Fishery Management Plan
Environmental Impact Statement
Regulatory Impact Review
and
Initial Regulatory Flexibility Analysis
for the
Northeast Multi-Species Fishery

Prepared by

New England Fishery Management Council

in consultation with

Mid-Atlantic Fishery Management Council

August, 1985

COVER SHEET

RESPONSIBLE AGENCIES:

Assistant Administrator for Fisheries
National Oceanic and Atmospheric Adm.
U.S. Department of Commerce
Washington, DC 20235

New England Fishery Management Council
Suntaug Office Park
5 Broadway (Route 1)
Saugus, MA 01906

PROPOSED ACTIONS:

Adoption, approval, and implementation of the Fishery Management Plan for the Northeast Multi-Species Fishery.

FOR FURTHER INFORMATION CONTACT:

Douglas G. Marshall, Executive Director
New England Fishery Management Council
Suntaug Office Park, 5 Broadway (Route 1)
Saugus, MA 01906
(617) 231-0422

TYPE OF STATEMENT:

( ) Draft (X) Final

ABSTRACT:

The New England Fishery Management Council and the Assistant Administrator for Fisheries (NOAA) propose to adopt, approve and implement pursuant to the Magnuson Fishery Conservation and Management Act a Fishery Management Plan for the Northeast Mutli-Species Fishery.

The major species included in the Northeast Multi-Species FMP and for which fishing will be subject to specific regulations are cod, haddock, pollock, redfish, yellowtail flounder, winter flounder (blackback), American plaice (dab), witch flounder (gray sole), windowpane flounder, and white hake. The list is not exclusive, and if necessary, other species may be directly regulated under this plan in the future.

Major management measures include, but are not limited to, commercial minimum size regulations for cod, haddock, pollock, yellowtail, witch flounder, Am. plaice and winter flounder; minimum recreational sizes for cod and haddock; minimum mesh size regulations for the trawl and gillnet fisheries in the Gulf of Maine and on Georges Bank; major changes in regulations regarding the use of small mesh trawl gear in New England waters; extended closed areas for haddock spawning on Georges Bank; a closed area for yellowtail flounder in the Southern New England/Mid-Atlantic area; and gear marking requirements for longline and gillnet gear.

This Environmental Impact Statement has been prepared largely because of the FMP's significance as a new management program for fishery resources not heretofore regulated under the authority of the Magnuson Act. The proposed management program will not have a negative impact on fishery resources, habitat, public health or safety, or endangered or threatened species.

DATE BY WHICH COMMENTS MUST BE RECEIVED: ______________________________

8/30/85

MANAGEMENT POLICY & OBJECTIVES

The policy contains two basic goals for management:

1) to allow the multi-species fishery to operate with minimum regulatory intervention, and

2) to adopt initial measures to prevent stocks from reaching minimum abundance levels, defined as those levels below which there is an unacceptably high risk of recruitment failure.

The management objective is to control fishing mortality on juveniles (primarily) and on adults (secondarily) of selected finfish stocks in order to maintain sufficient spawning potential so that year classes replace themselves on a long-term average basis, to similarly reduce fishing mortality for the purpose of rebuilding those stocks which have insufficient spawning potential to maintain a viable fishery resource (currently Georges Bank haddock and redfish) and to promote the collection of information about the multi-species fishery and the effectiveness of the management program.

PROPOSED MANAGEMENT PROGRAM

The management program consists of three parts: (1) operative measures to achieve the management objectives, (2) administrative measures to promote both monitoring/enforcement of the FMP and provide for continued industry access to the resources, and (3) procedures to provide an effective basis for continuing management. Any fisherman holding a federal multi-species fishery permit must operate in accordance with federal regulations implementing this FMP even when fishing in state waters. However, where more stringent measures than those proposed in this FMP exist to regulate state landings, the more stringent measures shall prevail.

Operative Measures

1. Minimum Fish Size:

		Year 1	Year 2+
Commercial : (total length)	cod, haddock, pollock	17 inches	19 inches
	witch flounder	14 inches	14 inches
	yellowtail, Am. plaice	12 inches	12 inches
	winter flounder	11 inches	11 inches

All sizes are effective upon implementation of the FMP and will be enforced on the basis of possession in or from the FCZ. In addition, no fish taken subject to this FMP that are smaller than the prevailing commercial size limit may be sold, and minimum sizes will apply to imported fish.

Recreational: cod, haddock: 15 inches (year 1); 17 inches (year 2 & 3)
(total length) 19 inches (year 4 +)

Recreational fishermen are not subject to minimum size in possession requirements for pollock, American plaice, or yellowtail, winter and witch flounders. Each recreational fisherman may have in his possession a total of two undersized fish (cod and/or haddock).

8/30/85

2. Minimum Mesh Size: (mesh may be in either a diamond or a square configuration)

   Gulf of Maine (see Figure 1)

   - Regulated minimum mesh in cod end . . . . 5-1/2 inches
   - Regulated minimum mesh in bottom-tending gillnets . . 5-1/2 inches
   - Exemption - within the regulated mesh area illustrated in Figure 1, the conditional use of cod end mesh smaller than the regulated mesh size is allowed as described under #3 below.
   - Exception - within the area designated as the "redfish area" (Figure 1), the minimum cod end mesh requirement will not apply during the months of March through July or until the point in that time interval when 3500 mt of redfish have been landed within the calendar year.

   Georges Bank (see Figure 1)

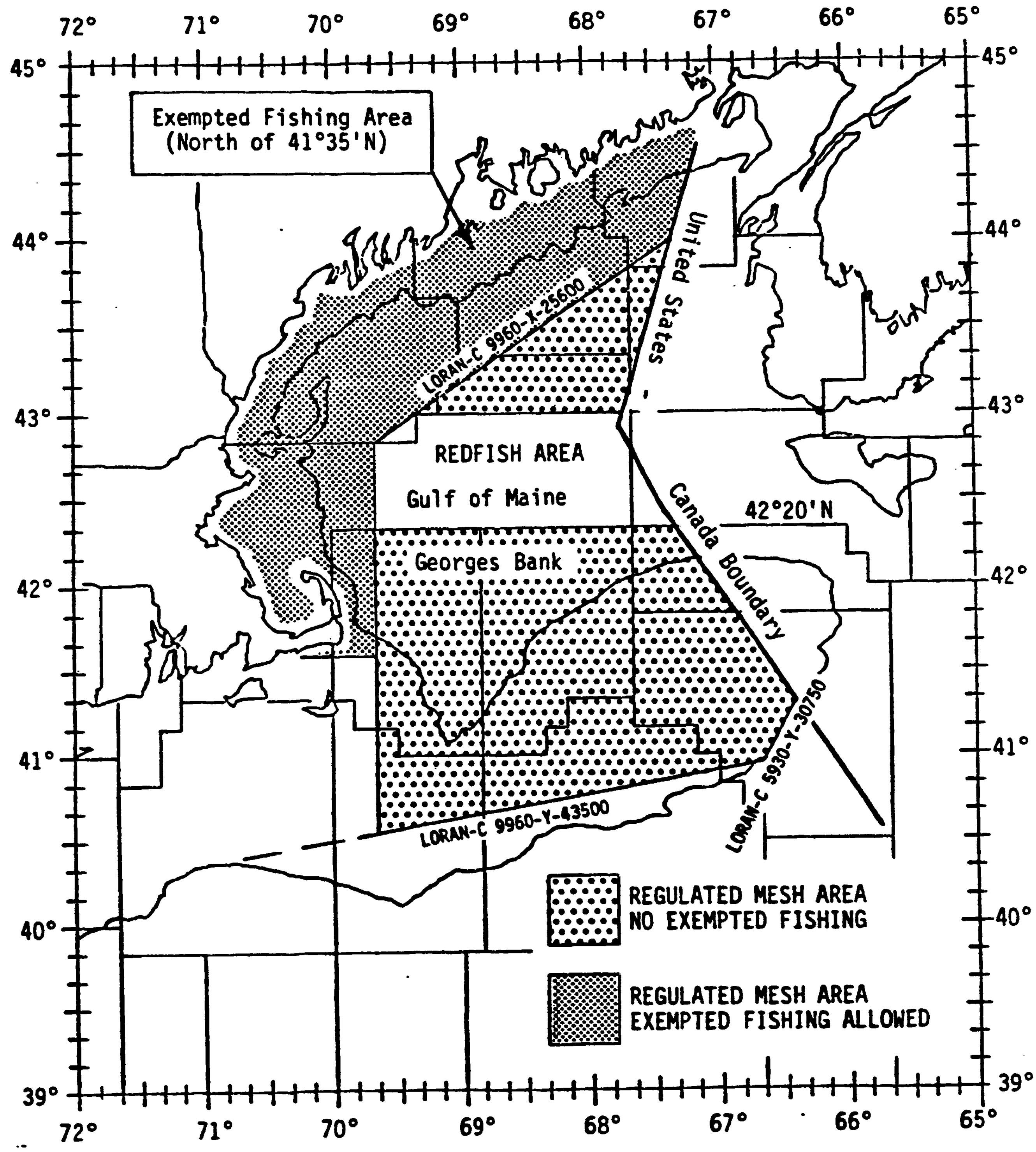
   - Regulated minimum mesh in trawl cod ends, and in bottom-tending gillnets shall be 5-1/2 inches in years 1 and 2 and shall increase to 6 inches within the third year.
   - Exemption - within the regulated mesh area north of 43°35'N and west of 69°40'W, illustrated in Figure 1, the conditional use of cod end mesh smaller than the regulated mesh size is allowed as described under #3 below.
   - Exception - in those parts of the New England area not otherwise regulated for mesh, the mesh in bottom-tending gillnets must be at least the Georges Bank area regulated mesh size during the months of November through February.

3. Exempted Fishery Regulations

   - Contain opportunities to fish with small mesh cod ends are provided in the the regulated mesh area shown in Figure 1.
   - Exempted fishery for commercially valuable species (exempt species) that require the use of mesh smaller than the regulated mesh size will be allowed as specified below. Exempted fisheries must be applied for independently and may not be granted for more than one exemption at a time.
   - Regulated species include cod, haddock, pollock, redfish, Am. plaice, and yellowtail, winter and witch flounders.

8/30/85

Figure 1



8/30/85

Seasonal restrictions on the Exempted Fisheries:

Period	Exempt Species	Comment
June-November	open	Regulated species may not exceed 10% of the total landings of all species over the reporting period.
January-April or as specified by ASMFC	shrimp	Regulated species may not exceed 10% of the amount of shrimp landed over the reporting period.
December-January	whiting	Regulated species may not exceed 10% of the amount of whiting landed over the reporting period; fishery will be subject to monitoring by sea sampling.
December-May	herring mackerel	Regulated species may not exceed 10% of the amount of herring plus mackerel landed over the reporting period.

- Area exception - a fishery for herring, mackerel and/or squid may be conducted in the non-exempted regulated mesh area of Georges Bank throughout the year using cod end mesh less than the regulated minimum, subject to the stipulation that mid-water trawl gear be used and the by-catch of regulated species be held to 1%.

- Reporting period - a continuous period of exempted fishing of 30 days or until withdrawal of a vessel from an exempted fishery, whichever is the shorter period.

- Report form - existing federal reporting form submitted by each participating fisherman to the Regional Director. In addition, each participant must be prepared to submit corroborating records of individual trip landings.

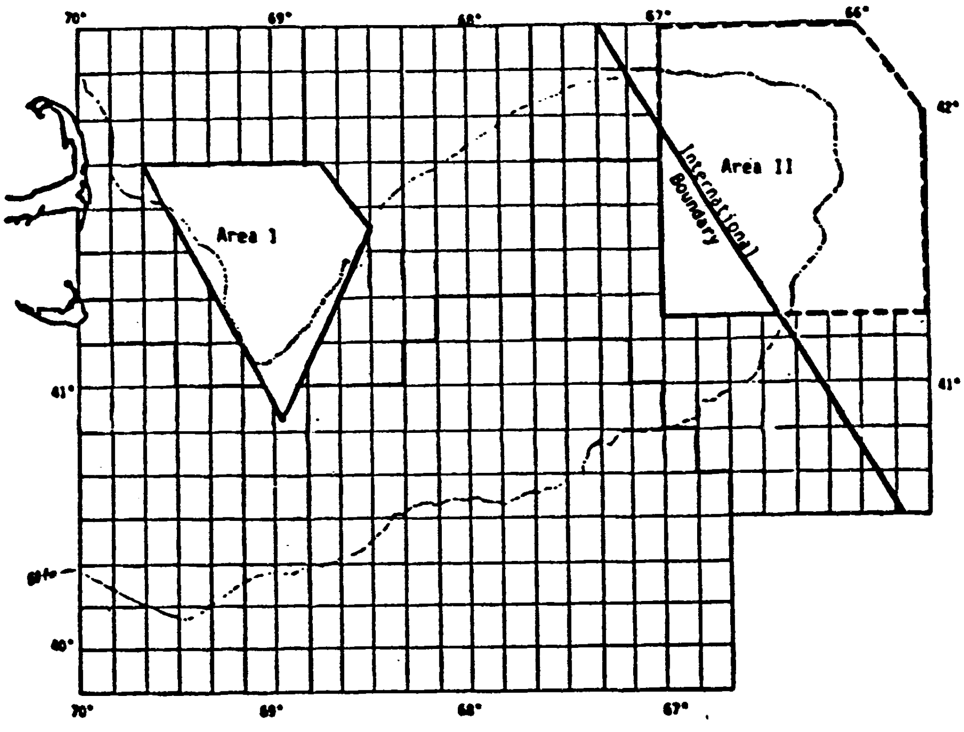
4. Area Closures

Georges Bank - Spawning areas, principally designed for haddock, will be seasonally closed to fishing with all mobile or fixed gear except with scallop dredge gear and hooks having a gape not less than 1.18 inches (30 mm.).

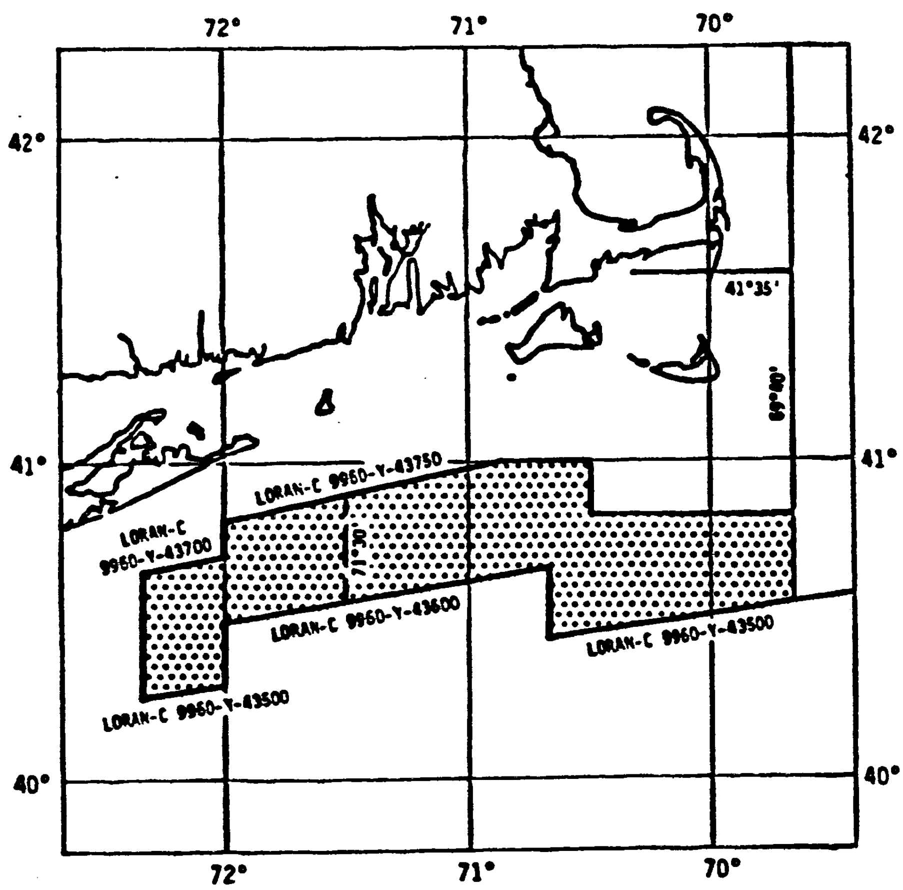
- Spawning areas to be closed include traditional areas I and II shown in Figure 2. It is recognized that only a small part of Area II is under U.S. control.

- The closure period in Area I will be from February 1 through May 31, except that each area (or relevant portion thereof) may be opened after April 30, upon the authority of the NMFS Regional Director. The closure period in Area II will be determined in consideration of Canadian management regulations.

Figure 2: Options for Closed Spawning Areas I and II



Southern New England Closed Spawning Area Option



8/30/85

Southern New England/Mid-Atlantic - A portion of the New England/Mid-Atlantic area west of 69°40', illustrated in Figure 2, is defined as an area to be seasonally closed to provide reduced mortality and enhanced spawning opportunity for yellowtail flounder. This closure is compatible with management efforts for yellowtail stocks in other resource areas.

The portion of this area east of 71°30'W longitude will close on March 1; whereas the portion west of 71°30'W will close on April 1. The total area will remain closed as far into May as the Council determines appropriate to achieve the objective of the FMP.

This area will be closed to all mobile gear fishing with the following exceptions: a) mid-water gear operating with a permit issued by the Regional Director and subject to the restriction of a zero by-catch of regulated species, and b) sea scallop or surf clam/ocean quahog dredges subject to the Regional Director's specification of by-catch reporting requirements. The Council may specify by-catch limits to sea scallops or surf clam/ocean quahog operations in the closed area after a careful review of by-catch information.

5. Additional Measures[1/]

Regulated Mesh Area - If fishing mortality for key species is determined to jeopardize achievement of the management objectives, or if a new year class of haddock is jeopardized by overfishing, then four options to further control fishing mortality will be considered for Council action using the regulatory amendment process (public hearings will be held):

- Make regulatory modifications promoting the effectiveness of existing measures.
- Establish other time/area restrictions on the fishery.
- Increase minimum fish size.
- Increase mesh size.

Non-regulated Mesh Area - If fishing mortality for key stocks not adequately protected by the regulated mesh area remains too high to achieve the plan objectives, then three additional options to further control fishing mortality will be considered for Council action using the regulatory amendment process (public hearings will be held):

- Close key grounds for limited periods of time until conditions change.
- Increase minimum fish size.
- Establish a minimum mesh size for all or part of the area during some or all of the year.

1/ The decision to proceed with additional measures that will impose area or gear restrictions in the Mid-Atlantic area will require joint Council concurrence before a regulatory change process can be utilized.

8/30/85

Other - The Council may, in addition, take action as warranted to ease or remove regulations, authorize experimental fishing, or modify regulations to accommodate advanced gear technology.

Administrative Measures

1. Gear Marking Requirements

Throughout the New England area, bottom-tending fixed gear must have the name of the owner or vessel, or the official number of that vessel permanently affixed to any buoys, gillnets or longlines. In addition:

- Bottom-tending gillnet or longline gear must be marked as follows: the westernmost end (meaning the half compass circle from magnetic south through west to and including north) of the gear must display a standard 12 inch tetrahedral corner radar reflector and a pennant positioned on a staff at least 6 feet above the buoy. The easternmost end (meaning the half compass circle from magnetic north through east to and including south) of the gear must display only the standard 12 inch radar reflector positioned in the same way.

- The maximum length of continuous gillnet sets shall not exceed 6,600 feet between end buoys.

- In the Gulf of Maine, sets of gillnet gear which are of an irregular pattern or which deviate more than 30° from the original course of the set shall be marked at the extremity of the deviation with an additional marker which must display a number of highly visible streamers and may either be attached or independent of the gear.

2. Data Reporting Requirements

This FMP establishes no new data reporting requirements other than those required under the exempted fishery regulations. Reports for the exempted fisheries are expected to use forms and procedures used in the Interim Groundfish FMP and already approved by OMB.

3. Permit Requirement

Any vessel wishing to participate in the Northeast multi-species finfish fishery, regardless of species sought, must obtain an annual permit. This permit does not supercede the permitting requirements of any other FMP.

4. FMP Technical Monitoring Group

A Technical Monitoring Group attached to the New England Council (Council) is established by the FMP to monitor the fishery and report at least annually on the status of the resources and the operation of the multi-species fishery in relation to the achievement of the FMP's objectives. The Technical Monitoring Group will be composed of 6 scientists and fishery analysts from the New England and Mid-Atlantic Fishery Management Councils and the National Marine Fisheries Service. The Monitoring Group will make its recommendations on continuing management to the New England Council's Multi-Species FMP Oversight Committee, which will in turn consult extensively with industry advisors and other interested parties and formulate a recommendation for action to the Council. The Council will take action on the recommendation as it deems appropriate. The Technical Monitoring Group will also inform the Mid-Atlantic Council of its findings.

TABLE OF CONTENTS

FINAL ENVIRONMENTAL IMPACT STATEMENT

Table of Contents

Part 1

PART 1: INTRODUCTION TO THE MANAGEMENT PROGRAM

§1.1 Purpose and Need for Management

The Council began work on a comprehensive groundfish management plan in May, 1978, following a year of eye-opening experience with single-stock quota management of cod, haddock and yellowtail flounder. Although it was not to be the Council's good fortune to extricate itself from the entanglements of trip limits, vessel class allocations and discard prohibitions until April of 1982, the Council used those four intervening years to lay the conceptual groundwork for the eventual reconciliation of its mandate for fishery management under the MFCMA with the operational and economic realities of a highly complex and dynamic multi-species fishery. This fishery management plan reflects an evolution of ideas and concepts relating to the purpose and scope of management, represents a melding of fishery science with practical experience and knowledge of the fishery, and stands as the most comprehensive basis ever developed for achieving optimum yield from the northeast multi-species finfish fishery.

The development of this FMP was motivated at two distinct levels. First, the limited success of the initial Groundfish FMP in managing the economically important cod, haddock and yellowtail flounder stocks brought into sharp focus the incompatability of stock-oriented management measures with the operational and economic realities of the multi-species fishery of which these stocks are an important part. In its earliest stages of development, this Multi-Species Finfish FMP benefitted from the Council's realization that economic, biologic and operational linkages exist among the resource components of a fishery that make it difficult and undesirable to try to isolate a stock from its fishery context for management purposes. Further, the Council acknowledged the management imperative that regulatory measures for stocks within one or more fisheries must be established with full recognition of their impacts on the harvesting and utilization of all regulated or non-regulated stocks in that fishery or other associated fisheries.

Having identified as a primary problem the inappropriateness of single-stock management methods for New England's mixed-trawl, multi-species fishery, the Council temporarily set aside development of the multi-species FMP in favor of creating an interim management environment that promoted the conservation of the cod, haddock and yellowtail flounder stocks through basic fishery-oriented methods, encouraged the collection of data and information on the resource and the industry, and most importantly, provided an opportunity for the Council to discuss in detail its goals and objectives of fishery management. The Interim Groundfish FMP became effective in April of 1982, and the Council's attention was immediately drawn to the fundamental management issues that would form the foundation for multi-species fishery management in the New England region. Thus, the second level of motivation for developing this FMP was the identification of problems and needs in the multi-species fishery that could and should be addressed through management action by the Council.

Beginning in the Spring of 1982, the Council sought to achieve a consensus on what considerations and values should ultimately guide the development of the multi-species FMP; that is, agreement on a policy to articulate the

Council's management intentions. Fundamental to the development of a Council policy was a process of acquainting Council members with the goal-oriented management options available to them, and then eliciting from them their judgement as to which options best represented the Council's management purview for the multi-species fishery. A list of 19 policy considerations was discussed among Council members, advisors and the interested public. These policy considerations ranged from concern for lost resource productivity due to overfishing to lost freedom of choice due to overregulation. The predominant concerns that emerged from the exercise reflected a broad spectrum of goals and interests that would ultimately have to be reconciled in the development of the management policy. Equally important, this exercise delineated the areas in which the Council would not exert an active interest, and thereby clarified the Council's management purview.

Ultimately, the views of the Council regarding the long-term management of the multi-species fishery crystalized into two major concerns:

1. a concern for the long-term viability of valuable, individual fish stocks, with particular reference to recruitment overfishing and the associated prospects for recruitment failure; and

2. a concern that the management program work in concert with the multi-species fishery, providing the opportunity for fishermen to continue to choose among fishing options in response to shifts in species price and availability.

These concerns reflect the Council's perception of existing or developing problems within the fishery. In recent years the Council has witnessed the decline of several major fishery resources, most in the face of intense exploitation. The fishing industry has come to accept the characteristic, cyclical variation of fish stocks, and relies on some stocks becoming increasingly abundant as others may be in natural decline. The Council would view as problematic a situation where the recruitment prospects for a stock were such that that stock could not be expected to provide for some level of fishing opportunity on a continuing basis.

The Council recognizes that the multi-species fishery is the natural adaptation of an industry faced with resource and market uncertainty. The Council believes that industry stability results from its continued ability to take advantage of fishing opportunities on a trip-by-trip, seasonal or annual basis. The Council views as problematic any management action that substantially interferes with the operational flexibility of the fishery in an attempt to secure benefits for a single fish stock. The Council believes that the perspective of management should be through the industry, that benefits must be realized through the industry, and that management actions will be most effective when they are in concert with the natural behavior of the industry. The Council does not intend that its concern for the conduct of the fishery should qualify any concern for the long-term viability of the stocks, but rather, that the long-term viability of the stocks can only be realized through measures that are compatible with the way fishing is conducted in New England.

§1.2 Multi-Species Management Policy

The policy for the management of the region's multi-species fisheries that emerged in August of 1983 included the following elements:

1. The Policy is a statement of intent regarding the management of the multi-species fishery; it contains two basic goals for management:

    a) allow the multi-species fishery to operate and evolve with minimum regulatory intervention, and

    b) adopt initial measures to prevent stocks from reaching minimum abundance levels (or stock conditions)[1/].

2. The Policy identifies what shall be considered in the management program:

    a) miminum abundance levels (or stock conditions) based on an unacceptable risk of recruitment failure;

    b) mimimum disruption of the normal behavior of the multi-species fishery;

    c) an emphasis on freedom of choice for participants in the various species fisheries;

    d) avoidance of abrupt economic dislocations;

    e) aquisition of the best possible data upon which to base fishery management decisions.

3. The Policy defines how the FMP will operate:

    a) initial measures will be based on relevant biologic, social and economic factors and will be designed only to limit the risk of reaching minimum abundance levels (or stock conditions); stocks below their minimum abundance levels (or in an unacceptable condition) may be immediately subject to restorative measures that will be applied in the context of the fishery.

    b) modifications of initial measures are possible if changes (which unexpectedly contribute to a deterioration in stock condition) are demonstrated in the biologic, social or economic design factors;

    c) measures to "restore" a stock which has fallen below its minimum abundance level (or is in an unacceptable condition) will take into consideration impacts on other related fisheries.

1/ The terms "stock condition" or "condition" have been purposefully inserted into the discussion to relate the reader more directly to the actual criterion used subsequently in the plan to identify species in need of active management action. The reader is referred to Parts 5 and 6 for a detailed explanation in context.

The actual policy statement adoped by the New England Council in August, 1983, and subsequently concurred with by the Mid-Atlantic Council in April, 1984 is given below.

Major Policy

1. The Council shall attempt to provide an environment in which the multi-species fishery can operate and evolve with a minimum of regulatory intervention or restriction of fishery options. Initial management measures shall be designed to prevent stocks from reaching minimum abundance levels of individual species within species groups included in the management plan with due consideration for the overall multi-species fishery.

2. Initial management measures will be designed on the basis of biological, social and economic factors operating at the time and may be modified only if significant changes in these factors are demonstrated.

3. Minimum abundance level is defined as that level of abundance below which there is an unacceptably high risk of recruitment failure (stock collapse). The Council, in establishing minimum abundance levels, shall not consider economic criteria.

4. Minimum regulatory intervention is defined as the use of measures which are only intended to limit the risk of reaching minimum abundance levels.

Other Considerations

1. The Council will seek the best possible data upon which to base its management decisions in fulfillment of this policy.

2. The Council shall place an emphasis on freedom of choice for fishermen participating in the various species fisheries so long as those species remain above their minimum abundance levels.

3. Consideration will be given to species not explicitly included in an FMP subject to this policy only if the required measures impact a fishery for those species.

4. If a species within a major species group falls below its minimum abundance level, the impact on the fishery for other species within that species group, as well as on other species groups, will be considered in efforts to restore the species to an appropriate abundance level.

5. The Council shall attempt to avoid or minimize abrupt economic dislocations in implementing this policy; however, in no event shall continued access by individual fleet sectors, net economic impacts on individual fishermen, or impacts on the quality of life be considered in framing management measures developed consistent with this policy.

Implications

Initial measures would be modified in response to major changes in the biological, social or economic factors operating within a fishery where those changes were judged to be contributory to abundance declining toward minimum abundance levels.

Initial freedom in the fishery might be restricted by adjustments in management measures dictated by a stock decline to the minimum abundance level.

Part 2

PAkT 2: DESCRIPTION OF THE RESOURCE

SUBPART A: DESCRIPTION OF THE STOCKS

§2A1 The Species and The Fisheries

Three major groundfish species, the Atlantic cod, haddock, and yellowtail flounder, have traditionally been the species of highest value to the overall demersal finfish complex in New England waters. However, other important species within that complex have also attracted directed fishing effort or have been caught as by-catch. In addition, several species (such as whiting, scup, and summer flounder) are the focus of seasonal fisheries, particularly in Southern New England. Species taken in the demersal finfish fishery are typically found on (flounders) or near (cod, haddock) the bottom, while others may spend only a portion of the time near the bottom (redfish, butterfish, whiting). All of these species are available to the fishery on a seasonal/geographical basis and thus have interactions at the harvesting and marketing levels. Fishing gear used in the demersal finfish fishery is characteristically bottom-tending including fixed (e.g., gillnets) and mobile (e.g., otter trawls) units.

This section gives a description of the important biological characteristics of the various species comprising the resource base with a brief resume of the historical fishery. To introduce the historical fishery for the overall multi-species complex, Table 2A1 provides catch data for the recent period 1976-1983, and Table 2A2 and Figure 2A1 give a more detailed breakdown of catches (provisional) for 1983.

ATLANTIC COD

The Atlantic cod (*Gadus morhua*) is distributed in the Northwest Atlantic from the southern end of Baffin Island to Cape Hatteras and from near-shore areas to depths exceeding 200 fathoms. In New England waters they concentrate over hard bottoms at depths from 5 to 75 fathoms, ranging in areas of plentiful food supply. Cod feed principally upon fish (about 60% of total diet), but also prey upon crustaceans and molluscs. They typically do not exhibit significant migratory behavior in New England waters, although a southern group of fish migrate from summer grounds off southern New England to wintering grounds off the coast of New Jersey. Characteristically, cod in New England waters exhibit seasonal movements into shoal waters in the spring followed by a retreat to deeper water during the winter in response to the annual temperature cycle.

Four major groups of Atlantic cod are recognized in U.S. waters (Wise, 1962). One is found distributed between eastern Georges Bank and southwestern Nova Scotia. Another is endemic to the western Gulf of Maine. The third group occurs in Southern New England waters west of the Great South Channel, and a fourth apparently reproductively isolated group migrates between Southern New England and New Jersey as noted above. These cod populations have been managed as two stock-units, Gulf of Maine and Georges Bank and Southward.

Table 2A1

COMMERCIAL LANDINGS (metric tons) FROM U.S. WATERS, 1976-1983

SPECIES	1976		1977		1978		1979		1980		1981		1982		1983	
	US	FOREIGN	US	FOREIGN	US	FOREIGN	US	FOREIGN	US	FOREIGN	US	FOREIGN	US	FOREIGN	US	FOREIGN
Cod	25078	5036	33564	6335	39005	9288	44319	6390	53581	8255	46382	9107	52773	19231	50737	14923
Haddock	4769	1511	11230	2935	16698	10820	18901	5439	24782	10304	24989	6175	18356	6209	14292	5215
Redfish	10131	565	13012	211	13992	92	14722	33	10085	98	7899	19	6797	167	5215	113
Pollock	10241	3138	12722	3517	17535	4754	15412	3032	17905	5634	18019	4050	14623	5374	13445	4383
Whiting	23063	58734	21919	55049	23984	14487	16488	4897	16461	1678	16237	2382	16564	957	16840	284
Red Hake	3941	24244	2587	5243	3444	2151	6892	978	4988	149	4247	52	2225	34	2159	11
White Hake	3071	195	3943	508	3798	184	3055	255	3596	307	5707	454	6074	766	6168	811
Yellowtail	17154	10	16590	39	11487	59	16019	17	19385	81	15594	12	27126	18	33066	46
Am. Plaice	3509	27	7068	190	9503	108	11354	89	13549	48	12881	17	15197	27	13159	37
Witch Fl.	1853	22	2478	24	3520	24	3011	17	3374	19	3421	7	5143	9	5850	45
Winter Fl.	6739	12	10583	25	12344	66	12204	19	17384	44	17779	19	15348	19	15467	19
Summer Fl.	10757	15	8884	52	8454	12	12330	11	11536	57	7958	41	7904	5	11780	-
Windowpane	2242	-	1880	-	2035	-	1587	-	966	-	1286	-	1098	-	1252	-
Scup	7228	87	8468	28	9328	3	8722	-	8497	16	9766	1	7955	-	7814	-
Other GFS	12827	3164	12982	4677	13163	1019	13974	783	10282	1454	8877	2650	7945	2142	8164	1675
TOTAL GFS	142603	96760	167910	78833	188290	43067	198990	21960	216371	28144	201042	24986	205128	34958	205408	27562
Mackerel	2712	205956	1377	53664	1605	371	1990	72	2683	406	2942	5282	3250	6298	3805	1481
Butterfish	1528	10280	1448	3205	3676	1326	2831	840	5356	879	4851	681	8693	450	4915	212
Illex squid	229	24707	1024	23859	361	17207	1593	15748	335	17529	619	7503	11451	3283	9789	968
Loligo squid	3602	21682	856	15902	725	9369	3896	13424	3744	19750	2091	9114	4540	4613	13839	5131

Source: ICNAF Statistical Bulletin, 1975-78.
NAFO Provisional Nominal Catches in the Northwest Atlantic, 1979. NAFO SCS Doc. 80/IX/27.
" " " " " " " " , 1980. NAFO SCS Doc. 81/VI/15 (Rev. 6 July 1981).
" " " " " " " " , 1981. NAFO SCS Doc. 82/VI/7.
" " " " " " " " , 1982. NAFO SCS Doc. 83/IX/22.
" " " " " " " " , 1983. NAFO SCS Doc. 84/VI/22.

Table 2A2

PROVISIONAL 1983 COMMERCIAL LANDINGS (metric tons)
FROM THE NORTHWEST ATLANTIC

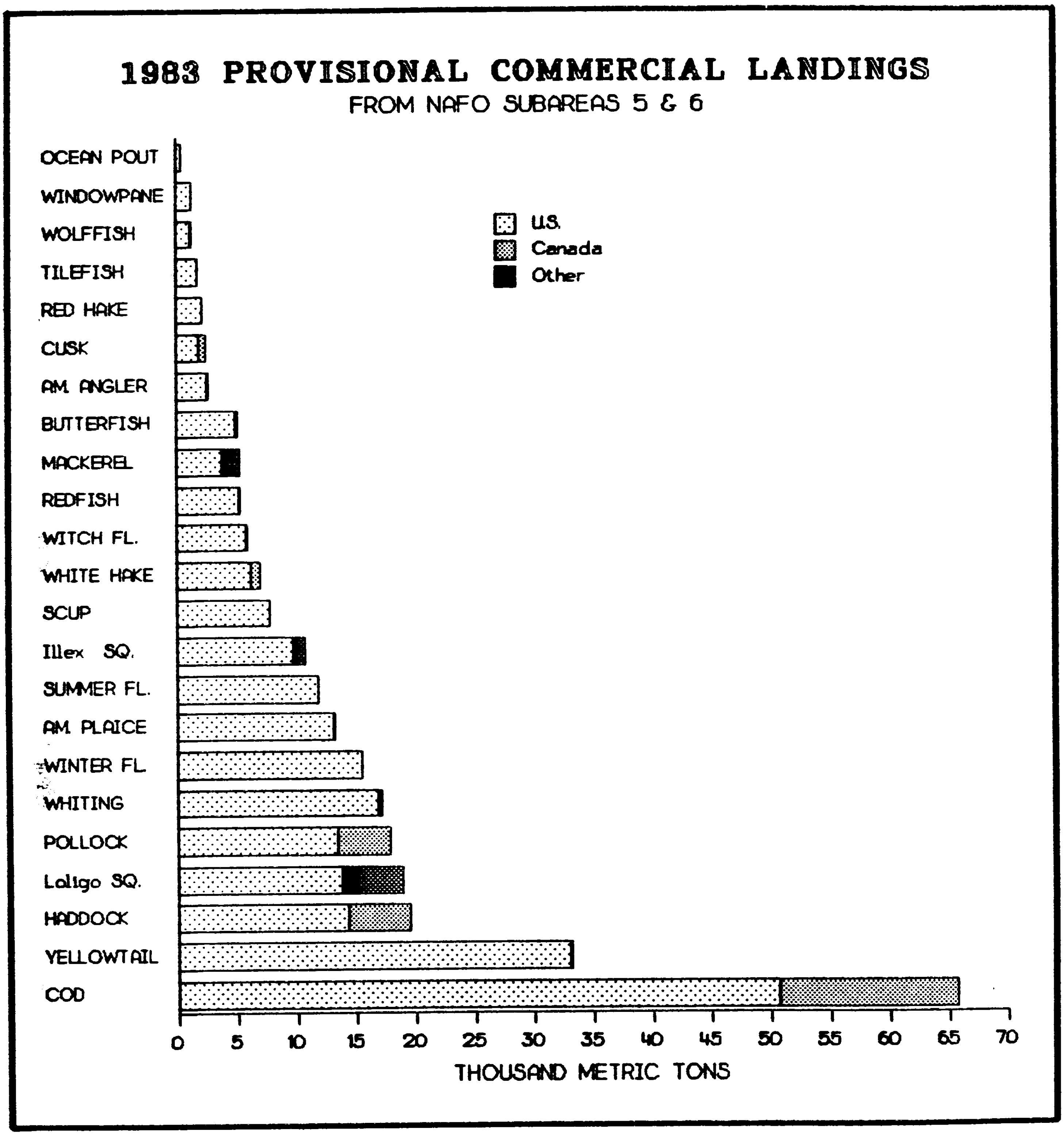
STATISTICAL AREA

	5Y			5Ze			5Zw			6			TOTAL 1/		
SPECIES	US	Canada	Other	US	Canada	Other	US	Canada	Other	US	Canada	Other	US	Canada	Other
Cod	13,867	2,752	-	34,149	12,171	-	1,778	-	-	376	-	-	50,737	14,923	-
Haddock	5,593	2,003	-	8,669	3,212	-	14	-	-	7	-	-	14,292	5,215	-
Redfish	3,889	91	-	1,325	22	-	1	-		-	-	-	5,215	113	-
Pollock	7,377	1,079	-	5,912	3,304	-	20	-	-	7	-	-	13,445	4,383	-
Whiting	4,800	-	-	1,149	-	73	5,415	-	59	5,473	-	152	16,840	-	284
Red Hake	818	-	-	78	-	5	546	-	5	716	-	1	2,159	-	11
White Hake	5,051	441	-	1,086	369	-	25	-	1	2	-	-	6,168	810	1
Yellowtail	1,314	3	-	19,389	43	-	10,343	-	-	2,000	-	-	33,066	46	-
Am. Plaice	9,137	7	-	3,955	30	-	40	-	-	4	-	-	13,159	37	-
Witch Fl.	4,468	11	-	1,214	34	-	107	-	-	43	-	-	5,850	45	-
Winter Fl.	2,095	5	-	8,013	14	-	3,569	-	-	1,643	-	-	15,467	19	-
Summer Fl.	61	-	-	1,112	-	-	1,887	-	-	8,708	-	-	11,780	-	-
Windowpane Fl.	53	-	-	696	-	-	479	-	-	24	-	-	1,252	-	-
Scup	3	-	-	23	-	-	3,021	-	-	4,702	-	-	7,814	-	-
Other Gfs.	3,530	172	-	1,903	1,086	40	1,557	-	50	1,361	-	110	8,381	1,258	200
TOTAL GFS	62,056	6,564	-	88,673	20,285	118	28,802	-	115	25,066	-	263	205,625	26,849	496
Mackerel	605	-	-	17	-	2	988	-	34	2,183	-	1,445	3,805	-	1,481
Butterfish	33	-	-	68	-	8	3,473	-	100	1,334	-	104	4,915	-	212
Illex squid	17	-	-	-	-	149	1	-	162	9,771	-	657	9,789	-	968
Loligo squid	25	-	-	56	-	851	6,627	-	820	7,131	-	3,460	13,839	-	5,131

1/ Totals include all landings which the data do not attribute to a specific statistical area.

Source: NAFO Provisional Nominal Catches in the Northwest Atlantic, 1983. NAFO SCS Doc. 84/VI/22.

Figure 2A1



8/30/85

The Historic Fishery

The cod has had a long history of exploitation in New England waters beginning in colonial times with a predominately trap fishery. However, the modern fishery may be separated into three periods: 1) an early period from 1893-1910 when record high landings in 1895 and 1907 were followed by much reduced catches, 2) a middle period from 1910-1950 during which landings remained relatively stable, and 3) the latest period since 1950 when landings rose to near record high levels with the introduction of the otter trawl and improved marine engines and navigation equipment.

During the period 1932-1960, annual U.S. commercial catches of cod from the Georges Bank and South stock complex fluctuated between 8,100 and 32,300 mt. With increased Canadian effort and the advent of the distant water fleets in the 1960's, total landings rose sharply to reach 52,000 mt in 1966. This increased effort and resultant catch followed an apparent modest increase in the size of the Georges Bank and South cod stock. The stock subsequently declined with landings stabilizing at around 26,000 mt during 1970-1975 as the fishery became more dependent upon current recruitment. Moreover, cod became less abundant in more southerly areas during the winter than formerly. Following reductions in fishing effort by the distant water fleets with the advent of the MFCMA and entry of significant recruiting year classes, total commercial landings from Georges Bank and South have risen to average more than 56,000 mt since 1977.

Commercial cod landings from the Gulf of Maine fishery have generally fluctuated between 2,700 and 14,500 mt since 1932 with the great bulk taken by U.S. fishermen. Since 1976, landings have consistently exceeded 10,000 mt and have averaged more than 13,000 mt since 1977.

Current Conditions and Future Prospects

Gulf of Maine. The total 1983 commercial cod landings from the Gulf of Maine (provisional) were 16,619 mt. U.S. commercial landings were 13,867 mt. The balance of 2,752 mt was taken by Canadian fishermen. The 1983 U.S. recreational cod catch in the Gulf of Maine is not known although party boat captains have reported a steady decline in landings over the past 5 years.

The 1982 NMFS research vessel autumn bottom trawl survey abundance and biomass indices were among the highest observed indicating continued high stock levels despite 7 continuous years (since 1976) of total annual catches which exceed the estimated MSY (8,000 mt). The above average strength of 4 year classes, 1977 through 1980, comprising over 80% of the autumn 1982 Gulf of Maine cod population (by number), give the expectation of a continued strong spawning stock and continued, good recruitment, given favorable environmental conditions and moderate catch levels. The 1981 and 1982 year classes appear to be average and below average in strength, respectively. (Serchuk et al, 1982)

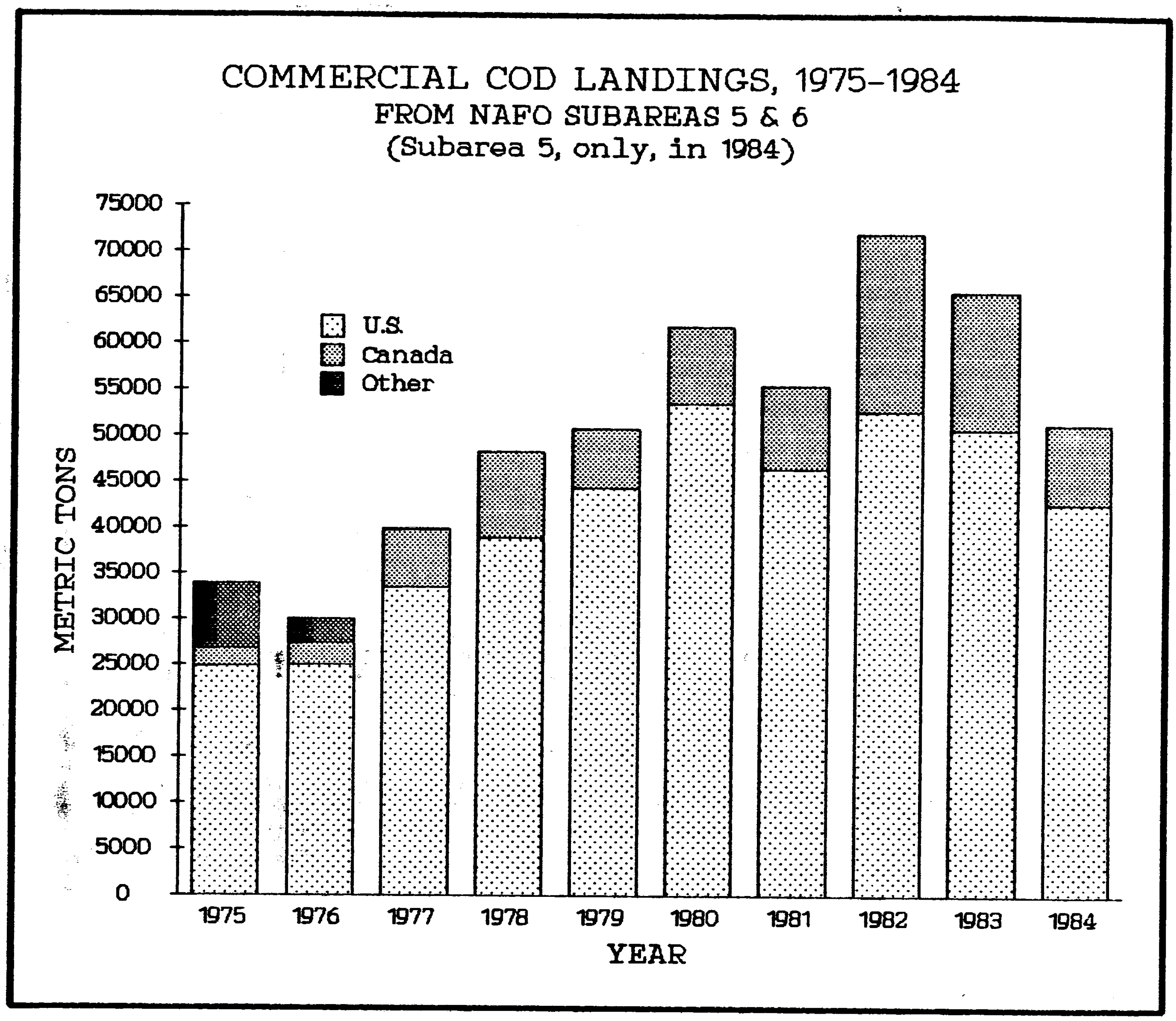
Recent fishing mortality rates in the Gulf of Maine cod fishery appear to have remained relatively stable although slightly exceeding the F-max level. Given current resource conditions, catch levels of about 12,000 mt appear to be consistent with maintenance of a strong spawning stock. Long-term prospects for good recruitment and continued, high yield from the fishery will be enhanced with a fishing mortality rate at the F-max level and with an age at first capture which approximates the mean age at maturity.

Georges Bank and South. The total 1983 commercial landings of cod from Georges Bank and South (provisional) was 48,474 mt (US landings were 36,303 mt), the second highest since 1975. Canadian landings of 12,171 mt accounted for the balance. The 1983 U.S. recreational landings are currently unavailable. A nominal catch level of 2,000-3,000 mt is probably not unreasonable.

Recent NMFS research vessel bottom trawl survey data indicate somewhat conflicting abundance indices. The autumn 1981 and spring 1982 survey results were above average, but the autumn 1982 survey indices were near the lowest observed. This inconsistency may have been due to reduced availability to the survey gear although actual declines in the cod populations are possible. The Georges Bank and South cod stocks are currently dominated by 3 above average or strong year classes, 1978-1980. The 1981 and 1982 year classes are believed to be strong and average, respectively. These results suggest the opportunity for maintaining a broadly based spawning stock (in terms of age classes) which has the potential for continued strong recruitment, but probably not at the continued 1983 catch level (which exceeded the estimated MSY of 35,000 mt by 38%).

Recent fishing mortality rates in the Georges Bank and South cod fishery have substantially exceeded F-max, but the succession of above average or strong year classes (including the 1981 and 1982) may support, in the short run, significant catch levels. The current fishing mortality rate has been estimated to range from F=0.6 to F=0.8. Thus, the 1982 and 1983 catch levels were apparently accompanied by substantial increases in F. If the resulting stock sizes register persistent declines, this may jeopardize not only the expectation of continued high catch levels but may also affect future recruitment. The combination of very high F's and the (possibly anomalous) low autumn 1982 survey index suggests the need for responsive remedial action to reduce fishing mortality to the level of F-max.

Figure 2A2



8/30/85

HADDOCK

The haddock (Melanogrammus aeglefinus) is distributed in the Northwest Atlantic from West Greenland to Cape Hatteras and, in U.S. waters, is most common in the western Gulf of Maine and Georges Bank at water depths of 25-75 fathoms. Haddock are less widely distributed than cod and are more closely associated with the bottom as reflected in a diet which is dominated by crustacea and polychaetes. Georges Bank haddock appear to be relatively sedentary, undergoing seasonal adjustments of depth distribution in response to spawning and feeding conditions. The generally less abundant haddock populations which inhabit wintering grounds in the southwestern Gulf of Maine migrate to summer grounds along the coast of Maine east of Mt. Desert.

There are thought to be three haddock groups in New England waters. The largest group is distributed generally on eastern Georges Bank and the northern edge, but is considered to be reproductively isolated from haddock east of the Fundian Channel. A smaller group inhabits the area from Nantucket Shoals to the western Georges Bank. The last group is distributed in the Gulf of Maine as indicated. These haddock groups have been managed as two stock-units, Georges Bank and the Gulf of Maine.

The Historic Fishery

The haddock stock on Georges Bank has been a classic for fishery management. During the period from 1930 to the early 1960's, with total commercial landings averaging near 50,000 mt, all of the available information indicated that the populations remained very stable despite fluctuations in the strength of recruiting year classes. The large number of year classes in the population has been considered to be the major factor for providing that stability. The stock collapsed in the 1960's as a result of a succession of poor recruiting year classes which occurred just prior to the extremely heavy removals by distant water fleets which reduced the spawning stock to only 10% of former levels. Throughout the late 1960's and early 1970's, the spawning stock remained at very low levels and recruiting year classes remained very poor (and occasionally not detectable). Moreover, the variability between year-class strengths increased at least ten-fold. With recruitment of the extremely strong 1975 year class, the population size increased substantially. Total landings which averaged 6,100 mt over the period 1972-1976 and fell to 5,100 mt in 1974, doubled to 14,200 mt in 1977 and doubled again to 27,500 mt in 1978 as the 1975 year class recruited to the commercial fishery. With recruitment of the strong 1978 year class, average total landings during 1980-1981 increased to 33,100 mt but have subsequently declined to a total of 24,565 mt in 1982. The 1975 year class was extremely strong, ranking with the larger ones which occurred prior to 1964. The fact that such good year classes have been so infrequent since then as compared to previously supports the overall importance of maintaining a strong spawning stock, particularly one with several age classes. It should be noted that the strong 1978 year class, which compares in strength with those seen in 1930-1960, was the first to be spawned by the 1975 year class.

Current Conditions and Future Prospects

Gulf of Maine. The total commercial catch of haddock from the Gulf of Maine (provisional) in 1983 was 7,596 mt, 5,593 mt by U.S. fishermen and the balance of 2,003 mt by Canadians. The nominal catches of haddock by recreational fishermen between 1980-1983 in the Gulf of Maine have been estimated to range 500-600 mt. The most recent recreational survey information (1979) indicated a catch of 406 mt, nearly all of which was taken in the western Gulf of Maine.

The 1983 NMFS survey indices continue a trend of declines in haddock abundance in the Gulf of Maine which has been in evidence since 1978. (Overholtz et al, 1983) Since the early to mid-1970's, when the survey index was at an all time low, only one reasonably strong year class (1975) has recruited to the fishery, although the 1979 and 1980 year classes were at least moderate in strength. Commercial landings of haddock from the Gulf of Maine, supported principally through recruitment from the 1975 year class (and more recently the 1978, 1979, and 1980 cohorts), have reached levels since 1980 which are the highest seen since 1960. These recent trends in commercial landings are the result of increased levels of fishing mortality, currently about F=0.6, which are significantly higher than F-max.

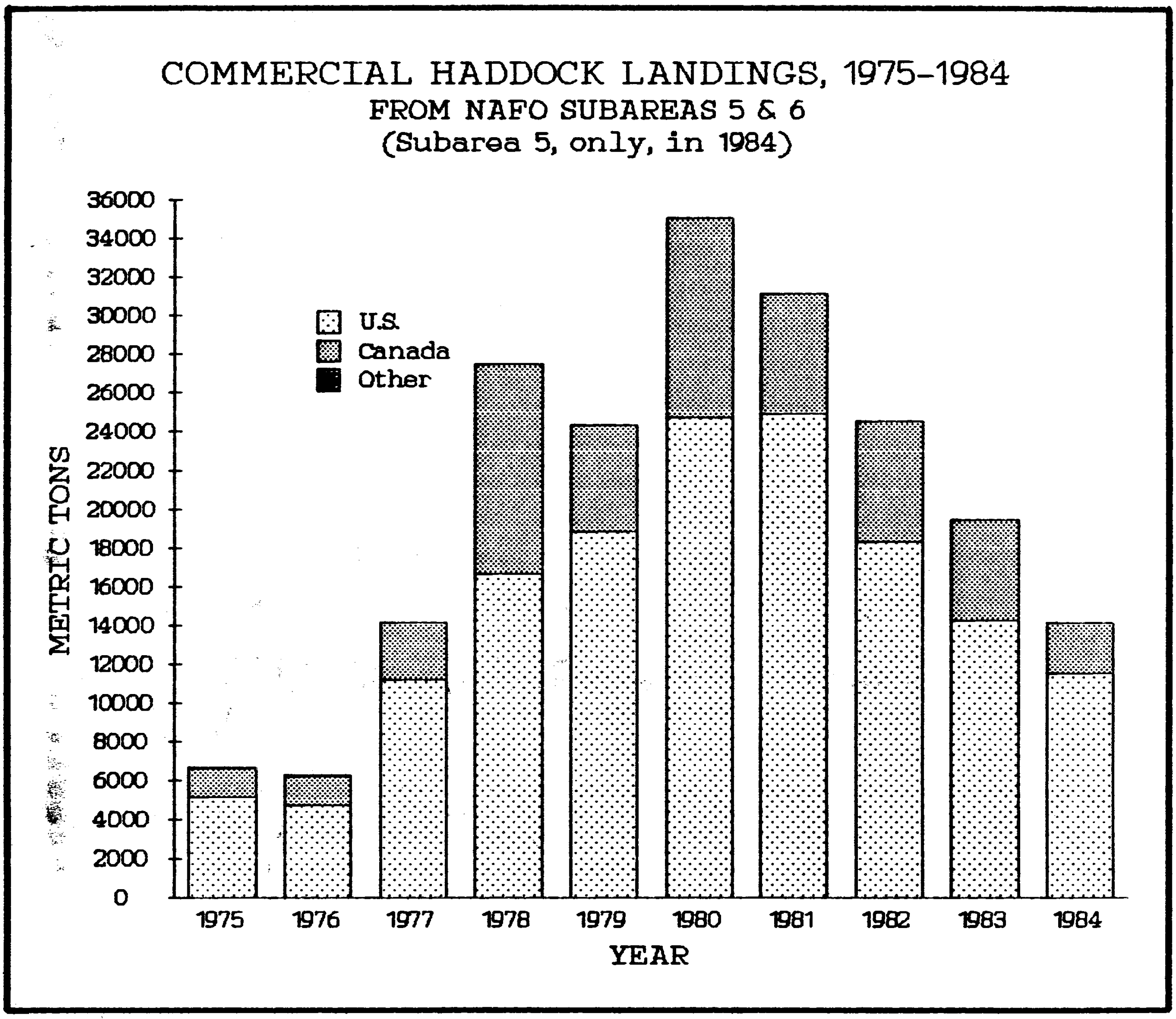
The 1981 year class appears to be very weak, continuing the trend since the 1977 year class. The 1979, 1980, and 1982 year classes appear to be at least moderately strong. Therefore, resource conditions suggest some degree of stability through 1984, although abundances may be expected to register further declines without reductions in fishing mortalities. The current presence of three moderately strong year classes suggests the opportunity for obtaining some degree of stability in spawning stock size, optimizing prospects for consistently good recruitment in the near future, provided that fishing mortalities are moderated.

Georges Bank. The total commercial catch (provisional) of haddock from Georges Bank in 1983 was 11,900 mt. Of this total, the U.S. catch was 8,688 mt with the balance of 3,212 mt taken by Canadian fishermen. Recreational catches from the Georges Bank haddock stock have traditionally been negligible.

NMFS bottom trawl survey indices for 1983 indicate that stock sizes have declined to levels seen in the 1970s when stocks were minimal. Survey catch per tow in weight rose sharply in the series of NMFS spring surveys from 1974 to 1979 and in the 1975 to 1980 autumn surveys reflecting significant recruitment and growth of the 1975 and 1978 year classes. These two year classes have been the primary support for the Georges Bank haddock fishery since they began to recruit in 1977. With the exception of the below average 1980 year class, all other year classes since 1978 have been very weak.

The NMFS survey data indicate that fishing mortality rates since 1977 (when the 1975 year class began to recruit) among recruiting year classes of haddock at age 2 have been substantially higher than F-max. Estimates of the 1983 Georges Bank haddock stock are only about 10% of the average size of the age 2 and older stock seen in the period 1935-1960 and are comparable to the stock sizes seen in the mid-1970s. The immediate prospects through at least 1986 are for a continuation of the very poor conditions seen in the mid-1970s.

Figure 2A3


COMMERCIAL HADDOCK LANDINGS, 1975-1984
FROM NAFO SUBAREAS 5 & 6
(Subarea 5, only, in 1984)
U.S.
Canada
Other
METRIC TONS
36000
34000
32000
30000
28000
26000
24000
22000
20000
18000
16000
14000
12000
10000
8000
6000
4000
2000
0
1975
1976
1977
1978
1979
1980
1981
1982
1983
1984
YEAR

REDFISH

Several species of the redfish group, Sebastes spp., are distributed on both sides of the North Atlantic. In New England, Sebastes fasciatus, also known as ocean perch and rosefish, is most common in deep waters of the Gulf of Maine to depths exceeding 150 fathoms in the temperature range 3-8°C. Redfish are a slow growing, long-lived species which may be found in large, discrete aggregations extending over rather broad geographic areas. Moreover, redfish are apparently segregated by fish size and depth. Large, older individuals are virtually the only redfish found at depths exceeding 200 fathoms. Redfish live in excess of 50 years and reach maximum sizes of 18-20 inches, attaining sexual maturity in 8-9 years at an average length of 8-9 inches. With a rather narrow range of preferred water temperatures, movements of redfish are not extensive. Diurnal vertical migrations occur, probably in response to similar movements by their crustacean prey, especially the shrimp-like euphausids. In addition, the viviparous female redfish undergo season vertical migrations during the spring and summer to liberate their young in the upper part of the water column.

Areas of principal concentrations of redfish in U.S. waters have historically included Jeffreys Ledge, Cashes Ledge, the northern approach to the Great South Channel, the deep basins in the Gulf of Maine, and along the southern margin of Georges Bank. All of these aggregations are collectively recognized as the NAFO Subarea 5 redfish stock.

The Historic Fishery

The fishery for redfish arose out of virtual non-existence in the early 1930's following the development of quick-freeze processing and the discovery that redfish yielded a small, white fillet similar in taste to fresh water perch. Frozen fillets of redfish, sold under the name "ocean perch", found ready acceptance in a large market in the Midwest and South. Total landings of redfish in New England from all areas rapidly increased from an average of about 100 mt in the early 1930's to a peak of over 117,000 mt in 1951 and then steadily declined. The fishery began in the Gulf of Maine and then expanded to the Nova Scotia banks, the Gulf of St. Lawrence, and the Grand Banks of Newfoundland as the more accessible aggregations of fish became depleted. By 1960, most areas of redfish production within reasonable steaming time from New England ports showed the effects of heavy fishing.

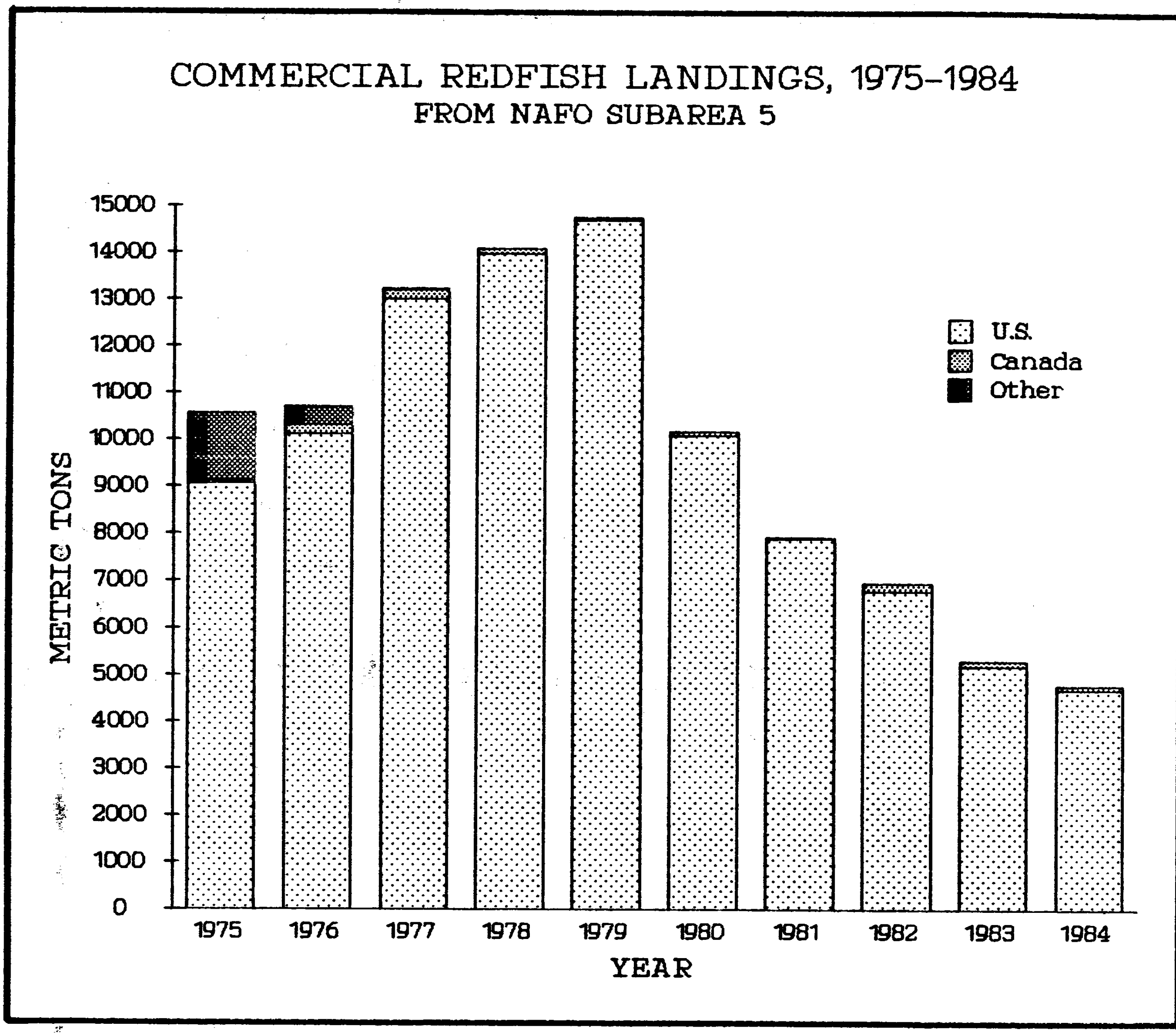
In the Gulf of Maine-Georges Bank region, total catches, taken entirely by U.S. fishermen, peaked at nearly 56,000 mt in 1942 (4 times the estimated MSY level of 14,000 mt) as accumulated biomass was removed from an essentially virgin stock. Subsequent catches then steadily declined until the relatively stable period 1954-1963 when an average of 14,100 mt were taken annually. With a nearly 70% reduction in total effort over the period 1964-1968, total catches declined to only about 8,500 mt, but the stocks underwent partial rebuilding as the strong 1963 year class entered the population. By 1971 as the 1963 year class recruited to the fishery, effort was resumed at near the level seen in the 1950's resulting in catches which, again, approximated MSY (14,000 mt) until falling below 10,000 mt since 1980. Prior to 1971 the redfish fishery in Subarea 5 was virtually an exclusively U.S. enterprise. By 1972, over 31% of SA5 redfish catches were taken by foreign vessels, principally Canada and the USSR. Since 1979, redfish catches in SA5 have once again been taken almost exclusively by U.S. vessels.

Current Conditions and Future Prospects

The total 1983 commercial catch of redfish from the Gulf of Maine-Georges Bank area (provisional) was 5,328 mt, with 5,215 mt taken by U.S. fishermen and the balance of 113 mt by Canadians. The 1983 catch level continues a declining trend seen since a peak of 14,755 mt was reached in 1979. Preliminary information indicates a further decline in 1984 (see Figure 2A4). There is no recreational fishery for redfish.

Available evidence indicates that the Gulf of Maine redfish population is currently dominated by the 1971 year class, the only significant recruiting year class since the 1963. However, the NMFS bottom trawl survey indices indicate that redfish abundances have been declining since 1979 suggesting that growth and recruitment of the 1971 year class are no longer compensating for total mortality (Mayo et al, 1983). The estimated fishing mortality rate being exerted upon the 1971 year class is about 0.3-0.4 (2 to 3 times F-max=0.14) which, in consideration of the current condition of the stock, may be too high. Bottom trawl survey results indicate that the only significant recruitment since the 1971 year class were the 1978 and 1979 cohorts. However, these year classes are only about one tenth the size of the 1971 cohort, thus further declines in redfish biomass are expected to continue in the near future.

Figure 2A4


COMMERCIAL REDFISH LANDINGS, 1975-1984
FROM NAFO SUBAREA 5
METRIC TONS
15000
14000
13000
12000
11000
10000
9000
8000
7000
6000
5000
4000
3000
2000
1000
0
1975
1976
1977
1978
1979
1980
1981
1982
1983
1984
YEAR
U.S.
Canada
Other

POLLOCK

Pollock (Pollachius virens) is a member of the cod family which inhabits cool temperate and boreal waters on both sides of the North Atlantic. Pollock off North America are distributed from Newfoundland to Cape Hatteras but are most abundant in the Gulf of Maine and on the Scotian shelf, usually in water depths of 20 to 100 fathoms (depending upon the availability of food). Pollock feed principally upon crustacea (about 70% of total diet) with fish as their secondary prey. Pollock is a schooling species which exhibits substantial shifts in abundance by area through movements and migrations associated with their search for food and for purposes of spawning. The major identified spawning grounds, to which fish from the Gulf of Maine and the Scotian shelf migrate during the autumn and winter, appears to be in the southwestern Gulf of Maine. Larval pollock use the sublittoral zone as a nursery area, and continue to reinvade shoal waters in large schools during the summer through age 2, but gradually tend to remain offshore at depth as they become older.

Although three stocks of pollock were once thought to be endemic to the Gulf of Maine and the Scotian shelf, the mix of fish which appear on the spawning grounds in the southwestern Gulf of Maine suggest that these are all a single stock. Accordingly, pollock from Cape Breton Island southward have been assessed and managed as a unit, the Gulf of Maine-Scotian Shelf stock.

The Historic Fishery

Traditionally, pollock have been taken primarily as by-catch in directed fisheries for other groundfish, but in recent years more effort has been directed towards this species. Transfers of fishing effort, back and forth, when past events affected fisheries for cod and haddock have influenced landings of pollock. Thus, historic patterns of pollock landings may not necessarily reflect real changes in abundance.

U.S. landings of pollock from the Gulf of Maine and Georges Bank remained relatively stable over the period 1940-1960, averaging 12,500 mt. Landings from the same area by U.S. fishermen declined sharply to an average of only 4,900 mt in the decade 1963-1973, but then increased to about 16,300 mt during 1977-1981.

Total commercial landings of pollock by all nations from the Scotian shelf, Gulf of Maine, and Georges Bank averaged 38,600 mt from 1960-1966, declined sharply to an average of 23,800 mt from 1968-1970, and then increased to 43,200 mt in 1973. Landings remained relatively stable at about 38,200 mt during 1974-1977, then sharply increased to average 55,200 mt in 1980-1981.

The fishery has historically been dominated by the U.S. and Canada. Nominal catches by distant water fleets have declined from 9,900 mt in 1973 to an average of 900 mt during 1977-1981, almost all of which was taken by the USSR on the Scotian shelf. Most of the Canadian landings have been taken on the western Scotian shelf while U.S. catches have been predominantly from the western Gulf of Maine.

Current Conditions and Future Prospects

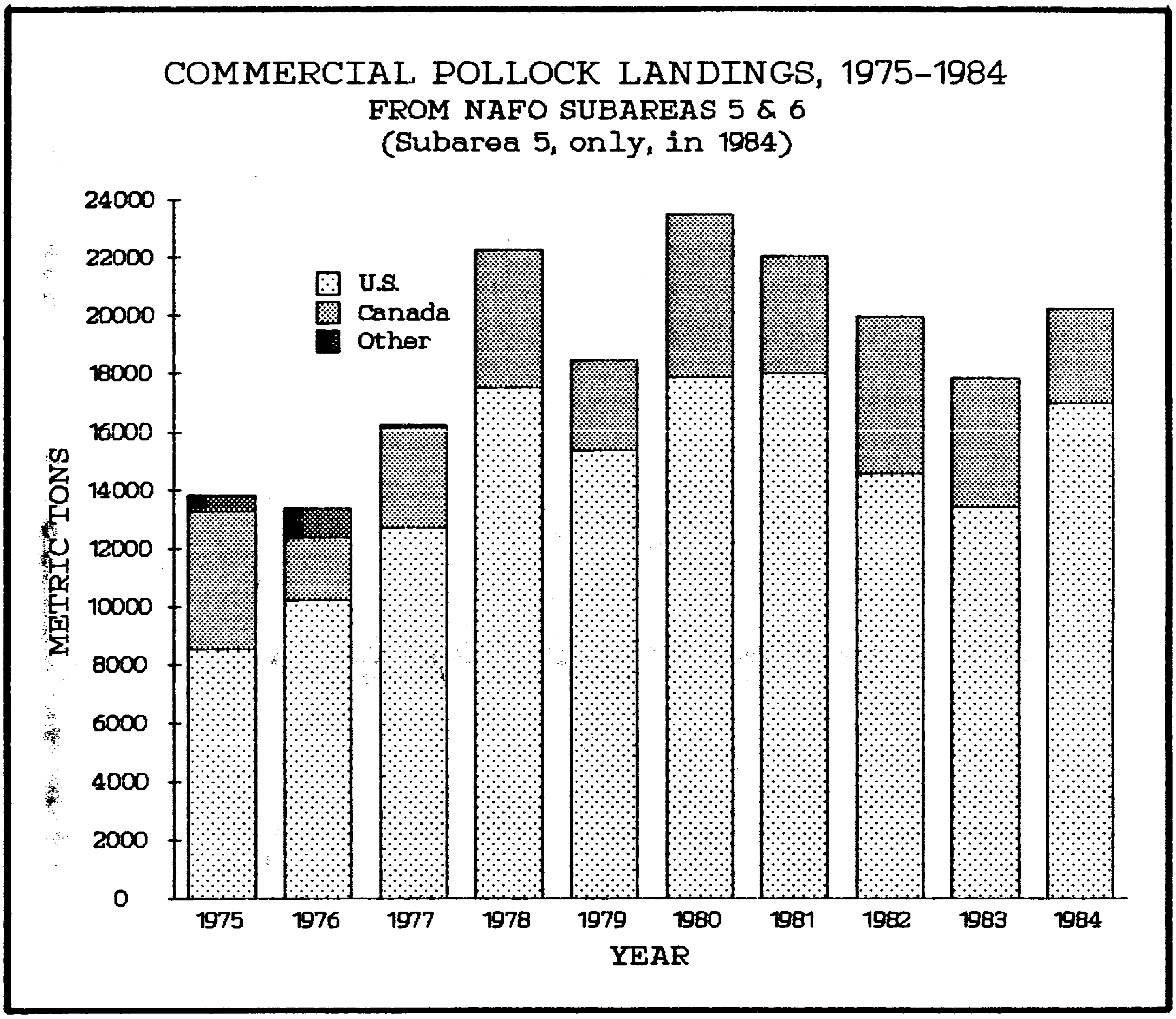
The total 1983 commercial catch of pollock from the Gulf of Maine and Georges Bank (provisional) was 17,828 mt, 13,445 mt was landed by U.S. fishermen and the balance by Canadians. This represents a decline from a total nominal catch of 23,500 mt reported in 1980, but the latter may have been biased upwards by misreporting of other species (e.g., haddock). The U.S. recreational pollock catch for 1983 is unknown but may approximate that estimated for 1979 (1,600 mt). The Canadian recreational pollock harvest appears to be of minor importance.

The total nominal catch of pollock (including recreational) from the FCZ plus the Scotian shelf increased from an average of 26,100 mt in 1968-1970 to 47,600 mt during 1978-1979. In 1980, total landings increased further to 57,400 mt while provisional statistics for 1981 indicate a total catch of 56,700 mt. Again, however, the accuracy of the reported data for recent years is not known.

The total size of the Gulf of Maine-Scotian shelf stock of pollock appears to be relatively high at present although the exact nature of current trends are somewhat obscured by conflicting evidence. Canadian commercial catch per unit of effort (CPUE) information, consistent with the Canadian summer survey index, indicated substantial increases in stock sizes in 1980. U.S. commercial CPUE indices, however, have not increased since 1979. The U.S. spring trawl survey results are lacking in any consistent trends, although the summer survey abundance indices for the period 1977-1980 are substantially higher than were seen in the 1960's. The U.S. autumn survey data have shown a definite decline in abundance (numbers of fish), however, in 1981 and 1982. It has been suggested that some of these inconsistencies may be explainable on the basis of fish distribution and availability to gear.

Virtual population analysis of commercial catch at age data indicate a decline in total numbers of fish in the Gulf of Maine-Scotian shelf stock of pollock from 1978 to 1982. However, biomass increased through 1981 due to growth of fish in the strong 1971, 1975, 1976, and 1979 year classes. Fishing mortality rates in 1982-1983 were about F = 0.26 (approximately at the F-0.1 level). With a continuation of the same level of effort in 1984, stocks should exhibit modest increases to about 321,000 mt while yielding about 50,000 mt. At equilibrium, fishing at the F-0.1 level would yield 56,500 mt from a stock of 338,300 mt; fishing at F-max would provide an equilibrium yield of 60,700 mt from a stock of 224,800 mt. Thus, recent catches of about 57,000 mt from a stock size at about 88% of the F-0.1 equilibrium level were probably at fishing mortalities approximating F-max.

