trip expenses. The average price paid per pound for their bait is reported to be $0.20, with a range from $0.12 per pound to $0.25 per pound. On average, red crab fishing vessels spend approximately $12,600 per trip on the above types of expenses.

Vessel owners and operators also provided information on the division of revenue between the vessel and the crew. All owners and operators reported calculating the boat and crew shares after deducting trip expenses from the gross ex-vessel revenue. On average, 48% of proceeds are paid out as crew shares of the revenue (including the captain's share).

8.5.1.5 Annual Expenses

In addition to the questions on trip expenses, vessel owners and operators were asked about their annual expenses to maintain their business, vessel, and participation in the fishery. Information was requested on such things as interest on any loans, insurance, docking fees, vessel permits and license fees, administrative overhead, association fees, employee benefits, other shore-side expenses, and the depreciation of their vessel and gear. Red crab vessel owners and operators report spending an average of approximately $397,000 per year on these types of annual expenses.

8.5.1.6 Total Variable and Fixed Costs

The information summarized above was used to calculate the total variable and fixed costs for a fishing vessel in the red crab fishery. Variable costs include all per trip expenses, plus half of the annual vessel repair costs divided by the average number of fishing trips taken per year. Fixed costs include all annual expenses plus the other half of the annual vessel repair costs. For the red crab fishery, based on the responses summarized here, the variable costs average $15,000 per trip and the fixed costs average $470,000 per year.

8.5.1.7 Relationship with Processors

The survey completed by red crab vessel owners and operators also included questions on the relationships with red crab processors. They indicated that most use only a single processor, although one owner reports occasionally using a second. Five respondents report that they do not have any contracts with the processors they use, but three report that they do. Respondents indicate that their contracts include processing, marketing, off-loading, and moorage. Some contracts may also include annual and sometimes weekly landings commitments. The survey included a question as to why the red crab fishermen choose to use a particular processor. Most respondents indicated that they choose to sell their red crab to a particular processor in large part out of loyalty to that processor. Offering the best price and developing the best markets were also reasons given for choosing to sell to a particular processor.

8.5.2 Processing Sector

None of the respondents identified as processors report processing red crab exclusively. Other commercial fishery products processed include: clams, dogfish, Jonah crab, lobster, monkfish, mussels, rock crab, scallops, skates, snow crab, and squid.

Processors report that they obtain red crab product from vessels from a variety of ports, including Fall River and New Bedford, Massachusetts, as well as other ports in Massachusetts and Rhode Island. The processors report obtaining red crab product from between one and four vessels each, with an average of two vessels per processor. One respondent indicates that they purchase the red crabs from the vessels and then contract with a third party to actually process red crab, although they do process other fishery-related products.

8.5.2.1 Employees

The number of employees currently employed by the processors varies significantly, from 5 to 1000 with an average of over 300 employees per processor. According to the respondents, the majority of these employees are seasonal in nature, with an average of 146.5 year-round employees per processor. As would be expected given the responses summarized above, most processing employees work either on other fishery-related products or at least do not work exclusively on red crab. On average, less than 13% of processing employees work exclusively on red crab.

8.5.3 Wholesale and Retail Sector

The people and businesses that sell red crab product at the wholesale or retail level are an important component of the fishing industry and of fishing communities. These people and businesses may also be affected by regulations or when conditions change in the fishery. The questions in this section of the survey were an attempt to collect information on the dependence on the red crab fishery of the people and businesses in this sector of the industry. These questions focused on the dependence of wholesalers and retailers on the red crab fishery, their employment, and the products they sell.

8.5.3.1 Business operations

None of the survey respondents identified as wholesalers or retailers report selling red crab exclusively. Other commercial fishery products sold include: calamari, clams, dogfish, groundfish, Jonah, rock and snow crab, lobster, monkfish, mussels, scallops and skates.

Table 29 provides summary information on the characteristics of red crab wholesalers and retailers, based on the responses of those who participated in the survey. They reported that although the majority of their business revenue is derived from commercial fishing-related products (averaging 90%), a smaller proportion of this business revenue is derived from the sale of red crab products. The percentage of their business revenue that comes from the sale of red crabs ranges from less than 1% to 33% and averages slightly more than 25%. The number of employees retained by the respondent red crab wholesalers and retailers ranges from 2 to 150 and averages 32.8 per business operation.

Question	Minimum	Maximum	Average	Median	*n*
Percent revenue from fishing-related products	50%	100%	90.0%	100%	5
Percent revenue from red crab products	< 1%	33%	25.8%	25%	5
Total number of employees	2	150	32.8	3.5	5

Table 29: Characteristics of red crab wholesalers and retailers.

8.5.4 Fishery-Dependent Service Industries

There are no data available on the baseline economic characteristics of the fishery-dependent service industries that provide support services to the red crab fishery. All information known about these industries is provided in the section of the FMP identifying the social and cultural entities involved in the red crab fishery.

8.5.5 International Trade

There are no data available on the economic characteristics of any international trade related to the red crab fishery. The only information available is that at least two wholesalers and/or retailers of red crab products sell between 10% and 15% of their red crab product to foreign enterprises.

8.5.6 Business and Markets

8.5.6.1 Red crab products sold by processors

Three processors report selling between 50 and 75% of their red crab to food service companies, three report selling between 10 and 30% to retail centers, one reports selling 40% to distributors, and one reports selling 100% of their red crab product to a wholesaler. Three respondents report selling only frozen red crab product, in a mixture of whole crabs, claws, sections, and picked meat. Of these, only one respondent reports selling whole crabs and the majority crab product of these respondents appears to be picked meat. A fourth respondent reports selling 100% of their red crab product in the form of fresh picked meat.

8.5.6.2 Red crab products sold by wholesalers and retailers

Three wholesalers and retailers report selling only frozen red crab product, in a mixture of whole crabs, claws, sections, and picked meat. Of these, only one respondent reported selling whole crabs and the majority of all crab product by these respondents appears to be picked meat. A fourth respondent reports selling 100% of their red crab product in the form of fresh picked meat. A fifth respondent reports selling a variety of fresh and frozen red crab. They report selling fresh crabs as whole, claws, sections, and picked meat. They also report selling frozen crabs whole, claws, and sections. Three respondents report selling between 60 and 100% of their red crab product to companies in the U.S. but not in New England; three report selling between 5 and 100% of their red crab product to companies in New England; and two report selling between 10 and 15% or their red crab product to foreign enterprises.

8.6 Description of the Baseline Social Characteristics of the Fishery

Much of the following information is taken from a report on social and economic baseline information for the deep-sea red crab fishery. This report is provided in its entirety as Appendix B. The following is provided only as a summary of the information provided in the report.

8.6.1 Harvesting Sector

8.6.1.1 Family involvement in fishing

All of the harvesters responding to the survey report that their parents and grandparents were not involved in commercial fishing. Three-quarters of the respondents report being the first generation of their family involved in commercial fishing, the rest report being the second generation. Most report that no other members of their families are involved in commercial fishing, although one respondent did report as many as four other family members are involved in commercial fishing. Of the other family members involved in fishing, responses included wives, brothers, and sons.

When asked about their interest in having their children pursue a career in commercial fishing, only two report being interested. Six respondents report being not interested in having their children become involved in commercial fishing, and answers for why they are not interested ranged from a belief that there is no future in fishing to a preference that they attend college. Other reasons included children being female, too many variables in fishing, and the suggestion that the decision was the choice of their children. When asked about whether their children themselves are interested in commercial fishing, only two report their children are interested. Five respondents report that their children are not interested in commercial fishing. Reasons given for why their children are not interested in commercial fishing include that they are too young, they have other interests, they are attending or planning to attend college, and that it is their choice.

Respondents were asked about their family work practices and the amount of time they and their spouses spend in a typical week on various activities. Spouses appear to be primarily responsible for household finances and some record-keeping. The fishermen themselves are primarily responsible for vessel operations, supervising crew, repairing and maintaining the vessel, and sales operations. No one reports any non-fishing related employment by either themselves or their spouses.

Most respondents indicate that they would not have to move from their communities if fishing became more difficult with only two respondents reporting that they would have to move. When asked what they might be able to do to earn a living in the area in which they live (if they were no longer fishing for red crab), suggestions included employment in carpentry, some other boating-related activity, or lobster fishing. Two respondents report not knowing what they could do if they were not fishing and one reported that there would not be much that they could do.

Most respondents report belonging to at least one fishing-related organization and most of these individuals report active participation in the organizations. About half the respondents report that either they or members of their household participate in community organizations, including school and church groups. A majority of respondents report they would not advise young people to go into the fishing industry. Only two suggested that they would advise young people to enter the fishing industry.

The owners and operators of red crab fishing vessels were asked about their time not fishing ("down time") spent on fishing-related activities (gear repair, vessel maintenance, trip planning, attending meetings, etc.). All respondents indicate that they spend more than 10% of their down time on fishing-related activities. The largest percentage of respondents report spending more than half of their down time on fishing-related activities. Five respondents report that the amount of down time they spend on fishing-related activities has increased over time, while four report that this has not increased.

8.6.2 Processing Sector

Other than the information already provided on this sector of the fishery, there is no information available on the baseline social characteristics of the processing and wholesale sectors of the red crab fishery.

8.6.3 Fishery-Dependent Service Industries

There is no information available on the baseline social characteristics of the fishery-dependent service industries that provide support services to the red crab fishery. All information known about these industries is provided in the section of the FMP identifying the social and cultural entities involved in the red crab fishery.

8.7 Protected Species

The primary geographic area affected by the red crab fishery includes Northeast and Mid-Atlantic waters of the United States Exclusive Economic Zone. Although the red crab trap/pot gear is very similar to that used in the American lobster fishery, the deep sea red crab fishery is geographically limited by the narrow shelf edge habitat of the red crab as shown in Figure 23. Red crabs are only found on the continental shelf and slope seabed from the Scotian Shelf to Cape Hatteras in the Northeast waters, although their range extends at similar depths into the Gulf of Mexico. Depth preferences for red crab may be dictated by temperature and salinity and can range between 200 and 1,800 meters. Red crab size may be in inverse proportion to the depth, with larger crabs found in the shallower water (200-400m).

8.7.1 Identification of Protected Species

The Council has determined that the following list of species protected either by the Endangered Species Act of 1973 (ESA), or the Marine Mammal Protection Act of 1972

(MMPA) may be found in the environment utilized by the deep sea red crab fishery under the proposed FMP.

8.7.1.1 Cetaceans

Northern right whale (*Eubalaena glacialis*)	Endangered
Humpback whale (*Megaptera novaeangliae*)	Endangered
Fin whale (*Balaenoptera physalus*)	Endangered
Blue whale (*Balaenoptera musculus*)	Endangered
Sei whale (*Balaenoptera borealis*)	Endangered
Sperm whale (*Physeter macrocephalus*)	Endangered
Minke whale (*Balaenoptera acutorostrata*)	Protected
Beaked whales (*Ziphius* and *Mesoplodon* spp.)	Protected
Risso's dolphin (*Grampus griseus*)	Protected
Pilot whale (*Globicephala* spp.)	Protected
White-sided dolphin (*Lagenorhynchus acutus*)	Protected
Common dolphin (*Delphinus delphis*)	Protected
Spotted and striped dolphins (*Stenella* spp.)	Protected
Bottlenose dolphin (*Tursiops truncatus*)	Protected

8.7.1.2 Sea Turtles

Leatherback sea turtle (*Dermochelys coriacea*)	Endangered
Kemp's ridley sea turtle (*Lepidochelys kempii*)	Endangered
Green sea turtle (*Chelonia mydas*)	Endangered
Hawksbill sea turtle (*Eretmochelys imbricata*)	Endangered
Loggerhead sea turtle (*Caretta caretta*)	Threatened

8.7.1.3 Fish

Shortnose sturgeon (*Acipenser brevirostrum*)	Endangered
Atlantic salmon (*Salmo salar*)	Endangered

8.7.1.4 Birds

Roseate tern (*Sterna dougallii dougallii*)	Endangered
Piping plover (*Charadrius melodus*)	Endangered

8.7.1.5 Critical Habitat Designations

Right whale	Cape Cod Bay Great South Channel

8.7.2 Protected Species Not Likely Affected by this FMP

The Council has reviewed the current information available on the distribution and habitat needs of the endangered, threatened, and otherwise protected species listed above in relation to the action being considered in the Red Crab FMP. Following this review, the Council has made an assessment that deep sea red crab fishing operations, as managed by the Red Crab FMP, are not expected to affect the shortnose sturgeon *(Acipenser brevirostrum*), the Gulf of Maine distinct population segment (DPS) of Atlantic salmon (*Salmo salar*), the roseate tern (*Sterna dougallii dougallii*), the piping plover (*Charadrius melodus*) or the Kemp's ridley *(Lepidochelys kempii),* green (*Chelonia mydas*) and hawksbill sea turtles (*Eretmochelys imbricata*), all of which are listed species under the Endangered Species Act of 1973.

There are several cetaceans protected under the Marine Mammal Protection Act of 1972 (MMPA) that are found in the waters fished by the deep-sea red crab fishery, namely the minke whale (*Balaenoptera acutorostrata*), beaked whales (*Ziphius* and *Mesoplodon* spp.), Risso's dolphin (*Grampus griseus*), pilot whale (*Globicephala* spp.), Atlantic white-sided dolphin (*Lagenorhynchus acutus*), common dolphin (*Delphinus delphis*), spotted and striped dolphins (*Stenella* spp.), and Atlantic bottlenose dolphin (*Tursiops truncatus*).

However the red crab fishery is not expected to adversely affect these populations in any way that may compromise their ability to maintain optimum sustainable population levels, or cause their serious injury and mortality levels to exceed the potential biological removal (PBR) levels allowed for commercial fisheries. In addition, the Council believes that the red crab fishing operations will not adversely affect the right whale critical habitat areas listed above. The Council will be asking the NMFS and USFWS for concurrence in these assessments.

8.7.2.1 Shortnose Sturgeon

Shortnose sturgeon are benthic fish that mainly occupy the deep channel sections of large rivers. They can be found in large rivers along the western Atlantic coast from St. Johns River, Florida (possibly extirpated from this system), to the Saint John River in New Brunswick, Canada. The species is considered to be anadromous and individuals have been captured in otter trawl gear on the continental shelf. The deep sea habitat of the red crab is likely to be beyond the foraging range of sturgeon. There have been no documented cases of shortnose sturgeon taken in red crab trap/pot gear, or fisheries using similar gear types.

8.7.2.2 Atlantic Salmon

The recent ESA-listing for Atlantic salmon covers the wild population of Atlantic salmon found in rivers and streams from the lower Kennebec River north to the U.S.-Canada border. These include the Dennys, East Machias, Machias, Pleasant, Narraguagus, Ducktrap, and Sheepscot Rivers and Cove Brook. Atlantic salmon are an anadromous species with spawning and juvenile rearing occurring in freshwater rivers followed by migration to the marine environment. Juvenile salmon in New England rivers typically migrate to sea in May after a two to three year period of development in freshwater streams, and remain at sea for two winters before returning to their U.S. natal rivers to spawn from mid October through early November. While at sea, salmon generally undergo an extensive northward migration to waters off Canada and Greenland.

Data from past commercial harvest indicate that post-smolts overwinter in the southern Labrador Sea and in the Bay of Fundy.

The numbers of returning wild Atlantic salmon within the Gulf of Maine Distinct Population Segment (DPS) are perilously small with total run sizes of approximately 150 spawners occurring in 1999 (Baum 2000). Although capture of Atlantic salmon has occurred in commercial fisheries (usually otter trawl or gillnet gear) or by research/survey, no salmon have been reported captured in red crab trap/pot gear, or fisheries using similar gear types.

8.7.2.3 Roseate Tern and Piping Plover

The roseate tern and piping plover inhabit the Northeast coastal waters and nest on the coastal beaches of the Northeast. These birds rely on small schooling fishes (terns) or shoreline invertebrates and other small fauna (plovers) for food. The trap/pot fishing gear and vessel operations conducted by the deep sea red crab fishery poses no threat to these species or their forage species.

8.7.2.4 Kemp's Ridley, Green, Hawksbill, and Loggerhead Sea Turtles

The endangered Kemp's ridley, green, and hawksbill and the threatened loggerhead can be found within the red crab management unit. The deep sea red crab fishery takes place along the continental shelf edge at depths and in oceanographic areas that are beyond the foraging zones of these sea turtle species. Therefore, based on the distribution and foraging patterns, Kemp's ridley, green, hawksbill and loggerhead sea turtles are not likely to interact with red crab trap/pot gear.

8.7.2.5 Minke Whale

Minke whales have a cosmopolitan distribution in polar, temperate, and tropical waters. The Canadian east coast population is one of four populations recognized in the North Atlantic. Minke whales off the eastern coast of the U.S are considered to be part of this population that extends from Davis Strait off Newfoundland to the Gulf of Mexico. The species is common and widely distributed along the U.S continental shelf. They show a certain seasonal distribution with spring and summer peak numbers, falling off in the fall to very low winter numbers. Like all baleen whales, the minke whale generally occupies the continental shelf proper, rather that the continental edge region where the red crab fishery largely occurs. For these reasons minke whales are not likely to interact with red crab pot/trap gear.

8.7.2.6 Beaked Whales

The two genus of beaked whale that inhabit the continental shelf edge of the U.S are *Mesoplodon and Ziphius* are known from strandings to be distributed from Nova Scotia around the Gulf of Mexico into the Caribbean. The population level of these genera are unknown, although a minimum population estimate of 2,419 has been derived for U.S waters (NMFS 2000) from limited survey estimates. Beaked whales are deep diving animals feeding on squid and other deep water fishes. Beaked whales have been observed taken in the pelagic drift gillnet fishery, but not in any other fishery observed by the NMFS. Although their habitat and feeding behavior may bring them to depths where the red crab fishery occurs, their external physiology (narrow body shape with small pectoral flippers and flukes) make it less likely for them to become entangled in buoy or groundlines between traps. Therefore, it is unlikely that the take in this fishery will be at levels that compromise their ability to maintain optimum sustainable population levels, or cause their serious injury and mortality levels to exceed the PBR levels allowed for commercial fisheries.

8.7.2.7 Risso's Dolphin and Pilot Whale

The Risso's dolphin and pilot whale are two odontocetes with similar distribution and feeding patterns. Both species are distributed along the continental shelf edge of North America from Cape Hatteras to Georges Bank. Minimum population estimates for the Risso's dolphin and pilot whale of 22,916 and 11,343 respectively have been derived for U.S waters (NMFS 2000) from limited survey estimates. Both species have been observed taken in the pelagic drift gillnet fishery, pelagic longline, and mid-water trawl fisheries, but have never been reported in any pot/trap gear. Although their feeding habitat overlaps the distribution of the red crab fishery, their pelagic prey species (squid and schooling fishes) would make it unlikely that they would encounter the bottom tending pot/trap gear of the red crab fishery. Therefore, it is unlikely that the take in this fishery will be at levels that compromise their ability to maintain optimum sustainable population levels, or cause their serious injury and mortality levels to exceed the PBR levels allowed for commercial fisheries.

8.7.2.8 Atlantic White-Sided Dolphin

White-sided dolphins are found in the temperate and sub-polar waters of the North Atlantic, primarily on the continental shelf waters out to the 100 m depth contour. The species is distributed from central western Greenland to North Carolina, with the Gulf of Maine stock commonly found from Hudson Canyon to Georges Bank and into the Gulf of Maine to the Bay of Fundy. A minimum population estimate for the white-sided dolphin 19,196 has been derived for U.S waters (NMFS 2000) from limited survey estimates. White-sided dolphins have been observed taken in the multispecies sink gillnet fishery, the pelagic drift gillnet fishery, and several mid-water and bottom trawl fisheries, but have never been reported in any pot/trap gear. Their feeding habitat and range is at the shallow end of the red crab fishery, and their pelagic prey species (squid and schooling fishes) and small size would make it unlikely that they would encounter the bottom tending pot/trap gear of the red crab fishery. Therefore, it is unlikely that the take in this fishery will be at levels that compromise their ability to maintain optimum sustainable population levels, or cause their serious injury and mortality levels to exceed the PBR levels allowed for commercial fisheries.

8.7.2.9 Pelagic Delphinids (Common, Spotted, Striped, and Bottlenose Dolphins)

The pelagic delphinid complex is made up of small odontocete species that are broadly distributed along the continental shelf edge, where depths range from 200 - 400 meters. They are commonly found in large schools feeding on surface or near surface schools of fish. The minimum population estimates for each species number in the tens of thousands. They are known to be taken in pelagic and sink gillnets gear as well as mid-water and bottom trawl gear, but never in pot/trap gear. Their pelagic prey species and small size would make it unlikely that they would encounter the bottom tending pot/trap gear of the red crab fishery. Therefore, it is unlikely that the take in this fishery will be at levels that compromise their ability to maintain optimum sustainable population levels, or cause their serious injury and mortality levels to exceed the PBR levels allowed for commercial fisheries.

8.7.2.10 Right Whale Critical Habitat

The Council has also assessed the potential for deep sea red crab fishing operations adversely affecting critical habitat that has been designated for the right whale. NMFS evaluated the potential effects of the proposed Federal lobster fisheries on the critical habitats that have been designated in the Great South Channel and Cape Cod Bay in the Biological Opinion issued for that fishery on June 14, 2001. In that Opinion NMFS found no evidence that suggest that the operation of the Federal lobster fishery had any adverse effects on the value of critical habitat designated for the right whale. The deep sea red crab fishery does not occur in the Cape Cod Bay area and is prevented from fishing in the Great South Channel during the right whale high use period for that area (April 1 until June 30) under the existing ALWTRP regulations. Therefore, the Council does not believe the red crab fishery, as operated under the Red Crab FMP, will affect right whale critical habitat.

8.7.3 Status of Protected Species Potentially Affected by this FMP

The potential impacts of the management alternatives and measures being considered under this FMP on protected species are described within Section 5.3 and Section 5.4. This remainder of this section will focus on the status of the various species listed above that inhabit the red crab fishing area and may adversely be affected by the fishing operations occurring under the Red Crab FMP. Additional background information on the range-wide status of these species and a description of the critical habitat can be found in a number of published documents, including sea turtle status reviews (NMFS and USFWS 1995, Marine Turtle Working Group - TEWG 1998, 2000) and biological reports (USFWS 1997), recovery plans for the humpback whale (NMFS 1991a), right whale (NMFS 1991b), loggerhead turtle (NMFS and USFWS 1991) and leatherback turtle (NMFS and USFWS 1992) and the 2000 and Draft 2001 Marine Mammal Stock Assessment Reports (Waring et al. 2000).

8.7.3.1 Right Whale

Right whales have occurred historically in all the world's oceans from temperate to subarctic latitudes. NMFS recognizes three major subdivisions of right whales: North Pacific, North Atlantic, and Southern Hemisphere. NMFS further recognizes two extant subunits in the North Atlantic: eastern and western. A third subunit may have existed in the central Atlantic (migrating from east of Greenland to the Azores or Bermuda), but this stock appears to be extinct (Perry et al. 1999). Because of our limited understanding of the genetic structure of the entire species, the most conservative approach to this species would treat these right whale subunits as recovery units whose survival and recovery is critical to the survival and recovery of the species.

Of all of the large whales, the North Atlantic right whale has the highest risk of extinction. The scarcity of right whales is the result of an 800-year history of whaling that continued into the 1960s (Klumov 1962). In the North Atlantic, records indicate that right whales were subject to commercial whaling as early as 1059. Between the 11^{th} and 17^{th} centuries an estimated 25,000-40,000 right whales are believed to have been taken. The size of the western North Atlantic right whale population at the termination of whaling is unknown. The stock was recognized as seriously depleted as early as 1750. However, right whales continued to be taken in shore-based operations or opportunistically by whalers in search of other species as late as the 1920's. By the time the species was internationally protected in 1935 there may have been fewer than 100 right whales in the western North Atlantic (Hain 1975; Reeves et al. 1992; Kenney et al. 1995 in Waring et al. 2000).

Intense whaling was likely the first step toward the critically endangered status of North Atlantic and North Pacific right whales. Currently, the North Pacific population is so small that no reliable estimate can be given, and the eastern subpopulation of the North Atlantic population may already be extinct. The western North Atlantic subpopulation is the most numerous of the North Atlantic right whales but is only estimated to number approximately 300 animals. North Atlantic right whales have been protected for more than 50 years from the pressures of whaling, yet most stocks show no evidence of recovery. In contrast, the southern right whale is recovering with a growth rate of 7% in many areas.

Right whales appear to prefer shallow coastal waters, but their distribution is also strongly correlated to the distribution of their prey (zooplankton). In both northern and southern hemispheres, right whales are observed in the lower latitudes and more coastal waters during winter, where calving takes place, and then tend to migrate to higher latitudes during the summer. The distribution of right whales in summer and fall in both hemispheres appears linked to the distribution of their principal zooplankton prey (Winn et al. 1986). They generally occur in western North Atlantic waters west of the Gulf Stream and are most commonly associated with cooler waters (21º C). They are not found in the Caribbean and have been recorded only rarely in the Gulf of Mexico.

Right whales feed on zooplankton through the water column, and in shallow waters may feed near the bottom. In the Gulf of Maine they have been observed feeding on zooplankton, primarily copepods, by skimming at or below the water's surface with open mouths (NMFS 1991b; Kenney et al. 1986; Murison and Gaskin 1989; and Mayo and Marx 1990). Research suggests that right whales must locate and exploit extremely dense patches of zooplankton to feed efficiently (Waring et al. 2000). New England waters include important foraging habitat for right whales and at least some portion of the North Atlantic right whale population is present in these waters throughout most months of the year. They are most abundant in Cape Cod Bay between February and April

(Hamilton and Mayo 1990; Schevill et al. 1986; Watkins and Schevill 1982) and in the Great South Channel in May and June (Kenney et al. 1986; Payne et al. 1990) where they have been observed feeding predominantly on copepods, zooplankton commonly found in that area (Waring et al. 2000). Right whales also frequent Stellwagen Bank and Jeffrey's Ledge, as well as Canadian waters including the Bay of Fundy and Browns and Baccaro Banks, in the spring and summer months. Mid-Atlantic waters are used as a migratory pathway from the spring and summer feeding/nursery areas to the winter calving grounds off the coast of Georgia and Florida.

NMFS designated right whale critical habitat on June 3, 1994 (59 FR 28793) to help protect important right whale foraging and calving areas within the U.S. These include the waters of Cape Cod Bay and the Great South Channel off the coast of Massachusetts, and waters off the coasts of southern Georgia and northern Florida. In 1993, Canada's Department of Fisheries declared two conservation areas for right whales; one in the Grand Manan Basin in the lower Bay of Fundy, and a second in Roseway Basin between Browns and Baccaro Banks (Canadian Recovery Plan for the North Atlantic Right Whale 2000).

There is, however, much about right whale movements and habitat that is still not known or understood. Approximately 85% of the population is unaccounted for during the winter (Waring et al. 2000). Telemetry technology, used to track whales, has shown lengthy and somewhat distant excursions into deep water off of the continental shelf (Mate et al. 1997). In addition, photographs of identified individuals have documented northern movements as far as Newfoundland, the Labrador Basin and southeast of Greenland (Knowlton et al. 1992). During the winter of 1999/2000, appreciable numbers of right whales were recorded in the Charleston, SC area. Because survey efforts in the mid-Atlantic have been limited, it is unknown whether this is typical or whether it represents a northern expansion of the normal winter range, perhaps due to unseasonably warm waters. Sixteen satellite tags were attached to right whales in the Bay of Fundy, Canada, during summer 2000 in an effort to further elucidate the movements and important habitat for North Atlantic right whales. The movements of these whales varied, with some remaining in the tagging area and others making periodic excursions to other areas before returning to the Bay of Fundy. Several individuals were observed to go to the coastal waters of Maine, while others traveled to the Scotian Shelf. One individual was successfully tracked throughout the fall, and was followed on her migration to the Georgia/Florida wintering area.

Recognizing the precarious status of the right whale, the continued threats present in its coastal habitat throughout its range, and the uncertainty surrounding attempts to characterize population trends, the International Whaling Commission (IWC) held a special meeting of its Scientific Committee from March 19-25, 1998, in Cape Town, South Africa, to conduct a comprehensive assessment of right whales worldwide. The workshop's participants reviewed available information on the North Atlantic right whale. The conclusions of Caswell et al. (1999) were particularly alarming. Using data on reproduction and survival through 1996, Caswell determined that the western North Atlantic right whale population was declining at a rate of 2.4% per year, with one model suggesting that the mortality rate of the right whale population has increased five-fold in less than one generation. According to Caswell, if the mortality rate as of 1996 does not decrease and the population performance does not improve, extinction could occur in 191 years and would be certain within 400 years.

The IWC Workshop participants expressed "considerable concern" in general for the status of the western North Atlantic right whales. Based on recent (1993-1995) observations of near-failure of calf production, the significantly high mortality rate, and an observed increase in the calving interval, it was suggested that the slow but steady recovery rate published in Knowlton et al. (1994) may not be continuing. Workshop participants urgently recommended increased efforts to reduce the human-caused mortality factors affecting this right whale population.

In addition to the concerns of the high mortality rate for North Atlantic right whales, there has been concern over the decline in birth rate. In the three calving seasons following Caswell's analysis, only 10 calves are known to have been born into the population, with only one known right whale birth in the 1999/2000 season. However, the 2000/2001 calving season had 31 right whale calves sighted, with 27 surviving. Although these births are encouraging, biologists recognize that there may be some natural mortality with these calves and cautious optimism is necessary because of how close the species is to extinction. In addition, efforts to reduce human-caused mortality must be accelerated if these individuals are to survive to sexual maturity and help reverse the population decline.

One question that has repeatedly arisen is the effect that "bottlenecking" may have played on the genetic integrity of right whales. Several genetics studies have attempted to examine the genetic diversity of right whales. Results from a study by Schaeff et al. (1997) indicate that North Atlantic right whales are less genetically diverse than southern right whales; a separate population that numbers at least four times as many animals with an annual growth rate of nearly seven percent. A recent study compared the genetic diversity of North Atlantic right whales with the genetic diversity of southern right whales. The researchers found only five distinct haplotypes (a maternal genetic marker) exist amongst 180 different North Atlantic right whales, versus 10 haplotypes amongst just 16 sampled southern right whales. In addition, one of the five haplotypes found in the North Atlantic right whales was observed in only four animals; all males born prior to 1982 (Malik et al. 2000). Because this genetic marker can be passed only from female to offspring, there is an expectation that it will be lost from the population. The last known female with this type was the animal killed by the shore fishery at Amagansett, Long Island in 1907. Interestingly, this haplotype is basal to all others worldwide (i.e., it is the most ancient).

While such low genetic diversity is of concern, there is a lack of information on how this limited genetic variation might affect the reproduction or survivability of the North Atlantic right whale population. It has been suggested that North Atlantic right whales have been at a low population size for hundreds of years and, while the present population exhibits very low genetic diversity, the major effects of harmful genes are thought to have occurred well in the past, effectively eliminating those genes from the population (Kenney 2000). To help determine how long North Atlantic right whales have exhibited such low genetic diversity, researchers have analyzed DNA extracted from museum specimens. Although the sample size was small (n=6), Rosenbaum et al. (2000) found these samples represented four different haplotypes, all of which are still present in the current population. This study suggests that there has not been a significant loss of genetic diversity within the last 191 years and any significant reduction in genetic diversity likely occurred prior to the late 19th century.

The role of contaminants or biotoxins in reducing right whale reproduction has also been raised. Contaminant studies have confirmed that right whales are exposed to and accumulate contaminants, but the effect that such contaminants might be having on right whale reproduction or survivability is unknown.

It has been suggested that competition for food resources may be impacting right whale reproduction. Researchers have found that North Atlantic right whales appear to have thinner blubber than right whales from the South Atlantic (Kenney 2000). However, there is no evidence at present to demonstrate that the decline in birth rate and increase in calving interval is related to a food shortage. It has also been suggested that oceanic conditions affecting the concentration of copepods may in turn have an effect on right whales since they rely on dense concentrations of copepods to feed efficiently (Kenney 2000). Once again, however, evidence is lacking to demonstrate the relationship between oceanic conditions and copepod abundance to right whale fitness and reproduction rates.

General human impacts and entanglement

Right whales may be adversely affected by habitat degradation, habitat exclusion, acoustic trauma, harassment, or reduction in prey resources due to trophic effects resulting from a variety of activities including the operation of commercial fisheries. However, the major known sources of anthropogenic mortality and injury of right whales clearly are ship strikes and entanglement in commercial fishing gear.

Based on photographs of catalogued animals from 1959 and 1989, Kraus (1990) estimated that 57% of right whales exhibited scars from entanglement and 7% from ship strikes (propeller injuries). Hamilton et al. (1998) updated this work using data from 1935 through 1995. The new study estimated that 61.6% of right whales exhibit injuries caused by entanglement, and 6.4% exhibit signs of injury from vessel strikes. These data may be misleading as a ship strike may be less of a "recoverable" event than entanglement in rope. It is also known that several whales have apparently been entangled on more than one occasion, and that some right whales that have been entangled were subsequently involved in ship strikes. These numbers are primarily based on sightings of free-swimming animals that initially survive the entanglement. Because some animals may drown or be killed immediately, the actual number of interactions may be higher.

It should be noted that no information is currently available on the response of the right whale population to recent (1997-1999) efforts to mitigate the effects of entanglement and ship strikes. However, as noted above, both entanglements and ship strikes have continued to occur. Therefore, it is not possible to determine whether the declining trend reported by Caswell et al. (1999) is continuing. Furthermore, results reported by Caswell suggest that it is not possible to determine that anthropogenic mortalities alone are responsible for the decline in right whale survival. However, the IWC concluded that reduction of anthropogenic mortalities would significantly improve the species' survival probability.

The best available information makes it reasonable to conclude that the current death rate exceeds the birth rate in the western North Atlantic right whale population. The nearly complete reproductive failure in this population from 1993 to 1995 and again in 1998 and 1999 suggests that this pattern has continued for almost a decade, though the 2000/2001 season appears the most promising in the past five years in terms of calves born. Because no population can sustain a high death rate and low birth rate indefinitely, this combination places the North Atlantic right whale population at high risk of extinction. Coupled with an increasing calving interval, the relatively large number of young right whales (0-4 years) and adults that are killed, by human-related factors, the likelihood of extinction is clear. The recent increase in births gives rise to optimism, however these young animals must be provided with protection so that they can mature and contribute to future generations in order to be a factor in stabilizing of the population.

8.7.3.2 Humpback Whale

Humpback whales calve and mate in the West Indies and migrate to feeding areas in the northwestern Atlantic during the summer months. Six separate feeding areas are utilized in northern waters after their return (Waring et al. 2000). Only one of these feeding areas, the GOM, lies within U.S. waters and is within the action area of this consultation. Most of the humpbacks that forage in the GOM visit Stellwagen Bank and the waters of Massachusetts and Cape Cod Bays. Sightings are most frequent from mid-March through November between 41º N and 43º N, from the Great South Channel north along the outside of Cape Cod to Stellwagen Bank and Jeffreys Ledge (CeTAP 1982), and peak in May and August. Small numbers of individuals may be present in this area year-round. They feed on a number of species of small schooling fishes, particularly sand lance and Atlantic herring, by targeting fish schools and filtering large amounts of water for their associated prey. Humpback whales have also been observed feeding on krill (Wynne and Schwartz 1999).

Various papers (Barlow and Clapham 1997; Clapham et al. 1999) summarized information gathered from a catalogue of photographs of 643 individuals from the western North Atlantic population of humpback whales. These photographs identified reproductively mature western North Atlantic humpbacks wintering in tropical breeding grounds in the Antilles, primarily on Silver and Navidad Banks, north of the Dominican Republic. The primary winter range also includes the Virgin Islands and Puerto Rico (NMFS 1991a). In general, it is believed that calving and copulation take place on the winter range. Calves are born from December through March and are about 4 meters at birth. Sexually mature females give birth approximately every 2 to 3 years. Sexual maturity is reached between 4 and 6 years of age for females and between 7 and 15 years for males. Size at maturity is about 12 meters.

Humpback whales use the mid-Atlantic as a migratory pathway, but it may also be an important feeding area for juveniles. Since 1989, observations of juvenile humpbacks in the mid-Atlantic have been increasing during the winter months, peaking January through March (Swingle et al. 1993). Biologists theorize that non-reproductive animals may be establishing a winter feeding range in the mid-Atlantic since they are not participating in reproductive behavior in the Caribbean. Those whales using this mid-Atlantic area that have been identified were found to be residents of the GOM and Atlantic Canada (Gulf of St. Lawrence and Newfoundland) feeding groups, suggesting a mixing of different feeding stocks in the mid-Atlantic region.

In concert with the increase in mid-Atlantic whale sightings, strandings of humpback whales have increased between New Jersey and Florida since 1985. Strandings were most frequent during September through April in North Carolina and Virginia waters, and were composed primarily of juvenile humpback whales of no more than 11 meters in length (Wiley et al. 1995). Six of 18 humpbacks for which the cause of mortality was determined were killed by vessel strikes. An additional humpback had scars and bone fractures indicative of a previous vessel strike that may have contributed to the whale's mortality.

New information has become available on the status and trends of the humpback whale population in the North Atlantic. Although current and maximum net productivity rates are unknown at this time, the population is apparently increasing. It has not yet been determined whether this increase is uniform across all six feeding stocks (Waring et al. 2000). For example, the overall rate of increase has been estimated at 9.0% (CV=0.25) by Katona and Beard (1990), while a 6.5% rate was reported for the Gulf of Maine by Barlow and Clapham (1997) using data through 1991. The rate reported by Barlow and Clapham (1997) may roughly approximate the rate of increase for the portion of the population within the red crab management area.

A variety of methods have been used to estimate the North Atlantic humpback whale population. However, a photographic mark-recapture analyses from the Years of the North Atlantic Humpback (YONAH) project gave a North Atlantic basin-wide estimate of 10,600 (95% c.i. = 9,300 - 12,100) is regarded as the best available estimate for the North Atlantic population.

General human impacts and entanglement

The major known sources of anthropogenic mortality and injury of humpback whales include entanglement in commercial fishing gear and ship strikes. Based on photographs of the caudal peduncle of humpback whales, Robbins and Mattila (1999) estimated that at least 48% --- and possibly as many as 78% --- of animals in the Gulf of Maine exhibit scarring caused by entanglement. Several whales have apparently been entangled on more than one occasion. These estimates are based on sightings of free-swimming animals that initially survive the encounter. Because some whales may drown immediately, the actual number of interactions may be higher. In addition, the actual number of species-gear interactions is contingent on the intensity of observations from aerial and ship surveys.

Humpback whales may also be adversely affected by habitat degradation, habitat exclusion, acoustic trauma, harassment, or reduction in prey resources due to trophic effects resulting from a variety of activities including the operation of commercial fisheries.

8.7.3.3 Fin Whale

Fin whales inhabit a wide range of latitudes between 20-75° N and 20-75° S (Perry et al. 1999). Fin whales spend the summer feeding in the relatively high latitudes of both hemispheres, particularly along the cold eastern boundary currents in the North Atlantic and North Pacific Oceans and in Antarctic waters (IWC 1992). Most migrate seasonally from relatively high-latitude Arctic and Antarctic feeding areas in the summer to relatively low-latitude breeding and calving areas in the winter (Perry et al. 1999).

As was the case for the right and humpback whales, fin whale populations were heavily affected by commercial whaling. However, commercial exploitation of fin whales occurred much later than for right and humpback whales. Although some fin whales were taken as early as the 17th century by the Japanese using a fairly primitive open-water netting technique (Perry et al. 1999) and were hunted occasionally by sailing vessel whalers in the 19th century (Mitchell and Reeves 1983), wide-scale commercial exploitation of fin whales did not occur until the 20th century when the use of steam power and harpoon-gun technology made exploitation of this faster, more offshore species feasible. In the southern hemisphere, over 700,000 fin whales were landed in the 20th century. More than 48,000 fin whales were taken in the North Atlantic between 1860 and 1970 (Perry et al. 1999). Fisheries existed off of Newfoundland, Nova Scotia, Norway, Iceland, the Faroe Islands, Svalbard (Spitsbergen), the islands of the British coasts, Spain and Portugal. Fin whales were rarely taken in U.S. waters, except when they ventured near the shores of Provincetown, MA, during the late 1800's (Perry et al. 1999).

Various estimates have been provided to describe the current status of fin whales in western North Atlantic waters. Based on the catch history and trends in Catch Per Unit Effort, an estimate of 3,590 to 6,300 fin whales was obtained for the entire western North Atlantic (Perry et al. 1999). The latest (Waring et al. 2001) SAR gives a best estimate of abundance for fin whales of 2,814 (CV = 0.21). This is currently an underestimate, as too little is known about population structure, and the estimate is derived from surveys over a limited portion of the western North Atlantic.

In the North Atlantic today, fin whales are widespread and occur from the Gulf of Mexico and Mediterranean Sea northward to the edges of the arctic pack ice (NMFS 1998a). A number of researchers have suggested the existence of fin whale subpopulations in the North Atlantic. Mizroch et al. (1984) suggested that local depletions resulting from commercial overharvesting supported the existence of North Atlantic fin whale subpopulations. Others have used genetics information to provide support for the belief that there are several subpopulations of fin whales in the North Atlantic and Mediterranean (Bérubé et al. 1998). In 1976, the IWC's Scientific Committee proposed seven stocks for North Atlantic fin whales. However, it is uncertain whether these stock boundaries define biologically isolated units (Waring et al. 2000). The NMFS has designated one stock of fin whale for U.S. waters of the North Atlantic (Waring et al. 1998) where the species is commonly found from Cape Hatteras northward.

During 1978-1982 aerial surveys, fin whales accounted for 24% of all cetaceans and 46% of all large cetaceans sighted over the continental shelf between Cape Hatteras and Nova Scotia (Waring et al. 1998). Underwater listening systems have also demonstrated that the fin whale is the most acoustically common whale species heard in the North Atlantic (Clark 1995). The single most important area for this species appeared to be from the Great South Channel, along the 50 meter isobath past Cape Cod, over Stellwagen Bank, and past Cape Ann to Jeffrey's Ledge (Hain et al. 1992).

Despite our broad knowledge of fin whales, less is known about their life history as compared to right and humpback whales. Age at sexual maturity for both sexes ranges from 5-15 years. Physical maturity is reached at 20-30 years. Conception occurs during a 5 month winter period in either hemisphere. After a 12 month gestation, a single calf is born. The calf is weaned between 6 and 11 months after birth. The mean calving interval is 2.7 years, with a range of between 2 and 3 years (Agler et al. 1993). Like right and humpback whales, fin whales are believed to use northwestern North Atlantic waters primarily for feeding and migrate to more southern waters for calving. However, the overall pattern of fin whale movement consists of a less obvious north-south pattern of migration than that of right and humpback whales. Based on acoustic recordings from hydrophone arrays, Clark (1995) reported a general pattern of fin whale movements in the fall from the Labrador/Newfoundland region, south past Bermuda, and into the West Indies. However, evidence regarding where the majority of fin whales winter, calve, and mate is still scarce.

The overall distribution of fin whales may be based on prey availability. This species preys opportunistically on both invertebrates and fish (Watkins et al. 1984). The predominant prey of fin whales varies greatly in different geographical areas depending on what is locally available. In the western North Atlantic fin whales feed on a variety of small schooling fish (i.e., herring, capelin, sand lance) as well as squid and planktonic crustaceans (Wynne and Schwartz 1999). As with humpback whales, fin whales feed by filtering large volumes of water for their prey through their baleen plates. Photo identification studies in western North Atlantic feeding areas, particularly in Massachusetts Bay, have shown a high rate of annual return by fin whales, both within years and between years (Seipt et al. 1990).

As discussed above, fin whales were the focus of commercial whaling, primarily in the 20th century. The IWC did not begin to manage commercial whaling of fin whales in the North Atlantic until 1976. In 1987, fin whales were given total protection in the North Atlantic with the exception of a subsistence whaling hunt for Greenland. In total, there have been 239 reported kills of fin whales from the North Atlantic from 1988 to 1995.

General human impacts and entanglement

The major known sources of anthropogenic mortality and injury of fin whales include ship strikes and entanglement in commercial fishing gear. However, many of the reports of mortality cannot be attributed to a particular source. Of 18 fin whale mortality records collected between 1991 and 1995, four were associated with vessel interactions, although the proximal cause of mortality was not known. These numbers should be viewed as absolute minimum numbers; the total number of mortalities and injuries cannot be estimated but is believed to be higher since it is unlikely that all carcasses will be observed. In general, known mortalities of fin whales are less than those recorded for right and humpback whales. This may be due in part to the more offshore distribution of fin whales where they are either less likely to encounter entangling gear, or are less likely to be noticed when gear entanglements or vessel strikes do occur. Fin whales may also be adversely affected by habitat degradation, habitat exclusion, acoustic trauma, harassment, or reduction in prey resources due to trophic effects resulting from a variety of activities including the operation of commercial fisheries.

8.7.3.4 Sei Whale

Sei whales are a widespread species in the world's temperate, subpolar and subtropical and even tropical marine waters. However, they appear to be more restricted to temperate waters than other balaenopterids (Perry et al. 1999). Mitchell and Chapman (1977) suggested that the sei whale population in the western North Atlantic consists of two stocks, a Nova Scotian Shelf stock and a Labrador Sea stock. The Nova Scotian Shelf stock includes the continental shelf waters of the northeastern United States, and extends northeastward to south of Newfoundland. The IWC boundaries for this stock are from the U.S. east coast to Cape Breton, Nova Scotia and east to longitude 42° (Waring et al. 2000). This is the only sei whale stock within the red crab management area.

Sei whales became the target of modern commercial whalers primarily in the late 19th and early 20th century after stocks of other whales, including right, humpback, fin and blues, had already been depleted. Sei whales were taken in large numbers by Norway and Scotland from the beginning of modern whaling (NMFS 1998a). In the western North Atlantic, sei whales were originally hunted off of Norway and Iceland, but from 1967-1972, sei whales were also taken off of Nova Scotia (Perry et al. 1999). A total of 825 sei whales were taken on the Scotian Shelf between 1966-1972, and an additional 16 were taken from the same area during the same time by a shore based Newfoundland whaling station (Perry et al. 1999). There is no estimate for the abundance of sei whales prior to commercial whaling. Based on whaling records, approximately14,295 sei whales were taken in the entire North Atlantic from 1885 to 1984 (Perry et al. 1999).

Sei whales winter in warm temperate or subtropical waters and summer in more northern latitudes. In the northern Atlantic, most births occur in November and December when the whales are on the wintering grounds. Conception is believed to occur in December and January. Gestation lasts for 12 months and the calf is weaned at 6-9 months when the whales are on the summer feeding grounds (Draft Recovery Plan, NMFS 1998a). Sei whales reach sexual maturity at 5-15 years of age. The calving interval is believed to be 2-3 years (Perry et al. 1999).

Sei whales occur in deep water throughout their range, typically over the continental slope or in basins situated between banks (Draft Recovery Plan, NMFS 1998a). In the northwest Atlantic, the whales travel along the eastern Canadian coast in autumn, June and July on their way to and from the Gulf of Maine and Georges Bank where they occur in winter and spring. The sei whale is most common on Georges Bank and into the Gulf of Maine/Bay of Fundy region during spring and summer, primarily in deeper waters. Individuals may range as far south as North Carolina. It is important to note that sei whales are known for inhabiting an area for weeks at a time then disappearing for year or even decades; this has been observed all over the world, including in the southwestern GOM in 1986. The basis for this phenomenon is not clear.

Although sei whales may prey upon small schooling fish and squid in the action area, available information suggests that calanoid copepods and euphausiids are the primary prey of this species. There are occasional influxes of sei whales further into Gulf of Maine waters, presumably in conjunction with years of high copepod abundance inshore. Sei whales are occasionally seen feeding in association with right whales in the southern Gulf of Maine and in the Bay of Fundy. However, there is no evidence to demonstrate interspecific competition between these species for food resources. There is very little information on natural mortality factors for sei whales. Possible causes of natural mortality, particularly for young, old or otherwise compromised individuals are shark attacks, killer whale attacks, and parasites.

There are insufficient data to determine trends of the sei whale population. Because there are no abundance estimates within the last 10 years, a minimum population estimate cannot be determined for NMFS management purposes (Waring et al. 2000). Abundance surveys are problematic not only because this species is difficult to distinguish from the fin whale but more significant is that too little is known of the sei whale's distribution, population structure and patterns of movement; thus survey design and data interpretation are very difficult.

General human impacts and entanglement

Few instances of injury or mortality of sei whales due to entanglement or vessel strikes have been recorded in U.S. waters. Entanglement is not known to impact this species in the U.S. Atlantic, possibly because sei whales typically inhabit waters further offshore than most commercial fishing operations, or perhaps entanglements do occur but are less likely to be observed. A small number of ship strikes of this species have been recorded. The most recent documented incident occurred in 1994 when a carcass was brought in on the bow of a container ship in Charlestown, Massachusetts. Other impacts noted above for other baleen whales may also occur. Due to the deep-water distribution of this species, interactions that do occur are less likely to be observed or reported than those involving right, humpback, and fin whales that often frequent areas within the continental shelf.

8.7.3.5 Blue Whale

Like the fin whale, blue whales occur worldwide and are believed to follow a similar migration pattern from northern summering grounds to more southern wintering areas (Perry et al. 1999). Blue whales range in the North Atlantic extends from the subtropics to Baffin Bay and the Greenland Sea (Aecium and Leatherwood 1985). The IWC currently recognizes these whales as one stock (Perry et al. 1999).

Blue whales were intensively hunted in all of the world's oceans from the turn of the century to the mid-1960's (NMFS 1998b). Blue whales were occasionally hunted by sailing vessel whalers in the 19th century. However, development of steam-powered vessels and deck-mounted harpoon guns in the late 19th century made it possible to exploit them on an industrial scale (NMFS 1998b). Blue whale populations declined worldwide as the new technology spread and began to receive widespread use (Perry et al. 1999).

In the North Atlantic, Norway shifted operations to fin whales as early as 1882 due to the scarcity of blue whales (Perry et al. 1999). In all, at least 11,000 blue whales were taken in the North Atlantic from the late 19th century through the mid-20th century. Blue whales were given complete protection in the North Atlantic in 1955 under the International Convention for the Regulation of Whaling. However, Iceland continued to hunt blue whales until 1960. There are no good estimates of the pre-exploitation size of the western North Atlantic blue whale stock but it is widely believed that this stock was severely depleted by the time legal protection was introduced in 1955 (Perry et al. 1999). Mitchell (1974) suggested that the stock numbered in the very low hundreds during the late 1960's through early 1970's (Perry et al. 1999). Photo-identification studies of blue whales in the Gulf of St. Lawrence from 1979 to 1995 identified 320 individual whales (NMFS 1998b). The NMFS recognizes a minimum population estimate of 308 blue whales for the western North Atlantic (Waring et al. 1999).

Blue whales are only occasional visitors to east coast U.S. waters. They are more commonly found in Canadian waters, particularly the Gulf of St. Lawrence where they are present for most of the year, and other areas of the North Atlantic. It is assumed that blue whale distribution is governed largely by food requirements (NMFS 1998b). In the Gulf of St. Lawrence, blue whales appear to predominantly feed on zooplankton (NMFS 1998b).

Compared to the other species of large whales, relatively little is known about this species. Sexual maturity is believed to occur in both sexes at 5-15 years of age. Gestation lasts 10-12 months and calves nurse for 6-7 months. The average calving interval is estimated to be 2-3 years. Birth and mating both take place in the winter season (NMFS 1998c), but the location of wintering areas is speculative (Perry et al. 1999). In 1992 the U.S. Navy and contractors conducted an extensive blue whale acoustic survey of the North Atlantic and found concentrations of blue whales on the Grand Banks and west of the British Isles. One whale was tracked for 43 days during which time it traveled 1,400 nautical miles around the general area of Bermuda (Perry et al. 1999).

There is limited information on the factors affecting natural mortality of blue whales in the North Atlantic. Ice entrapment is known to kill and seriously injure some blue whales, particularly along the southwest coast of Newfoundland, during late winter and early spring. Habitat degradation has been suggested as possibly affecting blue whales such as in the St. Lawrence River and the Gulf of St. Lawrence where habitat has been degraded by acoustic and chemical pollution. However, there is no data to confirm that blue whales have been affected by such habitat changes (Perry et al. 1999).

General human impacts and entanglement

Entanglements in fishing gear and ship strikes are believed to be the major sources of anthropogenic mortality and injury of blue whales. However, confirmed deaths or serious injuries from either are few. In 1987, concurrent with an unusual influx of blue whales into the Gulf of Maine, one report was received from a whale watch boat that spotted a blue whale in the southern Gulf of Maine entangled in gear described as probable lobster pot gear. A second animal found in the Gulf of St. Lawrence apparently died from the effects of an entanglement. In March 1998, a juvenile male blue whale was carried into Rhode Island waters on the bow of a tanker. The cause of death was determined to be due to a ship strike, although not necessarily caused by the tanker on which it was observed, and the strike may have occurred outside the U.S. EEZ (Waring et al. 2000). No recent entanglements of blue whales have been reported from the U.S. Atlantic. Other impacts noted above for other baleen whales may occur.

8.7.3.6 Sperm Whale

Sperm whales inhabit all ocean basins, from equatorial waters to the polar regions (Perry et al. 1999). In the western North Atlantic they range from Greenland to the Gulf of Mexico and the Caribbean. The sperm whales that occur in the western North Atlantic are believed to represent only a portion of the total stock (Blaylock et al. 1995). Total numbers of sperm whales off the U.S or Canadian Atlantic coast are unknown, although eight estimates from selected regions of the habitat do exist for select time periods. The best estimate of abundance for the North Atlantic stock of sperm whales is 4,702 (CV=0.36) (Waring et al. 2000). The minimum population estimate for the western North Atlantic sperm whale is 3,505 (CV=0.36).

The IWC estimates that nearly a quarter-million sperm whales were killed worldwide in whaling activities between 1800 and 1900 (IWC 1971). With the advent of modern whaling the larger rorqual whales were targeted. However as their numbers decreased, greater attention was paid to smaller rorquals and sperm whales. From 1910 to 1982 there were nearly 700,000 sperm whales killed worldwide from whaling activities (Clarke 1954).

Sperm whales were hunted in America from the 17th century through the early 20th century. In the North Atlantic, hunting occurred off of Iceland, Norway, the Faroe Islands, coastal Britain, West Greenland, Nova Scotia, Newfoundland/Labrador, New England, the Azores, Madeira, Spain, and Spanish Morocco (Waring et al. 1998). Some whales were also taken off the U.S. Mid-Atlantic coast (Reeves and Mitchell 1988; Perry et al. 1999), and in the northern Gulf of Mexico (Perry et al. 1999). There are no catch estimates available for the number of sperm whales caught during U.S. operations (Perry et al. 1999). Recorded North Atlantic sperm whale catch numbers for Canada and Norway from 1904 to 1972 total 1,995. All killing of sperm whales was banned by the IWC in 1988.

Sperm whales generally occur in waters greater than 180 meters in depth. While they may be encountered almost anywhere on the high seas, their distribution shows a preference for continental margins, sea mounts, and areas of upwelling, where food is abundant (Leatherwood and Reeves 1983). Sperm whales in both hemispheres migrate to higher latitudes in the summer for feeding and return to lower latitude waters in the winter where mating and calving occur. Mature males typically range to much higher latitudes than mature females and immature animals but return to the lower latitudes in the winter to breed (Perry et al. 1999). Waring et al. (1993) suggest sperm whale distribution is closely correlated with the Gulf Stream edge.

In the U.S. EEZ, sperm whales occur on the continental shelf edge, over the continental slope, and into the mid-ocean regions (Waring et al. 1993), and are distributed in a distinct seasonal cycle; concentrated east-northeast of Cape Hatteras in winter and shifting northward in spring when whales are found throughout the mid-Atlantic Bight. Distribution extends further northward to areas north of Georges Bank and the Northeast Channel region in summer and then south of New England in fall, back to the mid-Atlantic Bight (Waring et al. 2000). Sperm whale distribution may be linked to their social structure as well as distribution of their prey (Waring et al. 2000). Sperm whale populations are organized into two types of groupings: breeding schools and bachelor schools. Older males are often solitary (Best 1979). Breeding schools consist of females of all ages, calves and juvenile males.

In the Northern Hemisphere, mature females ovulate from April through August. During this season one or more large mature bulls temporarily join each breeding school. A single calf is born after a 15-month gestation. A mature female will produce a calf every 4-6 years. Females attain sexual maturity at a mean age of nine years, while males have a prolonged puberty and attain sexual maturity at about age 20 (Waring et al. 2000). Bachelor schools consist of maturing males who leave the breeding school and aggregate in loose groups of about 40 animals. As the males grow older they separate from the bachelor schools and remain solitary most of the year (Best 1979). Male sperm whales may not reach physical maturity until they are 45 years old (Waring et al. 2000). The sperm whales prey consists of larger mesopelagic squid and fish species (Perry et al. 1999). Sperm whales, especially mature males in higher latitude waters, have been observed to take significant quantities of large demersal and mesopelagic sharks, skates, and bony fishes (Clarke 1962, 1980).

General human impacts and entanglement

Few instances of injury or mortality of sperm whales due to human impacts have been recorded in U.S. waters. Because of their generally more offshore distribution and their benthic feeding habits, sperm whales are less subject to entanglement than are right or humpback whales.

Documented takes primarily involve offshore fisheries such as the offshore lobster pot fishery and pelagic driftnet and pelagic longline fisheries. The NMFS Sea Sampling program recorded three entanglements (in 1989, 1990, and 1995) of sperm whales in the swordfish drift gillnet fishery prior to permanent closure of the fishery in January 1999. All three animals were injured, found alive, and released. However, at least one was still carrying gear. Opportunistic reports of sperm whale entanglements for the years 1993-1997 include three records involving offshore lobster pot gear, heavy monofilament line, and fine mesh gillnet from an unknown source. Sperm whales may also interact opportunistically with fishing gear. Observers aboard Alaska sablefish and Pacific halibut longline vessels have documented sperm whales feeding on longline caught fish in the Gulf of Alaska (Perry et al. 1999). Behavior similar to that observed in the Alaskan longline fishery has also been documented during longline operations off South America where sperm whales have become entangled in longline gear, have been observed feeding on fish caught in the gear, and have been reported following longline vessels for days (Perry et al. 1999).

Sperm whales are also struck by ships. In May 1994 a ship struck sperm whale was observed south of Nova Scotia (Waring et al. 2000). A sperm whale was also seriously injured as a result of a ship strike in May 2000 in the western Atlantic. Due to the offshore distribution of this species, interactions that do occur are less likely to be reported than those involving right, humpback, and fin whales that more often occur in nearshore areas. Preliminary data for 2000 indicate that of ten sperm whales reported to the stranding network (nine dead and one injured) there was one possible fishery interaction, one ship strike (wounded with bleeding gash on side) and eight animals for which no signs of entanglement or injury were sighted or reported.

8.7.3.7 Leatherback Sea Turtle

Leatherback turtles are widely distributed throughout the oceans of the world, and are found in waters of the Atlantic, Pacific, Caribbean, and the Gulf of Mexico (Ernst and Barbour 1972). The leatherback sea turtle is the largest living turtle and ranges farther than any other sea turtle species, exhibiting broad thermal tolerances (NMFS and USFWS 1995). Evidence from tag returns and strandings in the western Atlantic suggests that adults engage in routine migrations between boreal, temperate and tropical waters (NMFS and USFWS 1992). In the U.S., leatherback turtles are found throughout the action area of this consultation. Located in the northeastern waters during the warmer months, this species is found in coastal waters of the continental shelf and near the Gulf Stream edge, but rarely in the inshore areas.

A 1979 aerial survey of the outer Continental Shelf from Cape Hatteras, North Carolina to Cape Sable, Nova Scotia showed leatherbacks to be present throughout the area with the most numerous sightings made from the Gulf of Maine south to Long Island. Shoop and Kenney (1992) also observed concentrations of leatherbacks during the summer off the south shore of Long Island and off New Jersey. Leatherbacks in these waters are thought to be following their preferred jellyfish prey. This aerial survey estimated the leatherback population for the northeastern U.S. at approximately 300-600 animals (from near Nova Scotia, Canada to Cape Hatteras, North Carolina).

Compared to the current knowledge regarding loggerhead populations, the genetic distinctness of leatherback populations is less clear. However, genetic analyses of leatherbacks to date indicate female turtles nesting in St. Croix/Puerto Rico and those nesting in Trinidad differ from each other and from turtles nesting in Florida, French Guiana/Suriname and along the South African Indian Ocean coast. Much of the genetic diversity is contained in the relatively small insular subpopulations. The most conservative approach would be to treat leatherback nesting populations as distinct populations whose survival and recovery is critical to the survival and recovery of the species.

Leatherbacks are predominantly a pelagic species and feed on jellyfish (Rebel 1974), medusae, siphonophores and salps. Time-Depth-Recorder data recorded by Eckert et al. (1998b) indicate that leatherbacks are night feeders and are deep divers, with recorded dives to depths in excess of 1000 meters. However, leatherbacks may come into shallow waters if there is an abundance of jellyfish nearshore. Leatherbacks also occur annually in places such as Cape Cod and Narragansett Bays during certain times of the year, particularly the fall.

Although leatherbacks are a long lived species (> 30 years), they are somewhat faster to mature than loggerheads, with an estimated age at sexual maturity reported as about 13-14 years for females, and an estimated minimum age at sexual maturity of 5-6 years, with 9 years reported as a likely minimum (Zug and Parham 1996) and 19 years as a likely maximum (NMFS 2001). In the U.S. and Caribbean, female leatherbacks nest from March through July. They nest frequently (up to 7 nests per year) during a nesting season and nest about every 2-3 years. During each nesting, they produce 100 eggs or more in each clutch and thus, can produce 700 eggs or more per nesting season (Schultz 1975). The eggs will incubate for 55-75 days before hatching. The habitat requirements for post-hatchling leatherbacks are virtually unknown (NMFS and USFWS 1992).

General human impacts and entanglement

Anthropogenic impacts to the leatherback population are similar to those discussed above for the loggerhead sea turtle, including fishery interactions as well as intense exploitation of the eggs (Ross 1979). Eckert (1996) and Spotila et al. (1996) record that adult mortality has also increased significantly, particularly as a result of driftnet and longline fisheries. Zug and Parham (1996) attribute the sharp decline in leatherback populations to the combination of the loss of long-lived adults in fishery related mortality, and the lack of recruitment stemming from elimination of annual influxes of hatchlings because of intense egg harvesting.

Poaching is not known to be a problem for U.S. nesting populations. However, numerous fisheries that occur in both U.S. state and Federal waters are known to negatively impact juvenile and adult leatherback sea turtles. These include incidental take in several commercial and recreational fisheries. Fisheries known or suspected to incidentally capture leatherbacks include those deploying bottom trawls, off-bottom trawls, purse seines, bottom longlines, hook and line, gill nets, drift nets, traps, haul seines, pound nets, beach seines, and surface longlines (NMFS and USFWS 1992). At a workshop held in the Northeast in 1998 to develop a management plan for leatherbacks, experts expressed the opinion that incidental takes in fisheries were likely higher than is being reported.

Leatherback interactions with the southeast shrimp fishery are also common. Turtle Excluder Devices (TEDs), typically used in the southeast shrimp fishery to minimize sea turtle/fishery interactions, are less effective for the large-sized leatherbacks. Therefore, the NMFS has used several alternative measures to protect leatherback sea turtles from lethal interactions with the shrimp fishery. These include establishment of a Leatherback Conservation Zone (60 FR 25260) established to restrict shrimp trawl activities from off the coast of Cape Canaveral, Florida to the Virginia/North Carolina Border. It allows the NMFS to quickly close the area or portions of the area to the shrimp fleet on a short-term basis when high concentrations of normally pelagic leatherbacks are recorded in more coastal waters where the shrimp fleet operates.

Leatherbacks are also susceptible to entanglement in lobster and crab pot gear, possibly as a result of attraction to gelatinous organisms and algae that collect on buoys and buoy lines at or near the surface, attraction to the buoys which could appear as prey, or the gear configuration which may be more likely to wrap around flippers. The total number of leatherbacks reported entangled from New York through Maine from all sources for the years 1980 - 2000 is 119; out of this total, 92 of these records took place from 1990-2000. Entanglements are also common in Canadian waters where Goff and Lien (1988) reported that 14 of 20 leatherbacks encountered off the coast of Newfoundland/Labrador were entangled in fishing gear including salmon net, herring net, gillnet, trawl line and crab pot line.

Spotila et al. (1996) describe a hypothetical life table model based on estimated ages of sexual maturity at both ends of the species' natural range (5 and 15 years). The simulations indicated that leatherbacks could maintain a stable population only if both juvenile and adult survivorship remained high, and that if other life history stages (i.e., egg, hatchling, and juvenile) remained static. Model simulations indicated that an increase in adult mortality of more than 1% above background levels in a stable population was unsustainable.