Figure 2A5



8/30/85

WHITING

The silver hake (*Merluccius bilinearis*), known commercially as whiting, is a widely distributed, slender, swiftly swimming fish which ranges from Newfoundland to South Carolina, but is most abundant off the New England coast. Whiting are largely bottom dwellers inhabiting continental shelf waters from the shore to depths of about 50 fathoms during the summer. As winter approaches, fish move to more offshore waters to depths of 100 fathoms or more. Thus, although temperature affects the distribution of whiting, the availability of food is also important. Whiting are voracious predators, nearly 80% of their diet consists of prerecruit finfish, but they also feed on euphausids and other crustacea. As one of the more numerous species of finfish in the Northwest Atlantic, whiting predation on other fish may exceed the total harvest of the commercially exploited species. Thus, the impact of whiting on the overall biota is potentially very great.

The preponderance of evidence seems to indicate that there are two major groups of whiting along the U.S. Atlantic coast. On the basis of morphometric characteristics, a group inhabiting the waters off Southern New England and the Mid-Atlantic may be distinguished from two northerly groups found in the Gulf of Maine and on Georges Bank (but the latter groups are not demonstrably separable on the same basis). Biochemical studies indicate genetic differences between a northern group (Gulf of Maine and northern Georges Bank) and a southern group (southern Georges Bank and southern New England - Middle Atlantic). In consideration of these various lines of investigation, it is expected that future stock assessments will be based on a two-stock approach. The currently available assessments follow the three-stock system established under ICNAF which was based principally on the existence of three major identified spawning areas. These include the coastal Gulf of Maine from Cape Cod to Grand Manan, southern and southeastern Georges Bank, and the Southern New England waters south of Martha's Vineyard. (Almeida and Anderson, 1980)

The Historic Fishery

Prior to the 1920's, whiting were generally considered a nuisance by fishermen with landings amounting to only about 3,000 mt. With the development of quick-freezing and mechanization in the processing sector which allowed the marketing of a higher quality product, the fishery gradually expanded with landings increasing from 4,901 mt in 1931 to 65,840 mt in 1955. Beginning in the 1960's, distant water fleets (principally the USSR) began to heavily exploit the whiting stocks of Georges Bank and Southern New England-Middle Atlantic. Total reported catches rose dramatically to almost 400,000 mt in 1965 and thereafter declined to average about 116,000 mt between 1973 and 1976. With the more recent substantial reductions in fishing effort, the Georges Bank stock appears to be stabilizing at a level about twice the size seen in the 1950's. The Southern New England-Middle Atlantic stock is rebuilding as the result of good recruitment and may be almost as large as it was prior to the massive foreign effort.

In the Gulf of Maine, the whiting fishery has remained almost exclusively a U.S. enterprise. But the stock size declined steadily throughout the 1960's as a result of poor recruiting year classes and very high fishing mortality rates. A contributing factor may have been the mortality exerted on prerecruit fish by the small mesh nets used in the northern shrimp fishery. With the recent decline of the shrimp fishery, the spawning stock of whiting gradually recovered to about one-third the level seen at its peak.

Current Conditions and Future Prospects

Total provisional 1983 landings of whiting from the U.S. Fishery Conservation Zone were 17,124 mt. U.S. vessels caught a total of 16,840 mt with the remaining 284 mt taken by distant water fleets (DWF). No Canadian catches were recorded. The 1983 recreational catch may approximate that estimated for 1982 (3,000 mt), the bulk of which was probably taken from the Southern New England-Middle Atlantic stock.

Gulf of Maine. The total provisional 1983 landings of whiting from the Gulf of Maine, 4,800 mt taken entirely by U.S. vessels, representing a slight increase over the 1982 level, interrupted a trend of gradually reduced catches observed since 1976. No recreational catches of whiting were estimated or were known to occur in the Gulf of Maine.

The recent series of spring and autumn NMFS bottom trawl survey results reflect the commercial catch per effort data which indicated a continuously increasing stock biomass from 1971 through 1976 followed by declines in 1977 and 1978 with a resurgence through 1980. This pattern in overall abundance was due to strong 1972, 1973, and 1974 year classes followed by the relatively weak 1975, 1976, and 1979 year classes. The stronger 1977 and 1978 year classes contributed to the increases in biomass seen in 1980, but apparently were not sufficient in preventing declines seen in the 1981 and 1982 survey abundance indices. The 1980 and 1981 year classes appear to be at least average in strength with the 1980 year class being potentially quite strong. Spawning stock biomass (age 2+) maintained a high level of about 157,000 mt during the decade, 1955-1966, supporting an average catch level of 28,500 mt at fishing mortalities at or below F-0.1. Since falling to less than 16,000 mt in 1971, the spawning stock has generally been continuously rebuilding and is projected to have reached about 44,000 mt in 1982, but it is still at a level which is less than 30% of that seen formerly.

Fishing mortality rates in the Gulf of Maine whiting fishery since 1976 have been less than F-0.1 ($F_{0.1}$ = 0.55), reversing the trend seen in the late 1960's culminating in the very high F's of about 1.0 seen in 1970-1971. With the more recent declining catch levels, fishing mortalities over the period 1979-1981 have been estimated at F = 0.14. With a continuation of low catches and assuming only average strength for the 1980 and 1981 year classes, stock biomass should remain at current levels. If the 1980 year class proves to be of exceptional strength, then somewhat higher catch levels would still be consistent with maintenance of a stable stock biomass.

Georges Bank. The total provisional 1983 commercial catch of whiting from Georges Bank was only 1,222 mt, all but 73 mt (taken by DWF trawlers) being landed by U.S. fishermen, reflecting a continuing trend of extremely low catches seen since 1979. Recreational catches were nil.

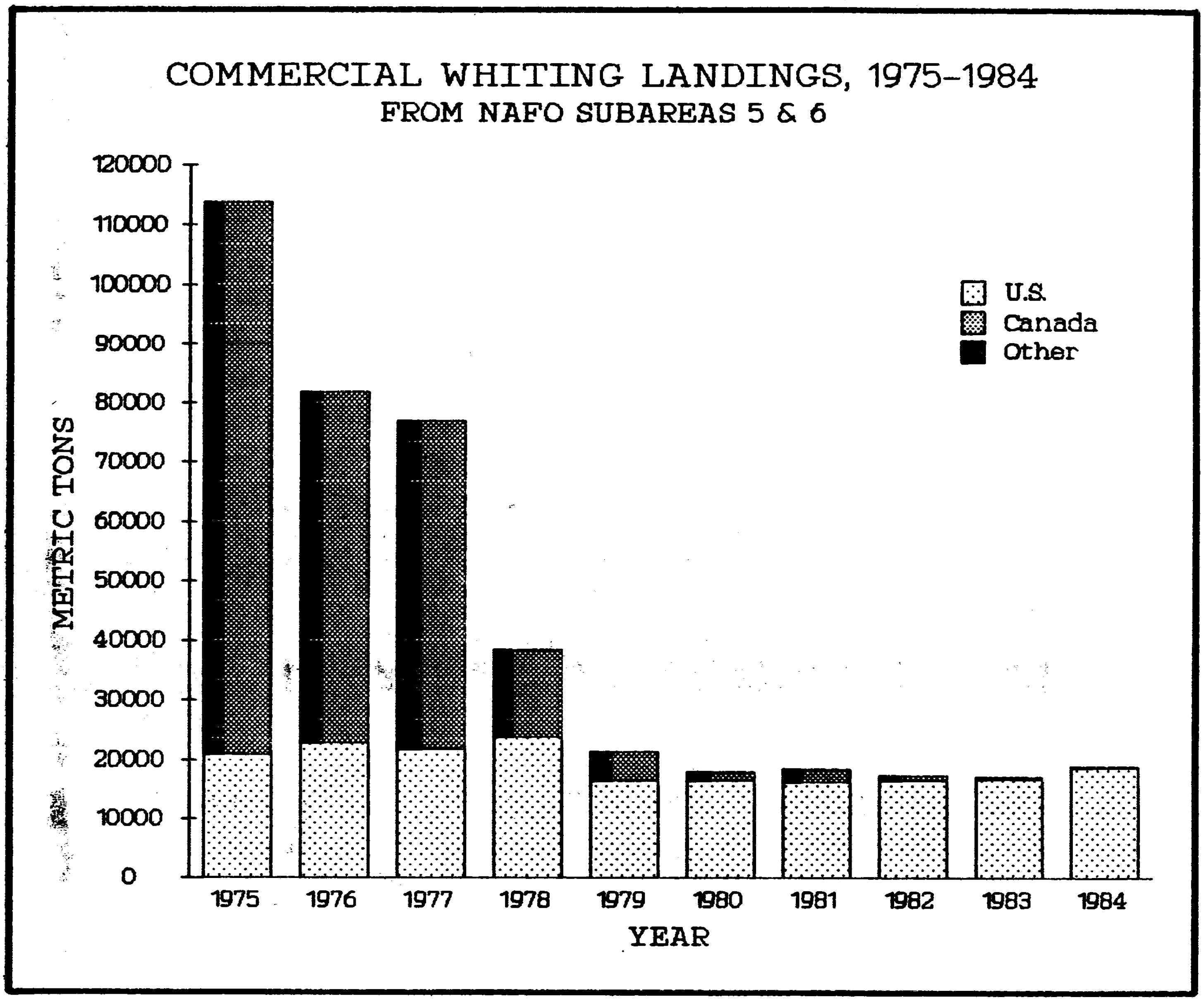
NMFS bottom trawl survey data indicate that the 1973 and 1974 year classes were quite strong, dominating catches through 1978, but that since 1975 no year classes of any substantial strength have appeared. Spawning stock biomass (age 2+), which reached nearly 600,000 mt just prior to massive removals by the DWF (principally the USSR), appeared to stabilize at about 167,000 mt over the period 1966-1976, but then sharply declined to only about 20,000 mt in 1978 due to a combination of high fishing mortality rates and relatively poor recruitment. Despite currently low recruitment levels (less than 30% of the 1955-1982 median), continuation of the recent low catches may be expected to result in gradual increases in stock sizes.

Southern New England-Middle Atlantic. The 1983 commercial catch of whiting in the Southern New England-Middle Atlantic area was 11,099 mt (provisional). The U.S. share of this total was 10,888 mt with the remaining 211 mt taken by foreign nationals other than Canada. The recreational catch of whiting from the Southern New England-Middle Atlantic stock may approximate 3,000 mt. Hence, total landings approximating 14,000 mt were at about the same level as were taken during the period 1955-1962 just prior to the sharp increases in stock size which attracted massive foreign effort during 1963-1969.

NMFS bottom trawl survey data indicate, as with the Gulf of Maine and Georges Bank stocks, that the 1973 and 1974 year classes were of superior strength as compared to more recent years. Since the 1974 year class, the 1976 and 1978 year classes appear to be the strongest. The 1980 and 1981 year classes are apparently average in strength. Total stock biomass (age 1+) at the beginning of 1982, estimated to be 79,100 mt, was substantially less than the peak value of about 450,000 mt which was reached in 1965, but was identical to the 1955-1960 average of 79,000 mt estimated from VPA. The spawning stock biomass (age 2+) at the beginning of 1982 was estimated to be 64,100 mt, slightly higher than the 1955-1960 average of 60,000 mt.

The most recent available estimate of fishing mortality (1981), F = 0.47 for the fully recruited age classes, continues a trend seen since 1976 of Fs less than F-0.1. The provisional 1983 catch of some 14,000 mt probably generated a fishing mortality rate less than F-0.1 in 1983. Thus, spawning stock sizes at the beginning of 1984 probably registered further increases over the 1983 level. For the forseeable future, maintenance of the current stock size is attainable with total removals of about 18,000 mt or less.

Figure 2A6



8/30/85

RED HAKE

The red hake (Urophycis chuss), variously known as the squirrel hake or ling, is a member of the true hakes (as opposed to the silver hake or whiting) and a close relative of the haddock, pollock, and Atlantic cod. The red hake is not at all cod-like in appearence, being a relatively slender, soft-bodied fish tapering from the shoulders to a small weak tail. Juvenile red hake are very similar in appearance to their white hake siblings, a fact which has led to some confusion with regard to some of the existing catch-at-age information. The early life history of the two species, however, differ appreciably. Red hake migrate to the bottom abandoning a postlarval existence in the plankton on reaching a total length of about 30 mm (1-3/16 inches). On reaching the bottom, postlarval red hake instinctively enter the mantle cavity of the sea scallop (Placopecten magellanicus) where they live inquilinistically until they are literally too large to enter the host animal (110-140 mm total length). By contrast, white hake remain in the surface waters until reaching a total length of about 80 mm and establish no similar relationship with sea scallops or any other animal upon descent to the bottom.

The red hake is a temperate species ranging from south of the Gulf of St. Lawrence to North Carolina. During the summer months they migrate shoreward to shoal, warm waters to spawn. Major spawning areas include the southwest part of Georges Bank, and off Southern New England south of Montauk Point. Overwintering areas include the deep waters of the Gulf of Maine and along the outer continental shelf and slope south and southwest of Georges Bank. On the basis of the two, rather distinct, spawning grounds, distribution studies, and trends in abundance, the red hake in U.S. waters are considered to be comprised of two stocks, the Georges Bank stock and the Southern New England-Middle Atlantic stock.

The Historic Fishery

There was no directed fishery for red hake on Georges Bank until the advent of substantial foreign effort, principally by the USSR, in 1963. Total commercial catches then reached a peak of 53,202 mt on Georges Bank in 1965 and 61,153 mt in 1966 from the Southern New England-Middle Atlantic region. The U.S. commercial fishery for red hake derived its major impetus from the industrial fishery in the Southern New England-Middle Atlantic area, with hake becoming an important component by the 1950's. Since 1966, however, with the expanding Peruvian anchovy fishery dominating the industrial fishery products market, total U.S. landings of red hake were sharply reduced to current levels fluctuating between 2,000 and 7,000 mt.

Current Conditions and Future Prospects

The total 1983 commercial landings of red hake (provisional) from the U.S. Fishery Conservation Zone were 2,170 mt, all but 11 mt of by-catch by DWF trawlers were taken by U.S. vessels. Recreational catches of red hake in 1982 were estimated to be about 500 mt, all of which was taken in the Mid-Atlantic Bight. The 1983 recreational catch is unknown but may approximate the 1982 level.

Georges Bank. The provisional 1983 commercial landings of red hake from the Georges Bank stock was 901 mt, most of which was taken in areas of the southern and western Gulf of Maine. The catch from Georges Bank (5Ze) was only 83 mt, reflecting the low abundance indices based upon the NMFS bottom trawl surveys. The spring trawl survey catch per tow index increased steadily during 1978-1981 but dropped sharply in 1982 to the lowest level seen in the 1968-1982 time series. Survey data indicate that the 1973 and 1974 year classes were quite strong as compared to other years while the 1975 and 1976 year classes were weak. Year classes produced since the 1977 appear to be average in strength although the 1980 year class shows indications of being quite strong.

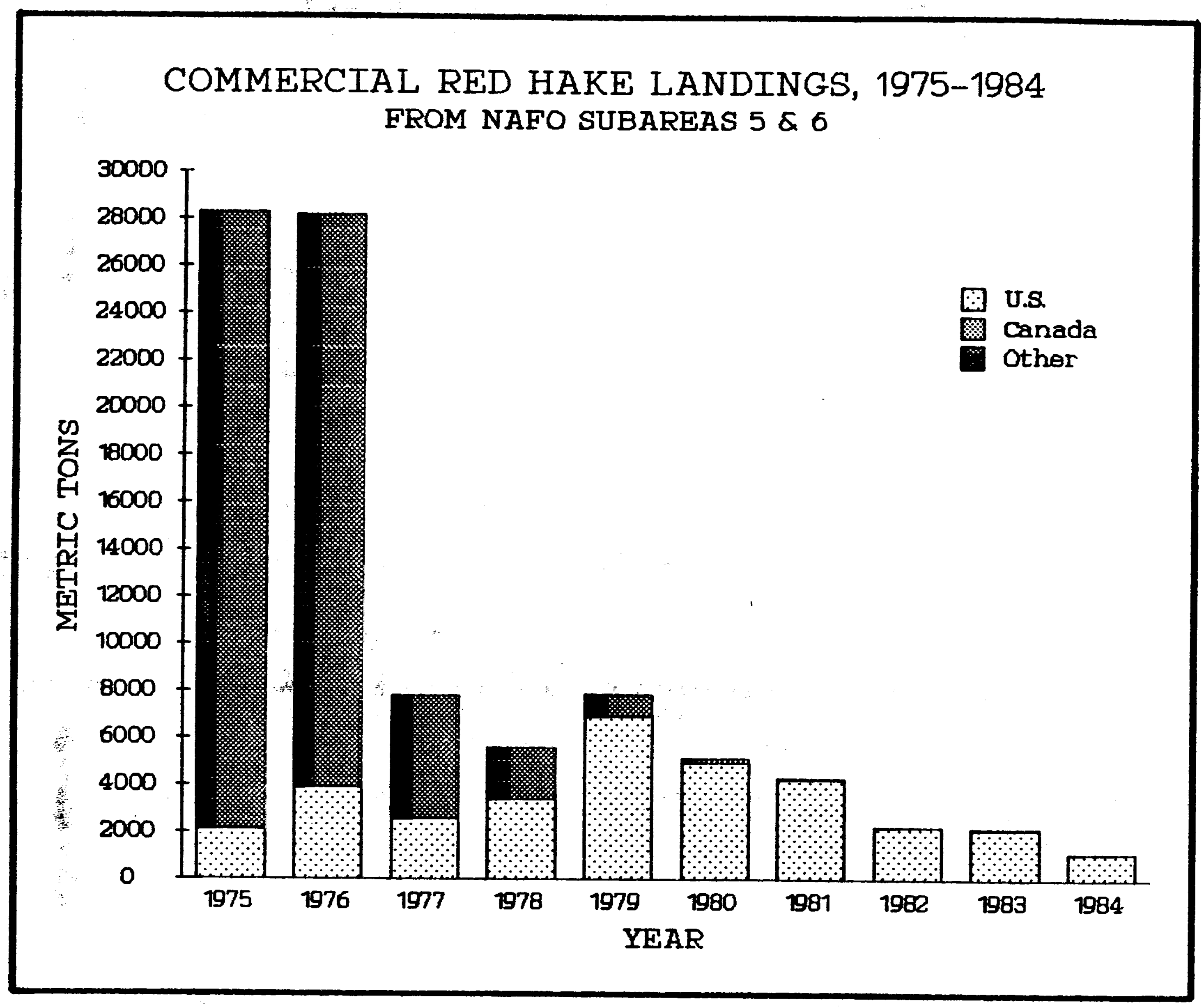
Fishing mortality rates for fully recruited age classes have shown two distinct peaks in recent years, exceeding F=1.0 in 1972-1973 and in 1976. The former was due to heavy removals principally by the USSR, the latter was probably due to a combination of poor recruitment and significant catch levels. Since 1979, F's have probably been only about F=0.1, substantially less than the F-0.1 level. Spawning stock (age 2+) biomass fell sharply from a peak of about 160,000 mt during 1965-1968 with very high catches in 1965 and 1966, recovered to nearly 87,000 mt in 1971, but declined steadily to less than 12,000 mt in 1977 with the heavy catches in 1972, 1973, and 1976. Since 1977, the spawning stock has slowly been rebuilding.

Southern New England-Middle Atlantic. The total 1983 commercial landings of red hake in the Southern New England-Middle Atlantic area was 1,268 mt (provisional). The total recreational catch of red hake from all areas (assumed to be 500 mt) was probably taken in the Mid-Atlantic Bight.

The NMFS spring bottom trawl abundance indices increased steadily during 1979-1981 but declined somewhat in 1982 to levels approximating their long-term average. Autumn trawl survey data show a similar pattern. Information regarding the strength of recruitment has shown that every fifth year since 1969 has produced a relatively strong year class, 1969, 1974, and 1979. The remaining year classes, including the 1980 and 1981, were average in strength.

Fishing mortality rates for fully recruited fish averaged about F=0.8 (significantly higher than F-0.1) during 1972-1976, but fell sharply to an average of F = 0.23 during 1977-1980 with the substantially reduced catch rates during those years, and has since been only about F = 0.1 with further reductions in catch. Spawning stock (age 2+) biomass has exhibited a pattern over time which is similar to that for the Georges Bank stock. Spawning stock biomass has gradually increased from a low of about 30,000 mt reached in 1977 to a projected 43,000 mt estimated for 1985 with a 1984 catch of 1,200 mt.

Figure 2A7


COMMERCIAL RED HAKE LANDINGS, 1975-1984
FROM NAFO SUBAREAS 5 & 6
METRIC TONS
30000
28000
26000
24000
22000
20000
18000
16000
14000
12000
10000
8000
6000
4000
2000
0
1975
1976
1977
1978
1979
1980
1981
1982
1983
1984
YEAR
U.S.
Canada
Other

WHITE HAKE

The white hake (Urophycis tenuis), also known as the mud hake, Boston hake, and ling, is one of the true hakes and a relative of the Atlantic cod, haddock, and American pollock. Smaller individuals of the white hake are similar in appearance to the red hake, giving rise to an indeterminable bias in some of the reported catch at age information. White hake, however, grow to a significantly larger size such that all hake larger than 55 cm (22 inches) which appear in landed catches are probably white hake. Whereas red hake is basically a temperate species with a center of distribution in the New England-Middle Atlantic area, white hake is a boreal species which is most abundant in the Gulf of St. Lawrence and off Newfoundland. In U.S. waters, white hake are found most commonly in the deep waters of the Gulf of Maine over muddy bottom and along the edge of the continental shelf and slope. Although smaller individuals may be found in shoal water, adult white hake are most common at depths from 50 fathoms to over 500 fathoms or where cool water temperatures prevail. White hake of the Scotian Shelf, Gulf of Maine, and Georges Bank are considered to be a single stock.

The Historic Fishery

White hake have long been an important element in the overall mix of groundfish, particularly in the eastern Gulf of Maine. The larger catches of white hake from the American stock of fish have been by Canadian fishermen on the Scotian Shelf. However, the great majority of landings from the Gulf of Maine-Georges Bank area have been by U.S. vessels with a significant proportion of those landings being larger fish taken by gillnets. Since 1971, commercial landings have generally ranged from 3,000 to 4,000 mt with a gradual upward trend. Total catches averaged 3,630 mt over the period 1975-1980, then rose sharply to 6,160 mt in 1981. Recreational catches of white hake are generally considered to be insignificant.

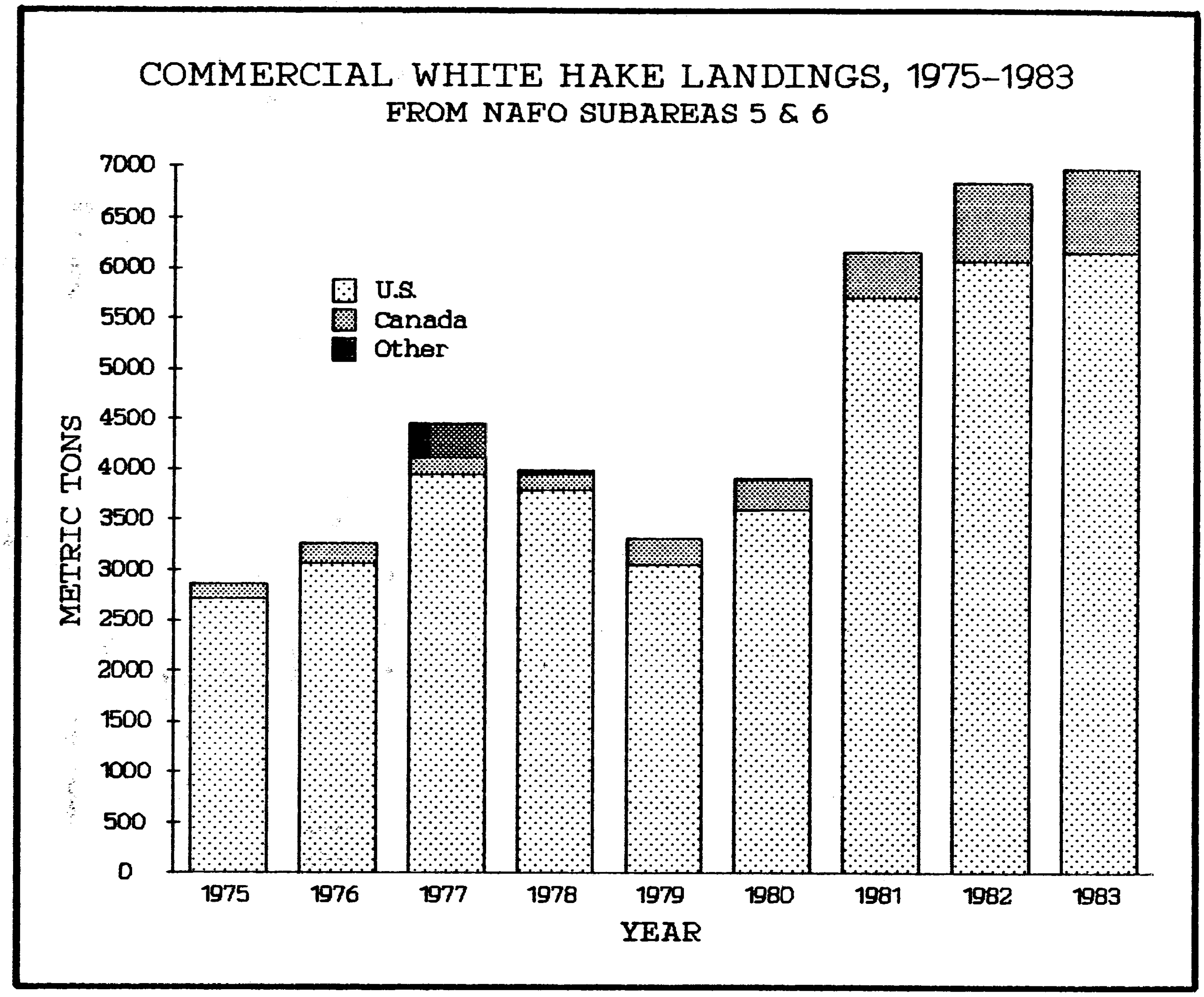
Current Conditions and Future Prospects

The total 1983 commercial catch of white hake from the Gulf of Maine - Georges Bank area (provisional) was 6,979 mt, of which 6,168 mt were by U.S. fishermen with virtually all of the balance of 811 mt by Canadians.

The NMFS spring trawl survey abundance index fluctuated about an average of 13.1 kilograms per tow over the period 1973-1977, registered a drop to 5.0 kilograms in 1979, sharply increased to 19.9 kilograms in 1981, but has since continuously declined to only 4.1 kilograms in 1984. The autumn survey index has fluctuated without definite trends since the late 1960s but has also shown significant declines in 1982 and 1984. US commercial catch per unit of effort (CPUE) information has remained relatively high since 1980, but such indices may have been biased upwards with the increasing share of the catch by larger (tonnage class 4) vessels, operating with relatively higher fishing power, at the expense of class 2 vessels (Burnett et al, 1984).

In the face of a declining biomass since the sharp peak in 1981, 1982 and 1983 catch levels have remained in the 6,000-7,000 mt range, strongly suggesting that fishing mortality rates have been increasing and may continue to increase with such levels of catch. Although more information is needed for proper evaluation of the white hake resource, it appears doubtful that continuation of recent recruitment will be able to sustain harvest levels in the 6-7,000 mt range (Burnett et al, 1984).

Figure 2A8


COMMERCIAL WHITE HAKE LANDINGS, 1975-1983
FROM NAFO SUBAREAS 5 & 6
U.S.
Canada
Other
METRIC TONS
7000
6500
6000
5500
5000
4500
4000
3500
3000
2500
2000
1500
1000
500
0
1975
1976
1977
1978
1979
1980
1981
1982
1983
YEAR

YELLOWTAIL FLOUNDER

The yellowtail flounder (Limanda ferruginea) is a medium sized, small mouthed, 'right handed' flounder which ranges from Newfoundland to Chesapeake Bay with major concentrations in U.S. waters on Georges Bank and in the Southern New England mid-shelf area at depths to about 40 fathoms. It may also be found along the outer edge of Cape Cod to Massachusetts Bay and to a lesser degree along the western periphery of the Gulf of Maine. Yellowtail is a relatively sedentary species which prefers sandy mud bottoms in rather distinct geographic areas. Although fish in the Georges Bank-Cape Cod-Southern New England assemblages exhibit insignificant seasonal movement patterns such that these areas represent rather distinct groupings, yellowtail found in the western Gulf of Maine may undergo seasonal north-south movements along the coast.

Since fish are concentrated in two major areas, western Georges Bank and Southern New England, which have attracted the bulk of effort in the historic commercial fishery, yellowtail have been managed on the basis of the same two areas delimited by the Great South Channel (69°W Long). Whereas this definition probably encompasses the two major spawning units of fish, it is somewhat ambiguous with regard to the Cape Cod and western Gulf of Maine assemblages. In particular, the former group may constitute a separate spawning stock. However, both the Cape Cod and western Gulf of Maine assemblages have arbitrarily been grouped with the Southern New England unit (West of 69°W) for management purposes.

The Historic Fishery

Yellowtail flounder were relatively unexploited prior to 1935. Concurrent with a decline in the abundance of winter flounder, the Southern New England yellowtail fishery rapidly developed, exhibiting two apparent cycles with peak landings reaching 36,000 mt to 38,000 mt in the 1940's and 1960's and falling to 2,000 mt or less during the 1950's and 1970's. Foreign catches, which were insignificant prior to 1965, peaked in 1969 with a nominal catch of 17,600 mt. The Georges Bank fishery developed more slowly, not reaching landings of 10,000 mt until 1962. Catches then peaked at about 21,000 mt in 1969-1970 but subsequently declined to reported landings of only 5,000 mt in 1978. Although some of the more recent reported landings may be biased to some unknown degree (missreported with respect to which side of the 69° meridian the catches were actually taken) when restrictive catch quotas were in effect under the Atlantic Groundfish FMP, the overall cyclical nature of reported yellowtail landings is probably a true reflection of actual catches. Landings of yellowtail from the Cape Cod grounds since 1935 have consistently averaged about 2,000 mt, although recent catches have been somewhat higher (reaching 5,700 mt in 1980) with increased levels of fishing effort. Catches in the western Gulf of Maine have been relatively insignificant, about 500 mt or less.

Current Conditions and Future Prospects

The total 1983 commercial landings of yellowtail flounder from the U.S. Fishery Conservation Zone were 33,112 mt (provisional), the highest level of landings since 1972. All but 46 mt, taken by Canadian fishermen principally on Georges Bank, were landed by U.S. vessels. There is no significant recreational fishery for yellowtail although some fish are apparently taken in the Mid-Atlantic area.

Georges Bank. The provisional 1983 commercial landings of yellowtail flounder from Georges Bank (area 5Ze) were 19,432 mt, including 43 mt by Canadians. This represents a 100% increase over the 1981 level of about 9,700 mt from the same area. Catch at age information from the 1982 and 1983 landings indicated that the increase in landings over the 1981 level largely resulted from recruitment of the 1980 year class with significant contributions from the 1979 and 1981 cohorts. Preliminary information indicates a 1984 catch level of only 5,765 mt from the area east of 69°W Long, a precipitous decline from the 1983 level.

Commercial catch per unit of effort information has remained stable since 1982 but NMFS spring and autumn trawl survey indices have significantly declined. Consistent with landings data, survey data reflect the strength of the 1979-1981 year classes, particularly the 1980 year class. The 1982 and 1983 year classes appear to be among the weakest observed in the history of the trawl surveys. Since 1982, the autumn trawl survey abundance index has declined to the lowest level seen in the history of the survey. These results indicate a rapid deterioration of resource condition in the past two years which is not likely to improve in the near future, given the poor indications from the 1982 and 1983 year classes.

Fishing mortality rates in the historic Georges Bank yellowtail flounder fishery have consistently exceeded F-max = 0.5, but have been nearly double that level in recent years. Assuming a natural mortality rate, M=0.2, for yellowtail, then estimated fishing mortalities, based on analysis of survey data, range from F=0.62 to F=1.12 (mean 0.84) for the period 1977-1983, and F=0.59-1.24 (mean 0.85) during 1980-1983. The total cost to the fishery from foregone potential yield associated with such excessive exploitation rates is very substantial.

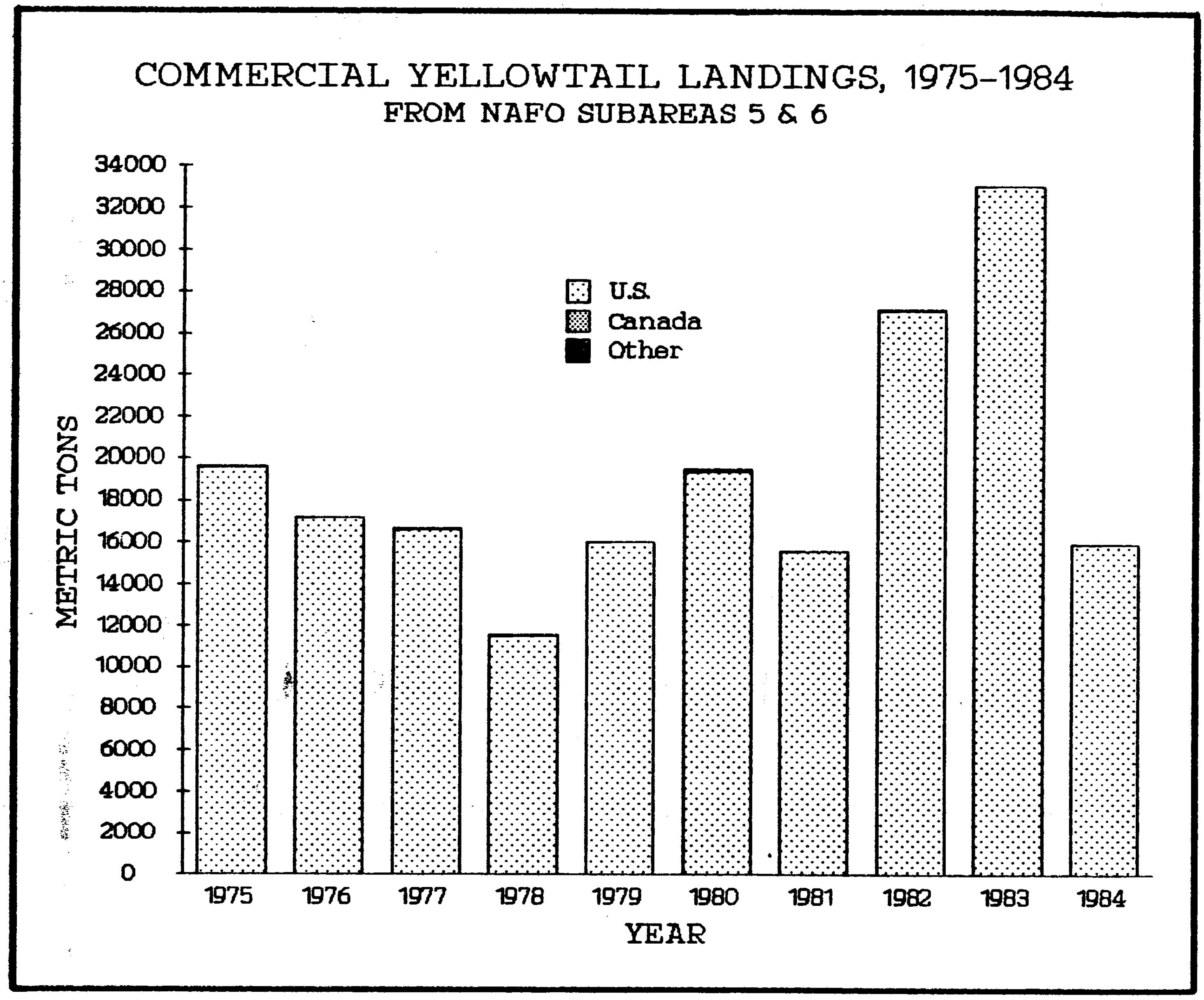
Southern New England-Middle Atlantic. The total 1983 commercial landings (provisional) of yellowtail flounder from area 5Zw-6 were 12,343 mt, all by U.S. fishermen. The 1981 catch level from the same fishing grounds was only about 3,750 mt. Catches more than doubled to about 7,850 mt in 1982 and registered a further increase of nearly 60% to the 1983 level. Recreational catches of yellowtail flounder are not well documented, but it is likely that all such catches occur in the Mid-Atlantic area and probably do not exceed 50 mt, annually.

NMFS bottom trawl surveys indicated a substantial increase in yellowtail abundance (by number) and biomass through 1982 for the Southern New England and Mid-Atlantic areas followed by a precipitous decline through 1984 to levels near the lowest seen in the historic time series. Age data indicate that the 1979, 1980, and 1981 year classes were the strongest since the mid-1970's with the 1980 year class being the stronger. With recruitment of these year classes in 1982 and 1983, intensified fishing effort rapidly dissipated stock biomass. With the weak appearance of the 1982 and 1983 year classes, the 1984 stock biomass reached the low levels last seen in the mid to late 1970s. The Cape Cod assemblage has not shown any consistent trend in recent years; indices are currently at near the long-term average.

Fishing mortality rates of yellowtail flounder in the southern New England-Middle Atlantic areas have historically exceeded F-max. Based upon analysis of survey data, estimates of F over the period 1980-1983 range F=0.8-1.33, capping a trend of high mortality rates seen over the past twenty years (Clark et al, 1984). So long as fishing mortality rates continue to exceed F-max, yield from the fishery will continue to be dependent upon the newly recruiting year classes. Moreover, with the appearance of strong recruiting year classes (e.g., 1980 year class) additional effort may be expected to enter the fishery, resulting in higher fishing mortality which is concentrated principally on the recruits with a concurrent increase in discards.

Despite the historic pattern of excessive fishing mortality rates in the yellowtail flounder fishery, there is little evidence that recruitment is in any serious jeopardy. It is probable, however, that the intensive exploitation of the species has contributed to the extreme variability seen in the strength of recruiting year classes and that a less intensive fishery would allow the creation of a more stable spawning population. It is certain that reductions in the levels of fishing mortality and discarding would have a dramatic impact on yield from the fishery.

Figure 2A9


COMMERCIAL YELLOWTAIL LANDINGS, 1975-1984
FROM NAFO SUBAREAS 5 & 6
34000
32000
30000
28000
26000
24000
22000
20000
18000
16000
14000
12000
10000
8000
6000
4000
2000
0
METRIC TONS
U.S.
Canada
Other
1975
1976
1977
1978
1979
1980
1981
1982
1983
1984
YEAR

AMERICAN PLAICE

The American plaice or dab (Hippoglossoides platessoides) is a large mouthed, 'right handed' flounder which occurs on both sides of the North Atlantic and is distributed in North America from southern Labrador to the waters off Rhode Island. The American plaice is an arctic-boreal species, preferring a temperature range of about 35° to 45°F, and is most commonly found on sandy mud bottoms in the Gulf of Maine and on Georges Bank at depths of 20 to 100 fathoms. Commercial concentrations in U.S. waters are generally in the depth range 50-100 fathoms. American plaice tend to remain within the same general locality once taking up a benthic existence after metamorphosis, exhibiting no significant seasonal or spawning migrations.

There are two recognized stock units of American plaice, Gulf of Maine and Georges Bank. Spawning appears to be a widespread phenomenon in the western Gulf of Maine and on the continental shelf south of Martha's Vineyard with the Massachusetts Bay region representing a major nursery area. American plaice is one of the few species of commercially important fish which exhibits spawning activity in the Bay of Fundy although there is no evidence that such activity is successful in producing viable larvae.

The Historic Fishery

Commercial interest in American plaice has principally been as an alternative to winter flounder and yellowtail flounder. Historic landings of American plaice from the 1940's through the 1960's were variable from less than 2,000 mt to over 5,000 mt (in 1951) as landings of the alternative, higher valued, flounders waxed and waned. Despite commercially significant abundance levels (in terms of numbers of fish), historic demand for American plaice failed to stimulate development of a significant directed fishery probably because of the slow growth rate of American plaice relative to other, commercially more attractive flounders. With a slow growth rate for American plaice, most of the fish taken may be too small to be marketable and are either discarded or are used as bait in other fisheries.

In recent years, landings of American plaice have increased as a reflection of greater demand as abundances of yellowtail flounder were in decline. Catches in the FCZ increased from 2,000-3,000 mt in the mid-1970's to average 12,646 mt over the period 1979-1981.

Current Conditions and Future Prospects

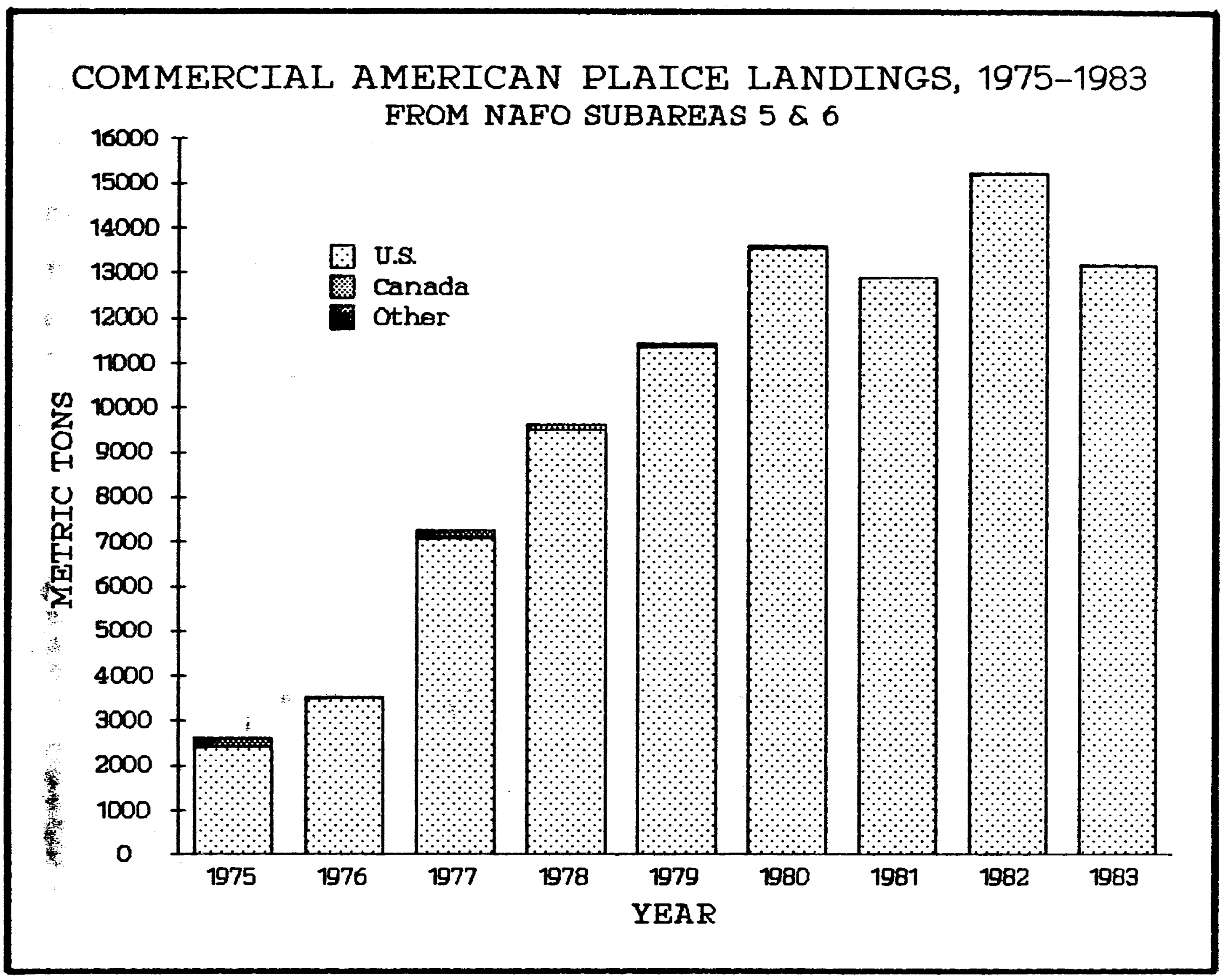
The total 1983 commercial landings of American plaice from the FCZ decreased 13% from the record 1982 landings to 13,196 mt (provisional). All but 37 mt, taken by Canadians principally from Georges Bank, were by U.S. fishermen. There is no recreational fishery for American plaice.

Gulf of Maine. The 1983 commercial landings of American plaice from the Gulf of Maine amounted to 9,144 mt (provisional), a 19% decline from the record 1982 level, and represented over 69% of the total commercial landings of American plaice from the FCZ. This continues a trend of dominance by Gulf of Maine catches seen since

1975. Historic catches, particularly since 1970, have generally paralleled NMFS autumn bottom trawl biomass indices which currently suggest that Gulf of Maine American plaice stock biomass is at near record-high levels. Current levels of fishing mortality rates are unknown. (U.S. DOC, 1982)

Georges Bank. The 1983 commercial landings of American plaice from Georges Bank and South were 3,985 mt (provisional) for a new record level of catch. All but 30 mt, taken by Canadians, were landed by U.S. vessels. American plaice landings from Georges Bank have been trending upwards since 1976, paralleling a similar trend in NMFS autumn bottom trawl biomass indices seen since 1974. The 1982 NMFS spring index was the highest in the time series. The survey data suggest continuing improvement in the population of American plaice on Georges Bank with current abundance and biomass approaching historically high levels. There are no current estimates of fishing mortality. (U.S. DOC, 1982)

Figure 2A10


COMMERCIAL AMERICAN PLAICE LANDINGS, 1975-1983
FROM NAFO SUBAREAS 5 & 6
U.S.
Canada
Other
METRIC TONS
16000
15000
14000
13000
12000
11000
10000
9000
8000
7000
6000
5000
4000
3000
2000
1000
0
1975
1976
1977
1978
1979
1980
1981
1982
1983
YEAR

WITCH FLOUNDER

The witch flounder or gray sole (Glyptocephalus cynoglossus) is a medium sized, small mouthed, 'right handed' flounder which is common throughout the Gulf of Maine and also occurs in the deeper areas on and adjacent to Georges Bank and along the edge of the shelf as far south as Cape Hatteras. Witch flounder is a boreal species found on both sides of the North Atlantic and as far north as Newfoundland in North American waters. It is a fish of moderately deep water with the majority of catches being from 60 to 150 fathoms in bottom water temperatures of 2°-4°C in winter and 7°-9°C in summer. Witch flounder is apparently slow-growing since fish 24 inches in length taken on the Scotian Shelf have been found to be 18-20 years old.

Witch flounder exhibit no significant seasonal movements or spawning migrations, remaining in the same locality year round. Spawning occurs widespread throughout the Gulf of Maine and along the shelf edge of Georges Bank and South with peak activity occurring during July and August. The southwestern part of the Gulf of Maine may be an important nursery area. Research vessel survey data suggest that the Gulf of Maine population may be relatively discrete from fish in other areas.

The Historic Fishery

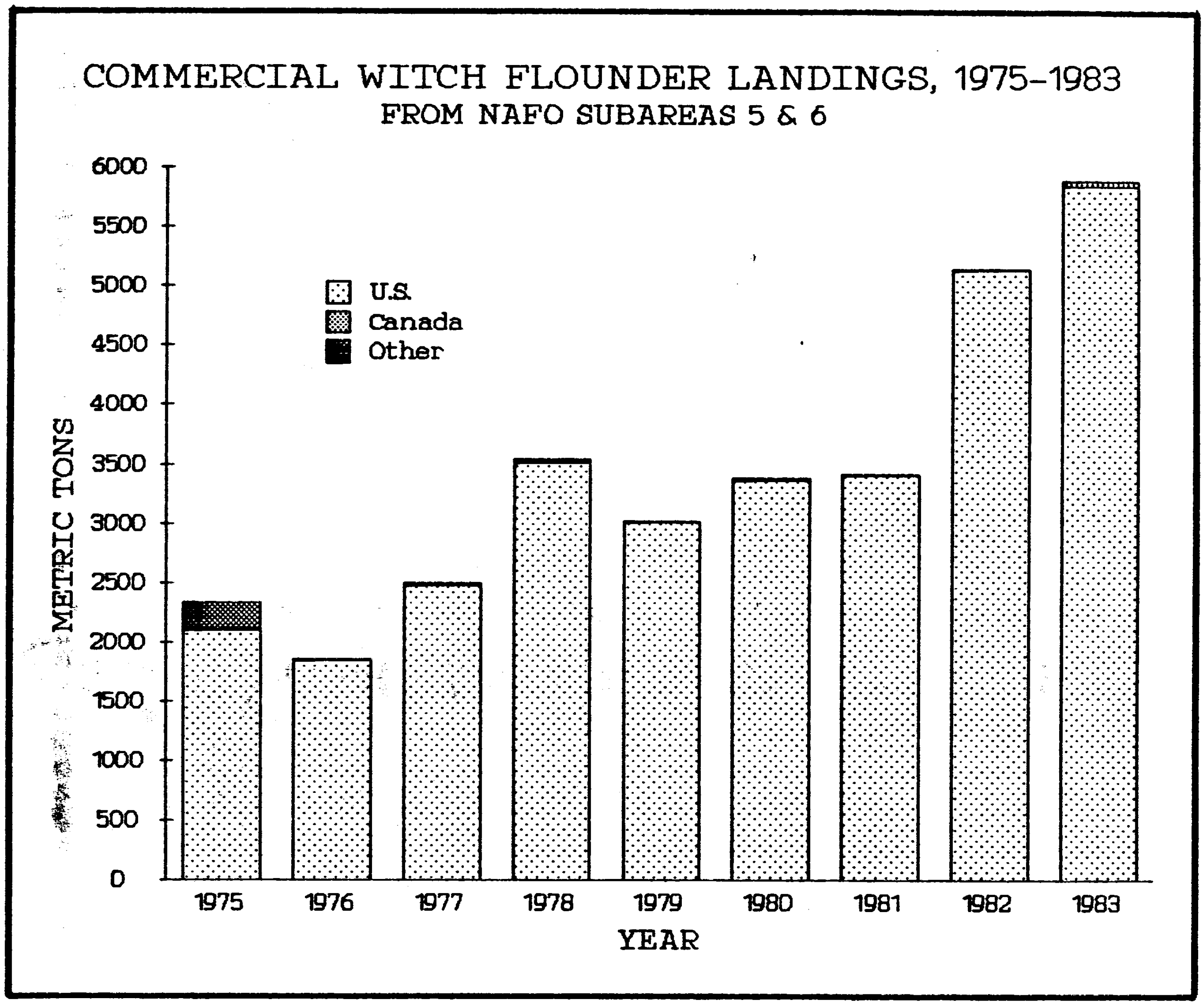
There is no significant directed U.S. fishery for witch flounder. However, a sporadic Canadian fishery exists on the Scotian Shelf. U.S. catches of witch flounder are usually taken as by-catch in directed fisheries for other species or as a component of mixed catches. Reported U.S. commercial landings of witch flounder over the period 1937-1977 have been variable, ranging 1,200-5,000 mt, exhibiting an historical pattern very similar to that for American plaice. Total reported commercial landings of witch flounder from the FCZ during 1965-1977 averaged 3,334 mt, with 78% (2,592 mt) by U.S. fishermen. Foreign catches (principally by the USSR) reached 2,600 mt in 1971-1972, then subsequently declined to insignificant levels by 1977. Recent U.S. catches from the FCZ have increased slightly to average 3,348 mt during 1978-1981, while Canadian catches have generally averaged less than 30 mt. There is no recreational fishery for witch flounder.

Current Conditions and Future Prospects

The total 1983 commercial catch of witch flounder from the U.S. Fishery Conservation Zone was 5,895 mt (provisional), all but 45 mt (Canada) by U.S. vessels. Continuing the trend seen in recent years, the bulk of the catch (76%) was taken in the Gulf of Maine.

The NMFS spring bottom trawl survey indices fail to exhibit a consistent trend over the time series, although the autumn survey data indicate a general decline since the late 1960's. The spring surveys indicate significant peaks in numbers and biomass in 1973 and 1981, the latter peak being reflected in the Massachusetts inshore spring survey. With the NMFS spring survey results being corroborated by the Massachusetts inshore survey, it is possible that the apparent declines traced by the NMFS autumn survey may be attributable to declining availability to the survey gear. However, in light of the apparent increased levels of exploitation in recent years, particularly by the larger vessel classes, and in light of the fact that witch flounder is a long-lived and slow-growing species less resilient to exploitation than other flatfish, further development of the fishery should proceed with caution. (Burnett and Clark, 1983)

Figure 2A11



8/30/85

WINTER FLOUNDER

The winter flounder (Pseudopleuronectes americanus), also known as the blackback and lemon sole, is a medium sized, small mouthed, 'right handed' flounder which is distributed in coastal waters and on offshore banks from southern Labrador to Georgia. Winter flounder generally exhibit only small scale movement patterns. In Mid-Atlantic waters, however, they undergo more extensive seasonal inshore-offshore migrations, inshore during the winter and offshore during the summer, in response to water temperatures.

Restricted movement patterns, and differences in meristic and morphometric characteristics suggest that relatively discrete local groups exist. Winter flounder tend to occupy the same spawning locations in consecutive years. Coastal populations of winter flounder move into estuaries, embayments and salt ponds during the winter to spawn and return to the adjacent coastal areas in the following spring. These inland waters then serve as nursery areas. Spawning also occurs offshore on Georges Bank, where ripe, partly spent, and wholly spent fish have been observed in research vessel catches coincident in time with inshore spawning activity. Together with data from tagging and meristic studies, the evidence indicates that the Georges Bank populations are self-sustaining. Nursery areas on Georges Bank are undefined but young fish, following a planktonic phase, probably seek shelter on hard, rocky bottom.

The Historic Fishery

Winter flounder were of little economic importance until about 1910. The small market demand was generally satisfied by catches with traps and beam trawls. Increased demand, leading to the introduction of the otter trawl around 1915, stimulated the development of a significant domestic commercial flounder fishery (principally winter flounder) with landings reaching 7,000 mt. Catches continued to rise to about 23,000 mt in 1930. Subsequent catches declined and have fluctuated between about 6,000 and 14,000 mt since 1937. Substantial foreign catches of winter flounder, taken by distant water fleets in the late 1960's and early 1970's, peaked at 6,900 mt in 1969 but have declined to insignificant levels since 1977.

U.S. commercial landings of winter flounder during 1972-1976 averaged only 7,961 mt (dropping to a low of 6,739 mt in 1976), repeating a period of reduced catches seen in the 1950's and early 1960's, but have since exceeded 10,000 mt annually, reaching 17,800 mt in 1981.

Recreational fishing for winter flounder is popular from Maine to Delaware Bay as it is one of the more accessible sport fish from shore and small boats during much of the year. Estimates of the recreational catch of winter flounder range from 7,500 to 15,800 mt, depending upon the recreational survey methodology.

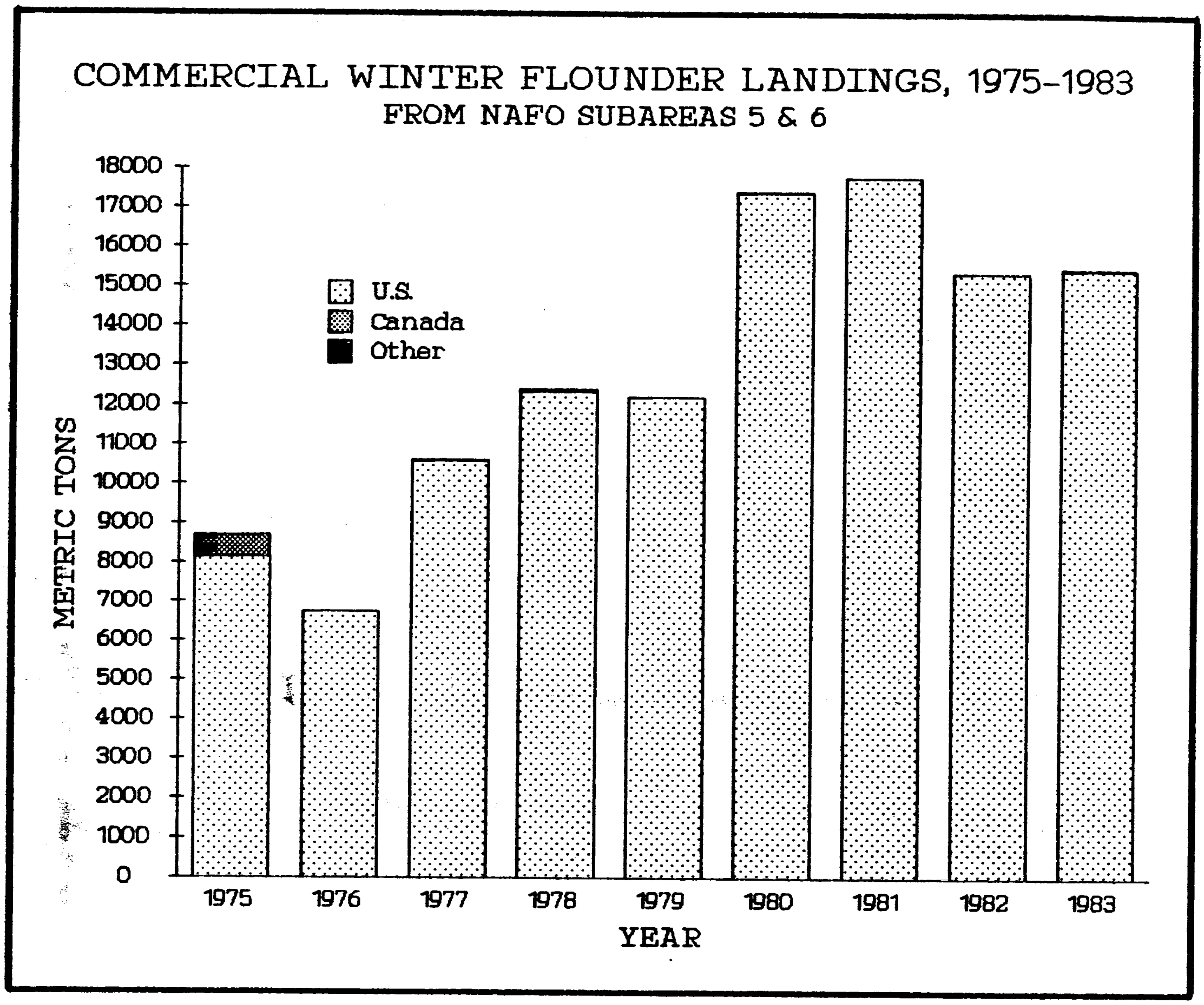
Current Conditions and Future Prospects

The total 1983 commercial landings of winter flounder from U.S. coastal waters and the FCZ were 15,486 mt (provisional). Annual Canadian landings over the last three years have amounted to only 19 mt, the balance being landed by U.S. fishermen. Over half (52%) of the 1983 landings were from

Georges Bank; Southern New England and Mid-Atlantic catches accounted for 34% of the total, and Gulf of Maine catches of 2,100 mt comprised 14% of the total 1983 landings.

The time series of NMFS bottom trawl survey data indicate that winter flounder stock sizes were significantly reduced during the early 1970's, probably as a result of heavy removals during years of substantial foreign participation in the offshore fishery. More recent trends in the survey indices suggest that stocks, particularly on Georges Bank, have regained former abundance levels seen in the early 1960's. Current levels of fishing mortalities are unknown. (U.S. DOC, 1982)

Figure 2A12



8/30/85

WINDOWPANE FLOUNDER

The windowpane flounder (Lophopsetta masculata), also known as the sand flounder or sand dab, is the closest North American relative to the European turbot. It is a relatively small, large mouthed, 'left handed' flounder which is distributed in coastal waters from the Gulf of St. Lawrence to South Carolina, occurring in greatest numbers south of Cape Cod and on Georges Bank. Windowpane are found on sandy bottoms from the shoreline out to about 25 fathoms off Southern New England and to about 40 fathoms on Georges Bank. Tagging studies in Southern New England indicate that it is a relatively sedentary species. But, research vessel survey catches of windowpane are made in somewhat deeper water during the winter than in summer indicating limited seasonal movements, probably in response to temperature.

Windowpane flounder spawn during April-June on Georges Bank and somewhat earlier in more southerly localities. Metamorphosis to the adult form is complete in late summer at a length of only 10 millimeters (0.4 inches) when juveniles take to the bottom. Nursery areas remain undefined but it is likely that rocky areas in coastal waters are of importance. Windowpane reach sexual maturity in 3-4 years at a length of 7-10 inches. Based upon analysis of U.S. commercial landings, females apparently grow faster and reach a larger size than males since few males grow to a marketable size.

The Historic Fishery

The commercial fishery for this small, thin-bodied flounder began during World War II in response to a demand created by food shortages. However, after 1945, the demand fell off and fish were no longer landed. The fishery for windowpane resumed in 1975 as landings of yellowtail flounder were in decline. Landings of windowpane averaged 2,035 mt during 1975-1978 with much of the catch taken on Georges Bank where the largest individuals of this species are found. Recently, landings have declined to average 1,280 mt during 1979-1981 coincidental to increasing catches of yellowtail. In addition to food landings, approximately 500 mt of windowpane flounder were landed annually in the industrial fishery in Southern New England during the 1940's and 1950's.

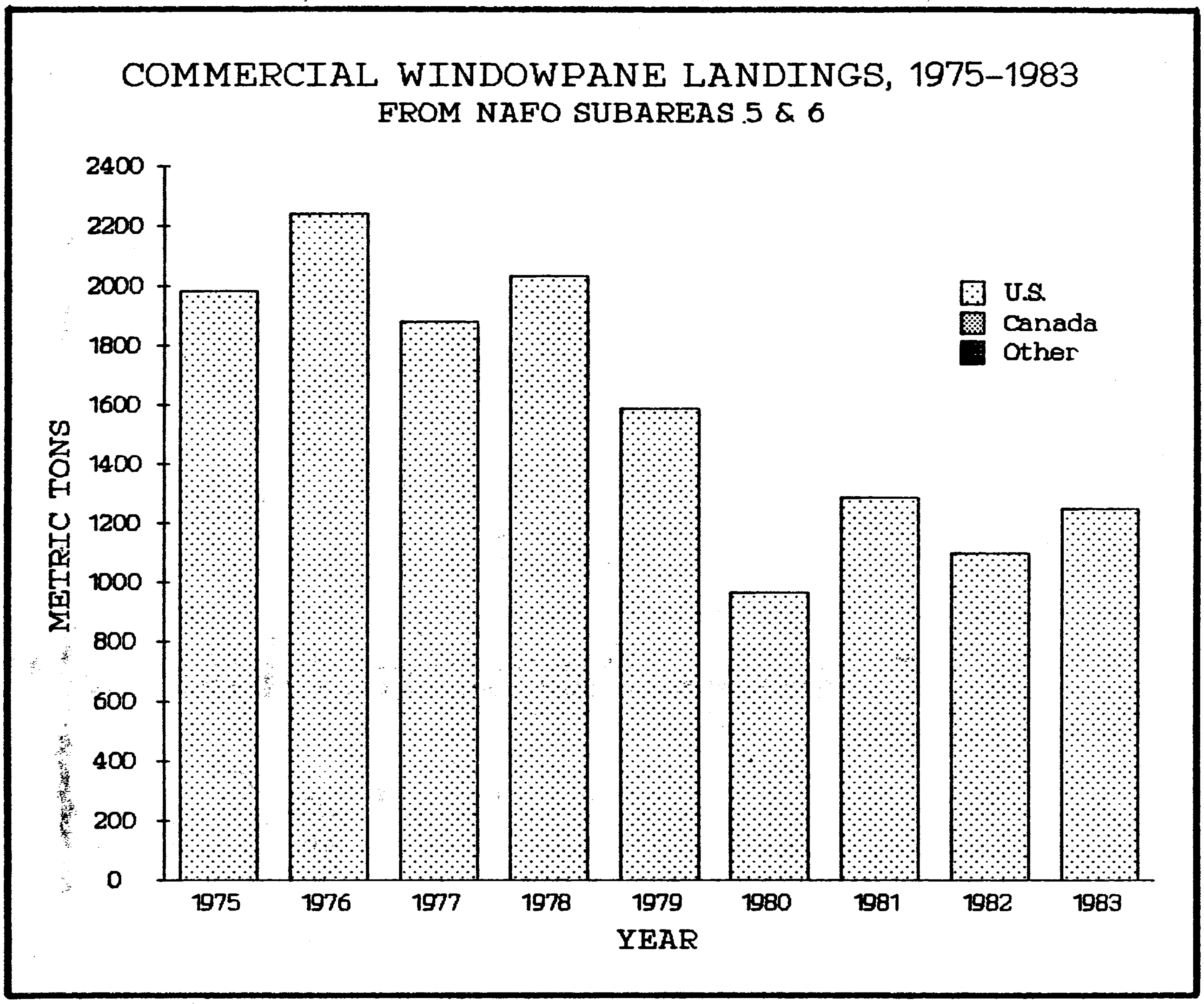
Current Conditions and Future Prospects

The 1983 commercial landings of windowpane flounder from the FCZ were 1,252 mt (provisional), all taken by U.S. fishermen. Ninety six percent (96%) of the overall catch was split between Georges Bank and Southern New England. The reported 1983 landings continue a trend of generally stable, low-level catches seen since 1981, following a period of declining catches, 1976-1980.

NMFS bottom trawl survey abundance indices (numbers of fish) of windowpane flounder on Georges Bank were substantially higher during the 1970's than during the 1960's. Relative abundances of windowpane in Southern New England have exhibited a modest recovery from reduced levels seen in the early 1970's. (U.S. DOC, 1982) Therefore, there does not appear to be any significant correlation between stock size and levels of catch, but such a conclusion may be premature since catch data are in existence only since 1975. It is likely that the major importance of windowpane flounder to the overall groundfish fishery is that it represents one of the possible alternative species during periods of decline of the higher valued yellowtail and winter flounders.

8/30/85

Figure 2A13


COMMERCIAL WINDOWPANE LANDINGS, 1975-1983
FROM NAFO SUBAREAS 5 & 6
METRIC TONS
2400
2200
2000
1800
1600
1400
1200
1000
800
600
400
200
0
1975
1976
1977
1978
1979
1980
1981
1982
1983
YEAR
U.S.
Canada
Other

§2A2 Geographical Species Assemblages

The geographic distribution of groundfish species in the Northwest Atlantic over the years' time and the commercial and recreational fisheries which are dependent upon them is a complex mosaic whose wealth of detail is difficult to grapple with. To aid in reaching an understanding of the overall complex, a hierarchical approach was taken by fishery scientists at the Northeast Fisheries Center. Considering that the total mixed trawl groundfish fishery comprises the overall management unit, a subset of separable components was identified on the basis of the mix of fish species contained within each, while taking into account the operational characteristics of the various fisheries. Thus, the identified components of the overall management unit were based upon underlying ecological production areas on which commercial fishing enterprises act to give rise to the observed landings.

Hierarchical cluster analyses were applied to NMFS spring and autumn bottom trawl survey data to aid in defining the separable components of the overall management unit from the resource perspective. A second set of cluster analyses were applied to commercial landings data to provide operational dimensions to those definitions. (Murawski et al, 1981)

Resource Assemblages. The results of cluster analysis of the 1967-1981 series of spring and autumn bottom trawl survey data are depicted in Figures 2A14 and 2A15 (W. Gabriel, pers. communication). The strongest, most persistent transition zone occurs along the 100 fathom contour on the northern periphery of Georges Bank, separating the Bank from the deep water Gulf of Maine (shown as vertical hatching in Figures 2A14 and 2A15). This transition zone appears to extend northward from the South Channel to Cape Cod during the autumn. A second transition zone occurs inshore between Cape Cod and Cape Ann, possibly reflecting northern coastal declines in abundance of haddock, cod, and winter flounder.

The deep water Gulf of Maine species assemblage includes thorny skate, American plaice, witch flounder, redfish, white hake, and cusk. There are small scale variations in species composition which are probably due to local banks and swells. An inshore Gulf of Maine species assemblage, including cod, haddock, winter flounder, and mixed flounders, appears to be persistent.

The central Georges Bank species assemblage includes cod, haddock, winter flounder, yellowtail flounder, windowpane flounder, and pollock. This assemblage generally extends westward to the Southern New England area with a discontinuity at the South Channel which acts as a stock boundary for some species. The northeast peak of Georges Bank, strongly defined in the autumn but less evident during the spring, is characterized by cod and haddock.

A species assemblage, including red hake, whiting, cod, haddock, sea raven, American angler, and yellowtail flounder, is found along the southern periphery of Georges Bank to Southern New England inshore of the 100 fathom contour, and appears to seasonally move back and forth across the shelf, particularly in its southerly extension. The Southern New England offshore species assemblage, centered along the 100 fathom contour, includes red hake, Gulfstream flounder, fourspot flounder, and redfish.

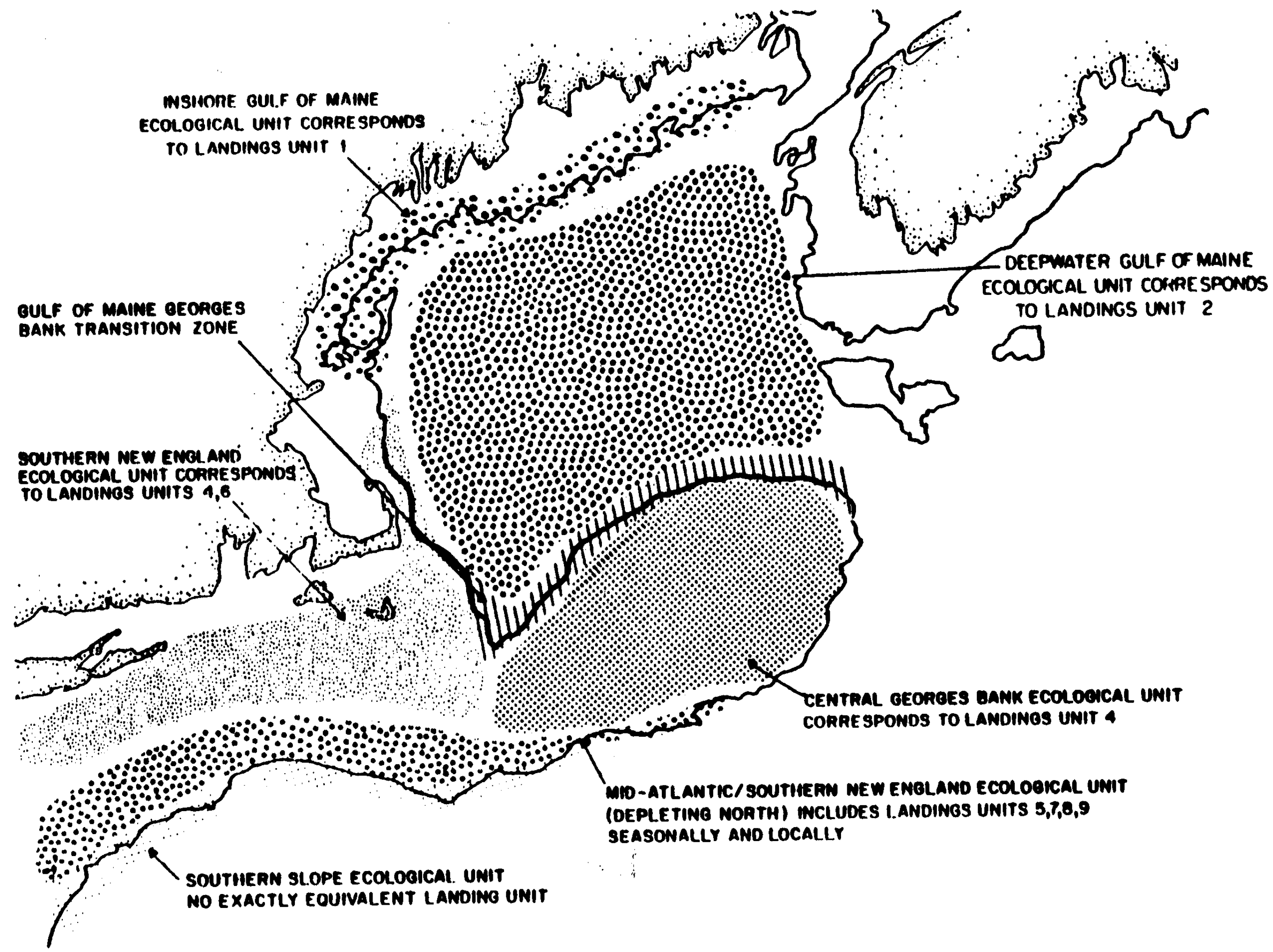


Figure 2A14: Assemblage Regions - Spring Trawl Data, 1967-1981.

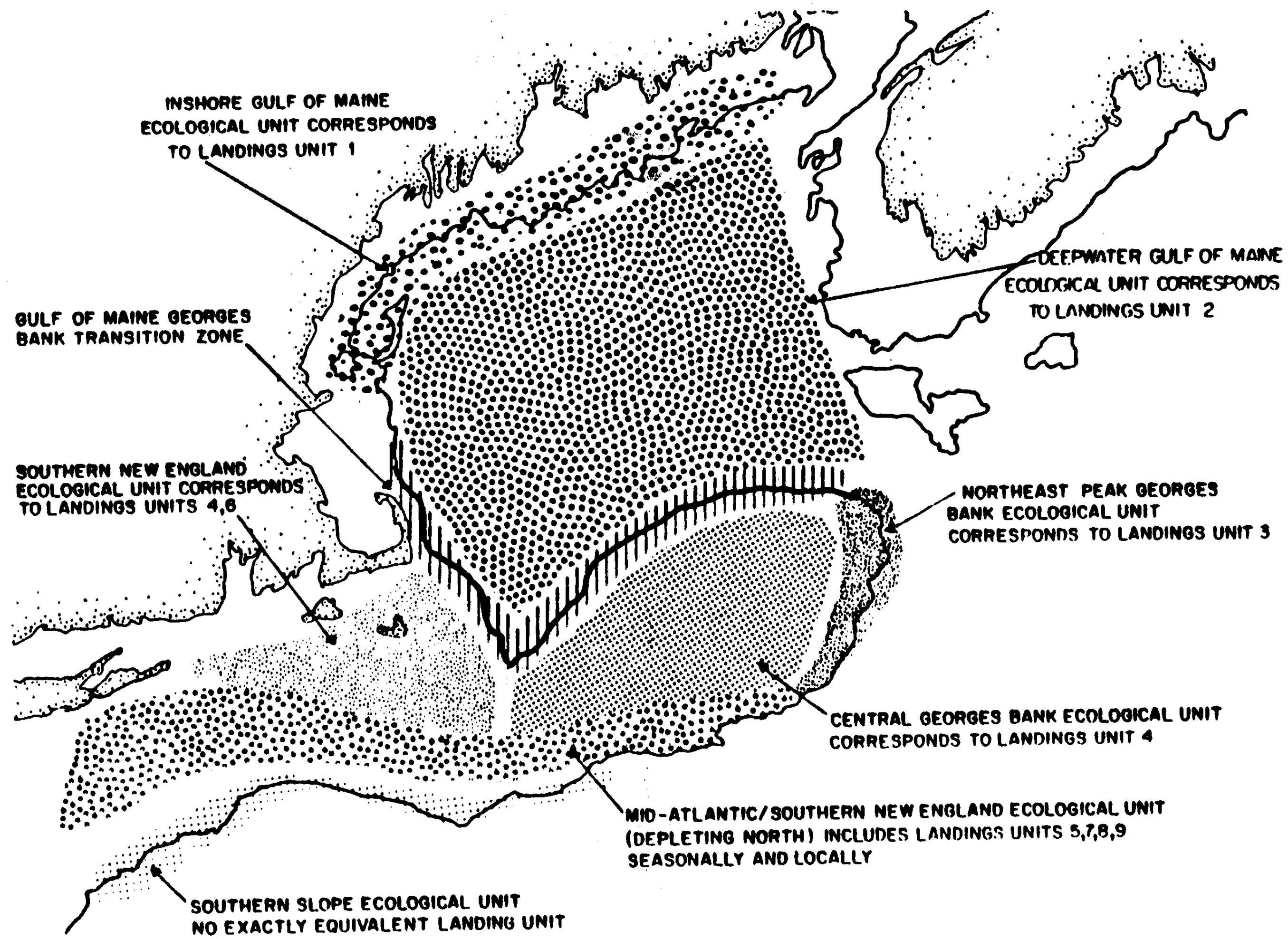


Figure 2A15: Assemblage Regions - Autumn Trawl Data, 1967-1981.