There are many human-related sources of mortality to leatherbacks. A tally of all leatherback takes anticipated annually under current biological opinions projected a potential for up to 801 leatherback takes, although this sum includes many takes expected to be nonlethal. Leatherbacks have a number of pressures on their populations including: injury or mortality in fisheries; degradation of nesting habitats; direct harvest of eggs, juvenile and adult turtles; the effects of ocean pollutants and debris; lethal collisions; and natural disturbances such as hurricanes (which may wipe out nesting beaches).

Spotila et al. (1996) recommended not only reducing mortalities resulting from fishery interactions, but also advocated protection of eggs during the incubation period and of hatchlings during their first day, and indicated that such practices could potentially double the chance for survival and help counteract population effects resulting from adult mortality. They conclude, “stable leatherback populations could not withstand an increase in adult mortality above natural background levels without decreasing . . . the Atlantic population is the most robust, but it is being exploited at a rate that cannot be sustained and if this rate of mortality continues, these populations will also decline.”

Status and Trends of Leatherback Sea Turtles

Estimated to number approximately 115,000 adult females globally in 1980 (Pritchard 1982) and only 34,500 by 1995 (Spotila et al. 1996), leatherback populations have been reduced worldwide, not only by fishery related mortality but, at least historically, primarily due to intense exploitation of the eggs (Ross 1979). On some beaches nearly 100% of the eggs laid have been harvested (Eckert 1996). Eckert (1996) and Spotila et al. (1996) record that adult mortality has also increased significantly, particularly as a result of driftnet and longline fisheries. Spotila (2000) states that a conservative estimate of annual leatherback fishery-related mortality (from longlines, trawls and gillnets) in the Pacific during the 1990s is 1,500 animals. He estimates that this represented about a 23% mortality rate (or 33% if most mortality was focused on the East Pacific population).

Nest counts are currently the only reliable indicator of population status available for leatherback turtles. The status of the leatherback population in the Atlantic is difficult to assess since major nesting beaches occur over broad areas within tropical waters outside the United States. Recent information suggests that Western Atlantic populations declined from 18,800 nesting females in 1996 (Spotila et al. 1996) to 15,000 nesting females by 2000. It appears that the western North Atlantic portion of the population is being subjected to mortality beyond sustainable levels, resulting in a continued decline in numbers of nesting females.

8.7.4 Protected Species Assessment

The current red crab fishery uses fixed trap gear that is slightly larger than traditional lobster traps, and is set in trawls of 90 to 120 traps per trawl. The configuration of the gear is very similar to the offshore sector of the American lobster fishery. The common method of red crab fishing is to set traps for a short time (<24 hours) to reduce the amount of crab mortality in the traps. The fixed trap gear used in the lobster fishery is known to cause serious injury and mortality to whales and certain species of sea turtles. Gear interactions may occur if gear is concentrated in high-use area/times for endangered whales or sea turtles. The common points of whale or sea turtle entanglement are in the pot warp gear that runs from the traps to the buoy at the surface and the groundline that connects the traps together along the ocean floor.

The American Lobster FMP has undergone consultation pursuant to Section 7 of the Endangered Species Act (ESA), with the most recent Biological Opinion (Opinion) dated June 14, 2001. The Opinion concluded that the lobster fishery is likely to jeopardize the continued existence of the North Atlantic right whale and has required NMFS to implement a Reasonable and Prudent Alternative (RPA) to remedy the jeopardy finding. The RPA’s call for significant further action under the Atlantic Large Whale Take Reduction Plan (ALWTRP).

The ALWTRP contains a series of regulatory measures designed to reduce the likelihood of fishing gear entanglements of large whale species in the North Atlantic. The RPA’s called for three key regulation changes: (1) new gear modifications; (2) implementation of a Dynamic Area Management system (DAM) of short-term closures to protect unexpected concentrations of right whales; and (3) establishment of a Seasonal Area Management system (SAM) of additional gear modifications to protect known seasonal concentrations of right whales. All of the above regulatory changes have now been implemented. The new gear modifications were published on January 10, 2002 (67 FR 1300), and were effective February 11, 2002. NMFS established the criteria for implementing the DAM restrictions in final form on January 9, 2002 (67 FR 1133) that became effective February 8, 2002. NMFS also published the interim final regulations for the SAM program on January 9, 2002 (67 FR 1142) that became effective on March 1, 2002, following a public comment period that ended on February 8, 2002.

Whereas lobster fishing effort is concentrated primarily in the Gulf of Maine, with 80% of the effort located within state waters, the deep sea red crab fishery is limited by the narrow shelf edge habitat of the red crab. Red crabs are primarily found on the continental shelf and slope seabed from the Scotian Shelf to Cape Hatteras in the Northeast, although their range extends at similar depths into the Gulf of Mexico. Depth preferences for red crab may be dictated by temperature and salinity and can range between 200 and 1,800 meters. Red crab size may be in inverse proportion to the depth, with larger crabs found in the shallower water (200-400m).

The majority of lobster fishing effort is concentrated in northeastern waters when right, humpback, minke and fin whales are present thus increasing the risk of gear interactions from traditional lobster gear during the summer and fall for these species. However, the physical location of red crab gear significantly lessens the likelihood of interaction for those species while increasing the risk for the blue, sei and sperm whales that frequent offshore waters. Therefore, adverse effects could occur because right, humpback, minke and fin whales are vulnerable to entanglement in red crab trap gear, but they also are not known to concentrate in the red crab fishing areas along the continental shelf.

Right and humpback whales are known to move through the continental shelf region usually in the spring and fall as they enter and leave the Gulf of Maine feeding areas. Minke and fin whales are broadly distributed along the shelf waters where their primary prey (small schooling fish) are commonly found. They are not known to frequent the shelf edge waters where the red crab fishery takes place.

The preferred foraging areas of blue and sei whales are unknown. However, the limited surveys that were conducted in those areas (by CeTAP surveys in 1979-81 and NMFS summer ship and aerial surveys conducted from 1990-98) did not locate significant sightings of either of these species in shelf edge waters. The known feeding behavior of blue and sei whales suggest they focus on plankton/zooplankton resources that are found in the upper water column. This could limit the threat of entanglement in red crab gear to encounters with the pot warp line that comes from the traps on the seabed to the surface buoys. Although these species may be affected by the operations of the red crab fishery, mitigation should be provided by the ALWTRP, which is anticipated to benefit all species of large whales. Specifically, risks should be reduced as the result of gear modifications that require weak links to be installed at each buoy.

8.7.4.1 Sperm Whales

Sperm whales are frequently found along the shelf edge throughout red crab habitat. Sperm whale feeding habits involve deep dives to feed on squid and fish that inhabit these deep ocean regions, and are known to have become entangled in deep-sea cables at great depth. Because of these characteristics, sperm whale encounters with both the buoy line and groundline of red crab gear are more likely than with other large whale species, thus posing potential adverse effects. However, the following factors make it unlikely that the red crab fishery will cause significant adverse impacts to the sperm whale population that inhabits the U.S. east coast offshore waters:

- The Red Crab FMP will prevent the amount of red crab fishing effort from expanding significantly beyond present levels;
- The red crab fishery utilizes large trap trawl sizes (average – 107 per trawl/560 total) thus reducing the number of vertical lines in the water column;
- Red crab fishing strategy encourages short soak times (average 22.5 hours) to reduce crab mortality and injury in the trap, thus increasing the likelihood that an entangled whale will be seen in the gear and disentanglement efforts initiated;
- All red crab fishermen must comply with any current ALWTRP regulations;
- One of the future measures that may be implemented under the MMPA to meet the RPAs contained in the ESA consultation for the Lobster FMP involves the use of neutrally buoyant buoy lines and potential modifications to groundlines --- measures that may be effective to protect sperm whales; and
- The sperm whale population that extends along the entire shelf edge is fairly robust.

8.7.4.2 Right Whales

In view of the northern right whale's apparent decline and high probability of extinction, any entanglement that causes serious injury and mortality reduces appreciably the likelihood of survival and recovery of this species. Documented entanglements underestimate the extent of the entanglement problem since not all entanglements are likely to be observed. Consequently, the total level of interaction between fisheries and right whales is unknown. However, recent studies have estimated that over 60% of right whales exhibit scars consistent with fishery interactions. The three key regulation changes to the ALWTRP mentioned above address this issue. New gear modifications will make the gear less of a threat to right whales. Implementation of the DAM program and SAM system will provide further separation of fixed gear and known seasonal concentrations of right whales. Therefore, although the red crab fishery continues to pose a risk of entanglement to northern right whales, it is not expected to cause irreversible impacts.

Given the known anthropogenic sources of right whale mortality, their low population size, and their poor reproductive rate, the loss of even one northern right whale as a result of operation of the red crab fishery may reduce appreciably the likelihood of both survival and recovery of this species by reducing the number of right whales and their ability to reproduce. The following factors suggest that the red crab fishery could affect, but by itself, is not likely pose jeopardy to the continued existence of the Northern right whale:

- The Red Crab FMP will prevent the amount of red crab fishing effort from expanding significantly beyond present levels;

- The red crab fishery utilizes large trap trawl sizes (average 107 per trawl; 560 total) thus reducing the number of vertical lines in the water column;

- The depth of water fished (200m - 1,800m) is likely to eliminate the likelihood of right whale encounters with groundlines;

- Red crab fishing strategy encourages short soak times (average 22.5 hr) to reduce crab mortality and injury in the trap, thus increasing the likelihood that an entangled whale will be seen in the gear and disentanglement efforts initiated;

- The restricted red crab distribution along the continental shelf edge precludes any overlap with known right whale high use foraging area or critical habitat; and

- All red crab fishermen must comply with any current ALWTRP regulations, including recent measures implemented under the MMPA to further separate fixed gear from known right whale concentrations.

8.7.4.3 Sea Turtles

Red crab fishing effort occurs along the Northeast and Mid-Atlantic shelf edge waters in depths that generally preclude encounters with benthic feeding sea turtles such as loggerhead, green, hawksbill, or ridleys. Little information exists detailing the encounters of sea turtles in the similarly prosecuted offshore lobster fishery. Of the offshore lobster trips that the NEFSC has observed from May 1994 through December 2000, there have been no observed takes of marine turtles associated with the lobster fishery. However, there have been 119 reported entanglements of leatherback sea turtles (1980-2000) in coastal lobster pot gear from Maine to New York. Leatherbacks are known (from encounters in swordfish longline gear) to inhabit the shelf edge areas in the spring and early summer and may encounter the pot warp lines of red crab gear. Given that they may be affected, there are factors that may reduce the likelihood of significant injuries or mortalities to leatherback sea turtles:

- The Red Crab FMP will maintain the red crab effort at a low level;
- The average red crab trawl size minimizes the number of vertical lines;
- The short soak times significantly reduce the likelihood of entanglement from that observed in the inshore lobster fishery; and
- Entangled leatherbacks are likely to be found and released before serious injury or death.

8.7.4.4 Birds

The roseate tern and piping plover inhabit the coastal waters and nest along the coastal beaches along the Northeast continental shelf. Bottom-tending trap/pot gear set at the typical depths of the red crab habitat would appear to make it impossible for the red crab fishing operations to result in any injury to either of these species.

8.7.4.5 Other Marine Mammals

It is recognized that the red crab fishery will be prosecuted in the continental shelf waters frequented by several species of offshore odontocetes including beaked whales (Mesoplodon and Ziphius genus), pilot whales, Risso's dolphin, offshore bottlenose dolphin, white-sided, spotted and striped dolphins. It appears unlikely that the deep-water trap/pot gear used by the red crab fishery will affect these odontocetes, given they are too small to become entangled in the typical large diameter line used in the buoy lines. In addition, the depth of the gear would place the traps and groundlines below the diving range of these species with the exception of the beaked whales. The small mouth and streamlined shape of these species would minimize any threat from this gear.

8.7.4.6 Conclusion

The Council prepared this document with the intent that it serve as a Biological Assessment for the Red Crab FMP, to meet the ESA mandates. The Council concludes that the Red Crab FMP, in combination with implementation of the RPA's contained in the recent Opinion for the American Lobster FMP, will affect, but is not likely to jeopardize the continued existence of right whales, humpback whales, fin whales, blue whales, sei whales, sperm whales or leatherback sea turtles. Furthermore, the Council has determined that the red crab fishery will not affect the endangered roseate tern, Piping plover, loggerhead, ridley, and hawksbill sea turtles, shortnose sturgeon or Atlantic salmon.

Given the current critical status of the right whale population and the aggregate effects of human-caused mortality that has led to the species current status, the Council understands that the right whale population cannot sustain additional incidental mortality. The Council also understands that the red crab fishery uses a gear type, which has been known to cause serious injury and mortality to right whales. The Council's assessment of no jeopardy is based on an understanding that the Red Crab FMP will maintain satisfactory control over expanding effort in a fishery that is restricted by the distribution of the target species to the fringe of the right whale's range. In addition, the red crab fishing gear will continue to be subject to regulations implemented under the ALWTRP to meet the mandate for further reduction in entanglement threat called for under the Biological Opinion issued for the American Lobster FMP to remove the likelihood of jeopardy in that fishery.

8.8 Safety Considerations

The potential impacts to the safety of human life at sea are discussed as part of the social impacts of each proposed management measure and alternative in Sections 5.3 and 5.4 of this FMP. This section of the FMP is concerned with the consideration of management adjustments for fishery access for vessels otherwise prevented from harvesting because of weather or other ocean conditions affecting the operational safety of the vessels.

8.8.1 Fishery Access and Weather-Related Vessel Safety

The primary vessel safety related concern identified for the red crab fishery is the distance from shore in which the fishery is prosecuted. Red crabs occur in deep water on the continental slope along the southern flank of Georges Bank, southern New England, and south to Cape Hatteras. Ocean conditions in the areas where the red crab fishery occurs are often more variable and more hazardous than in nearshore areas. One of the issues considered by the Council in the development of this FMP was to not exacerbate these safety concerns by selecting management measures that would increase risk-taking behavior by the members of the red crab fishery.

Measures initially considered by the Council for the Red Crab FMP included the use of a hard total allowable catch (TAC) as a primary control on fishing effort and landings. There was significant concern that any management approach that relied on a hard TAC as the primary management tool would encourage the development of a derby-style fishery for red crab. This concern was supported by the experience of the fishery under the emergency regulations. During the first emergency period, a six-month TAC was harvested in three months; during the second emergency period, a six-month TAC was harvested in two months. Even with trip limits and trap limits, the use of the hard TAC created a derby-style fishery where all participating vessels fished as hard as possible to harvest as much as possible before the TAC was reached and the fishery shut down. Under a hard TAC system, there would be periods of time when fishing vessels would have been precluded from participating in the fishery. These periods of time may or may not have occurred in conjunction with improved ocean conditions.

Instead of a hard TAC approach, the Council selected a management system that utilizes a target TAC and a day-at-sea (DAS) allocation. The intent of this system is to allocate a certain number of DAS to each vessel participating in the directed fishery, such that the total number of DAS allocated to the fleet will be approximately the correct number necessary to harvest the target TAC. If the target TAC is exceeded, however, the fishery will not shut down as it would under the hard TAC approach. With the assurance that the fishery will not be shut down, fishing vessels will be free to use their DAS at whatever time they deem appropriate. This approach should remove all incentive for the development of a derby-style fishery.

Management of this fishery does not include measures such as fishing seasons, in-season time or area closures or other restrictions, or frequency limits, which are believed to potentially affect the operation of fishing vessels and safety risks taken by vessel operators under adverse weather or ocean conditions. As a result of the management measures selected and proposed for this FMP, the relationship between the management measures and vessel safety is not considered a significant issue. The conclusion of this analysis is that the management measures do not pose additional safety risks. In addition, the U.S. Coast Guard reviewed the safety aspects of this management plan and concluded that there were no major safety issues associated with the proposed management measures.

8.8.2 Flexibility

Flexibility to adjust management measures for safety concerns is not a specific part of this FMP (e.g., weather and ocean conditions are not included as factors to consider in framework adjustments when making decisions such as in-season adjustments), but this is because the FMP, by virtue of the proposed management measures, already provides the vessel owners and operators with as much flexibility as possible to choose when and where to fish.

8.8.3 Procedures

The Council will continue to monitor safety issues related to the red crab fishery and will utilize its industry advisory panel (composed of many members of the directed red crab fishery) to evaluate and report on the effect of management measures, including their effect on vessel or crew safety, particularly under adverse weather or ocean conditions.

8.8.4 Other Safety Issues

To the extent possible, this FMP is intended to minimize the dangers to human life at sea while achieving the conservation and management objectives of the plan. Fishing is an inherently dangerous occupation; participants must constantly balance the risks imposed by weather and other natural conditions against the potential economic benefits. A management plan should be designed so that it does not encourage dangerous behavior by the participants. Certain measures, such as the hard TAC that could result in a derby-type fishery, could have had an adverse effect on the safety of human life at sea but were not selected by the Council, which decided instead to use a target TAC approach. Other measures proposed in this FMP, such as trip limits, trap limits, and DAS, are intended to reduce the potential for a derby-type fishery and, thus promote the safety of human life at sea. The potential impacts to the safety of human life at sea are discussed as part of the social impacts of each proposed management measure and alternative in Sections 5.3 and

5.4 of this FMP. The conclusion of this analysis is that the management measures do not pose additional safety risks. No specific comments were received during public hearings on this issue, and no written comments were received that identified concern for the impact of the proposed measures on vessel safety.

9.0 Information and Research Needs

Information and research needs related to the management of the red crab resource and its fishery are identified in several places throughout this FMP, including, at a minimum, Sections 2.4, 3.4, 3.5, 3.6, 8.1.6, 8.2.5, and Appendix A. A summary of these extensive lists of information and research needs is provided here. In particular, the following issues are identified as priorities for information collection and new research on the resource and fishery.

9.1 Bycatch Issues

Initial reports indicate that there is very little, if any, bycatch of other species in the directed red crab fishery. This initial assessment needs to be tested and, if possible, substantiated. The new reporting requirements proposed to be implemented in the FMP are intended to assist with providing the necessary information to better account for any potential bycatch of other species in the directed red crab fishery. The proposed voluntary subsampling program, if implemented and endorsed by the industry, is intended to provide more robust and detailed data on bycatch, among other things, than can be derived from the VTR data.

A more significant problem than any potential bycatch of other species in the directed red crab fishery is the potential for bycatch of red crabs in other fisheries. Although participants of other fisheries will be able to catch, retain, and land up to the proposed incidental catch limit of red crab (assuming they obtain an open access incidental catch permit), the amount and mortality of red crabs that may be harvested above the incidental catch limit are of concern. Increased attention should be placed on bycatch reporting on VTRs from the offshore monkfish fishery, as this is the fishery with the highest likelihood of significant interaction with the red crab resource. These issues also can be addressed through increased observer coverage and reporting on both red crab and monkfish vessels. Observer coverage is discussed below.

9.2 Observer Coverage

Very little is known about the operations of the directed red crab fishery, except for what has been self-reported by some members of the industry (see Appendix B). Less is known about the operations of other fisheries, such as the offshore lobster fishery, the tilefish fishery, and the monkfish fishery, and their interactions with red crabs. Observer coverage in these fisheries, with particular attention to the catch of other species in the red crab fishery and the catch of red crab in the above mentioned other fisheries should be made a priority for the observer program. As mentioned above, the levels of bycatch of red crab in the offshore monkfish fishery is of particular concern, not only because there may be significant interactions between this fishery and the red crab resource, but also because the mortality of red crabs that may be caught in the offshore monkfish fishery is unknown. Observers should be used to characterize the degree to which red crabs are caught in the monkfish fishery and to attempt to determine the mortality of those crabs, above what are allowed to be landed under the incidental catch limit. Observers should also measure and report on the size of the red crabs being landed in the directed red crab fishery, as well as those landed as incidental catch in other fisheries.

9.3 Stock Assessment

As mentioned several times throughout the FMP, the current status of the red crab resource is unknown (see Sections 2.4, 3.4, and 8.1.3). The lack of fishery-independent data presents a real challenge to the management system, as we have no current estimates of red crab biomass to be used to determine the present stock condition. This information is critical not only to assess the status of the resource and determine whether or not the species is overfished, but also to understanding and monitoring the effectiveness of the FMP once it is implemented. If NMFS cannot develop and implement a directed red crab survey, it should at a minimum provide funding to external researchers willing to undertake such a survey.

9.4 Rate of Natural Mortality

As described in Section 3.4.2, the rate of natural mortality (M) for the deep-sea red crab is currently unknown. The rate used in the FMP is assumed as such based on ranges of natural mortality estimated for other similar species. Research is necessary to study the Atlantic deep-sea red crab and determine the natural mortality rate for this species.

9.5 Escape Vent Selectivity Study

In this FMP, the Council considered requiring an escape vent in all traps used in the controlled access directed red crab fishery. The intent of requiring an escape vent is to reduce the probability of undersized crabs being retained in the traps and subject to increased mortality due to handling during fishing operations. Although the Council intended to implement an escape vent requirement for all fishing gear used in the directed red crab fishery, there was not sufficient information available at this time to determine the specific size and dimensions that the escape vent should be. There was also not sufficient information for the Council even to determine the need for an escape vent in this fishery. The design of the traps currently used in the fishery may reduce or eliminate the need for an escape vent.

Unfortunately, although this option may have had benefits to the red crab resource, no selectivity studies have been done to determine the appropriate size escape vents needed in this fishery. If the required escape vents were too small, then undersized crabs would be retained and much of the anticipated benefits would be lost. If the required escape vent was too big, then market-sized crabs would also escape and the yield of the fishery would decline. It would be impossible, with the available information, to suggest a proper biologically-based escape vent size. This may not be immediately necessary, as fishermen have reported that a mechanism already exists for the escapement of undersized crabs. The trap design most commonly used in the directed red crab fishery is a rectangular wood and wire trap, and the wood lathes are spaced approximately two inches apart. The fishermen report that this lathe spacing allows small crabs to escape.

NMFS, or another appropriate scientific group (possibly working in conjunction with the fishing industry), should conduct selectivity studies on a variety of escape vent sizes. Upon completion of these studies and the data being made available, the Council would be able to consider whether additional action is necessary to require a minimum escape vent size and would have the information with which to determine the appropriate size for the escape vent.

9.6 Port Sampling of Landed Crabs (Size Structure)

As described in Section 4.2.2, the FMP will not regulate a minimum allowable size for the red crab landed in either the controlled access directed fishery or the open access incidental catch fishery. The minimum size of crabs currently harvested is approximately four inches in carapace width (CW) and this size is maintained by market constraints. The Council determined that implementing a regulated minimum size of four inches CW at this time would be redundant with existing market constraints and would significantly complicate enforcement and increase the administrative burden both on NMFS and the fishing industry.

There remains, however, the concern that market conditions or other factors could change that would result in smaller crabs being landed and/or processed. Any downward trend in the size of the crabs landed could have significant implications for the sustainability of the resource. The problem with an increase in undersized crabs being landed is that male crabs could start being harvested before they have an adequate opportunity to reproduce. As a result, the Council acknowledges the need to monitor the size of crabs being landed in the directed and incidental catch fisheries, and reserves the right to take action and implement a regulated minimum size via a framework adjustment to the FMP if it determines that the average size of landed crabs is beginning to decline and/or if the number of crabs smaller than four inches CW increases.

The option selected by the Council to deal with this situation was to establish an "operational minimum size" of four inches CW that represents the smallest size crab that should be harvested. Although it would not be a violation to land crabs smaller than this size, the Council intends to use self-reporting, observer coverage and port sampling to track the sizes of red crabs being landed. If the proportion of crabs smaller than the operational minimum size begins to increase, the Council will consider taking appropriate action at that time to regulate a minimum size and ensure the enforceability of such an action.

The Council has proposed a voluntary sub-sampling program in which participating controlled access vessels will report the size of a sample of all crabs harvested. The Council has also requested observer coverage for this fishery (see above). The third component of information necessary to the Council to monitor the size of red crabs being landed is a thorough port sampling program. The Council requests that NMFS implement port sampling in at least three of the primary red crab ports: New Bedford, Gloucester, and Fall River, Massachusetts. A key element of this port sampling program should be the measurement of landed crabs.

9.7 Handling Mortality

"Handling mortality" is the rate of mortality to red crabs that results from being brought to the surface, handled, and returned to the seafloor. In the directed red crab fishery, this is associated with the sorting of the crabs harvested in the traps and the return of females and undersized males. Handling mortality may result from injury to the crabs during handling, being out of the water too long, being subjected to temperature stress from high water temperatures at the surface or rapid temperature changes, predation while in the water column, or settlement to different areas of the bottom where survival is lower. There are no precise estimates of the magnitude of handling mortality, but high handling mortality would indicate that a large percentage of the discarded females and small males would die even though they are returned to the sea and not landed. Mark/recapture studies performed under typical fishing conditions should be designed and implemented in order to better estimate handling mortality.

9.8 Habitat Issues

The habitat research recommendations include the need for expanded life history information that will allow for the comprehensive identification of red crab habitat requirements, including all life history stages, as well as habitat-related information that defines the interrelationship between the species, its environment and the food web. Improved information is also needed on adverse impacts from both non-fishing and fishing activities. A specific research and information need associated with this FMP is to identify the potential impacts of a deep-water trap fishery on a variety of benthic habitats, including the habitats contained in the deep-water canyons. This would essentially be an extension of the Eno et al. (1999) report, but focused on deep-water habitats of the Northeast U.S., including the canyons, most likely subjected to fishing by the red crab fishery.

9.9 Other

There are many other general and specific things we need to learn about the deep-sea red crab resource. We need to know more about the distribution of the species at all life stages, the variability and trends in population abundance and dynamics, and a way to adequately sample larval stages. We need better information about the dispersal patterns of the larval stages and where they settle. Further research is also needed on: (1) age-size relationships; (2) lengths of intermolt periods for all life stages; (3) yield per recruit; (4) upslope and lateral migrations; (5) genetic comparisons of the Northwest Atlantic and Florida/Gulf of Mexico populations; (6) when and where females primarily spawn; (7) the possibility of sperm storage by females; and (8) male mating effectiveness by size.

10.0 Social Impact Assessment

This fishery management plan has been prepared primarily in response to the requirements of the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act). This integrated Red Crab FMP document contains all elements of the Fishery Management Plan and the Environmental Impact Statement (EIS) (which is required by NEPA), including the Social Impact Assessment. This chapter addresses the components of the Social Impact Assessment (SIA). Some of the components of the SIA are discussed in the body of the FMP and are not repeated here. Section and page references are provided. In other cases, the SIA element is not found elsewhere and is addressed fully in this chapter. The table of contents for the SIA is provided to aid reviewers in referencing the appropriate corresponding sections of the FMP.

10.1 Introduction

Mandates to conduct a social impact assessment (SIA) comes from both the National Environmental Policy Act (NEPA) and the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act). NEPA requires Federal agencies to consider the interactions of natural and human environments by using a "systematic, interdisciplinary approach which will ensure the integrated use of the natural and social sciences . . . in planning and decision-making" (NEPA § 102 A). The Council on Environmental Quality (CEQ), in their *Regulations for Implementing the Procedural Provisions of the National Environmental Policy Act* (CEQ 1986), clarified the term "human environment" to include the relationship of people with their natural and physical environment (40 CFR 1508.14). Moreover, agencies need to address the aesthetic, historic, cultural, economic, social, or health effects which may be direct, indirect, or cumulative.

Under the Magnuson-Stevens Act, fishery management plans (FMPs) must "achieve and maintain, on a continuing basis, the optimum yield from each fishery" (MSCMA § 301(a)(1)). When considering "a system for limiting access to the fishery in order to achieve optimum yield," the Secretary of Commerce and the Regional Fishery Management Councils are to consider both the social and economic impacts of the system, and other factors (MSMFC § 303(b)(6)). Consideration of social impacts is a growing concern as fisheries experience increased participation and/or declines in stocks. With an increasing need for management action, the consequences of such changes need to be examined in order to mitigate the negative impacts experienced by the populations concerned.

10.2 Statement of the Problem

For a statement of the problem associated with this SIA, please see Section 2.2 of the FMP.

10.3 Management Goals and Objectives

For a description of the management goals and objectives associated with this SIA, please see Section 3.1 of the FMP.

10.4 Identification of Social and Cultural Entities Involved in the Fishery

10.4.1 Fishing Vessel Owners/Operators

For an identification of the social and cultural entities involved in the red crab fishery, particularly the fishing vessel owners and operators, please see Section 8.4.1 and Appendix B of the FMP.

10.4.2 Fishing Vessel Crew

For an identification of the social and cultural entities involved in the red crab fishery, particularly the fishing vessel crew, please see Section 8.4.2 and Appendix B of the FMP.

10.4.3 Processors

For an identification of the social and cultural entities involved in the red crab fishery, particularly the processors, please see Section 8.4.3 and Appendix B of the FMP.

10.4.4 Fishery-Dependent Service Industries

For an identification of the social and cultural entities involved in the red crab fishery, particularly the fishery-dependent service industries, please see Section 8.4.4 and Appendix B of the FMP.

10.4.5 Fishing Communities

For an identification of the social and cultural entities involved in the red crab fishery, particularly the fishing communities, please see Section 8.4.5 and Appendix B of the FMP.

10.5 Description of the Baseline Social Characteristics of the Fishery

10.5.1 Harvesting Sector

For a description of the baseline social characteristics of the red crab fishery, particularly the harvesting sector, please see 8.6.1 Appendix B of the FMP.

10.5.2 Processing Sector

For a description of the baseline social characteristics of the red crab fishery, particularly the harvesting sector, please see Section 8.6.2 and Appendix B of the FMP.

10.5.3 Fishery-Dependent Service Industries

For a description of the baseline social characteristics of the red crab fishery, particularly the harvesting sector, please see Section 8.6.3 and Appendix B of the FMP.

10.6 Summary of the Impact Assessment

The social impact analysis and assessment conducted for the Red Crab FMP employed the use of specific social impact factors that were evaluated for each management measure and alternative under consideration. The social impact factors were developed based in part upon the issues of concern identified by groundfish fishermen and their communities (NEFMC 2000a), tailored to represent the most significant issues of concern to red crab fishermen and their communities. The factors considered included: (1) changes in occupational opportunities; (2) changes in community infrastructure; (3) safety; (4) support for the management program; and (5) flexibility, stability, and uncertainty. While it is understood that there are differences among fisheries in what are perceived to be social impacts, there are some issues that are considered universal to all fisheries (i.e., safety at sea). While these are not the only factors that could or should be considered, they are largely indicative of the types of social issues that should be considered in the decision-making process. There may be other social issues which may affect fishermen and their communities, but they are even more difficult to define.

There are no data available with which to evaluate the potential impacts of this measure on the social and cultural aspects of New England and Mid-Atlantic fishing communities. The small size, few participants, and distributed nature of this fishery, however, suggests that any social or cultural impacts to these fishing communities will be negligible. For example, there is one red crab vessel based in Gloucester, Massachusetts. Relative to the other fishing activities based in Gloucester, any impacts to this red crab vessel, its owners and operators, crew, fishing-related support services, and their families, that arise as a result of the measures proposed in this FMP are unlikely to significantly affect the community of Gloucester.

Based on information provided by members of the red crab fishing industry in response to a survey collecting baseline information on the fishery, few consider the communities in which they live to be fishing communities, and fewer still consider their communities to be significantly dependent upon fishing activities (see Appendix B). The implementation of new management programs for the red crab fishery, therefore, would not be expected to significantly disrupt the social frameworks of these communities.

Two of the proposed management measures (incidental catch limits and males-only) are not expected to have any social impacts on the fishermen involved in the directed red crab fishery or their communities, as these proposed measures would not change their current fishing practices but simply codify self-enforced measures that have been utilized in the fishery for many years. A couple of the proposed measures (target TAC and days-at-sea limits) are expected to provide positive social benefits to the fishermen involved in the directed red crab fishery (at least, those authorized to participate in the fishery at directed levels) by preventing a derby fishery and allowing them more flexibility and stability, while reducing any uncertainty they feel associated with the fishery.

The remaining measures (butchering/processing restrictions, trap limits, gear requirements/restrictions, trip limits, and a controlled access system) may provide positive social benefits, have no effect, or cause adverse social impacts on the fishermen involved in the directed fishery, depending on the specific option selected and the status of the individual fishermen. In some cases, a single option may have positive social benefits for some members of the red crab fishery and negative social impacts for other members.

The proposed processing restrictions are expected to have positive social impacts on the fishermen involved in the directed red crab fishery. Trap limits could have adverse social impacts if the trap limit selected is significantly below the level of traps currently used in the directed fishery. The gear requirements options generally offer potential social benefits, assuming the proposed prohibition on all fishing gear other than traps is selected. Otherwise, this measure would have no social effects.

The TAC measure may have adverse social impacts if it is set significantly lower than the level of landings to which the current fishery participants are accustomed. Also, without other complementary controls, the establishment of a TAC could create a derby-type fishery, with undesirable social consequences. Depending upon the option selected and the level of the trip limit set for the directed red crab fishery, trip limits may be expected to have a positive social impact on members of the red crab fishery by mitigating some of the potential negative social impacts associated with a hard TAC. A controlled access system will provide positive social impacts on the vessels authorized to participate in the directed red crab fishery, but may result in adverse social impacts to any vessels excluded from the directed fishery.

The relative social and cultural impacts to fishermen and their communities of each management alternative under consideration are compared against those of two baselines: Alternative 1, the emergency action alternative, and Alternative 10, the no action alternative. Although in large part dependent upon the specific options selected for each proposed measure, the management alternatives that involve DAS allocations (either with or without trip limits) or an IVQ-type system would most likely result in the most positive social benefits. Alternatives that rely on a hard TAC (either with or without trip limits) may provide some social benefits, but these benefits may be limited by the probability of the fishery to develop into a derby-type fishery. Neither the no action alternative, nor the emergency rule alternative offer potential social benefits to the members of the directed red crab fishery. Overall, implementing any management program for the red crab fishery that reduces the probability of overfishing and reduces the likelihood of the fishery becoming overcapitalized will have a positive effect on the social and cultural aspects of the fishery.

10.7 Social Impacts of the Proposed Measures and Alternatives

For a description of the social impacts of the proposed measures and the management alternatives under consideration in this FMP, including the preferred alternative, please see Section 5.0 of the FMP.

11.0 Regulatory Impact Review and Initial Regulatory Flexibility Act Analysis

This fishery management plan has been prepared primarily in response to the requirements of the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act). This integrated Red Crab FMP document contains all elements of the Fishery Management Plan and the Environmental Impact Statement (EIS) (which is required by NEPA), including the Regulatory Impact Review (RIR) and Initial Regulatory Flexibility Act Analysis (IRFAA). This chapter addresses the components of the RIR and the IRFAA. Some of the components of the RIR are discussed in the body of the FMP and are not repeated here. Section and page references are provided. In other cases, the RIR element is not found elsewhere and is addressed fully in this chapter. The table of contents for the RIR is provided to aid reviewers in referencing the appropriate corresponding sections of the FMP.

11.1 Introduction

A Regulatory Impact Review (RIR) is required for all regulatory actions which either implement a new fishery management plan (FMP) or significantly amend an existing plan. An RIR is required by NMFS for all regulatory actions which are part of the "public interest." The Regional Fishery Management Council (in this case, the New England Council) prepares the RIR with assistance from NMFS when proposing a new plan or an amendment to an existing plan. The RIR is a required component of the process of preparing and reviewing FMPs or amendments and provides a comprehensive review of the economic impacts associated with proposed regulatory actions. The RIR addresses many concerns posed by the regulatory philosophy and principles of Executive Order (E.O.) 12866. The RIR serves as the basis for assessing whether or not any proposed regulation is a "significant regulatory action" under criteria specified by E.O. 12866.

The RIR must provide the following information: (1) a comprehensive review of the level and incidence of economic impacts associated with a proposed regulatory action or actions; (2) a review of the problems and policy objectives prompting the regulatory proposals; and (3) an evaluation of the major alternatives which could be used to meet these objectives. In addition, an RIR must ensure that the regulatory agency systematically and comprehensively considers all available alternatives such that the public welfare can be enhanced in the most efficient and cost effective manner.

Under the Regulatory Flexibility Act (RFA) of 1980 as amended by Public Law 104-121, new FMPs or amendments also require an assessment of whether or not proposed regulations will have a significant economic impact on a substantial number of small business entities. The primary purposes of the RFA are to relieve small businesses, small organizations, and small government agencies from burdensome regulations and record-keeping requirements, to the extent possible.

This section of the Red Crab FMP provides an assessment and discussion of the potential economic impacts, as required of an RIR and the RFA, of various proposed management and regulatory actions consistent with the problems that must be resolved and the goals and objectives outlined, respectively, in Sections 2.4 and 3.1 of this document.

11.2 Problems and Objectives

The biological aspects and habitat characteristics related to the red crab fishery are described in Sections 8.1 and 8.2 of this FMP; the history of exploitation and the social and economic characteristics of the fishery are presented in Section 8.3. The problems which should be resolved or addressed by the proposed management action are as follows (Section 2.0): (1) overfishing must be prevented; (2) overcapitalization should be avoided; (3) the FMP must be developed in the absence of a current stock assessment; (4) better data on the resource and its fishery are needed; (5) there must be consideration for vessels to land incidental catch levels of red crab and minimize potential discards in other fisheries; (6) identify the appropriate level of fishing power for the fishery; (7) a consistent supply of red crab product should be maintained all year long; (8) comply with marine mammal protection requirements; (9) the management unit and area of jurisdiction for the management program need to be identified; and (10) the incidence of handling mortality should be determined.

The overall goals of the proposed FMP are found in Section 3.1. To achieve the overall goals, the following management objectives have been adopted: (1) achieve OY for the U.S. fishing industry; (2) prevent overfishing of red crab; (3) develop a definition of overfishing; (4) develop biological, economic and social measures of success for the red crab fishery; (5) develop a controlled access system to keep fishing capacity matched to the available resource; (6) adopt measures that constrain fishing mortality; (7) promote research and improve the collection of data; (8) minimize adverse impacts on other fisheries; and (9) maintain a twelve month fishery.

11.3 Framework for Analysis

This section provides an overview and description of the procedures used to assess the potential economic impacts of allowing the fishery to continue operating with no regulation (i.e., the status quo); regulating the fishery using the preferred management alternative (i.e., implementation of a controlled access program for the directed red crab fishery, a target TAC, days-at-sea limits, trip limits, and trap limits); and implementing each of the non-preferred alternative regulatory strategies (including the continuation of the emergency action as a non-preferred alternative) instead of the preferred alternative.

Under different circumstances and data availability, an analysis of economic impacts would include the following: (1) a price model for estimating prices, revenues, and consumer surplus; (2) information on costs to estimate net returns and an approximation of producer surplus; and (3) an expectations framework for calculating the expected value of the various regulatory alternatives given that the probabilities of the alternatives to achieve the plans objectives are different. Estimation of net national benefits requires estimation of consumer and producer surpluses. Consumer surplus represents the maximum amount consumers are willing to pay to purchase a good or service less what they actually must pay. Producer surplus equals the difference between total revenue received by the producer and the resource costs of providing a good or service (e.g., fish).

The economic impacts would be assessed in terms of changes in landings, prices, revenues, and net returns for each of the regulatory options and the status quo. Net returns would be estimated by deducting from the estimated ex-vessel revenues total operating costs, all fixed costs, and repair and maintenance costs. The impacts on landings, revenues, operating and total costs, and net returns would also be assessed. However, in the absence of projected landings for each of the alternatives and the status quo, prices, economic impacts and net benefits could not be quantitatively assessed.

11.4 Data

11.4.1 Data Used for the Analysis and Limitations

This section describes the data sources available for management of the red crab fishery and the limitations for use in economic analyses.

11.4.2 Landings Data

Several basic types of data were available: (1) data from the dealer weight-outs purchase reports; (2) data from the vessel logbooks (VTRs); and (3) a voluntary survey from the Council's industry advisors, representing the majority of the current directed red crab fleet. Total reported landings in 2000 (2001 preliminary) logbooks for Maine through North Carolina equaled 654,270 (1,933,748) pounds; landings from the weigh-out data for the same region and period equaled 6,900,480 (7,264,507) pounds -- a difference between data sources of over 6 and 5 million pounds in each of the two most recent years. The voluntary survey reported the majority of the economic and social data available for the red crab fleet.

11.4.3 Ex-Vessel Price Data

The ex-vessel price of red crab, according to the dealer weighout database, which is the only available source of revenue information, ranged from $.55 to $.94 per pound for individual vessels in 2000. This range in ex-vessel price among vessels is partly due to their different methods of processing and marketing, whether landed whole or with some degree of processing having taken place at sea. The ex-vessel price of red crab by month ranged from $.63 to $.81. Average prices for each month were $.69, $.64, $.71, $.63, $.63, $.66, $.67, $.73, $.74, $.80, $.81, $.76 from January to December 2000, respectively. The ex-vessel price by port ($.55 to $.92) was very similar to the price received by vessels, reinforcing the perception that vessels land predominately in only one port.

11.4.4 Cost and Revenue Data

In most other fisheries, vessels land other species along with their target species (joint in inputs) or fish for other species during other parts of the year independent of their target species (nonjoint in outputs). In the red crab directed fishery, these complications for assessing fixed costs are minimal. Also, from the voluntary survey, we have estimates of fixed and variable costs as well as an estimate of the gross revenue per day needed to break even. For the non-directed fleet (those who would be regulated under the incidental catch restriction), we have no cost information.

The reported gross revenue per day required to break even ranges from $4,000 to $5,000. Based on the prices listed above, this would require minimum landings ranging from 2,200 pounds to 4,700 pounds per day. An average trip lasting 8 days means vessels would have to land between 17,600 pounds and 37,600 pounds per trip to break even. The preferred alternative which includes a trip limit of 75,000 pounds (or the highest recorded landing prior to the control date) would enable red crab vessels to break even, that is, cover their variable costs. The average variable cost/trip is approximately $15,000. Vessels must cover their variable costs in the short run in order to continue fishing. In the long term, vessels must cover their fixed costs to remain profitable. It appears from this information that red crab vessels would be able to allocate some of their trip revenue to cover their fixed costs. See Appendix B for a complete discussion of the revenues and costs of red crab vessels.

11.4.5 Consumer Demand and Consumer Surplus

Consumer surplus or the net benefit a consumer receives in excess of actual expenditure requires an analysis of final demand. In order to estimate final consumer demand, however, it is necessary to have data on quantities and retail prices for at-home and away-from-home consumption. It also is desired to have information on consumer expenditures on fish. None of the desired data are available, and thus, it is not possible to accurately assess consumer surplus at the final consumer level.

11.4.6 Limitations and Simplifying Assumptions

Although the analysis of the potential economic impacts was largely qualitative, it is still necessary to point out the numerous problems with the data. The first problem is incomplete information on landings, revenue and ex-vessel prices. Second, although not a big problem, red crab are sometimes caught with other species (lobster and hagfish, for example), and data necessary for adequately assessing the multi-species nature of the fishery were not available.

11.5 Description of the Economic Characteristics of the Fishery

11.5.1 Harvesting Sector

Harvesters' economic dependence upon commercial fishing and red crab fishing is presented in Appendix B. Most respondents report 100% dependence on the red crab fishery for their annual income. Some, but not all, of the red crab directed fleet hold permits in other fisheries. It would be expected that in response to financial losses, vessel operators would redirect fishing activities to other fisheries; the other fisheries or species that might be targeted are unknown.

Of the 17 vessels that had LOAs to fish for red crab in 2001 under the emergency regulations, 14 had permits to fish in other fisheries. Nine of the 14 held a lobster permit (some of those held a lobster permit in more than one category). Nine held at least one multispecies permit and nine held some type of scallop permit. Nine also held an ocean quahog permit. Eight held a spiny dogfish permit and eight had a surf clam permit. Seven held a bluefish permit and seven held some type of squid/mackerel or butterfish permit. Seven also held an Atlantic herring permit. Five vessels held a monkfish permit and five held a tilefish permit. Three each held a black sea bass and summer flounder permit. Only two held a scup permit. The average number of permits held was between six and seven.

Of those 17 vessels that had LOAs to fish for red crab in 2001, five would be regulated entities under the preferred alternative. Of the 12 remaining vessels, 10 had permits to fish in other fisheries. The number of vessels with permits to fish under other fishery management plans is shown in Table 30. The average number of other fisheries in which they could fish was between seven and eight. Of the expected five vessels who would qualify under the preferred alternative, four vessels have an average of four permits each to fish in other fisheries. The vessels are expected to be impacted by the preferred alternative have a greater number of non-red crab alternatives to continue fishing in some capacity in other fisheries than do those expected to qualify for the controlled access program.

Northeast Region Permit Status	Number of Vessels	Percent of Permitted Vessels
Scallop	8	67%
Lobster	6	50%
Dogfish	6	50%
Squid, Mackerel, Butterfish	6	50%
Surf Clam	6	50%
Bluefish	6	50%
Herring	6	50%
Ocean Quahog	6	50%
Tilefish	5	42%
Multispecies	5	42%
Monkfish	4	33%
Black Sea Bass	3	25%
Summer Flounder	3	25%
Scup	2	17%

Table 30: Commercial permits held by the impacted vessels, based on LOAs in 2001.

11.5.2 Processing Sector

From Appendix B, we can see how dependent red crab processors are on red crab. They all process many on other species in addition to red crab. On average, red crab accounts for 11.5% of their total fishery-related processing operations, with a maximum of 25% of total processing operations. The number of employees currently employed by the processors varies significantly, from 5 to 1000 with an average of 300 employees per processor. The majority of the employees are seasonal in nature, with an average of 147 year-round employees per processor. Most processing employees work on other fishery-related products in addition to red crab. For a description of the baseline economic characteristics of the red crab fishery, particularly the processing sector, please see Appendix B of the FMP.

11.5.3 Wholesaling and Retail Sector

The people and businesses that sell red crab product at the wholesale or retail level are an important component of the fishing industry and of fishing communities. These people and businesses may also be affected by regulations or when conditions change in the red crab fishery. In the wholesaling and retail sector, the majority of business revenue is derived from commercial fishing-related products (averaging 90%), though only a small proportion of this business revenue is derived from the sale of red crab products. The percentage of their business revenue that comes from the sale of red crab ranges from less than 1% to 33% and averages slightly more than 25%. The number of employees retained by the respondent (to the survey) red crab wholesalers and retailers ranges from 2 to 150 and averages 33 per business operation. For a description of the baseline economic characteristics of the red crab fishery, particularly as they relate to business and markets, please see Appendix B of the FMP.

11.5.4 International Sector

A large portion of the live red crab landed in New England is sold to U.S. dealers and shipped to Canada for processing. Respondents to the survey indicated that most use only a single processor. Three respondents reported that the processor they use is located in their community, one primarily uses one out of their community and three report that the processors are not in their community. Of the processors not located in the respondents' communities, these processors are reported to be located in Portland, Maine; New Brunswick, Canada; and Prince Edward Island, Canada. Most respondents indicated that they choose to sell their red crab to a particular processor out of loyalty to that processor. For a description of the baseline economic characteristics of the red crab fishery, particularly as they relate to international trade, please see Appendix B of the FMP. There were no data on red crab imports or exports available from the U.S. Bureau of the Census.

11.5.5 Fishery-Dependent Service Industries

For a description of the baseline economic characteristics of the red crab fishery, particularly fishery-dependent service industries, please see Appendix B of the FMP.

11.6 Impacts of the Status Quo, Preferred Alternative, and the Non-Preferred Alternatives

11.6.1 Overview of Economic Impacts

In this section, a summary of the potential impacts of the various regulatory options is presented. Impacts are summarized, where possible, in terms of landings, ex-vessel revenues, operating costs, fixed costs, employment, distributive effects, consumer surplus, producer surplus, and net benefits. We can attempt to determine the direction of change in net benefits from the baseline levels, but it is difficult to determine the comparable net benefits of all alternatives. An attempt was made in Table 21 to outline the economic principles that should be considered when making comparisons between the alternatives. The degree of uncertainty in the direction of change from the baselines becomes clear. This section will summarize the information that was presented in detail in Section 5.4.

There are some comments that apply to all alternatives. All management alternatives (except "no action") include some level of incidental catch limits. While they may have economic impacts for those vessels which are potentially disqualified from the fishery, the impacts would be felt equally across all alternatives. All management alternatives (except "no action") include some degree of gear requirements and/or restrictions to, at a minimum, deal with marine mammal requirements, gear markings, and to ensure that the directed fishery is regulated as trap only. Any economic impacts from this measure would be felt equally among all alternatives. With the exception of the two baselines, all management alternatives include a provision for a controlled access system, consistent with an objective of the FMP. Although there are economic impacts from this measure, this measure would not be the cause of differing distributive impacts between the alternatives. All management alternatives (except "no action") include reporting requirements to ensure that information is collected that is necessary for the continued management of the resource. There would be additional costs due to enforcement (which may include observers) and reporting but these appear to be non-controversial and would impact all alternatives equally (except "no action").

While the alternatives differ from each other in their combinations of management measures, many have the potential to result in the development of a derby-type fishery. Effort control measures such as trip limits, days-at-sea, trap limits, and individual vessel quotas would tend to spread out the catch over time and make the fishery less like a derby-type fishery. These effort control measures differ in the efficiency and flexibility with which vessels can operate.

An issue with economic significance is the disproportionate effects, by vessel size, for every alternative. A second significant issue is the share of the catch to be allocated among vessels with a history in the fishery and recent or new entrants. This is related to the interpretation of the control date of March 1, 2000 in qualifying recent or new entrants.

When compared to the no action alternative, all of these alternatives have a positive economic effect on the level of harvest. Since taking no action would inevitably drive the stock level down in the long term, any action at all would be an improvement over what the harvest level would become without any management.

11.6.2 Short Term Economic Impacts on Directed Red Crab Vessels and Incidental Vessels

The economic impacts are summarized relative to the status quo, the preferred alternative, and the non-preferred regulatory options. The first year of regulation will consist of the remainder of the emergency regulations, an interim period until the FMP is implemented, and a phase-in period of implementation followed by full implementation. The year beginning March 2003 is assumed to be the first full year. In the short term, the various regulatory options have the potential to generate substantial impacts.

There will be short term benefits from some of the alternatives, but they may not be sustainable. In restrictive management alternatives, costs are incurred in the short-term and benefits are realized later.

The type of management measures considered in the alternatives would dictate the short term impacts. The use of a hard TAC (Alternatives 1, 2, 3 and 7) would cap landings, revenues, and net returns, to be equivalent to the emergency rule (Alternative 1). As would be expected, taking no regulatory action (Alternative 10) would generate the highest level of landings and revenue in the short term. Because Alternatives 4, 5, 6, 8 and 9 rely on effort controls and a limited fleet size, the landings and revenue would decrease in the short term. Relative to the incidental catch category and excluding the no action option, short term changes would be the same among all the alternatives.

11.6.3 Long Term Economic Impacts on Directed Red Crab Vessels and Incidental Vessels

This section presents a summary of the potential economic impacts over the long term planning horizon. The cumulative impacts suggest a different ranking of impacts than does the short-term total impacts. Since no specific revenues, net returns, and net benefits have been calculated, Table 21 is relied upon to summarize the different economic elements that are important to the fishery. Alternatives with a greater number of negative effects (-) in its column are inferior to alternatives that have more positive (+) or neutral effects (0). Alternative 10 imposes the largest adverse impacts on the fishery.

The type of management measures considered in the alternatives would dictate the long term impacts. The use of a hard TAC (Alternatives 1, 2, 3 and 7) would cap landings, revenues, and net returns, to be equivalent to the emergency rule (Alternative 1). Because Alternatives 4, 5, 6, 8 and 9 rely on effort controls and a limited fleet size, the landings and revenue would decrease in the short term but increase over the long term. Relative to the incidental catch category and excluding the no action option, there would be no differential effect in the long term.

All alternatives may work toward achieving some of the goals for the fishery, but since a year round fishery is a stated objective, only Alternatives 4, 5, 8 and 9 would predictably fulfill all the plans objectives.

11.6.3.1 <u>Alternative 1</u>

Alternative 1 would not preclude the continuation of all vessels in the fishery. Since it is very similar to the measures implemented under the emergency regulations, we can see where a derby fishery would result. When quotas are relatively low, fishermen generally attempt to land as much as possible prior to a fishery closure. This is known to result in considerable economic waste and additional market problems. This alternative would be ranked inferior to all the other alternatives, except for no action.

11.6.3.2 <u>Alternative 2</u>

This alternative would also control effort by forcing vessels to operate at less than their full capacity. Alternative 2 would control total fishing effort and landings primarily through the use of a hard TAC. Trap limits work by reducing the efficiency of the fishing activity, by forcing fishermen to use a smaller number of traps than that to which they may be accustomed. A lesser number of traps may reduce the catch, without any associated reduction of costs, resulting in reduced profitability. Since this alternative relies exclusively on trap limits to help spread the landings out over the year, to do so effectively the limit would have to be set so low that it would affect all vessels revenue. Alternative 2 would force participating vessels to be very inefficient (affecting some vessels more than others) because the primary mechanism to control effort is through a trap limit. Cost per crab harvested would be higher; to utilize their full vessel capacity, they may try to extend the length of their trip. Vessels would then be operating inefficiently, not due to a trip limit (as in Alternative 1), but due to restrictive trap limits instead. Trap limits in conjunction with a hard TAC would almost certainly have the fishery shut down prior to the end of the fishing year. Employment in the processing sector would have to adjust to fluctuating supply. Instability of supply would cause fluctuations in availability and price. This alternative (as Alternative 1) would be ranked inferior to the preferred alternative.

11.6.3.3 Alternative 3

In an effort to spread out the landings of red crab and reduce the potential for creating a derby-style fishery, Alternative 3 includes all the measures from the previous alternative with the addition of trip limits. The trip limit, in combination with the hard TAC, would help reduce (although certainly not eliminate) the likelihood of a derby fishery and allow for a more equitable distribution of landings in time and space. Under equal trip limits, vessels capable of landings far greater than the trip limit may be forced to operate in an inefficient manner or not participate in the fishery at all. They may not cover their variable costs on these limited trips. This one measure may possibly force some vessels out of the fishery or preclude them from entering the fishery. Larger vessels presumably have greater expenses and the trip limit may not allow them to earn enough revenue to justify making such a trip. While some impacted vessels might continue to make trips and land only up to the trip limit, some vessels might cease making trips, because the trip limit would not provide for profitable trips. It is possible that the effort from the eliminated trips could move into other areas where vessels could make up for lost revenue. However, it is not clear at what level this would occur, or how much additional revenue this would create for vessels. An equal trip limit would require the more productive vessels to take more trips than their ability requires. A trip limit equal to the highest trip on record would not be restrictive, which would make it equivalent in impacts to Alternative 2.

Compared to the preferred alternative (#5), increased inefficiency of vessel operations due to both trap limits and trip limits would raise vessels costs without a corresponding increase in revenue. Both trap and trip limits strive to control effort by forcing vessels to operate at less than their full capacity. Additional controls would increase enforcement costs.

11.6.3.4 Alternative 4

The principle mechanism to control effort in the fishery under alternative 4 would be the use of vessel days-at-sea (DAS). The objective of the alternative would be to allow the appropriate number of DAS to harvest, but not exceed, the target TAC. The effectiveness of this alternative is not directly dependent on the number of vessels participating, but on the calculation of the total number of days that would allow for the target catch to be landed. If the additional measures (especially trap limits) were not used as limiting factors, this alternative has potential to have one of the higher levels of net benefits, since it allows for the market to control production. As long as other measures are not introduced to affect the behavior of vessels, they will be able to maximize their outputs from a given level of inputs, assuming the biomass increases over time.

The potential OY for the fishery that would determine the TAC ranged from 1.254 to 7.904 million pounds. Using this range, we can calculate a range of possible DAS allocations, depending on MSY and fleet size. This range is 11 DAS per vessel if 17 vessels are fishing on a TAC of 1.254 million pounds, up to 296 DAS per vessel if only four vessels are fishing on a TAC of 7.904 million pounds. This range from 11 to 296 DAS illustrates the degree of flexibility that exists in the individual measures. The preferred alternative specifies an OY for the fishery of 5.928 million pounds. This would translate into 53 DAS per vessel if 17 vessels were fishing up to 228 DAS per vessel if only four vessels were fishing. The preferred alternative would allow for five vessels and an allocation of 183 DAS. If a sixth vessel were able to substantiate a landings history to qualify, the allocation would be 152 days for each vessel. Given that the reported number of days absent among the red crab vessels varies from 200 to 300, we can assume that they would all have to cut back on their effort. Since DAS will be restrictive, they can make adjustments to their behavior to accommodate this change, by planning for other sources of income.

This alternative would allow greater continuity of effort and supplies to the market and avoids a negative response to short term fluctuations. A high degree of flexibility is afforded to participants in the fishery concerning when and how long to fish. Processors will be assured of a steady supply of fresh product. The success of this alternative would depend on allowing the DAS to be the principle restriction, and on the careful calculation, and adjustment of the effort restriction. Alternative 4 allows a more predictable level of supplies to market (retailers and consumers) and to the processors. The continuous annual adjustment in target TAC enables management of the resource to respond to changes in stock condition without costly and timely management process. This alternative would be ranked very similar to Alternative 5 and superior to 1, 2 or 3.

11.6.3.5 Alternative 5 (Preferred Alternative)

The preferred alternative includes a controlled access program where vessels must demonstrate that their average annual landings of red crabs during the three years prior to the control date (March 1, 1997 - February 29, 2000) were greater than 250,000 pounds. This option is expected to allow a minimum of five vessels to qualify for the directed fishery (see Table 17). During that three year period, eight out of 30 vessels could have qualified under less restrictive criteria. This means that there are three vessels that will not qualify for the controlled access program, which would have qualified had other criteria been preferred. For example, if the criteria, using the same three years prior to the control date, had been vessels must have a total of at least 40,000 pounds for the three years, eight vessels would have qualified. Clearly, a total of 40,000 pounds for three years is a significantly different situation than an average of 250,000 pounds for three years.

The preferred alternative specifies an OY for the fishery of 5.928 million pounds. This would translate into 53 DAS per vessel if 17 vessels were fishing up to 228 DAS per vessel if only four vessels were fishing. The preferred alternative would allow for five vessels and an allocation of 183 DAS. If a sixth vessel were able to substantiate a landings history to qualify, the allocation would be 152 days for each vessel. Given that the reported number of days absent among the red crab vessels varies from 200 to 300, we can assume that they would all have to cut back on their effort.

The preferred alternative enforces the use of the control date. Without the control date, additional vessels may have qualified under different criteria. As an indication of interest in the fishery, 17 vessels requested letters of authorization (LOAs) from the NMFS Regional Administrator to allow them to harvest more than 100 pounds of red crab per trip during the first emergency rule period, May 18 - November 14, 2001. However, out of seven vessels that actually reported landings of red crab, only six made multiple trips during the emergency period and consistently landed at or near the trip limit. The 17 vessels that requested LOAs could be taken as an upper limit when calculating those vessels that did not qualify for controlled access. This would imply a potential of 12 vessels that will not qualify had other criteria been selected (such as under the no action alternative). Ten of these 12 vessels have the ability to participate in other fisheries. A description of the other fisheries in which they may participate is included in Table 30. Again, only six of the 17 vessels made multiple trips during the first emergency rule period, so most vessels were presumably fishing in other fisheries during that time. This implies there is one vessel that fished consistently under the emergency rule that will not be allowed to fish in the directed red crab fishery under the preferred alternative. The impact of the preferred regulation on that one vessel may be severe. Because of confidentiality concerns, we cannot describe the home port or community of that vessel. A discussion of the twelve vessels that did not qualify and their community profiles are given in Section 7.1.8 (compliance with National Standard 8).

The preferred alternative would allow for a baseline possession limit for all controlled access vessels of 75,000 pounds of whole red crab (or the equivalent). Based upon public comments, a preferred option was selected that would allow vessels to operate at their best historical level. If a vessel can show proof of a trip higher than 75,000 pounds during the controlled access qualification period, then that vessel will qualify for a trip limit equal to the larger trip, rounded to the nearest 5,000 pounds. It is not always possible for a vessel to duplicate their highest level of landings, so that their average will be less then their individual trip limit. This form of differential trip limit will enable most vessels to operate at their peak efficiency, in the most economical way possible, within the constraints necessary for the resource. This form of trip limit constitutes a limit on fleet capacity, without creating vessel safety concerns. It also allows each vessel to operate in the most economical way, while still enforcing restraint. Under the preferred alternative, each qualifying vessel will maintain their same competitive position relative to each other, and the total fleet will be constrained to meet the conservation objectives. Under the preferred alternative, the use of differential trip limits, instead of equal trip limits, will allow for the benefits of an effort reduction program to occur.

A decrease in effort always results in a short-term decrease in catch rate, but importantly, may lead to an increase in the long term. In standard yield-effort relationships, the short-term catch rate will always increase with increasing levels of effort. It is only over the long term, when the process of population dynamics has resulted in decreased fish stock, that yield will ultimately decline. The use of days-at-sea as a management option would allow more continuity of effort and supplies to the market, and avoids any response to short term fluctuations.

The preferred alternative selected by the Council would allocate DAS equally to all vessels authorized to participate in the controlled access fishery. All vessels authorized to receive a controlled access red crab permit must, on an annual basis, declare their intent to participate or not in the directed fishery for the next fishing year at least six months prior to the start of the fishing year. This will allow the annual allocation of DAS to be calculated based on the actual number of participants in the fishery. The small number of vessels in the fishery means that each vessel's participation has a large impact on the appropriate number of DAS that the fleet will utilize in catching the target TAC. The advance knowledge and planning for efficient harvest will have economic benefits from harvesting to processing to marketing. Public comments supported this declaration of intent.

The preferred alternative would be exactly the same as the previous alternative, with the addition of differential trip limits. It trip limits were equal across all vessels, it would force each trip taken by a red crab vessel to be roughly equivalent and would contribute to inefficiency in the red crab fleet, restricting some vessels more than others. This could lead to dissatisfaction and disruption of the relationship that exists among members of the red crab fleet. If the calculation of days at sea is accurate, this measure should not be necessary. One justification for the inclusion of the trip limits into the preferred alternative was so that the transition between the emergency action period and the implementation of the final FMP would be smooth. Due to the administrative burden of implementing a DAS program, there would be a short lapse in time before the complete FMP was implemented, whereas the trip limit could take effect with the initial implementation of the FMP. DAS will be measured as a full day for any portion of a day in which the vessel is absent. Because red crab trips are typically at least a week in duration, it will be possible to plan for this type of measurement. This alternative would be ranked very similar to Alternative 4 and superior to Alternatives 1, 2 or 3.

11.6.3.6 Alternative 6

The principle mechanism to control effort in the fishery would be the use of a specified trip limit and an authorized number of potential fishing trips. Vessels would know, up front, what they could land per trip and how many trips they could take. Individual vessels would have the opportunity to plan for alternative sources of revenue. Even though a TAC is not specified for this alternative, the calculation of number of trips and a trip limit would have to take the total catch into account. Depending on the level of the trip limit, it could restrict vessels to operate in a very inefficient manner. Slightly better, differential trip limits may allow one class of vessels to take advantage of their increased hold capacity. Each vessel could end up with a trip limit and number of trips that may make it unprofitable to participate in the fishery. Differential trip limits would not be as restrictive as Alternative 1 for some vessels. This alternative would allow different size classes of vessels to participate at levels more appropriate for them. There may be administrative problems associated with the implementation of this alternative. This alternative is expected to have impacts similar to Alternative 3.

11.6.3.7 Alternative 7

Alternative 7 includes all possible management measures except for an IVQ system. This alternative would rely on so many different measures, it would be impossible to determine the degree of impact from any one measure and therefore be difficult to adjust to changing stock conditions. The effectiveness of a days-at-sea program is greater if other measures are not also used to undermine its effectiveness. Many of these measures would make it inefficient to operate in the fishery, raising costs, without the benefit of additional revenue. If all measures are used as a way to limit catch or effort, the entire fleet would operate inefficiently; the increased costs would be passed on to the consumer and no one would benefit. If all of the measures of Alternative 7 are not constraining to the behavior of the fleet, then this alternative would have economic benefits similar to those of the preferred alternative. With all options constraining, this alternative would be very difficult to enforce, as well as costly and difficult to administer.

Alternative 7 includes all options from the preferred alternative with the addition of a minimum size. Public comments supported the idea that market control over the minimum size of red crabs is adequate to prevent the landings of small crabs. If that situation is believed to change, then future frameworks can implement a minimum size.

11.6.3.8 Alternative 8

Alternative 8 would implement both a controlled access system to limit the number of vessels participating in the directed fishery and an individual vessel quota to allocate each vessel an individual percentage-based share of the TAC. Vessels would be able to operate at their peak efficiency, selecting the least cost combination of inputs. The supply of red crabs would be consistent throughout the year, maintaining a constant supply to processors, retailers, and consumers. Controlled access will limit the number of vessels harvesting red crab and make it easier to monitor and enforce the individual vessel quotas, whose sum would be equivalent to a hard TAC. From society's point of view, this means there is a reduction in the accumulation of excess capital and lower costs. Those other resources (who are not in the fishery) can be directed elsewhere. Trip revenue would increase as there would be no limits on the amount of crab landed per trip.