The following tabulation summarizes the essential characteristics of the species assemblages previously described.

ASSEMBLAGE REGION

INSHORE G.of M.	DEEP G.of M.	CENTRAL G.B./SNE	NORTHEAST PEAK	SOUTHERN G.B./SNE OFFSHORE	DEEP SNE
Cod	Thorny skate	Cod	Cod	Red hake	Red hake
Haddock	Am. plaice	Haddock	Haddock	Whiting	Gulfstream fl.
Winter fl.	Witch fl.	Winter fl.		Cod	Fourspot fl.
	Redfish	Yellowtail		Haddock	Redfish
	White hake	Pollock		Sea raven	
	Cusk			Am. angler	
				Yellowtail	

The species assemblages which have been identified on the basis of survey data exhibit varying degrees of stability in terms of their species composition over time. The deep water Gulf of Maine and the deepest assemblage off Southern New England appear to be the most stable. Next in order is the central Georges Bank assemblage followed by its extension in the Southern New England area. In general, the deep water assemblages appear to be the most stable in terms of their species composition while the more shoal areas, particularly in Southern New England, appear to be the most variable from season to season and year to year. Autumn survey data were generally more variable than the spring data. This suggests that much of the apparent regional and seasonal variability may be traced to migratory behavior patterns of some of the species such as red hake, whiting, and spiny dogfish.

Fishery Assemblages. Cluster analyses of otter trawl landings data, for the period 1977-1979, from the commercial fishery were developed with the view of capturing, from the operational perspective, identifiable components of the overall groundfish fishery (Murawski et al., 1981). Based on the results of those analyses, nine major components (major fisheries) were identified as persistent subgroups within the overall complex. The following discussion provides a description of the identified major fisheries. Table 2A3 gives the relative species composition within each major fishery.

Major Fishery 1 - Inshore Gulf of Maine. Fishing activity occurs along the western periphery of the Gulf of Maine from Maine to Cape Cod in water depths to 60 fathoms. Fishing occurs throughout the year, but in 1977-1979 was concentrated during the months April-July (47.2%). Major species landed in 1977-1979 were cod (34.5%), pollock (14.4%), American plaice (12.1%), and haddock (10.5%). Other species having minor importance include whiting, yellowtail flounder, redfish, witch flounder, and winter flounder.

Table 2A3. Weighted average percent species composition of otter trawl landings from the nine major fisheries, 1977 - 1979

SPECIES	MAJOR FISHERY 1	2	3	4	5	6	7	8	9
Cod	34.5	13.4	44.9	37.3	0.2	0.3	4.0	1.7	0.4
Haddock	10.5	13.7	30.1	12.5	0.2	-	0.1	-	0.1
Redfish	3.9	33.7	1.7	0.6	19.3	-	0.1	-	1.4
Pollock	14.4	10.2	5.1	4.1	1.3	-	0.2	-	0.2
Whiting	5.2	13.7	0.6	0.8	20.3	0.6	17.9	4.4	3.1
Red Hake	1.4	0.3	-	0.1	1.4	-	1.3	0.1	-
White Hake	1.1	2.0	0.5	0.2	3.5	-	0.1	-	0.2
Yellowtail Flounder	4.4	1.3	5.4	21.1	-	0.1	7.0	6.6	0.9
American Plaice	12.1	4.7	2.7	1.6	0.1	-	0.1	0.1	0.3
Witch Flounder	3.2	1.9	0.9	0.6	0.6	-	0.1	0.2	0.2
Winter Flounder	2.7	0.9	6.3	13.9	-	11.9	6.4	10.1	0.3
Windowpane Flounder	0.3	-	0.3	2.9	-	5.2	1.1	0.3	0.3
Butterfish	-	-	-	0.1	0.2	0.4	8.9	11.3	4.3
Summer Flounder		-	-	1.0	-	3.9	4.0	10.4	66.4
Mackerel	-	-		-	-	-	0.3	0.9	0.1
Scup		-	-	0.1	-	25.4	1.5	34.2	0.4
Northern Shrimp	0.8	0.1	-	-		-		-	-
Loligo Squid		-		-	-	39.6	0.5	1.9	1.9
Illex Squid	0.2	0.3	-	-	1.6			-	-

Major Fishery 2 - Deep-Water Gulf of Maine. This fishery generally encompasses the waters of the offshore Gulf of Maine to the northern periphery of Georges Bank in the depth zone 61-150 fathoms (but including the offshore banks such as Cashes and Fippennies Ledges) and is conducted throughout the year. During 1977-1979, the primary species landed were redfish (33.7%), whiting (13.7%), haddock (13.7%), cod (13.4%), and pollock (10.2%), with small quantities of American plaice, white hake, and witch flounder.

Major Fishery 3 - Northeast Peak of Georges Bank. This is a fishery which is located along the northeastern periphery of Georges Bank at all depths to 150 fathoms and is prosecuted most predominately during the months of April-October when 77.7% of the annual landings were taken in 1977-1979. Landings over the three-year period were dominated by cod (44.9%), and haddock (30.1%), with lesser amounts of winter flounder (6.3%), yellowtail flounder (5.4%), and pollock (5.1%).

Major Fishery 4 - Central Georges Bank/Southern New England. A major fishery encompasses the shallow water areas of Georges Bank and extends seasonally into the western Gulf of Maine and Southern New England in water depths of 100 fathoms or less. Landings from this major fishery are evenly distributed throughout the year. During 1977-1979, the major species landed were cod (37.3%), yellowtail flounder (21.1%), winter flounder (13.9%), and haddock (12.5%), with pollock, windowpane flounder, and American plaice of lesser importance.

Major Fishery 5 - Southern Georges Bank Offshore Lobster Fishery. This fishery, which may be characterized as the offshore lobster trawl fishery, is located along the southern and eastern periphery of Georges Bank in water depths of 61 to greater than 300 fathoms primarily during the months of March, April and May. The primary species landed during 1977-1979 was American lobster (33%), but there were significant catches of whiting (20.3%) and redfish (19.3%) with small quantities of American angler and white hake.

Major Fishery 6 - Squid Fishery (Vineyard and Nantucket Sounds). As the name indicates, this fishery is prosecuted entirely within the shoal waters (30 fathoms and less) of Vineyard Sound and Nantucket Sound during May and June. Loligo squid accounted for 39.6% of the 1977-1979 landings, with significant catches of scup (25.4%), and winter flounder (11.9%), and lesser amounts of windowpane flounder and summer flounder (fluke).

Major Fishery 7 - Southern New England Industrial Fishery. This fishery may be characterized as the mixed species industrial/Southern New England small mesh fishery which is shifted seasonally between areas in Cape Cod Bay, Long Island Sound, and Southern New England inshore/offshore waters at all depths to 150 fathoms. During 1977-1979, industrial species of fish accounted for 36.8% of the total landings. The landings of important food fish included whiting (17.9%), butterfish (8.9%), yellowtail flounder (7.0%), and winter flounder (6.4%), with smaller amounts of sea herring, cod, and summer flounder (fluke).

Major Fishery 8 - Southern New England/Middle Atlantic Scup Fishery. This fishery is prosecuted in the Southern New England/Mid-Atlantic Bight in depths to 100 fathoms during the spring and autumn in response to seasonal inshore/offshore migrations of the major constituent species. In 1977-1979, those species included scup (34.2%), butterfish (11.3%), summer flounder (10.4%), and winter flounder (10.1%). Minor amounts of industrial species, yellowtail flounder, and whiting were also landed.

Major Fishery 9 - Middle Atlantic Fluke Fishery. This major fishery is primarily for summer flounder in deep offshore waters of Southern New England/Middle Atlantic during the winter and spring months. Landings between 1977-1979 were principally summer flounder (66.4%), but with significant quantities of tilefish (11%) and butterfish (4.3%).

If the 1977-1979 landings data are aggregated, by species, across the nine major fisheries, the relative magnitude of species landings by area is made clear. Table 2A4 provides that insight. Simplifying the data, major fisheries 1 and 2 were further aggregated to represent the overall Gulf of Maine, and major fisheries 3, 4, and 5 were aggregated as Georges Bank. Finally, major fisheries 6, 7, and 8 were aggregated as the Southern New England/Mid-Atlantic (SNE/MA) small mesh fishery (see Table 2A5). Major fishery 9 cannot be considered a small mesh fishery but, as seen in Table 2A4, the relative importance of all species except summer flounder is minimal.

The most striking feature of the data in Table 2A5 is the emergence of relatively clear-cut species assemblages by major fishing area. Thus, more than 50% of the total landings of haddock, redfish, pollock, whiting, red hake, American plaice, witch flounder, northern shrimp, and Illex squid were taken in the Gulf of Maine in 1977-1979. Using the same criteria, the Georges Bank assemblage includes cod, white hake, yellowtail flounder, winter flounder, and windowpane flounder. Caution is warranted in viewing these results, however, particularly in regard to the important, ubiquitous species, cod and haddock which are more evenly distributed than most. The SNE/MA small mesh fishery is dominated by the warm-water species including butterfish, summer flounder, mackerel, scup, and Loligo squid (discounting the industrial species), but important elements of the overall fishery include whiting, red hake, and winter flounder. Moreover, the relative importance of yellowtail flounder to Georges Bank versus Southern New England has undergone significant changes in the past and may be expected to exhibit similar shifts in the future.

From an operational point of view, as the data in Table 2A4 clearly show, management of the overall groundfish complex in the Gulf of Maine should take into account the small-mesh northern shrimp fishery in Major Fishery 1 as well as that for redfish and Illex squid in Major Fishery 2. On the other hand, it may be noted that management action directed towards cod and especially haddock on the northeast peak of Georges Bank (Major Fishery 3) may be expected to have minimal impact upon the overall fishery for other species.

Table 2A4. Percent of total species landings occurring in each of the nine major fisheries, 1977 - 1979

SPECIES	MAJOR FISHERY 1	2	3	4	5	6	7	8	9
Cod	14.9	20.9	8.2	53.0	0.1	0.1	2.1	1.0	0.1
Haddock	9.2	43.4	11.2	36.1	0.1	-	0.1	-	-
Redfish	3.3	94.6	0.6	1.5	0.1	-	0.1	-	0.1
Pollock	21.2	54.2	3.2	19.9	1.3	-	0.4	-	0.1
Whiting	6.1	58.1	0.3	3.1	0.2	0.1	25.0	7.0	0.2
Red Hake	31.1	24.1	-	7.3	0.3	-	34.3	3.0	-
White Hake	5.4	35.7	1.0	56.9	0.2	-	0.7	-	0.1
Yellowtail Flounder	4.5	4.8	2.3	70.8	-	0.1	8.5	9.1	0.1
American Plaice	33.9	47.5	3.2	14.7	0.1	-	0.3	0.4	0.1
Witch Flounder	25.0	53.5	3.0	15.4	0.1	-	0.9	2.1	0.1
Winter Flounder	3.5	4.2	3.5	59.3	-	2.1	9.8	17.6	0.1
Windowpane Flounder	2.4	-	1.0	76.9	-	5.8	10.5	3.3	0.1
Butterfish		-	-	1.3	0.1	0.2	40.1	57.7	0.7
Summer Flounder		-	-	12.9	-	2.1	18.6	54.8	11.6
Mackerel		-		-	-	-	22.7	77.0	0.3
Scup		-	-	0.6	-	6.8	3.4	89.0	0.1
Northern Shrimp	68.9	31.1						-	-
Loligo Squid		-		-	-	63.0	6.8	29.2	1.0
Illex Squid	15.4	83.5	-	-	1.1	-	-	-	-

Table 2A5. Percent of total species landings occurring by major geographic fishery, 1977 - 1979

SPECIES	GULF OF MAINE	GEORGES BANK	SNE/MA SMALL MESH
Cod	35.8	61.3	3.2
Haddock	52.6	47.4	0.1
Redfish	97.9	2.2	0.1
Pollock	75.4	24.4	0.4
Whiting	64.2	3.6	32.1
Red Hake	55.2	7.6	37.3
White Hake	41.1	58.1	0.7
Yellowtail Flounder	9.3	73.1	17.7
American Plaice	81.4	18.0	0.7
Witch Flounder	78.5	18.5	3.0
Winter Flounder	7.7	62.8	29.5
Windowpane Flounder	2.4	77.9	19.6
Butterfish	-	1.4	98.0
Summer Flounder	-	12.9	75.5
Mackerel		-	99.7
Scup	-	0.6	99.2
Northern Shrimp	100.0	-	-
Loligo Squid	-	-	99.0
Illex Squid	98.9	1.1	-

§2A3 Ecological Relationships

A fundamental problem in establishing a scientific basis for fishery management has been the separation of natural environmental effects from the impacts by man. The accumulated circumstantial evidence around the world indicates that, with the exception of a few anadromous species, it is the natural environment that plays the major role in controlling the abundance and distribution of marine fish. However, in some cases the effects of man's activities have been more evident.

The massive buildup of foreign fleets in the Northwest Atlantic in the 1960's and the associated heavy fishing pressure resulted in substantial reductions in the total finfish biomass. The level of exploitation probably exceeded the finfish productive capacity of the region. Although some species were much more affected than others (e.g., sea herring and haddock), an overall reduction of 65% in total finfish biomass was seen from 1963 to 1974.

With such notable exceptions, the distribution and abundance of fish species is predominately affected by ecological conditions but the understanding of the actual mechanisms involved is extremely limited. Variability in survival of fish larvae is generally believed to be the major factor in controlling the major fluctuations in population size. The important factors affecting the survival of fish larvae are thought to be food availability, predation, and larval transport within some satisfactory range of temperatures. There is little information, however, regarding the relative importance of these factors and how they interact.

The relationship between spawning stock size and the number of progeny is probably defined by the complex small-scale dynamics of plankton communities over the several months when the fate of a population of fish larvae is determined. Collectively, the various sources of larval mortality may be termed either density-dependent or density-independent. Density-independent mortality, that component of total mortality which is not affected by the size of the larval population, may be exerted principally by physical factors of the environment such as temperature, salinity, turbulence and water currents, storm winds, etc. Density-dependent mortality, which is affected by the size of the larval population, may be caused by certain types of predator-prey relationships such as cannibalism, or other factors such as competition for available habitat or for a limited food supply. Depending upon the intensity of those factors which contribute to density-independent mortality within the time span encompassed by any given reproductive cycle, very large year classes of fish can result despite the density-dependent effects. Thus, the likelihood of obtaining consistently good recruitment to a fishery is optimized by a consistently high level of spawning activity which implies the desirability of maintaining an adequate spawning stock.

Abiotic Factors

The interaction between the temporal and geographic distribution of fish species and environmental conditions is perhaps more apparent during the juvenile and adult phases of the economically important species by virtue of the information generated by the commercial and recreational fisheries.

Of all the physical attributes of the environment, temperature is perhaps the most extensively documented. Most fish species have temperature tolerances which are narrower than those seen in the normal seasonal temperature cycle. Thus, most fish are forced to migrate offshore in winter to reach water temperatures which do not fall below a preferred minimum. Species with a more southerly distribution in their range such as scup and summer flounder having higher minimum temperature tolerances not only move offshore during the winter but also move to more southern waters. The reverse migrations occur during the spring with the annual warming trend. Sea surface temperatures in inshore waters during the summer may actually reach levels which exceed the upper temperature tolerances of fish species. However, temperature stratification usually develops in the summer period to provide for cooler bottom water in areas relatively close to shore.

Most species of marine fish spawn within relatively narrow temperature ranges, thus time of spawning is usually closely linked to the seasonal temperature cycle. The time and place of spawning of endemic species exhibit a close linkage with the temporal and geographic progression of seasonal warming and cooling, progressing from south to north for spring spawners and north to south for autumn spawners.

A dominant feature of Southern New England continental shelf bottom waters is the so-called "cold cell" located in depths ranging from about 20 to 60 fathoms off Delaware Bay northeastward to the waters off Martha's Vineyard. Summer bottom temperatures typically range only 4°C to 10°C with warmer water both shoreward and seaward of the cell (see Figures 2A16 and 2A17, autumn bottom temperatures). Yellowtail flounder spawn chiefly in water temperatures from 4°C to 9°C corresponding to the range of temperatures frequently found in the cold cell. Since yellowtail occur on the same part of the shelf where the cold cell rests, it is possible that spawning success may be related to the extent and temperature of the cold cell.

The annual cycle in sea water temperatures are superimposed upon long-term temperature trends which appear to be characteristic of large areas of the world. The scale and nature of the temperature trends vary with the size and location of the region considered. For the whole northern hemisphere there was a gradual warming trend in air temperatures from the late 1800's until about 1940, followed by a cooling trend until the mid-1960's. Mean annual sea surface temperatures along the U.S. east coast reveal a pronounced warming trend beginning in the 1940's and peaking in the early 1950's, with the trend progressively stronger from south to north. Following peak temperatures in the early 1950's, the trend was reversed with temperatures declining until 1967 when another warming trend began as illustrated by sea surface temperatures at Boothbay Harbor, Maine (see Figure 2A18). Similar warming and cooling trends have occurred in the offshore New England area both at the surface and at depth. Since 1967, temperatures rose until about 1973-1974, but have since been declining. (Grosslein and Azarovitz, 1982)

On the basis of landings' statistics, a number of fish and invertebrates (notably, mackerel, lobster, menhaden, silver hake and yellowtail flounder) in the Gulf of Maine recorded a northward shift in their range during the warming trend of the 1940's. (Grosslein and Azarovitz, 1982)

Figure 2A16

Bottom temperatures, 1973 trawl surveys (spring-left, autumn-right)

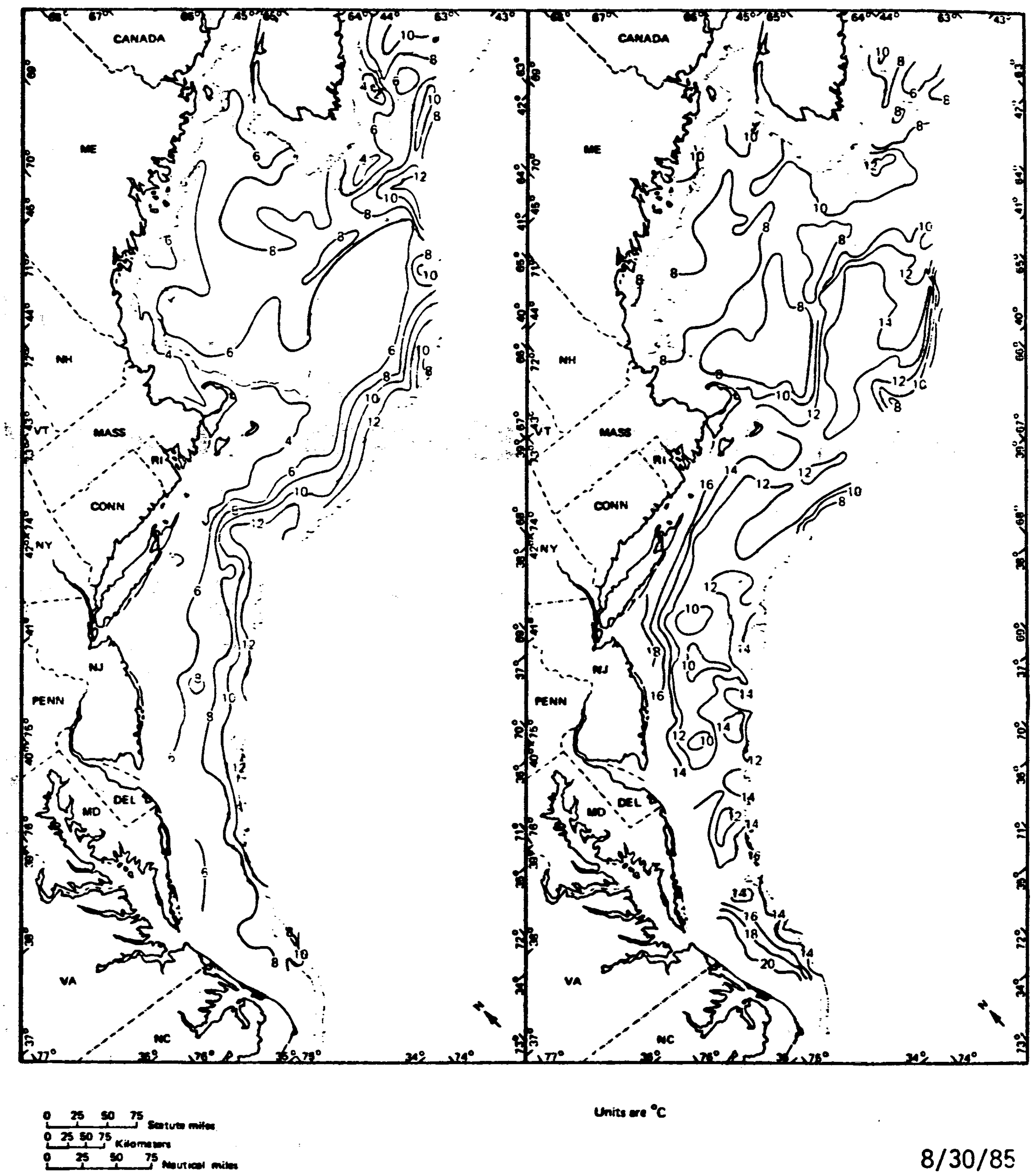
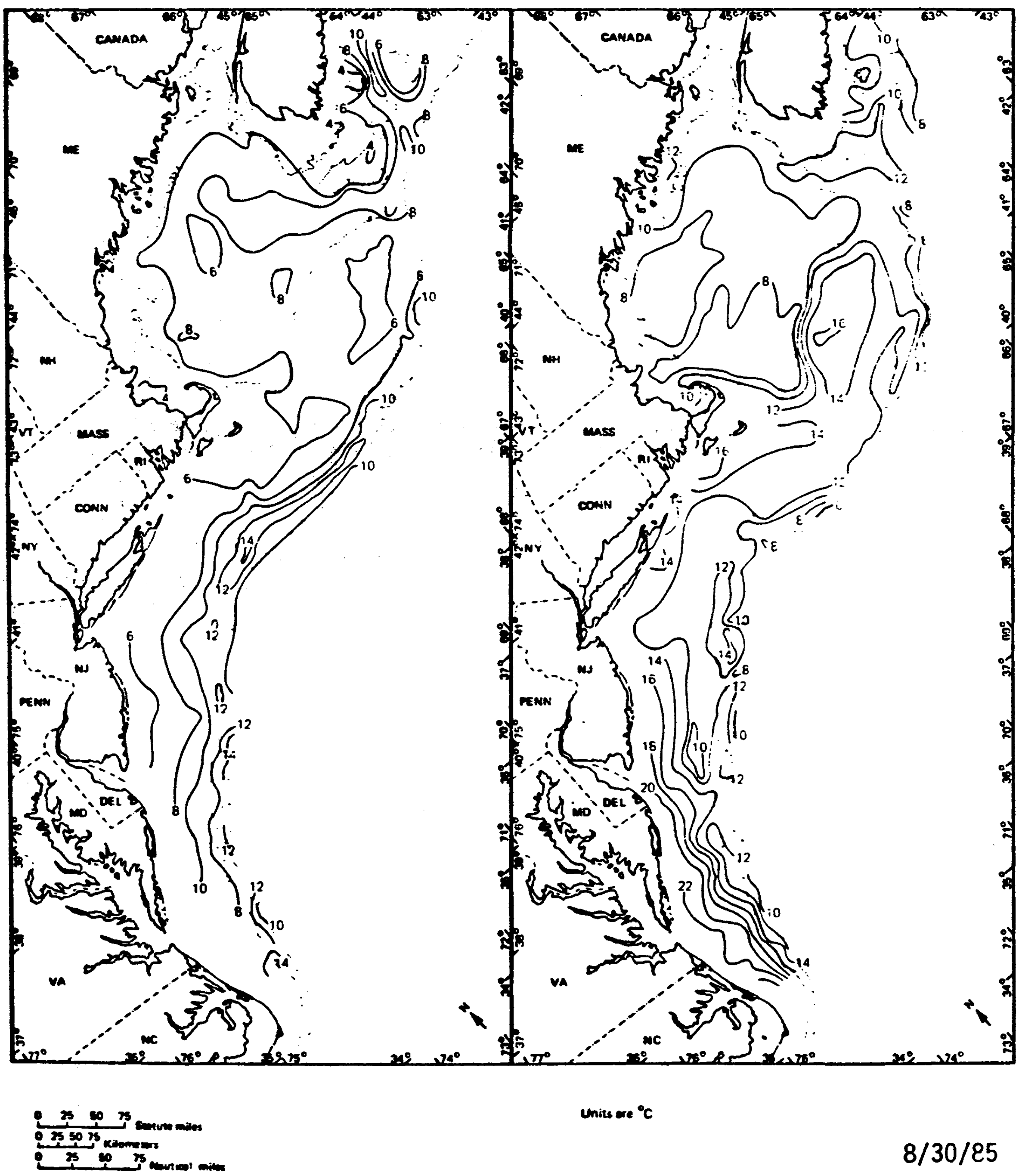


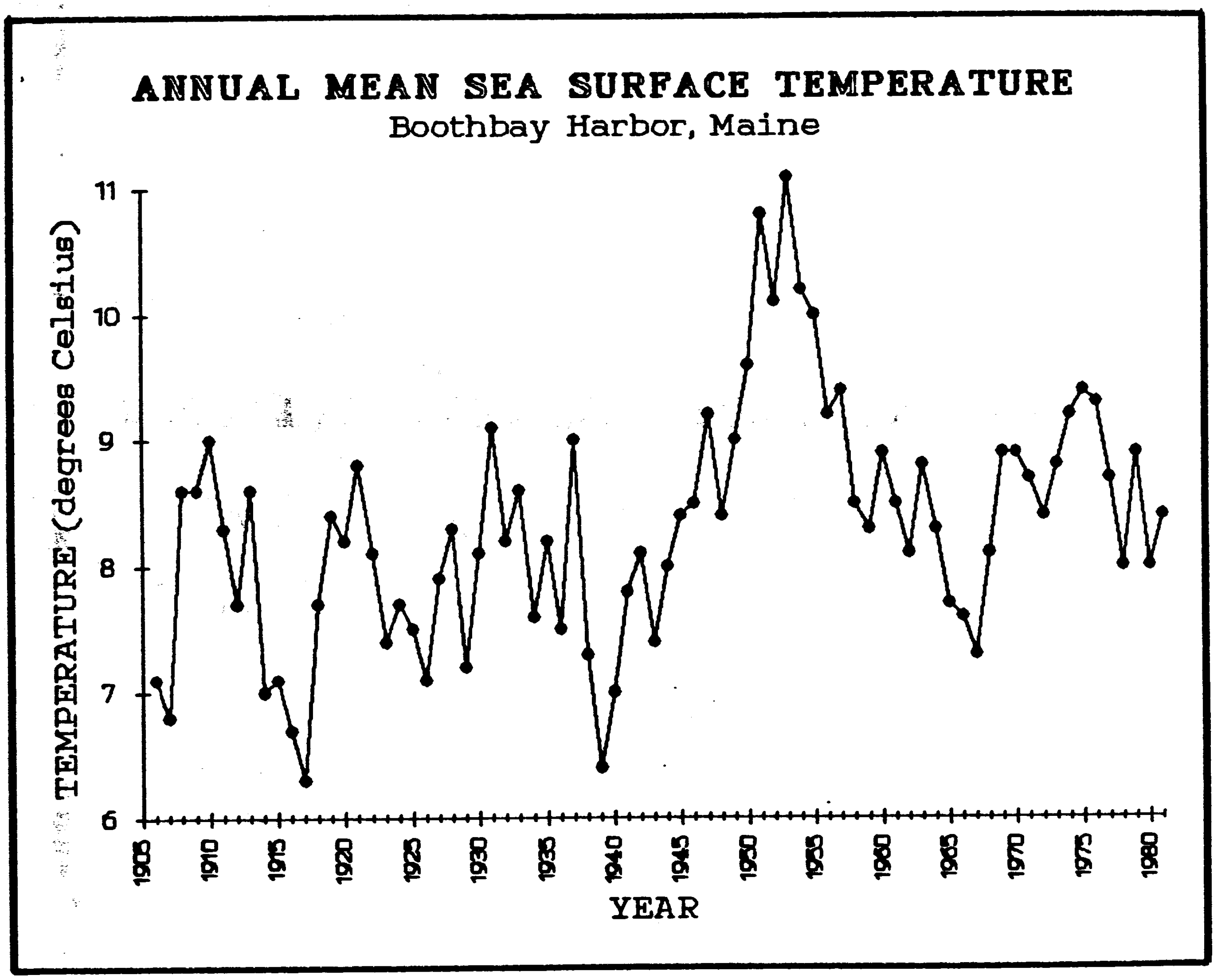
Figure 2A17

Bottom temperatures, 1974 trawl surveys (spring-left, autumn-right)



8/30/85

Figure 2A18


ANNUAL MEAN SEA SURFACE TEMPERATURE
Boothbay Harbor, Maine
TEMPERATURE (degrees Celsius)
11
10
9
8
7
6
1905
1910
1915
1920
1925
1930
1935
1940
1945
1950
1955
1960
1965
1970
1975
1980
YEAR

During the following cooling trend from the 1950's to 1967, NMFS trawl surveys indicated slight southward shifts in American plaice and butterfish, plaice extended their southern limit and butterfish contracted their northern limit. In the same series of surveys, however, haddock and yellowtail flounder did not exhibit any change and there were no significant changes in the distribution or composition of the overall demersal fish population. (Grosslein and Azarovitz, 1982)

In general, the degree of effect and association between trends in mean annual temperatures and the abundance of a species in a given area will depend upon whether there is a change in the living space or the reproductive potential. For example, it has been suggested that spawning success of yellowtail flounder on the Southern New England grounds may be related to the extent and temperature of the "cold cell" in the mid-shelf area. Since the environmental factors affecting year-class success probably operate chiefly during the first few months of life, it is unlikely that annual mean temperatures will be significantly correlated with year-class strength. Ideally, comparisons should be made between temperature conditions present at the time and place that egg and larval development of a population occurs and the subsequent strength of that particular year class. A sufficient time span of the requisite data are generally not available.

Biotic Factors

The major biotic factors affecting the distribution and abundance of fish species were briefly examined in the introductory paragraphs of this section. Clearly, the reproductive capacity or the total fecundity sets the theoretical upper limit on the size of fish populations. Among the life-history stages subsequent to egg hatching, fish survival is highly dependent upon there being available a sufficient quantity of the right kinds of food organisms. One of the stronger driving forces in the biotic environment is competition. Fish among the same as well as different species compete for the available food supply through complex predator-prey relationships which are woven into the tapestry characterizing marine food webs.

Obviously, the continued existence of a species of fish requires that successful spawning activity take place. However, among marine fish species more than 99% of the eggs (i.e., potential individual fish) produced fail to survive to recruitment. Most of this staggering level of mortality occurs during the early life history stages of development. The survival of larval fish depends upon the physical (discussed above) and biological characteristics of the environment. The biological dimensions of survival are dynamic processes which match the distribution of fish larvae in space and time with their prey and mismatch their distribution with that of their predators.

Spawning Stock Size - Recruitment. In general, the more extensive and consistent (year after year) the occurrance of spawning, the greater the likelihood that, over the long-term, stocks of fish will be maintained at some optimum level of abundance which maximizes the surplus production available for harvest. In the short run, however, recruitment is highly variable among all species of marine fish that have been examined. But different species exhibit differing levels of variability. Hennemuth et al. (1980) report that the ratio of the largest to the smallest level of recruitment for Georges Bank haddock was 19:1 during the stable period 1931-1965, and increased sharply to 2700:1 after extending the time series to 1973 to encompass the negligible levels of recruitment which occurred after 1966. The ratio for Georges Bank cod, however, was only 2.5:1 over the period 1960-1973. The ratios for Georges Bank sea herring and silver hake (whiting) were intermediate at 5.2:1 and 9.6:1 over the historical periods 1963-1974 and 1955-1973, respectively.

Several stock-recruitment models, most notably by Ricker (1958) and Beverton and Holt (1957), have been formulated in attempts to deal with the variability of recruitment as a mathematical function of the spawning stock size, but they have universally proven to be inadequate in explaining more than a fraction of that variability. The reason is that spawning stock size alone is not a sufficient basis for predicting recruitment. But spawning stock size is obviously a relevent management concern since some spawning stock is necessary or there would be no recruitment. In fact, despite all its variability, the Georges Bank haddock stock provides evidence of the importance of spawning stock size. When stocks have been reduced below 75,000 mt, recruitment exceeded 50 million fish only 10% of the time. But, at stock sizes greater than 75,000 mt, recruitment exceeded 50 million fish about half of the time.

If fisheries management is to evolve from the reactive mode, which characterizes past efforts, to a predictive mode whereby some credible long-term planning becomes possible, then the problem of predicting the magnitude of future recruitment must be solved. Recruitment may not be estimable as a function of stock size, alone, at a level of precision sufficient to serve as a basis for management. However, an alternative approach has been suggested which is based upon the probability distribution function of the observed recruitment levels seen in the historic fishery. Hennemuth et al. (1980) examined the statistical properties of the historic recruitment of a number of fish stocks, world-wide. The conclusion they reached was that, almost without exception, the observed year-class strengths seen in any given stock of fish could be described by a log-normal probability distribution. A log-normal distribution is one in which the natural logarithms of the historic series of recruitment levels conform to the bell-shaped, normal curve. These results may represent a significant step forward in efforts to develop new types of fishery models aimed at achieving a predictive capability in the long-term perspective. However, as seen with haddock in the previous discussion, the size of the spawning stock may act to modify the parameters of the probability distribution function. Short-term predictive models, which are not so complex as to preclude their practicable application, continue to elude the best efforts of fishery scientists.

<u>Food and Feeding Habits - Predation and Competition</u>. Most food habit studies of marine fish have had their primary focus upon the adult forms for the very practical reason that the food remains typically found in the gut of larval fish are usually not identifiable, even to major taxa. Nevertheless, it is known that all species of fish larvae feed upon various forms in the plankton, and to varying degrees, are prey for other planktonic organisms as well as juvenile and adult fish. The appropriate planktonic prey are usually found in a patchy distribution in the water column. Depending upon whether the distribution of the larval fish is coincident in time and space with the patchy aggregations of their prey, food is probably not limiting. However, the caveat may be of critical importance since larval fish must feed almost continuously to survive and undergo normal development.

Since 1963, various studies of the food habits of the major species of adult fish on Georges Bank have been conducted by the National Marine Fishery Service. The most scientifically rigorous of these studies has been ongoing since 1969. Based upon this study, the food habits of a number of demersal fish collected from Georges Bank between 1969 and 1972 have been summarized in Figure 2A19 (Grosslein et al., 1980). The data are expressed as the percent by weight of the total stomach contents for all the fish of each species examined. Included among the crustacean prey organisms are various kinds of shrimp and crabs, and most commonly, the small, shrimplike euphausiids (i.e., krill). Nearly all of the most common forms of fish appear as prey organisms, with the herrings and the mackerels predominating. But the flounders, the various cod-like forms, the sculpins and the sand launces are also represented. Polychaetes, which are an important element in the diet of many bottom fish, are a large grouping of marine worms which typically live in and near the bottom sediments. Echinoderms, also important items in the diet of bottom fish, include starfish, brittle stars, and sea urchins. Molluscan food organisms are the clams and snails living in the sediments as well as squid. The "other phyla" category of food organisms include, principally, other forms in the plankton, and "miscellaneous" is unidentified animal remains, sand, and rock.

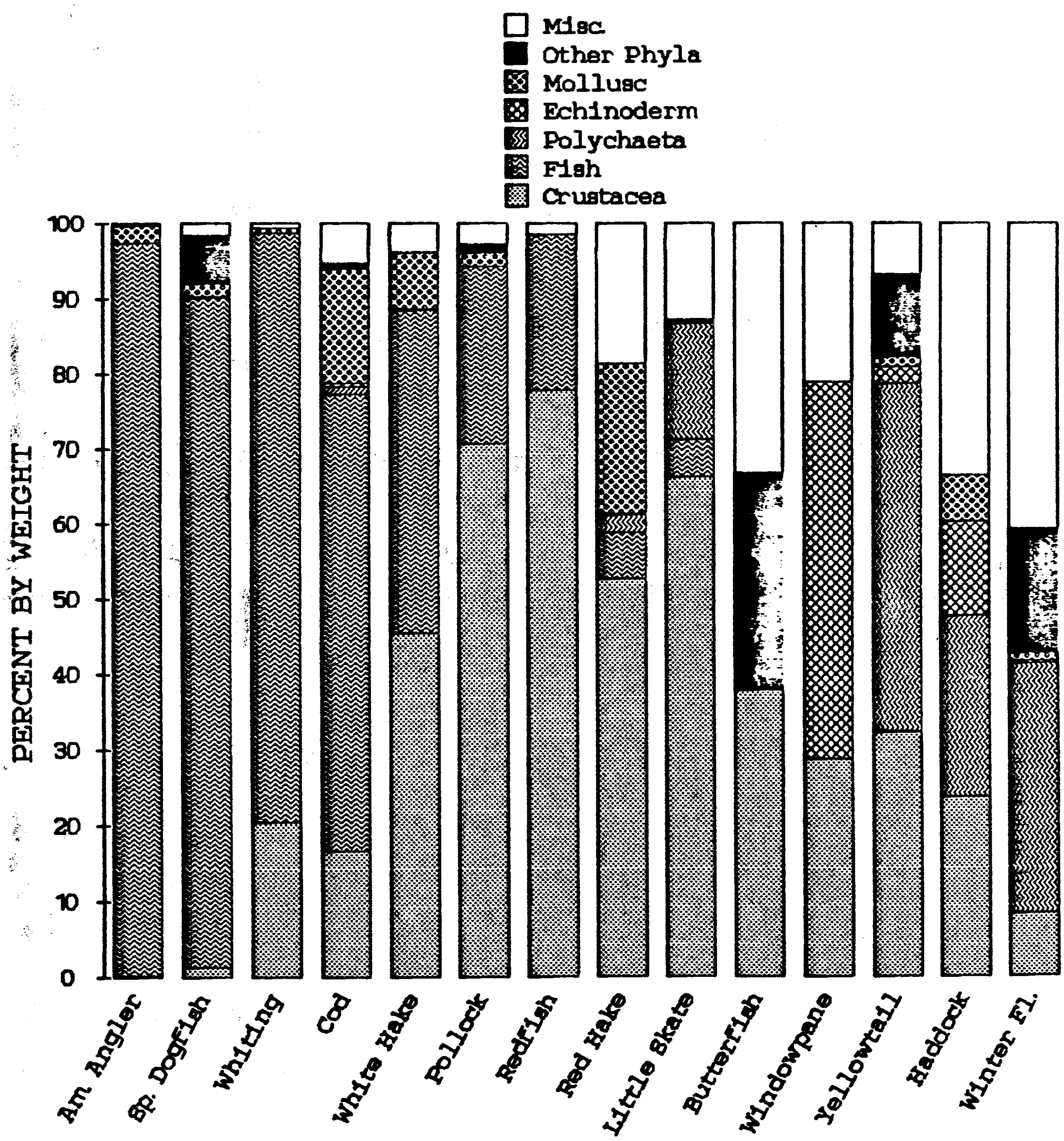
The fish shown in Figure 2A19 have been ordered from left to right in terms of the prevalence of fish in their diets. Thus, the angler (monkfish) and spiny dogfish are the major fish predators, followed by whiting, cod, and white hake. In the center of Figure 2A19 are those fish which feed principally upon crustaceans, white hake, pollock, redfish, red hake, and little skate. Finally, it is seen that for three species of flounder (windowpane, yellowtail, and winter flounder), as well as haddock, a significant portion of their diet consists of benthic organisms (molluscs, echinoderms, and polychaetes).

The data presented in Figure 2A19 are all relative, they do not reflect the absolute magnitudes of predation occurring in the ecosystem. For example, Grosslein et al. (1980) estimated that the total consumption of fish by silver hake (whiting) on Georges Bank far exceeds the total production of exploitable fish of that area. This implies that whiting must eat a considerable quantity of pre-recruit (non-exploitable) fish. It is also likely that they consume significant quantities of exploitable-sized fish.

The emerging knowledge of food habits and predator-prey interactions in marine ecosystems underscores the importance of maintaining an adequate biomass of suitable forage species to support populations of the commercially valuable forms. In past years, huge populations of the herrings filled that need. With collapse of the Georges Bank herring stock, recent years have seen a burgeoning of populations of sand launce to the near-record high levels of about 1-3 million metric tons estimated for 1981-1982. Moreover, the recent increased abundances of Atlantic mackerel, which competes with sea herring for the same or similar food organisms (Maurer, 1976), further emphasizes the dynamic nature of trophic relationships. Thus, the diversity and inherent, short-term, instability of the ecosystem may, in fact, provide for the greatest assurance of stability in the long-term perspective.

Figure 2A19

FOOD TYPES FOR GEORGES BANK DEMERSAL FISH
Based Upon Analysis of Stomach Contents



8/30/85

§2A4 Biological Management Parameters for Major Species

A summary of important management parameters for the major species of fish within the overall mixed groundfish resource complex is given in Table 2A3. The table has been organized on the basis of the recognized stock structure for each species. For example, where growth parameters differ from one stock to another, such are indicated by a numbering system which corresponds to the same numbering system used to differentiate the separate stocks. The same system applies to estimates of MSY as well as the important benchmarks of fishing mortality, where separate estimates by stock are in existence. The Gulf of Maine cod stock, indicated by "1) GM", has the growth parameters, k=0.120 and L =148.1 cm. The fishing mortality indices for the Gulf of Maine cod stock are, F-0.1=0.16, F-max=0.30, and the most recently available estimate of the current fishing mortality in the fishery (F-current) is 0.38. All cod stocks have a natural mortality, M=0.2. Finally, the estimated MSY for the Gulf of Maine cod stock is 8,000 mt.

The following discussion is an explanation of the significance of the entries in Table 2A3 with regard to fishery management.

Stocks. Stock differentiation is intended to specify those groups of fish of a given species which have a high degree of integrity in their breeding populations and which tend to have similar rates of growth and mortality. Stock differentiation does not imply that there is no intermixing. Nevertheless, there is sufficient separation between stocks over time and space that interactions and effects on a stock from one area are usually not immediately seen in stocks from other areas. Thus, stock structure may have implications in consideration of the definition of management units.

Growth. The growth parameter, k, is a term in the growth equation which is a measure of the rapidity with which fish grow to the average maximum size, L . The absolute maximum age and size indicate the maximum time that a cohort of fish may be expected to remain in the ecosystem and be available to the fishery and the maximum length that individual fish have been observed to attain. Fish of that age and size would not be expected to be abundant in a heavily fished population.

Ages in the Fished Population. The age range given represents the most commonly encountered given the growth characteristics of the species and the prevalent statis of the fishery. The age range is not as broad as would normally occur in an unfished population nor does it include the rare older fish in a moderately fished stock. Also included is an indication of the age at recruitment and the current predominate year classes.

Maturity. The average size and age when fish achieve sexual maturity has been indicated, by sex, when such information is available. These data have relevance in consideration of appropriate mesh sizes for the fishery where an objective for management is the prevention of recruitment overfishing. An indication of the time and place of spawning activity may also be an important management consideration.

Mortality. Estimates of rates of natural mortality (M), as well as important indices of fishing mortality, F-0.1, and F-max, are given with the latter included for comparison with F-current, the latest available estimate of fishing mortality currently being generated in the fishery.

TABLE 2A6. SUMMARY OF IMPORTANT MANAGEMENT PARAMETERS FOR MAJOR SPECIES WITHIN THE OVERALL MIXED GROUNDFISH RESOURCE

STOCKS	GROWTH k	GROWTH L	AGES IN FISHED POPULATION	MATURITY	MORTALITY M	MORTALITY F-0.1	MORTALITY F-max	MORTALITY F-current	MSY	BY-CATCH/ DISTRIBUTION
COD 1) GM 2) GB 3) SNE-MA	1) 0.120 2) 0.116 3) 0.257 Max age=22 yrs Max length = 183 cm (72 in)	148.1 146.5 112.9	2-15+ years GM recruits at age 3 GB recruits at age 2 GM: Currently, 1977-1980 yr classes dominate population GB/SNE-MA: 1978, 1979, and 1980 yr classes dominant	50% maturity: GM: Male 4.2 yr (21.3 in) Female 3.8 yr (19.7 in) GB/south: Male 2.6 yr (17.3 in) Female 2.9 yr (20.3 in) Max egg production: age 12	0.2	1)0.16 2)0.15	1)0.30 2)0.30	1).6-.8 2).6-.8	1) 8,000 mt 2) 35,000 mt	Haddock, pollock, yellowtail, other flounders, other groundfish Demersal GB stock migrates south in autumn
HADDOCK 1) GM 2) GB	1) 0.352 2) 0.376 Max age=18 yrs Max length = 112 cm (44 in)	72.91 73.80	2-9+ years GM recruits at age 2.7 GB recruits at age 2.3 GM: 1975 yr class was strong, 1979 & 1980 cohorts moderate GB: 1975 and 1978 yr classes only major recent recruitment.	50% mature at age 2 Size at maturity: Males, 16.3 in Females, 16.9 in Spawn Feb-May, peak Mar-Apr on GB Max egg production: age 6	0.2	0.26	0.55	1)0.6 2)0.6	1) 5,000 mt 2) 47,000 mt	Cod, yellowtail, other flounders, other groundfish Demersal Move inshore off New England between Jan and June
REDFISH Single stock GM/GB	0.104 Max age >50 yrs Max length = 45-50cm (20 in)	37.80	6-25+ years Recruits at age 5 1971 yr class only major recent recruitment	Mature at age 8-9 Size at maturity: 8.5-9 in Spawning peak in late June-early Aug	0.1	0.14	>1.0	0.3-0.4	14,000 mt	Relatively pure fishery, some taken in mixed trawl and northern shrimp fisheries Demersal Nonmigratory
POLLOCK Single stock NS/GM/GB	0.215 Max age=23 yrs Max length = 106 cm (42 in)	97.77	2-13+ years Recruits at age 3.5 Strong 1971, 1975, 1976, and 1979 yr classes	50% mature by age 5 Males, 19.7-25.6 in Females, 21.7-27.6 in Spawn Nov-Mar, peak late Dec, Western GM	0.2	0.25	0.49	0.26	52,000 mt NS, GM, GB combined	Herring (fall only) Groundfish (when on bottom) Pelagic/Demersal

KEY: NS = Nova Scotia GM = Gulf of Maine GB = Georges Bank SNE = Southern New England MA = Mid-Atlantic

TABLE 2A6 continued.

STOCKS	GROWTH k L	AGES IN FISHED POPULATION	MATURITY	MORTALITY M	F-0.1	F-max	F-current	MSY	BY-CATCH/ DISTRIBUTION
WHITING 1) GM 2) GB 3) SNE-MA	1) 0.182 65.41 2) 0.246 50.72 3) 0.416 46.08 Max age: Males=6 yrs Females=12 yrs Max length = 66 cm (26 in)	2-12+ yrs Recruits at age 2 GM: 1977, 1978, and 1980 yr classes GB: 1978 and 1980 yr classes SNE-MA: 1980 and 1981 yr classes average 1976 and 1978 yr classes stronger	50% mature at age 2 1) Males, 9.2 in Females, 9.4 in 2) Males, 9.6 in Females, 10.3 in 3) Males, 9.9 in Females, 9.9 in Spawn Jun-Sept Max egg production: age 4	0.4	1)0.55 2)0.65 3)0.55	1)>2.0 2)>2.0 3)>2.0	1)0.13 2)0.14 3)0.47	1) 17,000 mt 2) 55,000 mt 3) 35,000 mt	Red hake, mackerel, other groundfish Demersal/Pelagic Move inshore in spring-summer
RED HAKE 1) GM (small) 2) GB 3) SNE-MA	0.37 approx 42.6 Max age=12 yrs Max length = 75 cm (30 in)	2-10+ yrs Recruits at age 3 GB: yr classes since 1977 are average, 1980 may be strong SNE-MA: 1979 yr class is strong, 1980 and 1981 are average	50% mature at age 2 Size at maturity= 11.1 inches Spawn in summer on southern GB	0.4	2)0.85 3)0.45	Unk	2)0.10 3)0.18	2) 13,000 mt 3) 26,000 mt	Whiting, other flounders, other groundfish Demersal Inshore/offshore in autumn, offshore in winter/spring
WHITE HAKE Single stock NS/GM/GB	Males: 0.11 110.6 Females: 0.09 135.3 Max age=23 yrs Max length = 120 cm (47 in)	Unknown	50% maturity age= Unk Size at maturity= 42 cm (16.5 in) Spawn on slope in MA (summer), Scotian Shelf in early autumn	Unk	Unk	Unk	Unk	Unknown	Red Hake, other groundfish Demersal Move inshore in GM and SNE in autumn
YELLOWTAIL FL 1) GB 2) SNE-MA (including Cape Cod)	0.335 50.0 Max age=14+ yrs Max length = 55 cm (22 in)	2-12+ yrs Recruits at age 2 1980 yr class strong, 1979 and 1981 above average. 1982 &1983 classes weak.	50% mature at age 2 Size at maturity= 10 in Spawn Mar-Aug Max egg production: age 7	0.2	0.3	0.5	1)1.0 2)1.0	1) 16,000 mt 2) 23,000 mt	Cod, haddock, other groundfish, other flounder Demersal Little movements Major concentration on GB and SNE

KEY NS = Nova Scotia GM = Gulf of Maine GB = Georges Bank SNE = Southern New England MA = Mid-Atlantic

TABLE 2A6 continued.

STOCKS	GROWTH k	GROWTH L	AGES IN FISHED POPULATION	MATURITY	MORTALITY M	MORTALITY F-0.1	MORTALITY F-max	MORTALITY F-current	MSY	BY-CATCH/ DISTRIBUTION
AM. PLAICE 1) GM 2) GB	Unk	Unk	1-9 yrs	50% maturity: Male 3.2 yr (10.1 in) Female 3.8 yr (11.7 in) Spawn Mar-Jun Western Gulf of Maine and south of Martha's Vineyard	0.2	0.17	0.34	Unk	Unknown	Other flounders, other groundfish
	Slow growing Max age=Unk Max length = 83 cm (33 in)									Demersal
										Concentrated at depths of 50-100 fm
WITCH FL. 1) GM 2) GB	Males: 0.13 Females: 0.08	61.1 79.1	Unknown	50% mature at 13 inches (age unknown) Spawning peak Jul-Aug Cape Cod to Delaware Bay	Unk	Unk	Unk	Unk	Unknown	Skates, cod, haddock, whiting, pollock, wh. hake, redfish, Am. plaice
	Max age = Unk Max length = 63 cm (25 in)									Demersal
										Sedentary Deep water
WINTER FL. 1) GM 2) GB 3) SNE	1) 0.69 2) 0.67 3) 0.75	45.5 57.8 48.2	2-12+ yrs Recruitment appears to be good	50% mature at age 2 Male: 9.8 in Female: 10.2 in Spawn Jan-May inshore GM and SNE Apr-May on GB	Unk	Unk	Unk	Unk	Unknown	Cod, haddock, other groundfish
	Max age=12+ yrs Max length = 62 cm (24 in)									Demersal
										Winter spawning migrations into estuaries
WINDOWPANE FL. 1) GB 2) SNE-MA	Unk	Unk	Recruit at age 2 Older ages (4+) taken for food	Mature at age 2-4 Spawn Apr-Jun on Nantucket Shoals and south	0.2-0.3	Unk	Unk	Unk	Unknown	Sp. dogfish, little skate, whiting, red hake, scup, btrfish yellowtail, squid, winter flounder
	Max age=Unk Max length = 38 cm (15 in)									Demersal

KEY: NS = Nova Scotia GM = Gulf of Maine GB = Georges Bank SNE = Southern New England MA = Mid-Atlantic

TABLE 2A6 continued.

STOCKS	GROWTH k	GROWTH L	AGES IN FISHED POPULATION	MATURITY	MORTALITY M	MORTALITY F-0.1	MORTALITY F-max	MORTALITY F-current	MSY	BY-CATCH/ DISTRIBUTION
SUMMER FL.										
Single stock GB/SNE/MA	0.209	92.24	2-7 yrs Recruitment begins at age 1, complete by age 4	50% mature at age 2 Size at maturity= 12.6 in Spawns Sept-Apr Max egg production: age 7	0.2	0.16	0.19	Unk	15-20,000 mt	Mixed groundfish, winter fl, Loligo, scup Demersal Migrates offshore in autumn
	Max age=20 yrs Max length = 95 cm (37 in)									
SCUP										
1) SNE 2) New Jersey	1) 0.195 2) 0.216	40.79 39.58	2-15 yrs Catch dominated by 2-3 yr old fish	50% mature at age 2 Spawn May-Aug	--Current Data-- --Not Available--				15,000 mt	Demersal Seasonal migration in/offshore
	Max age=19 yr Max length = 43 cm (17 in)									
BUTTERFISH										
1) No. of Cape Hatteras 2) So. of Cape Hatteras	0.862	21.02	1-6 yrs Age 3 dominate catch during Jan-Jun Age 0-1 dominate catch during Jul-Dec	50% mature at age 1.5 Spawn May-Aug in MA to southwest GB	0.8	0.69	1.33 (60 mm mesh)	Unk	16,000 mt	Loligo offshore; mixed gfish inshore Pelagic/Demersal Move offshore and south in autumn, inshore in April
	Max age=6 yrs Max length = 30 cm (12 in)									

KEY: NS = Nova Scotia GM= Gulf of Maine GB = Georges Bank SNE = Southern New England MA = Mid-Atlantic

Maximum Sustainable Yield. MSY provides a useful guide to the long-range biological productivity of the stocks, provided that the limitations of MSY are kept in mind. The indicated estimates of MSY are, in some cases, based upon analytical models, and in other cases are based upon long-term historical catch averages. MSY is not necessarily an indication of what may be taken in any given year, but what might be taken on the average over a similar long-term historical period. If catches were maintained at the MSY level for a period of time, stocks would likely decline due to annual variations in the strength of recruitment. Catches would then decline since productivity from the reduced stock would be less than before. The estimates of MSY, where given by stock, give an indication of the relative productivity of those stocks.

By-Catch and Distribution. The data under this category demonstrate that a unit of fishing effort in the mixed groundfish fishery may be directed at several species, simultaneously. A unit of fishing effort directed at one species may catch, perhaps less effectively, other species that are associated with it in the environment. Moreover, in the mixed fishery, fishing trips which are initially directed towards one species may often be switched to other species through conscious effort by the vessel captain in order to make an economically viable trip. Other information in this category attempt to characterize the predominate portion of the water column where fish reside and to give some indication of patterns of movement and migration.

§2A5 Prediction of Resource Abundance

In support of the fishery management decision-making process, the New England Fishery Management Council has a requirement for up-to-date assessment information pertaining to the stocks of fish under management. Current information with respect to health of the stocks is most useful when it may be viewed against a background of trends in the historical fishery, and has particular relevance within the overall management process when formulating management objectives and setting optimum yields. When comprehensive historical fishery data are available then more complete stock assessments may be generated which have short-term predictive capabilities of future stock conditions. Thus, feasible planning of future management action, predicated upon the attainment of long-range objectives, is contingent on a comprehensive fishery data base and an enhanced predictive capability.

The spectrum of currently available stock assessment information ranges from the series (since 1963) of relative abundance indices derived from NMFS research vessel bottom trawl surveys to complete stock assessments developed for selected, economically important species. Survey catch data provide a relative index of stock abundance and recruitment prospects and indicate, in the context of prior year's data, trends over time of these parameters. Until recently, survey data alone could provide no indication of absolute stock abundances (i.e., in the context of minimum stock size constraints). Collie and Sissenwine (1983) have demonstrated a method for estimating population sizes from standardized survey data which should prove to be extremely useful in cases where insufficient fishery catch data are available for development of traditional stock assessments (e.g., virtual population analysis) such as the Gulf of Maine cod stock. Their method, however, has a limited predictive value since the relative abundance of the most recent recruiting year class does not enter into the analysis. Other techniques are available for estimating the absolute level of recruitment from survey relative abundance indices broken down by age class, such as regression analysis of historical recruitment data which are provided by another method (e.g., virtual population analysis).

The estimation procedure, virtual population analysis (VPA), developed by Gulland (1965), marked the initiation of the quantitative stock assessment in fishery management, worldwide. Prior to its development, only qualitative models (such as yield per recruit analysis) were available for providing specific advice to fishery managers. VPA is essentially a technique for estimating the instantaneous fishing mortality rates and stock sizes at age necessary to explain the observed landings plus losses from an assumed level of instantaneous natural mortality (i.e., all other sources of mortality other than from fishing). VPA has proven to be a powerful tool for fishery management, but not without discrimination in its use and interpretation of its results. The major sources of error in the VPA concern the assumptions regarding natural mortality, the accuracy of the catch-at-age information, and the level of fishing mortality assigned to the oldest age which is used to start the analysis. Landings-at-age information, regardless of the precision of estimation, may not necessarily reflect the actual removals from the stock with discards being the major source of error. The assumed level of natural mortality (M) may only partially compensate for such losses since the VPA assumes a constant M over all age classes.

Finally, to begin a VPA, the level of fishing mortality (F) appropriate to the oldest age class in the catch (the so-called "starting F") must be either assumed or estimated by another method. With a sufficient time span of historical catch data, errors associated with an incorrect "starting F" are quickly dampened out, particularly if fishing mortalities are high, but the results for the most recent 1-3 years are usually subject to considerable uncertainty.

Typically, in a complete stock assessment using the VPA, the estimates of the strength of the most recently recruiting year classes may be improved through regression analysis of historic VPA-derived estimates of recruitment on the corresponding year's bottom trawl survey catches. Thus, with a derived relationship, current survey catches may be converted to estimates of absolute abundance. With such estimates of current levels of recruitment, alternative scenarios of catch and resulting stock size may be projected 1-2 years in advance. Thus, fishery managers have the opportunity to evaluate the near-future consequences of possible management actions.

As an outgrowth of inquiries into the overall relationship between the size of the spawning stock and the number of progeny resulting from spawning activity, the effect of certain environmental variables, mediated through egg and larval survivability, has received attention in recent years. The effect of temperature has received particular attention. It has long been known that many stocks of marine fish and shellfish exhibit more or less well defined long-term cycles in catch levels. Whether such cycles are also descriptive of actual stock abundances may be problematic. Seawater temperature has been of particular interest since, as with catches of certain species, long-term cycles are demonstrable. For example, the Boothbay Harbor, Maine, sea surface temperatures depicted in Figure 2A18 may be shown to exhibit strong autocorrelation with a remarkably smooth 22-year cycle (NEFMC, unpublished data). Moreover, historic catch levels of yellowtail flounder are similarly autocorrelated.

A number of investigators (Dow, 1977; Edwards, 1965; Flowers & Saila, 1972; Sissenwine, 1974; Sutcliffe et al., 1977) have examined the overall question of the relationship between sea water temperature and the abundance of fish and invertebrates with the view of developing a short-term predictive capability. Based upon these studies, qualitative comparisons between temperature and trends in population abundance of selected species are shown in Table 2A7 (Grosslein and Azarovitz, 1982). It is seen that all eight species showing negative (inverse) correlations with temperature are northern species - yellowtail flounder, mackerel, cod, winter flounder, Illex squid, American lobster, silver hake and red hake. On the other hand, all but one of the species showing positive correlations with temperature (sea scallop, Loligo squid, summer flounder and scup) are resident to the New England-Middle Atlantic Bight area. Menhaden, showing a weak positive correlation, is a southern species.

This overall pattern is what may be expected if lower temperatures are presumed to enhance the suitability of the New England-Middle Atlantic area for northern species while warmer temperatures presumably enhance conditions for resident or southern species. This consistency with expectations lends

Table 2A7. Qualitative associations between temperature trends and abundance of selected species.

	Species	Relative Strength of Correlation	Faunal Group
Positive Correlation With Temperature	Sea Scallop	Moderate	Resident
	Loligo Squid	Moderate	Resident
	Summer Flounder	Weak	Resident
	Scup	Weak	Resident
	Menhaden	Weak	Southern
Negative Correlation With Temperature	Yellowtail Flounder	Strong	Northern
	Mackerel	Moderate	Northern
	Cod	Moderate	Northern
	Winter Flounder	Moderate	Northern
	Illex Squid	Moderate	Northern
	American Lobster	Moderate	Northern
	Silver Hake	Weak	Northern
	Red Hake	Weak	Northern

credence to the idea that temperature may have a real association with fish abundance. Unfortunately, the data are not adequate to distinguish between simple extensions of seasonal migrations and real population changes, except for sea scallops and possibly the American lobster. Yellowtail flounder may be another case where real changes occur since this species exhibits little or no migratory activity.

All of the studies cited above have demonstrated significant correlations between mean temperature data and subsequent lagged catch data for a number of important commercial species of fish and invertebrates. The results suggest that, in selected cases, fish abundance is related to the sea water temperature at the time fish were spawned or during the first winter of life. The actual mechanism involved is not explained on the basis of the correlation, thus a causal relationship is yet to be demonstrated. This does not imply that the association between fish abundance and temperature is spurious. On the contrary, that association may be useful, at least as a qualitative consideration, in short-term predictions of resource abundance.

SUBPART B: DESCRIPTION OF THE HABITAT

§2B1 Ecological Relationships

§2B1.1 Bathymetry

The fishery resources of importance to the multi-species fisheries off the northeast coast of the United States are typically distributed along the continental shelf from Georges Bank southward to the Mid-Atlantic Bight and in the Gulf of Maine. The continental shelf on the U.S. east coast is narrowest off Cape Hatteras, North Carolina, where the 100 fathom contour is only about 20 miles offshore. As one travels northward, the shelf extends out considerably further with the 100 fathom counter located about 80 miles off Cape May, New Jersey, and about 100 miles off Cape Cod.

Between Cape Cod and Nova Scotia is the expansive Gulf of Maine, enclosed to the seaward by Brown's Bank and Georges Bank. The topography of the Gulf, scoured by glaciation, includes many deep basins and shallow banks and ledges. Water exchange with the Atlantic Ocean takes place primarily through the deep Northeast Channel region and the shallow Great South Channel.

Georges Bank is a large, relatively shallow bank located between the Great South Channel and the Northeast Channel. The shallowness of the water, in combination with the mixture of nutrient rich water within the circulation pattern, makes Georges Bank an area of high biological productivity and a rich fishing ground.

§2B1.2 Sediments

From Cape Hatteras north to Cape Cod, the bottom sediments of the shelf are mostly sand, with areas of silt/clay, gravel and gravel/sand mixtures. Gulf of Maine sediments vary considerably, from rocks to silt, gravel and sand. Georges Bank is primarily sand, with pockets of gravel and sand/gravel, and large rocky areas on the Northeast peak.

§2B1.3 Hydrography

Nearshore surface circulation from Cape Cod to Cape Hatteras is generally southwesterly throughout the year. Further offshore, the Gulf Stream flows northwesterly. Shelf waters along the cost are strongly influenced by the extensive extuaries of the region, including Chesapeake Bay, Delaware Bay, Hudson River, Narragansett Bay, and the estuaries behind the barrier beach systems.

On Georges Bank itself, a clockwise gyre forms during the early spring. Currents outside of the 60 meter isobath on the north side of the Bank are northeasterly at up to 30 cm/sec; on the eastern side of the Bank the flow is to the south, and on the southern side the flow is southwesterly. The flow along the eastern side of the South Channel at depth is toward the north, completing the clockwise gyre on the Bank. Currents on the west side of the South Channel are weak, resulting in sediment deposition in the general area of Nantucket Shoals. Currents along the southern flank of Georges Bank are westerly at about 10 cm/sec toward the Mid-Atlantic Bight. By summer, the flow at the eastern edge of the bank is southerly and offshore. By autumn, the flow over the western edge becomes westerly and southerly, marking a weakening of the clockwise gyre. In winter, the surface drift over Georges Bank is, in general, southwesterly. Throughout the year, the water over Georges Bank shallower than 60 minutes is vertically well mixed, owing to the combined effects of tidal currents, winds, waves and storms.

Surface circulation in the Gulf of Maine is basically counterclockwise. Slope water enters through the Northeast Channel and shelf water enters over the Scotian Shelf and Brown's Bank. Water flow continues to the Bay of Fundy. During the winter, a southerly flow exists along the western side of the Gulf, and washes out over Georges Bank. Several eddies develop near the northeastern part of the Gulf at this time. Propelled by fresh water run-off from river systems along the Bay of Fundy and the Maine coast in the spring the Gulf of Maine eddy develops into a strong counterclockwise gyre, and then starts to break down in early summer as river flows abate. By late autumn the currents are weak, and water flow begins to resemble the winter pattern. There is very slow (0.1 miles/day) movement of water, primarily shoreward, in the deeper parts of the Gulf. Pronounced upwelling of nutrient-laden bottom waters occurs, particularly in the eastern and northeastern edges of the Gulf, as a result of tidal forces and circulation patterns.

Surface water temperatures in shelf waters of the Mid-Atlantic Bight vary from less than 3°C in February in the northern region to 27°C off Cape Hatteras in late summer. The annual temperature range of shelf waters may exceed 20°C. Water temperatures vary at different depths, especially in the summer. Salinity of the region is lowered by large estuarine fresh water inflow in the spring. Intrusion of offshore saline water eventually raises salinity to maximum again in the winter. Salinities in this area average 32 parts per thousand.

Frequent vertical mixing of waters at the eastern edge of the Gulf of Maine and Georges Bank minimizes vertical salinity and temperature gradients in those regions. The western part of the Gulf is stable in summer, resulting in warm temperatures and low salinities at the surface, and little vertical mixing. Water temperatures range from 2°C to 17°C at the surface of the Gulf and Georges Bank, while the cold deeper waters of the Gulf range from 4°C to 9°C. Surface temperatures decrease easterly and northeasterly across the Gulf in summer, while deep water temperatures and salinities generally increase easterly and northeasterly at all seasons. Average salinity is 32 parts per thousand.

§2B1.4 The Biotic Assemblage

Zoogeographically, the Gulf of Maine region is boreal, and the fauna is typically Acadian. South of Cape Cod to Cape Hatteras is warm temperate, and the fauna is Virginian. Although Cape Cod is the general dividing line, many species are found throughout the region from the Gulf of Maine to Cape Hatteras. Gulf of Maine fauna may include subtropical, tropical, temperate, and arctic immigrants at various times of the year.

The Plankton. The plankton are microscopic plants (phytoplankton) and animals (zooplankton) that drift in the water column. The annual cycle of the plankton community is typical of the temperate zone. Nutrients are abundant in the water but phytoplankton abundance is low because productivity is suppressed by low levels of solar radiation and temperature. The level of solar radiation increases as spring approaches, and causes an intense phytoplankton bloom which is comprised primarily of diatoms. This level of productivity results in a decrease of inorganic nutrients, and as summer approaches, phytoplankton abundance begins declining.

Zooplankton feed predominantly on phytoplankton, but fish larvae commonly feed on zooplankton (often copepods). During summer, zooplankton reach maximum abundance, while the phytoplankton decline to near winter levels. Dinoflagellates and other phytoplankters, apparently more suited to warm, nutrient-poor waters, become abundant during summer. Although bacteria in the sediments actively remineralize nutrients from organic debris (detritus), summer stratification of the water column may prevent nutrients from being returned to the near surface (euphotic zone) where they may contribute to primary productivity through photosynthesis. On Georges Bank and the eastern and northeastern edge of the Gulf of Maine, vertical mixing of the water column occurs during the summer, thereby recirculating nutrients and maintaining high plankton productivity. Water column stability may be affected by severe storms, and anomalies in temperature may disturb the timing between annual cycles of interacting species. In the autumn, decreasing water temperatures result in a breakdown of the vertical temperature gradient, and nutrients are again circulated up into the euphotic zone. Another phytoplankton bloom results, and lasts until low solar radiation levels inhibit photosyntheses. Phytoplankton and zooplankton levels then decline to the winter minimum, and nutrient levels increase to their winter maximum.

The Nekton. The nekton are animals that swim in the water column. They are predominantly fish, but also include other animals such as squid, whales and porpoises. The ability to swim allows nektonic organisms to migrate between locations or to maintain a specific breeding location with some consistency year after year.

The feeding habits of nekton vary by species, by the size of the individual, and probably by season and food availability. Adults of many commercially important species of the region feed on either fish or invertebrates, but small fish, including the young of some large species, often feed on plankton. Adults of some large species, such as various whales, basking sharks and ocean sunfish, are plankton eaters throughout life.

The Benthos. The benthos are animals that live on or within the bottom sediments. They are predominantly invertebrates (e.g., tube worms, starfish), although strongly bottom-oriented fishes are considered benthic. Benthic organisms are extremely diversified, and include species from several phyla. They can be classified by size (meiobenthos, macrobenthos), by their location on or in the sediments (epifauna, infauna), by the type of bottom in which they live (sand, mud, gravel, rock, etc.), by feeding type (deposit feeders, suspension feeders, herbivores, carnivores), and by the type of community with which they are associated.

§2B2 Habitat Characteristics and Requirements

The fishery resources of a region are influenced by the quantity and quality of available habitat. Depth, temperature, substrate, circulation, nutrient supply, and contaminant concentrations are important physical and chemical parameters of a given habitat which, in turn, determine the type and level of resource populations that the habitat supports. Among continental shelf ecosystems, the Georges Bank region ranks among the most highly productive marine habitats, exclusive of upwelling zones.

Industrial, urban and agricultural activities are major contributors to marine habitat degradation in the Northeast. Developmental pressures in coastal areas have altered the type and decreased the amount of habitat available for fishery production, while point and non-point source pollution have degraded the quality of what remains. Impacts on fish include mortality, disease, increased susceptibility to predation, or reduced reproductive success, all potentially resulting in significant population declines of important commercial and recreational species, or those species upon which they depend for food.

The effects of habitat alteration on fishery yield offshore are not as well-defined as inshore, but concern is warranted to the extent that (1) the offshore environment is subject to habitat degradation from either inshore activities or offshore uses, and (2) offshore species are dependent either directly or indirectly on inshore habitats for reproduction and food supply.

The major causes of habitat alteration that may be affecting groundfish populations in the New England area are located within the coastal drainage basins along the Northeast coast. Point source discharges from power plants, sewage treatment plants, and various industrial processes discharge polychlorinated biphenyls (PCBs), other chlorinated hydrocarbons, petroleum by-products, nutrients, and metals into rivers, bays, and estuaries. Urban and agricultural run-off contributes even greater amounts of these contaminants. Coastal construction, dredging, and filling degrades or destroys productive wetlands and nearshore areas that often serve as nursery grounds for commercial fish and their food species. Ocean disposal of dredged material and industrial wastes, discharge of oil from ships, and other commercial and recreational uses of the ocean also contribute significant amounts of contaminants and debris.

The purpose of this section is to relate the biological requirements of the species of this FMP to existing or potential causes of habitat alteration in both the inshore and offshore regions. In this way, threats to the resource as well as data gaps can be identified, and appropriate measures to respond to identified threats can be recommended.

Atlantic cod, in the Southern New England and Middle Atlantic area, move into the New York Bight to overwinter, but generally avoid the Bight during the summer when temperatures exceed 20°C. The majority of cod between Cape Cod and the Grand Banks exhibit only minor inshore-offshore seasonal migrations. In the Gulf of Maine, large cod are found at depths greater than 40 m during summer, but as shallow as 5 m during winter. Few cod are caught deeper than 200 m.

Cod prefer temperatures between 0°C and 10°C. Small cod are more tolerant of higher temperatures, spreading into warm, shoal waters during the summer.

The largest catches of cod are made on rocky and pebble grounds, and on gravel, sand, and gritty types of clay with broken shells. Young cod may be found foraging among Irish moss and other seaweeds. Cod usually lie within a few meters of the bottom, the larger the cod the closer to the bottom.

Cod prefer shoal areas for spawning. Spawning grounds include eastern Georges Bank, Nantucket Shoals, western Massachusetts Bay, and just north of Cape Ann. Optimum spawning and hatching temperatures range from 5° to 7°C. Spawning takes place near the bottom but eggs and larvae are pelagic. After taking to the bottom, many young cod live in shoal water extending into the littoral zone.

Small cod (less than 50 cm) eat mainly decapod crustaceans. The larger fish (greater than 50 cm) consume significant quantities of fish including herring and other clupeids, silver hake and other hakes, sand lance, sculpin, mackerel and redfish. Decapod crabs, particularly *Cancer irroratus*, are also important forage species.

Haddock are found in the Gulf of Maine, on the Scotian Shelf and on Georges Bank. Few are caught in less than 10-20 m or deeper than 200 m; most are caught between 50 and 150 m. They generally do not cross the deep Northeast Channel separating Georges Bank from Browns Bank and the Scotian Shelf.

Haddock prefer a temperature range of 2°C to 11°C. This implies that the shoaler areas of the Gulf of Maine are too warm in late summer and too cold in late winter. Few haddock occur south of Cape Cod as temperatures, particularly during summer, exceed the optimum range.

Haddock tolerate a salinity range of 31.5°/°° to 34.5°/°°; most are caught in salinities greater than 32°/°°. Haddock enter the bays of Maine but never run up estuaries into brackish water. They are chiefly taken on broken ground, gravel, pebbles, clay, smooth hard sand, sticky gritty sand, and broken shell; but not in kelp beds or over ledges, rock, or silty mud.

Spawning on Georges Bank occurs at a temperature of 2°-6°C. Active spawning occurs at temperatures from 1.5 to 7°C. Eggs are buoyant. During their first few months as pelagic organisms, fry feed on copepods. Depending on temperature, the pelagic stage can last about three months during which time considerable drift may occur.

Haddock may spawn anywhere on Georges Bank, except Georges Shoal which is too shallow. The northeast part of the Bank is the center of spawning. There are secondary spawning areas around the Great South Channel and Nantucket Shoals. Spawning occurs along the Maine coast in 30-100 m.

Small haddock (less than 25 cm) feed on various crustaceans (euphausiids, amphipods and decapods), and polychaetes. Larger haddock (greater than 25 cm) feed on amphipods, polychaetes and echinoderms.

Redfish prefer rocky, hard ground or mud but not sand. They range in depth from near the tidal zone to more than 700 m. Most of the redfish catches are between 80 and 350 m. Redfish have a temperature range of 0.5°C to 10°C, preferring the bottom of the deep channels in the Gulf of Maine in winter. Redfish are ovoviparous, bearing their young alive from early May to early September (peaking during June and July) in temperatures of 3° to 9°C and salinities of at least 32°/°°. The pelagic fry may be found in large numbers in the Gulf near the 50 fathom contour; fish are about 2.5 cm long when they seek the bottom. Redfish prey heavily on crustacea, principally euphausiids and pelagic shrimp.

Pollock are active schooling fish. They live throughout the water column depending on food supply and season. In the Gulf of Maine, they may be found at any depth from the surface to at least 200 m. Adults avoid surface water temperatures greater than 11°C. Small "harbor pollock" (up to 20 cm in length) are rarely found in water temperatures above 16°C.

Pollock spawn in the area of Massachusetts Bay to the Isle of Shoals in 100-120 m depth. At least 3°C is needed for eggs to incubate, this probably sets the northern limit of a permanent resident population. Spawning is in late autumn and early winter. On Massachusetts Bay grounds, spawning starts at 9°C and ends (in late December) at 6°C.