Vessels could operate to their full potential and utilize their hold capacity. This alternative would shift a substantial part of the management to a market mechanism, because it eliminates some of the gear, vessels, and processing restrictions that are a greater burden to enforce. This alternative should encourage technological development and innovation. Vessels participating in the directed fishery would have the freedom to choose the most appropriate fishing methods (aside from gear restrictions), fishing times, and strategies. The creation of use rights means that some gain and some lose; this creates a redistribution of wealth and has equity implications.

In addition to granting the right to be in the fishery, individual quotas also convey the right to harvest a specified quantity to fish (or proportion of TAC). Since it works back from a predetermined TAC to the amount available to the individual vessel, it provides much tighter control over each year's catch than would control of inputs (such as DAS or trip limits). A great degree of freedom and flexibility would be granted to the individual vessel. His choice of area or fishing time would be his own. There is no incentive to over invest in the vessel and gear, or to select anything but the least cost combination of inputs.

11.6.3.9 Alternative 9

This alternative is very similar to the previous alternative, except that it would rely entirely upon an individual vessel quota system to control the harvest of red crabs in the directed red crab fishery. Any vessel with a history of red crab landings prior to the implementation of the FMP would be able to continue fishing for red crab, albeit at the same relative rate at which they previously fished. The composition of the fleet would remain as it is now. Without controlled access, a greater number of vessels would be participating in the fishery, but because of this, each vessel would have a lesser quota than the previous alternative. It would not preclude any vessel now operating in the fishery from participating but would still provide an upper limit on the quantity of labor and capital in the fishery. With a greater number of vessels operating in the fishery, there would be a loss of revenue among some, if not all vessels.

With individual quotas, vessels are less likely to harvest in the manner of a fishing derby. Trip revenue may increase as there would be no limits on the amount of crab landed per trip, although total revenue may not. Vessels could operate to their full potential and utilize their hold capacity. This alternative would shift a substantial part of the management to a market mechanism, because it eliminates some of the gear, vessels, and processing restrictions that are a greater burden to enforce. This alternative should encourage technological development and innovation. Vessels participating in the directed fishery would have the freedom to choose the most appropriate fishing methods (aside from gear restrictions), fishing times, and strategies.

11.6.3.10 Alternative 10

Alternative 10 would have the greatest economic impact of all alternatives. This can be defined as what is likely to occur in the absence of any of the proposed regulatory actions. With no restrictions, additional entrants would be allowed into the fishery; based on recent occurrences, this would be expected to occur. In the short term, landings may increase, but because they are not sustainable, the long term economic effect will be negative. With the entry of additional vessels, and vessels of increasing size, the catch per vessel would decrease. Historic participants could be eliminated from the fishery or at least become marginally viable. With no action, the most likely outcome would be that overfishing will occur and a future FMP would need to implement measures that would end and prevent future overfishing. Worse, if appropriate exploitation rates are greatly exceeded or, if it is determined that the red crab stock is overfished, the FMP will need to include a number of restrictive measures to eliminate overfishing and/or rebuild the resource under a statutory time schedule. Therefore, the no-action alternative would likely reduce long-term economic benefits to the fishery.

In the absence of regulation, there would be an increased supply of red crabs to consumers initially, but the long term effect would be decreased supply and presumably higher prices. In the same manner, an initial increase in processing requirements may occur, depending on the quantity that is processed at sea and the quantity that is processed on shore. Since most of the red crab product is processed, increased supply may not have as large of an effect on price, since processed products have a longer shelf life and are not perishable. In the absence of regulation, there would likely continue to be significant under-reporting, since there would be no incentive for the vessels or dealers to report their landings. Also, the uncontrolled and potentially escalating effort could have negative economic impacts on those businesses who depend on the red crab fishery. In the long term, Alternative 10 is predicted to be ranked the lowest of the alternatives.

11.6.4 Impacts of Framework Adjustment Measures Under the Preferred Alternative

The next regulatory action establishes the framework adjustment process which enables the modification of management measures through a stream lined decision-making and rule-making procedure. The framework adjustment process allows the Councils to add or modify management measures through a streamlined public review process. The following management measures could be implemented or modified through framework adjustment procedures.

1. Optimum yield
2. Management unit
3. Technical parameters for MSY
4. Incidental catch limits
5. Minimum size of landed crabs
6. Male crabs only
7. Butchering and/or processing restrictions
8. Trap limits
9. Gear requirements and restrictions
10. Total allowable catch
11. Trip limits
12. Controlled access system
13. Days-at-sea limits

The framework adjustment procedures listed above may be used to modify the FMP to ensure the objectives of the plan. These provisions may add flexibility to the method of managing red crab. The effectiveness of size limits is not known and has been cited as an area for further research. Almost all of these measures are being included in some form in the preferred alternative. The specifics of each measure would need to be modified through a framework adjustment process. Detailed discussion of their impacts is included in Section 5.3.

11.7 Additional Issues

Allowing fishermen to be more deliberate in their actions would take away the incentive to race for fish. It would also serve to improve safety, extend the fishing season, improve the availability of product, and stabilize market prices. The preferred alternative would provide sufficient opportunities to fish with respect to time, location, and other individual qualifiers.

The previous description attempted to highlight the potential impacts of each alternative on the economic performance of the fleet. In addition to the potential impacts, there are other potential issues for the fishery which should be considered. Vessels, which might be forced out of the red crab fishery, may redirect fishing effort into other fisheries. The potential other fisheries that may be affected, however, have not been identified. It is important to note that the vessels excluded from participating in the red crab fishery under the preferred alternative consist of very recent entrants. The historical fishing practices and dependence on the fishery would remain.

Attempts were made to mitigate the impact on vessels that will not qualify for the controlled access program. The range of criteria considered by the Council had considerable flexibility and offered a wide range of options. They choose neither the most restrictive nor the least restrictive criteria. Provisions which were taken into account include (1) the present participation in the fishery; (2) the historical fishing practices in, and dependence on, the fishery; (3) the economics of the fishery; (4) the capability of fishing vessels to engage in other fisheries; and (5) the social framework relevant to the fishery.

11.8 Summary of Economic Impacts

Uncertainty about the status of the red crab stock, as well as the uncertainty inherent in the data has limited the probability with which we can predict the potential outcomes of the various alternatives. One of the most positive outcomes from this FMP will be the collection of data that will reduce the uncertainty about the future of the resource and its management. The preferred alternative is ranked above most others given that the selection must end likely increases in overcapacity, deal with a control date, have a transition period prior to the implementation of the regulations, and provide an operating environment similar to what has gone on historically.

11.9 Review of Impacts Relative to the Regulatory Flexibility Act

11.9.1 Introduction and Methods

The Regulatory Flexibility Act (RFA) requires federal rulemakers to examine the impacts of proposed and existing rules on small businesses, small organizations, and small governmental jurisdictions. In reviewing the potential impacts of proposed regulations, the IFRA determines whether the proposed action would have a "significant economic impact on a substantial number of small entities." The Small Business Administration (SBA) size standards define whether a business entity is small and, thus, eligible for Government programs and preferences reserved for "small business" concerns. Size standards have been established for all for-profit economic activities or industries in the North American Industry Classification System (NAICS). The SBA defines a small business in the commercial fishing and recreational fishing sector, as a firm with receipts (gross revenues) of up to $3.5 million. The SBA has just issued an interim final rule (IFR) which adjusts for inflation in its criteria for defining a small business. In related businesses that deal in canned and cured fish and seafood or prepared fish or frozen fish and seafood, a small business is one that employs 500 employees or fewer. In fish and seafood wholesalers, a small business is defined as one that employees 100 or fewer employees. For fish and seafood markets, a small business is defined as a firm with receipts of up to $6.0 million.

A complete description of the red crab fishery is found in Section 8.0 of this document. In addition, the need for, and objectives of this FMP can be found in Sections 2.3 and 3.1, respectively.

The proposed measures could affect any vessel that has participated in the red crab fishery in the past. All these vessels readily fall within the definition of small business. The VTR and Dealer databases were used to identify all individual vessels with more than one pound of reported red crab landings during the years 1991 - 2001, inclusive. Where there was a discrepancy between the amount of landings in the VTR data and the amount in the dealer data, the greater of the two was used. There were 86 individual vessels that reported some landings of red crab during this period. Of these, 47 reported less than 1,000 pounds of landings total over the eleven years. Of the remaining vessels, 22 had total landings of more than 1,000 pounds but less than 10,000 pounds. Only one of these 22 vessels had less than 1,000 pounds of landings in each of the eleven years, but only two vessels had 5,000 pounds or more in any one year.

There were four vessels that reported between 10,000 and 100,000 pounds of landings during this period. Three of these vessels only reported landings in a single year and the fourth vessel reported landings in only two of the eleven years. There were another six vessels with reported landings between 100,000 and 1,000,000 pounds. None of these vessels reported any landings prior to 1995. Of these, two vessels reported landings only in 2001. Seven vessels reported landings greater than 1,000,000 pounds. Of the seven, two vessels have not reported any landings since 1993. The remaining five vessels reported landings greater than 1,000,000 pounds and have a current reporting history.

For the purposes of the RFA, more recent data should be considered. For the one year period following the control date (March 1, 2000 - February 28, 2001), there were 14 vessels which reported landing at least one pound of red crab. Total reported landings in 2000 (2001 preliminary) logbooks for Maine through North Carolina equaled 654,270 (1,933,748) pounds; landings from the weigh-out data for the same region and period equaled 6,900,480 (7,264,507) pounds -- a difference between data sources of over 6 and 5 million pounds in each of the two most recent years.

Not all landings and revenues reported through the federal dealer data can be attributed to a specific vessel. Vessels with no federal permits are not subject to any federal reporting requirements with which to corroborate the dealer reports. This has 2 consequences. First, the stated number of entities subject to the regulation is a lower bound estimate, since non-federally permitted dealers cannot be counted. Second, the portion of activity by these uncounted vessels may cause the estimated economic impacts to be inaccurate. Until the emergency rules were enacted for red crab, there were no requirements for permits or reporting of landed red crab. Since landings and revenue figures varied so widely between the VTR and dealer data, a voluntary survey of all participants was relied upon. Since quantitative data were not available, the effects of actions were analyzed by employing qualitative analyses.

The RFA asks agencies to implement less burdensome regulations on small entities if the objectives of the regulation are not compromised as a result. In this case, the magnitude of impact (of at least one vessel) is due to a qualification rule not a conservation objective. Since management is not through a hard quota, it cannot be argued that the conservation objectives will be met regardless of how many vessels are allowed to participate in the fishery. Under this circumstance, one could argue that the opportunity to accommodate the few vessels that are most impacted exists. It is important to (1) acknowledge that vessels that are most impacted are impacted because they do not qualify for limited access; (2) to identify which qualification criterion vessels fail to meet; and (3) why these vessels cannot be accommodated (e.g., the vessel entered the fishery after the control date).

11.9.2 Control Date Discussion

An issue with economic significance is the share of the catch to be allocated among vessels with a history in the fishery and recent or new entrants. This is related to the interpretation of the control date of March 1, 2000, in qualifying recent or new entrants. The preferred alternative includes a controlled access program where vessels must demonstrate that their average annual landings of red crabs during the three years prior to the control date (March 1, 1997 - February 29, 2000) were greater than 250,000 pounds. This option is expected to allow a minimum of five vessels to qualify for the directed fishery (see Table 17). During that three year period, eight out of 30 vessels could have qualified under the least restrictive criteria. This means that there are three vessels that will not qualify for the controlled access program, which would have qualified had other criteria been preferred. For example, if the criteria, using that same three years prior to the control date, had been vessels must have a total of at least 40,000 pounds for the three years, eight vessels would have qualified.

One of the stated objectives of the plan is to "develop a controlled access system to keep fishing capacity matched to the available resource." The primary decision to use the control date to limit participation is consistent with the plan's objectives. It is because of this interpretation that recent or new entrants would not qualify. Given the least restrictive criteria in the NMFS data and the control date cut-off, eight vessels could have qualified. Since the data are questionable, an upper bound consistently used as potential qualifiers is the 17 vessels that applied for authorization to fish under the emergency rule in 2001. This would be without consideration of the control date.

11.9.3 Description of the Alternatives

A complete description of the red crab fishery is found in Section 8.0of this document. In addition, the need for, and objectives of this FMP can be found in Sections 2.3 and 3.1, respectively. A detailed description of the measures and alternatives evaluated in this document is presented in Section 4.0, and in Section 4.2.1 for the incidental catch limit category in particular. In addition, an overall discussion of the impacts associated with each measure and alternative is presented in Section 5.0.

11.9.4 Analyses of Impacts of Alternatives

The RFA is intended to identify impacted vessels and to characterize the potential economic impact on directly affected entities. The term "regulated entity" in this case means those vessels that would be impacted by this rule. It does not just refer to those vessels that would qualify to be in the fishery. It also includes those vessels who are excluded from the fishery, and who have either been in it in the past, or have indicated a desire to be in it. To further characterize the potential impacts on indirectly impacted entities, a discussion of the communities within which owners of impacted vessels reside is needed. These communities are discussed in Section 7.1.8 (National Standard 8). In addition to this, a detailed description and analysis of the potential impacts to dealers and processors is presented in this section. Lastly, the impacts associated with the proposed permit and reporting requirements for commercial vessels and dealers, and operators permit is also presented in this section.

Generally, the percent of revenue reduction for impacted vessels would vary considerably based on the permits it held (i.e., based on the fisheries in which it was able to participate) and species it landed. Diversity in the fleet would help to balance loss in one fishery with revenue generated from other fisheries. A discussion of the number of permits held by those entities that are affected by the regulation is presented in Section 11.5.1 and in Table 30. Of the 17 vessels that had LOAs to fish for red crab in 2001, five would qualify under the preferred alternative. Of the 12 remaining vessels, 10 had permits to fish in other fisheries. It would be expected that vessel operators would redirect fishing activities to other fisheries.

The general purpose of the information presented below is to provide a general overview of the potential impacts on regulated entities associated with the management alternatives.

11.9.5 Economic Impacts on Vessels

11.9.5.1 Alternative 1

Alternative 1 would not preclude the continuation of all vessels in the fishery. Since it is very similar to the measures implemented under the emergency regulations, we can see the type of fishery behavior that would result. Since there is no controlled access program in this alternative, all vessels would continue operating in a derby manner to land as much as possible prior to closure of the fishery. Each regulated entity would experience unstable revenue and have to deal with market problems. Profitability from the red crab fishery over the course of a year would be low for all vessels, since they would be operating in a very inefficient manner, due to restrictive trap and trip limits.

11.9.5.2 Alternative 2

This alternative would also control effort by forcing vessels to operate at less than their full capacity. Trap limits work by reducing the efficiency of the fishing activity. A lesser number of traps would reduce the catch, without any associated reduction of costs, resulting in reduced profitability. A controlled access system would limit the number of participants, and so there would be some that would be shut out of the fishery entirely. Cost per crab harvested would be higher.

11.9.5.3 Alternative 3

A controlled access system would limit the number of participants, so there would be some that would be shut out of the fishery entirely. This would affect their profitability and they would have to seek alternative sources of income. For those that qualify, under equal trip limits, vessels capable of landing far greater than the trip limit may be forced to operate in an inefficient manner or not participate in the fishery at all. They may not cover their variable costs on these limited trips. While some impacted vessels might continue to make trips and land only up to the trip limit, some vessels might cease making trips, because the trip limit would not provide for profitable trips. It is possible that the effort from the eliminated trips could move into other areas where vessels could make up for lost revenue. However, it is not clear at what level this would occur, or how much additional revenue this would create for vessels. Increased inefficiency of vessel operations due to both trap limits and trip limits would raise vessel's costs without a corresponding increase in revenue, thus affecting a vessels profitability.

11.9.5.4 Alternative 4

The effectiveness of this alternative is not directly dependent on the number of vessels participating, but on the calculation of the total number of days that would allow for the target catch to be landed. As long as other measures are not introduced to effect the behavior of vessels, they will be able to maximize their outputs from a given level of inputs, assuming the biomass increases over time. Controlled access is still a measure of this alternative, so it would exclude some vessels from participating.

The range of possible DAS allocations, depending on MSY and fleet size, is 11 DAS per vessel if 17 vessels are fishing on a TAC of 1.254 million pounds, up to 296 DAS per vessel if only four vessels are fishing on a TAC of 7.904 million pounds. The preferred alternative specifies an OY for the fishery of 5.928 million pounds. This would translate into 53 DAS per vessel if 17 vessels were fishing up to 228 DAS per vessel if only four vessels were fishing. The preferred alternative would allow for at least five vessels and an allocation of up to 183 DAS. Given that the reported number of days absent among the red crab vessels varies from 200 to 300, they would all have to cut back on their effort and this would affect their profitability. They would have the flexibility to plan for other sources of income. Each trip that was taken under this alternative would be as productive as possible, reflecting the lack of a trip limit.

11.9.5.5 Alternative 5 (Preferred Alternative)

The preferred alternative includes a controlled access program where vessels must demonstrate that their average annual landings of red crabs during the three years prior to the control date (March 1, 1997 - February 29, 2000) were greater than 250,000 pounds. This option would allow for at least five vessels to participate in the directed fishery (see Table 15). During that three year period, eight out of 30 vessels could have qualified under less restrictive criteria. This means that there are three vessels that will not qualify for the controlled access program, which would have qualified had less restrictive criteria been selected. These three vessels landed at least 10,000 total pounds of red crab for three years prior to the control date, for an average of 3,333 pounds per year. Subtracting the incidental catch of 500 pounds (assuming the most restrictive assumption that the landings represented only one trip per year), would mean that each of the three vessels' loss would be equivalent to 2,833 pounds, or $2,833 (assuming $1 per pound).

The preferred alternative would allow for at least five vessels and a potential DAS allocation of up to 183 DAS. Given that the reported number of days absent among the red crab vessels varies from 200 to 300, they would all have to cut back on their effort, but in different amounts. Based on public comments, the five vessels would all be profitable on an allocation of 183 days.

The preferred alternative implements the March 1, 2000 control date. Without the control date, additional vessels may have qualified under different criteria. As an indication of interest in the fishery, 17 vessels requested letters of authorization (LOAs) from the NMFS Regional Administrator to allow them to harvest more than 100 pounds of red crab per trip during the first emergency rule period, May 18 - November 14, 2001. However, out of seven vessels that landed red crab, only six made multiple trips during the emergency period and consistently landed at or near the trip limit. The 17 vessels that requested LOAs could be taken as an upper limit when calculating the number of vessels that would not qualify for controlled access. This would imply a potential of 12 vessels that will not qualify had other criteria been selected (such as under the no action alternative). Ten of these 12 vessels have the ability to participate in other fisheries. A description of the other fisheries in which they may participate is included in Table 30. Again, only six of the 17 vessels made multiple trips during the first emergency rule period, so they were presumably fishing in other fisheries during that time. This implies there is one vessel that fished consistently under the emergency rule that will not be allowed to fish in the directed red crab fishery under the preferred alternative. The impact of the preferred regulation on that one vessel's profitability could be severe.

The preferred alternative would allow for a baseline possession limit for all controlled access vessels of 75,000 pounds of whole red crab (or the equivalent). Based upon public comments, a preferred option was selected that would allow vessels to operate at their best historical level. It is not always possible for a vessel to duplicate their highest level of landings, so that their average will be less then their individual trip limit. This form of differential trip limit will enable vessels to operate at their peak efficiency, in the most economical way possible, within the constraints necessary for the resource. Under the preferred alternative, each qualifying vessel will maintain their same competitive position relative to each other, and the total fleet will be constrained to meet the conservation objectives.

The preferred alternative would be exactly the same as the previous alternative, with the addition of differential trip limits. One justification for the inclusion of the trip limits into the preferred alternative was so that the transition between the emergency action period and the implementation of the final FMP would be smooth.

11.9.5.6 Alternative 6

A controlled access system would limit the number of participants, so there would be some that would be shut out of the fishery entirely. This would affect their profitability and they would have to seek alternative sources of income. For those that qualify, the principle mechanism to control effort in the fishery would be the use of a specified trip limit and an authorized number of potential fishing trips. Individual vessels would have the opportunity to plan for alternative sources of revenue. Even though a TAC is not specified for this alternative, the calculation of number of trips and a trip limit would have to take the total catch into account. Depending on the level of the trip limit, it could restrict vessels to operate in a very inefficient manner. Slightly better, differential trip limits may allow one class of vessels to take advantage of their increased hold capacity. Each vessel could end up with a trip limit and number of trips that may make it unprofitable to participate in the fishery.

11.9.5.7 Alternative 7

Again, a controlled access system would limit the number of participants. Alternative 7 includes all possible management measures except for an IVQ system. The effectiveness of a days-at-sea program is greater if other measures are not also used to undermine its effectiveness. Many of these measures (if constraining) would make it inefficient to operate in the fishery, raising costs, without the benefit of additional revenue, affecting profitability of those who qualify. If all the measures of Alternative 7 were not constraining to the behavior of the fleet, then this alternative would have economic benefits similar to those of the preferred alternative.

11.9.5.8 Alternative 8

Alternative 8 would implement both a controlled access system to limit the number of vessels participating in the directed fishery and an individual vessel quota to allocate each vessel an individual percentage-based share of the TAC. Vessels would be able to operate at their peak efficiency, selecting the least cost combination of inputs, and maximizing their revenue, and thus their profit. The creation of use rights means that some gain and some lose; this creates a redistribution of wealth and has equity implications. In addition to granting the right to be in the fishery, individual quotas also convey the right to harvest a specified quantity of fish (or proportion of TAC). Those vessels that do not qualify would be the losers.

11.9.5.9 Alternative 9

Under this alternative, the composition of the fleet would remain as it is now. Without controlled access, a greater number of vessels would be participating in the fishery, but because of this, each vessel would have a lesser quota than the previous alternative. It would still provide an upper limit on the quantity of labor and capital in the fishery. With a greater number of vessels operating in the fishery, there would be a loss of revenue among some, if not all vessels. This alternative would create a redistribution of wealth among a larger group of vessels. Some of them may be more profitable than others.

11.9.5.10 Alternative 10

In the absence of any of the proposed regulatory actions, additional entrants would be allowed into the fishery. In the short term, landings and revenue may increase for some vessels if not all, but because they are not sustainable, the profitability of all vessels would suffer. With the entry of additional vessels, and vessels of increasing size, the catch per vessel would decrease.

In the absence of regulation, there would be an increased supply of red crabs to consumers initially, but the long term effect would be decreased supply and presumably higher prices. Also, the uncontrolled and potentially escalating effort could have negative economic impacts on those businesses that depend on the red crab fishery.

11.9.6 Economic Impacts on Dealers

A description of red crab dealers and their overall dependence on red crab is presented in Appendix B. In the dealer data, in 2001 there were seven federal seafood dealers who handled red crab. Of these seven, only one handled greater than 1500 pounds in a year. The other six depended on red crab for only a very minor portion of their revenues. Of the pounds reported in the dealer database, 96% was reported by an unknown dealer. Another way to look at dependence is by absolute value. By this measure, only one dealer depended on red crab revenues for over $200,000. In calendar year 2000, there were three dealers listed in the dealer data, although 88% of the red crab recorded landings were from an unknown dealer. Because of this obvious inadequacy of the dealer data to provide information on dealers, we must rely on the voluntary survey summarized in Appendix B for further information.

Dealers would be regulated entities under the RFA only to the extent that they have to get a permit under any of the alternatives proposed. Overall, it was felt that very few dealers would be affected by any of the alternatives.

11.9.7 Economic Impacts on Processors

Processors would not be considered regulated entities for purposes of the FRA. Appendix B provides an overview of the processing sector as it relates to the red crab fishery.

11.9.8 Description of Permit and Reporting Requirements

A detailed discussion of all permit and reporting requirements was presented in Sections 3.8 (general overview), 3.8.1 (permit requirements for commercial vessels), 3.8.3 (dealer permits and fees), 3.8.5 (vessel reporting), and 3.8.6 (dealer reports). All of the alternatives (except no action) contain the same provisions and requirements for permitting and reporting, so this factor does not cause any differential effects by alternative. Additional analysis on the impacts of permit and reporting requirements on small entities is presented below.

11.9.9 Economic Impact of Permit and Reporting Requirements

Under all alternatives there are proposed permit and reporting requirements for commercial vessels, vessel operators and seafood dealers. Accounting for all activities in the fishery are necessary to enforce provisions of the FMP and ensure that the objectives are met. Permits and reporting requirements for all sectors which harvest or sell red crab provides the foundation for effective monitoring and enforcement of regulations. Section 303(b)(1) of the Magnuson-Stevens Act specifically addresses the need for permit issuance. The purpose of permits is to (1) list the characteristics of fishing vessels and/or dealer/processor operations; (2) exercise influence over compliance; (3) provide a mailing list for dissemination of information to the industry; (4) register participants to be considered for limited entry; and (5) provide a universe for data collection. Limited access permits are issued to those who meet the specific qualification criteria for a fishery.

It is anticipated that vessels landing red crab for sale will be required to have permits, dealers purchasing this species from permitted vessels will be required to have permits, operators of commercial vessels (vessels with permits to sell red crab) will be required to obtain permits, vessels landing red crab for sale would need to submit logbook reports, and dealers purchasing this species from permitted commercial vessels would need to submit reports.

It is estimated that there will be minimal, if any, new dealer permit applicants. The cost associated with the dealer and processed products reports are $30 for the public and $66 for the government. Under all of the alternatives, any vessel desiring to fish commercially for red crab must obtain a federal vessel/owner red crab permit. In the one year following the control date (March 1, 2000 - February 28, 2001) there were at least 14 vessels which landed at least one pound of red crab. Because all of the alternatives (except no action and emergency rule) impose limited access and enforcement of the control date, a portion of these vessels would not be eligible for a red crab permit. They would all be eligible to land red crab under the incidental category. The preferred alternative supports criteria for five vessels to apply for permits. Initial costs for vessel permits would be $38 for public burden ($7.50 per vessel) and $63 for the government burden. Similarly, for operator permits there would be a $75 cost for the public burden ($15 per operator) and a $42 cost for the government burden. For vessel identification numbers, there would be a $56 public cost burden ($11.29 per vessel). It is estimated that there may be one vessel that may also incur additional costs associated with confirmation of permit history, replacement and upgrades, and permit vessel appeals which are estimated at $135 per vessel and $300 for the government. Costs of submitting vessel logbooks would be $100 annually for the public ($20 per vessel) and $125 for the government. Given the small number of new permits expected in this fishery, the impact of permit and reporting requirements is predicted to be minimal.

11.9.10 Competitive Effects Analysis

Most of the vessels, dealers, and processors fall within the definition of small entities. There is some indication that there is participation in this fishery by large entities. In particular, a processor specified in the survey he employs 1000 people (greater than the 500 employees defined as a small entity). However, the maximum number of year-round employees, as opposed to seasonal, for any processor was listed as 400. There is also an indication in the survey that a fish and seafood wholesaler employs 150 people (which is greater than the 100 employees defined as a small entity). However, only a small proportion of their business revenue is derived from the sale of red crab products. The percentage of their business revenue that comes from the sale of red crab products ranges from less than 1% to 33% and averages only slightly more than 25%. This does indicate that there may be large businesses involved in the industry. Because of the small nature of the fishery and the issue of confidentiality we cannot determine if there are disproportionate small versus large effects. There are no disproportionate costs of compliance among the effected small entities.

11.9.11 Identification of Overlapping Regulations

The proposed action does not create regulations that conflict with any state regulation or other federal laws.

12.0 Relationship to Applicable Law

This fishery management plan has been prepared primarily in response to the requirements of the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act). It also addresses requirements of the Marine Mammal Protection Act and the Endangered Species Act. However, these are not the only laws and administrative orders that the Council must consider in developing an FMP. In preparing a fishery management plan, the Council must comply with requirements of the National Environmental Policy Act (NEPA), the Regulatory Flexibility Act (RFA), the Administrative Procedures Act (APA), the Paperwork Reduction Act (PRA), the Coastal Zone Management Act (CZMA), and Executive Orders 12612 (Federalism), 12866 (Regulatory Planning), and 13158 (Marine Protected Areas).

These other applicable laws and administrative orders help ensure that, in developing an FMP, the Council considers the full range of alternative actions and their expected impacts on the marine environment, living marine resources, and the human communities that could be affected. This integrated Red Crab FMP document contains all elements of the Fishery Management Plan and the Environmental Impact Statement (EIS) (which is required by NEPA). This chapter addresses the requirements of these other applicable laws and administrative orders. Some of the requirements of the other applicable laws are discussed in the body of the FMP and are not repeated here. Section references are provided. In other cases, the element required by law is not found elsewhere and is addressed fully in this chapter.

12.1 Administrative Procedures Act

Sections 551-553 of the Federal Administrative Procedures Act establish procedural requirements applicable to informal rulemaking by federal agencies. The purpose is to ensure public access to the federal rulemaking process, and to give the public notice and an opportunity to comment before the agency promulgates new regulations.

Development of this fishery management plan provided many opportunities for public review, input, and access to the rulemaking process. Section 14.0 details a list of public meetings at which the proposed measures in the Red Crab FMP were discussed. In addition to entertaining public comments throughout the development process, the Council notified the public of two formal review and comment periods, a 20-day FMP scoping period (65 FR 4941) and a 38-day review period for the Draft FMP/DEIS (66 FR 59404 and 66 FR 59787).

12.2 Coastal Zone Management Act

12.2.1 States Contacted and Council Determination of Consistency with State Programs

Section 307(c)(1) of the Federal Coastal Zone Management Act of 1972 requires that all federal activities which directly affect the coastal zone be consistent with approved state coastal zone management programs to the maximum extent practicable. The coastal zone management plans of the following states were reviewed to determine the consistency of the proposed Red Crab FMP with the state programs: Maine, New Hampshire, Massachusetts, Rhode Island, Connecticut, New York, New Jersey, Pennsylvania, Delaware, Maryland, Virginia, and North Carolina. The draft FMP was provided to all affected states. The final FMP and all supporting documents were also provided to all affected states, along with a letter stating the Council's initial CZMA consistency determination. Copies of these letters are provided in Appendix E.

12.2.2 States Contacts

The following individuals were contacted regarding the CZMA consistency determination for the Red Crab FMP:

Ms. Kathleen Leydon, Maine Coastal Program
Mr. David Hartman, New Hampshire Coastal Program
Mr. Tom Skinner, Massachusetts Coastal Zone Management
Mr. Grover Fugate, Rhode Island Coastal Resources Council
Mr. Todd Oullette, Connecticut Office of Long Island Sound Programs
Mr. George Stafford, New York Division of Coastal Resources
Mr. Richard H. Kropp, New Jersey Department of Environmental Protection
Mr. E. James Tabor, Pennsylvania Department of Environmental Protection
Mr. Nicholas Di Pasquale, Delaware Division of Natural Resources
Ms. Gwynne Schultz, Maryland Coastal Zone Management Division
Ms. Laura McKay, Virginia Coastal Resources Management Program
Ms. Donna Moffitt, North Carolina Division of Coastal Management

12.2.3 CZMA Consistency Determination Transmittal Letters

Copies of the CZMA consistency determination transmittal letters are provided in Appendix E.

12.2.4 State Concurrences

At the time of this submission, the Council received consistency determination concurrences from two states, New Jersey and Virginia. It should be noted that both were in response to the Draft FMP. No state concurrences with the Council's determinations have been received on the Final FMP at the time of the submission of this FMP.

12.3 Endangered Species Act

Section 7 of the Endangered Species Act requires federal agencies conducting, authorizing or funding activities that affect threatened or endangered species to ensure that those effects do not jeopardize the continued existence of listed species. The Council has concluded, and NMFS has concurred, that the Red Crab FMP and the prosecution of the red crab fishery is not likely to result in jeopardy to any ESA-listed species under NMFS jurisdiction, or alter or modify any critical habitat, based on the discussion in this document (see NMFS ESA Section 7 Consultation Biological Opinion dated February 6, 2002). For further information on the potential impacts of the fishery and the proposed management action, see Sections 5.3, 5.4 and 8.7.4.

12.4 Executive Order 12612 (Federalism)

The Executive Order on Federalism established nine fundamental federalism principles to which Executive agencies must adhere in formulating and implementing policies having federalism implications. The E.O. also lists a series of policy making criteria to which agencies must adhere when formulating and implementing policies that have federalism implications. However, no federalism issues or implications have been identified relative to the actions proposed in this fishery management plan and the associated regulations.

The FMP does not contain policies with federalism implications sufficient to warrant preparation of an assessment under E.O. 12612. The affected states have been closely involved in the development of the proposed management measures through their involvement in the Regional Fishery Management Council process (i.e., all affected states are represented as voting members on at least one Council). This FMP was developed with the full participation and cooperation of the state representatives of the New England Council, and the draft FMP was provided to the Mid-Atlantic Council for their review and consideration. No comments were received from any state officials relative to any federalism implications of the proposed Red Crab FMP.

12.5 Executive Order 12866 (Regulatory Review)

This executive order applies to the issuance of new rules and the review of existing rules. E.O. 12866 requires that the Office of Management and Budget (OMB) review proposed regulatory programs that are considered to be “significant.” A significant rule is one that is likely to (1) have an annual effect on the economy of $100 million or more or adversely affect in a material way the economy, a sector of the economy, productivity, competition, jobs, the environment, public health or safety, or state, local, or tribal governments or communities; (2) create a serious inconsistency or otherwise interfere with an action taken or planned by another agency; (3) materially alter the budgetary impact of entitlements, grants, user fees, or loan programs or the rights or obligations of recipients thereof; or (4) raise novel legal or policy issues arising out of legal mandates, the President’s priorities, or the principles set forth in the Order.

Section 11.0 of this FMP provides the Regulatory Impact Review (RIR) which includes an assessment of the costs and benefits of the proposed action and other alternatives in accordance with the guidelines established by E.O. 12866. The analysis included in the RIR shows that the Red Crab FMP is not a “significant regulatory action” since it will not adversely affect in a material way the economy or a sector of the economy. The proposed regulations will not have an annual impact on the economy of $100 million or more, and will not adversely affect productivity, competition, the environment, public health or safety, or state, local or tribal governments or communities over the long term. The proposed action also does not interfere with an action planned by another agency since no other agency regulates the harvest of deep-sea red crabs. The FMP does not materially alter the budgetary impact of entitlements, grants, user fees, or loan programs, or the rights and obligations of recipients. The FMP also does not raise any novel legal and/or policy issues because it extends the types of fishing regulations already in place in many other federally-managed fisheries.

12.6 Executive Order 13158 (Marine Protected Areas)

The Executive Order on Marine Protected Areas requires each federal agency whose actions affect the natural or cultural resources that are protected by an MPA to identify such actions, and, to the extent permitted by law and to the maximum extent practicable, in taking such actions, avoid harm to the natural and cultural resources that are protected by an MPA.

The E.O. directs federal agencies to refer to the MPAs identified in a list of MPAs that meet the definition of MPA for the purposes of the Order. The E.O. requires that the Departments of Commerce and the Interior jointly publish and maintain such a list of MPAs. As of the date of submission of this FMP, the list of MPA sites has not been developed by the departments. However, it is likely that when the list is available, the Stellwagen Bank National Marine Sanctuary and the Council's year-round groundfish closed areas (Closed Area I, Closed Area II, Nantucket Lightship Closed Area, and Western Gulf of Maine Closed Area), at a minimum, will meet criteria for an MPA and thus may be considered in the population of the list.

The fishing activities proposed to be managed under this FMP, and all actions associated with this FMP, occur well outside the boundaries of any areas that might be considered to meet the intention of E.O. 13158 as an MPA. The red crab fishery does not occur in the Gulf of Maine or on Georges Bank; therefore, there is no potential harm to either the natural or cultural resources protected by the Stellwagen Bank National Marine Sanctuary or any of the groundfish closed areas.

12.7 Marine Mammal Protection Act

The Council has reviewed the impacts of the Red Crab FMP on marine mammals and concluded that the management actions proposed are consistent with the provisions of the MMPA and will not alter existing measures to protect the species likely to inhabit the red crab management unit. For further information on the potential impacts of the fishery and the proposed management action, see Sections 5.3, 5.4 and 8.7.4.

12.8 Paperwork Reduction Act

The purpose of the Paperwork Reduction Act (PRA) is to control paperwork requirements imposed on the public by the federal government. The authority to manage information and record-keeping requirements is vested with the Director of the Office of Management and Budget (OMB). This authority encompasses establishment of guidelines and policies, approval of information collection requests, and reduction of paperwork burdens and duplications.

This proposed Red Crab FMP contains collection of information requirements subject to the PRA. The FMP includes requirements for four types of permits: open access incidental catch vessel permits, controlled access directed fishery vessel permits, vessel operator permits, and dealer permits. The FMP includes four types of record-keeping requirements: open access incidental catch vessel trip reports, controlled access directed fishery vessel trip reports, controlled access directed fishery vessel interactive voice response call-in reports, and dealer weighout purchase reports. The FMP also includes gear marking requirements for the controlled access directed fishery vessels.

The PRA package prepared in support of this FMP and the information collection identified above, including the required 83-I forms and supporting statements, is provided as Appendix D. This PRA package is under review and will be submitted to OMB for approval.

12.9 Regulatory Flexibility Act

The purpose of the Regulatory Flexibility Act (RFA) is to reduce the impacts of burdensome regulations and record-keeping requirements on small businesses. To achieve this goal, the RFA requires government agencies to describe and analyze the effects of proposed regulations and possible alternatives on small business entities. On the basis of this information, the Regulatory Flexibility Act Analysis (RFAA) determines whether the proposed action would have a "significant economic impact on a substantial number of small entities."

Section 11.9 of this FMP provides the Initial Regulatory Flexibility Act Analysis (IRFAA) which includes an assessment of the expected effects of the proposed action and other alternatives in accordance with the guidelines established by RFA.

Deep-Sea Red Crab Fishery Management Plan

Proposed Actions: Measures to implement the fishery management plan for deep-sea red crab, which include preventing overfishing, identifying essential fish habitat, implementing controlled access in the Northeast deep-sea red crab fishery, and other measures to comply with Federal law.

Type of Statement: Final Environmental Impact Statement

Lead Agency: New England Fishery Management Council

Cooperating Agencies: National Marine Fisheries Service

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Abstract: The New England Fishery Management Council proposes management measures to implement a new fishery management plan (FMP) for the Northeast U.S. deep-sea red crab fishery. The proposed measures address the requirements of the Magnuson-Stevens Fishery Conservation and Management Act, including preventing overfishing and controlling bycatch mortality and identifying essential fish habitat.

The Council has selected Alternative 5 as the preferred alternative for the Red Crab FMP. This alternative includes measures to limit the landing of red crab as incidental catch in other fisheries, control access to the directed red crab fishery, restrict landings to male crabs only, prohibit the complete processing of crabs at sea and/or claw-snapping, establish a maximum of 600 traps per vessel, restrict the directed red crab fishery to be trap/pot only, control effort using a days-at-sea program based on a target TAC, and set maximum trip/possession limits for the directed fishery. The FMP will also implement a permit program for vessels, operators, and dealers, and require reporting and record-keeping of the same.

12.10 Environmental Impact Statement

The National Environmental Policy Act (NEPA) requires preparation of an Environmental Impact Statement (EIS) for major Federal actions that significantly affect the quality of the human environment. The Council published a Notice of Intent (NOI) to prepare this EIS in the *Federal Register* on February 2, 2000 (65 FR 4941) followed by two public scoping meetings. The Council prepared a scoping document that outlined some of the major issues and types of management measures that the Council might consider in the Red Crab FMP. The Council invited discussion on this document and any other issues of concern at the scoping meetings. The Council invited public comment on the types of measures that would be appropriate for consideration in this fishery. During preparation of the FMP/EIS, the Council held 6 meetings of its Red Crab Oversight Committee and four meetings of its Red Crab Advisory Panel. A Notice of Availability (NOA) on the Draft EIS was published in the *Federal Register* on November 30, 2001 (66 FR 59786). The comment period on the Draft EIS was open from November 30, 2001 until January 7, 2002. In December 2001, the Council held two public hearings on the Draft EIS, on in Gloucester, MA and one in New Bedford, MA. All of these meetings were open to the public. The Council considered public comments received during this time when developing the final program of management measures to propose to NMFS in the FMP.

The table of contents for the EIS is provided to aid reviewers in referencing the appropriate corresponding sections of the FMP.

12.10.1 Executive Summary

For an executive summary for this EIS, please the executive summary for the overall FMP, beginning on page xiii.

12.10.2 Background and Purpose

12.10.2.1 Background

For a description of the background for this EIS, please see Section 2.1 of the FMP.

12.10.2.2 Statement of the Problem

For a statement of the problems associated with the red crab fishery, please see Section 2.2 of the FMP.

12.10.2.3 Purpose and Need for the Action

For a description of the purpose and need for the action associated with this EIS, please see Section 2.3 of the FMP.

12.10.2.4 Management Goals and Objectives

For a description of the management goals and objectives associated with this EIS, please see Section 3.1 of the FMP.

12.10.2.5 Scoping Process

In February 2000, the Council's Notice of Intent to Prepare an Environmental Impact Statement (EIS) was published in the *Federal Register*, officially beginning the Council's FMP scoping process (65 FR 4941). The Council hosted two scoping meetings, held in Portsmouth, NH and New Bedford, MA, that were well attended by the red crab industry and other interested parties. The Council prepared a scoping document that outlined some of the major issues and types of management measures that the Council might consider in the Red Crab FMP. The Council invited discussion on this document and any other issues of concern at the scoping meetings. The Council invited public comment on the types of measures that would be appropriate for consideration in this fishery. At the scoping meetings, there was general support for the development of a Red Crab FMP, including the consideration of management measures such as a limited entry program, setting a minimum allowable size, restricting the fishery to male crabs only, prohibiting the processing of red crabs at sea, and some type of reasonable trap limits. There was less support for measures such as closed areas, closed seasons, and quotas (either trip limits or IFQs).

During preparation of the draft FMP/DEIS, the Council held five meetings of its Red Crab Oversight Committee and three meetings of its Red Crab Advisory Panel. Once the DEIS was available for review (66 FR 59786), the Council held two public hearings on the DEIS and accepted written comments from November 30, 2001 - January

7, 2002. The Council held additional meetings of its Red Crab Advisory Panel and Red Crab Oversight Committee. All of these meetings were open to the public.

12.10.3 Summary of the EIS

12.10.3.1 Issues to be Resolved

For a description of the issues to be resolved associated with this EIS, please see Section 2.4 of the FMP.

12.10.3.2 Major Conclusions

The EIS concludes that the proposed management program and measures for the red crab fishery will have positive impacts on the physical, biological, and human environment.

12.10.3.3 Areas of Controversy

NOAA Administrative Order 216-6 defines "controversial" as referring to a substantial dispute which may concern the nature, size, or environmental effects, but not the propriety, of a proposed action. The need for management is widely recognized throughout the red crab fishery (it was, in fact, a request by a majority of the fishery participants that initiated the Council's involvement with the red crab fishery and it was at their request that the Council undertook to develop this FMP). There is near universal agreement with the proposed requirements for permits, reporting, an incidental catch limit, a prohibition on landing female crabs, gear limits and restrictions, restrictions on processing at sea, and the use of a target TAC with DAS allocations. There are, however, several proposed measures that create some controversy.

The proposed controlled access program for the directed red crab fishery, a cornerstone of this FMP, generated controversy based on the Council's proposed criteria. The proposed criteria, which are expected to allow the majority of current participants to continue to participate in the directed fishery but will exclude several others, polarized the participants. The proposed criteria are considered necessary to control and reduce the capacity of the fishing fleet -- vessels entering the fishery in late 2000 and early 2001 increased the number of vessels targeting red crab by 40% and increased the fleet capacity by 180%. A strict controlled access program that maintains the capacity of the fishing fleet to levels comparable to the time prior to the March 1, 2000 control date was a necessary component of the FMP in order to comply with the goals and objectives established for the FMP.

Related to the overall controlled access program, the March 1, 2000 control date also generated controversy, as this is the date the Council is proposing be used to distinguish participants who may qualify for the controlled access program from those who will not. The Council recognizes that the use of the control date may disadvantage some vessels who wish to continue participating in the directed fishery (there were two vessels that began landing red crabs in the northeast in January 2001, ten months after the publication of the control date). However, the published intent of the control date was to serve this express purpose. The Council considered alternatives to the control date as a controlled access qualification criterion, but none of these met all the goals and objectives of the FMP.

The proposed differential trip limit also resulted in controversy. There were several options for a differential trip limit (as well as a standard trip limit) considered by the Council. None of the options were deemed to be fair and equitable for all potential participants of the directed fishery. All options were considered by members of the industry to be more favorable to some participants than others. The Council considered having no trip limit as a potential solution, but this option was also considered unfair by some members of the industry and the Council became concerned that without a trip limit, the FMP would not be as effective. After several debates on the issue, the Council developed a form of differential trip limit it believed to be the most fair possible to the largest number of potential participants in the directed red crab fishery.

12.10.4 Description of the Management Alternatives

12.10.4.1 Description of the Management Measures

For a description of the management measures considered with this EIS, please see Section 4.2 of the FMP.

12.10.4.2 Description of the Management Alternatives

For a description of the management alternatives considered with this EIS, including the no action alternative, please see Section 4.3 of the FMP.

12.10.4.3 Measures Considered but Rejected

For a description of the measures considered but rejected for further analysis and review in this EIS, please see Section 4.4 of the FMP.

12.10.4.4 Identification of the Preferred Alternative

The Council's preferred alternative is the alternative that the Council believes will fulfill its statutory mission and responsibilities under the Magnuson-Stevens Act, giving full consideration, to the extent possible, to economic, social, environmental, and technical factors. For a description of the preferred alternative, please see Section 4.3.1 of the FMP.

12.10.4.5 Identification of the Environmentally-Preferable Alternative

The "environmentally-preferable" alternative is the alternative that is believed to best promote the national environmental policy expressed in NEPA. Generally, this means the alternative that causes the least damage to the biological and physical environment; it also may mean the alternative which best protects, preserves, and enhances historic, cultural, and natural resources.

In the case of the proposed Red Crab FMP, the alternative that causes the least damage to the biological and physical environment, in fact, the alternative that best protects the biological and physical environment, would be one of the management alternatives that implements a hard TAC as an upper cap on potential landings in the directed red crab fishery (Alternatives 2 or 3). What is consistent in these two alternatives is that there is a firm control on potential landings in the directed red crab fishery, through an annual hard TAC, which would result in the fishery being shut down once the annual TAC is reached. The management alternatives that implement an individual vessel quota (IVQ) program (Alternatives 9 or 10) offer similar controls on the total annual landings, but these alternatives did not propose controls on individual vessel effort or gear use, such that the total fishing effort and the total number of traps in use could be greater under these alternatives than under other alternatives considered.

Although Alternative 2 or 3 may be the environmentally-preferable, neither of these is the Council's preferred alternative (Alternative 5). This is because the use of a hard TAC would have significant and detrimental economic and social impacts on the red crab fishery and their communities compared with the alternatives that propose a target TAC with a control on overall fishing effort (through the days-at-sea program). Alternative 5, the Council's preferred alternative, minimizes not only the potential adverse impacts to the red crab resource and its environment, but also the potential adverse impacts to the human environment dependent upon the red crab resource and its fishery. For a description of Alternatives 2 and 3, please see Sections 4.3.3 and 4.3.4 of the FMP. For a description of Alternative 5, the preferred alternative, please see Section 4.3.1 of the FMP.

12.10.5 Description of the Affected Environment

12.10.5.1 Introduction

A full description of the affected environment, including a description of the resource species, the habitat, fishing activities, economic characteristics, and social characteristics of those likely to be affected by the actions under consideration and proposed in this EIS can be found in Section 8.0 of the FMP. Additional background material can be found in Appendix A and Appendix B. Appendix A is a complete description of the life history and habitat characteristics of the deep-sea red crab. Appendix B is a description of baseline social and economic information relevant to the Northeast red crab fishery.

The description of the affected environment is intended to present sufficient background information on the various resources and entities likely to be affected by the actions proposed and/or under consideration in this EIS. This section presents relevant information on the resource components of the existing environment. This section summarizes the available information on the physical, biological and ecological, and human components of the environment involved in the red crab fishery. The components of the environment described herein include those that would be affected by the alternatives and that would affect the alternatives if they were implemented. Although this section deals with the *affected* environment, it does not present the effects of the proposed management program. Instead, this section provides the baseline against which the alternatives will be compared in the following sections.

The deep-sea red crab fishery is located only in the deep waters of the continental slope, beyond the 400 meter isobath. Because of the remote nature of this fishery, many components of the coastal and marine environment normally considered in fishery management plans are not described in this section, nor are they addressed in the sections dealing with the potential effects of the proposed management alternatives. Components of the coastal and marine environment such as estuaries, wetlands (including salt marshes), the intertidal zone, nearshore subtidal areas, riverine systems, and the majority of the continental shelf, while they are very important components of the overall ecosystem, are not integral components of the environment of the red crab fishery and are not directly affected by any of the management measures and alternatives under consideration.

The Gulf of Maine is excluded from this discussion in its entirety because although deep-sea red crabs occur in the Gulf of Maine, they are primarily small (< 3.1" CW) and the directed fishery does not occur in this area. There are many resource and non-resource species that occur in the marine environment along with the deep-sea red crab, such as monkfish, tilefish, and offshore hake, among others. These species are not considered in this EIS, however, because there is little interaction between the directed red crab fishery and these species.

12.10.5.2 Physical Environment

For a description of the physical environment affected by this EIS, please see Section 8.2 of the FMP.

12.10.5.3 Biological Environment

Abundance and Present Stock Condition

For a description of the fishery resource affected by this EIS, please see Section 8.1.3 of the FMP.

Ecological Relationships

For a description of the ecological relationships affected by this EIS, please see Section 8.1.4 of the FMP.

12.10.5.4 Human Activities

For a description of the human activities affected by this EIS, including a description of the fishery and the relevant social/cultural and economic factors, please see Section 8.3 of the FMP.

12.10.6 Environmental Impacts of the Alternatives

12.10.6.1 Preferred Alternative

Biological Impacts on Red Crab

For a description of the biological and ecological impacts on the red crab resource expected as a result of the preferred alternative, please see Section 5.4.6.1 of the FMP.

Ecological Impacts on Other Species

For a description of the ecological impacts on other species and their communities expected as a result of the preferred alternative, please see Section 5.4.6.2 of the FMP.

Impacts to Essential Fish Habitat

For a description of the impacts to the essential fish habitat of Federally-managed species expected as a result of the preferred alternative, please see Section 5.4.6.3 of the FMP.

Economic Impacts on the Fishery

For a description of the economic impacts on the fishery expected as a result of the preferred alternative, please see Section 5.4.6.4 of the FMP.

Social/Cultural Impacts

For a description of the social and cultural impacts on the fishery and associated communities expected as a result of the preferred alternative, please see Section 5.4.6.5 of the FMP.

Impacts on Protected Species

For a description of the impacts on protected species expected as a result of the preferred alternative, please see Section 5.4.6.6 of the FMP.

12.10.6.2 Other Alternatives

Biological Impacts on Red Crab

For a description of the biological and ecological impacts on the red crab resource expected as a result of the non-preferred alternatives, please see Section 5.4 of the FMP.

Ecological Impacts on Other Species

For a description of the ecological impacts on other species and their communities expected as a result of the non-preferred alternatives, please see Section 5.4 of the FMP.

Impacts to Essential Fish Habitat

For a description of the impacts to the essential fish habitat of Federally-managed species expected as a result of the non-preferred alternatives, please see Section 5.4 of the FMP.

Economic Impacts on the Fishery

For a description of the economic impacts on the fishery expected as a result of the non-preferred alternatives, please see Section 5.4 of the FMP.

Social/Cultural Impacts

For a description of the social and cultural impacts on the fishery and associated communities expected as a result of the non-preferred alternatives, please see Section 5.4 of the FMP.

Impacts on Protected Species

For a description of the impacts on protected species expected as a result of the non-preferred alternatives, please see Section 5.4 of the FMP.

12.10.7 Cumulative Impacts of the Proposed Action

12.10.7.1 <u>Background</u>

The National Environmental Policy Act (NEPA) requires that cumulative effects of "past, present, and reasonably foreseeable future actions" (40 CFR § 1508.7) be evaluated along with the direct effects and indirect effects of each proposed alternative. In environmental analyses, direct and indirect effects of an action are routinely addressed. For the actions proposed in this fishery management plan, the likely direct and indirect effects on the red crab resource, its environment, and the red crab fishery have been addressed in previous sections. Analyzing the likely cumulative effects of this action is more difficult because of the difficulty in defining the spatial and temporal boundaries of this proposed action as well as foreseeable future actions.

According to the Council on Environmental Quality (CEQ) (1997), if the spatial and temporal boundaries of an action are defined too broadly, the analysis of cumulative effects becomes unwieldy, but if they are defined too narrowly, significant issues may be missed. According to CEQ (1997), "determining the cumulative environmental consequences of an action requires delineating the cause-and-effect relationships between the multiple actions and the resources, ecosystems, and human communities of concern." In order to make this determination, analysts must first attempt to identify the specific possible actions that would substantially affect the resources of concern from among the entire complex network of possible actions (CEQ 1997). Then, they must describe the response of the resource to this environmental change using a variety of tools and methods (CEQ 1997).

The CEQ (1997) specifies that "the significance of cumulative effects depend on how they compare with the environmental baseline and relevant resource thresholds." The CEQ directs federal agencies to determine the significance of cumulative effects by comparing likely changes to the environmental baseline. On a more practical note, the CEQ (1997) states that the range of alternatives considered must include the "no-action alternative *as a baseline* against which to evaluate cumulative effects (emphasis added)." Thus, our cumulative effects analysis compares the likely effects of this action as compared to the no-action alternative.

12.10.7.2 Principles of Cumulative Effects Analysis

The CEQ (1997) identify eight principles of cumulative effects analysis. These eight principles are:

1. Cumulative effects are caused by the aggregate of past, present, and reasonably foreseeable future actions.

2. Cumulative effects are the total effect, including both direct and indirect effects, on a given resource, ecosystem, and human community of all actions taken, no matter who (Federal, non-Federal, or private) has taken the actions.

3. Cumulative effects need to be analyzed in terms of the specific resource, ecosystem, and human community being affected.

4. It is not practical to analyze the cumulative effects of an action on the universe; the list of environmental effects must focus on those that are truly meaningful.

5. Cumulative effects on a given resource, ecosystem, and human community are rarely aligned with political or administrative boundaries.

6. Cumulative effects may result from the accumulation of similar effects or the synergistic interaction of different effects.

7. Cumulative effects may last for many years beyond the life of the action that caused the effects.

8. Each affected resource, ecosystem, and human community must be analyzed in terms of its capacity to accumulate additional effects, based on its own time and space parameters.

12.10.7.3 Description of the Cumulative Effects

The likely effects of the preferred alternative will be described in terms of each of the above eight principles of cumulative effects analysis. In response to each principle, we will consider the likely cumulative effects of the preferred alternative compared to the likely cumulative effects of the no action alternative.

Cumulative effects are caused by the aggregate of past, present, and reasonably foreseeable future actions.

Except for the short-term regulations associated with the emergency rule, this FMP represents the first management program developed for the red crab fishery. There can be no effects of past actions to consider in a cumulative effects analysis for this fishery. The only present actions are those proposed in this FMP. Given the nature of this fishery and the likelihood of overfishing if adequate management action is not taken, it is reasonable to assume that even if management action is not taken at this time, qualitatively similar management action would be taken in the future.

The effects of the preferred alternative, or a qualitatively similar management program established in the future, are to reduce the probability of overfishing the red crab resource and prevent the stock from becoming overfished, to stabilize the red crab fishing industry and prevent or reduce overcapitalization, and to prevent or minimize the likelihood of adverse impacts to the ecosystem associated with the red crab fishery. The effects of the no action alternative would be to continue the current expansion of the red crab fishery with no controls on fishing effort or landings, and no controls on the operations of the fishery. Relative to the no action alternative, the most likely effects of the proposed action are expected to be positive for the red crab resource, its environment, and the directed red crab fishery.

Cumulative effects are the total effect, including both direct and indirect effects, on a given resource, ecosystem, and human community of all actions taken, no matter who (Federal, non-Federal, or private) has taken the actions.

This fishery occurs only in Federal waters within the exclusive economic zone (EEZ). The only management actions taken in this fishery would be taken under Federal jurisdiction. The direct and indirect effects of the preferred alternative are expected to protect the resource from overexploitation and maintain a sustainable fishery. The direct and indirect effects expected as a result of the no action alternative include overfishing of the red crab resource and a destabilized and overcapitalized fishery. There may also be effects on the ecosystem resulting from the lack of control on fishing methods used to harvest red crab. Relative to the no action alternative, the most likely effects of the proposed action are expected to be positive for the red crab resource, its environment, and the directed red crab fishery.

Cumulative effects need to be analyzed in terms of the specific resource, ecosystem, and human community being affected.

The effects of the present and reasonably foreseeable future actions will be to reduce the likelihood of the red crab resource being subject to overfishing and becoming overfished. The ecosystem in which red crabs live will be protected from undue adverse impacts that may be associated with changes in the operations, extent, and intensity of the red crab fishery. The human community, comprised of the participants in the red crab fishery, would be subject to both direct and indirect effects as a result the preferred alternative, but these effects would be much less severe than if the no action alternative is selected. Relative to the no action alternative, the most likely effects of the proposed action are expected to be positive for the red crab resource, its environment, and the directed red crab fishery.

It is not practical to analyze the cumulative effects of an action on the universe; the list of environmental effects must focus on those that are truly meaningful.

The effects most meaningful and relevant include:

- the effects on the red crab resource, such as overfishing;
- the potential effects on the ecosystem, especially impacts on the habitat and associated biological communities, that may result from changes fishing gear used in the red crab fishery such as from otter trawls and dredges; and
- the effects on the participants of the directed red crab fishery.

Relative to the no action alternative, the most likely effects of the proposed action are expected to be positive for the red crab resource, its environment, and the directed red crab fishery.

Cumulative effects on a given resource, ecosystem, and human community are rarely aligned with political or administrative boundaries.

All of the expected effects associated with the preferred alternative will be constrained to the U.S. EEZ. The red crab fishery does not occur within state waters.

Cumulative effects may result from the accumulation of similar effects or the synergistic interaction of different effects.

In addition to the direct and indirect effects on the resource, its ecosystem, and the participants in the fishery, there can also be cumulative effects as a result of similar or synergistic management actions. This is most often apparent in multi-species fisheries where single-species regulations combine to result in more significant effects on the participants of the fishery than would occur from the regulations for one species alone. The red crab fishery, however, is a single-species fishery with very little interactions or dependence upon any other Federally-regulated fishery. The majority of the participants in the directed red crab fishery are involved only in the red crab fishery and will only be affected by the regulations established by this FMP.

Cumulative effects may last for many years beyond the life of the action that caused the effects.

This FMP is intended to establish a management program for the directed red crab fishery that will last, in various forms depending upon the needs of the resource and the fishery, for many years. The expected effects of the no action alternative would also be expected to last many years, assuming that overfishing results from the lack of management and the resource becomes overfished, needing at least several years to recover and rebuild. Relative to the no action alternative, the most likely long-term effects of the proposed action are expected to be positive for the red crab resource, its environment, and the directed red crab fishery.

Each affected resource, ecosystem, and human community must be analyzed in terms of its capacity to accumulate additional effects, based on its own time and space parameters.

Section 5.0 of the FMP identifies and describes the potential effects of the proposed management actions on the red crab resource, its environment including habitat, associated species, and communities, and the fishery, including fishing communities. This section relates the potential long-term effects of the proposed management program and compares and contrasts these effects with those that would be expected to occur in the absence of management. Relative to the no action alternative, the most likely long-term effects of the proposed action are expected to be positive for the red crab resource, its environment, and the directed red crab fishery.

12.10.8 Determination of Significance

Section 6.02 of the NOAA Administrative Order 216-6, Environmental Review Procedures for Implementing the National Environmental Policy Act, provides specific guidance on determining the significance of fishery management actions. The nine criteria to be addressed are as follows:

a. *May the proposed action be reasonably expected to jeopardize the sustainability of any target species that may be affected by the action?*

The objective of the proposed action is to ensure the long-term sustainability of the Atlantic deep-sea red crab fishery. Section 2.3 describes the need for this proposed action and the likelihood that overfishing may occur without the proposed action. Thus, the proposed action would not be expected to jeopardize the sustainability of the target species directly affected by the action. The sustainability of the target species would be jeopardized if the proposed action is not implemented.

The red crab fishery occurs primarily in the deep waters of the continental slope (200 - 400 fathoms). Currently, very little fishing activity other than for red crabs occurs at these depths along the continental slope. Most other target species managed under federal fishery management plans occur primarily in more shallow waters on the continental shelf. This proposed action, therefore, is not be expected to jeopardize the sustainability of any other managed target species, as no other target species would be affected by this action.

Although the proposed action is not expected to jeopardize the sustainability of any target species that may be affected by the action, the no action alternative would be expected to result in overfishing of the red crab resource and would also be expected to jeopardize the sustainability of this target species. Thus, the proposed action is expected to have potentially significant positive effects on the red crab resource relative to the no action alternative.

b. *May the proposed action be reasonably expected to jeopardize the sustainability of any non-target species?*

The commercial red crab fishery is currently prosecuted entirely with traps and these traps are reported to retain very little in the way of by-catch species. The proposed action is intended to reduce the amount of fishing and the fishing capacity that occurs in the red crab fishery to ensure the sustainability of the red crab resource and its fishery. Because there are few, if any, species caught as bycatch in the red crab fishery, and the overall effort in the red crab fishery is expected to decrease as a result of the proposed action, the proposed action is not be expected to jeopardize the sustainability of any non-target species.

c. *May the proposed action be reasonably expected to cause substantial damage to the ocean and coastal habitats and/or essential fish habitat as defined under the Magnuson-Stevens Act and identified in FMPs?*

Section 8.2.3 provides the required assessment of the likely impacts of this proposed action on essential fish habitat. Of the many types of fishing gear used in the New England region (otter trawls, scallop dredges, gillnets, longlines, etc.), lobster and crab pots and traps are believed to have relatively little impact on ocean habitats, including essential fish habitat. While all fishing gears have some degree of impact on the environment, static gears such as traps and pots generally are not associated with adverse impacts to fish habitat (Barnette 2001; Eno et al. 1996; NEFMC 1998). Because there are no potential adverse impacts associated with this action, an EFH consultation and a proposed mitigation plan are not required. For this reason, the proposed action is not expected to cause substantial damage to the ocean and coastal habitats and/or essential fish habitat as defined under the Magnuson-Stevens Act and identified in FMPs.

d. *May the proposed action be reasonably expected to have a substantial adverse impact on public health or safety?*

The preferred alternative proposed in this document is not likely to have an adverse impact on either public health or safety. In developing management measures for any fishery, the Council and NMFS usually receive extensive comments from affected members of the public regarding the safety implications of various alternatives under consideration. No safety or public health concerns related to the measures proposed in this FMP were identified during the development of this proposed action.

e. *May the proposed action be reasonably expected to adversely affect endangered or threatened species, marine mammals, or critical habitats of these species?*

The management measures proposed in this action may affect, but are not likely to jeopardize, the continued existence of any endangered or threatened species, or prevent any marine mammal species from achieving optimum population levels. This action proposes to implement controls on a fishery that would otherwise remain uncontrolled and these controls are intended to reduce, rather than increase, the amount of fishing effort occurring in the red crab fishery. Thus, if there are any impacts to endangered or threatened species or marine mammals associated with the red crab fishery, these impacts would be reduced as a result of the proposed action.

f. *May the proposed action be reasonably expected to result in cumulative adverse effects that could have a substantial effect on the target species or non-target species?*

Aside from the short-term regulations implemented under the 2001-2002 emergency regulations, the management measures proposed in this action represent the first attempt at developing a management program for the red crab fishery. Because the proposed action represents the first long-term management action for this fishery, this action will not result in cumulative adverse effects that could have a substantial effect on the target species or non-target species. If the preferred alternative is not implemented, continued unregulated fishing activity could have adverse cumulative effects on the red crab resource, its environment, and the fishery dependent upon the resource.

Although the proposed action is not expected to result in cumulative adverse effects that could have a substantial effect on the target species or non-target species, the no action alternative would be expected to result in overfishing of the red crab resource and could have a substantial effect on the target species. Thus, the proposed action is expected to have potentially significant positive effects on the red crab resource relative to the no action alternative.

g. *May the proposed action be reasonably expected to have a substantial impact on biodiversity and ecosystem function within the affected area?*

The proposed action is not expected to have a substantial impact on biodiversity and ecosystem function within the affected area because the proposed action is intended to reduce the amount of fishing activity and limit the amount of red crabs harvested.

h. *Are significant social or economic impacts interrelated with significant natural or physical environmental effects?*

No significant social, economic, natural or physical environmental effects are predicted to result from the proposed action, thus there are no significant interactions between these types of effects predicted.

i. *What is the degree to which the effects on the quality of the human environment are likely to be highly controversial?*

The effects of the proposed action on the quality of the human environment may be highly controversial. Controversy may surround the selection of a preferred alternative if this preferred alternative limits the ability of some fishing vessels to harvest as much of the red crab resource as they would without the management program or limits the number of vessels that would otherwise wish to participate in the directed red crab fishery (through the proposed controlled access program). The only way to avoid this potential controversy would be to continue to allow the uncontrolled and unlimited harvest of the red crab resource, which would have significant effects on the resource and would also be controversial. The intent of the proposed action is to prevent overfishing the red crab resource and maintain a sustainable directed fishery for red crab in the Northeast U.S.