Eggs are buoyant. In European waters the young live near the surface for the first three months; the same behavior is assumed to apply to New England stocks. Harbor pollock appear inshore after early April. South of Cape Ann, they move offshore in June to avoid rising temperatures. In more northerly waters, they remain inshore throughout the summer and autumn. The larger fish tend to stay offshore year-round.

Pollock less than 75 cm in length feed primarily on crustaceans, with euphausiids and pelagic shrimp making up more than 60% of their diet. Larger pollock feed heavily on fish (more than 50% of their diet) including clupeids, silver hake, pollock, lantern fish, mackerel and redfish.

Silver hake have a temperature range from 4° to 18°C. Spawning silver hake migrate from deep overwintering grounds to shallower regions along the continental shelf and in the Gulf of Maine. Spawning in the Gulf of Maine occurs particularly on the eastern side of Cape Cod north to Cape Ann and to some extent to Grand Manan Island. Major spawning grounds on the continental shelf are along the southeast and southern slope of Georges Bank, around Nantucket Shoals, and south of Martha's Vineyard. Spawning occurs from May through November; peak spawning in the Gulf of Maine is during July and August, while peak spawning in the continental shelf area is during June and July. The lowest temperature at which spawning occurs is 5°C, most eggs are produced at 8°-13°C. Silver hake spawn near the bottom but their eggs are pelagic. Pelagic eggs and larvae drift with the currents for two months and then descend to the bottom. Juveniles stay in deep water during the following year before participating in annual spawning migrations.

Small silver hake (less than 20 cm) feed predominantly on crustaceans. more than 80% of their diet is amphipods, decapods, euphausiids, mysids, and copepods. Larger fish (greater than 20 cm) eat fish and some squid including clupeids, silver hake, sand lance, mackerel, butterfish and Loligo squid.

Red hake are demersal and are found over sand or mud bottom. Adult fish prefer a temperature range of 5° to 12°C. They exhibit a seasonal inshore-offshore migratory pattern, with overwintering in deeper offshore waters. Edwards, Livingstone and Hamer (1962) found fish most abundant between 60 m and 180 m off Southern New England in winter where bottom temperature was 8° to 10°C. In late spring, mature fish migrate inshore. In the Southern New England area they move offshore again as water temperature increases towards 10°C. During summer they are concentrated in less than 110 m between Martha's Vineyard and Long Island and southwestern Geoges Bank. In the Gulf of Maine, mature fish remain inshore throughout the summer where water temperatures remain less than 10°C.

Spawning begins in May in the Southern New England area and June in the Gulf of Maine. Domanevsky and Nozdrin (1963) report peak spawning on Georges Bank during mid-July in the 110 to 120 m depth range.

Red hake eggs and larvae are pelagic. During their first year of life, many juveniles live in the mantle of scallops. Musick (1969) suggested that as the number and size of scallops decrease from fishing, red hake populations may be affected. Juvenile red hake are generally found in less than 110 m depth and appear to avoid temperatures less than 4°C.

Small red hake (less than 25 cm) feed primarily on amphipods and decapod crustaceans. Medium size fish (25-40 cm) feed on decapod crustaceans. Larger fish (greater than 40 cm) consume a significant amount of fish.

White Hake are most abundant in deeper muddy basin areas of the Gulf of Maine. Seasonal movements between shallow (30 m) inshore and offshore areas to 400 m may be coordinated with spawning activity. A protracted spawning period probably occurs from November to April. Juveniles are pelagic, generally occurring in shoaler waters. They reportedly move inshore into harbors and estuaries in the spring, especially in more northerly areas of the Gulf, returning to offshore waters in the autumn.

Juvenile white hake are slightly more temperature-tolerant (2°C - 15°C) than the adults (upper range about 13°C). By the time they have attained lengths of about 32 cm, most juveniles have settled to the bottom in deeper areas to take up the adult pattern of existence. Most of the commercially important populations occur at depths greater than 120 m, but significant numbers of fish are taken in shoal water in the summer by gillnets.

Juvenile white hake feed principally on decapod shrimp and euphausiids. White hake larger than 40 cm in length feed primarily on fish including juvenile white hake, silver hake, argentines, winter flounder, and clupeids.

Yellowtail flounder occur in depths from about 10 to 100 m, but they are mostly caught in the depth range 27 to 64 m. They occur on coarse, medium and fine sand, mixtures of sand, and mud and tend to avoid soft mud and rock bottoms, at least in the late juvenile and adult stages. Off New England, their temperature range is from 1°C in winter to 18°C in summer.

Tagging studies show that fish move easterly from Block Island to Southern Nantucket Shoals during spring and summer with 3% going as far as

Georges Bank. They return westerly in the autumn-winter. Similarly, Georges Bank fish move west in winter with about 5% going off the Bank to Southern New England and back to the Bank in summer. Yellowtail flounder from east of Cape Cod show little movement.

Yellowtail flounder spawn from March through July, peaking in mid- May. Eggs and larvae are pelagic, drifting for three to four months. Juveniles seek the bottom by late summer. There is some evidence indicating that cold water temperature promotes the production of strong year classes. Large year classes of the late 1950's and 1960's were spawned during a cold period.

Small yellowtail flounder (less than 30 cm) feed primarily on amphipods with polychaetes being of secondary importance. The relative importance of amphipods and polychaetes is reversed for larger (greater than 30 cm) yellowtail flounder.

<u>American plaice</u> avoid rocky or hard bottom, they prefer fine, sticky, gritty mixtures of sand and mud. This bottom type is found on the floor of the Gulf of Maine between hard patches, from 40-200 m depth. American plaice are also found on soft mud in the deeper basins on the western side of the Gulf.

American plaice prefer a temperature of 1.5°-7°C, although they can tolerate a range of -1.5° to 13°C. They are never found in brackish water. Plaice do not exhibit significant migratory behavior, although an inshore movement to spawn can be inferred from the distribution of eggs and larvae.

Spawning in the Gulf of Maine occurs from March to mid-June, peaking in April and May. Eggs are found in coastal waters (less than 100 m depth) from Cape Cod to Cape Sable. The optimal spawning temperature is 3°-4°C. Eggs and larvae are pelagic. The pelagic stage probably lasts three or four months before juvenile fish seek the bottom.

Small American plaice (less than 25 cm) feed on polychaetes, crustaceans, mollusks and echinoderms. In larger fish (greater than 25 cm) the percentage of echinoderms increases until it reaches about 75% for fish larger than 40 cm. Sand dollars and brittle stars predominate in the diet.

<u>Witch flounder</u> are seldom found in water shallower than 10-15 m, the majority of the catches occur between 120 and 300 m. They are most abundant in fine mud, sand, clay, or mud. They are quite stationary with no evidence of inshore/offshore seasonal migrations.

Witch flounder occur in a temperature range of 2° to 9°C. They have an extended spawning season. Eggs and larvae are pelagic. The pelagic stage may last 4-6 months which is longer than for most flatfish. Small witch flounder (less than 20 cm) eat mostly euphausiids. More than 60% of the diet of larger fish (greater than 20 cm) is polychaetes. Echinoderms play a minor role.

<u>Winter flounder</u> populations inhabit soft mud, clay, sand or pebble in the shoal water (less than 55 m) of bays and estuaries and on Georges Bank on hard bottom in the typical depth range 45-80 m.

Discrete local stocks result from females laying demersal non-dispersive eggs. Except for the stock on Georges Bank, winter flounder spawn in estuaries. Estuarine-spawned fish exhibit a general tendency to gradually move offshore to coastal waters as they grow older. South of New York, fish regularly migrate to deeper water in the summer and return to bays and estuaries in the winter.

South of Cape Cod, adult winter flounder migrate out of bays and estuaries to cooler coastal waters as temperatures rise in late spring. North of Cape Cod, with cooler summer water temperatures, they remain in bays and harbors but may seek deeper holes as water temperatures reach the annual maximum. Winter flounder prefer water temperatures below 15°C.

Winter flounder spawn during winter, usually in shallow (2- 6 m) estuaries. Reproductive success among coastal populations is most dependent on upper estuarine spawning. Metamorphosis is completed after two to three months. Early life stages are most abundant in upper portions of estuaries. They gradually move into the lower portions of estuaries as they grow and are less susceptible to currents. Juveniles eventually leave estuaries to summer in coastal waters before returning to spawn for the first time.

Winter flounder feed predominantly on polychaetes, sea anemones are of secondary importance. Bigelow and Schroeder (1953) report that plant material may be an important part (up to 40%) of their diet. Winter flounder feed only during the day, being visual feeders.

Windowpane flounder are generally found on sandy bottom at depths to 80 m. They are common in inshore waters and estuaries south of Cape Cod. Spawning occurs primarily in water depths less than 40 m in the temperature range 8.5°-13.5°C from Chesapeake Bay to Cape Cod. Eggs are pelagic.

Windowpane flounder feed primarily on mysids. Other crustaceans are of secondary importance.

§2B3 Effects of Habitat Alteration

Habitat alteration can potentially lower both the quantity and quality of Atlantic groundfish products through physical changes or chemical contamination of habitat. It is difficult to separate the effects of habitat alteration from those of other factors such as fishing mortality, predation, and natural environmental fluctuations. Moreover, species and individuals within species differ in their tolerance to habitat alteration. Although a clear cause and effect relationship has not been demonstrated, that does not imply that habitat alteration is not affecting individuals or populations of species of interest. Species dependent on coastal areas during various stages of their life, particularly for reproduction, are more vulnerable to these effects than are species that remain offshore. Important groundfish species such as cod, winter flounder, pollock, silver hake, and windowpane flounder, which are especially dependent on the condition of near-shore habitat, are particularly vulnerable to the threats discussed below.

§2B3.1 Physical Alteration of Habitat

Tremendous developmental pressures exist along the Northeast coast. Approximately 2,000 permit applications for commercial, industrial, and private marine construction projects are reviewed annually by the Northeast Region of the National Marine Fisheries Service. These activities may result in habitat loss or modification, imposing significant impacts on marine biota. More often, projects are small-scale, causing minor losses or temporary disruptions to organisms and habitat. The significance of small-scale projects lies in the cumulative and synergistic effects from the large number of projects.

Construction or mining in and adjacent to waterways often involves dredging, which results in elevated suspended solids near the project area. The effect of the increased turbidity depends on tides, currents, the type and amount of substrate being dredged, and preventive measures employed by the contractor. Excessive turbidity can clog fish gills, decrease egg buoyancy, abrade sensitive tissues, lower dissolved oxygen concentrations, and reduce light penetration which affects photosynthetic activity.

The effects of turbidity and siltation are usually temporary. Other effects of construction can result in long-term habitat disruption. For example, dredging can degrade habitat by resuspending pollutants that have settled in the sediment. Further, filling to create uplands destroys productive marsh and shallow water habitats.

Thermal effluents from fossil fuel or nuclear power plants may cause stress or mortality to local populations. Reverse thermal shock occurs when fish, accustomed to artificially elevated water temperatures, are exposed suddenly to colder water during a plant shutdown. Entrainment of early life stages of fish and adults may cause significant mortalities in localized areas. Biocides used to reduce fouling may cause lethal or sublethal effects to egg and larval stages of fish and shellfish.

Oil and gas exploration in the Mid-Atlantic and North Atlantic lease areas may result in loss or degradation of benthic habitat from the deposition of discharged drilling muds and cuttings. Exploratory drilling for oil and gas is believed to have caused only minimal habitat degradation or biological impact thus far. However, should oil and gas development and production occur in these areas, the transport of the products inshore could threaten already stressed coastal ecosystems.

Demand is increasing for sand and gravel as a construction aggregate. As a result, mining may be expected to expand from shallow coastal areas to deeper waters as economic conditions permit. Adverse effects associated with sand and gravel mining include disruption of benthic habitat, burial of aquatic organisms by siltation, and altered sedimentation patterns. Coastal borrow pits created by mining are known to persist and accumulate very fine sediments which cause anoxic or hypoxic conditions in bottom waters. It is not known whether similar impacts would occur in offshore areas.

§2B3.2 Chemical Contamination of Habitat

Acute and sublethal effects on marine organisms can occur following exposure to chemical contaminants, including types of pesticides, synthetic organics and petroleum hydrocarbons. General effects include mortality, disease, reduced reproductive success, or increased susceptibility to predation. It is unclear whether effects observed in individual fish are affecting the overall populations, or if contaminant concentrations in fish pose a risk to consumers since the edible portions often contains lower amounts of contaminants than do the organs such as the liver, kidney or gonad. Contaminant burdens in organs can conceivably be high enough to affect the health of organisms even when levels in edible tissues are not an apparent threat to consumers.

Trends in contaminant effects on populations could be better anticipated by combining data on fish tissue concentrations with data on contaminant inputs into the environment. Estimates of discharge for over twenty pollutant categories for U.S. coastal areas have been compiled by NOAA's Ocean Assessments Division. This data base, the National Coastal Pollutant Discharge Inventory (NCPDI), provides useful information for comparing relative amounts of discharges among different coastal areas. Preliminary NCPDI data for discharges from Maine to Cape May indicate that the waters off the major Northeast metropolitan centers, Massachusetts Bay and the New York Bight, consistently receive the highest amounts of pollutants, and are therefore among those areas where habitat alteration problems are the most severe (Figures 2B1-2B5). For chlorinated hydrocarbons and PCBs, Narragansett Bay joins Massachusetts Bay and the New York Bight in the top category.

Effects of Contamination: Metals Analysis of metal concentrations in seven groundfish species in the New York Bight (could be considered the "worst case") revealed that concentrations were below the U.S. Food and Drug Administration's (FDA) action level (NMFS, Microconstituents Program). Chronic exposure to metals, however, can disrupt respiratory patterns and metabolic function. Some species appear to possess a mechanism for immobilizing certain metals, thereby allowing a buildup of the contaminant in tissue without disruption of normal metabolic function. Adult winter flounder may possess this ability for mercury or silver (Sindermann et al., 1982).

Effects of Contamination: Organics Acute and sublethal effects on fish and their food species may occur following exposure to pesticide residues, industrial organics and petroleum hydrocarbons. Impacts can include mortality, reduced fecundity, decreased survival of larvae and juveniles, disease and behavioral modifications.

Concentrations of organic contaminants are higher in degraded coastal and estuarine areas than offshore. In a survey of the New Bedford area, winter flounder had a mean of 6.4 ppm PCB, and a maximum of 22 ppm (Massachusetts Coastal Zone Management, 1982), significantly exceeding the FDA's action level of 2 ppm. Conversely, PCBs in flounder and plaice from Boston Harbor and Cape Cod Bay were below 0.14 ppm (Boehm et al., 1984), though sediments at several of the trawl stations were heavily contaminated with PCBs. In another study (Boehm and Hertzer, 1982), concentrations of petroleum hydrocarbons, PCBs and DDT in groundfish species in the Northwest Atlantic and Gulf of Maine were found to be of little concern. Silver hake had the highest levels of all

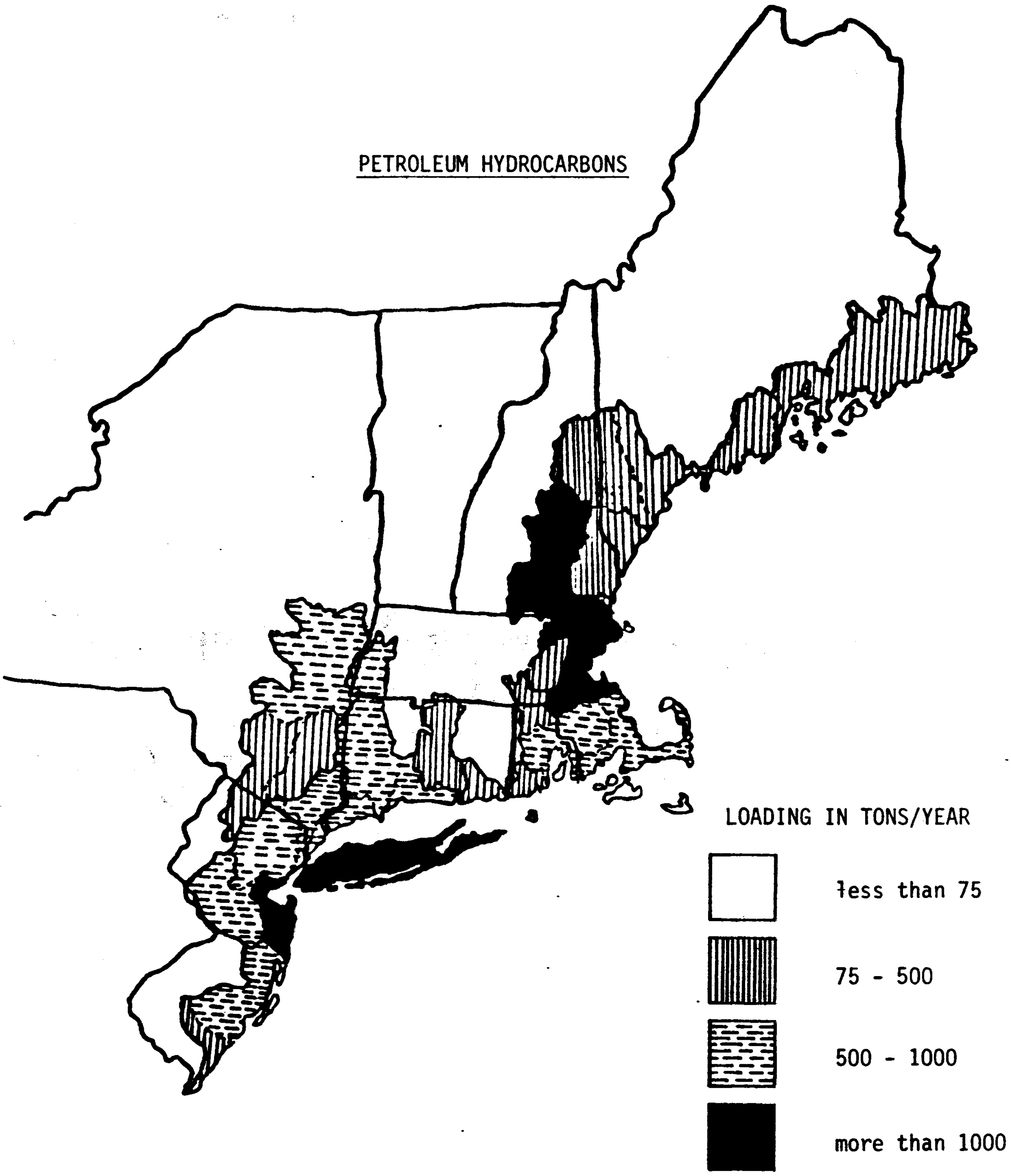


Figure 2B1. Petroleum hydrocarbon loading by hydrologic unit in tons/year, based on data from the National Coastal Pollutant Discharge Inventory.

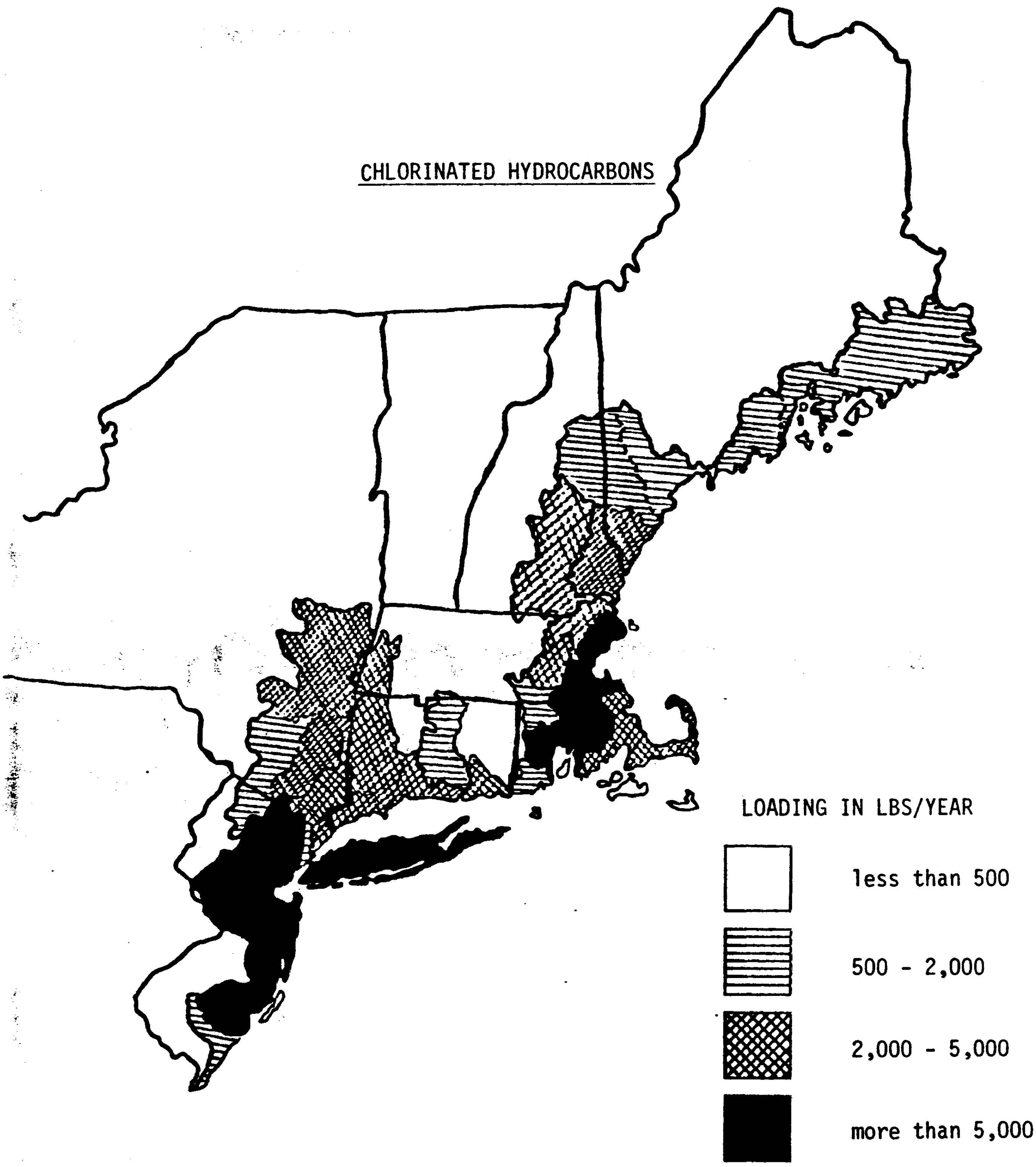


Figure 2B2. Chlorinated hydrocarbon loading by hydrologic unit in lbs/year, based on data from the National Coastal Pollutant Discharge Inventory.

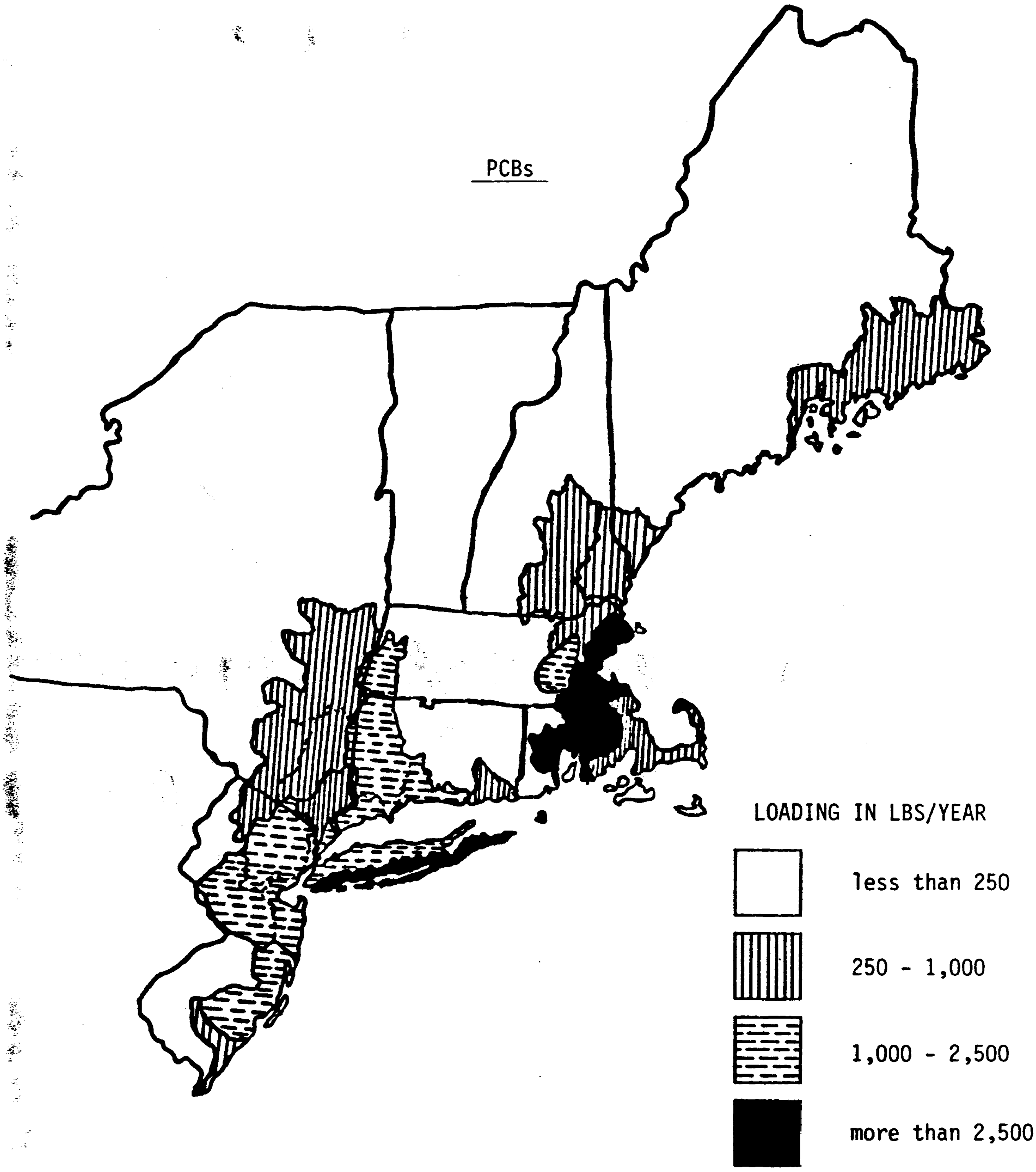


Figure 2B3. PCB loading by hydrologic unit in lbs/year, based on data from the National Coastal Pollutant Discharge Inventory.

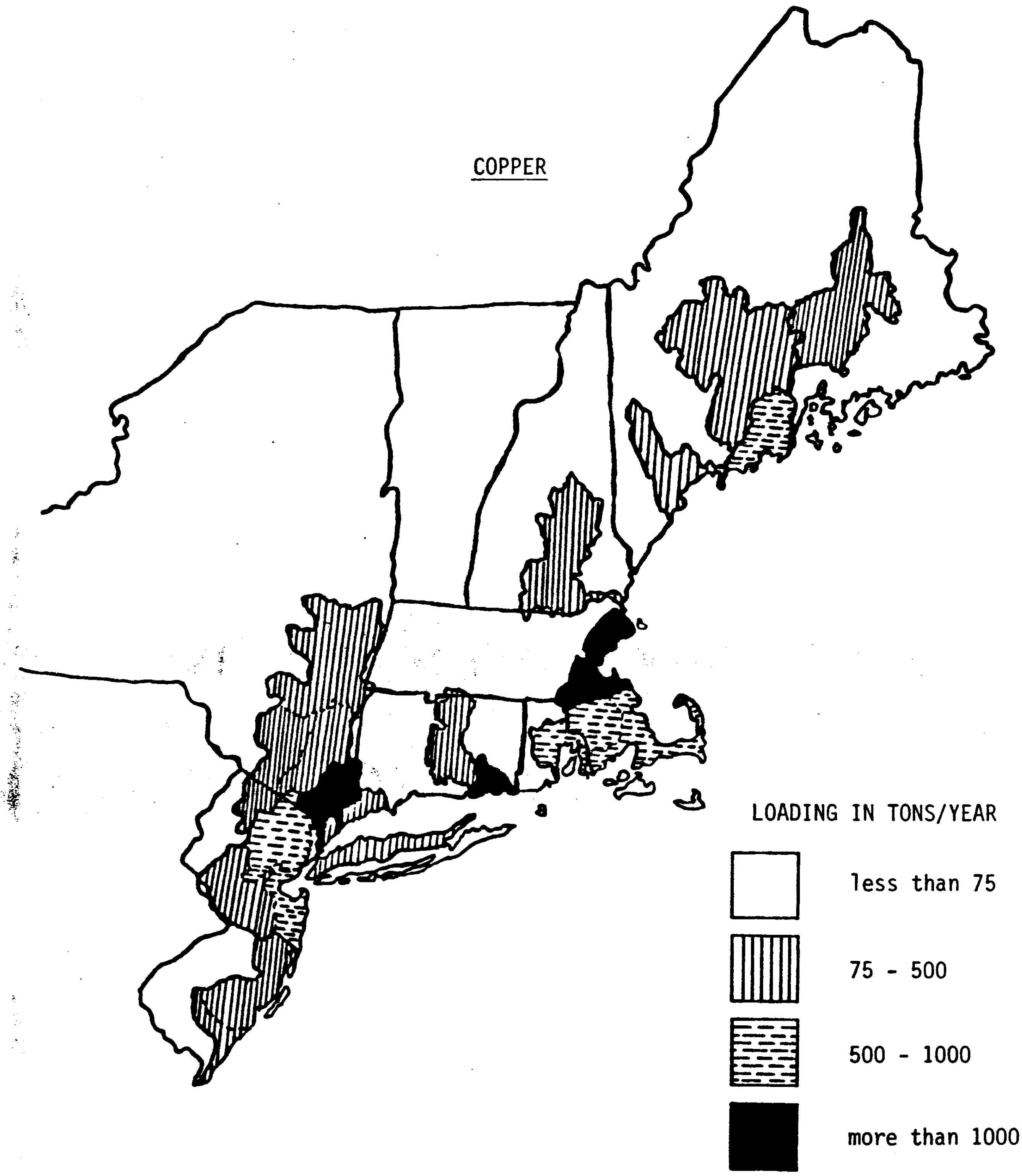


Figure 2B4. Copper loading by hydrologic unit in tons/year, based on data from the National Coastal Pollutant Discharge Inventory.

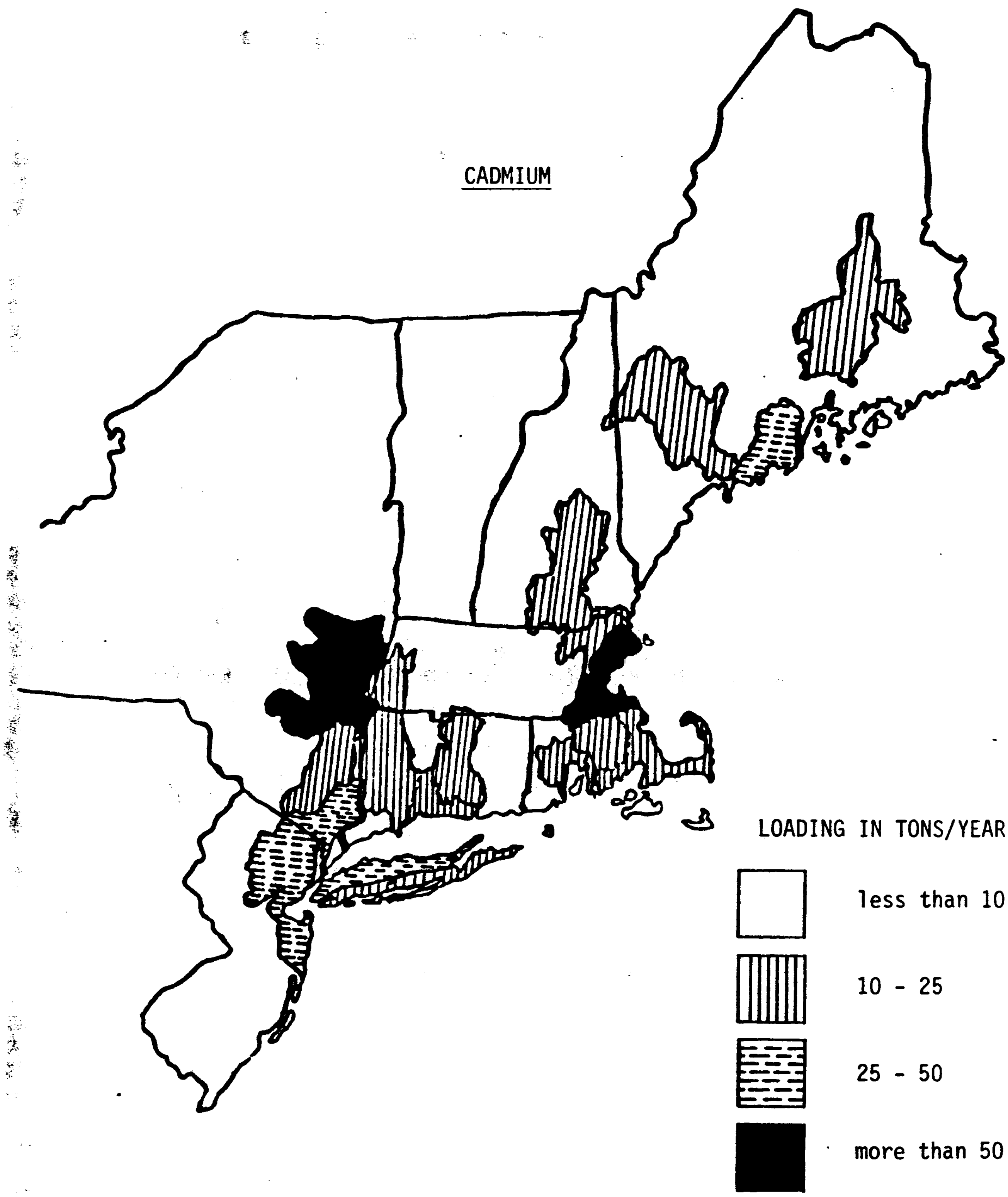


Figure 2B5. Cadmium loading by hydrologic unit in tons/year, based on data from the National Coastal Pollutant Discharge Inventory.

three classes of contaminants, which may be related to its higher fat content (fatty tissue attracts organic contaminants) and/or its diet.

PCBs are a major threat since they are very persistent in the environment, and concentrations in marine organisms may be increasing. PCBs have been documented to affect fish reproduction at levels that might be encountered in contaminated areas (Massachusetts Coastal Zone Management, 1982). The amounts of PCB residues in the edible tissues of commercially and recreationally important finfishes rarely exceed a few parts per million.

PCB residues are not distributed equally in all the tissues of the fish, but concentrate in fatty tissues. Fish concentrate PCB residues into their tissues directly from water, mainly through the gills, and from feeding on invertebrates which contain the chemical. The amount of residues in the muscle of fish are of concern because of the importance of fish as a food source for humans.

Most petroleum hydrocarbons are toxic only at fairly high concentrations, but these concentrations are reached or exceeded during spills. The juxtaposition of a large spill with a spawning stock or concentration of eggs, larvae or juveniles could have population-level effects. Models have been developed (e.g. Reed et al., 1984), and are being refined to predict impacts of various spill scenarios on resource species, including those in the Atlantic groundfish group. Information compiled on the effects of petroleum hydrocarbons on winter flounder show that effects are dependent on what type of dispersant the oil was mixed with (Sprague and Carson, 1978). Cod eggs sampled near the Argo Merchant oil spill showed high mortality (20%-98%), while many of the surviving embryos had abnormal chromosome patterns and were malformed and moribund (Longwell, 1977). Effects on pollock eggs following the Argo Merchant were similar to those noted for cod.

Polynuclear aromatic hydrocarbons (PAHs) are an important class of persistent petroleum hydrocarbons which can be carcinogenic or mutagenic. Concentrations of PAHs have been correlated with disease incidence in bottom fish in industrialized areas of Puget Sound, and they have been implicated in the appearance of cancers in winter flounder from the Boston Harbor area. As was the case for PCBs, however, concentrations of PAH in winter flounder and American plaice from Boston Harbor and Cape Cod Bay are quite low even though sediment concentrations were moderate to high.

Synthetic organics are another relatively hazardous class of contaminants. DDT and related compounds are among the few for which there is clear evidence of effects on marine populations, although the observed effects have been more dramatic in bird populations than in the fish they feed on. Most DDT is broken down within several months to years in the environment, and there is little or no input in the Northeast, so this hazard may be lessening. In a study of the sensitivity of ten marine fish species to endrin, P,p'-DDT and heptachlor, increased larval mortality in winter flounder was observed in areas receiving pesticide runoff, such as from cranberry bogs and mosquito control efforts along the Wewantic River in Massachusetts (Topp, 1968).

It has been reported that chlorinated hydrocarbon insecticides lower the resistance of fish to disease and may cause degeneration of reproductive functions. Other effects have included thickening of the gill membranes, lack of osmoregulation, lower blood counts, brain damage and reduced body weight. Until there is more systematic and regular monitoring of numbers of fish and targeted tissues, it will be impossible to assess whether or not pesticides seriously deplete overall numbers of fish. Present evidence makes this appear very unlikely, because there seems to be little difference in susceptibility of different species to pesticides.

Effects of Contamination: Disease Disease is a contributing factor to natural mortality in Atlantic groundfish species. However, the incidence of disease has only begun to be quantified. Disease removes individuals from populations continuously, and may reduce marketability of food fish. Environmental stress might be an important factor in disease incidence. For instance, correlations have been made between sediment contaminants and liver neoplasms and other diseases of bottom-dwelling fish in Puget Sound (Malins et al., 1984).

Many diseases of fish are caused by microorganisms. Contaminated environments may be enhancing the probability of infection, either by creating conditions that favor the microorganism or by increasing the susceptibility of the host to infection. Other environmental stresses, such as starvation (Segner and Moller, 1984) may also induce pathologies.

Nine of the Atlantic groundfish species (all except redfish, windowpane, and witch flounder) were included in a study of the diseases of Northeastern fish (Ziskowski et al., in prep.). The data revealed elevated prevalence of: (1) fin rot in winter flounder, yellowtail flounder and silver hake of the inner New York Bight; (2) fin rot on Atlantic cod, red hake, and white hake from eastern Massachusetts coastal waters; (3) abnormal pigmentation in winter flounder from southern Massachusetts coastal waters, and (4) bent fin rays in winter flounder for eastern Massachusetts coastal waters. This information suggests a possible relationship between environmental stress and disease. The study also revealed significantly higher incidence of ulcers on Atlantic cod and red hake on Georges Bank and lymphocystis on winter flounder from offshore Middle Atlantic Bight. These findings are being examined in light of possible environmental stress in those areas.

Scientists have recently found a significant incidence of types of neoplasms in adult winter flounder from the Boston Harbor area (Murchelano and Wolke, in press). No causative agent(s) have yet been identified, but the high concentrations of PAHs found in the sediments (Boehm et al., 1984), and their correlation with neoplasms observed in other areas (Malins et al., 1984), make these compounds likely candidates. These neoplasms may have adverse impacts on both population levels and marketability.

Effects of Contamination: Products and Marketability Epidemiological data suggests that 60-90% of all cancers occurring in human occupants of industrial societies are caused by environmental carcinogens. To date, no definitive data are available on the proportion of human cancers which develop as a consequence of exposure to chemical carcinogens. However, environmental chemicals are suspected to be etiologic agents on the basis of man's proven susceptibility to some chemical carcinogens. The effects of chronic exposure of indigenous plant and animal species to environmental carcinogens are not thoroughly known.

Polynuclear aromatic hydrocarbons (PAH) are persistent, carcinogenic compounds that are widely distributed in air, water and soil. It is well established that PAHs can be found in a variety of marine organisms, including those which may be used for human consumption. High levels of PAHs in edible tissue could represent a threat to consumers and the marketability of seafoods in the Northeast.

PCBs in edible fish remain far below existing or proposed maximum permissible levels for the majority of species investigated. However, both the Environmental Protection Agency (EPA) and the Food and Drug Administration (FDA) have advised U.S. consumers and state health department agencies of the potential risks of high PCB contamination. Several states have issued advisories and regulations dealing with the eating and taking of a number of species of fish due to PCB concentrations. New York has prohibited the sale of striped bass taken from the Hudson and Hackensack River areas; New Jersey advised limited consumption of fish from designated areas, and several states have issued warnings about PCBs in bluefish.

There have been few instances in which marketability of Atlantic groundfish species has been compromised by contaminants. In 1977, the Massachusetts Department of Public Health issued a warning against consumption of bottom-feeding fish from the New Bedford Harbor area because they could contain PCBs in excess of the federal action level (5 ppm at that time). In 1979, the harbor area inshore of a line between Ricketson Point and Wilbur Point was closed to the taking of all bottom-feeding fish. Chiefly affected was the recreational fishery for winter flounder. It is not known whether the reduction of the PCB action level from five to two ppm will extend the closed area and increase losses.

§2B4 Habitat Conservation Programs

§2B4.1 Federal Regulatory Programs

The U.S. Army Corps of Engineers (COE), under Section 10 of the River and Harbor Act of 1899, regulates all in-water construction and dredge-and-fill activities in navigable water (to extreme high water shoreline). The U.S. Environmental Protection Agency (EPA), under Section 404 of the Clean Water Act of 1977 (CWA), regulates the discharge of fill materials into waters of the U.S. and adjacent wetlands, in accordance with guidelines and standards established by EPA. EPA has delegated authority to the COE to administer all dredge and fill activities under one Section 10/404 program. Section 401 of the CWA requires the issuance of a State water quality certificate before dredging or disposal in State waters.

Point source pollutant discharges into aquatic areas are regulated either by EPA or the States. Section 402 of the CWA requires a National Pollutant Discharge Elimination System (NPDES) permit. Under Section 301(h) of the CWA, municipal wastewater treatment plants may request waivers from EPA that exempt them from secondary sewage treatment. Section 401 of the CWA requires State (or interstate) certification that all discharges into waters of the U.S. will not violate applicable water quality standards. Discharges covered by NPDES permits must meet ocean discharge criteria established under Section 403 of the CWA.

Responses to discharges of oil and releases of hazardous substances regulated under the CWA and the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA, or the "Superfund Act") are implemented through the National Oil and Hazardous Substances Contingency Plan (NCP). EPA and the U.S. Coast Guard are responsible for responding to spills in inland areas and in coastal or marine areas, respectively. NOAA assists these agencies by coordinating the scientific studies to assess the effects of accidental spills and is designated in the NCP as a "federal trustee for natural resources under its management or protection that may be destroyed or damaged by releases of oil or hazardous substances."

The U.S. Coast Guard regulates ship design, construction, and operation, and establishes vessel traffic control systems for ports and hazardous areas under the Ports and Waterways Safety Act of 1972, Port and Tanker Safety Act of 1978, and Deepwater Ports Act of 1974.

Ocean dumping of materials in the FCZ is regulated by the EPA under Title I, Sections 102 and 103, of the Marine Protection, Research, and Sanctuaries Act of 1972 (MPRSA, or the "Ocean Dumping" Act). Ocean disposal can occur only at sites designated by EPA; only if ocean discharge criteria established under the MPRSA and the CWA are met; and only if "such dumping will not unreasonably degrade or endanger human health, welfare, or amenities, or the marine environment, ecological systems, or economic potentialities."

Title III of the MPRSA authorizes NOAA to designate areas of the ocean as National Marine Sanctuaries for the purpose of "preserving or restoring such areas for their conservation, recreational, ecological, or esthetic values," and to issue "necessary and reasonable regulations" to control activities permitted within designated sanctuaries.

The Outer Continental Shelf Lands Act of 1953 (OCSLA), as amended, authorizes the Department of the Interior's (DOI) Minerals Management Service (MMS) to lease lands seaward of State marine boundaries, design and oversee environmental studies, prepare environmental impact statements, enforce special lease stipulations, regulate drilling activities, and issue pipeline rights-of-way. Effluent discharges are subject to EPA's NPDES or ocean dumping permit regulations.

Under the Marine Mammal Protection Act of 1972 and the Endangered Species Act of 1973, NMFS and the U.S. Fish and Wildlife Service (FWS) share responsibilities for protecting marine mammals and endangered species.

Activities regulated by other agencies such as the U.S. Soil Conservation Service, U.S. Forest Service, Federal Highway Administration, and Federal Energy Regulatory Commission also may indirectly affect groundfish habitat by influencing run-off of sediments and contaminants from agricultural, forested, industrial, and urban areas. Existing Federal and State regulatory programs do not adequately control non-point source pollution. To determine levels of pollution from all sources, NOAA's Ocean Pulse and Northeast Monitoring programs monitor materials entering estuarine and marine waters.

§2B4.2 Advisory Programs

NMFS's Habitat Conservation Program, and similar programs conducted by he FWS, EPA, and State fish and wildlife agencies, reviews the above activities, assesses their potential impacts on resources within their jurisdiction, and makes recommendations to mitigate those impacts. The Fish and Wildlife Coordination Act of 1934, as amended (FWCA), and the National Environmental Policy Act of 1969 (NEPA) provide consultative authority for all projects requiring federal permits or licenses, or that are implemented with Federal funds.

NOAA, FWS, EPA, and the States also share responsibilities for the protection of fish and wildlife resources and their habitats, and act in an advisory capacity in the formulation of OCS leasing stipulations that MMS develops for conditions or resources that are believed to warrant special regulation or protection. Standard mitigating measures include the Oil Spill and Fisherman's Contingency Funds, oil spill containment and clean-up equipment and contingency plans, and OCS Operating Orders and Notices to Lessees and Operators.

§2B4.3 State Programs

Many State programs also regulate proposed activities in wetlands and state waters. These programs are based on State laws that require State agencies to regulate the use of natural areas and their resources. For example, the following are some of the programs that exist in the State of Massachusetts:

a) The Coastal Wetlands Restriction Act imposes land-use restrictions on wetlands for the purpose of promoting the public safety, health, and welfare, and protecting public and private property, wildlife and marine fisheries.

b) The Wetlands Protection Act requires a permit for work in or within 100 feet of a wetland or floodplain, and prohibits activities that would have a significant adverse effect on prevention of pollution, protection of fish and shellfish, etc.

c) The Massachusetts Environmental Policy Act requires an evaluation of the environmental impacts of State actions, including permitting, project approval, and funding.

d) The Massachusetts Coastal Zone Management Act (MCZMA) established a program for the management, beneficial use, protection, and development of the land and water resources in the coastal zone. Federal licenses, permits, or funding must be certified consistent with the policies of the MCZMA.

e) The Scenic Rivers Act designates certain rivers or streams as scenic resources, and restricts or prohibits certain uses in these waters and their contiguous banks.

f) The Industrial Waste Treatment Facilities Act requires an evaluation to determine if proposed treatment will meet water quality standards, effluent limitations, and other applicable regulations.

g) A Marine Oil Treatment License is required for facilities that load, discharge, and store petroleum products from self-powered or towed vessels carrying more than 5,000 gallons of bulk oil.

h) The Subsurface Sewage Disposal Facilities Act requires approval for any subsurface sewage disposal system prior to construction.

i) State Water Quality Certification must be obtained for any project that would result in discharges to State waters.

j) State Dredging and Disposal of Dredged Material Permits must be obtained for all dredging in tidewaters or disposal of dredged materials.

k) A State Waterways License is required for any structure built seaward of the high tide line and for any structure involving government expenditure in or over great ponds and certain rivers and streams.

l) The Ocean Sanctuaries Act prohibits sand, gravel, and mineral mining; alteration of salinity; alteration of sediment flow; dumping or discharging of any material that could significantly degrade water quality, or erection of structures that could adverely affect plant and animal life.

m) Finally, the State has established a program to identify, acquire, protect, and promote or restrict uses in Areas of Critical Environmental Concern.

§2B5 Habitats of Concern

Many of the finfish species that are potentially subject to the northeast region's multi-species fisheries are heavily dependent on the bottom for feeding and spawning, and therefore the integrity of the benthic environment is of prime concern in areas where there exist concentrations of bottom tending finfish (groundfish). The relationship of any one of these species to the habitat is somewhat unique, and argues for active efforts to maintain the quality of the environment. Areas that have been described as harboring concentrations of groundfish should be considered prime habitats, and any alteration or contamination of these environments should be minimized. Likewise, spawning areas, particularly of cod and haddock, should be considered sensitive habitats during the time that the fish are concentrating for spawning.

The fish species subject to the multi-species fisheries share a common distribution in the Northwest Atlantic with marine mammals, sea turtles and, of course, other fish species. This common distribution becomes an important factor in multi-species plan development with regard to the several marine mammals and endangered species that occur in the area. Under the Marine Mammal Protection and Endangered Species Acts, these species receive special protection from activities which may affect the species adversely, or otherwise contribute to a population decline. Fishing is one activity that carries a potential for impact on these protected populations that may be either significant or negligible, depending upon the areas fished, gear and the species sought. This section contains a description of the marine mammal and endangered species habitats of concern in order that the relationships to fishing activity can begin to take form. The discussion of fishery impacts on marine mammals and endangered species follows in Part 7 of the FMP.

Marine Mammals[1/]

Numerous species of marine mammals inhabit the Gulf of Maine, Georges Bank and Southern New England waters in their range. Five of these, the finback, Balaenoptera physalus; humpback, Megaptera novaeangliae; right, Eubalaena glacilis; sei, Balaenoptera borealis and sperm whale, Physeter catodn are particularly important because they are endangered populations. Other marine mammals that are not endangered are the pilot whale, Globicephala spp.; harbor porpoise, Phocoena phocoena; white-sided dolphin, Lagenorhynchus acutus; bottlenosed dolphin, Tursiops truncatus; common dolphin, Delphinus delphis; grampus dolphin, Grampus griseus; and the harbor seal, Phoca vitulina.

The general distribution of these marine mammals is shown in Figure 2B6(a)-(d). Their distributions are presented on four graphics primarily for ease of discussion. In Figure 2B6(a), the sperm and pilot whale populations are concentrated in the vicinity of the continental slope from the Carolinas to the eastern point of Georges Bank. Pilot whales, however, will move into shallow waters such as northern portions of Georges Bank, most likely in

---

1/ Information presented above taken from CeTAP, 1982, and DEIS, Proposed February 1984 North Atlantic Outer Continental Shelf Oil and Gas Lease Offering, 1983.

pursuit of food. Both whales are deep divers and utilize the entire water column in pursuit of their diet of cepalopods, and gadoids in the case of pilot whales. The white-sided dolphin, in contrast, is found in shelf waters with concentrations extending from Cape Ann to the Great South Channel. It, too, feeds on cephalopods and gadoids (i.e. silver hake) and utilizes the entire water column to pursue its food. Their observed close association with baleen whales, known to feed on small schooling fish, may indicate a mutual relationship taking advantage of the plentiful sand launce.

The bottlenosed and common dolphins and grampus (Figure 2B6(b)) also show deep water distribution along the continental slope. The grampus dolphin adheres quite strictly to this area with only casual meanderings to shallower bank waters. The common dolphin, however, moves significantly into bank waters, as does the bottlenosed dolphin along inshore areas of Maryland and the Carolinas where the shelf narrows. All three pursue pelagic schooling fish and cephalopods as their primary foods. The harbor seal populations of interest to this plan are located in rocky coastal areas from Maine to Massachusetts where they feed on a variety of marine species.

The fin, right and humpback whales (Figure 2B6(c)) are common inhabitants of shelf waters. The fin whale is the most abundant and most widely distributed of the three, as its range extends well south of the others. All three, however, concentrate in the waters of Jeffreys Ledge, Stellwagen Bank, Cape Cod, the great South Channel and Georges Bank, their preferred feeding locations. The right whale is known as a zooplankton feeder, as is the fin whale which adds schooling fish such as herring and sand launce to its diet. The humpback feeds almost exclusively on the sand launce in this region.

The minke whale and harbor porpoise are also common in shelf waters, whereas the sei whale is concentrated in the same deep slope waters as the previously mentioned sperm and pilot whales (Figure 2B6(d)). The minke prefers near shore waters where it pursues sand launce, clupeids and gadoids. The harbor porpoise, too, prefers inshore waters concentrating in areas north of Cape Cod. It has a varied diet of cod, mackerel, squid and herring. The sei whale, like its baleen cousins, the right and fin whales, feeds on plankton such as copepods and krill.

Several endangered whales discussed above, the fin, right, humpback and sperm whales, show particular affinity to certain areas within their distribution. This has led NMFS to identify these areas as "preferred areas" in relation to oil and gas development activities in the region (see Figure 2B7). While these preferred areas have not been legally defined as critical to the species survival, they are areas in which these species concentrate while in the region. These areas, as well as the general distributions discussed above, will be considered under the discussion of impacts.

<u>Sea Turtles</u>

Three endangered and two threatened species of marine sea turtles occur in the waters of the North Atlantic. The three endangered species include the hawksbill (<u>Eretmochelys imbricata</u>), the leatherback (<u>Dermochelys coriacea</u>), and the Atlantic ridley (<u>Lepidochelys kempii</u>). The two threatened species are the loggerhead (<u>Caretta caretta</u>) and the green sea turtle (<u>Chelonia mydas</u>).

The loggerhead is the most abundant of these. It is distributed from the Carolinas to Cape Cod, though rarely occurs in the Gulf of Maine and only occasionally on Georges Bank. The population is concentrated along the shelf southward of Long Island and south of Cape Cod where its preferred feeding grounds are located. Loggerheads subsist on bottom organisms and flotsam.

Leatherbacks visit the Gulf of Maine regularly, but concentrate south of New England in the New York Bight and near shore Mid-Atlantic areas. Their major food item is jellyfish.

The Atlantic ridley prefers shallow coastal waters ranging as far north as Nova Scotia. Observations in New England waters are low, probably due to its shallow water preference and its low population size.

Green and hawksbill turtles are uncommon visitors in north Atlantic waters.

<u>Fish</u>

Only one endangered fish species occurs in northwest Atlantic waters, the shortnose sturgeon, <u>Acipenser brevirostrom</u>. This is an anadromous fish distributed along the eastern seaboard that dwells entirely within the influence of the river systems, therefore, is not encountered in FCZ waters.

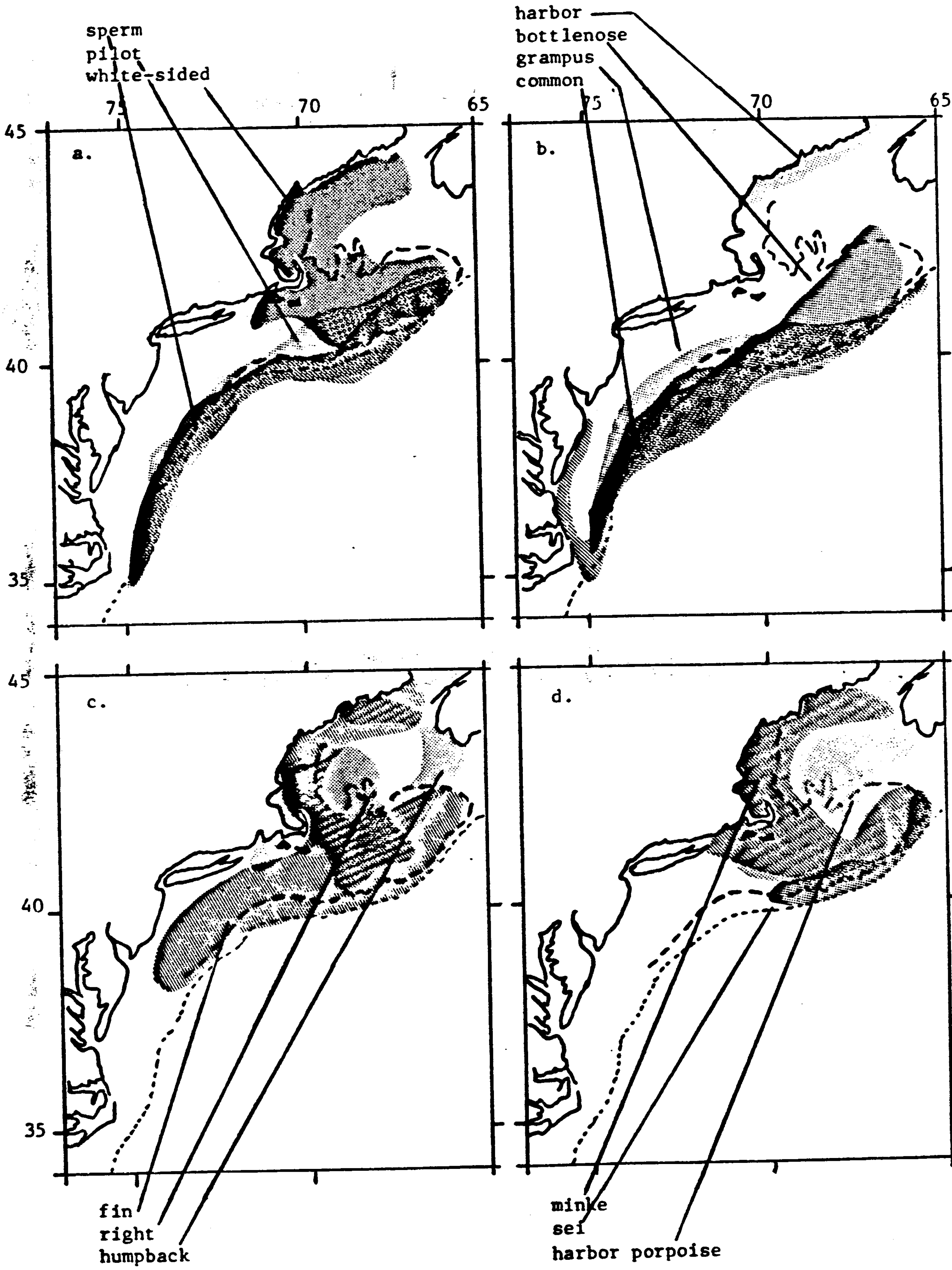


Figure 2B6 a-d. General distribution of marine mammals in the Northwest Atlantic common to the Multi-Species FMP management unit. (from CeTAP data, 1982)

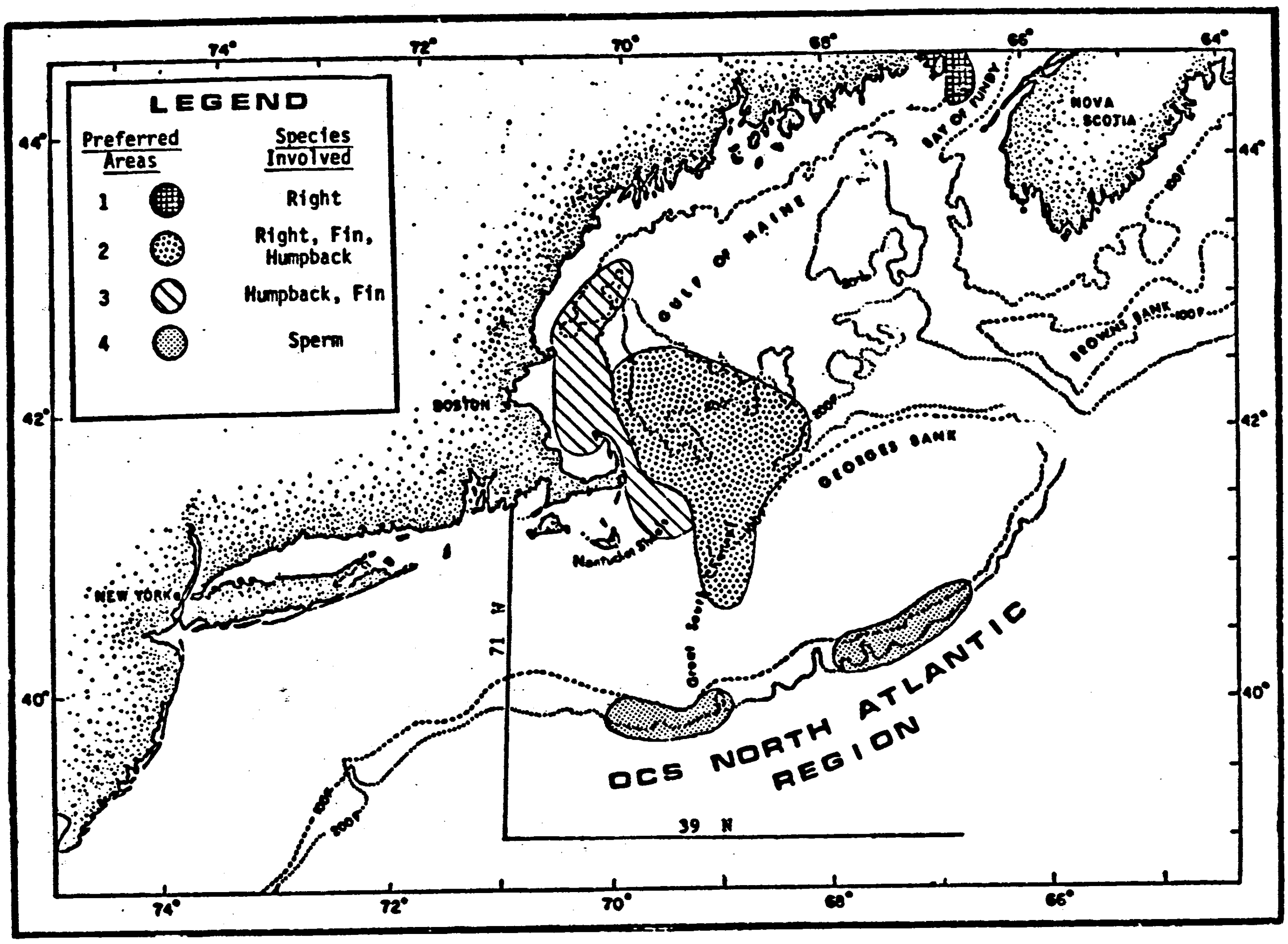


Figure 2B7. Preferred areas for whales in the OCS North Atlantic Region.

§2B6 Recommendations for Habitat Conservation and Restoration

The New England Fishery Management Council, under the authority of the Magnuson Fishery Conservation and Management Act, has the responsibility to prepare fishery management plans which address habitat requirements, describe potential threats to that habitat, and recommend measures to conserve and protect those habitats critical to the survival and continued optimal production of the species under management. The NMFS Habitat Conservation Policy establishes the basis for a partnership between NMFS and the Council to assess habitat issues specific to the resource being managed. The following recommendations are made in light of this mandate.

1. All natural habitat for groundfish stocks should be preserved by encouraging management of conflicting uses to assure continued access by fish to essential habitat. High water quality standards should be maintained to protect migratory routes and spawning, rearing, and feeding areas. Spawning and nursery areas are particularly important to continued productivity of the groundfish resource.

2. Filling of wetlands and shallow water areas is discouraged. Mitigating or compensating measures should be employed where filling is unavoidable. Filling should be permitted only for water-dependent projects found to be in the public interest when no feasible alternatives are available. Project proponents should be required to address the full range of impacts on groundfish stocks, their habitat, or food sources which may be associated with project implementation.

3. Coastal in-water construction and dredging projects should employ best engineering and management practices (e.g. seasonal restrictions, dredging methods, disposal options, etc.). Such projects should be permitted only for water-dependent projects found to be in the public interest when no feasible alternatives are available. Project proponents should be required to address the full range of impacts on groundfish stocks, their habitat, or food sources which may be associated with project implementation.

4. Potentially sited artificial reefs should enhance groundfish habitat, and should be constructed using best available technology, and not preclude access to important fishing areas. Such reef construction is supportable where substantial natural cover is absent; hydrographic conditions, materials used, and construction methods employed will ensure long term usefulness; the physical and biological oceanographic conditions will support reef species; and where it will not adversely affect other fisheries.

5. Coastal and open ocean waters should be protected from significant adverse effects of domestic and industrial waste disposal. The selection of methods and sites for disposal of sewage sludge, contaminated dredged material, and other domestic and industrial waste should be based on a comprehensive scientific assessment of all options (e.g. pretreatment, land based disposal, incineration, and ocean dumping). Ocean disposal should be allowed only if there is demonstration that there is no practicable alternative with less impact on the total environment. In such event, deepwater (off-shelf) sites should be used with disposal techniques that minimize impacts on the groundfish stocks and their habitat.

6. Sewage treatment plants should utilize best available technology to improve water quality. Such action is particularly important to facilitate recovery of presently degraded areas. EPA water quality standards should be enforced. Applications for Clean Water Act 301(h) waivers from secondary sewage treatment facilities should be reviewed on a case-by-case basis to prevent further degradation of water quality and additional accumulation of contaminants in areas important to winter flounder, pollock, cod and other groundfish that may frequent nearshore areas.

7. Dechlorination or effluent holding ponds should be used to reduce total residual chlorine to non-toxic levels in the mixing zones of sewage treatment and power plants currently operating in groundfish spawning or nursery areas. Where possible, the siting of new sewage treatment facilities and power plants should be avoided in areas important to groundfish.

8. Use of best available technology to control industrial wastewater discharges should be required in areas important to the reproduction and survival of pollock, winter flounder, windowpane flounder, and other groundfish species that frequent estuarine and nearshore areas. The EPA's Water Quality Criteria Series should be used as guidelines for determining harmful concentration levels of toxic substances in wastewater discharges. Prior to the siting of any potential new discharge, project proponents should be required to address the full range of impacts on groundfish stocks, their habitat, or food sources which may be associated with project implementation.

9. Except in designated mixing zones, industrial and power generating facilities should not discharge thermal effluents that would raise ambient water temperatures to levels harmful to affected groundfish stocks or their food supply. Important components of the overall groundfish complex (especially cod, pollock, winter flounder, and windowpane flounder) utilize the coastal and estuarine habitat as spawning and/or nursery areas. To minimize entrainment and impingement mortality, new facilities should not be located in spawning or nursery areas. Power plants should avoid shut-down operations at times when significant induced mortality may result from reverse thermal shock. Potential dischargers should be required to address the expected impacts such projects will have on groundfish habitat or food supply. Best management practices should be encouraged at existing facilities.

10. All available or potential natural habitat for groundfish stocks should be protected from significant adverse impacts from offshore oil and gas and non-energy mineral exploration and development activities. Siting and regulation of these activities should be conducted such that groundfish access to essential habitat is ensured, and the quality of the habitat is maintained to protect groundfish migratory routes, and spawning, nursery, overwintering, or feeding areas.

11. Dredge and fill permits issued by the U.S. Army Corps of Engineers under Section 404 of the Clean Water Act and Section 10 of the River and Harbor Act should require that project proponents address the full range of impacts on groundfish stocks, their habitat, or food sources which may be associated with project implementation. The 1982 Memorandum of Agreement between the Department of the Army, Department of Commerce, Environmental Protection Agency, and U.S. Fish and Wildlife Service should be revised so as to allow estimation of the biological and economic impact that proposed projects may have on groundfish and groundfish habitats. In the planning phase of proposed projects, sufficient lead time should be provided for concerned resource agencies to properly evaluate impacts on natural habitats which may be associated with project implementation.

12. The U.S. Soil Conservation Service, U.S. Forest Service, and other concerned Federal and State agencies should evaluate present agricultural and forestry practices to develop standards for best management practices to prevent further degradation of groundfish habitat by non-point source pollution. All options including vegetated buffer strips should be considered in agricultural and forested areas adjacent to groundfish spawning or nursery areas to minimize pesticide, herbicide, fertilizer, and sediment loads to those areas important for groundfish survival.

13. The New England Fishery Management Council will cooperate with the Mid-Atlantic Fishery Management Council in a review of the broad range of human activities having the potential to adversely impact groundfish habitat areas of mutual concern.

14. Future scientific investigations on groundfish should examine the possible long-term, synergistic effects of combinations of environmental stresses. One focus of these investigations should be the consequences of chronic environmental loading of all types of pollutants (e.g. heavy metals, insecticides, herbicides, petroleum products, halogenated hydrocarbons, other organics, etc.) in terms of early life and adult fish survival, reproductive capacity, and genetic effects. Another focus of needed studies is the cumulative impact of all projects involving habitat modification (including dredge and fill operations, in-water construction projects, and OCS drilling and mining activity) on the total production of the groundfish fishery resource.

Part 3

PART 3: DESCRIPTION OF THE FISHERY

SUBPART A: THE NORTHEAST MULTI-SPECIES FISHERY

Multi-species interactions result from resource and market characteristics. They may be summarized in the following categories:

(1) Joint harvesting relationships, commonly referred to as by-catch relationships, are prevalent in the demersal finfish fishery. They exist because demersal finfish congregate together as described above in §2A3, and because demersal finfish gear does not selectively harvest individual species.

(2) Seasonal switching among species or species-mixes is another form of interaction at the harvesting level. As the fisherman expects net revenues from one species or mix to increase relative to those of another he will shift his fishing effort, partially or entirely, to the more desirable species. A major reason behind such changes in relative net revenues is the seasonal change in availability and abundance of individual species. Seasonal switching of effort between species or mixes is the rule rather than the exception for otter trawlers and fixed gear fishermen.

(3) Substitution of species in the marketplace is also a form of species interaction. The price of cod is partially dependent on the price or landings of haddock, both of which are roundfish. See §3C2, The Processing Sector, for a further discussion of these multi-species market interactions.

Most of the figures and tables in Subparts A & B originate from the Northeast Fishery Center's (NMFS) commercial weigh-out files, unless otherwise noted.

§3A1 Joint Harvesting Relationships

The joint harvesting relationship can most easily be seen in Figure 3A1, which shows the number of trips on which a given number of species were caught, during the three year periods 1974-1976 and 1977-1979 and during 1982. Although single-species trips are landed by otter trawls, line trawls and gillnets (first column), they make up a small percent (7.4% for 1974-1976; 6.5% for 1977-1979; 4.8% for 1982) of the total number of trips taken by groundfish gears. The figure is not intended to imply that a maximum of only 13 species are ever caught on groundfish trips, because many species are combined into groups (see below for the species and species-groups used in this discussion).

Landings of many species on one fishing trip is evident when one looks at a sampling of otter trawl trips. Such a view of Point Judith is depicted in Figure 3A2, with trips ordered chronologically from front to back. In 1983, Point Judith trawls landed relatively large amounts of silver hake on trips for most of the year. High trip landings of yellowtail, summer flounder and squid appear during the middle of the year, whereas butterfish landings rise late in 1983. Species such as haddock, pollock and redfish are not of much importance to Point Judith. Low levels of winter flounder and yellowtail are caught together throughout the year. Pictures of Point Judith for 1973, 1976, 1979 and 1982 show similar seasonal landings.

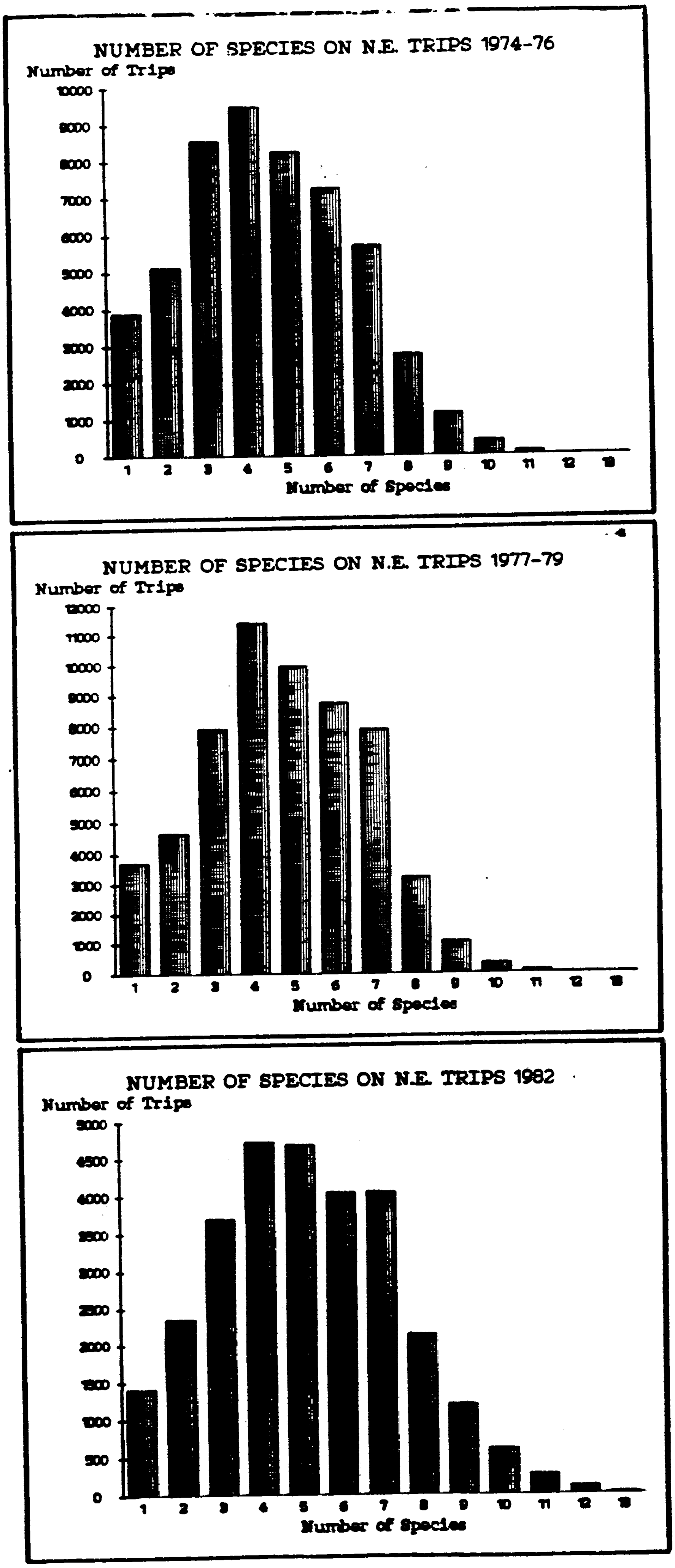


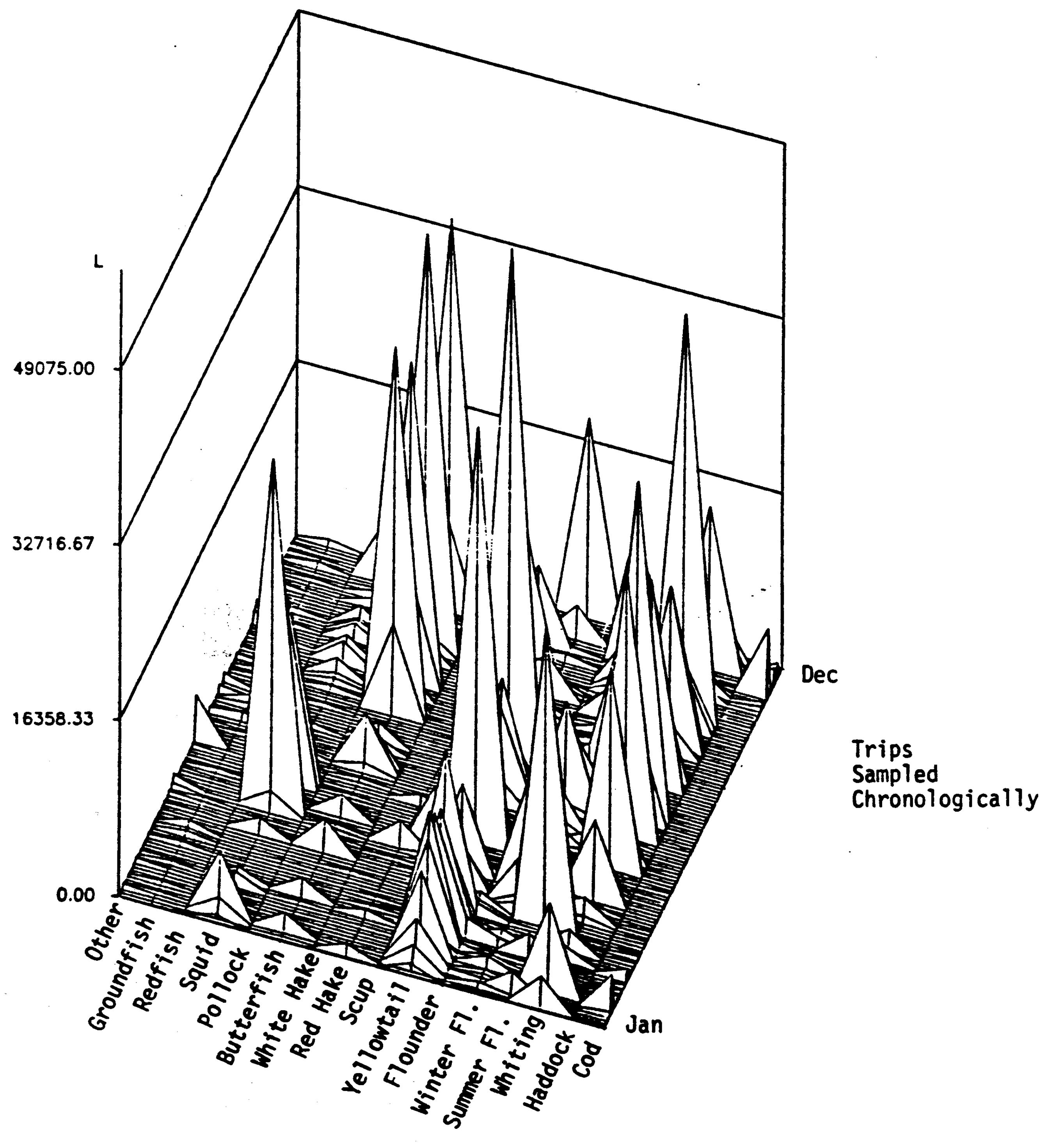
Figure 3A1

8/30/85

Figure 3A2

Point Judith

otter trawl trip catches 1983



Source: NEFC Weigh-Out Data.

A trip graph of Gloucester otter trawls in 1983 (Figure 3A3) displays a high level of trip landings of cod and haddock throughout the year, and pollock during the fall-winter. The catch composition of other more northly species such as cod and pollock stands in contrast to the important species in Point Judith. Flounders such as American plaice, witch flounder and sand dabs appear to be landed on almost every trip. From 1973 to 1983, Gloucester landings have shifted to cod, flounder and pollock, at the expense of silver hake and especially redfish, although high whiting landings still occur in summer. These changes reflect the species' abundance levels and price differentials during the period. New Bedford (Figure 3A4) illustrates yellowtail and winter flounder, and cod and haddock, almost always being caught together in 1983. This picture is similar to 1979 when New Bedford was also relatively more dependent on cod-haddock than on yellowtail-winter flounder. In 1973, 1976 and 1982 yellowtail-winter flounder were more important than cod-haddock in New Bedford. Portland (Figure 3A5) had looked like a single-species port for redfish in 1973 and 1976, but today landings include haddock, other flounder (American plaice, witch flounder and sand dabs), pollock, white hake, as well as redfish. By 1979 cod, haddock and other flounder had increased in importance. Trip landings of redfish in 1983 were one-tenth of what they were in 1973 and 1976, and overall redfish landings in Portland reflect the same trend dropping from 10 to 3 million pounds during the period.

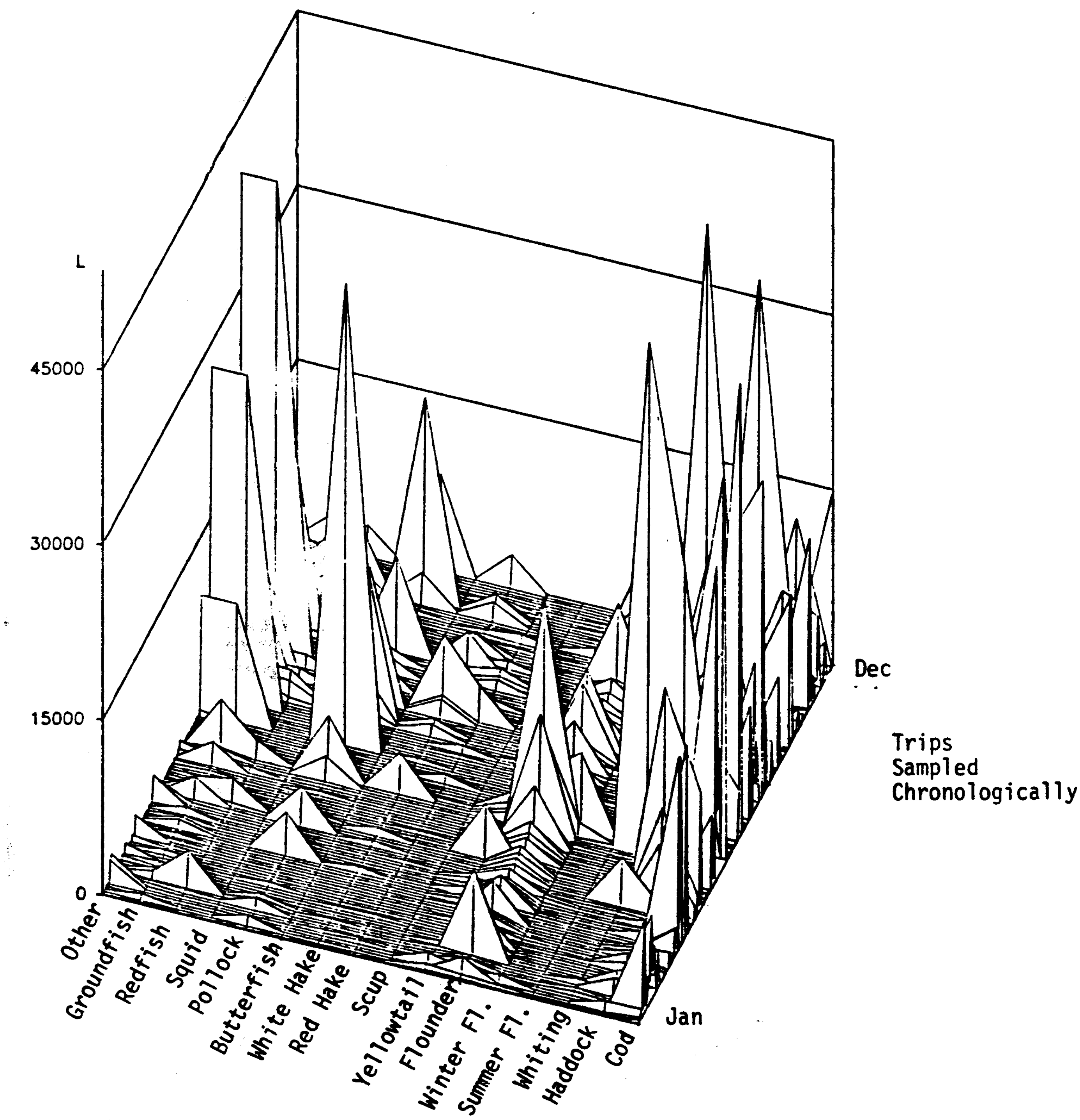
The view of Rockland (Figure 3A6) is quite similar to that of Portland, but other species (notably haddock and pollock) became relatively important more because redfish landings plummeted. Pollock and redfish seem to be caught together in both ports, with pollock increasing proportionately in recent years for the same reason. In Provincetown (Figure 3A7), most trips landed include cod and flounders (including yellowtail and winter flounder but excluding summer flounder) throughout the year. Landings of silver hake, red hake and pollock usually increase during the second half of the year. These patterns have persisted during the period 1973-1983 for otter trawls. Boston (Figure 3A8) is characterized by trip landings of cod and haddock, pollock and some redfish throughout the year and the period. Flounders have become less important overall, but are still landed on the majority of trips, and white hake generally increases during fall-winter in Boston. Flounder has consistently characterized trip landings in Newport (Figure 3A9), especially yellowtail and winter flounder. Summer flounder landings increased again in 1983, and cod has become seasonally important. Trip graphs for 1973, 1976, 1979 and 1982 are included in Appendix 3A.1.

Overall New England landings by otter trawls indicate that most major species are landed as by-catch (less than 50% of the trip catch). This is illustrated in Figure 3A10 for the two major fishing areas, the Gulf of Maine (GM) and Georges Bank and South (GB/S). Although cod and yellowtail from the Georges Bank and South area are listed as principally directed species, one should notice that between 45 and 50 percent of those landings are by-catch. Less than 15% of redfish landings are caught as by-catch. The major fishing areas, or stock areas, in which the multi-species fishery is conducted are important and are described in §2A2. Involvement in these stock areas is predicated on vessel location, or port of landings, from the harvesting industry standpoint (Figure 3A11). For example, port of landing of groundfish vessels (otter trawls, line trawls and gillnets) was examined with respect to area of catch for the period 1977-1979 and the year 1983. Portland and

Figure 3A3

Gloucester

otter trawl trip catches 1983

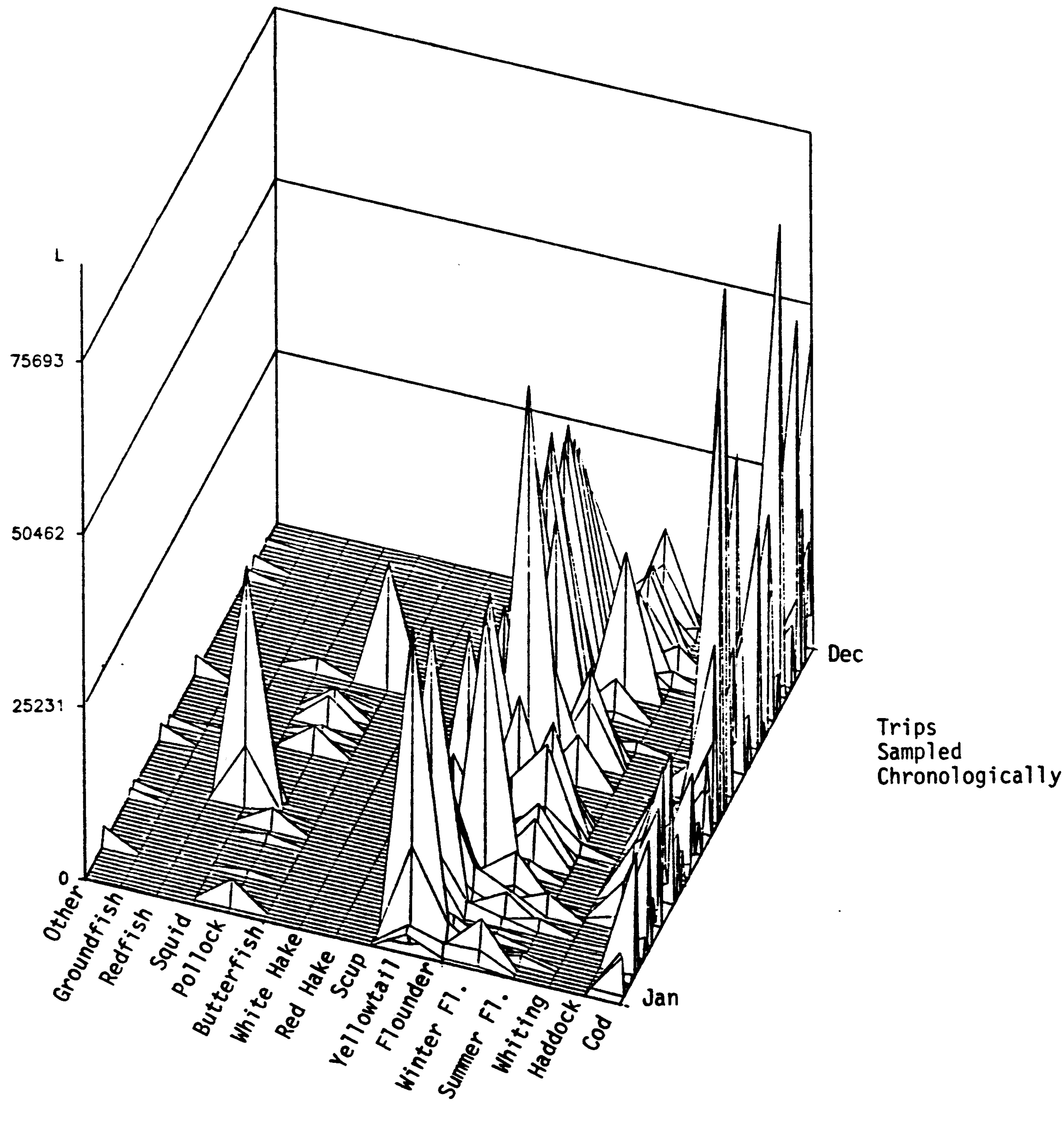


Source: NEFC Weigh-Out Data.

Figure 3A4

New Bedford

otter trawl trip catches 1983

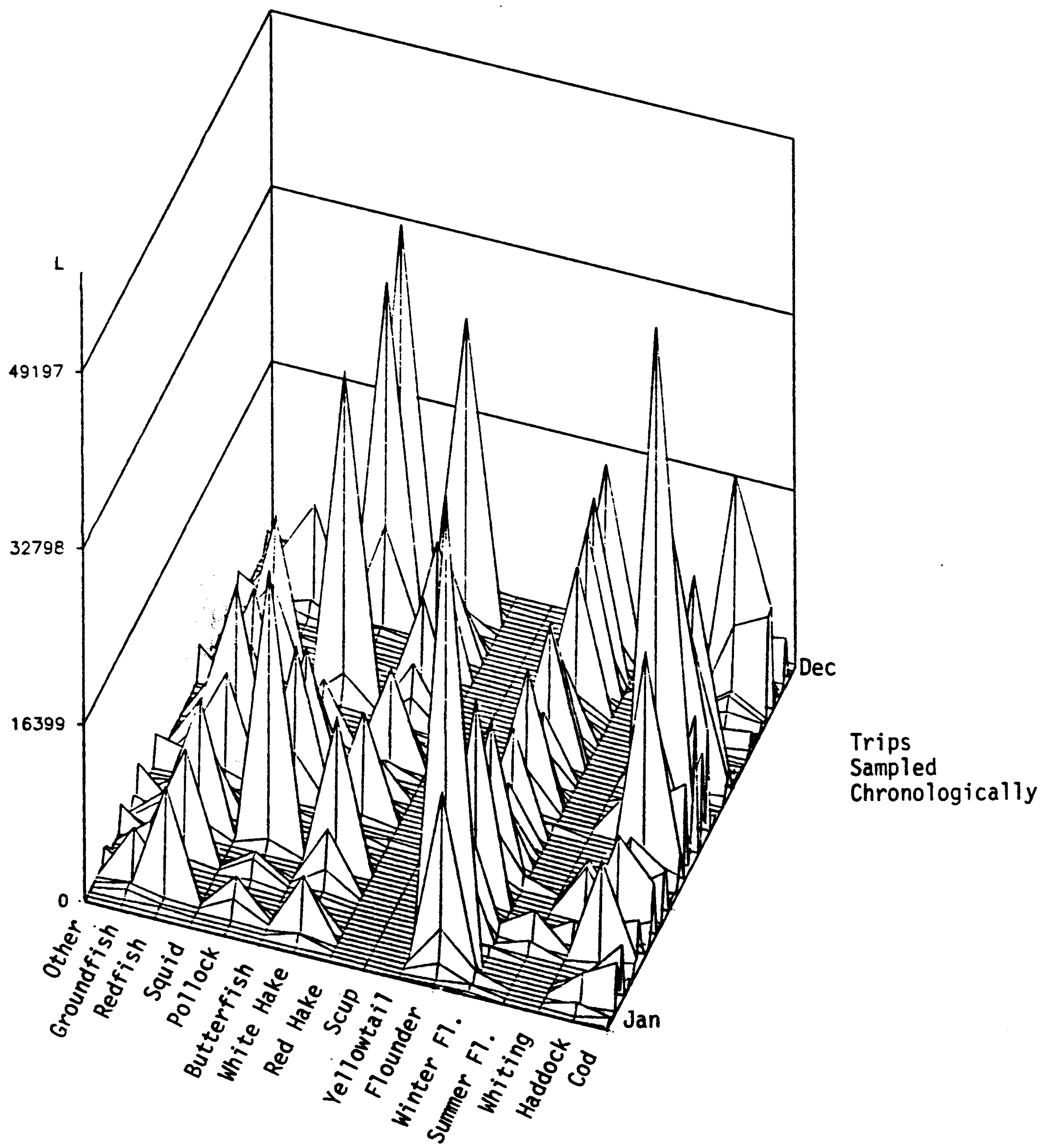


Source: NEFC Weigh-Out Data.

Figure 3A5

Portland

otter trawl trip catches 1983

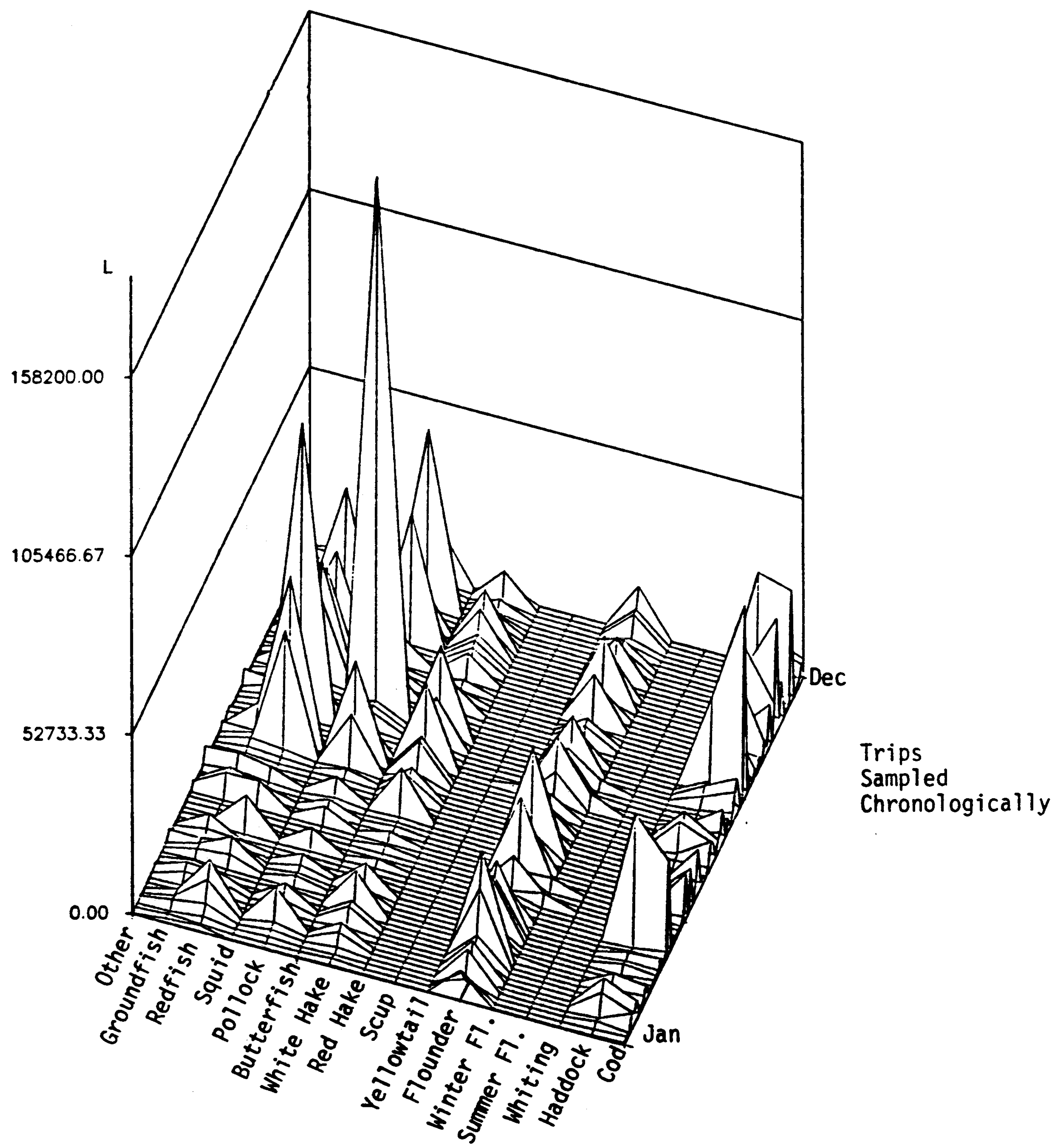


Source: NEFC Weigh-Out Data.

Figure 3A6

Rockland

otter trawl trip catches 1983

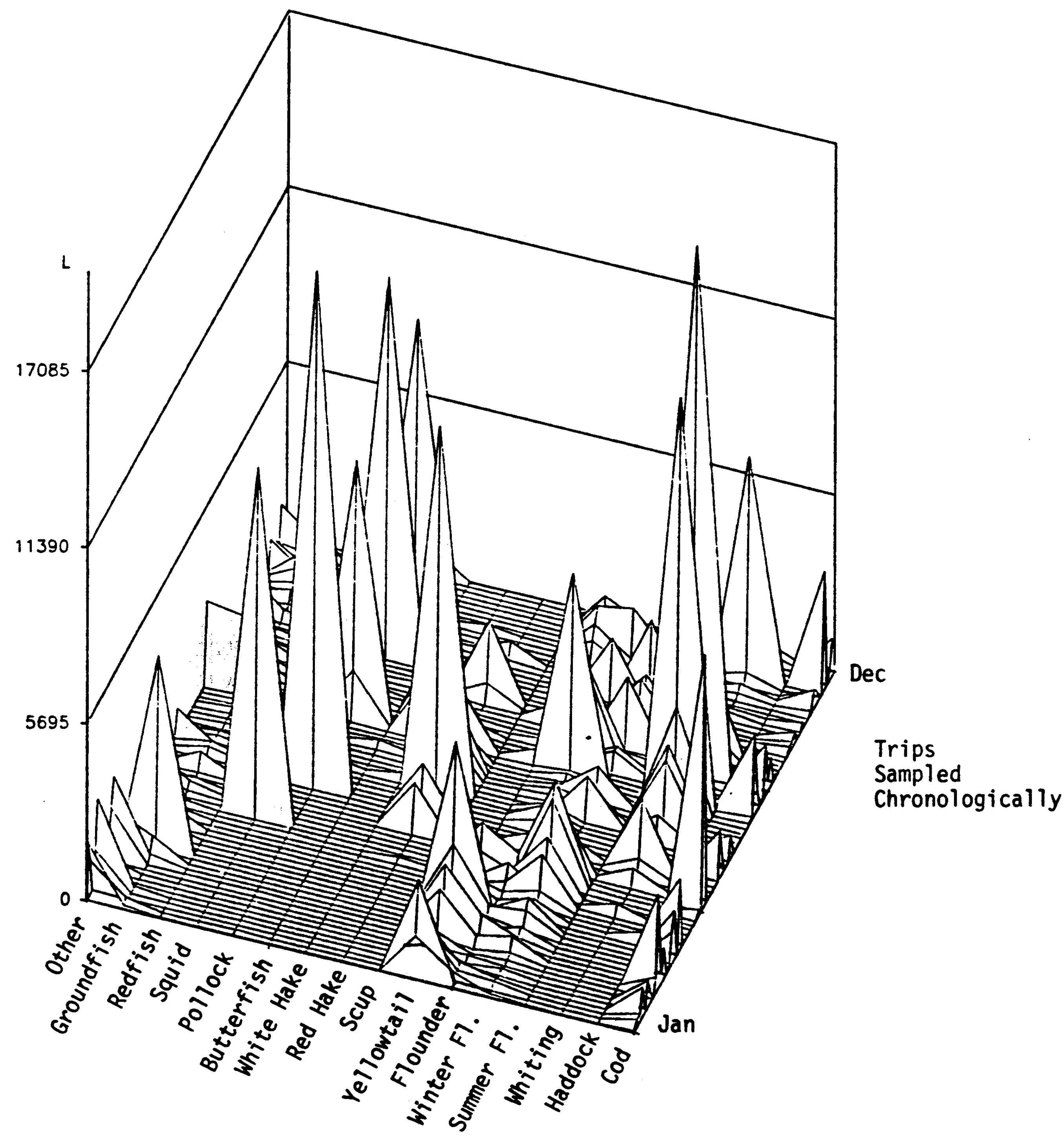


Source: NEFC Weigh-Out Data.

Figure 3A7

Provincetown

otter trawl trip catches 1983

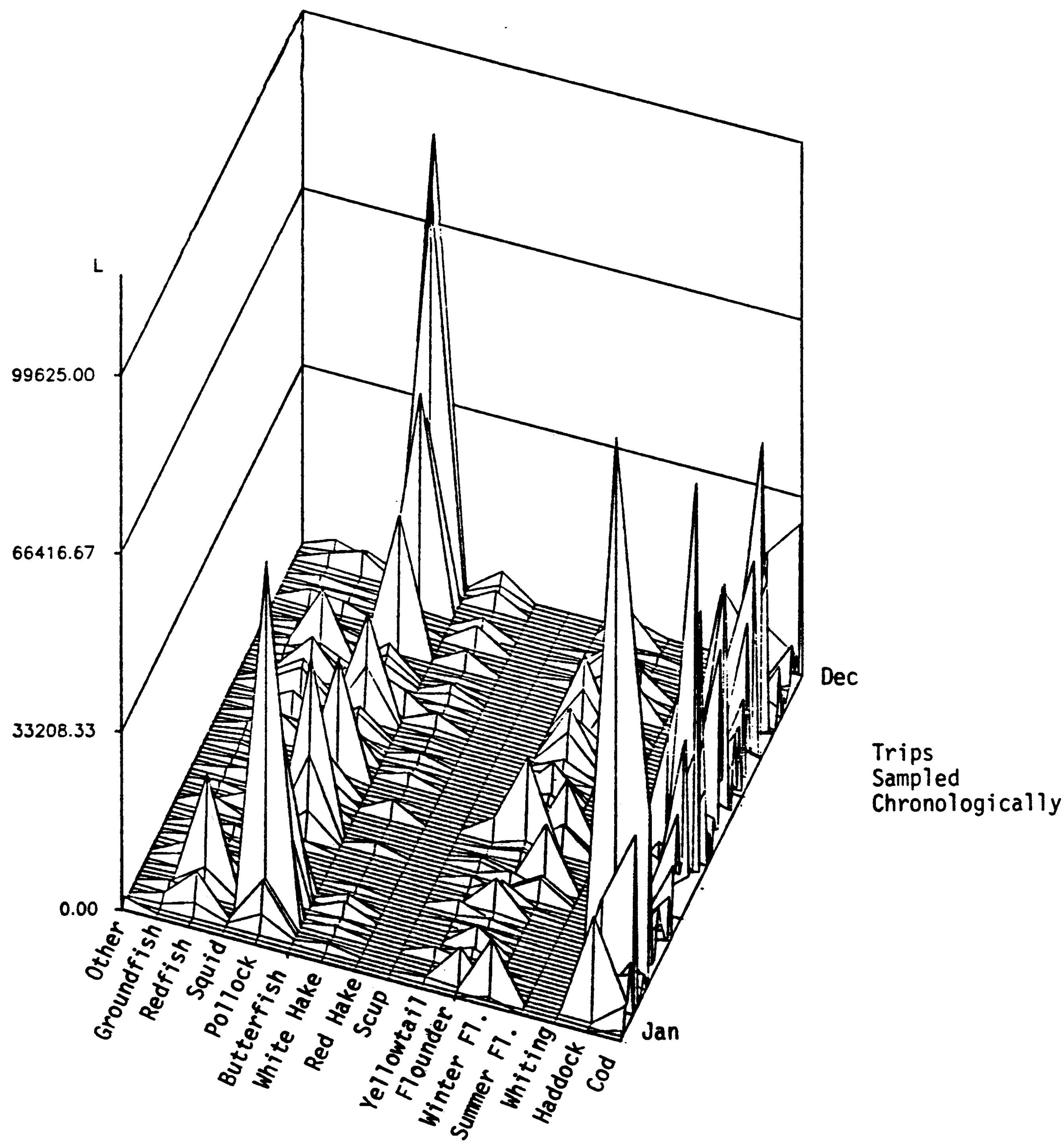


Source: NEFC Weigh-Out Data.

Figure 3A8

Boston

otter trawl trip catches 1983

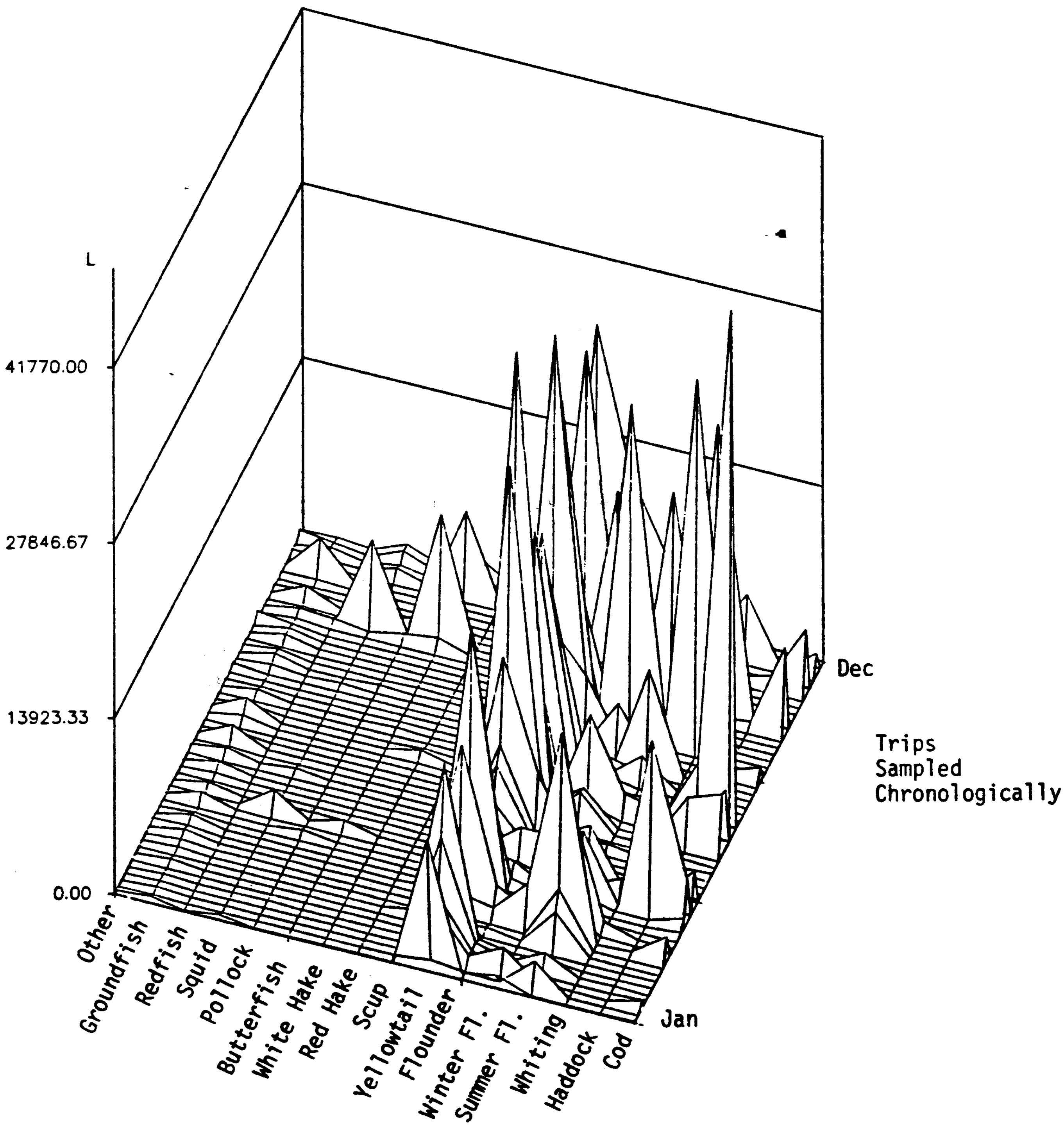


Source: NEFC Weigh-Out Data.

Figure 3A9

Newport

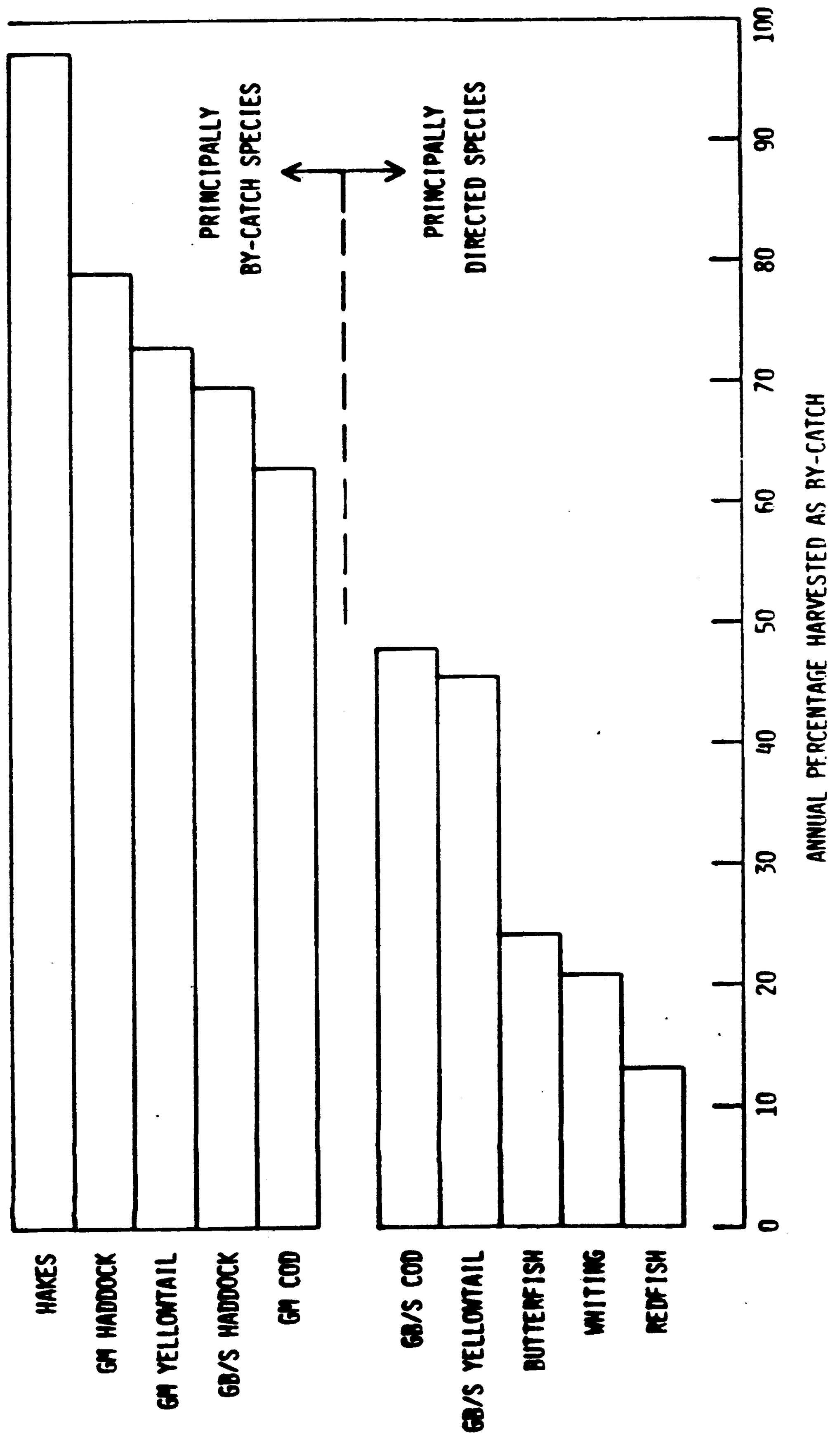
otter trawl trip catches 1983



Source: NEFC Weigh-Out Data.

8/30/85

Figure 3A10



Source: NEFC Weigh Out Data

Figure 3A11

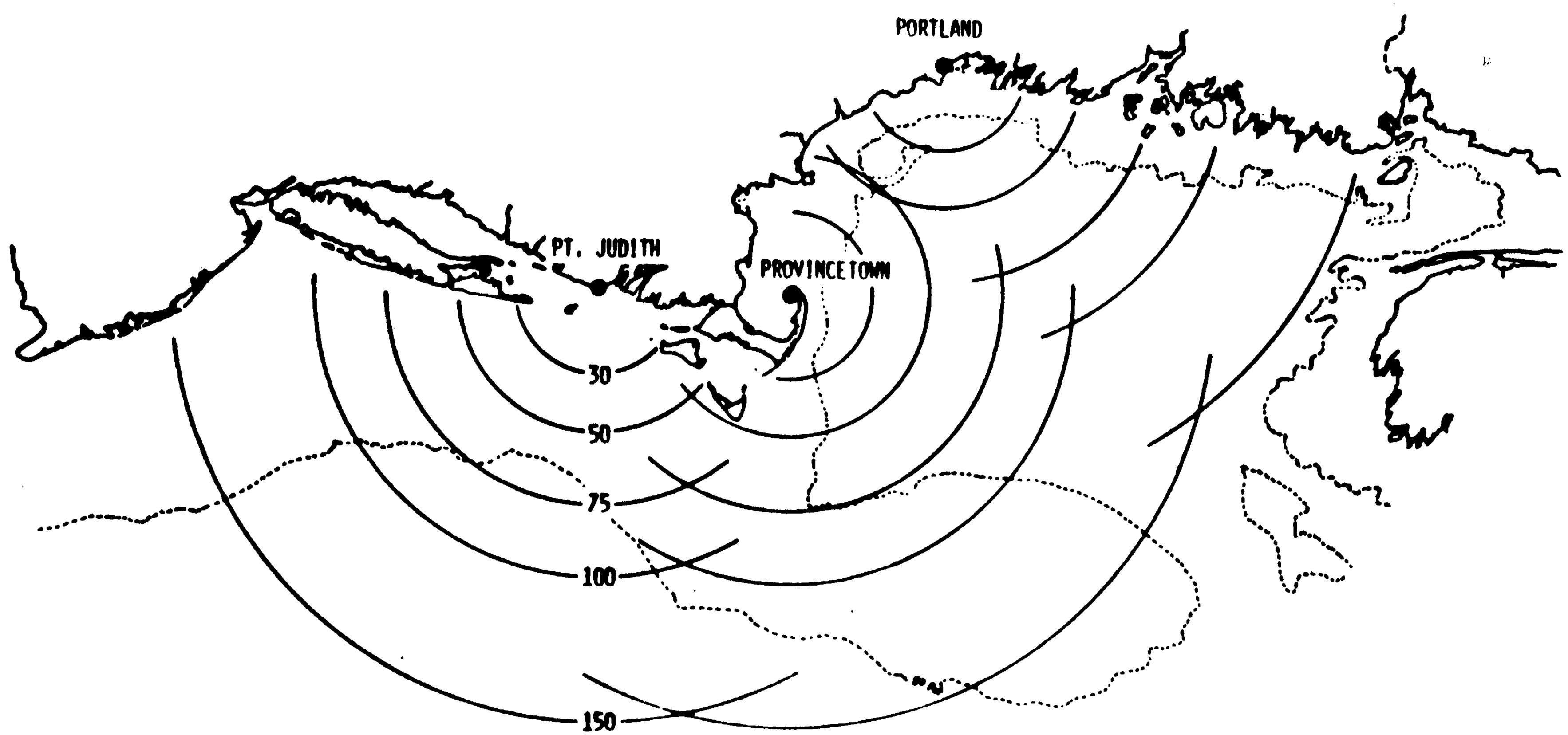


Illustration of the fishery range of vessels from various ports along the New England coast.

Rockland took nearly 95% and 75%, respectively, of their landings from the central-western Maine coast and the offshore Gulf of Maine (Statistical Areas 512, 513 and 515). Boston and Gloucester took about 87% and 96% of their landings from Massachusetts Bay and northern Georges Bank (SA 513, 514, 521-523). Provincetown took 95-99% from adjacent fishing areas (SA 514 and 521); New Bedford, 88% from Georges Bank (SA 521-526). Newport took 93-97% of its landings from Georges Bank and Southern New England waters (SA 521-526 and 537-539); Point Judith, 95% from Southern New England (SA 537-539 and 611).

The foregoing discussion has shown the importance of port of landing location in terms of trip catch composition and potential fishing areas. Such importance is further illustrated by comparing the most important species for each port (Table 3A1). The most valuable species change as we look down the coast: other flounder (mostly American plaice and witch flounder) and haddock in Portland and Rockland; cod, haddock and other flounder in Gloucester and Boston; yellowtail, cod and flounders in New Bedford and Provincetown; yellowtail-butterfish in Point Judith and yellowtail-summer flounder-scup in Newport. The flounders, including American plaice, winter flounder, witch flounder and yellowtail, are a mainstay throughout New England. State landings in 1984 indicate a similar catch composition in New England, except that cod has replaced haddock in importance, and show that summer flounder is the most important state species to the south (Table 3A2), New York to North Carolina.

§3A2 Switching Among Species Fisheries, Seasonal and Historical

Involvement in several multi-species fisheries during the year can be observed in the annual landings of groundfish vessels. A look at Point Judith otter trawls is presented in Figure 3A12 for 1979, ordered by increasing size (all greater than 5 GRT) from front to back. Recall that butterfish is landed in Point Judith late in the year, whether singly or with other species (see Appendix 3A.1), yet most of the approximately 60 trawls caught some butterfish (Figure 3A12). Additionally, every vessel catching butterfish appears to catch scup, which is generally harvested during the middle of the year, a pattern that is found in 1973 and 1976 as well. Finally, it is obvious from the figure that virtually all of these vessels are landing winter flounder (winter flounder) regardless of size, whereas the larger vessels are landing higher levels of yellowtail.

Gloucester vessels (Figure 3A13) that land redfish also land pollock, which is expected because these species were shown to be caught together (Figure 3A3; see Appendix 3A.1 for 1979). However, many of those landing silver hake appear to be small vessels while larger vessels land redfish-pollock, implying that two distinct fleets are operating at the same time. Meanwhile, nearly all of the Gloucester vessels are landing cod and haddock, especially the large vessels. The picture for Gloucester is similar in 1973 and 1976. All of the New Bedford vessels are involved in yellowtail and winter flounders, (Figure 3A14) but the larger vessels are involved more heavily in cod. By 1979, cod and haddock had become relatively more important for all vessels. Vessel graphs other than those displayed here (i.e., 1972, 1976, 1981, Portland, Rockland, Provincetown, Boston and Newport) are included in Appendix 3A.2 and basically confirm the view of each port given previously by the trip graphs.

Table 3A1

Relative Importance (Percent) of Groundfish Species
to Total Port Revenues, 1982:

PORTLAND		GLOUCESTER		NEW BEDFORD		PT. JUDITH	
Flounders	29	Cod	25	Yellowtail	15	Yellowtail	27
Haddock	14	Haddock	22	Cod	13	Butterfish	14
Cod	12	Flounders	14	Winter Fl.	8	Silver Hake	11
Pollock	8	Pollock	6	Haddock	4	Winter Fl.	10
Redfish	6	Redfish/ Silver Hake	6	Flounders	2	Summer Fl.	9
ROCKLAND		**BOSTON**		**PROVINCETOWN**		**NEWPORT**	
Flounders	22	Cod	34	Yellowtail	28	Yellowtail	22
Haddock	19	Haddock	24	Cod	21	Summer Fl.	8
Redfish	16	Flounders	6	Flounders	14	Scup	6
Cod	7	Pollock	6	Winter Fl.	11	Cod	5
Pollock	5	Redfish	5	Silver Hake	5	Winter Fl.	5

SOURCE: NMFS State Landings

Table 3A2

Percent Total State Revenues, 1984:

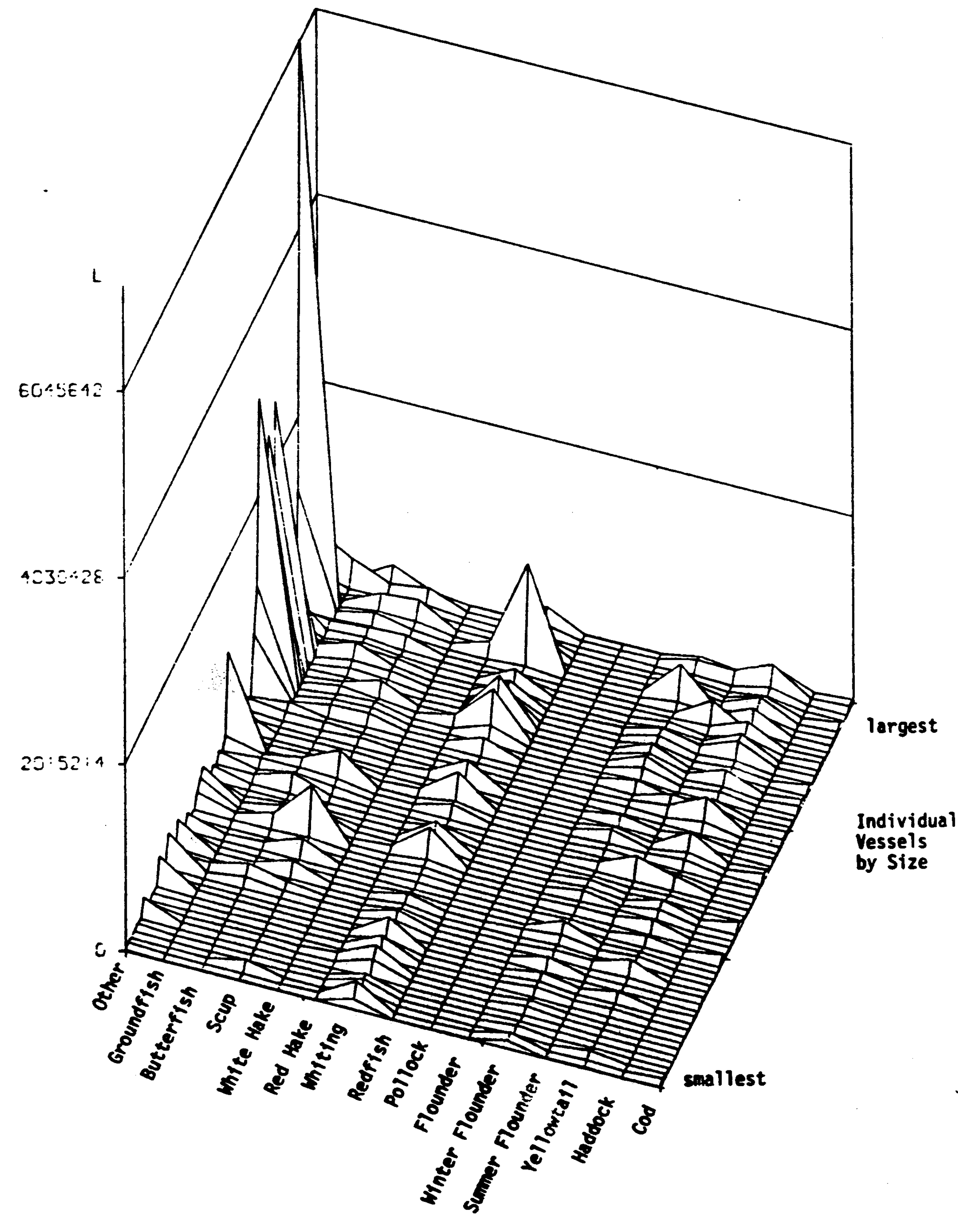
MAINE		NEW HAMPSHIRE		MASSACHUSETTS		RHODE ISLAND	
Am. Plaice	6	Am. Plaice	11	Cod	15	Yellowtail	12
Witch Fl.	5	Cod	11	Yellowtail	10	Butterfish	11
Cod	5	Witch Fl.	6	Winter Fl.	8	Summer Fl.	9
Haddock	4	Pollock	5	Haddock	7	Winter Fl.	7
Lobster	58	Lobster	58	Scallops	25	Lobster	29
CONNECTICUT		**NEW YORK**		**NEW JERSEY**		**VIRGINIA**	
Winter Fl.	8	Summer Fl.	13	Summer Fl.	7	Summer Fl.	18
Yellowtail	7	Yellowtail	9	Scup	4	Scup	2
Summer Fl.	2	Scup	8	Whiting	3	Bluefish	1
Butterfish	1	Whiting	6	Surf Clams	36	Scallops	56
Lobster	75	Lobster	21	Scallops	24	Surf Clams	20
NORTH CAROLINA		**DELAWARE**		**MARYLAND (OCEAN)**			
Summer Fl.	76	Bluefish	11	Summer Fl.	6		
Scup	8	Summer Fl.	2	Ocean Quahog	42		
Bluefish	5	Red Hake	1	Surf Clams	38		
Butterfish	1	Lobster	87	Swordfish	9		
Scallops	7						

SOURCE: NMFS State Landings

Figure 3A12

GRAPH OF OTTER TRAWL VESSEL LANDINGS 1979

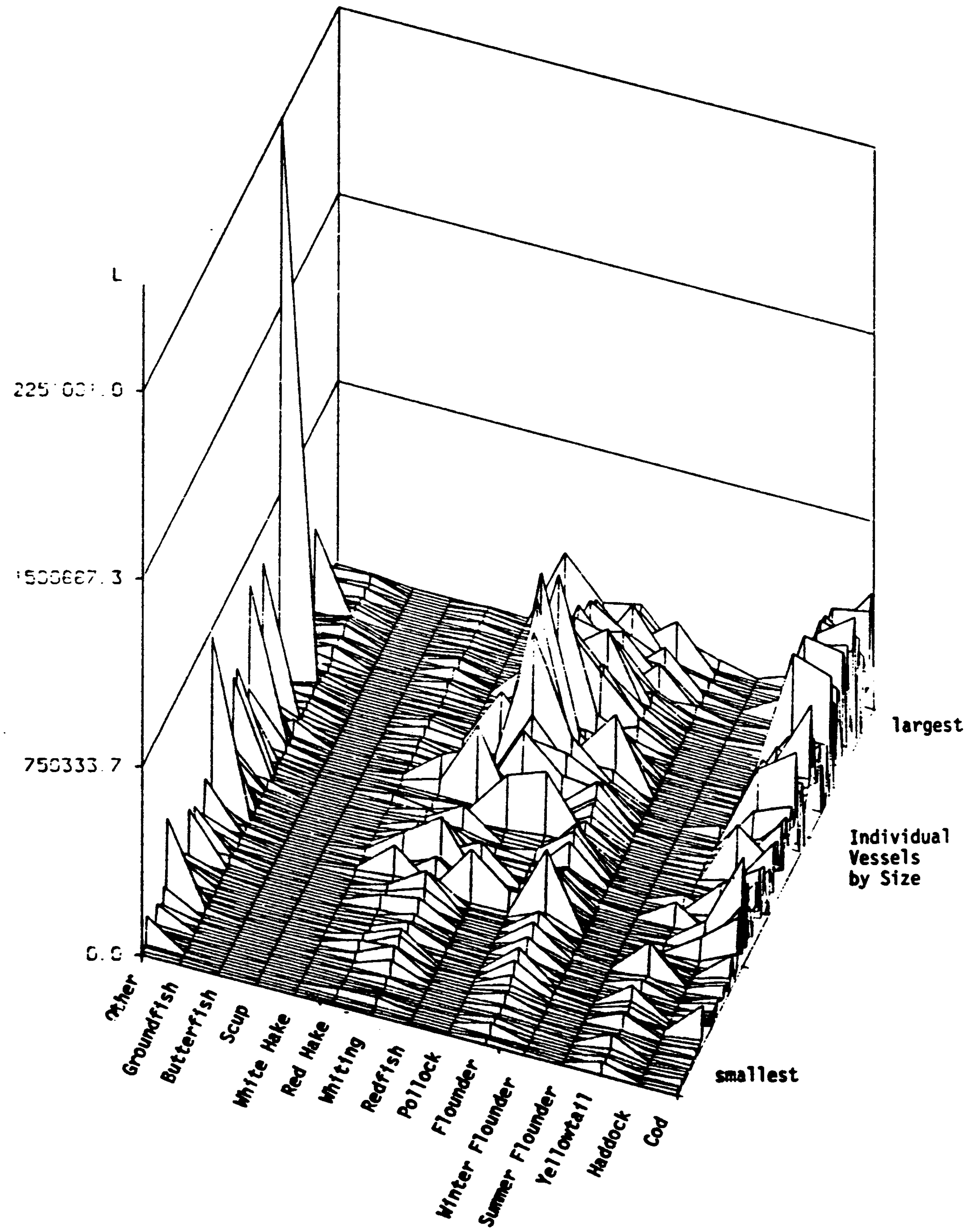
PORT=POINT JUDITH



Source: NMFS/NEFC Commercial Fishery Data Base

Figure 3A13

GRAPH OF OTTER TRAWL VESSEL LANDINGS 1979
PORT=GLOUCESTER

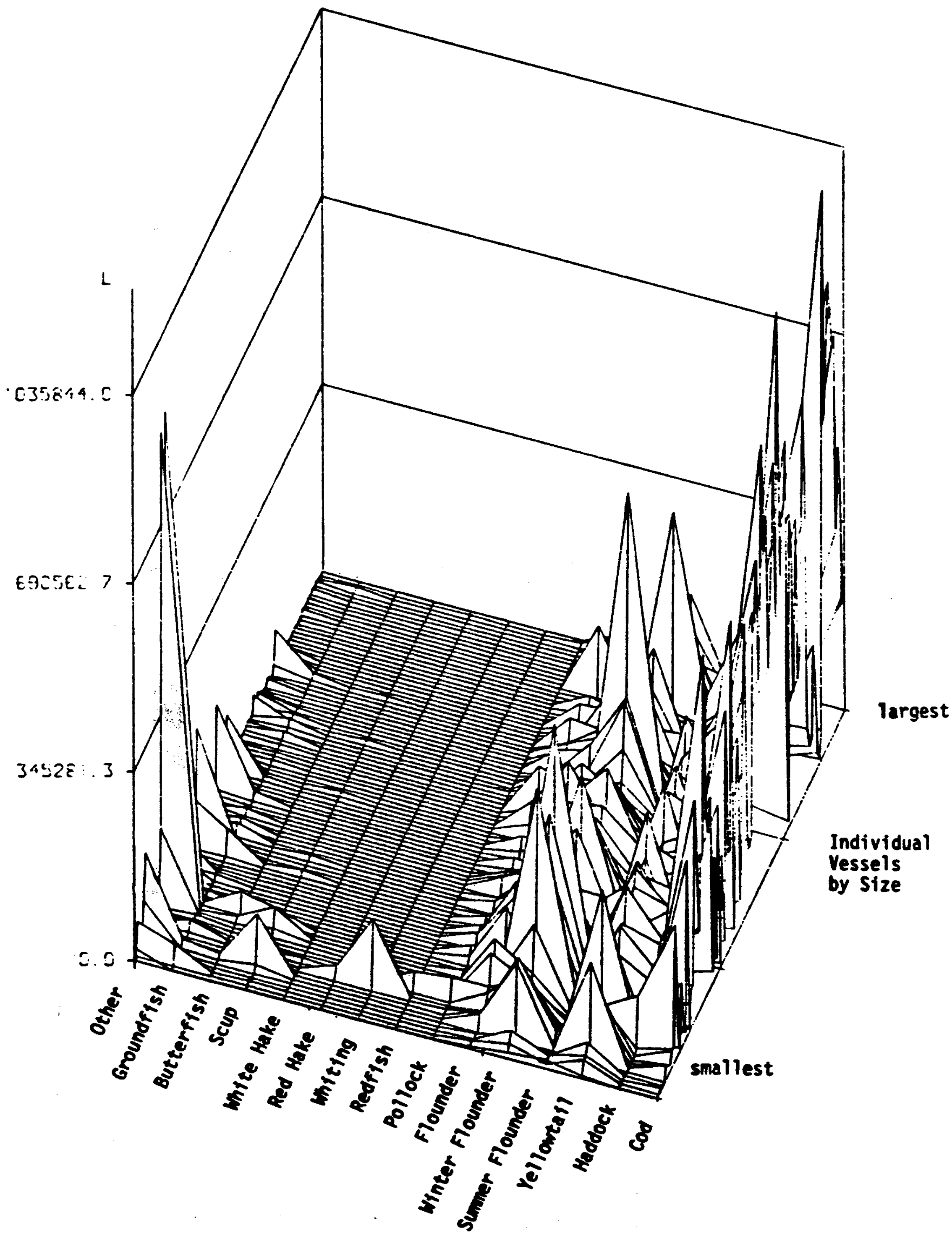


Source: NMFS/NEFC Commercial Fishery Data Base

Figure 3A14

GRAPH OF OTTER TRAWL VESSEL LANDINGS 1979

PORT=NEW BEDFORD



Source: NMFS/NEFC Commercial Fishery Data Base

The category including all species other than those listed on Figures 3A12, 3A13, 3A14 and Appendix 3A.2 (leftmost column) is an important component of otter trawl landings. This component consists mostly of squid, shrimp, herring, mackerel and menhaden, but even sea scallops and lobster, depending on the port of landings. Otter trawls may direct effort towards species such as squid, shrimp and herring by using various mesh sizes and trawl configurations, whereas landings of sea scallops and lobster are most likely by-catches on flounder trips. Additionally, sea scallop dredges land groundfish by-catches (see §3B2 for landings by gear). Finally, dogfish landings but not discarded dogfish catches are included in the Other category, and large amounts of the latter may influence the application of effort on groundfish.

Switching among species fisheries can occur not only seasonally, but across the years as well. A series of graphs showing groundfish landings by port from 1973 through 1982 may be found in Appendix 3A.3. These graphs illustrate the same species fishery composition for major ports with trip and vessel graphs for 1973-1976-1979-1982 above. Therefore, port by port species landings during 1980-1983 will be highlighted. In Maine, Washington, Hancock and Knox counties have each landed around one and two million pounds of groundfish a year recently, with cod, flounder (other than yellowtail, summer flounder and winter flounder), pollock and white hake composing 90% of the catch. Rockland has continued its replacement of declining redfish landings with cod, haddock, other flounder, pollock and white hake, increasing total groundfish landings to 22 million pounds in 1982. Landings have concentrated in Lincoln, Sagadahoc and Cumberland counties recently to the point where more than 50% of the 2 to 4 million pounds landed in each are other flounder. Portland landings have continued to increase to 36 million pounds in 1982 while switching away from redfish; cod, haddock, other flounder and pollock landings are all higher than redfish now. York county landings of groundfish dropped precipitously from 11.4 to 3.5 million pounds from 1978 to 1982, half of that loss was pollock, but they still consist mostly of cod, other flounder, pollock and white hake. New Hampshire landings in 1981-1982 ranged from 5 to 6 million pounds and were composed mainly of cod, haddock, other flounder and pollock.

The port of Gloucester has maintained landings at the 90 million pound level, relying on cod, haddock, other flounder and pollock while the redfish and silver hake fisheries have remained at low levels. Boston has fallen to the 26 million pound range for the first time since 1978, with almost 50% of landings being cod in 1982, and another 33% composed of haddock and pollock. Plymouth, Scituate, Sandwich and Provincetown continue as cod and flounder (everything except summer flounder) ports, landing nearly 30 million pounds among them. Provincetown also lands over a million pounds of silver hake. In 1982, Chatham landed 22 million pounds of groundfish and almost 80% of it was cod, which has been typical for this port. The rest of Cape Cod, landing over one million pounds, depends on cod, winter flounder and scup. Squid had also been an important species but dropped by an order of magnitude to 17 thousand pounds. Martha's Vineyard landed 5.5 million pounds of groundfish in 1982, almost 80% of that was cod and winter flounder. In New Bedford, groundfish landings were nearly 80 million pounds, just short of a ten-year-high of 83 million in 1980. Substantial increases in both cod and yellowtail led the recovery from a poor 1981; winter flounder remained steady but haddock continued to fall.

Newport landings have hovered around 20 million pounds during 1980-1982, with yellowtail and winter flounder as the most important species, followed by scup and butterfish and cod. Point Judith has continued to increase its groundfish landings, up to 47 million pounds in 1982, on the strength of silver hake, butterfish and yellowtail, with winter flounder, scup and squid remaining important. Connecticut landings during 1980-1982 (from the Connecticut Department of Environmental Protection) ranged from 1.5 to 3.9 million pounds and consisted primarily of yellowtail and winter flounders. Recent landings in New York, at about 16-18 million pounds, have been somewhat similar to Point Judith with yellowtail, silver hake and scup accounting for more than half, but as much summer flounder being landed as winter flounder and squid replacing butterfish in importance. Once down to New Jersey, with recent annual groundfish landings of 23-25 million pounds, southern species such as summer flounder and scup, but also silver hake and squid, predominate. Summer flounder, scup and squid have accounted for 90% of the 7-10 million pounds of groundfish in Virginia and Maryland.

§3A3 Substitution of Species in Markets

Substitution among groundfish at the various market levels takes place within two major groups of species; roundfish such as cod and pollock, and flatfish or flounders. Across these groups substitution may or may not occur within certain product types (e.g., whole vs. fillets, fresh vs. frozen). A description of species substitution in the marketplace may be found in §3C2 Product Type by Species.

SUBPART B: THE HARVESTING SECTOR

§3B1 History of Exploitation

Of the groundfish species, fishing for cod has the longest history. The fishery around New England was conducted with handlines from the early 17th century through the late 19th century. Trawl lines and dory fishing were introduced to the fishery about 1850, and by 1879 the harvest had reached about 91.9 million pounds. Annual landings during the first half of the 20th century were erratic, averaged about 33 million pounds per year and exhibited a general declining trend during the 1950's.

Beginning around 1950 there were numerous technological advances in vessels and gear employed in the cod fishery by U.S. fishermen. A substantial number of distant-water foreign vessels also started fishing in the western North Atlantic during the 1960's. Domestic and foreign landings of cod from the Gulf of Maine and Georges Bank and South increased to more than 150 million pounds in 1966 and subsequently declined to about 100 million pounds average from 1970 through 1984.

The haddock fishery began during the mid-1880's with most of the landings directed to the fresh fish market near the major New England ports. Annual landings prior to 1921 averaged about 68.3 million pounds; but subsequent improvements in refrigeration, markets and fishing methods increased the importance of this species. Domestic landings peaked in 1929 at over 289 million pounds.

The haddock fishery was fairly stable from 1935 to 1960, with average total landings of about 114.6 million pounds. Sharp increases in abundance in the early 1960's attracted substantially increased foreign and domestic fishing effort, which resulted in a brief period of very high landings. Total haddock catches peaked in 1965 at 341 million pounds and then rapidly declined. With sharply reduced stock abundance during the early 1970's, catches reached a low of only 11.2 million pounds in 1974. Landings then quintupled to 55 million pounds during 1980-1981, but have steadily declined to 26 million pounds in 1984.

Yellowtail flounder were relatively unexploited prior to 1935, but concurrent with a decline in the abundance of winter flounder, the Southern New England yellowtail fishery developed rapidly. This fishery has exhibited two apparent cycles, with peaks in the 1940's and 1960's of about 77 million pounds, and low catches during the 1950's and 1970's of only about 4.4 to 6.6 million pounds. The Georges Bank fishery developed more slowly and large catches were not made prior to 1961. This fishery expanded rapidly during the 1960's, peaking at over 46 million pounds in 1970 and subsequently declining through the late 1970's. The catch from the Cape Cod grounds has been consistently low and fairly stable since 1935 at about 4.4 to 6.6 million pounds. Total yellowtail landings had increased to over 72 million pounds in 1983, but fell to 39 million pounds in 1984.

Commercial landings of summer flounder have varied widely in the past. In 1964, U.S. commercial fishermen landed over 11 million pounds of summer flounder. Annual landings decreased to a low of approximately six million pounds in 1969, but have generally increased since then to over 40 million pounds in 1984.

Winter flounder (blackback) were of little economic importance until about 1910. The small market demand before then was satisfied by catches with traps or small beam trawls. Increasing demand led to the introduction of the European otter trawl around 1915, and the yearly commercial catch rose to 15.4 million pounds soon thereafter, at which time this species was the principal flounder landed. Catches continued to rise to about 51 million pounds in 1930. After 1930, the commercial catch dropped considerably, but currently runs about 32 to 39 million pounds annually. Substantial foreign catches of winter flounder peaked at 15.2 million pounds in 1969, but have declined to insignificant levels since 1977.

Historic landings of American plaice from the 1940's through the 1960's were variable from less than 4.4 to over 11 million pounds as landings of winter and yellowtail flounder waxed and waned. American plaice catch has averaged 8 million pounds per year from 1965 to 1977, with the U.S. landing 85% of that catch. The 1977 U.S. catch of 15.6 million pounds was 2.3 times this 13 year average, possibly reflecting greater demand for this species as a result of declining yellowtail, because foreign catch did not increase proportionately. Since 1977, domestic landings continually increased to 33.5 million pounds in 1982, but dropped to 23 million pounds in 1984.

The reported U.S. commercial catch of witch flounder (gray sole) in 1937-1977 has ranged from a low of 2.6 million pounds in 1961 to a high of 11 million in 1937. The last year when foreign catch of witch flounder was of any consequence was in 1975 when it reached half a million pounds. U.S. landings then rose continually and reached a new peak of 14.6 million pounds in 1984.

The commercial fishery for sand dabs (windowpane), a small, thin bodied flounder began because of the food shortage during World War II. Most of the fish were landed by Connecticut and New York vessels; New York landings reached about 0.4 million pounds in 1944 and 1945 but, after the war, demand dropped and the fishery stopped. Fishermen began landing sand dabs again in 1975, mostly at New Bedford and possibly due, in part, to a declining yellowtail fishery. Total landings did reach nearly 5 million pounds in 1976, had declined to 2.4 million in 1982, and have rebounded to 4 million pounds in 1984.

The pollock fishery has been largely incidental in nature, because there has never been a fishery of any prominence directed specifically toward pollock as there has been for cod, haddock and redfish. Significant past events affecting the cod fishery in general have also had an impact on the harvesting of pollock. During the early 1900's, a rapid increase in landings of pollock may be attributed to the introduction of the otter trawl in 1905. Increases in catch during the 1920's are not too evident, since they were probably dampened by World War I and the Depression. Sharp increases in U.S. landings occurred from 1930 to 1935, followed by a period of fluctuation from 1935 to 1960 reflecting World War II, and finally subsequent declines and upswings due to changes in pollock abundance and the availability of other primary species. Domestic landings have generally risen since 1970 to a historic high of 39.7 million pounds in 1981, declining to 31 to 32 million in 1983, and back up to 39.5 million pounds in 1984.

The fishery for redfish literally rose out of non-existence in the early 1930's; prior to this, the minimal quantities landed in no way competed with cod and haddock. In the mid-1930's, a new quick-freezing process was developed and the species was marketed as "ocean perch" in the Midwest and South where the taste of yellow perch was familiar. Thus, redfish landings in New England jumped from an average of 209,000 pounds in the period 1931-1933 to 17 million pounds in 1935. The peak year for landings from all areas was 1951 when over 258 million pounds were landed. Since then, U.S. landings from all areas have generally declined with less than 19 million pounds landed in 1982, 13.3 million pounds in 1983, and 12.3 million pounds in 1984.

Silver hake were of little commercial importance prior to the early 1920's because they spoiled easily and there were more valuable species available. Some were caught incidentally to catches of more important species and a small amount was sold as food or bait. Beginning in the early 1920's, a market developed for fried fish sticks and silver hake became a target species for that product. The demand for silver hake as a food fish increased in the 1930's and an otter trawl fishery, mostly of vessels less than 50 gross tons, developed in the U.S. at that time and has persisted to the present.

Total landings of silver hake increased steadily from 1931 (10.8 million pounds) to 1955 (145 million pounds). During the period 1956 to 1961, the total U.S. catch of silver hake averaged about 134.5 million pounds. Beginning in 1962, the distant water fleets of the foreign fisheries, principally the Soviet Union, began to heavily exploit the stocks of silver hake offshore on Georges Bank and in the Southern New England/Mid-Atlantic shelf waters. The foreign catches, when combined with those of the U.S., increased the total catch dramatically, to a peak of almost 882 million pounds in 1965. Thereafter, the total catch declined to an average of about 255 million pounds per year between 1973 and 1976. In 1978, foreign catch was reduced to a quarter of the previous year under the FCMA and has generally declined since then, amounting to only 2 million pounds in 1982. Domestic landings fell 31% in 1979 and remained steady; 36.6 million pounds were landed in 1982, 46.2 million in 1984.

White hake has for decades been an important food fish along the eastern Maine coast. While the white hake fishery far to the east might at times be characterized as a "directed fishery", as indeed it has been for some fishermen from Maine, those markets around Boston and farther south were supplied by hake taken as a by-catch of the cod or haddock or possibly the flounder fishery. White hake catches, mostly domestic, have generally been increasing in recent years to 14.9 million pounds in 1984.

Most red hake have been devoted to industrial purposes, landed usually with silver hake; although, some commercial landings and recreational landings south of New York use red hake for food. Industrial fisheries for red hake were established at Gloucester, Point Judith and New Bedford. After peak landings in the late 1950's, development of the Peruvian anchovy fishery depressed red hake prices and landings dropped precipitously by 1962. Then, in 1963, the Soviet fleet initiated a directed fishery for red hake, capitalizing on the dense concentrations found on southwest Georges. Foreign catches, in the majority until an 80% drop in 1977, have declined to almost nothing in 1982. Domestic landings, fluctuating annually since 1974, have dropped to less than 5 million pounds in 1982, 1983 and 1984.

Butterfish probably have contributed significantly to U.S. commercial fisheries only since the early 20th century. Landings of this species from the New York Bight area peaked in the late 1930's to early 1940's, when landings of food finfish in this region were at their maximum during recent history. The average U.S. catch of butterfish from 1964-1977 was 4.2 million pounds. A significant but unknown amount is taken by industrial fisheries, especially in southern states. The development of the butterfish export industry in 1978 has resulted in a sharp increase in domestic landings, an increased importance of the fishery in Rhode Island, and a larger proportion of the domestic catch being taken in the FCZ. Foreign landings of butterfish were first reported in 1963, and the foreign fishery for this species, which is dominated by the Japanese, soon outgrew the U.S. commercial fishery. Much of the Japanese catch of butterfish is taken in conjunction with the Loligo squid fishery. Foreign landings dropped in 1977 to about 30% of the previous year, and continued to decline to just under one million pounds in 1982. Meanwhile, domestic landings increased overall to 19 million pounds in 1982, fell to 9.8 million pounds in 1983, and rose to 26 million pounds in 1984.

Scup has greatly contributed to the commercial and sport fisheries of Southern New England and the Mid-Atlantic. Commercial scup landings from the region have declined steadily from 50 million pounds in 1960 to 16 million in 1976. Overall, scup landings have recently stabilized and stand at 17.7 million pounds in 1984.

The squid fishery of the northwest Atlantic off the United States was, until the mid-1960's, a small, relatively insignificant bait fishery pursued only by domestic fishermen, and landings never totaled more than a few million pounds. Exploitation of the squid resource in Statistical Areas 5 & 6 increased when foreign fishing began in 1964 when USSR trawlers reported small incidental catches. When Japan and Spain entered the fishery in 1967 and 1970, respectively, catches increased more rapidly with a reported 1971 total catch of 49 million pounds, ten times that caught by the U.S. alone in 1963 (the last year of sole domestic harvest). During 1972, trawlers from eleven countries operating in the fishery harvested 107.4 million pounds, a 119% increase over 1971. The U.S. was ranked sixth that year among the eleven nations harvesting squid. Total catch for both Loligo and Illex combined peaked in 1973 at 125 million pounds and then gradually declined during the next three years to 103.6 million pounds harvested in 1976. Since implementation of the FCMA in 1977, foreign catch has generally declined and was at 17.4 million pounds in 1982, whereas domestic catches have been erratic but reached 35 million pounds in 1982 (including joint ventures).

As alluded to in the descriptions of species exploitation above, foreign catches have been effectively reduced since the FCMA in 1977. By 1979, total foreign catches were down to 20-25% of their 1976 levels. A comparison of U.S. and foreign catch by fishing area and from 1975 to 1982 has been presented in Section 2A1. In 1982, the largest foreign landings of groundfish species from the FCZ were of cod, haddock and pollock, mostly by Canada.

§3B2 Gear and Vessels in the Fishery

Much of the discussion in Subpart A revolved around the groundfish gears: otter trawls, line trawls and gillnets. Table 3B1 presents the latest information available to illustrate that New England groundfish are, in fact, mostly caught by these three gears. The otter trawl is overall the most important groundfish gear type, catching more than 95% of haddock, (all) flounders, silver hake, redfish and butterfish, as well as almost 85% of cod. Gillnets and line trawls are important as groundfish gears because of the amounts of cod, and especially for gillnets, hakes and pollock caught. For all other gears combined, the only important groundfish species landed is scup, mostly by fish traps. Four percent of summer flounder landed by other gear in 1982 is by purse seines; one percent of yellowtail and winter flounder, by scallop dredges and Danish seines.

The number of otter trawl vessels in New England averaged 582 from 1970 to 1976. With the advent of the FCMA this number began to rise, especially during 1979 (Figure 3B1), and stood at 986 otter trawls in 1983. This is an average increase of 10% per year. Separately 44% of the total 302 vessels added to the fleet by 1981 were new, and 169 were existing vessels which either switched gear, moved to New England, or were newly acquired used vessels.

§3B3 Landings and Revenues

The most recent landings and values of groundfish and other managed species are shown in Table 3B2 (from Fisheries of the United States, 1984). Cod is the most valuable of the groundfish species and is an important segment of the total value in nearly every New England port. Of the groundfish, the flounders and haddock are also quite valuable, albeit more so for particular ports. For instance, haddock is very important in the northern ports such as Portland, Gloucester and Boston, although New Bedford relies on haddock revenues as well. Alternatively, the flounder group is more important to the southern ports (i.e., the south shore of Massachusetts and Cape Cod, New Bedford, Newport and south). Scup and swordfish are valuable alternatives, but more to the south. In New England, sea scallops have again fallen behind lobsters in 1984 as the most valuable fishery in the region.

Looking again at the most prolific groundfish gear, otter trawls, we observe that total value has until recently been increasing (Figure 3B2). The total deflated value of New England otter trawl landings has only managed to hold its own during this period (solid line). Given the increasing numbers of otter trawls shown in Figure 3B1, one might expect that deflated value per otter trawl has fallen. In fact, even undeflated value fell during 1979-1980 (Figure 3B3), and deflated value remained flat in 1981-1983. Indices of deflated gross value per otter trawl by GRT class found in Figure 3B4 indicate that the decline has hit all vessel sizes. Thus, potential financial problems for the fleet exist, but an analysis of net returns is required to better ascertain the status of the fleet and is examined in Section 3B4.