12.10.9 Other Required Considerations

12.10.9.1 Unavoidable Adverse Effects

Sections 5.3 and 5.4 identify the likely effects of the management measures and alternatives under consideration in this FMP, including the preferred alternative. This discussion includes descriptions of the potential biological, ecological, economic, and social impacts to the red crab resource, its environment, and the directed red crab fishery. There are no unavoidable adverse effects identified in this FMP. All potential adverse effects are avoidable in one way or another, although some of the methods that could be used to avoid one set of potential adverse effects would increase the likelihood of causing other adverse effects. For example, implementation of the proposed controlled access program for this fishery has the potential to cause adverse impacts to those elements of the directed red crab fishery that are no longer allowed to participate in the directed fishery. An alternative to reduce this potential adverse effect would be to increase the number of vessels allowed to qualify for the directed fishery, but this would increase the risk of overfishing the resource and jeopardizing the sustainability of the resource, as well as incur adverse economic effects on the other participants of the directed fishery who would be subject to more restrictive catch limits and reduced opportunities to fish. The Council has selected a preferred alternative management strategy intended to mitigate to the extent possible all possible social and economic adverse effects while minimizing the risks to the resource and its environment. Overall, the proposed action is expected to have potentially significant positive effects on the red crab resource relative to the no action alternative.

12.10.9.2 Relationship Between Short-Term Uses and Long-Term Productivity

The development and implementation of this FMP for red crab is intended to ensure the long-term productivity and sustainability of the red crab resource and, by extension, the directed red crab fishery. In order to ensure the long-term productivity of the resource and its fishery, the necessary management measures may cause some short-term adverse economic and social impacts to some current participants in the fishery. Without these management measures, the short-term use of the red crab resource via unregulated harvesting by an overcapitalized fishing fleet would have adverse impacts on the long-term productivity of the resource and the sustainability of the directed red crab fishery. Overall, the proposed action is expected to have potentially significant positive effects on the red crab resource relative to the no action alternative.

12.10.9.3 Irreversible and Irretrievable Commitments of Resources

There are no known irreversible or irretrievable commitments of resources associated with this FMP and the proposed action. Under the no action alternative, while there are unlikely to be any irreversible commitments of resources, there may be irretrievable losses if the red crab resource is overexploited to a level that takes a long time for the population to recover. The risks of irretrievable losses are higher in this fishery than in many others in the northeast due to the relatively slow growth and late maturation of this species.

12.10.10 List of Preparers

The list of individuals involved in the preparation of this FMP and EIS are provided in Section 13.0 of the FMP.

12.10.11 List of Persons Receiving Copies of DEIS

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12.10.12 Public Comments on the Draft EIS

The following section contains a summary of written and verbal comments received during the Red Crab DEIS public hearings and review period from November 30, 2001 - January 7, 2002. The comments received are summarized because the same point was often made by more than one individual. Further, a number of comments addressed points not directly relevant to FMP proposals, objectives, or analyses. These comments are not included in the summary. Appendix E includes all written comments submitted to the Council, as well as summaries of the public hearings. This section also includes brief responses from the Council related to the comments.

12.10.12.1 General Comments on the Draft EIS and FMP:

Comment: A large number of letters, form letters, and verbal comments from fishing organizations, individual fishermen, and fishing vessel support services, supported, in total, the Council's preferred alternatives for the Red Crab FMP.

Response: The Council has elected to retain as final management measures the measures proposed as the preferred alternatives, with minor adjustments based on information received during the public review process. The only adjustments to the management measures made after the public review process involved specifying certain elements of FMP in more detail than what was proposed in the draft FMP. For example, the draft FMP identified starting the fishing year based on information about the fishery, but did not specify any particular start date. Following the public review process, the Council specified that March 1 would be the start date of the fishing year. Similarly, although the Council originally identified differential trip limits as a preferred alternative, it did not specify how the trip limits would be differentiated or what the trip limits would be. In the final FMP, based on input received during the public review process, the Council has specified the particular trip limits and how they would be differentiated.

Comment: One commenter asked for the FMP to include an explicit preference for U.S.-based processors to receive product from fishing vessels.

Response: The FMP requires that all dealers who receive red crab be Federally-permitted, and requires that all Federally-permitted vessels sell red crab only to such Federally-permitted dealers. The FMP makes no distinction between dealers beyond the requirement to obtain a Federal permit. The FMP directly manages only the harvesting sector, establishing a controlled access program, trip limits, DAS limits, etc., and places no restrictions or constraints on the sale of their product other than to a Federally-permitted dealer. It is assumed that all vessels will choose a dealer based on who offers the best price, and that the market competition will result in an efficient allocation of product.

Comment: One commenter suggested that the FMP should include the means to prevent the unauthorized sale of red crab to foreign processors.

Response: The FMP will require that all vessels harvesting, possessing, landing, and/or selling red crab obtain either an open access incidental catch permit or a controlled access directed fishery permit. One of the requirements of the permit is that red crab may only be sold to Federally-permitted dealers. All dealers who receive red crab must obtain a Federal dealer's permit and they may only purchase red crab from a Federally-permitted vessel. Violation of any permit requirements will be grounds for revocation of the permit.

Comment: One commenter believes that the proposed management is based on suspect science.

Response: Compared to many of the other species managed by the Council, there is little information available on the deep-sea red crab; however, the Council has no reason to doubt the veracity of the information on which it is basing its management decisions. The commenter provided no rationale or justification for the claim.

Comment: One commenter indicated that the FMP should not reward five or six vessels with a monopoly on the fishery.

Response: The decision to develop a controlled access fishery that limits the number and/or capacity of the participants to a relatively low level was based not on the desire for a few participants to be rewarded with monopolistic control over the resource, but instead on the limitations of the resource and the ability of the resource to sustain a full-time fishery. All indications are that for the deep-sea red crab resource to sustain a full-time fishery, the number of participants must be small. Although the proposed controlled access system for the directed red crab fishery may limit the participants to five or six vessels, these vessels will not enjoy a pure monopoly simply due to the fact that there will be multiple independent firms involved in the fishery and none of these firms will be granted an overwhelming share of the market. Each participant will have equal access to the resource, limited by their own operating efficiencies, and no one firm currently dominates the market. This may be perceived as a shared monopoly or cartel, but this would require that all participants coordinate price and/or harvest levels. Currently, there is sufficient competition between the participants, there are multiple dealers, and there are differences in the products sold by the participants (live crabs, butchered sections, partially processed sections) to prevent the industry from acting as a monopoly.

12.10.12.2 Comments on Specific Elements of the Fishery Management Program:

Comment: There were two comments suggesting that the management unit should be defined only to the Virginia-North Carolina border. The comments indicated this was to avoid overlap with the Golden Crab FMP, managed by the South Atlantic Fishery Management Council, and specifically to avoid potential gear conflicts between the golden crab and red crab fisheries.

Response: The proposed boundaries reflect the traditional extent of the red crab fishery in the Northeast U.S., are consistent with prior action taken by the Secretary of Commerce (the Emergency Regulations), incorporate a well-known biogeographic boundary (Cape Hatteras, NC), and are consistent with other New England Council

FMPs. The option to set the management unit boundary at the Virginia-North Carolina border would have arbitrarily split the traditional fishing area into a managed area and an area subject to no management. This would not necessarily have solved the concern over potential gear conflict issues. In fact, it might have exacerbated it due to the fact that fishing for red crab could still occur south of the Virginia-North Carolina border, but this fishing activity would not be subject to the controls of the Red Crab FMP. It is anticipated that, under the Red Crab FMP, there will be one and at most two vessels that may choose to fish south of the Virginia-North Carolina border. Since the South Atlantic Council reports two golden crab vessels moving to the northern area, it appears that the potential gear conflicts will be limited to, at most, three or four vessels. This is a small number of vessels; thus, the potential for gear conflicts is considered to be small. The Council intends to monitor potential gear conflicts and will consider taking action if warranted.

Comment: One commenter suggested that the fishing year should start on the date that the FMP is implemented.

Response: The Council considered this suggestion, but decided that it would be better to determine the date on which the fishing year will start before submitting the FMP, in order to assist with analysis. It is impossible at this time to predict exactly when the FMP will be implemented. Also, the Council was concerned about the increased administrative burden on the NMFS if there was another fishing year offset from the other existing fishing years. March 1, as selected by the Council, meets the objectives of the Council's preferred alternative to base the start of the fishing year on the actual practices of the fishery, it is consistent with an existing fishing year for the Sea Scallop FMP, and it enables the Council and NMFS to plan when the next fishing year will begin prior to submitting the FMP.

Comment: One commenter suggested that the red crab MSY should be 12 - 15 million pounds, rather than the specified 6.24 million pounds.

Response: The commenter provided no information or rationale in support of the claim that the MSY should be 12 - 15 million pounds. All the information available to the Council and NMFS suggests that the MSY should be 6.24 million pounds, as is indicated in the FMP.

Comment: Several commenters supported the proposed program to require vessels in the controlled access directed fishery to declare into or out of the fishery on an annual basis.

Response: The Council adopted this measure and the FMP will require that all vessels in the controlled access program declare into or out of the fishery for the following fishing year. This will allow the Council to base the allocation of DAS on the number of vessels actually intending to participate in the fishery.

12.10.12.3 Comments on Specific Elements of the Proposed Management Measures:

Comment: A comment from a fishing organization asked the Council to consider an incidental catch limit of 1,000 pounds during the months of November - April, with zero pounds during May - October.

Response: The Council considered this request but was concerned with the proposed zero possession limit during May - October. The fishing organization making this request represents one sector of the fishing industry that may not need an incidental catch limit during May - October, but other sectors of the industry may still wish to have the ability to land some amount of red crab. Because it was the intent of the Council with this measure to allow small amounts of red crab to be landed as incidental catch, rather than to encourage directed fishing for red crab, the Council elected to maintain a 500 pound incidental catch limit year-round.

Comment: One commenter suggested that the incidental catch limit ought to be on the order of 5,000 pounds per trip.

Response: The Council considered a higher trip limit for the incidental catch fishery, but determined that 5,000 pounds exceeded the intent of the proposed incidental catch limit measure, which was intended to allow a small amount of red crab, caught as bycatch in other fisheries, to be landed by vessels not authorized to participate in the controlled access directed fishery. The person making this comment indicated their intent to develop a small directed fishery for red crab, rather than utilizing an incidental catch allowance. Since the development of small-scale but open access directed fishing for red crabs was not the intent of this measure, the Council did not elect to adopt the much higher incidental catch limit.

Comment: One commenter suggested that a minimum size of 4 ½" may be advisable.

Response: The Council considered implementing a minimum size limit for this fishery, but determined that this measure would be too complex and burdensome to effectively administer and enforce if butchering and/or processing at sea was to be allowed. The Council received many comments that butchering and partial processing at sea should be allowed to continue under the FMP. The Council also received many comments that market controls and constraints serve to maintain the average size of landed red crabs at a reasonable size and that undersized crabs (less than one pound) are not accepted. The Council acknowledges that markets can change, so it is requesting that NMFS conduct port sampling on red crab landings to monitor the sizes of the crabs being landed. If the size structure of the landings changes and/or there is an increase in the number or percentage of undersized crabs being landed, the Council will consider implementing an appropriate minimum size regulation at that time via a framework adjustment to the FMP.

Comment: One commenter indicated that he/she would not support a requirement for individual trap tags.

Response: The Council is not proposing to require individual trap tags. Instead, the Council is requiring that each vessel attach a permit declaration that indicates the maximum number of red crab traps they employ per string of traps. All vessels would then be limited in the number of trap strings they can fish to 600 (the maximum number of allowable red crab traps) divided by the maximum number per string specified on their permit declaration, rounded *down* to the nearest whole number. For example, a vessel that declares that they fish a maximum of 100 traps per string would be allowed to fish 6 strings, for a total of 600 traps; a vessel that declares they use a maximum of 180 traps per string would be limited to 3 strings for a total of 540 traps; and a vessel that declares they use a maximum of 125 traps per string would be limited to 4 strings, even though this indicates a maximum of 500 traps. Enforcement of the gear restrictions will utilize gear marking requirements on the buoys on the end of each trap string in conjunction with the permit declaration and occasional spot checks at sea to determine the number of traps actually being used per string.

Comment: One commenter reported that they do not support the need for a trip limit in the red crab fishery.

Response: The trip limit may not be necessary strictly in a fishing mortality control context, but the trip limit is still important as a mechanism to prevent changes in the per day efficiency of the fishing fleet. Large vessels, especially those with processing capabilities, can remain at sea for much longer than smaller vessels that land live crabs. As such, they can spend significantly more DAS actually fishing rather than traveling to and from the fishing grounds. Without a trip limit, there would be no control over how much time a vessel could spend on the fishing grounds versus traveling. This effect could undermine the DAS program and allow much more red crab to be caught per DAS than was anticipated during the DAS allocation process. The trip limit is intended to ensure that, as closely as possible, a DAS is roughly equivalent for all vessels in the fishery.

Comment: Comments from an industry organization indicated that they would support differential trip limits based on each vessel's highest trip on record.

Response: The Council considered this approach and is proposing a slight variation as a differential trip limit for the controlled access red crab fishery. This approach, as suggested by the industry organization, would have resulted in each vessel having a trip limit distinct from all other vessels. The Council felt that this would be too burdensome to implement and monitor for enforcement purposes. This approach also creates problems for how to assign a trip limit to new vessels that might be allowed to enter the fishery at some time in the future, if the Council determines that additional vessels may participate. Because the approach relies on landings history prior to the control date, for any vessel without landings history prior to the control date but granted access to the red crab fishery the Council would not be able to determine its trip limit. Instead, the Council decided to establish a baseline trip limit that would apply to all vessels, with the exception that any vessel that can establish a record of a higher trip during the controlled access qualification period would be granted a trip limit at that level (to the nearest 5,000 pounds).

Comment: Comments from an industry organization opposed individual trip limits based on a vessel's highest trip on record.

Response: As noted above, the Council did not propose to base the trip limit solely on a vessel's highest trip on record. Instead, the Council adopted a baseline trip limit of 75,000 for all vessels, unless they can show evidence of higher trips during the controlled access qualification period.

Comment: An industry organization suggested that, if a trip limit is imposed, they recommend two categories of trip limits: 150,000 pounds per trip for catcher-processor vessels and 75,000 pounds per trip for catcher vessels.

Response: The Council considered a two-tiered approach to the red crab trip limit, but was concerned that this system would allow any vessel claiming to be a catcher-processor to get a much higher trip limit than a vessel claiming to be a catcher vessel. Instead, the Council opted to implement a differential trip limit with a baseline of 75,000 pounds for all vessels, regardless of whether they are catcher-processor vessels or catcher vessels, with the allowance that a vessel with a history of higher trips during the controlled access qualification period could qualify for a higher trip limit. This approach is intended to be more equitable to all vessels, as all vessels would be subject to the baseline trip limit, except for those vessels who traditionally had higher trips. The trip limit does not differentiate between types of vessels.

Comment: An industry organization commented that they believe the controlled access program ought to include all current vessels that participated in the fishery under a letter of authorization during the emergency regulations.

Response: National Standard 1 of the Magnuson-Stevens Act requires the Council to prevent overfishing of all managed resources. The intent of the controlled access program was to establish a fishery with a harvest capacity similar to that which existed prior to the control date. The control date was established as an express way to differentiate participation in the fishery prior to the control date from recent and potentially speculative entrants into the fishery. The regulations implemented in the emergency rule did not control access to the fishery, but allowed an open access fishery for all vessels that requested a letter of authorization (LOA) from NMFS. This allowed vessels which had never participated in the red crab fishery prior to the emergency regulations to request an LOA and fish for red crab. Allowing all vessels that participated in the fishery during the emergency period to participate in the controlled access fishery under the FMP would increase the overall harvest capacity of the fleet to much more than what existed at the time of the control date. This excess harvest capacity could limit the ability of the Council and NMFS to prevent overfishing and maintain a sustainable resource that is not overfished. The excess harvest capacity would also threaten the sustainability of the fishery itself.

Comment: Comments from an industry organization suggested that the control date is invalid and should not be used as the basis for the controlled access program.

Response: The Council disagrees that the control date, March 1, 2000 (65 FR

11029), is invalid. The control date was established with the express purpose of delineating a time after which new entrants into the red crab fishery could be distinguished and potentially be treated separately from those that were involved in the fishery prior to the control date. The control date explicitly stated that the Council was considering developing a limited or controlled access system for the red crab fishery and that the control date could be used to establish qualification criteria for such a program.

Comment: One commenter suggested that the FMP should allow for new entrants to the red crab fishery.

Response: As written, the FMP does allow for new entrants to be allowed into the controlled access fishery, if, at some time in the future, new information indicates that an increase is appropriate and would not threaten the sustainability of the resource or the existing fishery. This type of change could be implemented through a future framework adjustment to the FMP.

Comment: One commenter indicated that they would not support vessel upgrading and transfer restrictions that were retroactive to the control date.

Response: The Council is proposing to implement restrictions on vessel upgrading and transfer, consistent with other FMPs in the Northeast, but these restrictions will not be retroactive. These restrictions are intended to prevent an increase in the overall harvest capacity of the fishing fleet, while allowing for vessels to be upgraded or replaced in order to improve vessel safety as they age.

12.10.13 Index

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14.0 List of Public Meetings

Date	Meeting	Location
January 18, 2000	Red Crab Committee	Danvers, MA
January 18-20, 2000	Council Meeting	Danvers, MA
February 11, 2000	Scoping Meeting	Portsmouth, NH
February 14, 2000	Scoping Meeting	New Bedford, MA
March 22-23, 2000	Council Meeting	Gloucester, MA
January 23, 2001	Red Crab Committee and Advisors	Danvers, MA
January 23-25, 2001	Council Meeting	Danvers, MA
February 26, 2001	Red Crab PDT Meeting	Woods Hole, MA
March 13, 2001	Red Crab Committee	New London, CT
March 14-15, 2001	Council Meeting	New London, CT
April 12, 2001	Red Crab PDT Meeting	Woods Hole, MA
May 1, 2001	Red Crab Committee	Peabody, MA
May 2-3, 2001	Council Meeting	Peabody, MA
May 15, 2001	Red Crab Advisors	Newburyport, MA
June 4, 2001	Red Crab PDT Meeting	Plymouth, MA
June 29, 2001	Red Crab Committee	Danvers, MA
July 24-26, 2001	Council Meeting	Portland, ME
August 8, 2001	Red Crab PDT Meeting	Woods Hole, MA
August 30, 2001	Red Crab PDT Meeting	Woods Hole, MA
October 11, 2001	Red Crab PDT Meeting	Woods Hole, MA
October 29, 2001	Red Crab Committee and Advisors	Danvers, MA
November 6-8, 2001	Council Meeting	Gloucester, MA
December 14, 2001	Public Hearing	Gloucester, MA
December 17, 2001	Public Hearing	New Bedford, MA
January 8, 2002	Red Crab Advisors	Newburyport, MA
January 9, 2002	Red Crab Committee	Mansfield, MA
January 15-17, 2002	Council Meeting	Portsmouth, NH
February 26-27, 2002	Council Meeting	Danvers, MA

15.0 List of Acronyms

ACCSP Atlantic Coastal Cooperative Statistics Program

ALWTRP Atlantic Large Whale Take Reduction Plan

B Biomass

B_0 Virgin Stock Biomass

B_{msy} Biomass at MSY-levels

CEQ Council on Environmental Quality

CPUE Catch-Per-Unit-Effort

CW Carapace Width

DAS Days at Sea

DEIS Draft Environmental Impact Statement

EA Environmental Assessment

EEZ Exclusive Economic Zone

EFH Essential Fish Habitat

EIS Environmental Impact Statement

ESA Endangered Species Act

F Fishing Mortality Rate

FMP Fishery Management Plan

F_{msy} Fishing mortality rate at MSY-levels

FR Federal Register

HAB Harmful Algal Bloom

IFQ Individual Fishing Quota

IVQ Individual Vessel Quota

IVR Interactive Voice Response

IWC International Whaling Commission

LOA Letter Of Authorization

M Natural Mortality Rate

MEY Maximum Economic Yield

MFMT Maximum Fishing Mortality Threshold

MMPA Marine Mammal Protection Act

MSST Minimum Stock Size Threshold

MSY Maximum Sustainable Yield

NEFMC New England Fishery Management Council

NEFSC Northeast Fisheries Science Center

NEPA National Environmental Policy Act

NMFS National Marine Fisheries Service

NOAA National Oceanic and Atmospheric Administration

NSGs National Standard Guidelines

OY Optimum Yield

PBR Potential Biological Removal

PDT Plan Development Team

PREE Preliminary Regulatory Economic Evaluation

RFA Regulatory Flexibility Act

RIR Regulatory Impact Review

RSW Refrigerated Sea Water

SAFE Stock Assessment and Fishery Evaluation

SAFMC South Atlantic Fishery Management Council

SFA Sustainable Fisheries Act

SIA Social Impact Assessment

TAC Total Allowable Catch

VTR Vessel Trip Report

WO Weigh Out

16.0 Glossary

B. Biomass, measured in terms of total weight, spawning capacity, or other appropriate units of production.

B_0. Virgin stock biomass, i.e., the long-term average biomass value expected for the stock in the absence of fishing. In the FMP, B_0 is used as the biomass of red crabs prior to the onset of commercial fishing for this resource.

Biomass weighted F. A measure of fishing mortality that is defined as an average of fishing mortality at age weighted by biomass at age for a ranges of ages within the stock (e.g., ages 1^+ biomass weighted F is a weighted average of the mortality for ages 1 and older, age 3^+ biomass weighted is a weighted average for ages 3 and older). Biomass weighted F can also be calculated using catch in weight over mean biomass. See also fully-recruited F.

B_{msy}. Long term average exploitable biomass of male red crabs that would be achieved if fishing at a constant fishing mortality rate equal to F_{msy}. For most stocks, B_{MSY} is about ½ of the carrying capacity. The proposed overfishing definition control rules call for action when biomass is below ¼ or ½ B_{MSY}, depending on the species.

B_{target}. A desirable biomass to maintain fishery stocks. This is usually synonymous with B_{MSY} or its proxy.

$B_{threshold}$. 1) A limit reference point for biomass that defines an unacceptably low biomass i.e., puts a stock at high risk (recruitment failure, depensation, collapse, reduced long term yields, etc). 2) A biomass threshold that the SFA requires for defining when a stock is overfished. A stock is overfished if its biomass is below $B_{threshold}$. A determination of overfished triggers the SFA requirement for a rebuilding plan to achieve B_{target} as soon as possible, usually not to exceed 10 years except certain requirements are met. $B_{threshold}$ is also known as $B_{minimum}$.

Carapace. The shield-like exoskeletal plate that covers at least part of the anterior dorsal surface of many arthropods.

Catch. The sum total of crabs killed in a fishery in a given period. Catch is given in either weight or number of crabs and may include landings, unreported landings, discards, and incidental deaths.

Control rule. A pre-determined method for determining fishing mortality rates based on the relationship of current stock biomass to a biomass target. The biomass threshold ($B_{threshold}$ or B_{min}) defines a minimum biomass below which a stock is considered overfished.

CPUE. Catch-per-unit-effort, or in this FMP, the average number of marketable red crabs caught per trap, where a single trap haul is considered the standard unit of fishing effort.

Days-at-sea (DAS). The total days, including steaming time that a boat spends at sea to fish.

Exploitable biomass. The biomass of crabs in the portion of the population that is vulnerable to fishing.

Exploitation pattern. Describes the fishing mortality at age as a proportion of fully recruited F (full vulnerability to the fishery). Ages that are fully vulnerable experience 100% of the fully recruited F and are termed fully recruited. Ages that are only partially vulnerable experience a fraction of the fully recruited F and are termed partially recruited. Ages that are not vulnerable to the fishery (including discards) experience no mortality and are considered pre-recruits. Also known as the partial recruitment pattern, partial recruitment vector or fishery selectivity.

Exploitation rate (f). The fraction of crabs in the exploitable population killed during the year by fishing. This is an annual rate compared to F, which is an instantaneous rate. For example, if a population has 1,000,000 crabs large enough to be caught and 550,000 are caught (landed and discarded) then the exploitation rate is 55%.

F. Instantaneous fishing mortality rate. Measures the effective fishing intensity for a given partial recruitment pattern.

$F_{0.1}$. A conservative fishing mortality rate calculated as the F associated with 10 percent of the slope at origin of the yield-per-recruit curve.

Fishing effort. The amount of time and fishing power used to harvest fish. Fishing power is a function of gear size, boat size and horsepower.

F_{MAX}. A fishing mortality rate that maximizes yield per recruit. F_{MAX} is less conservative than $F_{0.1}$.

F_{MSY}. A fishing mortality rate that would produce MSY when the stock biomass is sufficient for producing MSY on a continuing basis.

Framework adjustments. Adjustments within a range of measures previously specified in a fishery management plan (FMP). A change usually can be made more quickly and easily by a framework adjustment than through an amendment. For plans developed by the New England Council, the procedure requires at least two Council meetings including at least one public hearing and an evaluation of environmental impacts not already analyzed as part of the FMP.

$F_{threshold}$. 1) The maximum fishing mortality rate allowed on a stock and used to define overfishing for status determination. 2) The maximum fishing mortality rate allowed for a given biomass as defined by a control rule.

Growth overfishing. Fishing at an exploitation rate or at an age at entry that reduces potential yields from a cohort but does not reduce reproductive output (see recruitment overfishing).

Landings. The portion of the catch that is harvested for personal use or sold.

Limited-access permits. Permits issued to vessels that met certain qualification criteria by a specified date (the "control date").

Maturity ogive. A mathematical model used to describe the proportion mature at age for the entire population. A_{50} is the age where 50% of the crabs are mature.

Mean biomass. The average number of crabs within an age group alive during a year multiplied by average weight at age of that age group. The average number of crabs during the year is a function of starting stock size and mortality rate occurring during the year. Mean biomass can be aggregated over several ages to describe mean biomass for the stock. For example the mean biomass summed for ages 1 and over is the 1^+ mean biomass; mean biomass summed across ages 3 and over is 3^+ mean biomass.

Metric ton. A unit of weight equal to a thousand kilograms (1 kg = 2.2 lbs.). A metric ton is equivalent to 2,205 lbs. A thousand metric tons is equivalent to 2.2 million lbs.

MFMT. Maximum fishing mortality threshold. This is the reference point for determining if overfishing is occurring.

Mortality. See Annual total mortality (A), Exploitation rate (f), Fishing mortality (F), Natural mortality (M), and instantaneous total mortality (Z).

MSST. Minimum stock size threshold. This is the reference point for determining if the stock is in an overfished condition.

MSY. Maximum sustainable yield. The largest long-term average yield (catch) that can be taken from a stock under prevailing ecological and environmental conditions.

Natural mortality. A measurement of the rate of death from all causes other than fishing such as predation, disease, starvation, and pollution. Commonly expressed as an instantaneous rate (M). The rate of natural mortality varies from species to species, but is assumed to be M=0.15 for deep-sea red crab. The natural mortality rate can also be expressed as a conditional rate (termed n and not additive with competing sources of mortality such as fishing) or as annual expectation of natural death (termed v and additive with other annual expectations of death).

Open access. Describes a fishery or permit for which there is no qualification criteria to participate. Open-access permits may be issued with restrictions on fishing (for example, the type of gear that may be used or the amount of crabs that may be caught).

Overfished. An overfished stock is one “whose size is sufficiently small that a change in management practices is required in order to achieve an appropriate level and rate of rebuilding.”

Overfishing. Overfishing "occurs whenever a stock or stock complex is subjected to a rate or level of fishing mortality that jeopardizes the capacity of a stock or stock complex to produce MSY on a continuing basis."

Pre-recruits. Crabs in size or age groups that are not vulnerable to the fishery (including discards).

Recruitment. The amount of crabs added to the fishery each year due to growth and/or migration into the fishing area. For example, the number of crabs that grow to become vulnerable to fishing gear in one year would be the recruitment to the fishery. "Recruitment" also refers to new year classes entering the population (prior to recruiting to the fishery).

Recruitment overfishing. Fishing at an exploitation rate that reduces the population biomass to a point where recruitment is substantially reduced.

Relative exploitation. An index of exploitation derived by dividing landings by trawl survey biomass. This measure does not provide an absolute magnitude of exploitation but allows for general statements about trends in exploitation.

Retrospective pattern. A pattern of systematic over-estimation or underestimation of terminal year estimates of stock size, biomass or fishing mortality compared to that estimate for that same year when it occurs in pre-terminal years.

Spawning stock biomass (SSB). The total weight of crabs in a stock that are sexually mature, i.e., are old enough to reproduce.

Status Determination. A determination of stock status relative to $B_{threshold}$ (defines overfished) and $F_{threshold}$ (defines overfishing). A determination of either overfished or overfishing triggers a SFA requirement for rebuilding plan (overfished), ending overfishing (overfishing) or both.

Stock. A grouping of crabs usually based on genetic relationship, geographic distribution and movement patterns. A region may have more than one stock of a species (for example, Gulf of Maine cod and Georges Bank cod).

Surplus production models. A family of analytical models used to describe stock dynamics based on catch in weight and CPUE time series (fishery dependent or survey) to construct stock biomass history. These models do not require catch at age information. Model outputs may include stock biomass history, biomass weighted fishing mortality rates, MSY, F_{MSY}, B_{MSY}, K, (maximum population biomass where stock growth and natural deaths are balanced) and r (intrinsic rate of increase).

Surplus production. Production of new stock biomass defined by recruitment plus somatic growth minus biomass loss due to natural deaths. The rate of surplus production is directly proportional to stock biomass and its relative distance from the maximum stock size at carrying capacity (K). B_{MSY} is often defined as the biomass that maximizes surplus production rate.

Survival rate (S). Rate of survival expressed as the fraction of a cohort surviving the a period compared to number alive at the beginning of the period (# survivors at the end of the year / numbers alive at the beginning of the year).

Survival ratio (R/SSB). An index of the survivability from egg to age-of-recruitment. Declining ratios suggest that the survival rate from egg to age-of-recruitment is declining.

TAC. Total allowable catch. This value is calculated by applying a target fishing mortality rate to exploitable biomass.

Total mortality. The rate of mortality from all sources (fishing, natural, pollution) Total mortality can be expressed as an instantaneous rate (called Z and equal to F + M) or Annual rate (called A and calculated as the ratio of total deaths in a year divided by number alive at the beginning of the year)

Yield-per-recruit (YPR). The expected yield (weight) of individual crabs calculated for a given fishing mortality rate and exploitation pattern and incorporating the growth characteristics and natural mortality.

Z. Instantaneous rate of total mortality. The components of Z are additive (i.e., Z = F+M.)

17.0 List of References

Agler, B.A., R.L., Schooley, S.E. Frohock, S.K. Katona, and I.E. Seipt. 1993. Reproduction of photographically identified fin whales, *Balaenoptera physalus*, from the Gulf of Maine. J. Mamm. 74:577-587.

Armstrong, D.A. 1990. Commentary on crab management and the east coast United States geryonid fisheries. In *Geryonid Crabs and Associated Continental Slope Fauna: A Research Workshop Report*, W.J. Lindberg and E.L. Wenner, eds. Florida Sea Grant College Technical Paper 58: 23-29.

Barlow, J., and P.J. Clapham. 1997. A new birth-interval approach to estimating demographic parameters of humpback whales. Ecology, 78: 535-546.

Barnette, M.C. 2001. A review of the fishing gear utilized within the Southeast Region and their potential impacts on essential fish habitat. NOAA Technical Memorandum NMFS-SEFSC-449, 62pp.

Barr, B.W. 1993. Environmental impacts of small boat navigation: vessel / sediment interactions and management implications. In Proceeding of the Coastal Zone 1993 Conference, New Orleans, Louisiana, 19-23 July 1993.

Barry, J.P. and M.J. Tegner. 1989. Inferring demographic processes from size frequency distributions: simple models indicate specific patterns of growth and mortality. Fish. Bull. 88: 13-19.

Baum, E. 1997. Maine Atlantic Salmon, A National Treasure. Atlantic Salmon Unlimited, Hermon, Maine. 224 pp.

Berube, M. and A. Aguilar. 1998. A new hybrid between a blue whale, *Balaenoptera musculus*, and a fin whale, *B. physalus*: frequency and implications of hybridization. Mar. Mamm. Sci. 14:82-98.

Best, P.B. 1979. Social organization in sperm whales, *Physeter macrocephalus*, pp. 227-289. In: H.E. Winn and B.L. Olla (eds.), Behavior of marine animals, Vol. 3: Cetaceans. Plenum Press, New York.