Table 381

RELATIVE IMPORTANCE OF INDIVIDUAL GEAR TYPES IN HARVESTING INDIVIDUAL DEMERSAL FINFISH SPECIES (Various years)

	Percent of Total New England Landings Taken By:															
	Otter Trawl (%)				Gillnet (%)				Line Trawl (%)				Other (%)			
	1970	1977	1979	1982	1970	1977	1979	1982	1970	1977	1979	1982	1970	1977	1979	1982
Cod	84.3	86.0	81.5	84.0	4.1	8.9	8.8	13.0	9.3	4.4	7.1	1.0	2.3	0.7	2.5	1.0
Haddock	94.1	94.4	96.4	97.0	0.6	4.3	3.3	2.0	5.0	1.1	0.2	0	---	0.2	0.1	0
Yellowtail Flounder	99.9	99.2	95.8	99.0	0.1	0	0	0	---	0	0	0	---	0.8	4.2	1.0
Fluke	100.0	98.7	98.3	93.0	---	---	0	0	---	0	0	---	0	1.2	1.7	6.0
Other Flounders	99.8	99.2	98.8	98.0	0.1	0.6	0.3	1.0	---	0.1	0	0	0	0.4	1.0	1.0
Whiting	100.0	99.6	99.6	100.0	---	0.4	0.2	0	---	0	0	0	---	0	0.2	0
Red & White Hake	84.8	60.1	71.2	70.0	5.2	33.8	25.3	29.0	10.0	6.1	3.1	1.0	---	0	0.3	0
Pollock	89.6	60.9	52.6	69.0	7.2	37.0	42.8	31.0	1.7	2.1	3.8	0	1.5	0	0.8	0
Ocean Perch	100.0	99.8	99.8	99.0	---	0.2	0.2	0	---	0	0	0	0	0	0	0
Scup	92.1	89.3	62.2	51.0	---	---	0	0	---	0	0.7	---	8.9	10.7	37.1	49.0
Butterfish	99.1	97.9	97.4	99.0	---	---	---	0	---	---	0.1	---	0.9	2.1	2.5	1.0

Source: NMFS weigh-out files

0 = less than .05 of a percentage

Figure 3B1

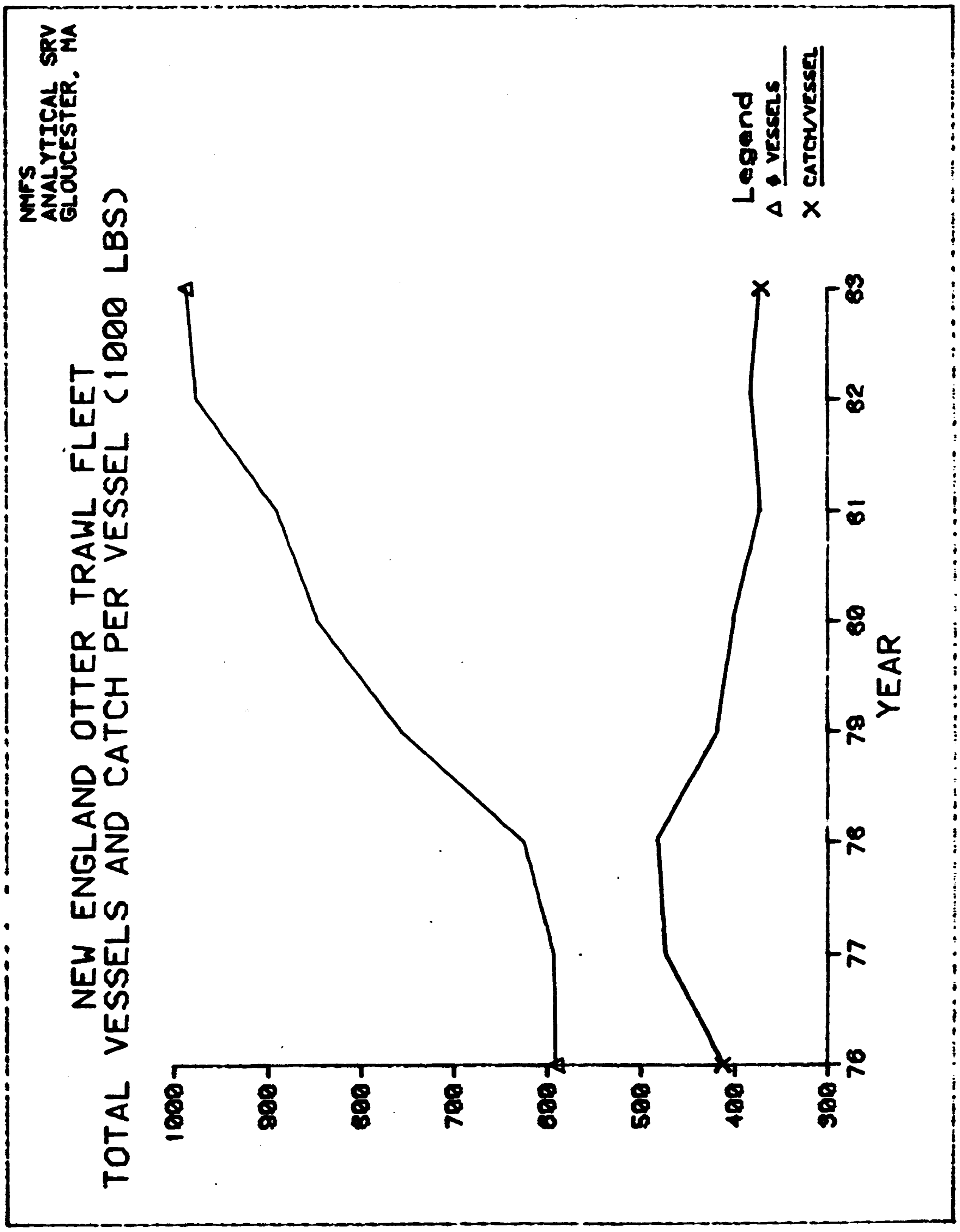

NEW ENGLAND OTTER TRAWL FLEET
TOTAL VESSELS AND CATCH PER VESSEL (1000 LBS)
NMFS
ANALYTICAL SRV
GLOUCESTER, MA
1000
900
800
700
600
500
400
300
76
77
78
79
80
81
82
83
YEAR
Legend
Δ # VESSELS
X CATCH/VESSEL

Table 3B2

U.S. COMMERCIAL LANDINGS, BY SPECIES, 1983 AND 1984 (1)

Species	1983		1984		5-year average (1979-1983)
Fish	Thousand pounds	Thousand dollars	Thousand pounds	Thousand dollars	Thousand pounds
Bluefish	16,718	2,576	12,713	2,382	15,719
Butterfish	10,601	3,310	26,026	7,056	10,745
Cod	112,474	37,928	96,775	36,143	106,994
Cusk	4,277	980	3,939	1,026	4,119
Flounders:					
Blackback	32,989	15,795	31,362	20,948	33,428
Fluke	35,276	22,940	40,204	27,635	30,223
Yellowtail	72,903	35,307	39,292	28,258	46,569
Other	46,002	23,973	43,824	29,220	45,540
Haddock	32,563	18,969	25,997	18,352	45,958
Hake:					
Red	4,767	578	5,024	549	5,523
White	14,140	2,235	14,919	2,551	11,870
Mackerel	6,418	1,337	6,835	1,018	6,019
Ocean Perch	13,289	3,498	12,333	3,550	21,787
Pollock	30,820	5,386	39,536	6,439	34,940
Scup	18,783	8,744	18,505	8,775	20,308
Sea Trout (Gray)	17,543	7,759	19,726	7,541	25,765
Striped Bass	1,679	2,984	2,697	3,816	3,148
Swordfish	11,940	31,883	12,831	37,063	9,599
Whiting	37,498	6,962	46,214	6,867	36,081
Ocean Quahog	35,232	10,753	38,812	11,829	34,937
Surf Clams	55,938	24,914	70,243	34,334	44,881
Lobster	44,206	106,766	43,967	114,348	39,056
Sea Scallops	20,478	111,529	18,427	97,675	26,460
Squid	33,459	10,053	30,948	7,157	16,120

(1) Landings are reported in round (live) weight for all items except univalve and bivalve mollusks, such as clams, oysters, and scallops, which are reported in weight of meats (excluding the shell).

Figure 3B2

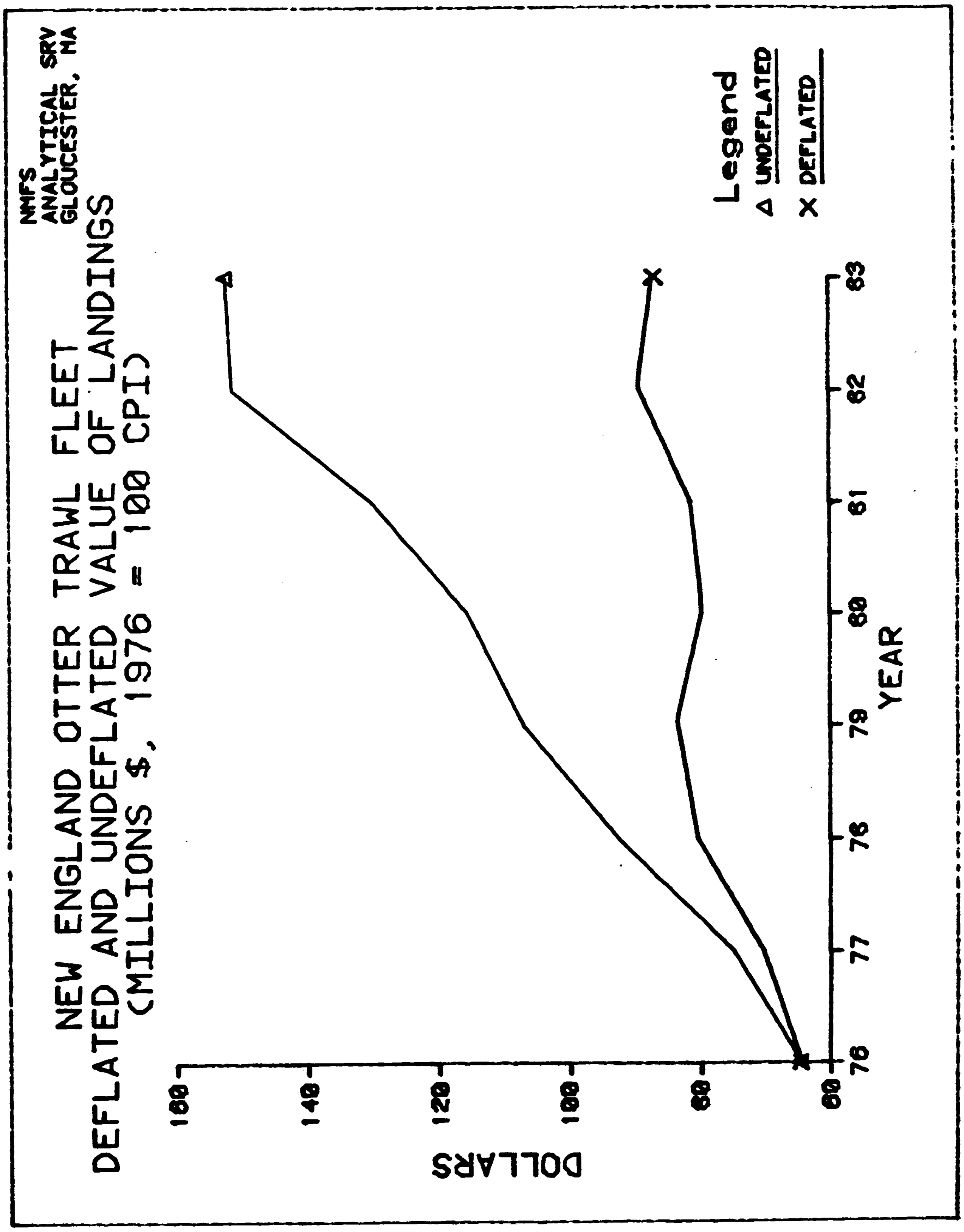

NEW ENGLAND OTTER TRAWL FLEET
DEFLATED AND UNDEFLATED VALUE OF LANDINGS
(MILLIONS $, 1976 = 100 CPI)
NMFS
ANALYTICAL SRV
GLOUCESTER, MA
DOLLARS
160
140
120
100
80
60
76
77
78
79
80
81
82
83
YEAR
Legend
Δ UNDEFLATED
× DEFLATED

Figure 3B3

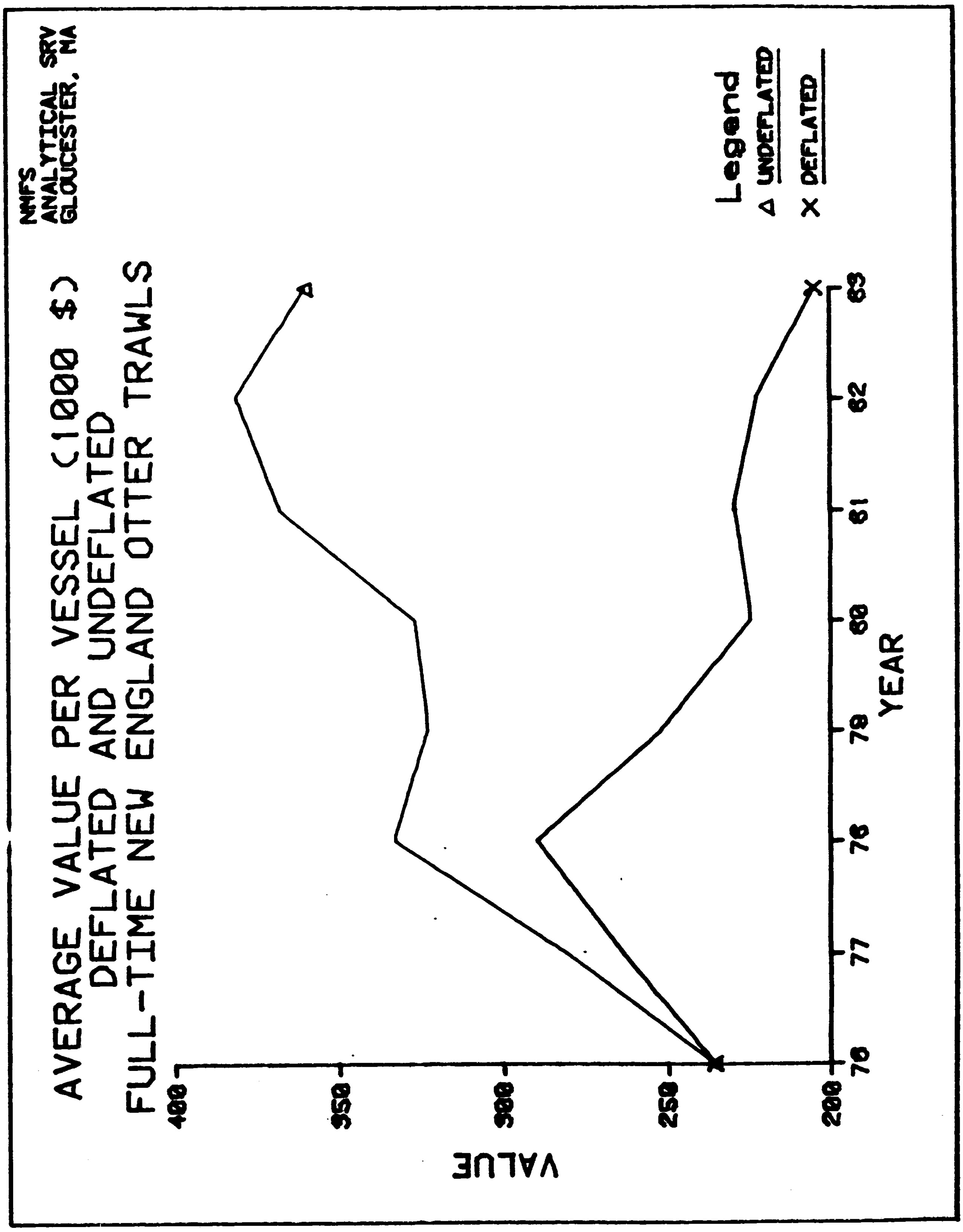
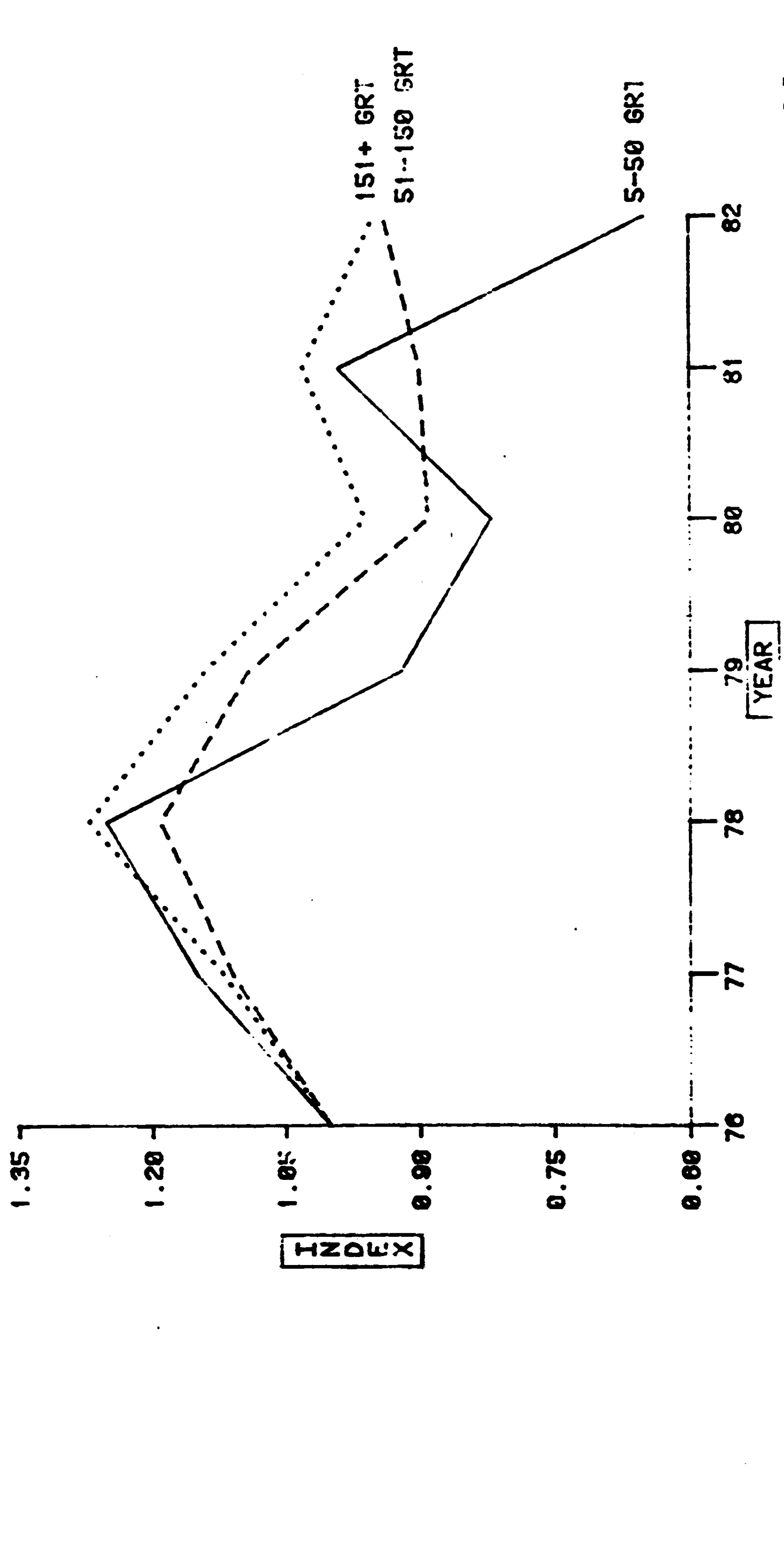

AVERAGE VALUE PER VESSEL (1000 $)
DEFLATED AND UNDEFLATED
FULL-TIME NEW ENGLAND OTTER TRAWLS
NMFS
ANALYTICAL SRV
GLOUCESTER, MA
Legend
UNDEFLATED
DEFLATED
VALUE
YEAR
400
350
300
250
200
76
77
78
79
80
81
82
83

Figure 3B4

NEW ENGLAND OTTER TRAWL FLEET
INDICIES OF DEFLATED* GROSS VALUE PER VESSEL
FULL-TIME VESSELS BY TONNAGE CLASS



FULL-TIME = 195+ DAYS AT SEA

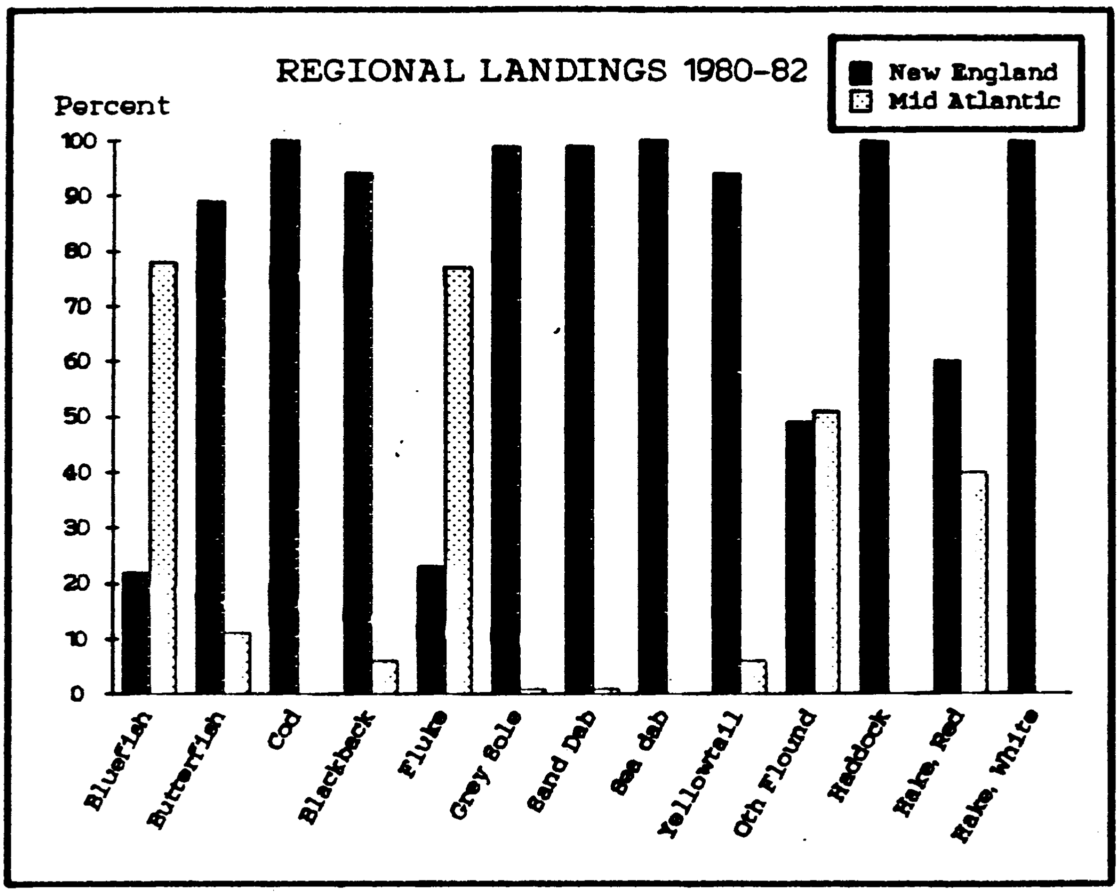
Source: Analytical Services Branch, NMFS, Gloucester, MA

Comparative landings between New England (except Connecticut) and the Mid-Atlantic (New York, New Jersey, Maryland and Virginia) from 1980 to 1982 may be found in Figure 3B5 (from State Landings, Maine to Virginia) and for 1984 in Table 3B3 (from state landings Maine to North Carolina). In terms of percent of total landings of groundfish species from Maine to Virginia, the New England region produces an overwhelming majority of butterfish, cod, winter flounder, witch flounder, sand dabs, American plaice (sea dabs), yellowtail, haddock, white hake, redfish (ocean perch) and pollock (dark bars). Additionally, New England produces the majority of red and silver hake. The Mid-Atlantic region dominates the fishery for summer flounder and produces the majority of scup and, as a group, squid. Table 3B4 shows regional dependence on species for 1984. The major fishery in each region as percent of value is sea scallops (26%) and lobster (30%) in the Mid-Atlantic and New England respectively; the major groundfish fishery is summer flounder (fluke) at 17% in the Mid-Atlantic and cod (10%) in New England.

Landing seasonality is discussed for the major ports in Sections 3A1 and 3A2 for the years 1973, 1976, 1979 and 1982. Graphs of average monthly landings during the period 1980-1983 are included in Appendix 3B. Washington, Hancock and Knox counties in Maine show marked seasonality, with their landings of cod, other flounder, pollock and white hake coming mostly around the summer months. Rockland seems to show higher landings of haddock and white hake later in the year, while other flounder is caught year-round, and redfish, the primary species, slows down somewhat during winter. Lincoln, Sagadahoc and Cumberland counties display summer seasonality, especially for the primary species other flounder, while cod is early in the summer and white hake is later in the summer. Silver hake landings in Sagadahoc peak in the early fall. Portland lands high levels of redfish all year but especially in the summer. Both Portland and York counties land similar species, but illustrate the difference between a large and small port. Both port areas land cod and haddock in early summer and white hake late in summer, but York county landings of other flounder peak in summer while those in Portland are high nearly year-round. Pollock landings in both ports peak in November and December. New Hampshire landings show similar patterns; cod and other flounder in summer, pollock in winter.

Cod and haddock landings in Gloucester peak during May-June and August-September, respectively. Other flounder is fairly constant, and pollock peaks in November and December. Redfish appear in summer, and silver hake appear in the fall. Cod and haddock are heavy all during the summer (May-September) in Boston. Lower levels of redfish peak in summer, and pollock is constant with some increase in winter. The ports surrounding Cape Cod Bay follow a seasonal pattern in the summer, landing cod and all flounders except summer flounder, but extending more towards the end of the year than seen in Maine, especially for yellowtail and winter flounder. In addition, Provincetown lands silver hake and pollock in the fall and winter, respectively. Chatham cod landings peak in summer, May to August. Barnstable and Dukes Counties' landings are mainly in the summer, consisting of winter flounder, scup and squid with a second peak of winter flounder in the fall. Dukes County also lands cod and yellowtail during two seasons, early spring and fall. Cod and yellowtail landings in New Bedford are heavy all year, although yellowtail is stronger during the second half of the year. Conversely, haddock landings are higher in the first half of the year. Winter flounder demonstrates the now familiar spring and fall seasons.

Figure 3B5


REGIONAL LANDINGS 1980-82
New England
Mid Atlantic
Percent
100
90
80
70
60
50
40
30
20
10
0
Bluefish
Butterfish
Cod
Blackback
Fluke
Grey Sole
Sand Dab
Sea dab
Yellowtail
Oth Flound
Haddock
Hake, Red
Hake, White

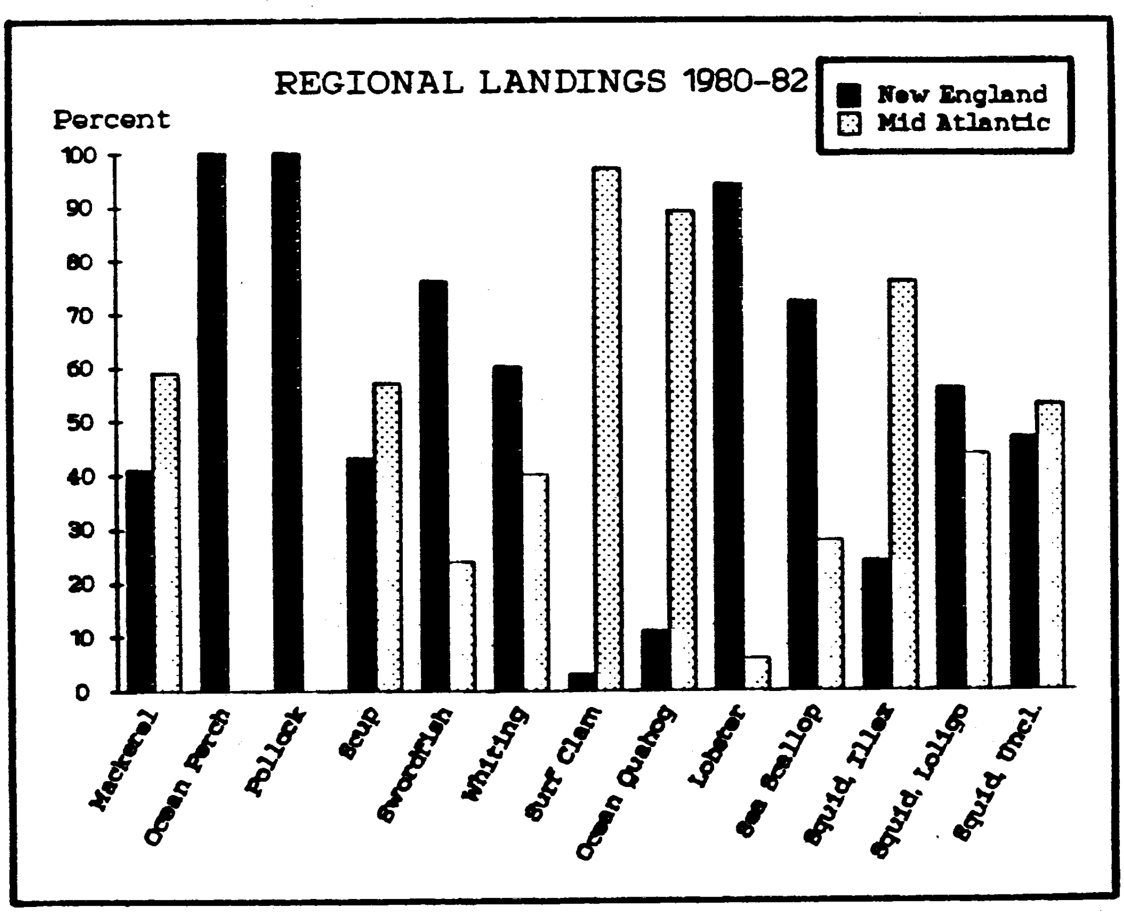

REGIONAL LANDINGS 1980-82
New England
Mid Atlantic
Percent
100
90
80
70
60
50
40
30
20
10
0
Mackerel
Ocean Perch
Pollock
Scup
Swordfish
Whiting
Surf Clam
Ocean Quahog
Lobster
Sea Scallop
Squid, Illex
Squid, Loligo
Squid Uncl

Table 3B3

REGIONAL LANDINGS & REVENUES (thousands) FOR 1984

Species	MID-ATLANTIC 1000lbs.	%	NEW ENGLAND 1000lbs.	%	TOTAL 1000lbs.	%
Bluefish	8362	80	2140	20	10502	100
Butterfish	2004	8	24021	92	26025	100
Cod	917	1	95858	99	96775	100
FLounder-Oth.	7	1	492	99	499	100
Fl-Blackback	1595	5	30892	95	32487	100
Fl-Fluke	33656	85	6094	15	39750	100
Fl-Gray Sole	141	1	14505	99	14646	100
Fl-Plaice	15	0	22536	100	22551	100
Fl-Windowpane	88	2	3947	98	4035	100
Fl-Yellowtail	3106	8	35941	92	39047	100
Haddock	5	0	25992	100	25997	100
Hake, Red	1324	26	3700	74	5024	100
Hake, White	16	0	14903	100	14919	100
Herring	41	0	72040	100	72081	100
Mackerel	3646	53	3189	47	6835	100
Ocean Perch	0	0	12333	100	12333	100
Pollock	16	0	39487	100	39503	100
Scup	9933	56	7724	44	17657	100
Swordfish	1881	42	2594	58	4475	100
Whiting	13235	29	32979	71	46214	100
Ocean Quahog	35564	92	3248	8	38812	100
Surf Clam	62368	89	7875	11	70243	100
Lobster	2460	6	41507	94	43967	100
Sea Scallop	6067	35	11100	65	17167	100
Squid, Illex	7044	96	265	4	7309	100
Squid, Loligo	10842	46	12549	54	23391	100
Squid, Uncl.	48	33	96	67	144	100

Table 3B4

REGIONAL LANDINGS & REVENUES (thousands) FOR 1984

	MID-ATLANTIC		NEW ENGLAND	
Species	$1000	%	$1000	%
Bluefish	1575	1	422	0
Butterfish	701	1	6355	2
Cod	565	0	35578	10
FLounder-Oth.	3	0	97	0
Fl-Blackback	753	1	21342	6
Fl-Fluke	21054	17	6297	2
Fl-Gray Sole	61	0	10988	3
Fl-Plaice	5	0	14919	4
Fl-Windowpane	22	0	1359	0
Fl-Yellowtail	1893	1	26265	7
Haddock	2	0	18350	5
Hake, Red	194	0	355	0
Hake, White	5	0	2546	1
Herring	6	0	3620	1
Mackerel	413	0	605	0
Ocean Perch	0	0	3550	1
Pollock	3	0	6432	2
Scup	4976	4	3167	1
Swordfish	6297	5	7716	2
Whiting	2630	2	4237	1
Ocean Quahog	10677	8	1152	0
Surf Clam	30733	24	3601	1
Lobster	7374	6	106974	30
Sea Scallop	32377	26	62478	18
Squid, Illex	775	1	55	0
Squid, Loligo	3129	2	3127	1
Squid, Uncl.	11	0	25	0
TOTAL	126234	100	351612	100

Newport landings of cod, yellowtail and winter flounder are fairly continuous throughout the year with some typical small peaks (yellowtail in July-August). However, other species such as butterfish (September-December), silver hake (June-August) and scup (May) are highly seasonal. The only constant in Point Judith is yellowtail landings; while silver hake, winter flounder and scup start up sometime in spring and continue through fall, and butterfish is landed from September to December. In New York, yellowtail and scup provide landings throughout the year; summer and winter flounder surge in May and last until the end of the year; silver hake provides landings through winter; and squid peaks in June and July. New Jersey landings are all seasonal. Silver hake and scup are winter fisheries; summer flounder peaks in January-March and September-October; red hake peaks in December-January and April-May; and squid is landed in summer. Maryland's summer flounder landings are primarily from November to January. Virginia's summer flounder landings basically start in November but last until April; scup landings run from January to April; and squid landings are high from May to September.

§3B4 Costs

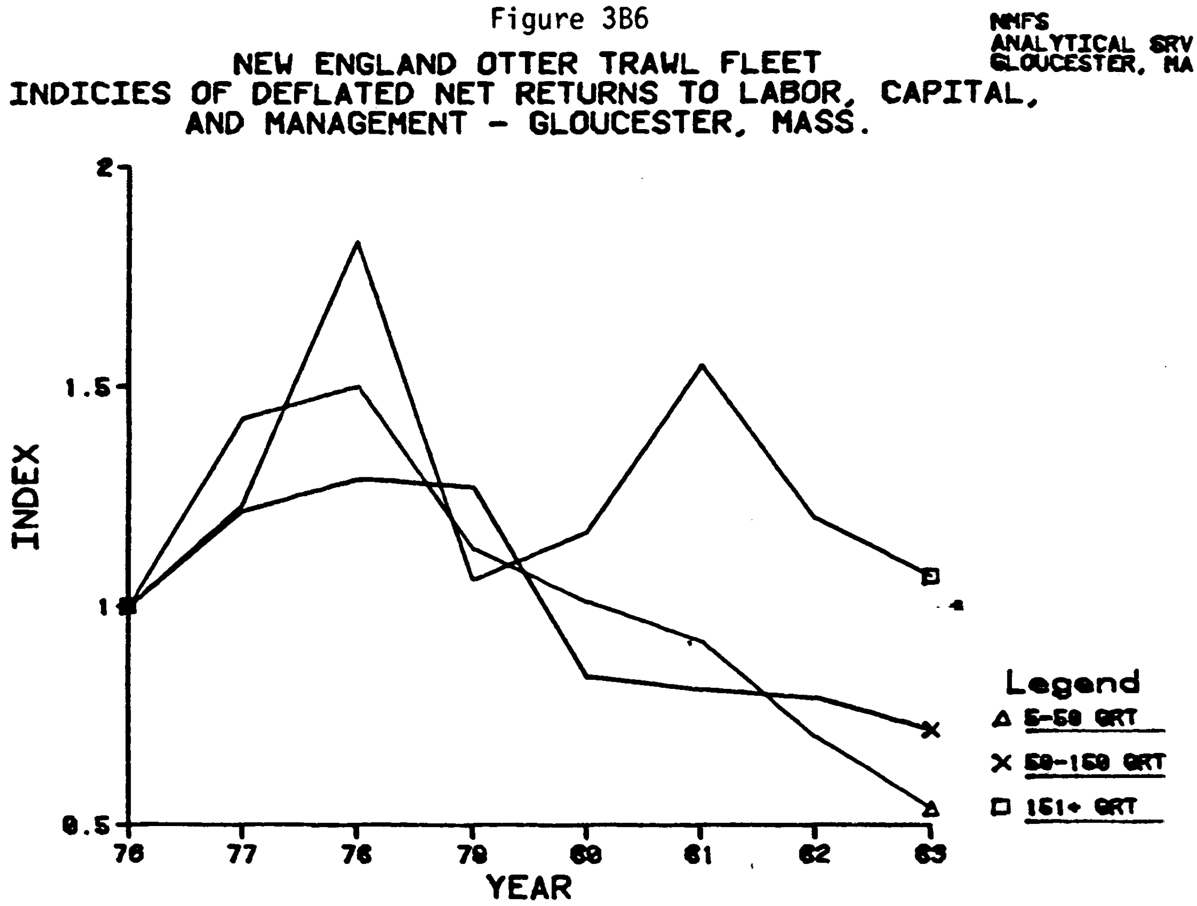
Data on the net returns of the otter trawl fleet have been reported by the Analytical Services Branch (NMFS Regional Office) for the two major groundfish ports, Gloucester and New Bedford.[1] Indices of net returns are presented in Figure 3B6 and show continual declines since 1978, except for the 151 GRT plus class in Gloucester in 1980-1981 and to a lesser extent New Bedford otter trawls in 1982. This contrasts with the upturn in gross returns shown for all New England otter trawls in 1981 (Figure 3B4). The reason for this reversal is easily observed by looking at fuel cost as a percent of gross stock in Gloucester, for example (Figure 3B7), which has doubled from 1978 to 1981 for all gear classes, but has leveled-off in 1982 and 1983. Additionally, interest expense as a percent of boat share has been increasing at about the same rate in New Bedford, for instance, (Figure 3B8), although 1982-1983 data indicate that that trend has at least stablized. All this has resulted in depressed debt coverage ratios (Figure 3B9), or the number of times the boat share covers the mortgage, and a generally unhealthy financial position for the fleet.

---

[1]The following four figures each contain graphs with different scales for Gloucester and New Bedford.

Figure 3B6

NEW ENGLAND OTTER TRAWL FLEET
INDICIES OF DEFLATED NET RETURNS TO LABOR, CAPITAL, AND MANAGEMENT - GLOUCESTER, MASS.



NEW ENGLAND OTTER TRAWL FLEET
INDICIES OF DEFLATED NET RETURNS TO LABOR, CAPITAL, AND MANAGEMENT - NEW BEDFORD, MASS

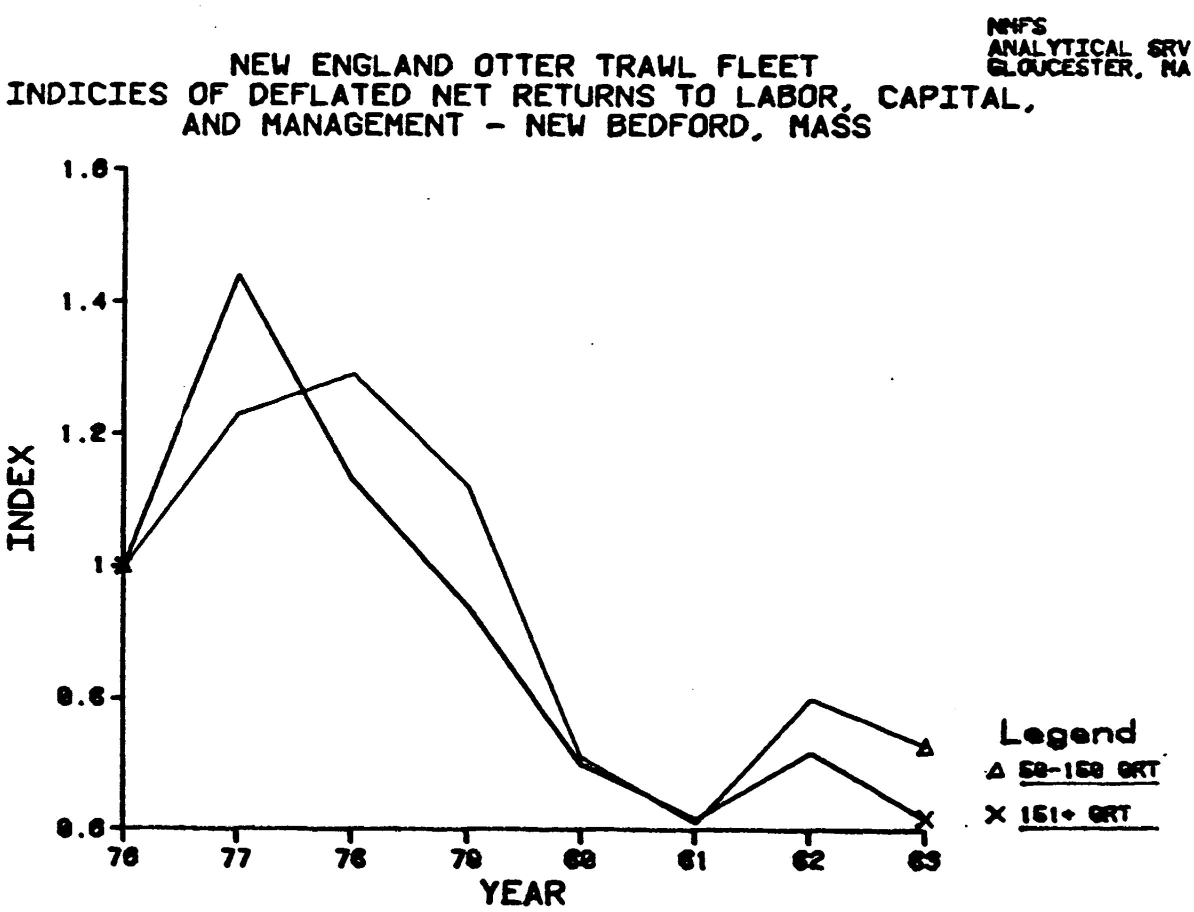


Figure 3B7

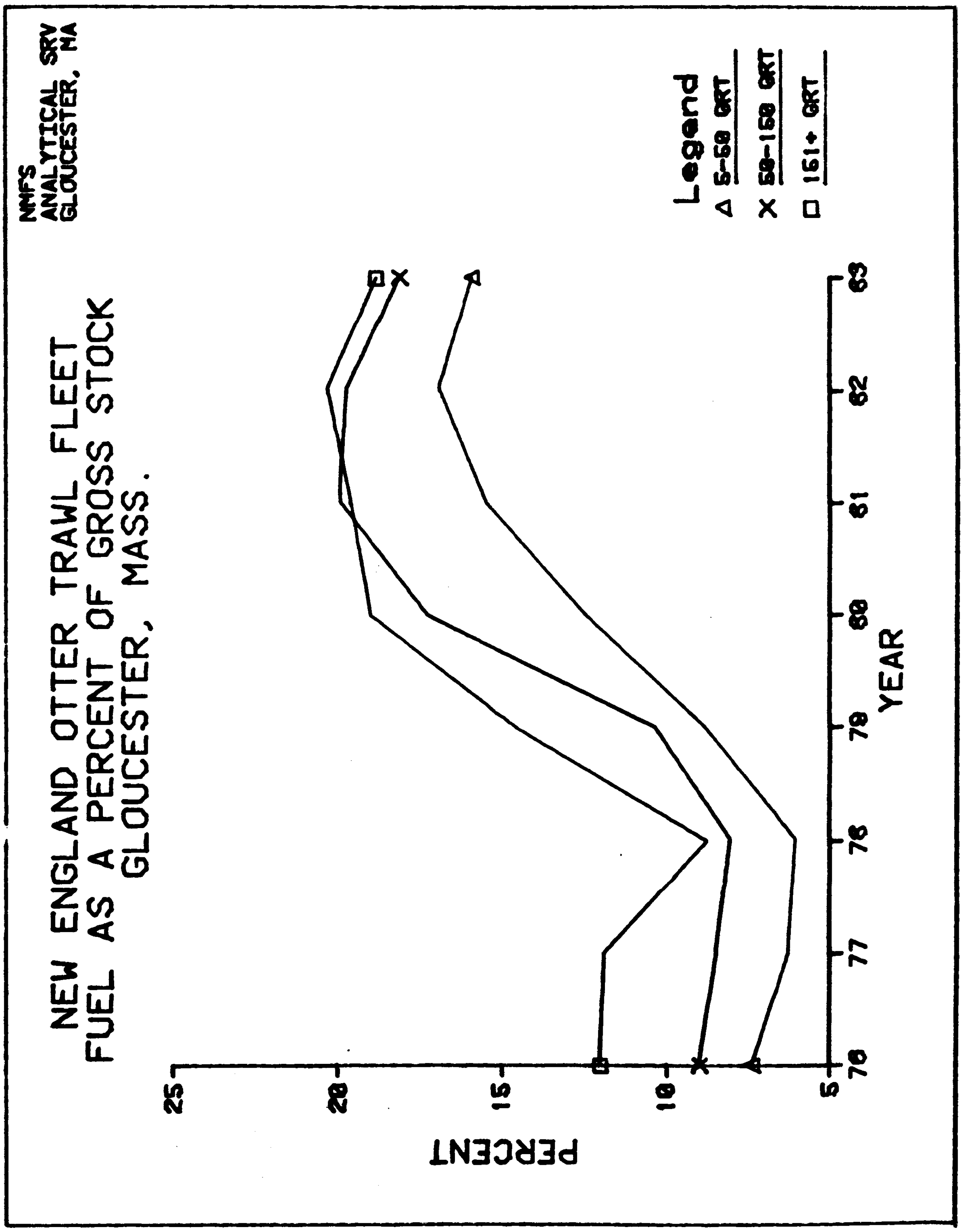

NEW ENGLAND OTTER TRAWL FLEET
FUEL AS A PERCENT OF GROSS STOCK
GLOUCESTER, MASS.
NMFS
ANALYTICAL SRV
GLOUCESTER, MA
Legend
5-50 GRT
50-150 GRT
151+ GRT
PERCENT
25
20
15
10
5
76
77
78
79
80
81
82
83
YEAR

Figure 3B8

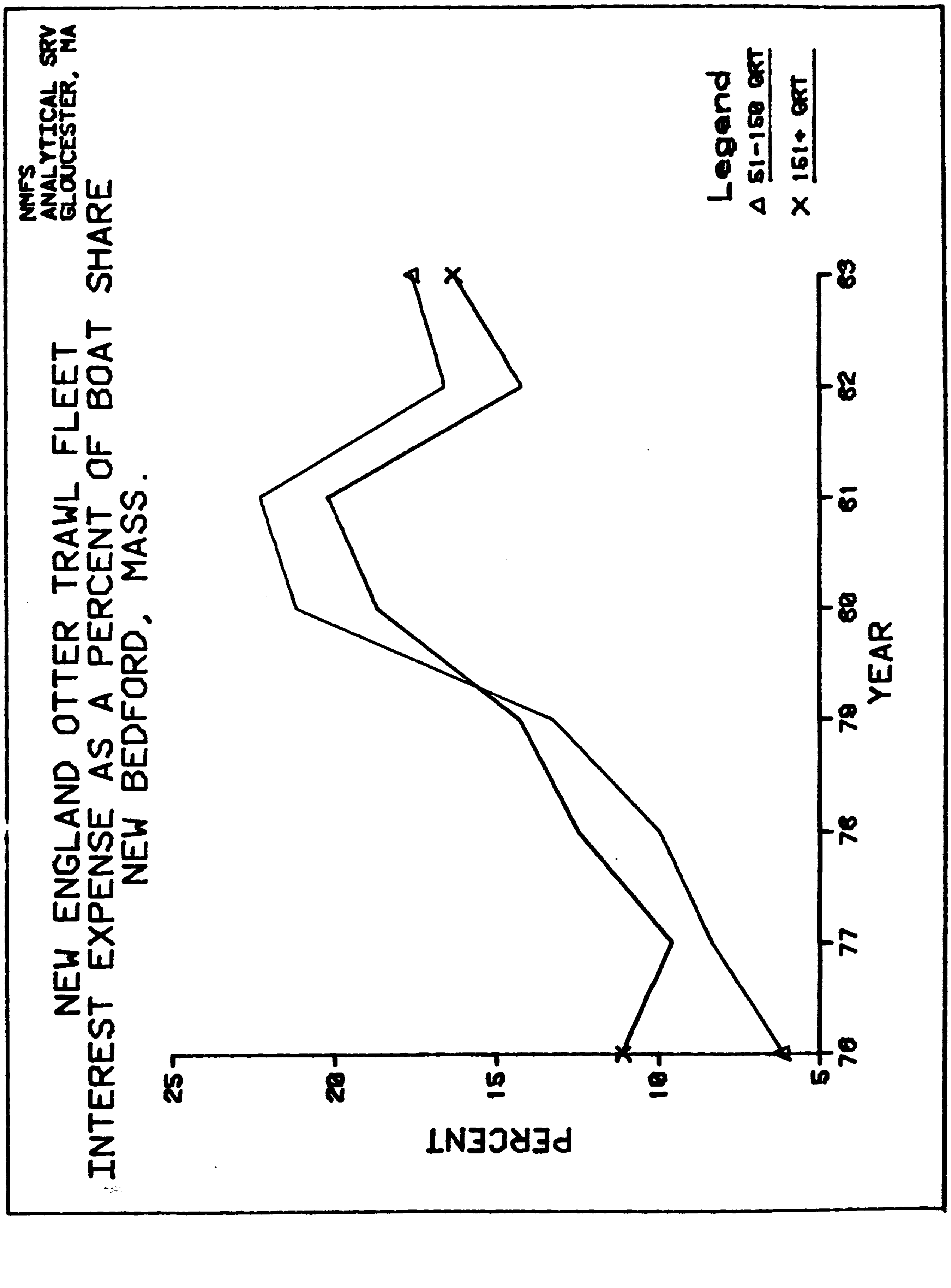
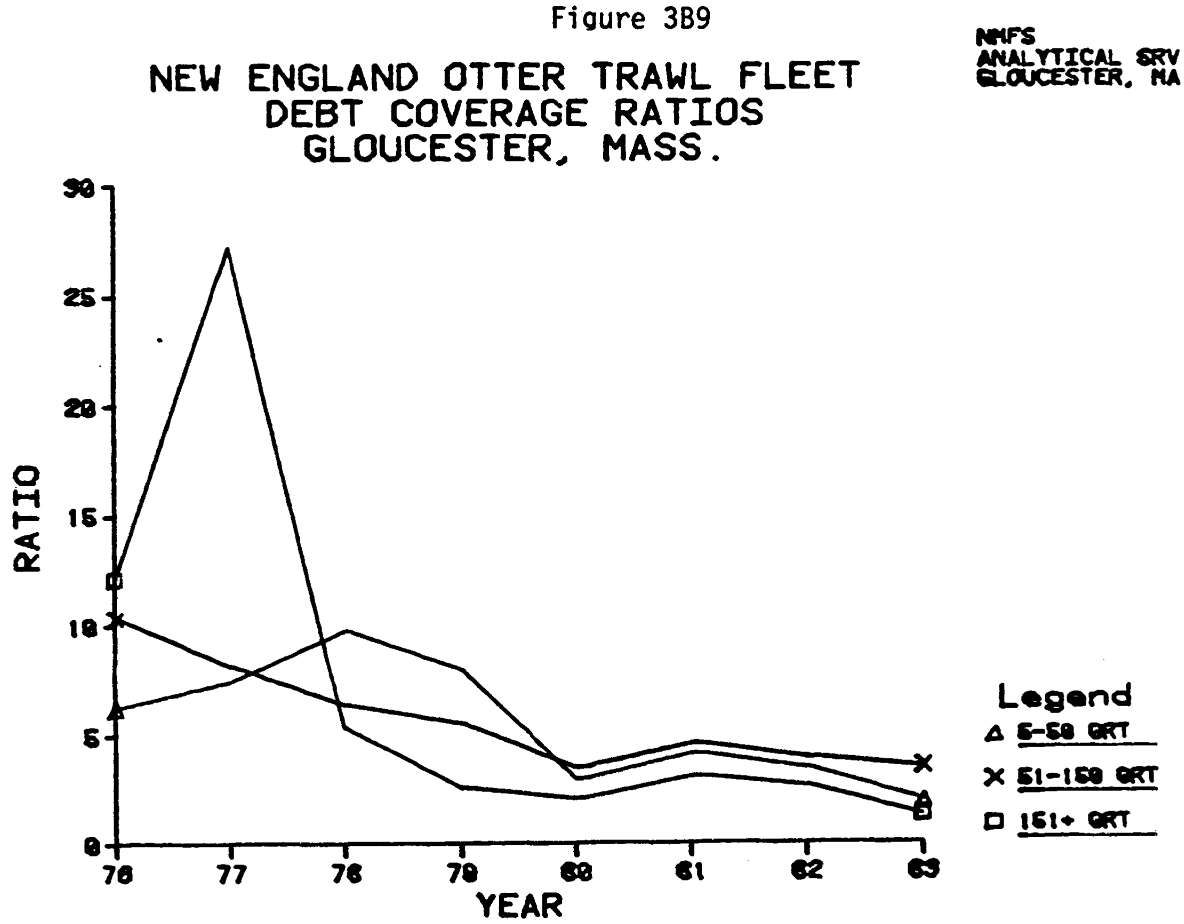
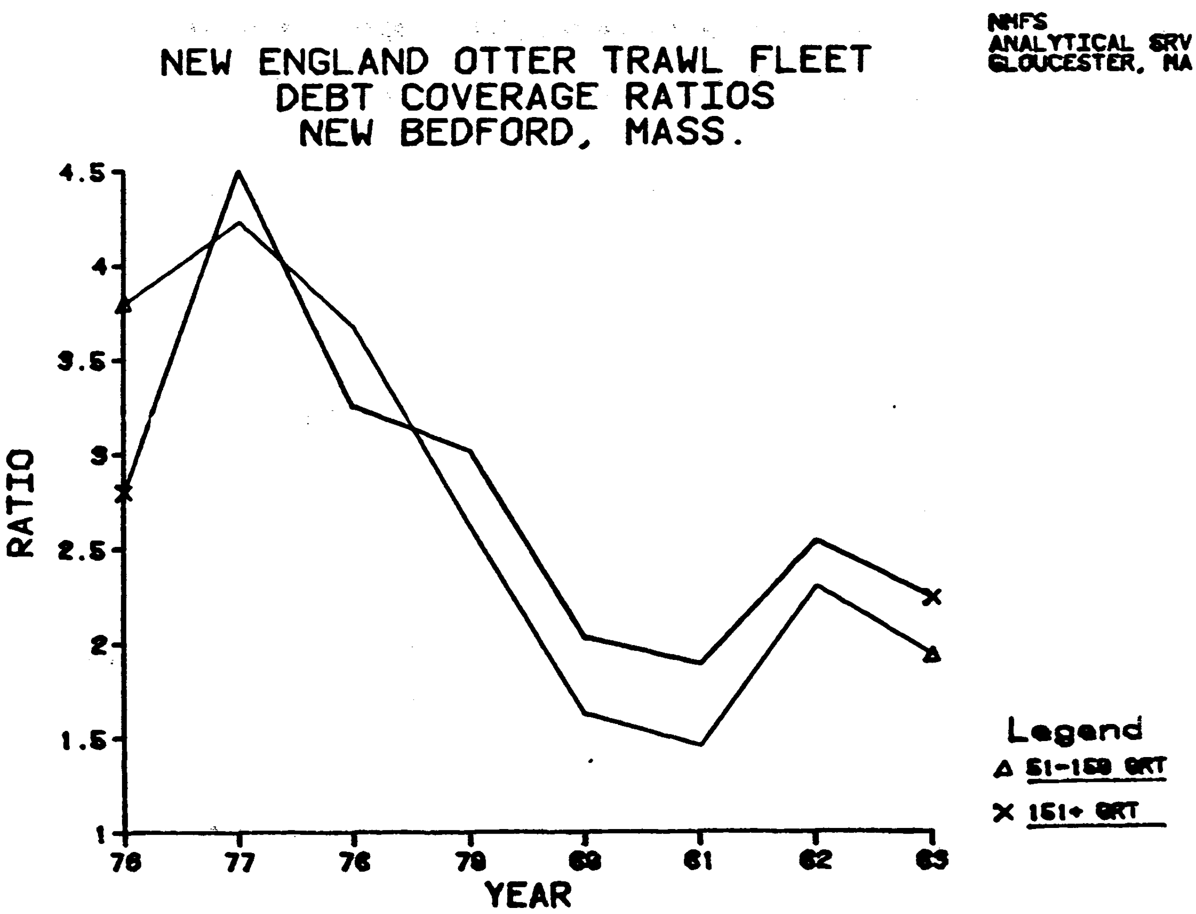

NEW ENGLAND OTTER TRAWL FLEET
INTEREST EXPENSE AS A PERCENT OF BOAT SHARE
NEW BEDFORD, MASS.
NMFS
ANALYTICAL SRV
GLOUCESTER, MA
PERCENT
25
20
15
10
5
76
77
78
79
80
81
82
83
YEAR
Legend
51-150 GRT
151+ GRT

Figure 3B9





8/30/85

SUBPART C: PROCESSING AND MARKETING

§3C1 Processing

There were 136 groundfish processing plants in the eastern U.S. in 1979 (Georgianna & Dirlam, 1983). Eighty-three of these firms were located in New England. Of these, 49 produced only fresh fish products, 21 produced fresh and frozen products and 8 produced only frozen products. Total sales from these plants were about $470 million. About one-third of this amount was comprised of fresh and frozen fillets and steaks made largely from domestic landings, and two-thirds were sticks and portions made almost entirely from frozen imported fish (Figure 3C1). Salted and cured groundfish products comprised less than one percent of New England's groundfish production. Flounder fillets comprised 43% of the total value of fillets, cod 23%, haddock 16%, ocean perch 5%, pollock 4% and other species 9% (Figure 3C2). None of the fish sticks and portions are classified according to species, but the majority of these products are made from imported cod blocks and slabs.

The processing of fresh fish products produced about $170 million in sales, provided about $50 million of added value to fish products, and employed about 2,000 people. Processing and marketing of fresh fish has developed differently than for frozen fish because of the limited shelf life of fresh fish products. It is characterized by great flexibility at the processing level and inflexibility at the distribution level. Two of the differences between fresh and frozen fish production are: (1) the plants which produce only fresh fish products tend to be smaller than those which produce either a mix of fresh and frozen or only frozen products; and (2) fresh plants generally handle a wider variety of species. Processors buy most of their raw fish from fishermen, but where this supply is limited, processors depend on brokered fish for a major part of their supply. Most of this fish is imported from Canada, but a fair amount is also trucked from Gloucester, Maine and Cape Cod to processing centers such as New Bedford and Boston.

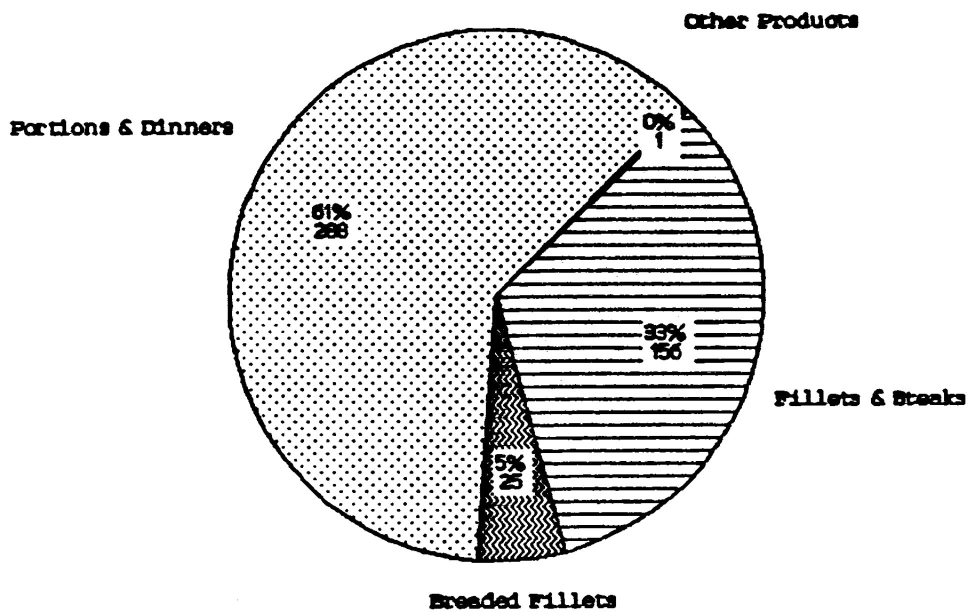
Frozen fish processing has less flexibility at the processing level but more flexibility at the distribution level. Frozen fish plants are generally larger and have more capital equipment than fresh fish plants. Higher levels of capital equipment require higher rates of capacity utilization and more careful production planning. Although frozen groundfish can be obtained in large quantities from Canada and Europe, frozen fish processors must meet specific product requirements of their buyers and cannot always substitute different varieties of fish as inputs. Frozen fish processors generally handle a smaller variety of species than fresh fish processors (Georgianna and Dirlam, 1983).

Most frozen fish products are imported from large, vertically-integrated foreign processing companies. Very often secondary processing such as cutting the fish into portions, breading and battering are completed within the U.S. An estimated 60% of imported frozen products are sold directly by foreign processors to large supermarkets or chain restaurants. The remaining portion is generally sold through a network of brokers to wholesaler/distributors who supply smaller retailers.

Figure 3C1

VALUE OF NEW ENGLAND GROUNDFISH PRODUCTS 1979

Million Dollars

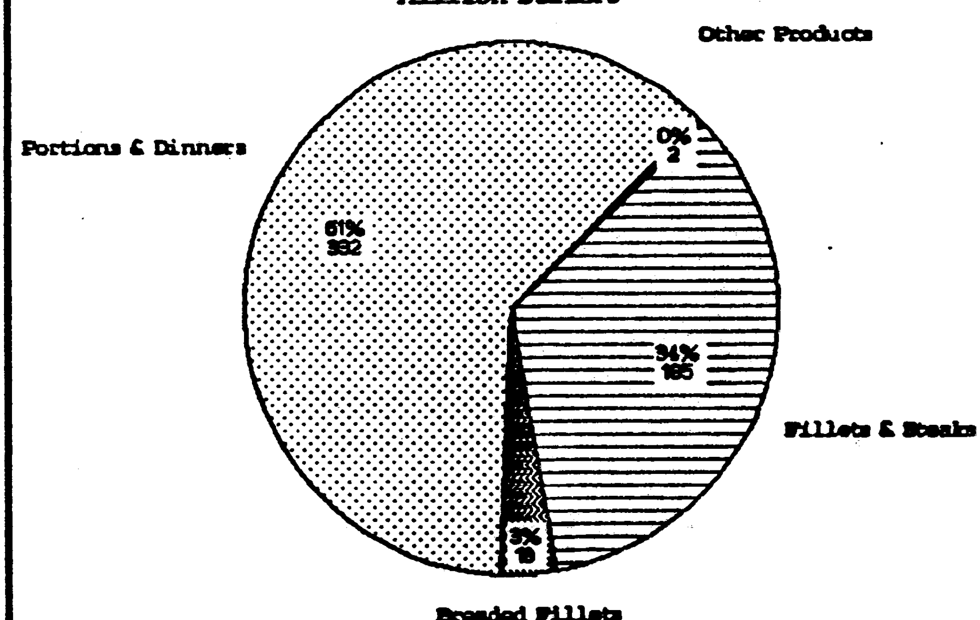


Source: Processed Fishery Products, 1979, NMFS

Figure 3C1

VALUE OF NEW ENGLAND GROUNDFISH PRODUCTS 1983

Million Dollars

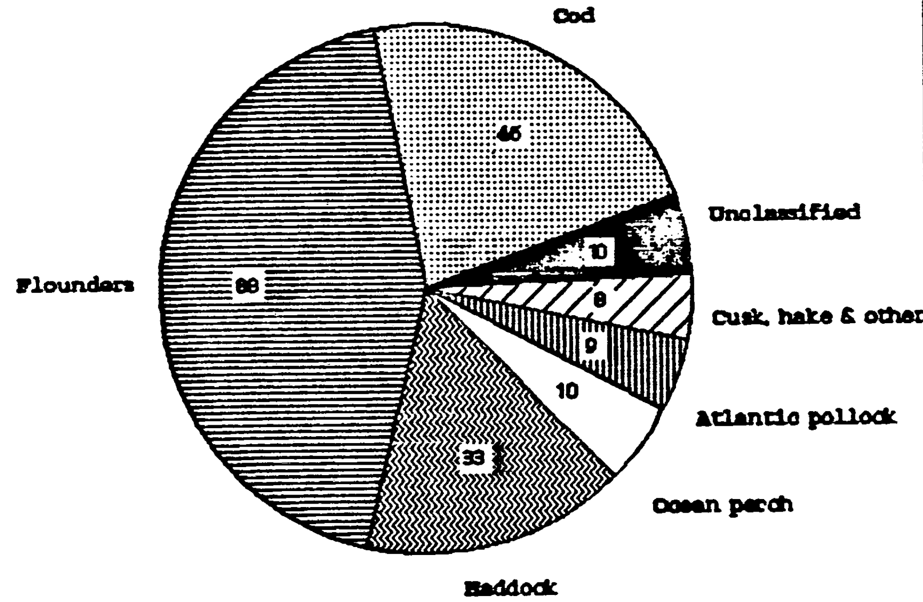


Source: Processed Fishery Products, 1983, NMFS

Figure 3C2

VALUE OF FILLET & STEAK PRODUCTION BY SPECIES 1979

Million Dollars

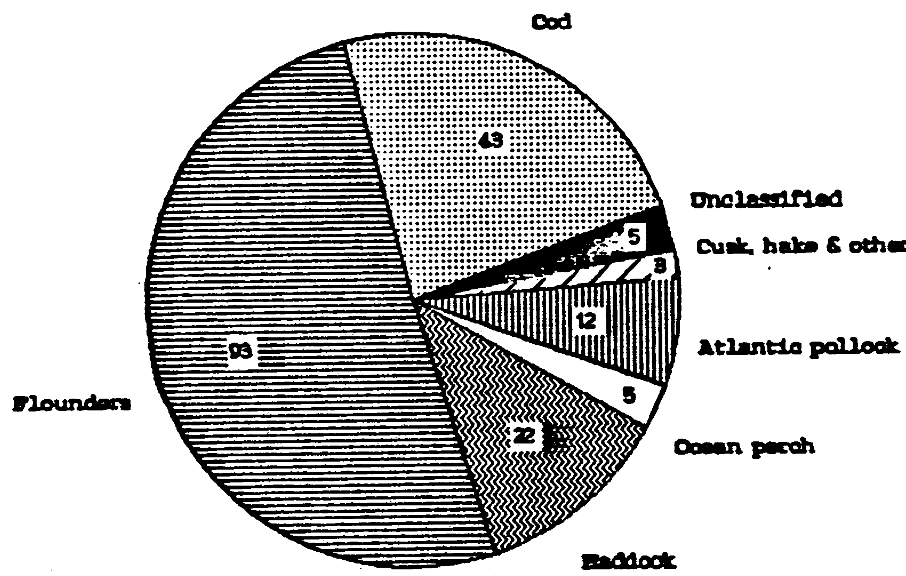


Source: U.S. Production of Fish Fillets & Steaks, Annual Summary 1979, NMFS

Figure 3C2

VALUE OF FILLET & STEAK PRODUCTION BY SPECIES 1983

Million Dollars



Source: U.S. Production of Fish Fillets & Steaks, Annual Summary 1983, NMFS

Processing Activity by Area

To a large extent, the variety of fish processed in any area is determined by the landings at that port. Some other factors important in determining the mix of fish processed in an area are the area's proximity to markets, its location along transportation routes to other processing centers, and the cost of its labor and manufacturing space.

New Bedford is the largest producer of fresh groundfish products. As recently as 1970, over 90% of New Bedford's processed groundfish were flounders. Georgianna (1983) found that while most yellowtail flounder was processed in New Bedford, winter and other flounder are often trucked to New York for processing. However, as flounder landings declined, many New Bedford plants processed more cod and haddock. In 1979, New Bedford plants processed an estimated 42 million pounds of cod and haddock and 61 million pounds of flounders. It is not known how much fish is trucked into New Bedford for processing, but because New Bedford's production of fresh groundfish products exceeds its landings, it is a net importer of raw fish from other New England ports. New Bedford's processing plants have a reputation for being modern and engineered to produce high quality products. Many of its plants have filleting machines which are most efficient for high volume production.

Boston's share of New England groundfish landings has declined steadily since the mid 1960's. Boston landings for 1983 were only 24% of what they were in 1964. This drop in landings has been attributed to the lower cost of processing fish and the greater number of fishermen in other ports. Much of the fresh groundfish now processed in Boston is imported by truck from Canada. The major species processed in Boston are haddock, cod and pollock. Historically, Boston plants processed most of the cod landed in New England. More recently there has been a shift in cod processing to New Bedford. In 1979, Boston plants produced 49% of New England's fresh cod products and New Bedford 40%. From 1976 to 1979, relatively large amounts of drawn pollock (4-6 million pounds) and haddock were trucked into Massachusetts, presumably to Boston. Boston plants also handle a wide variety of other species to supply the restaurant trade, both locally and nationwide. An estimated 50% of their sales are derived from species other than groundfish.

Gloucester plants process mainly ocean perch, cod, haddock and silver hake. However, most of the fresh cod and haddock processed in Gloucester is for local markets. The balance is trucked to Boston or New Bedford, rather than processed locally. In contrast, most of the ocean perch and silver hake landed in Gloucester is processed locally but sold to markets in the South and Mid-West.

Portland contains about two-thirds of the major processing plants in Maine. About one half of all the processing plants now operating in Maine began since the passage of the FMCA in 1976. In recent years, there has been a trend in production away from frozen products towards the production of fresh products, largely because of the decline in ocean perch landings and the greater landings of other kinds of groundfish locally. In addition to increases in the production of fresh cod, haddock, flounder and pollock fillets, there has been an increase in the production of fresh rather than frozen ocean perch fillets.

The Fulton Market plays an important role in both the processing and distribution of groundfish products. From 1974 to 1979, more drawn cod was trucked to Fulton from Maine, Canada and Rhode Island than to Massachusetts.

Processing Capacity

In a 1975 survey of fifty-four New England processors, most of whom processed groundfish, Smith and Peterson found that the most important constraint to plant expansion plans was the scarcity of raw fish supplies. Other constraints to expansion, in the order of their importance, were labor costs, capital costs and environmental regulations. There is no reason to believe that the relative importance of these factors has not substantially changed since 1975.

Although the processing industry can physically process all the groundfish likely to be landed in New England, ex-vessel prices for fresh groundfish products may suddenly drop when landings exceed the capacity of fresh markets to absorb them at the normal price. Using a modified peak-to-peak method, Georgianna and Ibara identified several instances when early summer landings exceeded market capacity for fresh cod, haddock, flounder and pollock in recent years. They argue that the resultant 25% drop in ex-vessel prices caused a significant loss in fishermen's revenues (see Figures 7B3 and 7B4).

§3C2 Product Types by Species

Cod

Most of the cod marketed in the U.S. is imported in frozen blocks and is further processed into either frozen fillets or breaded and battered portions. Most cod portions are sold to fast food restaurants. Domestically caught cod generally gets sold as fresh fillets. In 1983 U.S. production of Atlantic cod fillets was 30 million pounds compared to imports of 183 million pounds. About 60% of the U.S. produced fillets were fresh and 40% were frozen.

Haddock

About 20% (1983) of the haddock consumed in the U.S. is caught by domestic fishermen. Haddock is almost always sold in fillets, both fresh and frozen. Most of the domestically caught haddock is sold fresh. In addition to being trucked down from the Canada, fresh fillets are also air shipped from Iceland and Norway. Larger haddock fillets command a slightly higher price than do smaller ones.

Flounder

Most of the U.S. supply of flounder is imported. Canada provides almost 90% of this imported flounder and most of this is American plaice which is sold either as flounder or sole. Although a small amount, about 12%, of fresh flounder is trucked to U.S. markets, almost all flounder is imported as frozen boneless fillets. Most U.S. caught flounder is filleted, although headed and dressed flounder is provided by many suppliers.

A number of flatfish are usually sold as flounder while others are usually marketed as sole. Winter Flounder and dabs are sold both as flounder and as sole. The confusing differences among species and market categories creates an opportunity for cheaper species to be mislabeled as more expensive ones before they reach the consumer. Most consumers are not aware of precisely which flatfish species are sold as flounder and which are sole, however, they generally regard sole as the superior product.

SPECIES SOLD AS FLOUNDER AND SOLE

Species	Flounder	Sole
Atlantic		
Winter flounder, blackback		
Lemon sole - over 3.5 lbs.		X
under 3.5 lbs.	X	
Gray sole, witch flounder		X
American plaice, dab	X	X
Windowpane, sand flounder	X	
Summer flounder, fluke	X	
Yellowtail flounder	X	
European Dover sole		X
Pacific		
Arrowtooth flounder	X	
Dover sole		X
Petrale sole		X
Rex sole		X
Rock sole		X
Yellowfin sole		X
English sole		X

Greenland turbot

Although Greenland turbot is not caught by U.S. fishermen, it competes directly with frozen groundfish products in U.S. markets. Because it is a flatfish, it can be used as a substitute for either flounder or sole. Almost all of the turbot imported into the U.S. is in the form of frozen boneless fillets.

Ocean perch

Almost all of the landings of ocean perch go into the production of fillets. In 1983 about 54% of the catch of Atlantic ocean perch was used in the production of fresh fillets and 46% in the production of frozen fillets. Domestic landings provided only about 6% of the supply of ocean perch products consumed in 1983. Of the remaining 94%, 1% was imported whole, 9% in frozen blocks and 83% was imported in the form of fillets.there is an increasing amount of fresh ocean perch fillets trucked in from Canada or airshipped from Iceland. The largest market for ocean perch is in the Midwest where it was originally used as a substitute for fresh water perch. Smaller fillets are generally preferred by food service buyers.

Silver Hake

Because of its relatively low price, the demand for silver hake is strong in lower income consumer groups in both the Northeast and Midwest. In 1984 about 66% of the silver hake products were made from imported frozen blocks. Almost all of the remaining 34%, which is domestically landed, is sold in the round to local markets in the Northeast. Most New England landings not sold locally are shipped to Fulton's for sale to retailers. Surplus silver hake is sold at a discount in the Mid-Atlantic region but there is no market for silver hake south of Virginia (Earl Combs, Inc. 1977). A very small amount is filleted and sold locally in both New England and the Mid-Atlantic and there is also a small market for smoked silver hake in the Mid-Atlantic region. In 1983 all the production of frozen silver hake products from domestic landings took place in Massachussetts.

Cusk

Cusk's high quality and limited abundance restrict its distribution to local New England markets. Most cusk is sold as fresh fillets as a lower priced substitute for cod and haddock.

Ocean Catfish

Also known as wolffish, has similar abundance and product characteristics as cusk, however, because of lower consumer acceptance, it is sold at a slightly lower price than is cusk.

Production and Marketing of Squid, Mackerel, Butterfish & Scup

Butterfish

From 1970 to 1978 about 74% of the world supply of butterfish came from the Atlantic. Before 1978, most butterfish was landed and processed by foreign vessels for consumption in their domestic markets. In 1978 about 80% of the butterfish landed in the U.S. was used for human consumption. Most of this was sold as whole fish, either fresh or frozen. A small amount, less than 2%, of edible butterfish products consisted of smoked butterfish. Generally the largest amount of domestically consumed butterfish are used in smoked products which are mainly sold in New York, New Jersey and Pennsylvannia. Most of the remaining 20% of domestic landings was used as bait.

Since 1978 almost all of the growth in U.S. butterfish landings has been shipped to Japanese markets. Most of this fish, 89% by weight in 1984, has been landed and processed in Rhode Island. Because the production of frozen butterfish consists mainly of sorting and grading, most of the landings can be processed by a few large operations. The main requirements for processing butterfish, besides having an available market, are bulk offloading facilities, packaging machinery, freezing capacity and a ready, economical supply of labor. Any future increases in butterfish landings will probably go to foreign markets, both because domestic consumption of any non-major food fish such as butterfish is difficult to increase and because U.S. processors are increasingly able to meet the quality standards of foreign markets.