Blaylock, R.A., J.W. Hain, L.J. Hansen, D.L. Palka, and G.T. Waring. 1995. U.S. Atlantic and Gulf of Mexico marine mammal stock assessments. NOAA Tech. Memo. NMFS-SEFSC-363. U.S. Department of Commerce, Washington, D.C. 211 pp.

Boesch, D.F., D.M. Anderson, R.A. Horner, S.E. Shumway, P.A. Tester, and T.E. Whitledge. 1997. Harmful algal blooms in coastal waters: options for prevention, control and Mitigation. NOAA coastal Ocean Program Decision Analysis Series No. 10. NOAA Coastal Ocean Office, Silver Spring, MD. 46 pp. + appendix.

Buchholtz ten Brink, M.R., F.T. Manheim, and M.H. Bothner. 1996. Contaminants in the Gulf of Maine: What's there and should we worry? In The Health of the Gulf of Maine Ecosystem: Cumulative Impacts of Multiple Stressors, RARGOM Report 96-1, Dow, D. and Braasch, E., editors.

Caddy, J.R., R.A. Chandler, and D.G. Wilder. 1974. Biology and commercial potential of several underexploited molluscs and crustaceans on the Atlantic coast of Canada. A paper presented to the Federal-Provincial Fisheries Committee meeting on Utilization of Atlantic Resources, Montreal, CAN, 111pp.

Caswell, H., M. Fujiwara, and S. Brault. 1999. Declining survival probability threatens the North Atlantic right whale. Proc. Nat. Acad. Sci. 96: 3308-3313

Cetacean and Turtle Assessment Program (CeTAP). 1982. Final report or the cetacean and turtle assessment program, University of Rhode Island, to Bureau of Land Management, U.S. Department of the Interior. Ref. No. AA551-CT8-48. 568 pp.

Clapham, P.J. (Ed.) 1999. Predicting right whale distribution, Report of the workshop held on October 1 and 2, 1998, in Woods Hole, Massachusetts. Northeast Fisheries Science Center Reference Document 99-11. 44 pp.

Clark, C.W. 1995. Application of U.S. Navy underwater hydrophone arrays for scientific research on whales. Rep. Int. Whal. Comm. 45: 210-212.

Clarke, R. 1954. Open boat whaling in the Azores: the history and present methods of a relic history. Discovery Rep. 26:281-354.

Coe, J.M. and D.B. Rogers (eds.). 1997. Marine Debris: Sources, Impacts, and Solutions. Springer-Verlag New York, Inc.

Cutler, E.B. and K. Doble. 1979. North Carolina continental slope zoogeographical barrier. Deep-Sea Research 26:851-853.

DOC (Department of Commerce). 2001. Magnuson-Stevens Fishery Conservation and Management Act Provisions; Fisheries of the Northeastern United States; Atlantic Deep-sea Red Crab Fishery. NOAA, 50 CFR Part 648. *Federal Register* 66(141): 38165.

Duggan, D.R. and P. Lawton. 1998. Scotian shelf red crab. Canada DFO Science Stock Status Report C3-11, Dartmouth, Nova Scotia, 6pp.

Eckert, S.A., D.W. Nellis, K.L. Eckert, and G.L. Kooyman. 1996. Diving Patterns of Two Leatherback Sea Turtles, (*Demochelys coriacea*) During Interesting Intervals at Sandy Point, St. Croix, U.S. Virgin Islands. Herpetologica. Sep. 42(3):381-388.

Eldridge, P. 1972. The king crab fisheries in the Gulf of Alaska. Pages 211-266, in D.H. Rosenberg (ed), A review of the oceanography and renewable resources of the northern Gulf of Alaska. Institute of Marine Science Report, R72-72, University of Alaska Fairbanks. 690pp.

Elner, R.W. 1986. Overview of biology for deep-sea red crab, *Geryon quinquedens*, in the Northwest Atlantic. Canadian Atlantic Fisheries Scientific Advisory Committee, CAFSAC Research Document 86/82. 11pp.

Elner, R.W., S. Koshio, and G.V. Hurley. 1987. Mating behavior of the deep-sea red crab, *Geryon quinquedens* Smith (Decapoda, Brachyura, Geryonidae). Crustaceana 52(2):194-201.

Eno, N.C., D.S. MacDonald, and S.C. Amos. 1996. A study on the effects of fish (crustacea/mollusc) traps on benthic habitats and species, Final Report to the European Commission, Study Contract No. 94/076.

Ernst, C.H. and R.W. Barbour. 1972. Turtles of the United States. Univ. Press of Kentucky, Lexington. 347 pp.

Farlow, J. , Jr. 1980. Natural history and ecology of a demersal fish-megafaunal community from the upper continental slope off southern New England. Ph.D. dissertation. Yale Univ., New Haven. 430 pp.

Fernández-Vergaz, V. L., J. López Abellán, and E. Balguerias. 2000. Morphometric, functional and sexual maturity of deep-sea red crab *Chaceon affinis* inhabiting Canary Island waters: chronology of maturation. Mar. Ecol. Prog. Ser. 204: 169-178.

Ganz, A.R. and J.F. Herrmann. 1974. Investigations into the southern New England red crab fishery: A progress report. R.I. Dept. of Natural Resources, Div. of Fish and Wildlife, Marine Fisheries Section. 18pp.

Ganz, A.R. and J.F. Herrmann. 1975. Investigations into the southern New England red crab fishery. RI Dept. of Nat. Resources, Div. Fish Wildlife, June 1975.

Goff, G.P. and J. Lien. 1988. Atlantic leatherback turtle, *Dermochelys coriacea*, in cold water off Newfoundland and Labrador. Can. Field Nat.102(1):1-5.

Gray, G., Jr. 1970. Investigation of the basic life history of the red crab (*Geryon quinquedens*). RI Div. Of Conservation Completion Rept. P.L. 88-309, Project 3-46-R.

Gulland, J.A. 1971. The fish resources of the ocean. Fishing News Ltd., London, 255pp.

Haefner, P.A., Jr. 1977. Reproductive biology of the female deep-sea red crab, *Geryon quinquedens*, from the Chesapeake Bight. Fish. Bull. 75(1): 91-102.

Haefner, P.A., Jr. 1978. Seasonal aspects of the biology, distribution, and relative abundance of the deep-sea red crab, *Geryon quinquedens* Smith, in the vicinity of the Norfolk Canyon, western North Atlantic. Proc. Natl. Shellfisheries Assoc.

68:49-62.

Haefner, P.A., Jr. and J.A. Musick. 1974. Observations on distribution and abundance of red crabs in Norfolk Canyon and adjacent continental slope. Marine Fisheries Review, 36(1):31-34.

Hain, J. H. W. 1975. The international regulation of whaling. Marine Affairs J. 3: 28-48.

Hain, J.H.W., M.J. Ratnaswamy, R.D. Kenney, and H.E. Winn. 1992. The fin whale, Balaenoptera physalus, in waters of the northeastern United States continental shelf. Rep. Int. Whal. Comm. 42: 653-669.

Hall-Arber. M., C. Dyer, J. Pogge, J. McNealy, and R. Gagged. 2001. "Fishing Communities and Fishing Dependency in the Northeast Region of the United States;" Draft MARFIN Project Report, Grant #NA87FF0547.

Hamilton, P.K., and C.A. Mayo. 1990. Population characteristics of right whales (Eubalaena glacialis) observed in Cape Cod and Massachusetts Bays, 1978-1986. Rep. Int. Whal. Comm., Special Issue 12: 203-208.

Hamilton, P.K., M.K. Marx, and S.D. Kraus. 1998. Scarification analysis of North Atlantic right whales (Eubalaena glacialis) as a method of assessing human impacts. Final report to the Northeast Fisheries Science Center, NMFS, Contract No. 4EANF-6-0004.

Hastie, L.C. 1995. Deep-water Geryonid crabs: a continental slope resource. Oceanography and Marine Biology: an Annual Review, 33:561-584.

Hecker, B. 1983. Canyon and slope processes study. Biological Processes, Final Report to the U.S. Dept. of Interior, Minerals Management Service, Washington, D.C.

Hines, A. H. 1988. Fecundity and reproductive output of two species of deep-sea crabs, *Geryon fenneri* and *G. quinquedens* (Decapoda, Brachyura). J. Crust. Biol. 8: 557-562.

Hoagland, P. and H.L. Kite-Powell. 1997. *Characterization and Mitigation of Marine Debris in the Gulf of Maine*, A report prepared for the U.S. Gulf of Maine Association under contract no. GM 97-13.

Holmsen, A.A. 1978. The Red Crab Industry: A report to the New England Fishery Management Council. Kingston, RI. 25 pp.

Holmsen, A.A and H. McAllister. 1974. Technological and economic aspects of red crab harvesting and processing. University of Rhode Island Marine Technical Report Number 28, Kingston, Rhode Island, 35pp.

ICES (International Council for the Exploration of the Sea). 1991. Report of the study group on ecosystem effects of fishing activities. Lowestoft, 11-15 March 1991.

ICES C.M. 1991/G:7 Session Y.

IWC (International Whaling Commission). 1971. Report of the Special Meeting on Sperm Whale Biology and Stock Assessments. Rep. Int. Whal. Comm. 21:40-50.

IWC. 1992. Report of the comprehensive assessment special meeting on North Atlantic fin whales. Rep. Int. Whal. Comm 42:595-644.

Jivoff, P. 1997. Sexual competition among male blue crab, *Callinectes sapidus*. Biol. Bull. Mar. Biol. Lab. 193(3): 368-380.

Katona, S.K., and J.A. Beard. 1990. Population size, migrations, and feeding aggregations of the humpback whale (*Megaptera novaeangliae*) in the Western North Atlantic Ocean. Rep. Int. Whal. Comm., Special Issue 12: 295-306.

Kendall, M. S., D. L. Wolcott, T. G. Wolcott , and A. H. Hines. 2001. Reproductive potential of individual male blue crabs, *Callinectes sapidus*, in a fished population: depletion and recovery of sperm number and seminal fluid. Can. J. Fish. Aquat. Sci. 58(6): 1168-1177.

Kenney, R.D., M.A.M. Hyman, R.E. Owen, G.P. Scott, and H.E. Winn. 1986. Estimation of prey densities required by Western North Atlantic right whales. Mar. Mamm. Sci. 2(1): 1-13.

Klumov, S.K. 1962. The right whale in the Pacific Ocean. In P.I. Usachev (Editor), Biological marine studies. Trud. Inst. Okeanogr. 58: 202-297.

Knowlton, A. R., J. Sigurjonsson, J.N. Ciano, and S.D. Kraus. 1992. Long-distance movements of North Atlantic right whales (Eubalaena glacialis). Mar. Mamm. Sci. 8(4): 397-405.

Knowlton, A.R., S.D. Kraus, and R.D. Kenney. 1994. Reproduction in North Atlantic right whales (Eubalaena glacialis). Can. J. Zool. 72: 1297-1305.

Kraus, S.D. 1990. Rates and Potential Causes of Mortality in North Atlantic Right Whales (*Eubaleana glacialis*). Mar. Mamm. Sci. 6(4):278-291.

Kruse, G. H., L. C. Byrne, F. Funk, S. Matulich, and J. Zheng. 2000. Analysis of minimum size limit for the red king crab fishery in Bristol Bay, Alaska. N. Amer. J. Fisheries Manag. 20: 307-319.

Larsen, P.F. 1992. An overview of the environmental quality of the Gulf of Maine. In: The Gulf of Maine, NOAA coastal Ocean Program Regional Synthesis Series No. 1. 71-95.

Lawton, P. and D. Duggan. 1998. Scotian red crab. [Canadian] Maritimes Region – DFO Sci. Stock Status Rept. C3-11. 6p.

Leary, T.R. 1957. A schooling of leatherback turtles, Dermochelys coriacea, on the Texas coast. Copeia 1957:232.

Leatherwood, S., and R.R. Reeves. 1983. The Sierra Club handbook of whales and dolphins. Sierra Club Books, San Francisco, California. 302 pp.

Lux, F.E., A.R. Ganz, and W.F. Rathjen. 1982. Marking studies on the red crab *Geryon quinquedens* Smith off southern New England. Journal of Shellfish Research 2(1):71-80.

MacDiarmid, A. B. and M. J. Butler. 1999. Sperm economy and limitation in spiny lobsters. Behav. Ecol. Sociobiol. 46(1): 14-24.

Malik, S., M. W. Brown, S.D. Kraus and B. N. White. 2000. Analysis of mitochondrial DNA diversity within and between North and South Atlantic right whales. Mar. Mammal Sci. 16:545-558.

Manning, R.B. 1990. Studies on systematics of Geryonid crabs. *In* Geryonid Crabs and Associated Continental Slope Fauna: A Research Workshop Report, W.J. Lindberg and E.L. Wenner, eds. Florida Sea Grant College Technical Paper No. 58, FLSGP-W-89-001. 61 pp.

Manning, R.B. and L.B. Holthius. 1989. Two new genera and nine new species of geryonid crabs (Crustacea, Decapoda, Geryonidae). Proceedings of Biological Society of Washington 102(1):50-77.

Mate, B.M., S.L. Nieukirk, and S.D. Kraus. 1997. Satellite monitored movements of the North Atlantic right whale. J. Wildl. Manage. 61:1393-1405.

Mayo, C.A., and M.K. Marx. 1990. Surface foraging behavior of the North Atlantic right whale, Eubalaena glacialis, and associated zooplankton characteristics. Can. J. Zool. 68:2214-2220.

McCay, B. and M. Cieri. 2000. “Fishing Ports of the Mid-Atlantic: A Social Profile.” Report to the Mid-Atlantic Fishery Management Council, Dover, Delaware.

Meade, T.L. and G.W. Gray, Jr. 1973. The Red Crab. University of Rhode Island Marine Technical Report Number 11, Kingston, Rhode Island, 21pp.

Melville-Smith, R. 1987. Movements of deep-sea red crab (*Geryon maritae*) off south west Africa/Namibia. S. Afr. J. Zool. 22(2): 143-152.

Melville-Smith, R. 1988a. The commercial fishery for and population dynamics of red crab *Geryon maritae* off south west Africa, 1976-1986. South African Journal of Marine Science 6:79-95.

Melville-Smith, R. 1988b. Comparative population size estimates for a portion of the red crab *Geryon maritae* stock off the south west African coast. South African

Journal of Marine Science 6:23-31.

Melville-Smith, R. 1989. A growth model for the deep-sea red crab *Geryon maritae* off south west Africa / Namibia. Crustaceana 56(3):279-292.

Messieh, S.N., T.W. Rowell, D.L. Peer, and P.J. Cranford. 1991. The effects of trawling, dredging and ocean dumping on the eastern Canadian continental shelf seabed. Cont. Shelf Res. 11(8-10): 1237-1263.

MAFMC (Mid-Atlantic Fishery Management Council). 1999. Draft Tilefish Management Plan. Dover, DE. 240pp.

Mitchell, E. 1974. Present status of the northwest Atlantic fin and other whale stocks. Pages 108-169 in W. E. Schevill (ed) The Whale Problem: A status report. Harvard University Press. Cambridge, Massachusetts, 419pp.

Mitchell, E. and D.G. Chapman. 1977. Preliminary assessment of stocks of northwest Atlantic sei whales (Balaenoptera borealis). Rep. Int. Whal. Comm. Special Edition 1:117-120.

Mitchell, E. and R.R. Reeves. 1983. Catch history, abundance, and present status of northwest Atlantic humpback whales. Rep. Int. Whal. Commn (Spec. Iss. 5):153-212.

Mizroch, S.A. and A.E. York. 1984. Have pregnancy rates of Southern Hemisphere fin whales, *Balaenoptera physalus*, increased? Rep. Int. Whal. Commn (Spec. Iss. 6):401-410.

Murison, L.D., and D.E. Gaskin. 1989. The distribution of right whales and zooplankton in the Bay of Fundy, Canada. Can. J. Zool. 67:1411-1420.

Murray, H.E. 1974. Size distribution of deep-sea red crab, *Geryon quinquedens*, caught on RV Albatross IV cruises 74.6 and 74.7. Northeast Fisheries Center (NMFS). Lab. Ref. No. 74-2.

NCSU (North Carolina State University). 1998. *Pfiesteria piscicida* Homepage. Aquatic Botany Laboratory Website: www2.ncsu.edu/unity/lockers/project/ aquatic_botany/ pfiest.html.

NEFMC (New England Fishery Management Council). 1986. Lead Council Designation. Saugus, MA. 3pp.

NEFMC. 1998. [Omnibus] Essential Fish Habitat Amendment to the Groundfish, Sea Scallop, Monkfish, Atlantic Salmon and Atlantic Herring FMPs. Saugus, MA.

NEFMC. 2000a. Report from the Groundfish Social Impact Informational Meetings. Newburyport, MA. 73pp.

NEFMC. 2000b. Habitat Annual Review Report. Newburyport, MA. 120pp.

NMFS. 1982. Status of the Fishery Resources Off the Northeastern United States for 1981. U.S. Dept. of Commerce, NOAA Technical Memorandum NMFS-F/NEC-12, Woods Hole, MA. 114pp.

NMFS. 1983. Status of the Fishery Resources Off the Northeastern United States for 1982. U.S. Dept. of Commerce, NOAA Technical Memorandum NMFS-F/NEC-22, Woods Hole, MA. 128pp.

NMFS. 1986. Status of the Fishery Resources Off the Northeastern United States for 1986. U.S. Dept. of Commerce, NOAA Technical Memorandum NMFS-F/NEC-43, Woods Hole, MA. 130pp.

NMFS. 1991a. Final recovery plan for the humpback whale (*Megaptera novaeangliae*). Prepared by the Humpback Whale Recovery Team for the National Marine Fisheries Service, Silver Spring, Maryland. 105 pp.

NMFS. 1991b. Final recovery plan for the North Atlantic right whale (Eubalaena glacialis). Prepared by the Right Whale Recovery Team for the National Marine Fisheries Service, Silver Spring, Maryland. 86 pp.

NMFS. 1998a. Draft recovery plans for the fin whale (*Balaenoptera physalus*) and sei whale (*Balaenoptera borealis*). Prepared by R.R. Reeves, G.K. Silber, and P.M. Payne for the National Marine Fisheries Service, Silver Spring, Maryland. July 1998.

NMFS. 1998b. Recovery plan for the blue whale (*Balaenoptera musculus*). Prepared by Reeves, R.R., P.J. Clapham, and R.L. Brownell, Jr. for the National Marine Fisheries Service, Silver Spring, Maryland.

NMFS. 1999. Final Environmental Impact Statement and Regulatory Impact Review for Federal Lobster Management in the Exclusive Economic Zone, NMFS Northeast Region, Gloucester, MA. 165 pp.

NMFS. 2000a. Fisheries of the United States 1999. U.S. Dept. of Commerce, NMFS Current Fishery Statistics No. 9900, Silver Spring, MD. 126pp.

NMFS. 2000b. Guidelines for economic analyses of fishery management actions. Office of Sustainable Fisheries, Silver Spring, Maryland. 59 pp.

NMFS. 2001a. Secretarial Emergency Action for the Deep-Sea Red Crab (*Chaceon quinquedens*) Fishery Environmental Assessment and Regulatory Impact Review, NMFS Northeast Region, Gloucester, MA. 42pp.

NMFS. 2001b. Stock assessments of loggerheads and leatherback sea turtles and an assessment of the impact of the pelagic longline fishery on the loggerhead and leatherback sea turtles of the Western North Atlantic. U.S. Department of

Commerce, National Marine Fisheries Service, Southeast Fisheries Science Center, Miami, FL, SEFSC Contribution PRD-00/01-08; Parts I-III and Appendices I-IV. NOAA Tech. Memo NMFS-SEFSC-455, 343 pp.

NMFS. 2002. Endangered Species Act Section 7 Consultation Biological Opinion for the National Marine Fisheries Service, Gloucester, MA Consultation No. F/NER/2001/01245, 67pp.

NMFS and USFWS (U.S. Fish and Wildlife Service). 1991. Recovery plan for U.S. population of loggerhead turtle. National Marine Fisheries Service, Washington, D.C. 64 pp.

NMFS and USFWS. 1992. Recovery plan for leatherback turtles in the U.S. Caribbean, Atlantic, and Gulf of Mexico. National Marine Fisheries Service, Washington, D.C. 65 pp.

NMFS and USFWS. 1995. Status reviews for sea turtles listed under the Endangered Species Act of 1973. National Marine Fisheries Service, Silver Spring, Maryland. 139 pp.

NOAA (National Oceanic and Atmospheric Administration). 1994. Habitat Protection Activity Report 1991-1993. Office of Habitat Protection, Silver Spring, MD.

NOAA. 1997. NOAA's estuarine eutrophication survey. Vol. 2: Mid-Atlantic Region. Silver Spring, MD: Office of Ocean Resources Conservation and Assessment. 51p.

NSF (National Science Foundation) and NOAA. 1998. The Harmful Algae Page. Website: http://habserv1.whoi.edu/hab/.

O'Reilly, J.E. 1994. Nutrient loading and eutrophication. In Selected living resources, habitat conditions, and human perturbations of the Gulf of Maine. NOAA Tech. Mem. NMFS-NE-106.

Omori, M., S. VanDerSpoel, and C.P. Norman. 1994. Impact of human activities on pelagic biogeography. Prog. Oceanog. 34: 211-219.

Paul, A. J. and J. M. Paul. 1996. Observations on mating of multiparous *Chionoecetes bairdi* Rathbun (Decopoda: Majidae) held with different sizes of males and one-clawed males. J. Crust. Biol. 16(2): 295-299.

Payne, P.M., D.N. Wiley, S.B. Young, S. Pittman, P.J. Clapham, and J.W. Jossi. 1990. Recent fluctuations in the abundance of baleen whales in the southern Gulf of Maine in relation to changes in selected prey. Fish. Bull. 88 (4): 687-696.

Pearce, J.B. 1994. Mining of seabed aggregates. In Selected living resources, habitat conditions, and human perturbations of the Gulf of Maine. NOAA Tech. Mem. NMFS-NE-106.

Perry, S.L., D.P. DeMaster, and G.K. Silber. 1999. The Sperm Whale In: The great whales: History and status of six species listed as endangered under the U.S. Endangered Species Act of 1973. Mar. Fish. Rev. Special Edition. 61(1): 59-74.

Prescott, R.L. 1988. Leatherbacks in Cape Cod Bay, Massachusetts, 1977-1987, p 83-84 In: B.A. Schroeder (comp.), Proceedings of the Eighth Annual Workshop on Sea Turtle Conservation and Biology. NOAA Technical Memorandum NMFS-SEFC-214.

Pritchard, P.C.H. 1982. Nesting of the leatherback turtle, Dermochelys coriacea, in Pacific, Mexico, with a new estimate of the world population status. Copeia 1982:741-747.

Rebel, T.P. 1974. Sea turtles and the turtle industry of the West Indies, Florida and the Gulf of Mexico. Univ. Miami Press, Coral Gables, Florida.

Reeves, R.R., and Mitchell, E. 1988. History of whaling in and near North Carolina. NOAA Tech. Rep. NMFS 65: 28 pp.

Reeves, R.R., Breiwick, J.M., and Mitchell, E. 1992. Pre-exploitation abundance of right whales off the eastern United States. Pp. 5-7 in J. Hain (ed.), The right whale in the western North Atlantic: a science and management workshop, 14-15 April 1992, Silver Spring, Maryland. National Marine Fisheries Service, NEFSC Ref. Doc. 92-05.

Reid, R.N., F.P. Almeida, and C.A. Zetlin. 1999. Essential Fish Habitat Source Document: Fishery-Independent Surveys, Data Sources, and Methods. NOAA Technical Memorandum NMFS-NE-122, 39pp.

Restrepo, V.R., G.G. Thompson, P.M. Mace, W.L. Gabriel, L.L. Low, A.D. MacCall, R.D. Methot, J.E. Powers, B.L. Taylor, P.R. Wade, J.F. Witzig. 1998. Technical guidance on the use of precautionary approaches to implementing National Standard 1 of the Magnuson-Stevens Fishery Conservation and Management Act. NOAA Technical Memorandum NMFS-F/SPO-31, 54 pp.

Robbins, J., and D. Mattila. 1999. Monitoring entanglement scars on the caudal peduncle of Gulf of Maine humpback whales. Report to the National Marine Fisheries Service. Order No. 40EANF800288. 15 pp.

Ross, J.P. 1979. Green turtle, *Chelonia mydas*, Background paper, summary of the status of sea turtles. Report to WWF/IUCN. 4pp.

SAFMC (South Atlantic Fishery Management Council). 1995. Final Fishery Management Plan for the Golden Crab Fishery of the South Atlantic Region. Charleston, South Carolina. 195pp.

Sainte-Marie, B., N. Urbani, J.M. Sevigny, F. Hazel, and U. Kuhnlein. 1999. Multiple choice criteria and the dynamics of assortative mating during the first breeding season of female snow crab *Chionoectes opilio* (Brachyure, Majidae). Mar. Ecol. Prog. Ser. 181: 141-153.

Scarrat, D.J. 1987. Fisheries interests and ocean mining. Mar. Min. 6: 141-147.

Schaeff, C.M., Kraus, S.D., Brown, M.W., Perkins, J.S., Payne, R., and White, B.N. 1997. Comparison of genetic variability of North and South Atlantic right whales (Eubalaena), using DNA fingerprinting. Can. J. Zool. 75:1073-1080.

Schevill, W.E., W.A. Watkins, and K.E. Moore. 1986. Status of Eubalaena glacialis off Cape Cod. Rep. Int. Whal. Comm., Special Issue 10: 79-82.

Schmitz, W.J., W.R. Wright and N.G. Hogg. 1987. Physical oceanography, *In* The Marine Environment of the U.S. Atlantic Continental Slope and Rise, J.D Milliman and W.R Wright, eds. Boston/Woods Hole, MA.

Seipt, I., P.J. Clapham, C.A. Mayo, and M.P. Hawvermale. 1990. Population characteristics of individually identified fin whales, *Balaenoptera physalus*, in Massachusetts Bay. Fish. Bull. 88:271-278.

Serchuk, F.M. 1977. Assessment of the red crab (*Geryon quinquedens*) populations in the northwest Atlantic. NMFS Northeast Fisheries Center Laboratory Reference #77-23, Woods Hole, Massachusetts, 15pp.

Serchuk, F. and R. Wigley. 1979. Deep-sea red crab, *Geryon quinquedens* Smith 1879. New York Bight Atlas. 8 pp.

Shoop, C.R. and R.D. Kenney. 1992. Seasonal distributions and abundance of loggerhead and leatherback sea turtles in waters of the northeastern United States. Herpetol. Monogr. 6: 43-67.

Spotila, J.R., A.E. Dunham, A.J. Leslie, A.C. Steyermark, P.T. Plotkin, and F.V. Paladino. 1996. Worldwide Population Decline of *Demochelys coriacea*: Are Leatherback Turtles Going Extinct? Chelonian Conservation and Biology 2(2): 209-222.

Spotila, J.R., R.D. Reina, A.C. Steyermark, P.T. Plotkin, and F.V. Paladino. 2000. Pacific leatherback turtles face extinction. Nature. 405(6786):529-530.

Steimle, F.W., C. Zetlin, and S. Chang. 2001. Essential Fish Habitat Source Document: Red Crab, *Chaceon (Geryon) quinquedens*, Life History and Habitat Characteristics. U.S. Dept. of Commerce NOAA Tech. Mem. NMFS-NE-163. Woods Hole, MA. 27pp.

Stone, H. and R.F.J. Bailey. 1980. A survey of the red crab resource on the continental slope, N.E. Georges Bank and western Scotian Shelf. Can. Tech. Rep. Fish. Aquat. Sci. 977, iii + 9p.

Swingle, W.M., S.G. Barco, T.D. Pitchford, W.A. McLellan, and D.A. Pabst. 1993. Appearance of juvenile humpback whales feeding in the nearshore waters of Virginia. Mar. Mamm. Sci. 9: 309-315.

Tucholke, B.E. 1987. Submarine geology, *In* The Marine Environment of the U.S. Atlantic Continental Slope and Rise, J.D Milliman and W.R Wright, eds. Boston/Woods Hole, MA.

TEWG (Turtle Expert Working Group). 1998. An assessment of the Kemp's ridley (*Lepicochelys kempii*) and loggerhead (*Caretta caretta*) sea turtle populations in the Western North Atlantic. NOAA Technical Memorandum NMFS-SEFSC-409. 96 pp.

TEWG. 2000. Assessment update for the Kemp's ridley and loggerhead sea turtle populations in the western North Atlantic. U.S. Dep. Commer. NOAA Tech. Mem. NMFS-SEFSC-444, 115 pp.

USEPA (U.S. Environmental Protection Agency). 1994. Status and efforts to control aquatic debris. EPA-842-K94-002. USEPA Office of Water, Washington, D.C.

USFWS (U.S. Fish and Wildlife Service). 1997. Synopsis of the biological data on the green turtle, *Chelonia mydas* (Linnaeus 1758). Biological Report 97(1). U.S. Fish and Wildlife Service, Washington, D.C. 120 pp.

Waller, R., H. Perry, C. Trigg, J. McBee, R. Erdman, and N. Blake. 1995. Estimates of the harvest potential and distribution of the deep sea red crab, *Chaceon quinquedens*, in the northcentral Gulf of Mexico. Gulf Research Reports 9(2):75-84.

Waring, G.T., C.P. Fairfield, C.M. Ruhsam, and M. Sano. 1993. Sperm whales associated with Gulf Stream features off the northeastern USA shelf. Fish. Oceanogr. 2(2):101-105.

Waring, G.T., J.M. Quintal, S.L. Swartz (eds). 2000. U.S. Atlantic and Gulf of Mexico marine mammal stock assessments - 2000. NOAA Technical Memorandum NMFS-NE-162.

Waring, G.T., J.M. Quintal, S.L. Swartz (eds). 2001. Draft U.S. Atlantic and Gulf of Mexico marine mammal stock assessments - 2001. NOAA Technical Memorandum.

Watkins, W.A., and W.E. Schevill. 1982. Observations of right whales (*Eubalaena glacialis*) in Cape Cod waters. Fish. Bull. 80(4): 875-880.

Watkins, W.A., K.E. Moore, J. Sigurjonsson, D. Wartzok, and G. Notarbartolo di Sciara. 1984. Fin whale (*Balaenoptera physalus*) tracked by radio in the Irminger Sea. Rit Fiskideildar 8(1): 1-14.

White, A.W., J. Nassif, S.E. Shumway, and D.K. Wittaker. 1993. Recent occurrence of paralytic shellfish toxins in offshore shellfish in the northeaster United States. In: *Toxic Phytoplankton Blooms in the Sea*. T.J. Smayda and Y. Shimizu (eds.) Elsevier Science Publishers B.V.

Wiebe, P.H., E.H. Backus, R.H. Backus, D.A. Caron, P.M. Glibert, J.F. Grassle, K. Powers, and J.B. Waterbury. 1987. Biological oceanography, *In* The Marine Environment of the U.S. Atlantic Continental Slope and Rise, J.D Milliman and W.R Wright, eds. Boston/Woods Hole, MA.

Wigley, R.L., R.B. Theroux, and H.E. Murray. 1975. Deep-sea red crab, *Geryon quinquedens*, survey off northeastern United States. Marine Fisheries Review 37(8):1-21.

Wiley, D.N., R.A. Asmutis, T.D. Pitchford, and D.P. Gannon. 1995. Stranding and mortality of humpback whales, *Megaptera novaengliae*, in the mid-Atlantic and southeast United States, 1985-1992. Fish. Bull., U.S. 93:196-205.

Wilk, S.J. and B.W. Barr. 1994. Multiple-use issues in estuarine and coastal habitat loss. In Selected living resources, habitat conditions, and human perturbations of the Gulf of Maine. NOAA Tech. Mem. NMFS-NE-106.

Winn, H.E., C.A. Price, and P.W. Sorensen. 1986. The distributional biology of the right whale (Eubalaena glacialis) in the western North Atlantic. Rep. Int. Whal. Comm.. Spec. Iss. 10:129-138.

Wynne, K. and M. Schwartz. 1999. Guide to marine mammals and turtles of the U.S. Atlantic and Gulf of Mexico. Rhode Island Sea Grant, Narragansett. 115pp.

Young, R.R. 1989. Shell disease among red crabs inhabiting submarine canyons of the New York Bight. NOAA Technical Memorandum NMFS-F/NEC-77, 9pp.

Zug, G. R. and J.F. Parham. 1996. Age and growth in leatherback turtles, *Dermochelys coriacea*: a skeletochronological analysis. Chelonian Conservation and Biology. 2(2): 244-249.