Scup

Most of the scup landed in New England is either dressed or sold in the round to markets in New York, Philadelphia and Baltimore. Some scup is sold as a substitute for black drum in the southeast. An increasing portion of scup is sold to local markets in New England. A large part of the demand for scup comes from ethnic communities.

Squid

Increased ability to export domestic squid has caused an expansion of U.S. processing and harvesting of squid. Processing at sea has been carried out by foreign vessels participating in joint ventures with U.S. harvesters. At the same time, domestic processors have increased the amount of squid they supply both to export markets and to the developing domestic market.

According to the Mid-Atlantic Fishery Management Council's proposed Amendment #1 to the Fisheries Management Plan for Atlantic Mackerel, Squid, and Butterfish (August 1983), there are 29 firms which process squid. Eleven of the firms are in Massachusetts, eight in Rhode Island, seven in Virginia, one each in Maine, New York and New Jersey. New England companies are the largest producers of frozen squid on the Atlantic Coast, while New York and New Jersey companies produce smaller amounts of canned and frozen squid. Most of these firms make products, primarily groundfish, in addition to squid. The main requirements for processing squid are freezer space and labor.

Products made from squid are rings and strips, skinned tubes, and whole squid. The rings and strips may be breaded and pre-fried. These products may also be marinated, canned or simply frozen. Frozen squid dominates the foreign market, although there is also a limited market for fresh squid. Squid which is frozen whole at sea is generally superior to squid frozen ashore because it does not have as much time to deteriorate before processing. Shoreside product may also be used in squid rings and strips.

The primary markets for squid are in Spain, Italy, Portugal and Japan. Depending upon the strength of U.S. dollar and alternative supply of squid, exports could continue to increase. At present, the domestic market for squid is mostly limited to ethnic groups, however there are currently efforts to expand it through the Saltonstall/Kennedy Program.

Mackerel

Atlantic mackerel have been harvested off the Northeast Atlantic coast for over a century. The commercial catch of Atlantic mackerel is landed from Maine to North Carolina with the greatest portion of the catch being landed in New Jersey and New York. Most mackerel is sold whole or dressed. Smaller amounts are filleted, salted or pickled, canned, or smoked. There is very little information collected by NMFS about mackerel processing. Although reported landings for Atlantic mackerel were 5.8 million pounds in 1981, NMFS processed fish products data included only about 6,000 pounds of mackerel products for that year. Canadian statistics show that the U.S. exported 309,000 pounds of fresh, whole or dressed mackerel worth $93,000 and 1,096,000 pounds of frozen, whole or dressed mackerel worth $408,000 to Canada in 1981. In turn, Canada exported 1,832,000 pounds of frozen whole or dressed mackerel valued at $447,000 to the U.S.

The domestic market for whole, fresh mackerel seems to offer little potential for expansion, possibly because of consumer resistance to dark, oily fish such as mackerel. Foreign markets are limited by unstable demand, export duties and the availability of alternative supplies. Foreign at-sea processing through joint ventures may provide domestic fishermen greater opportunity for increasing the harvest in the future because of more direct access to foreign markets than is available to shoreside processors.

§3C3 Distribution

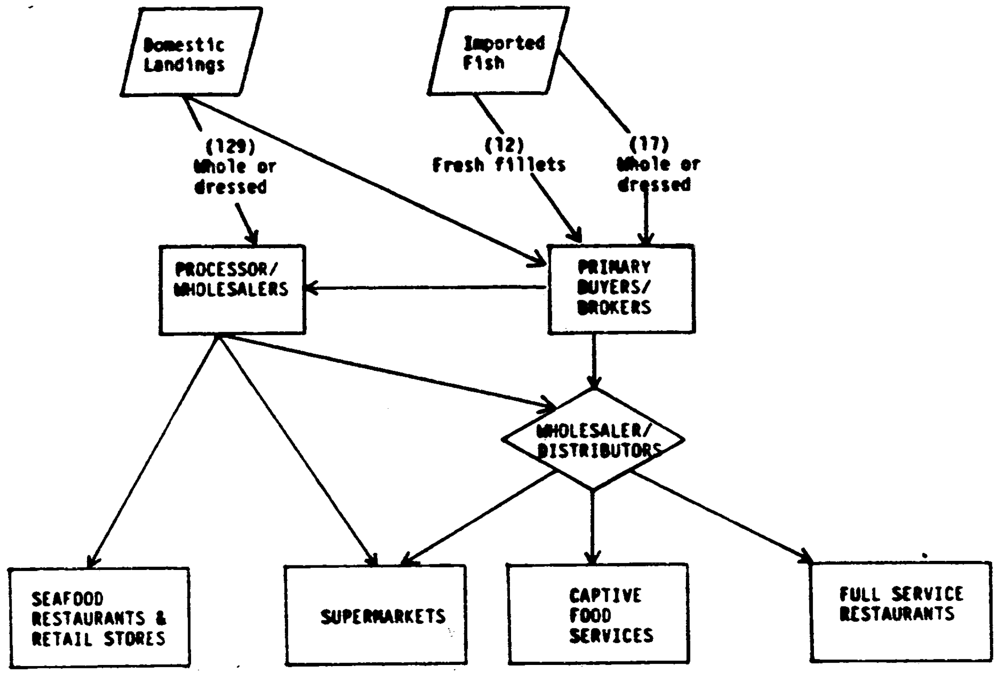
There are two fairly distinct distribution systems for Atlantic groundfish products (Figure 3C3), one for fresh groundfish products and another for frozen products. Most frozen Atlantic groundfish are imported from Canada, Iceland or Norway and are sold in large volumes nationwide to retail stores, large fast food restaurants and captive food services. Captive food services consist of cafeterias and other food services provided at business locations, hospitals, schools and other public and private institutions. In 1984, about 76% of Atlantic groundfish products were imported (Figure 3C4). Most of the fresh groundfish, about 88% by product weight in 1984, is from domestic landings and is sold in the Northeast to seafood restaurants, retail chain stores and more expensive full service restaurants. The final markets in which fresh and frozen groundfish most often compete are supermarkets, captive food services and seafood restaurants. It is not known how the availability of frozen groundfish affects the demand for frozen groundfish, however, fresh and frozen groundfish products have several different characteristics which tend to lessen direct price competition between them.

The limited shelf life and supply of fresh fish determine the way it is distributed from the fishermen to the retail level. Because fresh fish must reach the consumer within two weeks from when they are caught, they cannot be inventoried in the same way as frozen products. As a result, processors ship a large amount of fresh fish directly to the final markets. Even the largest fresh fish processors in Boston sell directly to individual restaurants. Although there are a few fresh fish brokers, they do not perform the same function as frozen fish brokers. Fresh fish brokers arrange shipment of whole fish and species that are not locally available from primary buyers to New England processors. These services are particularly important to Boston processors who must have a complete product line to sell directly to restaurants and retail stores. These processors must depend on brokers to provide swordfish, shrimp, salmon oysters and other fish.

Figure 3C3

DISTRIBUTION OF ATLANTIC GROUNDFISH PRODUCTS
(Final Product Weight in Million Pounds - 1981)

FRESH FISH DISTRIBUTION SYSTEM



FROZEN FISH DISTRIBUTION SYSTEM

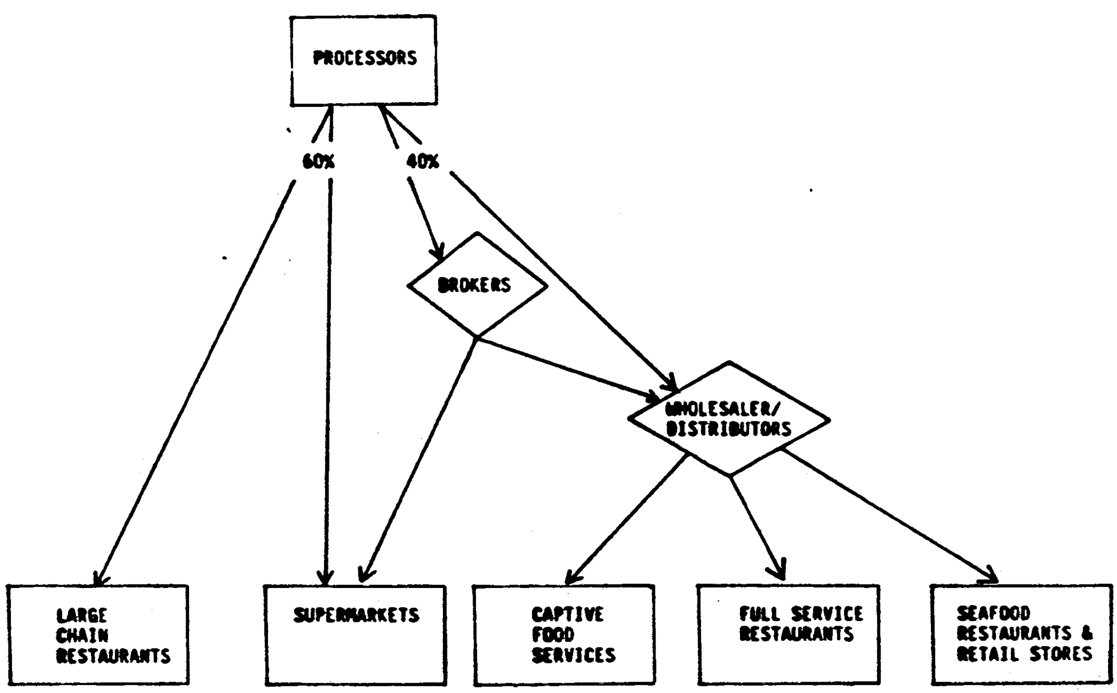
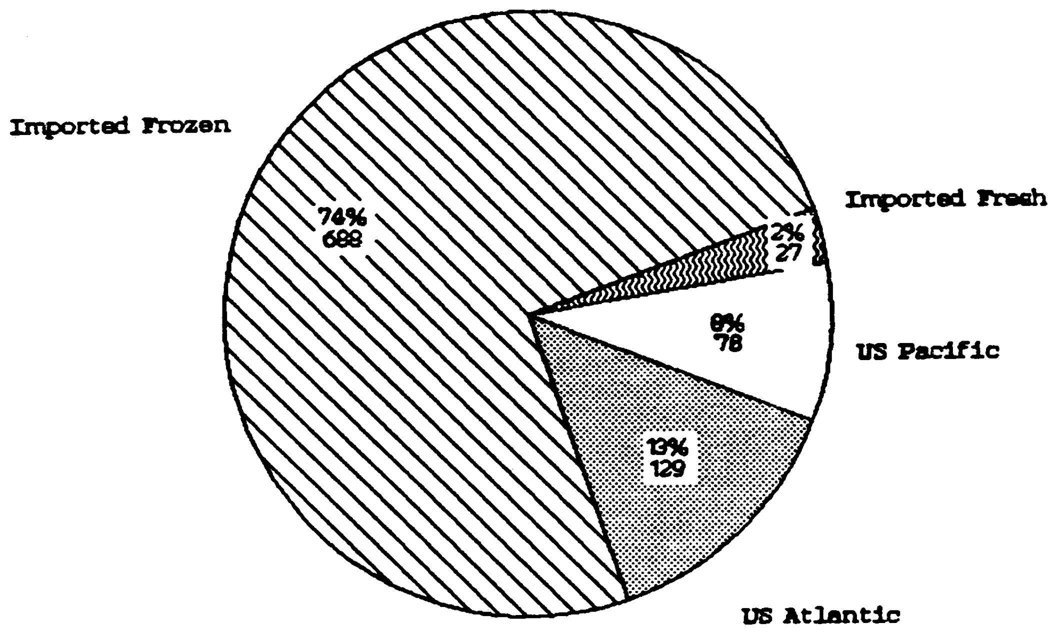


Figure 3C4

US GROUNDFISH PRODUCTS BY SOURCE 1981

Thousand Pounds Product Weight

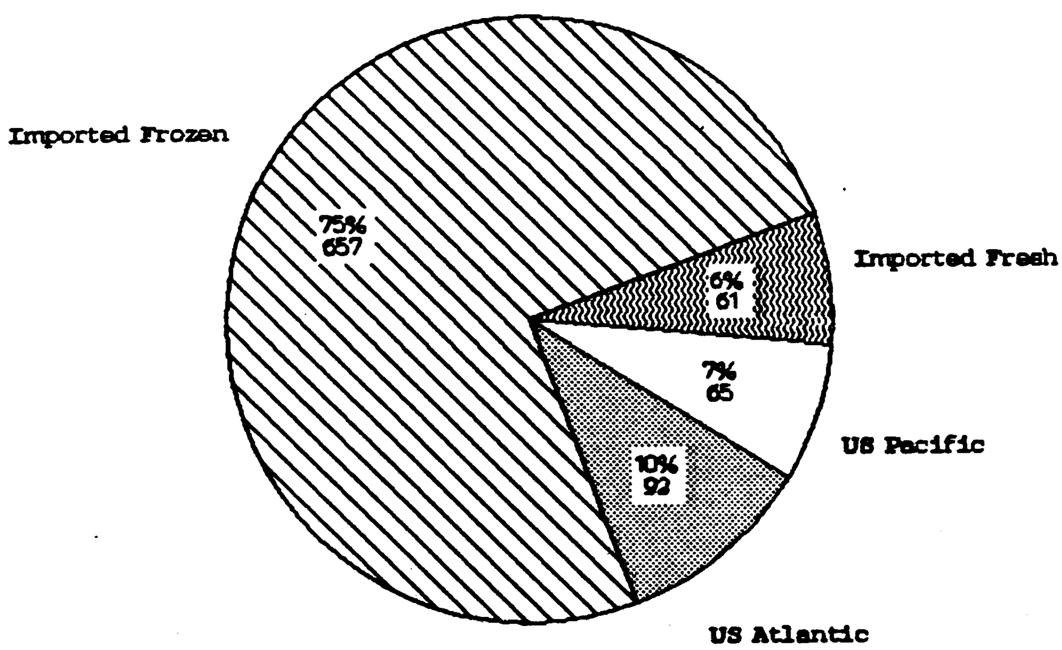


Sources: Fisheries of the United States 1981, NMFS
Canadian Fisheries Exports, December 1981

Figure 3C4

US GROUNDFISH PRODUCTS BY SOURCE 1984

Thousand Pounds Product Weight



Sources: Fisheries of the United States 1984, NMFS
Canadian Fisheries Exports, December 1984

The most recent, systematically collected information about the geographic distribution of fresh New England groundfish products was gathered in 1964-1965 (Gaston & Storey). At that time, an estimated 50 to 60% of fresh fish were sold in New England, 30 to 40% in New York, Pennsylvania and Ohio and 5 to 15% in other out-of-state markets.

Frozen groundfish products (1) generally cost less than fresh products, (2) are more available in measured portions, (3) are more available year-round, and (4) are more available outside of the coastal areas of the U.S. Fresh groundfish products (1) are generally considered superior in taste to frozen products if the freshness is maintained until it reaches the final consumer, (2) are bought by restaurants and retail stores that want to offer their customers a superior product or something different than what they might find in most restaurants or retail stores, and (3) are more expensive to carry because of spoilage and variability in quality.

The distribution system for frozen fish is similar to that of many processed food products. It is larger than the distribution system of fresh fish both because there is a much larger supply of frozen fish and because frozen products have a much longer shelf life. Most frozen fish products are imported from large vertically integrated foreign processing companies. Very often secondary processing, such as cutting the fish into portions, breading and battering, are completed within the U.S. An estimated 60% of imported frozen products are sold directly by foreign processors to large supermarkets or chain restaurants. The remaining portion is generally sold through a network of brokers to wholesaler/distributors who supply smaller retailers. Brokers differ from wholesalers in that the main services provide by brokers is locating the product and arranging shipment. They generally do not take legal possession of the product. In addition to providing frozen fish products to wholesaler distributors, brokers also provide frozen products to fresh fish processors who sell directly to retailers.

Wholesalers of fish products may handle fish as only a small part of their overall business. Much of the fish that goes through wholesalers is handled by institutional wholesalers who provide their customers with a number of services ranging from assembling many different products for shipment in order to minimize transportation costs to menu planning. Meat distributors and wholesalers are also an important distribution channel for both fresh and frozen fish products. Distributors of meat products can easily handle frozen fish products because they usually have their own refrigerated transportation system which allows them to deliver the products to existing customers at very little additional cost. When possible, some wholesalers buy their fish products directly from processors rather than from brokers.

§3C4 Market Organization

The final markets for groundfish products can be divided into three groups, public food services which include all types of restaurants from fast food chains to seafood restaurants, captive food services and retail stores such as seafood stores, grocery stores and supermarkets. These market segments consume 47%, 17% and 36% of groundfish products respectively (Figure 3C5). Each of these market sectors has different product requirements (Table 3C1).

The public food service market requires "a firm white-fleshed fish with a bland delicate flavor and no 'fishy' odor so that it appeals to the widest range of customers" (Kirby Commission, 1982). These product requirements are especially important to chain restaurants because chain restaurants strive to maintain a consistent level of quality which the consumer can identify throughout all the chain's outlets. Chain restaurants are an important market segment because they are a growth area for fish products and they sell 40% of all fish in the public food service sector. The species most often used by this sector are cod and flounder.

In the captive food sector, where cost is often more important than flavor, texture and appearance, ocean perch, pollock and silver hake are important species. However, some quality conscious segment of this market, such as school lunch programs, prefer cod. In the retail segments, cod, haddock and flounder dominate the demand for fillets while pollock and ocean perch are popular in portions and prepared dinners. Market substitution of one kind of fish product for another most often takes place between species used within a particular market segment (Table 3C1).

§3C5 Foreign Trade

Imports

The United States is the world's largest single market for groundfish products. In 1984, the U.S. imported 909 million pounds of groundfish products valued at about 912 million dollars. Of these, fresh products comprised 6% of the total quantity and 5% of the total value. Frozen fish products comprised 88% of both the quantity and value of imports and other products comprised 6% and 7% of the value.

For the domestic groundfish harvesting industry, perhaps the most significant trend in imports is the large increase in the amount of fresh groundfish products imported to the U.S., primarily from Canada. Between 1978 and 1984, the amount of whole, fresh fish imported from Canada has increased ninefold the amount of fresh fillets has increased 350% (Figure 3C6). Both fresh fish fillets and fresh products made from imported whole fish compete directly with products made from domestically landed fish. The Canadian government is actively seeking to increase the export of Canadian cod products to the U.S. to absorb large projected increases in Canadian landings. In addition, Norway, Denmark and Iceland can be expected to increase their effort to market cod in the U.S. because of major market collapses in Nigeria and Brazil. However, these countries will have to improve the quality of much of their cod products before they can compete in the U.S. fillet market.

Figure 3C5

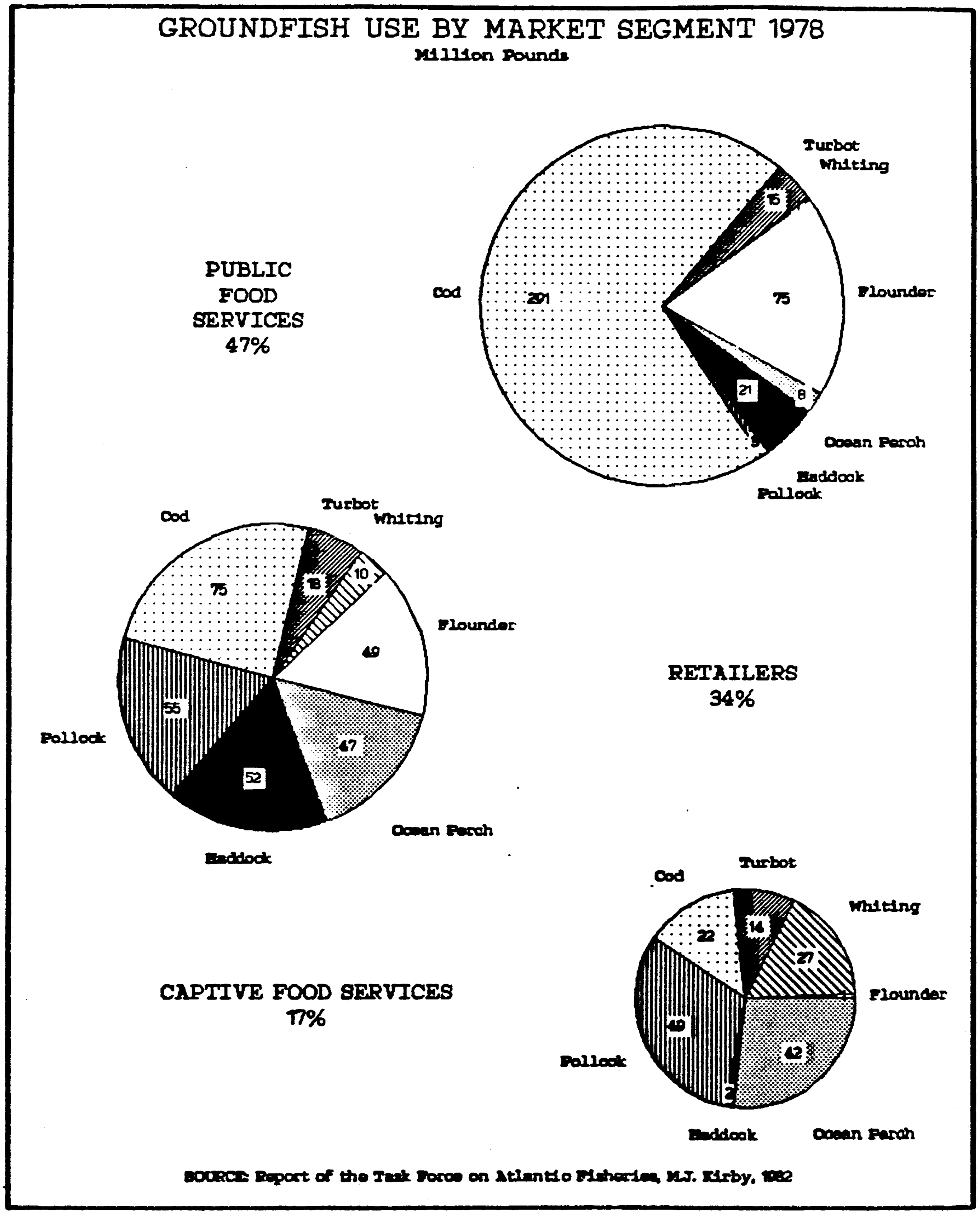

GROUNDFISH USE BY MARKET SEGMENT 1978
Million Pounds
PUBLIC FOOD SERVICES 47%
Turbot
Whiting
15
Cod
291
75
Flounder
21
8
Ocean Perch
Haddock
Pollock
Cod
Turbot
Whiting
75
18
10
Flounder
49
RETAILERS 34%
Pollock
55
47
52
Ocean Perch
Haddock
Cod
Turbot
Whiting
22
14
27
Flounder
CAPTIVE FOOD SERVICES 17%
49
42
Pollock
2
Haddock
Ocean Perch
SOURCE: Report of the Task Force on Atlantic Fisheries, M.J. Kirby, 1982

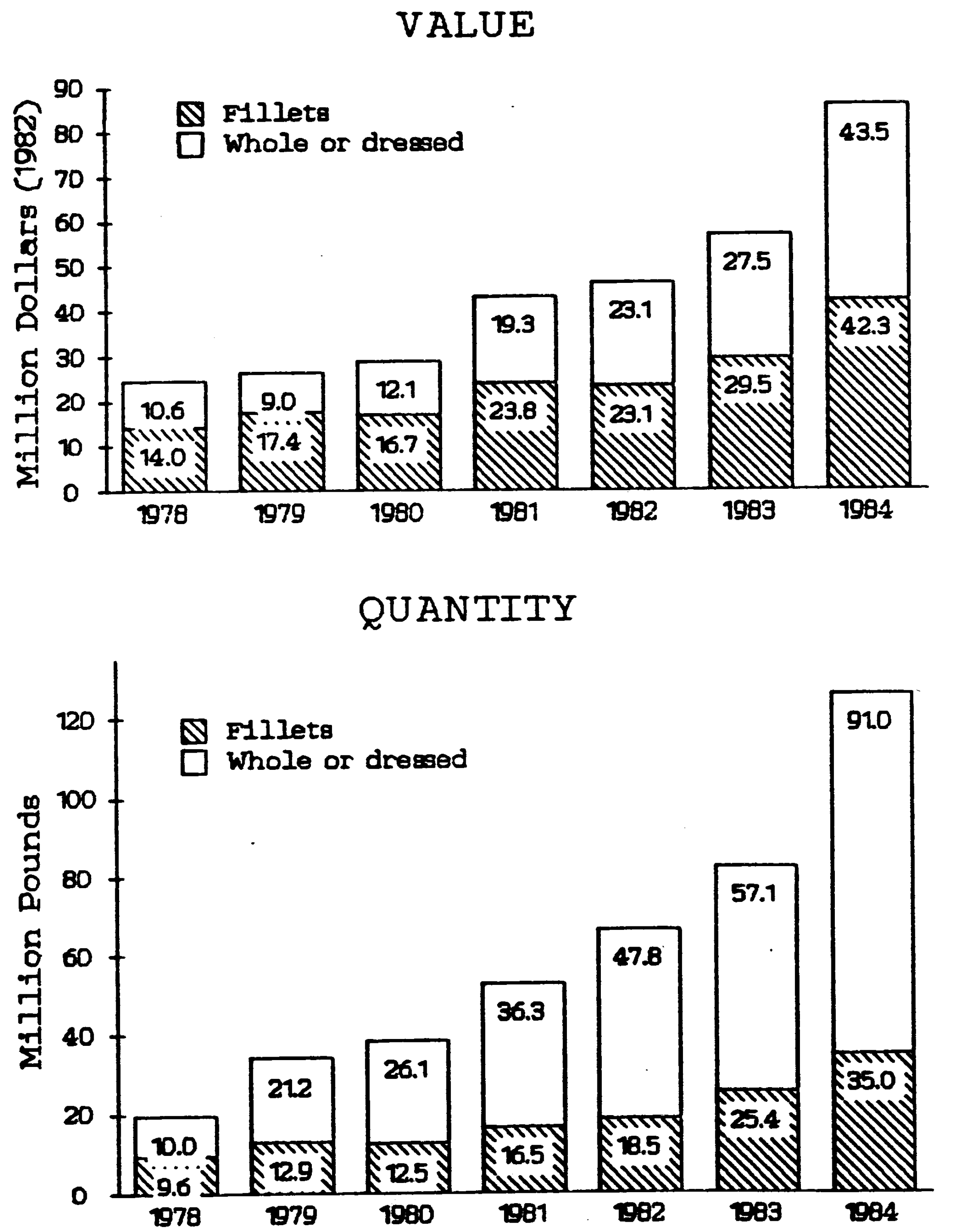
TABLE 3C1

Orientation of U.S. Market Segments

Segment	Market Share	Orientation	Primary Species Form
Public Food Service	46%	High quality/customer specifications; Relative price indifference; Limited species substitution	Cod portions Cod fillets Flounder fillets
Retail	36%	Price-oriented; Frozen; branded items in frozen form; wide species acceptability in fillets; Fresh; quality-oriented	Pollock sticks; all other in fillets
Captive Food Service	18%	Least quality concern; prime interest in price; Species substitution	Pollock sticks; Cod

Source: Report of the Task Force on Atlantic Fisheries, M.J. Kirby, 1982

Figure 3C6
IMPORTS OF FRESH GROUNDFISH FROM CANADA



SOURCE: Canadian Fisheries Exports, Government of Canada

The largest negative change in the imports of groundfish products has been the steady decline of imported frozen blocks and slabs. The quantity of imported frozen groundfish blocks declined 21% from 406 million pounds in 1978 to 317 million pounds in 1984. This decline has probably been caused by a general decline in consumer demand for frozen fish relative to other fish and food products and a strong U.S. dollar in 1981 and 1981 which made imported fish more expensive relative to domestic food products.

Exports

From the way export statistics for fish products are organized it is impossible to determine the quantity or value of Atlantic groundfish products which are exported from the U.S. The only groundfish products identified by species are dressed and salted pollock of which totaled 415,000 pounds worth $452,000 in 1984.

SUBPART D: THE RECREATIONAL SECTOR

§3D1 Overview of Recreational Fisheries

Regional and National Economic Value

There are substantial recreational fisheries for many of the species involved in the commercial multi-species trawl fisheries of the Northwest Atlantic. These recreational fisheries are economically valuable to the Mid-Atlantic and New England regions, particularly in the coastal communities, and they are important to the millions of recreational anglers from both coastal and inland states.

Specifically, the 1980 National Survey[1/] estimated that 7.7 million participants (See Figure 3D1) generated in excess of 1.2 billion dollars of retail sales in pursuit of recreational fishing in the Mid-Atlantic and New England regions.[2/] In the New England region the 1980 retail sales associated with marine recreational fishing are estimated at over $243 million, in the Mid-Atlantic region sales are closer to one billion dollars (Table 3D1). The greatest expenditures were for boat fuel, food and private transportation. The value added figure for New England is estimated over $100 million and near $450 million in the Mid-Atlantic. Wages and salary represent values of some $48 million for New England and $197 million for the Mid-Atlantic. Capital expenditures are close to $10 million for New England and over $40 million in the Mid-Atlantic (Table 3D1).

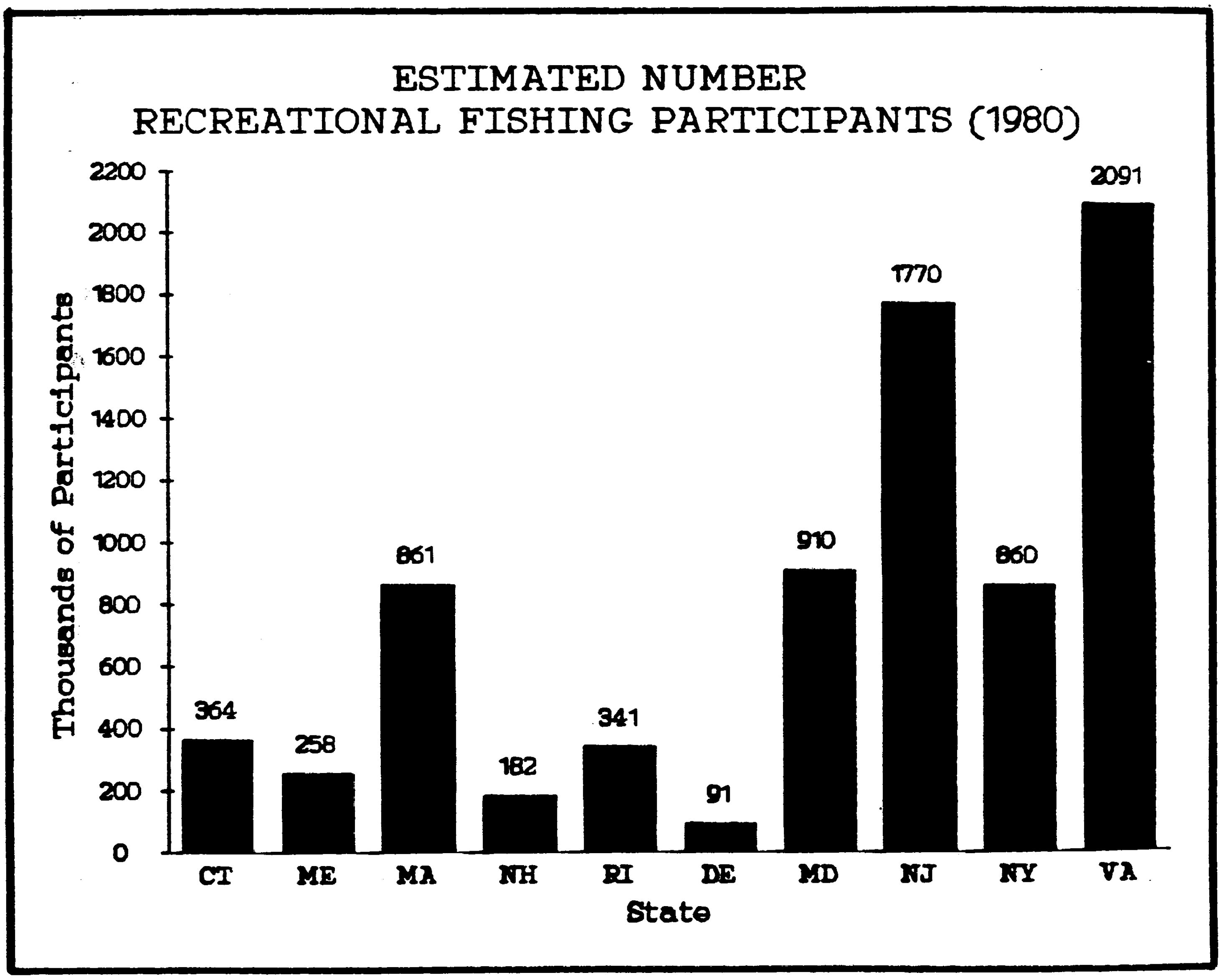
A specific breakdown of the New England proportion of this economic activity ($243,178,000) is found in Table 3D2. The Mid-Atlantic proportion ($996,010,000) is broken down in Table 3D3. Various industries which supply goods and services to marine recreational constituents at some market level (manufacturing, wholesale, retail) include those that produce fishing tackle, boats, outboard motors, boat fuels, trailers, bait, as well as providers of public transportation, restaurants and marina services. On the national level in 1980, the largest expenditures contributing to the approximate $4 billion in sales associated with marine recreational fishing were for boat fuel, transportation and food, according to 1980 results of a study conducted by Centaur Associates.[3/]

[1/]The NMFS' 1980 National Survey included a household survey which presents data collected from interviews of fishermen 12 years old and up as well as information provided by an adult on marine recreational fishing participation by persons younger than 12 years old. The Council is in receipt of preliminary 1981 and 1982 survey information but has not been authorized to use this data until the preliminary review period has been completed.

[2/]Another source of information on the number of salt water anglers is the National Survey of Fishing, Hunting, and Wildlife Associated Recreation conducted every 5 years by the Fish and Wildlife Service, U.S. Dept. of Interior and the Bureau of the Census, U.S. Dept. of Commerce. In 1980 this Survey estimates that there were 999,000 saltwater fishermen 16 years or older in New England and 2,047,000 fishermen in the Mid-Atlantic area.

[3/]"Economic Activity Associated with Marine Recreational Fishing in 1980" prepared for the Sport Fishing Institute by Centaur Associates, Inc., Washington, DC.

Figure 3D1



(Source: Preliminary 1980 National Survey)

New England Total: 2,006,000 participants
Mid-Atlantic Total: 5,722,000 participants

Combined Total: 7,728,000 participants

TABLE 3D1

Disaggregation of National Effects to Fishery Management Council Regions, 1980

Council	Retail Sales (x $1000)	Value Added (x $1000)	Employment (person-yrs)	Wages & Salaries (x $1000)	Capital Expenditures (x $1000)
New England	$243,178	$109,539	4,020	$ 47,988	$ 9,893
Mid-Atlantic	$996,010	$446,502	16,264	$196,505	$40,222

SOURCE: Economic Activity Associated with Marine Recreational Fishing in 1980, SFI/Centaur Associates, Washington, DC, 1983.

TABLE 3D2

Economic Activity Associated with
Marine Recreational Fishing in the New England Region:
Maine, New Hampshire, Massachusetts, Rhode Island, Connecticut

	Sales (thousands of dollars	Value Added (thousands of dollars	Employment (person-years of dollars)	Wages and Salaries (thousands of dollars)	Capital Expenditures (thousands of dollars)
Fishing Tackle:					
Manufacturing	3,780	2,186	65	953	131
Wholesale	2,954	762	15	298	24
Retail	11,007	3,985	133	1,608	244
Boats:					
Manufacturing	11,612	5,003	228	2,474	223
Retail	17,613	3,397	124	1,742	124
Motors:					
Manufacturing	2,548	1,172	22	515	105
Retail	3,435	663	24	341	25
Trailers:					
Manufacturing	936	322	14	198	31
Retail	1,122	167	8	111	6
Marinas	29,163	8,903	314	7,235	732
Commercial Sportfishing Vessels	11,252	6,756	406	1,823	941
Food:					
Manufacturing	20,989	9,738	126	4,092	524
Wholesale	25,110	3,740	72	1,555	250
Retail	32,692	6,933	266	3,365	554
Restaurants	11,483	6,004	384	2,770	530
Lodging	11,001	7,153	354	3,055	870
Public Transportation	4,217	2,478	188	2,186	363
Private Transportation:					
Manufacturing	22,716	3,566	12	840	524
Wholesale	25,754	2,912	62	822	256
Retail	32,150	6,075	280	2,234	739
Bait	17,278	5,426	236	2,299	363
Boat Fuel:					
Manufacturing	28,436	4,463	15	1,052	657
Wholesale	37,750	4,265	93	1,209	378
Retail	47,130	8,909	411	3,254	1,085
Boat Insurance	3,379	1,655	40	676	-
Other	10,256	2,904	128	1,281	214
Total	243,178[1/]	109,539	4,020	47,988	9,893

1/ Retail trade only.

SOURCE: Economic Activity Associated with Marine Recreational Fishing in 1980, SFI/Centaur Associates, Washington, DC, 1983.

TABLE 3D3

Economic Activity Associated with
Marine Recreational Fishing in the Mid-Atlantic Region:
New York, New Jersey, Delaware, Pennsylvania, Maryland, Virginia

	Sales (thousands of dollars	Value Added (thousands of dollars	Employment (person-years of dollars)	Wages and Salaries (thousands of dollars)	Capital Expenditures (thousands of dollars)
Fishing Tackle:					
Manufacturing	15,342	8,825	262	3,848	529
Wholesale	11,927	3,078	59	1,202	96
Retail	44,439	16,087	536	6,493	986
Boats:					
Manufacturing	49,226	21,209	965	10,486	946
Retail	74,666	14,402	527	7,385	526
Motors:					
Manufacturing	10,802	4,967	95	2,181	447
Retail	14,560	2,812	103	1,445	105
Trailers:					
Manufacturing	3,969	1,367	59	841	131
Retail	4,757	710	33	473	26
Marinas	123,629	37,740	1,331	30,670	3,101
Commercial Sportfishing Vessels	39,073	23,460	1,411	6,329	3,269
Food:					
Manufacturing	84,741	39,317	509	16,520	2,116
Wholesale	101,382	15,101	291	6,276	1,010
Retail	131,993	27,991	1,074	13,586	2,236
Restaurants	46,362	24,239	1,553	11,182	2,140
Lodging	44,415	28,880	1,429	12,336	3,511
Public Transportation	17,025	10,004	759	8,825	1,467
Private Transportation:					
Manufacturing	91,715	14,404	50	3,391	2,116
Wholesale	103,979	11,759	250	3,318	1,034
Retail	129,805	24,528	1,131	9,018	2,982
Bait	69,760	21,907	952	9,282	1,595
Boat Fuel:					
Manufacturing	120,546	18,992	65	4,460	2,785
Wholesale	160,029	18,082	392	5,125	1,603
Retail	199,793	37,767	1,742	13,796	4,599
Boat Insurance	14,324	7,017	169	2,865	-
Other	41,409	11,927	517	5,170	866
Total	996,010 1/	446,502	16,264	196,505	40,222

1/ Retail trade only.

SOURCE: Economic Activity Associated with Marine Recreational Fishing in 1980, SFI/Centaur Associates, Washington, DC, 1983.

Marine recreational fishing is a relatively expensive recreational activity particularly when the angler selects the party or charter boat mode for a fishing trip. It has been estimated that in 1981 the average total cost per fishing trip across all fishing modes was $36.85 on the Atlantic coast. The average total expenditures for a fishing trip on a party or charter boat was estimated to be about $59.06. It is important to note that the value of the anglers catch, regardless of the final disposition, may directly reduce the costs of the fishing trip.

Who, Why, When, Where

In 1981 a major effort was made to acquire and analyze social and economic information on marine recreational fishing on the Atlantic, Gulf and Pacific coasts for the NMFS.[4/] This study provides important regional information on recreational fishermen, their reasons for fishing, disposition of the catch and many other variables.

On the Atlantic Coast this study determined that marine recreational fishing is largely (72%) a male activity, predominantly (95%) white males, with minorities making up only about 5%. The average age of the Atlantic angler is 32 and he likely has 12 years of fishing experience. Some 71% of marine recreational fishing households have an annual income from $10,000 to $35,000; on the Atlantic coast some 67% of the anglers are employed full time and they fish for approximately 22 days per year. If the recreational fisherman is retired (some 6% of the total number of anglers), he fishes an average of 47 days per year.

In 1981, about 50% of these anglers stated "sport" (30%) or "to catch fish" (21%) as their reason for recreational fishing while about 35% gave "relaxation" as the primary reason. About 60% of these anglers report that they have a targeted species in mind when they go fishing with the balance of Atlantic anglers reporting no preference. Of those anglers reporting a preference, 22% indicated bluefish while 15% and 11% indicated summer and winter flounder, respectively, as the targeted species on their fishing trips.

The study also provides information which indicates that recreational fishing is a group-oriented activity involving friends and family on about 87% of the fishing trips taken on the Atlantic coast. When these anglers use party or charter boats, the average size of the group tends to be around 7 or 8 individuals; and when using private or rental boats the average size of the group is around 3 individuals.

Over 34% of the marine fishing households contacted reported owning one or more boats and about 85% of these boats were open or cabin motorboats; 63% of these boats were between 15 and 24 feet long.

[4/] "Socio-economic Aspects of Marine Recreational Fishing" prepared for NOAA/NMFS by KCA Research, Inc. May, 1983.

Along the Atlantic coast, anglers are reported to average approximately 23 trips a year across all recreational modes, although this figure is acknowledged to be biased in favor of the avid angler. For party/charter mode the average is about 11 trips. A 1975 state of Massachusetts study of recreational fishing concluded that resident boaters averaged approximately 19 trips a season and that the average across all modes was about 11 trips per season. The 1980 National Survey of Fishing, Hunting and Wildlife-Associated Recreation indicates that on a nationwide basis 12.3 million salt water anglers took almost 131 million trips or an average of almost 11 trips per angler.

The following data presents information on the average distance from home traveled by anglers to go fishing.

AVERAGE DISTANCE FROM HOME IN MILES BY FISHING MODE

Mode of Fishing	Altantlic Coast
Man-Made Structure	140.0 mi.
Beach-Bank	134.0 mi.
Party/Charter Boat	237.1 mi.
Private/Rental Boat	81.0 mi.
Total Average	137.0 mi.

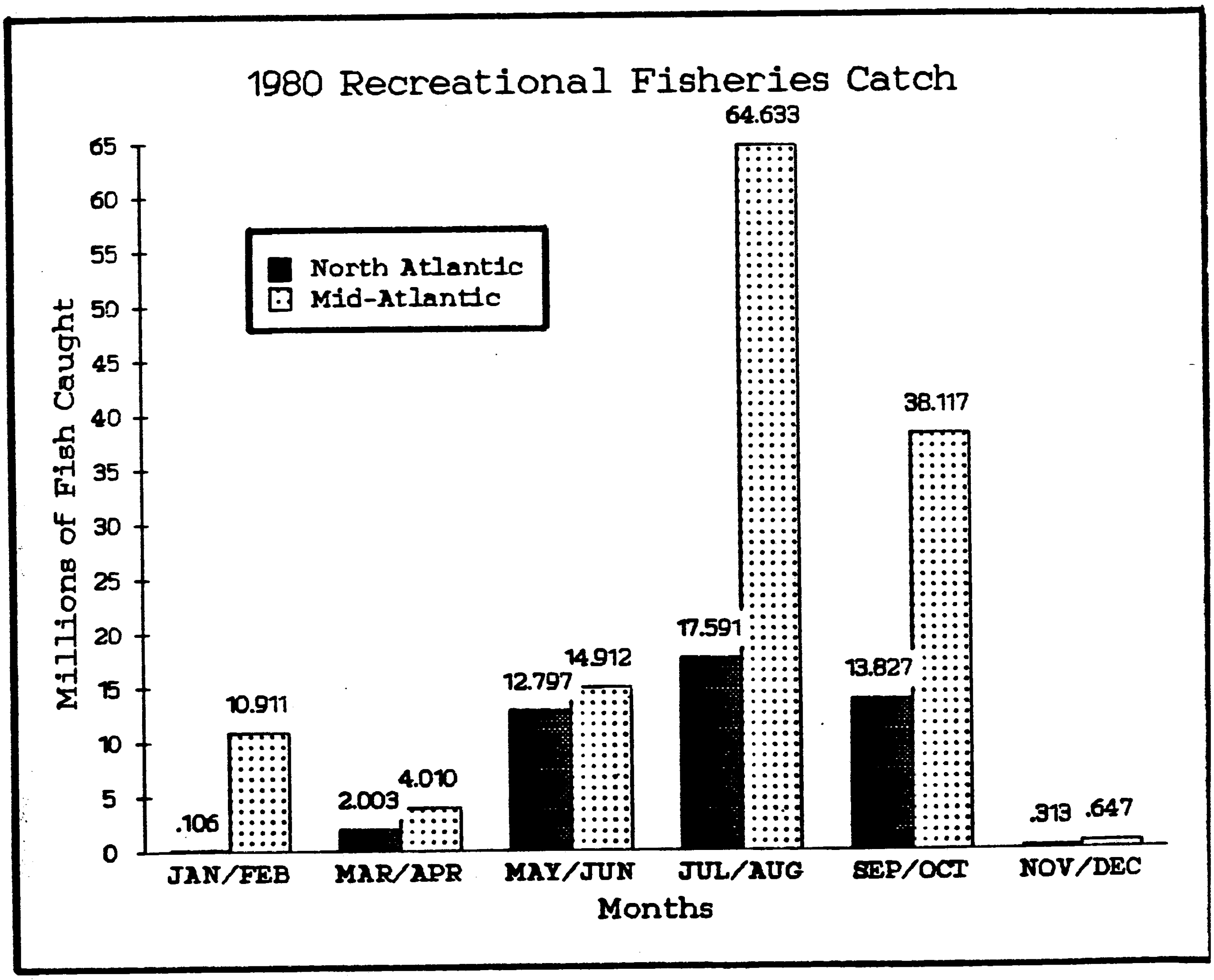
SOURCE: Socio-economic Aspects of Marine Recreational Fishing, KCA Research, Inc., 1983.

This information indicates that anglers using party and charter mode travel the furthest for their activity. The relatively long average distances travelled by anglers, across all modes, is an indication of the extent of the interrelationship between recreational fishing and tourism/vacations.

Recreational fishing in the New England area is a seasonal activity which peaks in mid-summer while there is only a minimum or no activity during the months of November through February. In the Mid-Atlantic, recreational fishing activity also peaks during the summer months but there is continued activity in the late fall and early winter months (Figure 3D2). The increased activity in the Mid-Atlantic in January may be explained by a substantial silver hake (whting) fishery off the southern Long Island and New Jersey coastlines which will occur if weather permits and the fish are available.

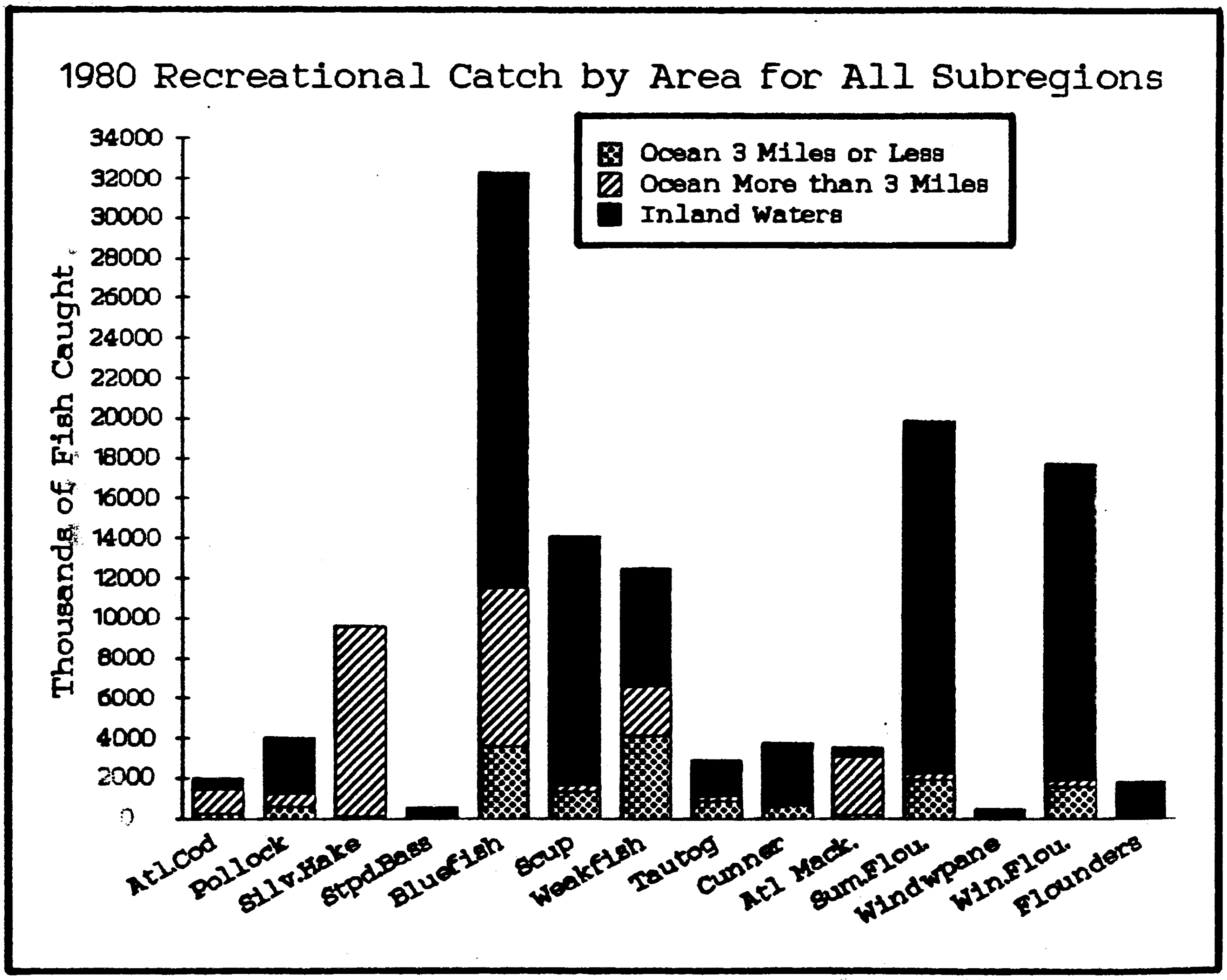
Review of the information provided in Figure 3D3 indicates that most of the recreational catch (numbers of fish) comes from "inland" marine waters ("Inland" refers to other bodies of saltwater besides the ocean which include sounds, inlets, tidal portions of rivers, bays, estuaries and other areas of salt or brackish waters.). The exceptions are silver hake, Atlantic mackerel and Atlantic cod. The territorial sea and offshore areas are also important recreational fishing areas for bluefish, scup, weakfish and, to a lesser degree, flounders.

Figure 3D2



Source: Preliminary 1980 National Survey

Figure 3D3



Source: Preliminary 1980 National Survey

Estimates of Catch and Disposition of Catch

Estimates of the weight[5/] of the 1980 New England and Mid-Atlantic recreational catch of individual species can be found in Figure 3D4. Estimates of the numbers of individual species caught by recreational anglers in New England and Mid-Atlantic areas are found in Figure 3D5. In both the Mid-Atlantic and New England, bluefish lead all other recreational species in total weight caught in 1980 with an estimated 115,712,000 pounds (52,487 mt). In New England, the recreational catch of cod and winter flounder are second and third in catch weight with an estimated 14,058,000 pounds (6,377 mt) and 10,379,000 pounds (4,708 mt) respectively. In the Mid-Atlantic, the catch of summer flounder and weakfish followed bluefish with 45,454,000 pounds (20.618 MT) and 40,029,000 pounds (18,157 mt) respectively.

An increasingly important variable with regard to the recreational fisheries appears to be the disposition of the catch which, until recently, has been poorly documented. Table 3D4 presents the percentage of the recreational catch kept as opposed to not kept for selected New England and Mid-Atlantic species. Table 3D5 shows the breakdown by percent of what happens to the recreational fish which are kept by the angler. It is clear from this information that most of the fish caught by anglers is kept predominately for eating purposes with the exception of Atlantic mackerel. In the case of Atlantic mackerel nearly 40% is given away by the angler. Presumably some of this mackerel is also eaten by the recipient.

[5/]The National Survey does not provide estimates of the weight of the total catch of individual species by recreational anglers. Consequently, a description of the derivation of these estimates from the National Survey is in order.

The National Survey uses a "complemented surveys" methodology, which consists of an intercept phase to collect information on species catch, numbers, weight, etc., and a household telephone survey phase, to gather information on recent number of trips, number of anglers per household, location and mode of trips, etc. Intercept information is combined with the household survey data to produce expanded estimates of total numbers of catch and partial estimates of the total weight of the catch. The survey provides an estimate of the total number and total weight of fish which is classified as Catch Type A, representing that portion of the recreational catch which was brought ashore in whole form and available for inspection. From Catch Type A data an average weight of the selected individual species was determined. This average weight was then applied to the remaining catch classifications which are: B.1 representing fish caught but used for bait, filleted or discarded dead before the intercept; and B.2 which represents fish fish caught but released alive. The assumption necessary for the estimates of the total weight of the recreational catch is that the average size of Catch Type A fish is representative of the average size of the fish in the other catch classifications.

TABLE 3D4

Percentage Distribution of Disposition of Catch: Atlantic Coast

Catch	Percent Kept	Percent Not Kept
Striped Bass	97.1	2.9
Bluefish	83.0	17.0
Codfish	69.2	30.8
Cunner-Tautog	48.6	51.4
Summer Flounder	58.3	41.7
Winter Flounder	82.0	18.0
Atlantic Mackerel	100.0	0.0

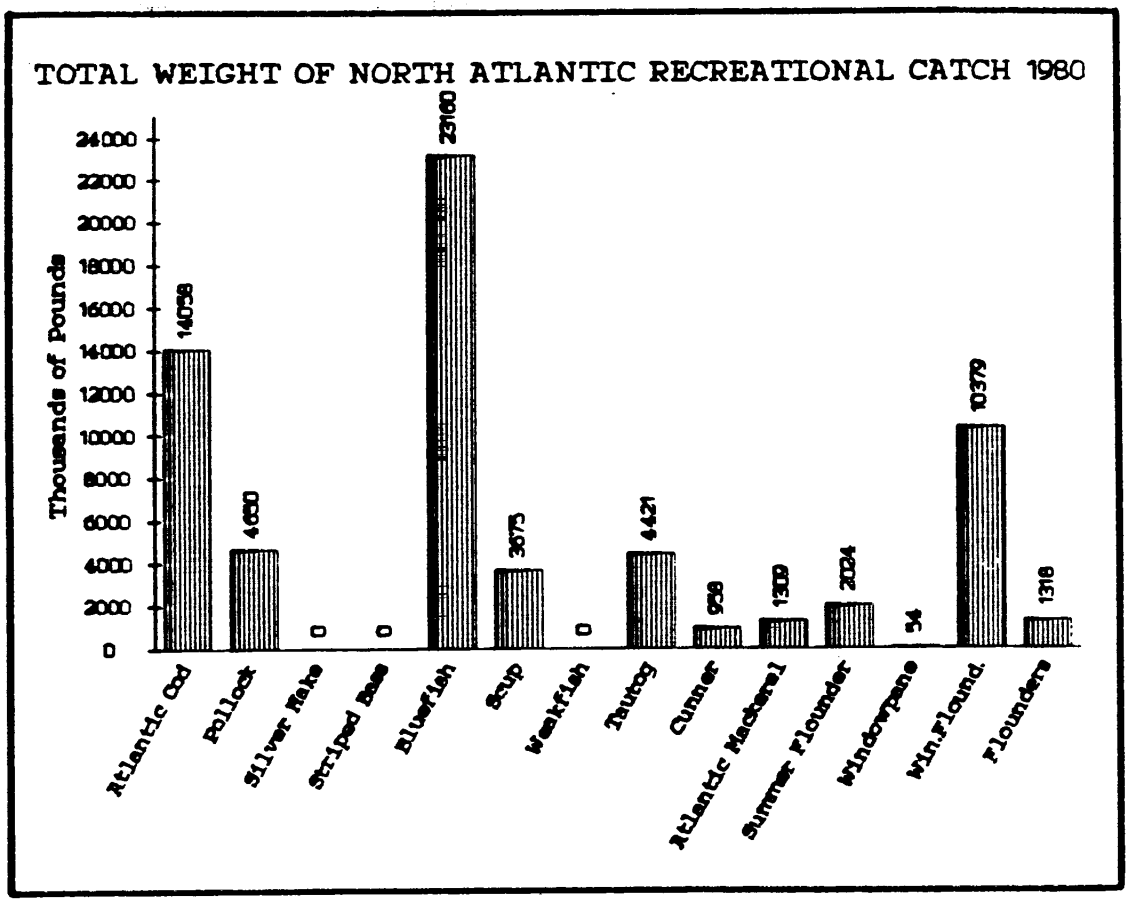
TABLE 3D5

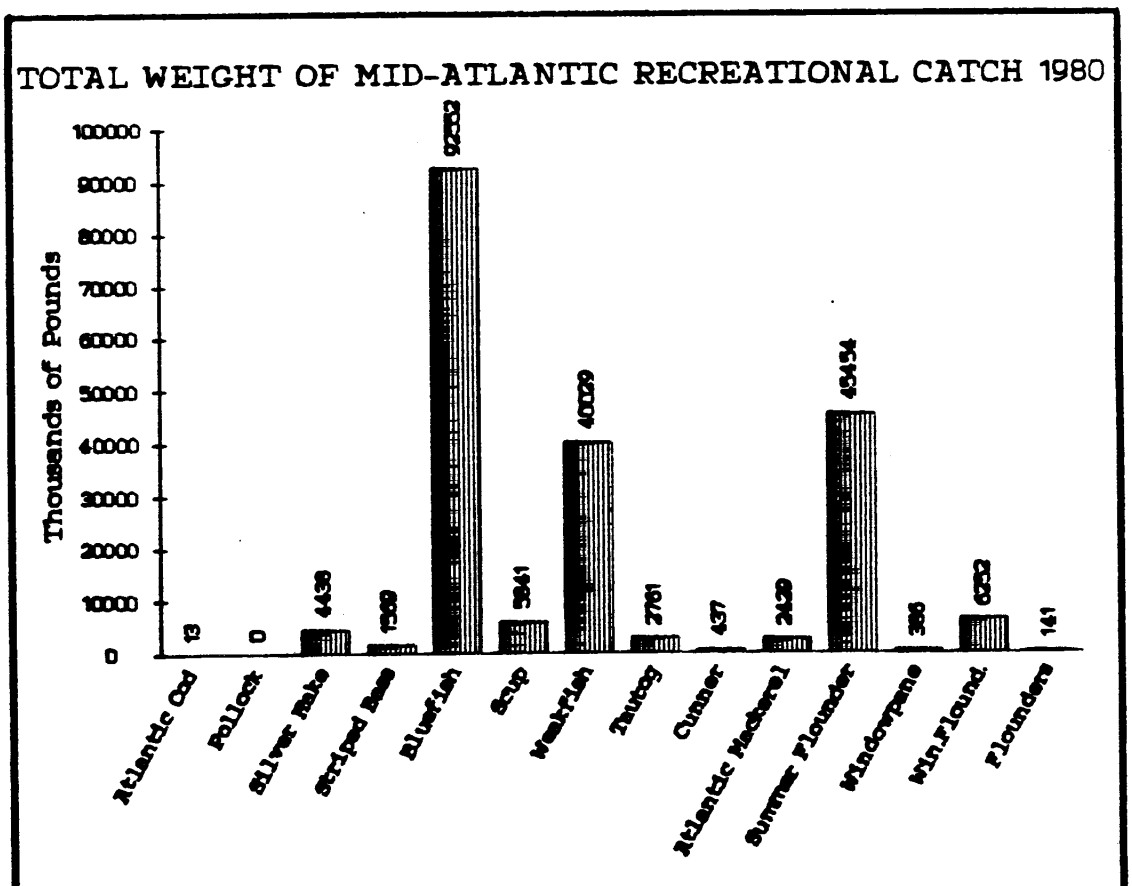
Percentage Distribution of Disposition of Fish Kept: Atlantic Coast

Category	% Eaten or Plan to Eat	% Thrown Away	% Used for Pet Food	% Sold	% Given Away	% Used for Bait	% Used for Other Purposes	% Plan to Use for Other Purposes	Total Percent
Striped Bass	96.8	0.0	0.0	3.2	0.0	0.0	0.0	0.0	100.0
Bluefish	69.5	1.2	0.1	0.6	26.5	1.6	0.1	0.4	100.0
Codfish	75.9	3.2	0.0	0.9	19.1	0.9	0.0	0.0	100.0
Cunner-Tautog	67.3	0.9	0.0	12.4	16.6	0.0	1.4	1.4	100.0
Summer Flounder	75.1	1.4	0.0	0.8	18.8	0.2	3.5	0.2	100.0
Winter Flounder	86.0	0.7	0.3	0.0	10.4	2.6	0.0	0.0	100.0
Atl. Mackerel	47.1	0.0	0.0	0.0	39.2	13.7	0.0	0.0	100.0

SOURCE: Socioeconomic Aspects of Marine Recreational Fish, KCA Research, Inc., Alexandria, Virginia. May, 1983.

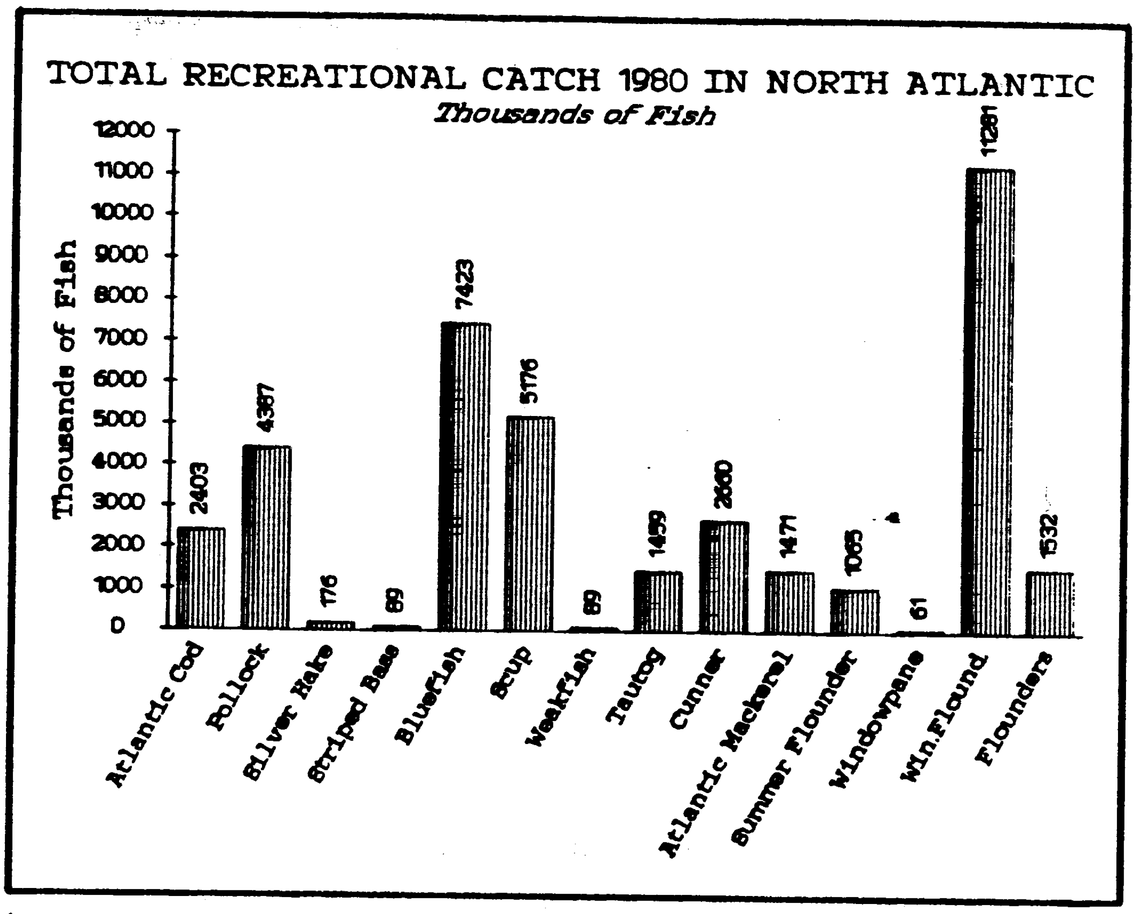
Figure 3D4

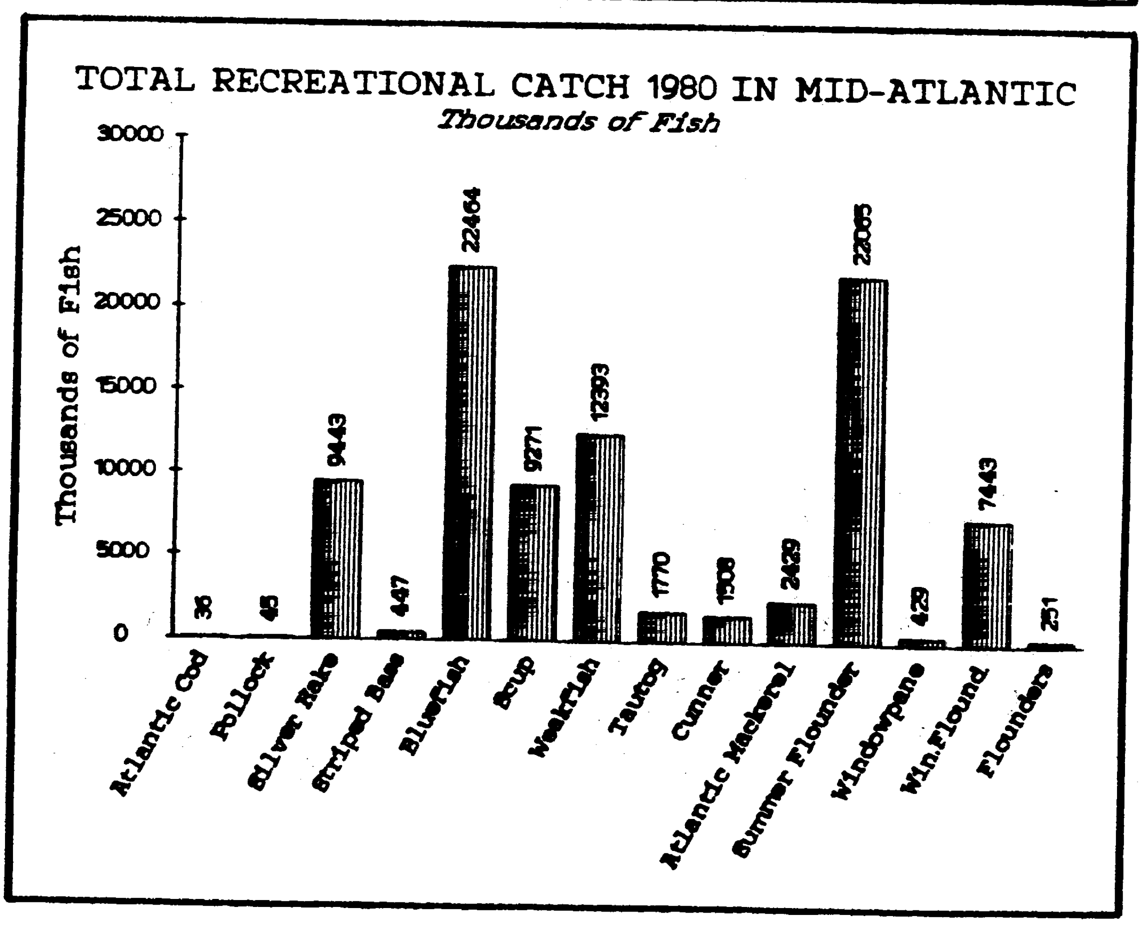




Source: Preliminary 1980 National Survey

Figure 3D5





Source: Preliminary 1980 National Survey

With regard to those species for which a relatively high percent of the catch is not kept, most of this catch is reported to be returned to the ocean alive. For example, it is estimated of the 51% of cunner which is not kept, 44% is returned alive with another 33% being used for bait. For summer flounder, codfish, winter flounder and bluefish not kept, 97%, 68%, 94% and 90% respectively are returned alive.

Table 3D5 also indicates that cunner-tautog show the highest percentage sold by the angler at 12.4% followed by striped bass at 3.2%. For all other species kept by anglers, the amount sold is reported as less than 1%. The information presented here from the work of KCA Research, Inc., is based on 3,600 interviews with Atlantic coast rod and reel fishermen at the completion of their fishing trips. Advisors to the Council suggest that the percentages of the total catch of striped bass and bluefish and other species reported sold by rod and reel fishermen in the KCA Research findings may be significantly underestimated. It is recognized that in the process of selecting intercept sites to locate and interview recreational anglers, commercial fish buying locations or businesses may not receive high priority and this may account for some level of underestimation. However, while a considerable percentage of the total recreational catch of certain species may be sold, a great majority of recreational fishermen do not sell any portion of their catch (Pers. Communication - Tom Morrisey). It must also be acknowledged that the issues surrounding the distinction between recreational rod and reel and rod and reel fishermen who sell some or all of their catch, have been receiving increased attention by fishery management agencies (e.g., Mid-Atlantic Council Bluefish FMP).

One method to analyze in detail the recreational fisheries for species also part of the North Atlantic multi-species commercial trawl fisheries is to examine the fisheries by mode of recreational pursuit. In this way recreational fishing can be categorized by three modes: party/charter boats, private boats and shore-based angling (combining bank/beach and man-made). If available for each mode, the number of vessels and/or participants, economic information, species catch, participant profiles and seasonality will be analyzed.

§3D2 <u>The Party/Charter Boat Sector</u>

Party boats, also known as headboats, deep sea fishing boats or open boats are licensed passenger carrying vessels in which the passengers pay a set fee to be able to sit or stand along the rail and fish for whatever species on a particular fishing ground the captain determines, or for which the vessel or company formally advertises. Generally party boats fish for bottomfish, although in recent years a number of party boats have sought bluefish. Party boats are open to as many passengers as vessel capacity will allow up to the maximum number of individuals whereby the mechanics of angling can be practically and safely conducted. Reservations are not usually required. Party boats tend to be larger than charter boats with a passenger carrying capacity ranging anywhere from ten to well over one hundred people. The distinction between party and charter boats is not absolute since even the largest party boats may be chartered on occasion, and since charter boats may infrequently operate as open boats for certain occasions or during set times of the year.

The party boat industry is comprised of owners, operators, crew members, bait suppliers, marina operators, advertisers, tackle manufacturers, and others. It is loosely organized with some regional and national associations for boat owners and captains whose memberships have become more active with the implementation of the MFCMA. Among the major concerns of these organizations are persistent problems of gear conflicts as well as general fishery resource allocation issues at the state and federal level.

For the vast majority of party boat operators, their party fishing enterprise provides most of their income. Most operators view themselves as full-time professionals. The further north and east one goes along the Atlantic coast, away from the New York/Boston megalopolis, the less this generalization holds. This is largely related to the inhospitable northern climate and consequent shorter fishing season. Over the past few years 'whale watching' excursions have become popular and an added source of revenue. Various party boats in the New England area commit time to this activity and a few operations have had new vessels built specifically for this purpose.

The party boat operation is similar to shore-based small businesses in that sole proprietorship and wholly-owned corporations are the dominant forms of financial organization. Party boat operations are usually a family business. A 1979 study conducted for the NEFMC[6/] showed that fully 40% of interviewed New England party boat operators were the second generation of the family involved in the business, and evidence suggests that this pattern holds throughout the Mid-Atlantic region as well. Increasing numbers of party boat businesses have become multi-vessel operations, which implies that at least for some operators the business is financially rewarding.

The size of the party boats vary anywhere from 30 feet to over 120 feet. Passenger capacity, availability of fish, and captain's experience are important factors in determining the economic success of the party boat. Weather is another important determinant of a party boat's profitability. The number of passengers a vessel can reasonably carry sets the upper limit on the potential gross revenue of a boat.

The recent trend has been toward construction of vessels ranging in size from 80-120 feet, constructed of aluminum or steel, and with sufficient power to achieve speeds of over 20 knots. These vessels not only are capable of generating higher potential revenue, but also afford greater comfort, seaworthiness, lower maintenance costs than wooden vessels, and have a greater fishing ground range.

For the most part, party boat fishing is by rod and reel. Tackle is rented from the vessel or brought by the angler. The species targeted depends on seasonal abundance and the operator's ability to locate the fish. Figure 3D10 indicates that party and charter boats catch a significant portion of the total number of codfish caught by recreational fishermen in New England in 1980. Bluefish and pollock also appear to be important to some party boat operations in New England. It is also known that north of Cape Cod, haddock

---

[6/] "Description of the Recreational Fisheries for Cod, Haddock, Pollock and Silver Hake off the Northeast Coast of the U.S." report to the New England Regional Fishery Management Council by L.E. Nicholson and R.P. Ruais, April, 1979.

is highly prized by some anglers using party boats, although the catch is relatively infrequent (which explains why this species is included in the 'other species' category of the National Survey). Cusk is another important species to party and charter operations north of Cape Cod and, in recent years, wolffish or catfish has also become a somewhat important species. Review of 1980 National Survey data presented in Figure 3D10b would indicate that in the Mid-Atlantic, party and charter boats caught most of the recreationally caught silver hake, and that weakfish, bluefish, and Atlantic mackerel are also important recreational species to the party and charter boat industries. Anglers fishing on party or charter boats nationwide are much more likely to be successful in catching fish on a given trip than when fishing by any other recreational mode, according to National Survey data.

Charter boats tend to be smaller than party boats, under forty feet in length and with a smaller carrying capacity than party boats. In general, they have shorter seasons and are less likely to provide an operator with full time employment and income. This is especially true the further north and east the operation is located. Charter boats are more likely to pursue gamefish or big game species although some operators may pursue bottomfish on a regular basis. The species to be pursued and the length of the trip are usually decided by the captain or the chartering party with seasonal availability and limitations of the vessel and gear as the major constraints.

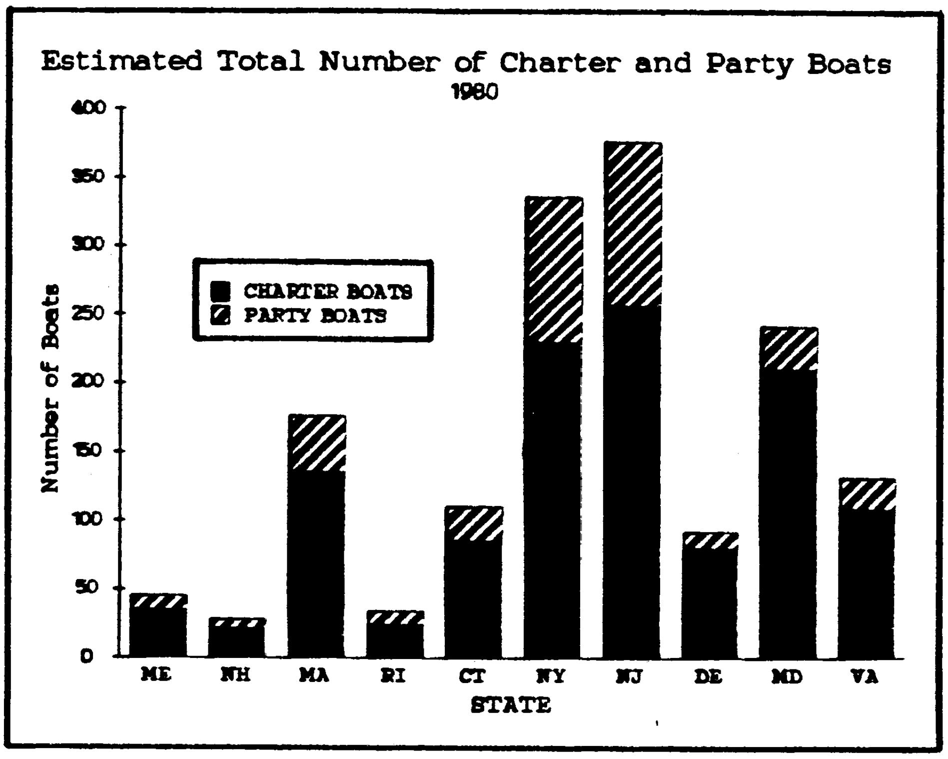
Charter boats tend to have more horsepower per registered ton than party boats, resulting in higher speeds and less steaming time to the fishing grounds. The boats are usually constructed of wood or fiberglass. Charter boats are usually equipped with outriggers and rod and reels are they usually supply all other necessary tackle or bait for their patrons. In addition to fishing for most of the same species sought by party boats, charter boats also fish for highly prized big game species such as tuna, swordfish, and marlin.

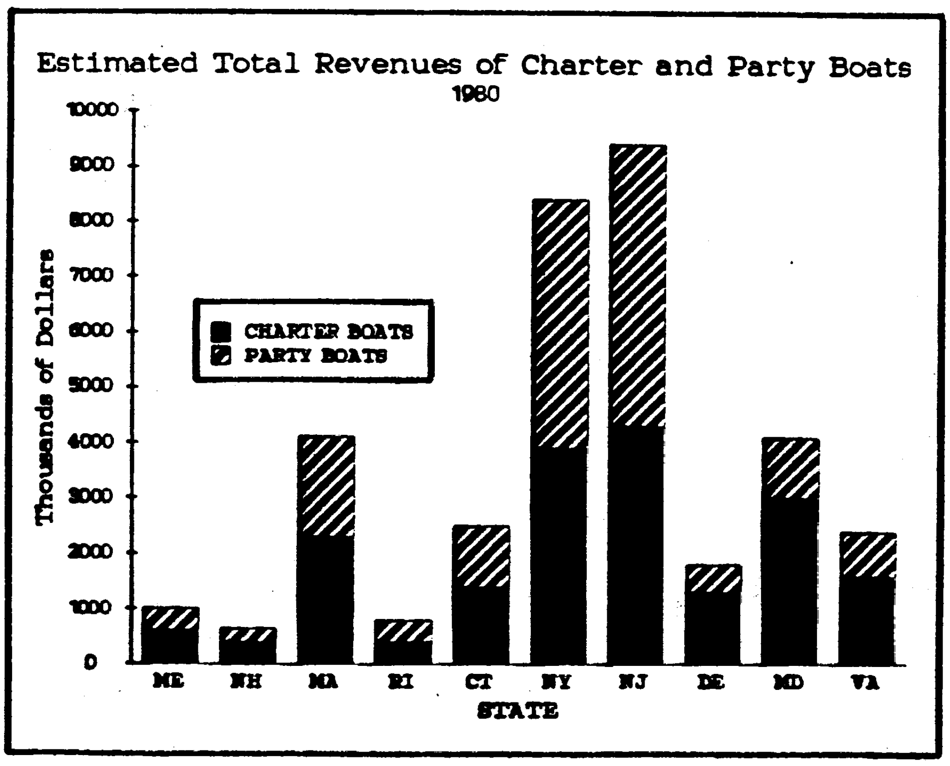
The cost of chartering a fishing vessel varies and may be substantial. For the several hundred dollars the angler pays, he choses his fishing companions, and has a direct relationship with the captain of the boat. Generally charter boats are hired for less than ten people. A vessel which offers to carry six or fewer passengers need not comply with rigorous Coast Guard inspection requirements as do vessels with a greater carrying capacity. It has been estimated that some 90% of the charter fleet is made up of vessels of six passenger capacity or less (1979, Nicholson and Ruais).

Accurate estimates of the number of vessels performing as charter boats at any given time are difficult to produce. Technically, any size private recreational vessel on a given fishing trip could be considered a charter boat if passengers are contributing or required to pay an amount greater than the expense of the trip. Further, it is known that some unlicensed private boat owners often subsidize their annual vessel costs (winter storage, fuel, maintenance, etc.) by charging other anglers or friends for fishing trips. The extent of either above situation is not known.

The number of charter and party boats in the Mid-Atlantic and New England regions as estimated in the 1980 National Survey varies, with the highest number in New York and New Jersey, followed by Massachusetts and Maryland (Figure 3D6a). Recent discussions with New England state officials and individuals knowledgeable about the party and charter boat industry indicate that the actual number of active charter and party boats today is lower than the National Survey data figures for 1980. Specifically, it has been

Figure 3D6





Source: Economic Activity Associated with Marine Recreational Fishing in 1980, prepared for SFI by Centaur Associates, Inc., Washington, DC.

8/30/85

indicated that New Hampshire has 14 active party and charter boats (pers. comm., Ray Gilmore), Massachusetts has 181 party and charter boats (pers. comm., Randy Fairbanks), Rhode Island has some 64, approximately 34 of which are active (pers. comm., Mario Pagano), Connecticut has 54 charter and party boats (pers. comm., Bob Sampson), and Maine has 65 (written comm., Clement Walton). These numbers do not reflect the private recreational boats which may occassionally operate as charter boats. The 1980 National Survey estimate of the total number of party and charter boats for all of the New England states differs from the sum of the current estimates provided by state officials and advisors by only 15 vessels overall. The total revenues estimated in the Survey parrallel the distribution of the estimated numbers of vessels, with the highest revenues in New York and New Jersey (Figure 3D6b).

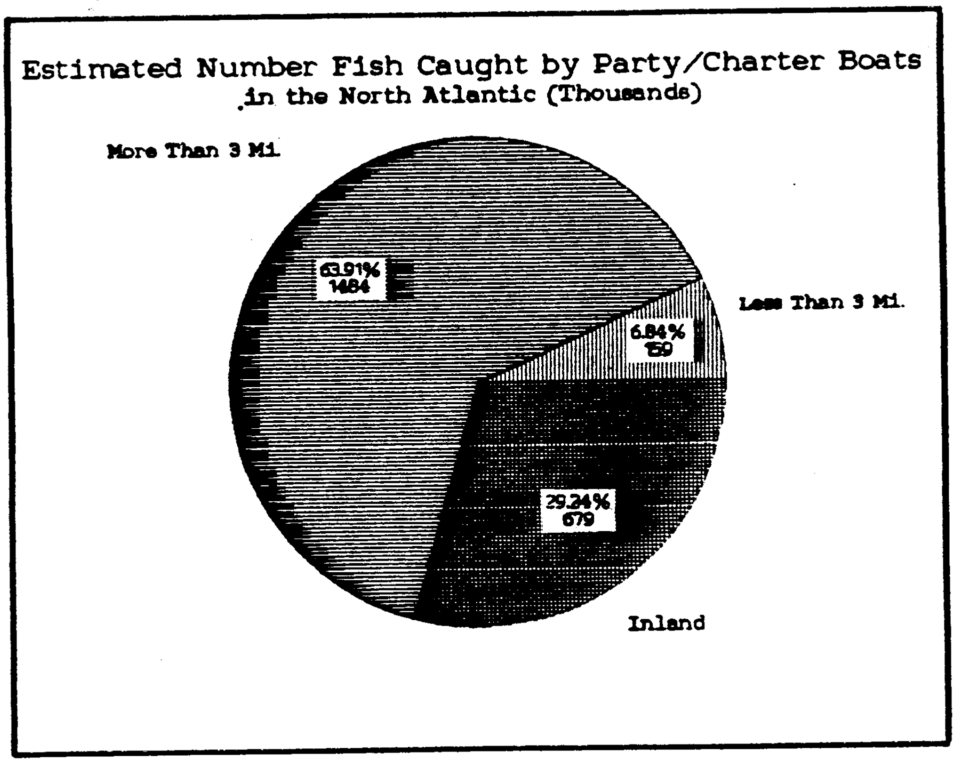
According to the 1980 National Survey, of the total number of fish caught by party and charter boats fishing in the North Atlantic, 64% are estimated caught outside of three miles from the coast, while 7% are caught inside of three miles from the coast. Approximately 29% of the party and charter boat catch in New England comes from inland waters (Figure 3D7a). In the Mid-Atlantic area the party and charter boat catch is also largely offshore with the remaining catch more evenly divided between territorial sea and inland waters (Figure 3D7b).

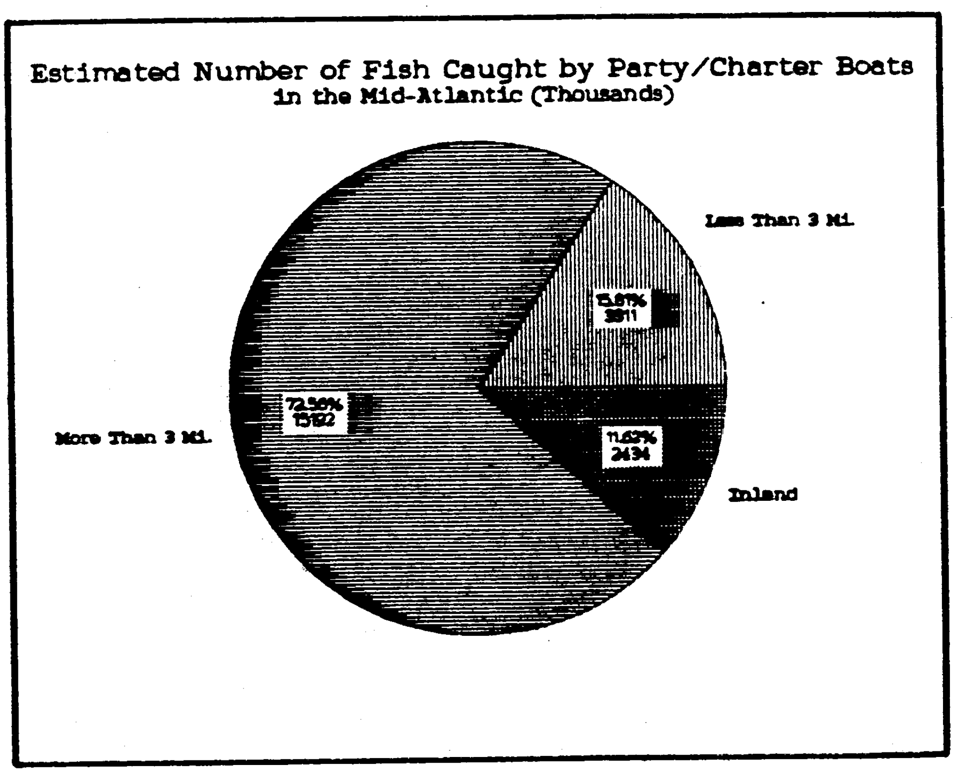
In the North and Mid-Atlantic in 1980 it is estimated that party and charter boats caught nearly 35% of the total weight of the recreational catch (Figures 3D8a, 3D8b). In the North Atlantic only 9% of the total number of fish caught recreationally is by party and charter boats, while in the Mid-Atlantic this mode accounts for only 20% of the total recreational catch in terms of numbers of fish (Figures 3D9a, 3D9b). The differences in percentage of total number and percentage of total weight demonstrate that fewer, but larger fish are caught by party and charter boats than by private and rental boats.

§3D3 The Private/Rental Boat Sector

Several sources suggest that private recreational boating has been a steadily increasing leisure activity over the last few decades in both marine and fresh water. Private boats of all sizes and types participate in marine recreational fishing along the coastal marine and tidal waters of the Eastern U.S. during the peak boating season. The introduction of fiberglass boat construction and mass production have had a dramatic effect on the recreational boating industry, particularly with regards to the sale of trailerable size boats. Coast Guard annual boating statistics show that over the last five years there continues to be a gradual increase in the number of boats which may be spending a portion of their time recreationally fishing in marine waters.

Figure 3D7





Source: Preliminary 1980 National Survey

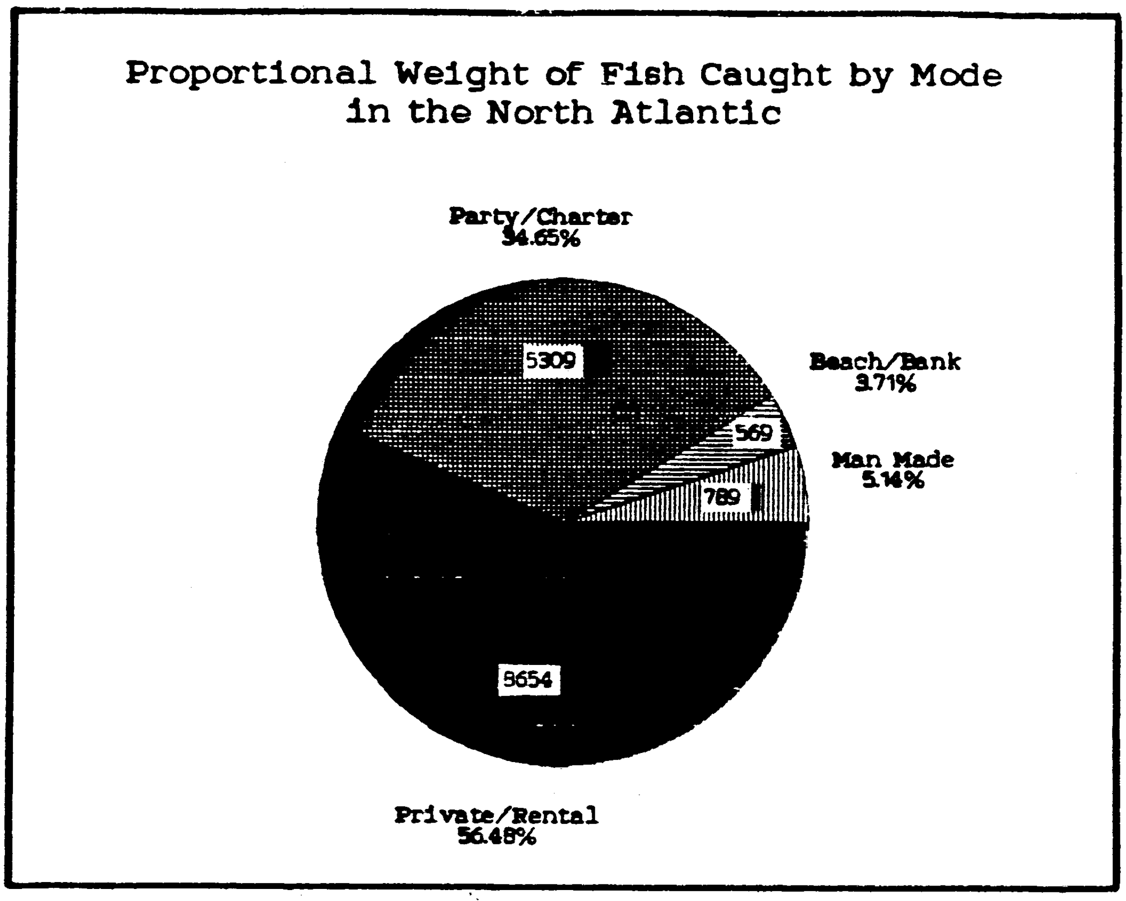
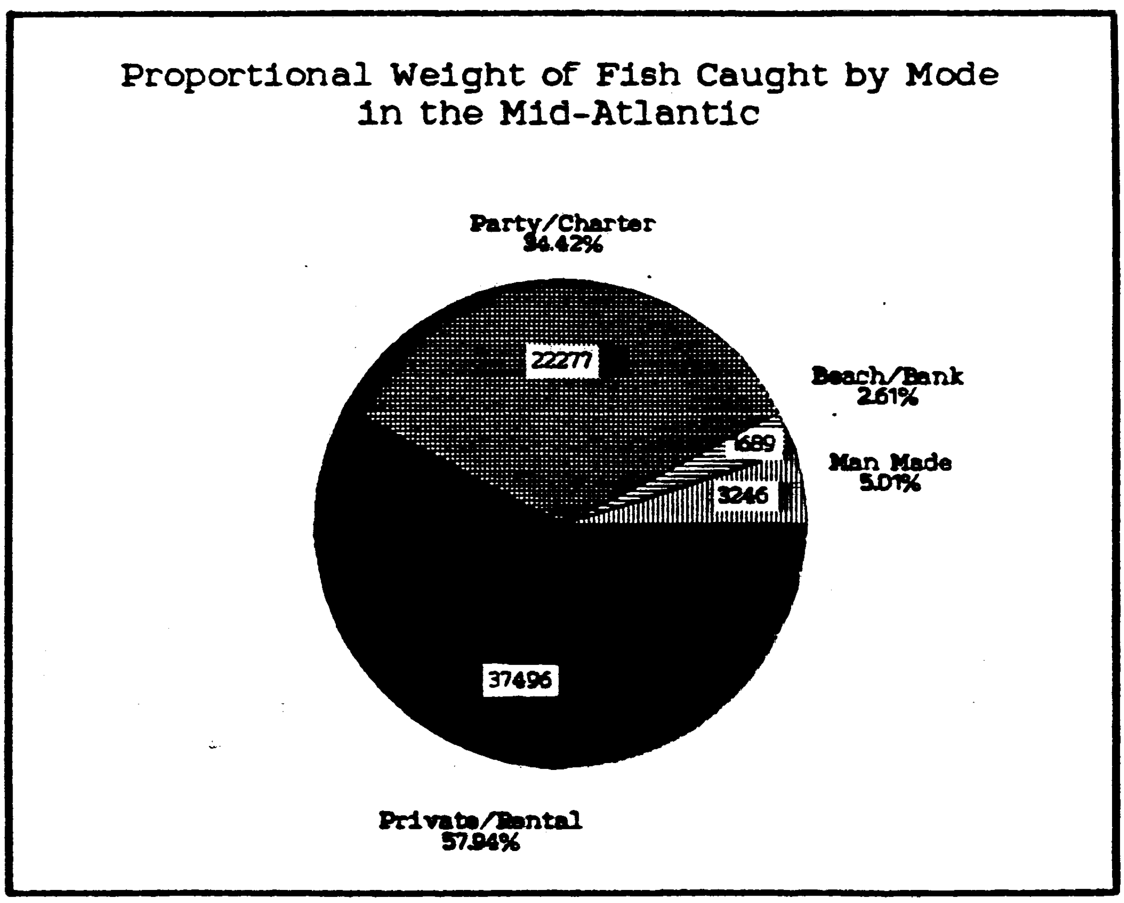


Figure 3D8



Source: Preliminary 1980 National Survey

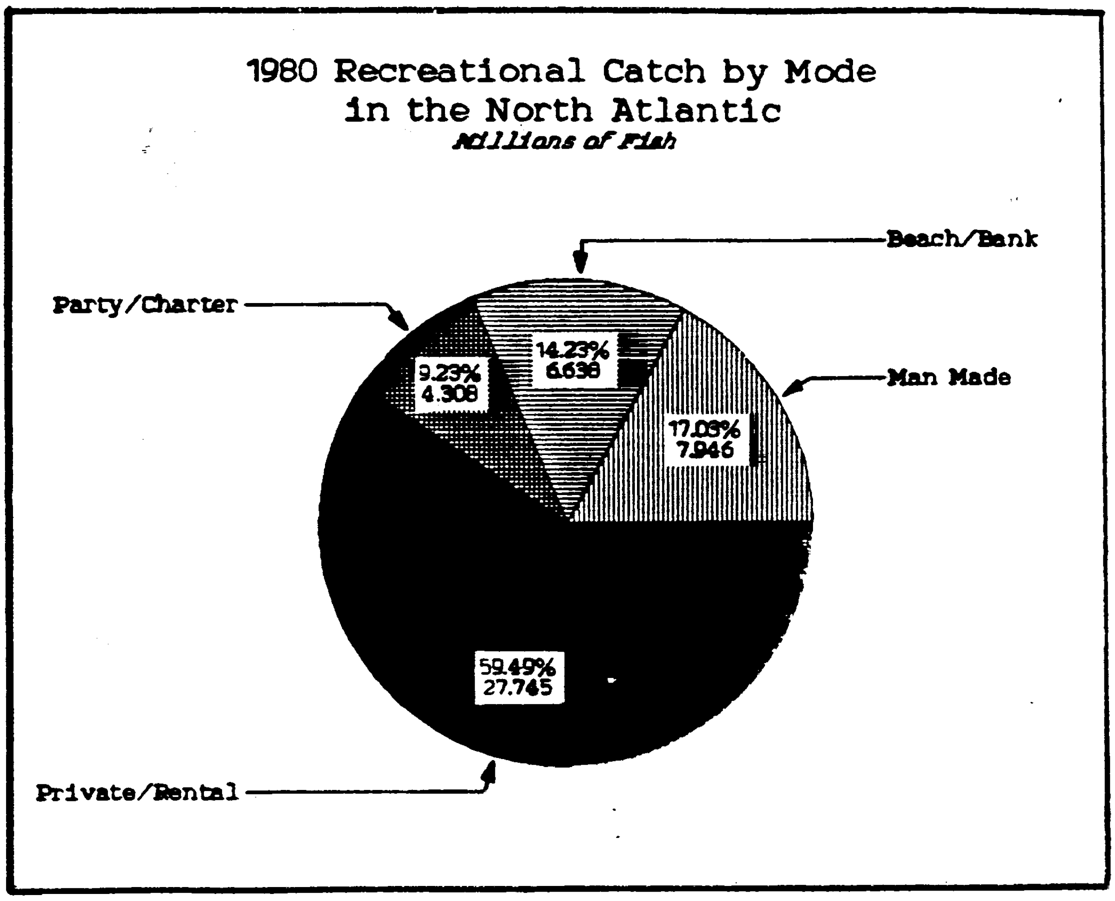
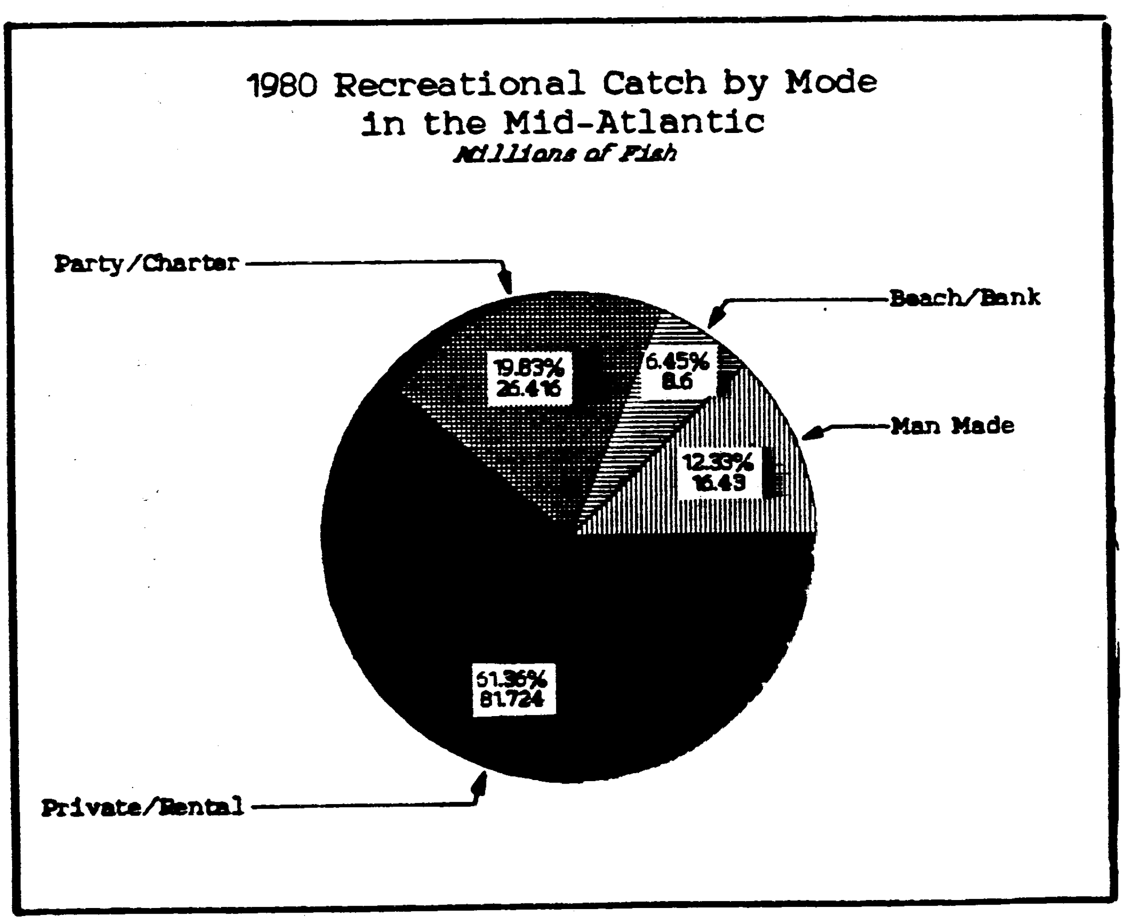


Figure 3D9



Source: Preliminary 1980 National Survey 9/20/85

It is currently not possible to derive an accurate count of the total number of private and rental boats which engage in recreational fisheries for species which are associated with the Atlantic demersal finfish complex. Part of the difficulty is due to the fact that some anglers transport their boats considerable distances. The 1983 KCA Socio-Economic Survey estimated that the average distance traveled by private recreational boaters is 81 miles. In some cases, the distance traveled may be well over this average as exemplified by those avid New England anglers who take their trailerable boats as far south as the Florida Keys for a winter vacation. Many anglers do not generally berth their vessels full time at the marina, but rather launch their boat at any one of the thousands of ramps on rivers, bays, sounds, beaches, etc., along the Eastern seaboard.

By the same token that an accurate boat count is near impossible to determine, the revenue generated by this sector of the recreational fishery is difficult to estimate. Much of the money for gas, bait, and vessel equipment is spent all along the coastal area or may be dispersed outside of the coastal area, perhaps outside of the state off which the fishing takes place.

A central problem in trying to determine the total fishing effort of private recreational boats on the Atlantic demersal finfish fishery arises from the inability to determine the portion of time these boats spend in salt versus fresh water and the total time the boats are engaged in fishing as opposed to other recreational pursuits. While it is clearly difficult to pin down the specific effort by private and rental recreational boats on the Atlantic demersal finfish fishery, the 1980 National Survey estimates that over 3.6 million fishing trips were taken by private or rental boats in the North Atlantic during that year. The Survey also reports that an average of eight fish per trip were caught by these private boat anglers.

The species sought by private recreational boat anglers depends on the size and range of the boat, species seasonality, weather, and individual preference. The results of the 1983 KCA Socio-Economic Survey results show that some 75% of private and rental boat anglers have a species preference on the Atlantic coast. In descending order, preferences are for are bluefish, summer and winter flounder, codfish, and striped bass. The same study indicates that an estimated 70% of those who went fishing caught something. Of that number, 58% of the anglers reported that they kept the fish they caught.

Although it is difficult to determine the numerical extent of private boat participation, it is clear from the 1980 National Survey data that this recreational mode is responsible for the bulk of, or a substantial portion of the total recreational catch with regards to selected species. In the North Atlantic it is believed that private and rental boats are responsible for most of the catch of winter and summer flounder, cunner, tautog, scup and Atlantic mackerel (Figure 3D10a). This user group also accounts for a substantial portion of the recreational catch of cod, pollock, and bluefish. In the

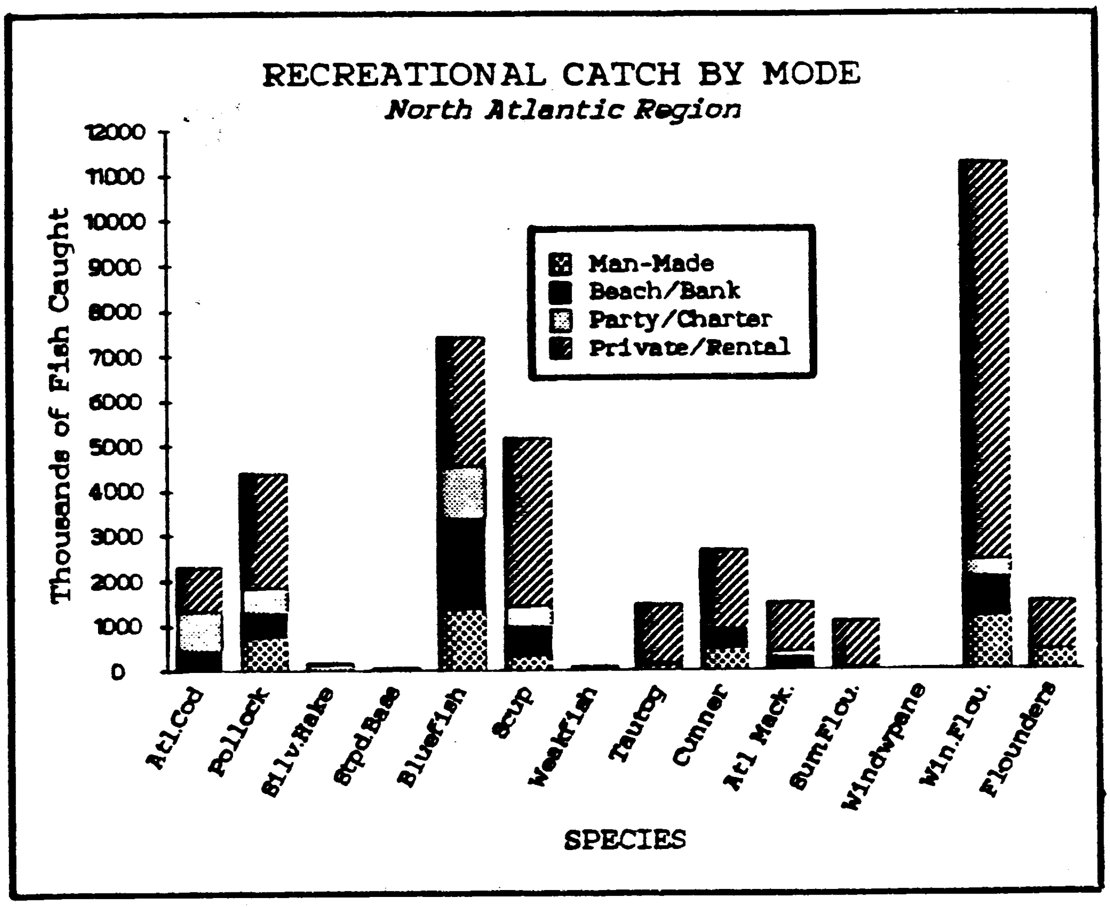
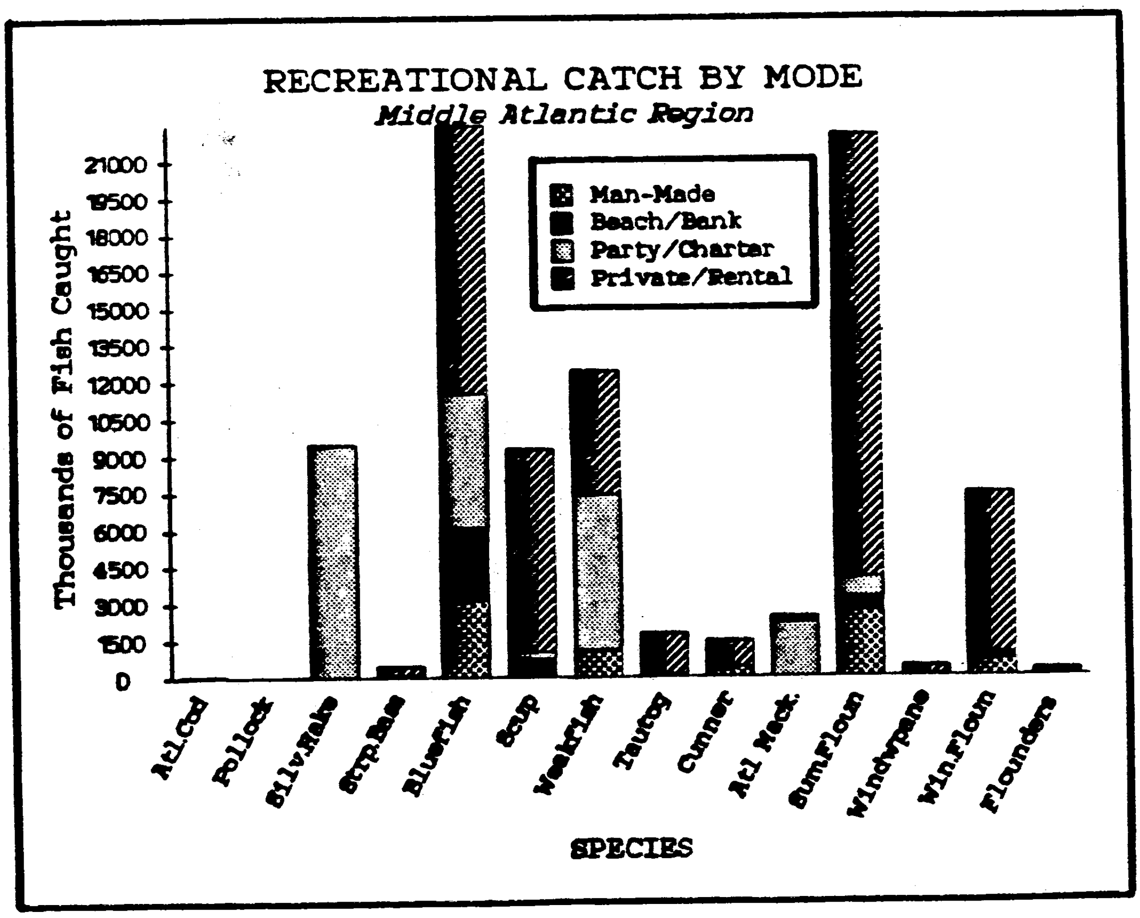


Figure 3D10



Source: Preliminary 1980 National Survey 8/30/85

Mid-Atlantic region, private and rental boats catch most of the recreational summer and the winter flounder, scup, tautog and cunner, and to a lesser extent bluefish and weakfish (Figure 3D10b). The percentage of the total number of recreationally caught fish in both areas by private and rental boats is 60% in the North Atlantic and 61% in the Mid-Atlantic (Figures 3D9a, 3D9b).

Private and rental angling represents an estimated 56% of the overall proportional weight of total recreational fish caught in the North Atlantic. Similarly, 58% of the total proportional weight of fish caught in the Mid-Atlantic is fished by private and rental boat anglers (Figures 3D8a, 3D8b).

Of the estimated number of fish caught by private and rental boats in the North Atlantic, 78% were caught inland, 11% were caught less than 3 miles from the coast, and 11% were caught more than three miles from the coast. In the Mid-Atlantic, some 84% of the fish caught by private and rental boats were caught inland, 11% inside of three miles and 5% caught outside of three miles (Figures 3D11a, 3D11b).

§3D4 Shore-Based Angling

Shore-based recreational angling is a year-round leisure activity, and a relatively inexpensive means of augmenting the household food supply with fresh fish. Information from the 1983 KCA Socio-Economic Survey verifies that shore-based angling is the least expensive mode of recreational fishing with the average expenditure per trip amounting to about $24.00. In most areas, shore-based angling is conducted close to home and does not require major expenditures for travel, lodging, food, or equipment. For many shore based anglers a major factor limiting the activity is the lack of easy access to the shoreline. In 1978 it was noted that in the North Atlantic region 83% of the total shoreline was privately owned. Although shore-based angling is a year round sport in many areas, participation usually peaks during the summer months. In New England, with the exception of a winter smelt fishery, all modes of marine angling are practically non-existent during the winter months. The 1980 National Survey of Fishing, Hunting and Wildlife-Associated Recreation estimated that of the total 12.3 million salt water anglers, 6.7 million (55%) fished from the surf and shore.

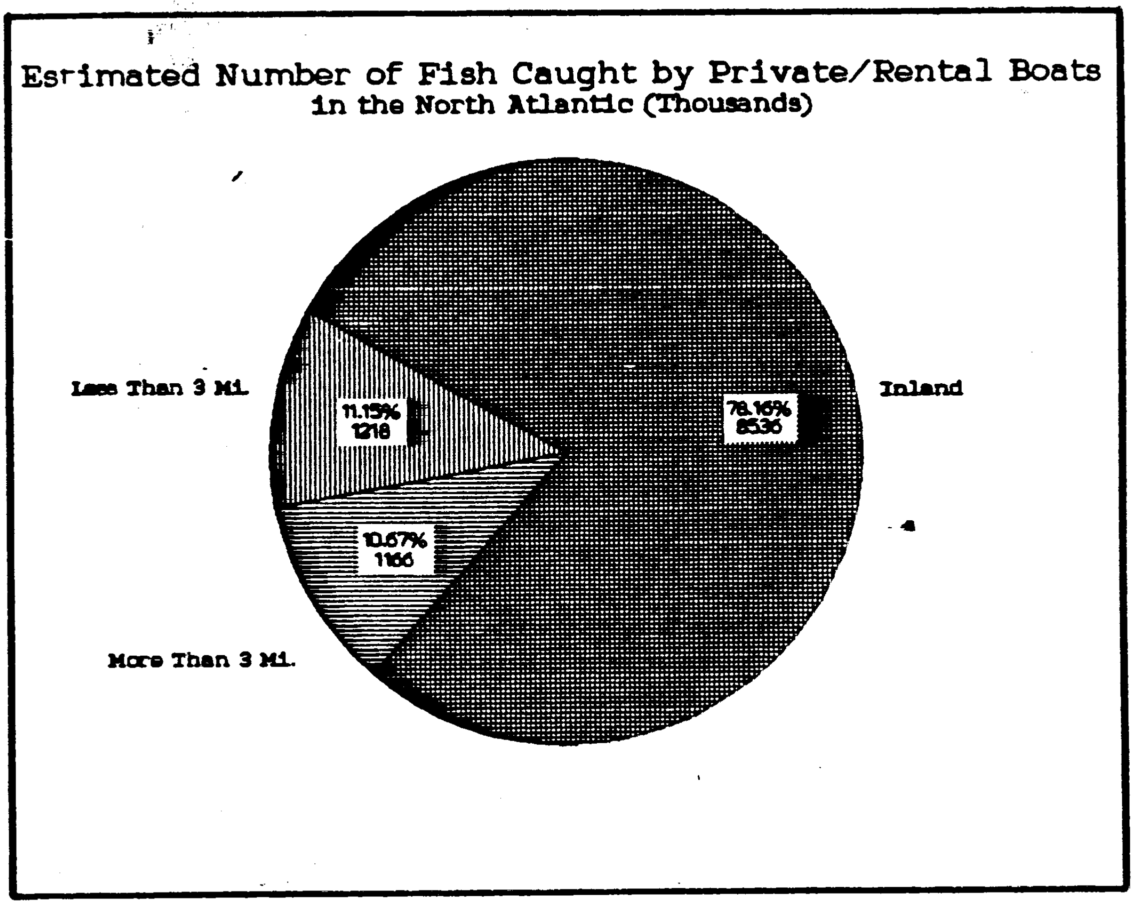
Shore-based angling has been defined according to the following modes:

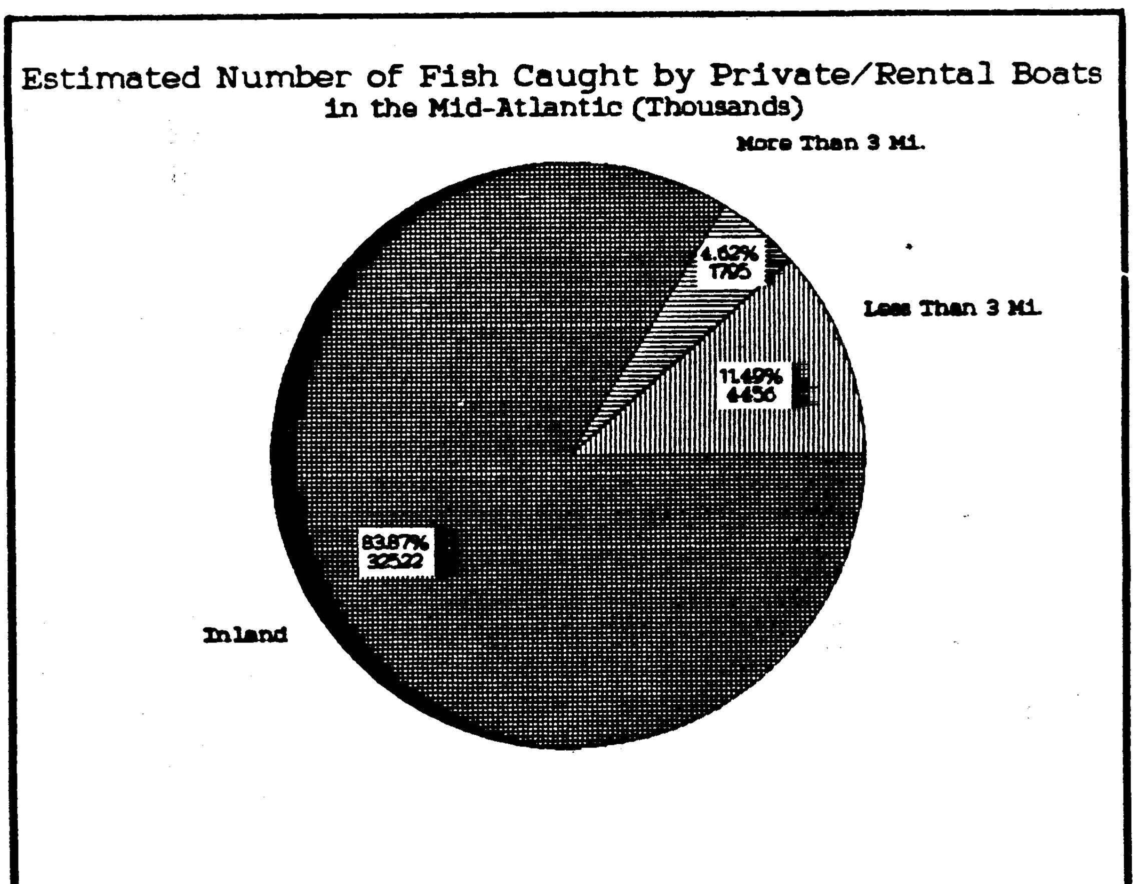
Man-Made or Surf fishing is understood to include fishing from any jetty, beach, or construction (pier) on the ocean;

Beach or Bank fishing includes those fishing areas situated on any bay, river, or sound.

Shore fishing along the 600 mile area from Cape Cod, Massachusetts, to Cape Hatteras, North Carolina, has been of considerable importance for more than 300 years (1978, Freeman). These shore fisheries have historically depended on about a dozen species, which include bluefish, striped bass, winter and summer flounder, and weakfish. Freeman (1978) reported that more than three-quarters of a million anglers fish along the shores, docks, bridges, piers, wharfs, bulkheads, and jetties of this area.

Figure 3D11





Source: Preliminary 1980 National Survey

9/20/85

Data from the 1980 National Survey indicate that in the North and Mid-Atlantic, shore-based anglers catch a substantial portion of the total catch of bluefish in numbers (See Figure 3D10a, 3D10b). In the North Atlantic, shore-based anglers also catch cod, pollock, silver hake, scup, cunner, mackerel, and winter flounder. The bulk of the catch of cod, pollock, and winter flounder by shore-based anglers occurs in April and May, and October through November. Mild weather during these months will allow considerable shore based effort to take place at many locally popular fishing sites throughout New England. In the Mid-Atlantic shore based effort accounts for a portion of the recreational catch of scup, weakfish, summer and winter flounder.

Overall, data from the National Survey indicates that the shore-based angler is responsible for just under 9% of the total weight of recreationally caught fish in 1980 (Figure 3D8a). This catch by shore-based angler in the North Atlantic represents approximately 31% of the total number of recreationally caught fish in 1980. In the Mid-Atlantic, under 8% of the total weight is caught by recreational anglers while this recreational mode accounts for almost 19% of the number of fish caught (Figure 3D8b).

SUBPART E: SOCIAL AND CULTURAL FRAMEWORK

§3E1 Scope of the Social and Cultural Descriptions

While the most apparent effect of fisheries management is likely to be economic, the consequences of fisheries management may be much broader. Other effects, however, are neither reliably predictable nor easily quantifiable since they are related to social-cultural characteristics of each fishing community. This section will outline the relationship between certain socio-cultural characteristics and economic issues common to most fishing communities. The social-cultural significance of the economic and other effects of the plan will thereby be indicated.

Fisheries management policies which affect economic returns have the effect of redistributing effort. This redistribution of effort is usually a switch to different fisheries; however, if the effect of the policies is perceived as being too severe, it is likely that there will be fishermen who will leave fishing for alternative occupations. Their response to changes in the industry and the potential for other opportunities, however, are affected by ethnicity, education, and the existence of alternative occupations.

Employment is a prominent issue in many New England fishing communities. Fishing has traditionally been the major employer in many of the rural coastal communities; however, with decreasing stocks, increasing fishing costs, and the use of closures and limited access techniques for fisheries management that result in long periods when it is impossible for some to fish, alternative employment opportunities are needed.

Generalizing broadly, the most widely available alternative employment in the New England region is seasonal, i.e., the summer tourism industry. In many of the more rural communities in New England, particularly in Maine, summer tourism is the only industry apart from fishing and fishing-related industries (fish processing plants, etc.). Summer, however, is also the most active period of fishing since weather constrains fishing in the winter. Consequently, employment in the tourism industry is not a viable alternative for most New England fishermen. It is, however, employment which can be important for fishermen's wives and other relatives.

In urban areas there is more variety in employment alternatives, but access to employment depends on age and education. The majority of fishermen in New England have not graduated from high school. This lack of formal education limits access to employment in other industries. In its traditional form, fishing was a skill learned by sons from their fathers, uncles and grandfathers and passed on to their own children. Success was not dependent on formal education. Boys often left school as soon as legally possible to go fishing full-time. Although fishing has become increasingly technical with the use of a variety of electronic devices, success still seems to rely on traditional skills and attitudes such as net mending and a willingness to fish for long hours, not formal education.

Related to opportunities for alternative employment are the issues of ethnicity and kinship. The significance of ethnicity is evident primarily in New Bedford and Gloucester where the Portuguese and Italian predominate. Besides a tradition of involvement in fisheries that stretches back to their

European origins, fisheries employment is so widespread, so embedded in the Portuguese and Italian communities of New Bedford and Gloucester that access to employment outside the fishing industry is limited. Fishing and related industries have dominated the economy of Gloucester since the 1700's. Today, fishing and related industries are thought to constitute 40 percent of the city's jobs and revenues. Fishing and related industries are believed to provide over 33 percent of New Bedford's economic base.

In both Gloucester and New Bedford, whole families are often involved in fishing and related industries. For example, in many instances a father, his brothers, and his sons fish together on one boat. In addition, wives often work in fish processing plants or are involved in marketing efforts. The involvement of large segments of the whole community in fishing-related employment obviously means that large numbers of individuals would be forced to seek alternative employment simultaneously should there be a management technique that tied up many of the boats.

Beyond the issue of employment itself is the issue of income. Income is socio-culturally significant for its role in the determination of lifestyles. Choices made in the use of income may directly and indirectly affect fisheries management. For example, if income is used for the education of children, occupations other than fishing might be later sought by those children. If, on the other hand, income is used to purchase technologically-advanced fishing gear, resulting impacts on stocks might require increased management.

Income may also be important in considering whether or not alternative employment would be considered by fishermen. If fishermen were making a significantly higher income than that which they might obtain in another occupation given their age, education and training, they would surely continue to fish even if their income were diminished by management measures. This is particularly true because fishing is considered by most fishermen as an intrinsically satisfying occupation.

Other social choices which have an economic bearing include residence, home port, and port used for off-loading. These factors must be considered in measuring social and economic benefits to communities which arise from the fishing industry (in expenditures by the fishermen, for example, or in employment in related industries, etc. See: "Estimation of Income and Employment Multipliers for Marine-Related Activity in the Southern New England Marine Region" URI 80-10). These are also important in measuring social and economic costs of the fishing industry to a community. For example, if a majority of boats are berthed in a port, but off-load elsewhere, and the fishermen reside still elsewhere, the economic costs of providing mooring space to the fishing boats may or may not be balanced, for example, by their attraction of tourists. The values community members place on such aspects as the scenic benefits of the boats and the diversity of lifestyles symbolized by the presence of fishermen and their boats are sometimes at odds with the values the same community might hold vis-a-vis environmental considerations. Harwich, Massachusetts, is currently involved in a controversy on the advisability of increasing commercial fishing and related industries with fears of water pollution and aesthetic considerations being offered as a basis for opposition by those who do not need the employment offered by the development.

Mooring space raises the issue of the conflict between commercial and recreational fisheries. There is an ideological level of the conflict between these groups with both commercial and recreational fishermen arguing that society benefits more from their operation than from the other group's and that they should therefore have a greater share of the resource than they now have. The commercial fishermen maintain that their jobs are more important than leisure activities, especially because their occupation results in the provision of food for large numbers of consumers. Recreational fishermen maintain that fishing is a basic right for individuals and point to the millions of dollars spent on recreational fishing as evidence of the importance of their industry. In addition, NMFS statisticians estimate that anglers land 30 to 35 percent of the total finfish poundage harvested for food in the United States (Hart, 1985).

The conflict is not always on an ideological plane since economic impacts of one group on the other can be significant. Where the recreational fishing boats crowd the harbor, making access to the piers difficult or time consuming, the conflicts are apt to be serious since the commercial fishermen view time as money. Although recreational fishermen theoretically do not catch fish for sale, the operations of recreational fisheries are very much a part of the commercial world. Charter and party boat operations depend on their reputations of bringing recreational fishermen to areas where they can catch fish. Fixed gear commercial fishing operations, however, are accused of blocking areas traditionally fished by recreational boats. Gear conflicts also arise when entanglements occur due to poor marking or visibility of fixed gear.

In some ports, a symbiotic relationship exists between commercial and recreational fishing interests. Tourists are attracted by "working harbors" where they can see commercial operations, especially if they can participate in a related activity such as recreational fishing. The recreational fishing industry may also serve as a benefit to the commercial fishing community in need of alternative employment opportunities. Additionally, the multiplier effects of the value of the recreational fisheries on related industries may be beneficial to commercial fisheries by, for example, decreasing costs of certain equipment.

Methods of operation, which stem from choice of fisheries, size and form of boats, and types of gear, have socio-cultural significance. Some researchers have found that forced changes in fishing techniques, coupled with moves to urban centers as occurred in Nova Scotia, can lead to negative social consequences such as alcoholism, suicide, and crime (Acheson, 1979). Features such as whether or not the majority of the fishing boats are small day boats with attendant constraints on operation dictated by foul weather or large trip boats able to fish year-around, affect the communities' patterns of life. Boats making long trips tend to be larger vessels with greater horsepower, greater available hold capacity, more crew members, greater value and average higher gross stocks for the year than do day trip boats (Peterson and Smith, 1979).

One might hypothesize as well that the method of operation may lead to self-esteem, pride in work and product, leading to quality which might be lost if perceived freedom of operation or independence of the fisherman is too extremely regulated. An important figure in the New England region is the owner-captain of a fishing boat. These individualistic entrepreneurs take considerable risks to finance boats, and many complain of the difficulties of making a living hunting an elusive prey, hampered by high costs and increasing management. Most though proudly acknowledge the benefits of "being their own boss," including freedom not to fish in heavy weather and freedom to decide on the amount of time to spend ashore (Peterson and Smith, 1979).

Finally, some comment on the local norms regarding management should be included. Fishermen are increasingly aware of the negative impacts of heavy fishing on certain stocks, and many acknowledge the necessity of fisheries management. However, fishermen want as little interference as possible with their usual operations, especially with their option to shift gear as necessary. Inshore or small-boat operators prefer boat quotas so they are not penalized by their inability to fish in rough weather.

All fishermen who agree that management is necessary comment that the key to successful management is enforcement. The perception that "everyone else is cheating" causes fishermen to devise a wide variety of techniques to avoid compliance with regulations in order to stay competitive with others who are avoiding the regulations. With active enforcement coupled with heavy fines or other strong economic sanctions, most fishermen say that fewer fishermen would be willing to take the risk of being caught.

Ethnicity, as defined by recent immigration, is a factor in acceptance of and adherence to management regulations. Recent immigrants who fish with other recent immigrants have, as a group, been criticized in both Gloucester and New Bedford for their disregard for fisheries management regulations (Miller and Van Maanen, 1979).

Enforcement of fisheries regulations is considerably easier when the fishermen agree that the regulations are necessary and appropriate. For example, many fishermen now agree that spawning area closures are often appropriate; however, if an area is closed for spawning when the fishermen know from analyzing the fish in their catch that spawning is over or in a different area, the regulations will often be ignored.

In addition, different communities of fishermen may find some regulations more acceptable than others because of the effects that the regulations have on other aspects of their lives. Not everywhere in New England are the motivations the same. Researchers have found that Maine fishermen, in general, must be able to remain in their natal community; their income must remain about the same; and they must have the freedom to fish when weather permits. Rhode Island fishermen, in contrast, have fewer ties to their natal community. It is their immediate or nuclear family (i.e., wife and children) rather than the extended family (cousins, etc.) and community that is important. Therefore, any plan which in effect demanded more time away from their wives and children would probably be opposed.

Brief profiles of the major ports in New England in the next section outline characteristics which are most commonly associated with socio-economic effects of fishery managment.

§3E2 Analysis of Specific Ports

The following selection of ports was based entirely upon accessibility of comparable data. Most of the information came from interviews with National Marine Fisheries Service port agents and New England Fisheries Management Council members, supplemented by interviews with a few commercial fishermen. Published articles on various ports were reviewed but were used primarily as a basis for interviews. In most cases, specific data in published reports are outdated. In addition, such reports focus on a broad range of topics, making comparisons between ports on specific issues difficult.

For six of these ports (New Bedford, Gloucester and Provincetown, Massachusetts; Portland and Rockland, Maine; and Stonington, Connecticut), U.S. Department of Commerce Census Bureau data was used to check estimates of population, educational level, and employment figures. The data, however, is not sufficiently focused on the fishing component of these communities to be reliable as a primary source of information. Point Judith (i.e., Galilee and Jerusalem), Rhode Island, and Stonington, Maine, are not separately listed in the published census data.

New Bedford, Massachusetts

New Bedford, Massachusetts, had landings with the highest value of any port in the country in 1983: $109.2 million for 111.8 million pounds of fish. Groundfish, particularly cod and yellowtail flounder, and scallops caught on Georges Bank make up the largest share of New Bedford's landings. Over 410 boats, employing at least 3,007 fishermen, use New Bedford as a home port. Of these boats, about 256 are rigged with otter trawls, and they usually have 6 crew members. Medium-size trawlers predominate; there are 181 in the 51- to 150-ton range. The other 154 boats, with an average of 9 men as crew, are scallopers most of the year. Boats fitted with scallop dredges tend to be large; there are 86 boats over 150 tons and 66 are in the 51-150 ton range. About 50 to 80 transient boats regularly land at New Bedford.

Most of the draggers fish offshore, making 8- to 10-day trips, with 3-day layovers in port. There is some switching (i.e., some fishermen scallop part of the year and drag part of the year), but this is reportedly much less common than in years past. The transient boats include 30 to 40 summer swordfish boats, 10 to 30 North Carolina scallopers (who spend up to 8 months in the region), 4 or 5 boats from Cape Cod, and 2 or 3 boats from Point Judith.

New Bedford's population is approximately 100,000 of which 38 percent are Portuguese. Twenty-four percent of the population is foreign born, and 40 percent speak a language other than English at home. Fishing and related industries are believed to provide one-third of the city's economic base. Among the related industries, processing of fish fillets is primary with twice as many processors today as there were one decade ago. Other related industries include box manufacturing and such services as transport; repair; food, fuel and ice provision; and unloading (lumpers).

As noted in the introduction to this section, ethnicity may have a significant effect on opportunities to obtain employment other than fishing. In New Bedford, 60 to 75 percent of the fishermen are Portuguese, including many who are relatively recent immigrants. Sons of previous Portuguese immigrants continue to flow into fishing and related industries. Fishing is often a family enterprise, with all members of the family involved in the various aspects of the industry. Lack of role models in other occupations, lack of contacts in other industries, and lack of education, especially among recent immigrants, mean that movement out of the fishing industry would be difficult.

For a number of years, a large portion of the New Bedford fleet was made up of Norwegian immigrants; but they did not share the Portuguese's devotion to fishing as family enterprise. Their sons are said to be "educated out of the fishing industry", so the Norwegian influence on the industry has waned. When they were active in the fisheries, the high-liners, the most successful fishermen in New Bedford were generally Norwegian (Smith and Peterson, 1977). The remainder of the population is not dominated by any ethnic group.

Many individuals entering the fisheries today have finished high school. Ten years ago the average was a tenth-grade education, so older crew members and captains are not high school graduates. The educational level among Portuguese immigrants is thought to be, in general, equivalent to a sixth-grade education. The city as a whole has a low percentage of high school graduates. Of adults over 25, only 38.1 percent have graduated; and among 16-19 year-olds who have not graduated, 28.2 percent are not attending school. As noted previously, lack of formal education limits opportunities for alternative employment. However, the education among fishermen, except for immigrants, apparently corresponds with that of the general population, so competition for jobs would not be with those far better educated.

Aside from fishing-related industries, other industries in New Bedford include textiles (needle trades which are dominated by women), electronics (employing 50 percent males and 50 percent females), services, machine shops and welding (many of which are also marine-related, however), and tourism. Unemployment in February 1984 was 9.2 percent, a considerable drop from the previous February's rate of 12.9 percent. Census Bureau data reported that New Bedford's median family income in 1979 was $14,930, ranking fourth among the six port communities. Per capita income was $5,431, ranking fifth among the six communities.

<u>Gloucester, Massachusetts</u>

Gloucester, Massachusetts, boats landed 150.9 million pounds of fish worth $38 million dollars in 1983, ranking it first in New England by poundage (seventh nationally), while ranking eighth nationally in value. Gloucester boats land a variety of groundfish, predominantly cod and pollock which are lower-valued species than New Bedford's yellowtail flounder and scallop catch.

Gloucester's fleet consists of 235 vessels over 5 tons, employing 1,133 fishermen. Of these vessels, 230 are draggers (96 are in the 5-50 ton class, 98 are in the 51-150 ton class, and 36 are over 150 tons). Five scallopers employing 42 men also work out of Gloucester, and only one is over 150 tons. In 1982, thirteen manufacturing plants produced food and kindred products, particularly seafood. They employed an average of 1,381 people with an annual payroll of $25,927,282. Gloucester's population is considerably smaller than New Bedford's, with approximately 28,500 inhabitants. Therefore, a larger percentage of the community is directly involved in fish harvesting and processing.

Some individuals conservatively estimate that 40 to 45 percent of the community's employment and revenue is dependent on the fishing industry. In recent years there has been increased development of fishing-related industries including the building of a $3.1 million seafood industrial park with space for 4 fish processing plants, building of a $6 million fish freezing and cold storage facility, construction of a third marine railway, investment in Cape Pond Ice Company, and establishment of two inland industrial parks which are the homes for several fishing-related industries. In fish processing plants, women are commonly hired as packers. Work is considered well-paid, but it is seasonal except in the plants which use imported frozen blocks of fish. The usual proliferation of industries serving (and thus dependent on) the fishing industry exists (e.g., banks and settlement houses; ice, food and oil provisioners; chandleries, machine shops, and railways).

The dominant ethnic group in Gloucester is Italian (16 percent of the population); and immigration continues today, although only 8.3 percent of the population is foreign born and 12.5 percent speak a language other than English at home. Those who immigrated before the 1950's tended to encourage their children to obtain an education and leave the fisheries, but more recent immigrants have bought their own boats and have encouraged their sons to enter the business. It is now difficult for someone without family connections to find a fishing job on a Gloucester boat. Many of the fishermen, even early immigrants, speak Italian on their boats, so their wives are frequently more fluent in English than they are. Like the Portuguese in New Bedford, the Italians in Gloucester dominate the fishing industry. This means that management efforts which negatively affect incomes from fishing will have a disproportionately greater effect on these ethnic groups. In addition, the concentration on fishing limits employment opportunities in other industries.

The educational level among fishermen in Gloucester is said by some fishermen to be about tenth grade on the average. Most fishermen are said to have had some high school training, but few actually graduated, and there is only one known college graduate. The general population has more formal education (65.5 percent are high school graduates and 14.2 percent are college graduates). Among 16-19 year-olds who have not graduated, 16.9 percent are not enrolled in school. Their educational level, therefore, would put many fishermen at a disadvantage in competition with the general population for alternative occupations.

Some fishermen of Italian descent say that fishing as a way of life is considered more important in Gloucester than the income itself. However, incomes are fairly high on the average. Large offshore boat crews average $30,000 to $40,000 per year, while their captains earn $50,000 to $55,000 per year. Crews on small boats which are considered highliners make $20,000 to $25,000 per year, while their captains make $35,000 to $40,000 per year. Crews on small boats which are not highliners make $15,000 to $20,000 per year, and their captains make $25,000 to $35,000 per year. Lumpers (who unload the boats) belong to a strong union which limits membership. Lumpers were originally from fishing families, and now tend to be sons of lumper fathers. Lumpers can make annual salaries of $30,000 to $60,000 depending upon whether or not freight traffic is high (supplying frozen blocks to processing plants). Census data lists the median family income of Gloucester as $19,213 and per capita income as $7,602, ranking the second highest of the six ports for which there is accessible census data.

In recent years Gloucester has made an effort to diversify its economic base. Tourism and light industry are the major non-fishing related employers. Many of the 2,000 employees in the light industries live outside of Gloucester. Computer components, brass and cork washers, boilers, water pumps, silk-screening, plastics, chemicals and tape are some of the products produced in the area. Unemployment in 1979 was 7 percent, but is currently under 5 percent.

Gloucester is also the home port of some of the larger New England based party/charter operations and services a fair number of private anglers' boats along the Annisquam River. The community's summer population increases by one-third with the influx of about 10,000 tourists and summer vacationers.

Provincetown, Massachusetts

The catch landed at Provincetown, Massachusetts, is a mixture. Like most inshore fishermen, the Provincetown fishermen seek the more valuable species such as yellowtail flounder and cod, but commonly switch to whiting or even dogfish when they are plentiful. Provincetown is home port for about 40 commercial fishing boats and close to 200 full-time fishermen. Of the 35 full-time draggers, 30 are 20 to 30 year-old wooden vessels and 5 are less than 6 years old and of metal construction. Two other boats are exclusively gillnetters, fishing June through September. Three small boats use gillnets for mackerel in December, March and April, and switch to inshore dragging for clams during other seasons. Currently there are only two boats with home ports elsewhere which unload in Provincetown. The harbor is shared with a few lobster boats and seasonally with large numbers of charter fishing boats.

The Provincetown groundfish boats are considered inshore draggers, primarily fishing 12- to 16-hour days or making short, 2- or 3-day trips. Only a couple of boats are not owner-operated. At least one of these is owned by the local seafood buyer.

Provincetown has a much smaller population than New Bedford and Gloucester with 3,372 inhabitants. Like New Bedford, 38 percent are Portuguese, though in contrast to New Bedford only 7.1 percent are foreign born and only 11.6 percent speak a language other than English at home. Fishermen in Provincetown usually refer to the fleet as a "Portugee fleet." Although only about 10 to 15 percent are Portuguese immigrants, the majority are Portuguese descendents. Although they do not speak Portuguese on their boats, there is an identification with Portuguese culture and tradition, as transplanted and transformed by American influences.

The ethnic traditions are reflected in crew recruitment. Most of the crews are family based, with fathers, sons and brothers working together. The 4- to 5-men crews are fairly young on the average (30 to 35 years old), and youth continue to enter the fisheries.

As in New Bedford and Gloucester, apart from recent immigrants, a majority of the fishermen have completed the tenth grade. In Provincetown, though, there are also a few college graduates, including at least one fisherman who graduated from the University of Rhode Island's fisheries program. The general population is quite well educated (74.8 percent are high school graduates and 20.2 percent are college graduates).

There are two businesses involved in fillet production for restaurants, one full-time, the other seasonal, each employing about 5 people. Aside from fishing-related businesses (railways, suppliers, etc.), tourism and the usual service businesses are the only alternative occupations. Only 3.7 percent of the population is engaged in manufacturing, and the unemployment rate is high at 19.5 percent. Hyannis, Orleans, Yarmouth and Dennis are the closest towns with significant alternative employment available.

Tourism has been the dominant industry in Provincetown in recent years and has received any development money the town could commit. In the past few months, however, there has been an indication that the town recognizes the value of maintaining a viable fishing industry and is seeking ways to help develop its potential. The town recently committed itself to renovating the town pier, where the fleet has been precariously berthed for years.

Fishermen are more supportive of management measures than in previous years because they fear a collapse of the fisheries. They would prefer boat quotas so that the small boats are not penalized by their inability to fish in rough weather. Increased enforcement of fishery regulations would be preferred if it would curb the pressure put on the fishing grounds by the four or five New Bedford boats commonly in the area. Most fishermen feel that they are making a subsistence level of living now. Median family income in Provincetown is only $13,009, ranking fifth among the six ports, and per capita income is $6,845, ranking third among the six.

<u>Point Judith, Rhode Island</u>

Point Judith, Rhode Island, landings were 61.6 million pounds, valued at $25.5 million, in 1983. The catch is a mixture, with switching among target species common. In order of importance in an average year, the species include yellowtail, silver hake, butterfish, squid, winter flounder, scup and summer flounder. Recently, cod has shown up in the landings as well. Point Judith is the landing port for 130 boats and about 579 fishermen. Of these boats, about 129 are full-time, year-around draggers, and 81 are in the 51 to 150 ton class. There are also 4 or 5 gillnetters and 1 scalloper (over 150 tons). Of approximately 50 lobster boats, 20 are full-time, year around. Ninety-three boats belong to the Point Judith Cooperative, and there are two other major fish dealers.

The majority of the fleet fishes 1- to 3-day trips south of Block Island and off of the Vineyard. The only boats currently fishing on Georges Bank are going for swordfish. The fleet is highly versatile, fishing for whichever species is abundant and likely to bring a reasonably high price. Although 80 percent of the time the fishermen know what they are going to catch before they leave port, if the target species is not readily or apparently available, the fishermen will switch to a different species by changing nets to another mesh size.

Ethnic affiliation is not noteworthy; general American mix predominates. Any categorization tends to be geographic rather than ethnic; that is, people are identified as "Westsiders" if they come from Jerusalem.

Most fishermen come from fishing families, and youth continue to enter the industry. There are four families who are said to have been the founders of the industry in Point Judith and to whom many currently in the industry are related. Most are dedicated to fishing and would probably continue to fish as long as they could make their boat payments, regardless of whether or not the business was profitable by objective standards.

Educational level varies, though probably higher on the average than most other ports. Most fishermen are high school graduates, and perhaps 20 percent are college graduates. One captain was formerly a professor at the University of Rhode Island. Many of the fishermen have taken fisheries courses, and a number have gone through the University of Rhode Island's fisheries program.

Tourism and service industries are the only alternatives to fishing-related industries in Jerusalem. Galilee does have other industry. It is conceivable that alternative occupations could be found in Newport or Providence. Employment in Connecticut and Massachusetts would also be accessible, although inconvenient.

Income levels vary with the boat, year and species available. In an average year the captains of highliner boats probably make in the vicinity of $70,000 with their crews making around $30,000. Trip boats (non-highliners) average $30,000 to $35,000 per year for their captains; day boats average $25,000 to $28,000 for their captains; and crews make approximately $20,000.

Conflicts between commercial and recreational fishermen are not uncommon in the area, as there is competition for space and for berths. The major gear conflict, however, is between commercial dragging and commercial lobstering.

Portland, Maine

Portland, Maine, had 53.9 million pounds of fish worth $16 million landed in 1983. There are approximately 450 fishermen on 104 full-time finfish or offshore scallop boats berthed in Portland. This number includes 25 to 30 boats which use gillnets at times. Most of the 92 otter trawlers are in the small (44) to medium (35) range. Of the 12 scallopers, 6 are in the 5 to 50 ton range, 3 are in the 51 to 150 ton range, and 3 are over 150 tons. In addition there are about 150 lobster boats, many of which are berthed on the islands. Mixed variety of groundfish is caught year around by the larger boats. Gillnetters slow down in the winter, and those under 40 feet switch their gear depending upon the season. The latter fish for cod in the spring, hake or lobster in the summer, pollock in the fall, and inshore scallops in the winter.

The fishing industry is said to rank fifth or sixth in economic importance in Maine. In Portland, with a general population in 1980 of 61,572, about 1,000 to 1,500 people are employed in fishing or fishing-related industries. Among these are the 300 finfishermen, 200-300 lobstermen, 6 large processors employing 6 to 30 cutters each, and 10 fish markets employing 2 or 3 cutters each.

Ethnicity is mixed among fishermen, though Italians are perhaps predominant among fishing families. In the general population, 4.5 percent are foreign born and 6.3 percent speak a language other than English at home.

The educational level of the general population is fairly high (72.9 percent of adults over 25 are high school graduates and 19.4 percent have had at least 4 years of college). Among 16-19 year olds not in school, 15.3 percent are not high school graduates. No estimate of the educational level of fishermen was offered by those interviewed.

Tourism, insurance companies and law are the other major employers in Portland. Although many national insurance companies have their head offices located in Portland and the industry is the largest employer in the city, the educational level among fishermen is usually not sufficient for employment in insurance companies to be considered a realistic alternative occupation, nor would law provide opportunities. Tourism is important in the summer and could offer some opportunities. With an unemployment rate of 6.4 percent in 1979, Portland's median family income was $16,616, ranking third among the 6 ports. The per capita income was $6,416, ranking fourth among the ports.

Rockland, Maine

Rockland, Maine, had landings of 54.6 million pounds worth $12.3 million in 1983. At least 42 vessels, with 230 crew members, use Rockland as home port. Of these vessels, 34 are draggers with 175 fishermen (11 are in the 5-50 ton range, 12 are in the 51-150 ton range, and 11 are over 150 tons). Of the 8 scallopers, 3 are small, 4 are medium, and 1 is large. There are also 50 inshore draggers and 1,000 small lobster boats in the county. Rockland, population about 8,500, was formerly a great redfish port; but with the decline of the species and exclusion from Canadian waters, fishermen now round out their redfish catch with a variety of other groundfish species.

Thirteen redfish/groundfish boats (7 operated by one company and 5 or 6 operated by another) are berthed at Rockland. Six of the boats operated by the first company are 120 feet, one is 95 feet. The other company's boats range in size from 80 feet to 105 feet. Each of the boats has a crew of 6 men. Besides these groundfish boats, there are 5 carriers with small boats attached which fish for pogies. In 1983, 24 million pounds were caught, sold for fish meal and oil production. There are also 10 or 12 herring boats (25 to 50 feet) which use purse seines and are owned by the sardine plant. This is a seasonal fishery, generally lasting from July to October, with an occasional short season in February. Weirs are also used for herring, but in recent years the herring has stayed too far offshore to make weirs useful. In the surrounding county there are approximately 50 inshore boats and more than 1,000 lobster boats.

Although opinions vary, the local fishing industry may provide about half of the town's economic base. There are sardine plants which operate in summer and a few processing plants which work with imported frozen fish blocks. Non-fishing related industries include a cement plant, a snow plow manufacturer and an Irish moss plant. Unemployment is about the same as it is for the state as a whole, i.e., appoximately 8-10 percent in the offseason and 5 percent during the most active fishing season.

There is no dominant ethnic group. Only 1.8 percent of the population in 1979 was foreign born, and only 3.9 percent speak a language other than English at home. The educational level for the town as a whole is about high school (63.8 percent of adults over 25 are high school graduates and 9.5 percent have had 4 or more years of college), although fewer fishermen are thought to actually be graduates.

Incomes for successful, company fishermen are in the $50,000 to $100,000 range for captains and in the $40,000 to $60,000 range for crew members. Independent fishermen earn less money considering that they are responsible for boat mortgages and maintenance, but are thought to do "not badly." Sardine fishermen probably make 10 to 15 percent less than the company fishermen, and the day-trippers make 10 percent less than the sardine fishermen. In contrast, the incomes in the area for non-fishing related employment tend to be in the lower-middle range. The median family income in 1979 was $12,867 and per capita income was $5,389, ranking lowest among the 6 ports.

The 14 inch minimum size option for redfish could create problems for the companies for more than one reason. Both companies process small redfish imported from Canada which are used for lobster bait. The companies also rely on the redfish catch to fulfill their government contracts, and there is some fear that the 14 inch minimum size would reduce their catch too drastically.

Stonington, Maine

Stonington, Maine, is the home port for 13 to 18 full-time commercial boats with 70 to 90 full-time fishermen. Of the boats, 10 to 15 are trawlers, a couple are year-around scallopers and gillnetters, and there are three offshore lobster boats which change over to gillnetting, dragging or scalloping as their prospects change with the season. Another 150-200 inshore lobster boats, employing 200 to 400 fishermen on a part-time basis, also use Stonington as home port. November to April scalloping attracts the most effort, even among the trawlers.

Fishing and fishing-related industries provide well over half the economic base of Stonington. Besides fishing, a boat yard is the largest employer in the town of 2,500 inhabitants. Commercial Fisheries News is the second largest employer. In addition, there is some tourism and a summer resident community with related service jobs. Quarrying, which provided the original economic base of the community, has recently resumed.

There is a strong attachment to Stonington as a community, and islanders would not leave to find fishing jobs elsewhere if they could find other employment. There is no dominant ethnic group, and most of the young fishermen have a high school education.

Fisheries management is regarded ambivalently in the community. Fishermen do not want interference with their operation, especially with regard to their option to shift gear as needed. As rules were promulgated, most fishermen intended to obey the regulations; however, it soon became evident that there would be no enforcement, confidence was eroded and the view that "everyone else was cheating" created a domino effect. The lack of enforcement of the scallop meat count was particularly bad for morale.

Stonington, Connecticut

Stonington, Connecticut, serves as the landing port for 20 to 25 boats, a dozen of which are resident, another dozen transient. In addition, there are about a 100 people who fish seasonally for winter flounder from a variety of boats and skiffs. Yellowtail, mixed flounder (especially in winter), squid, whiting, hakes, and cod are all caught by the fleet. Lobstering, however, dominates the fishing scene, with 95% of the fishermen considered lobstermen. In the last year and a half there has been some controversy between trawler fishermen who began to drag for lobsters and the lobster-pot fishermen. Other shellfishing, oysters and clams in particular, was historically significant and is still practiced.

Boats are owner-operated, and there is no corporate or blind ownership. Few of the boats fish in the large mesh area, although 4 or 5 boats are 65 feet to 85 feet and do occasionally go to Georges Banks for cod if the weather and prices are sufficiently favorable. Most of the catch is sold in Connecticut retail markets; perhaps a quarter of the catch goes to Fulton market in New York.

Ethnicity is not a major factor in Connecticut fisheries. About half of the fishermen claim no specific ethnic ancestry; the other half claim Portuguese descent, but do not form an ethnic community. In the general population of 16,220, 7 percent are foreign born and 9.8 percent speak a language other than English at home.

The educational level among fishermen is thought to be about high school. The general population is well-educated (71.3 percent of those over 25 are high school graduates and 19.2 percent have had 4 or more years of college). Only 9.2 percent of 16-19 year olds are not in school and not high school graduates.

Given the small size of the fishing fleet in Connecticut, fishing might itself be considered alternative employment to the majority of employees who work for industries dependent on defense work. The major employers in the area are General Dynamics (10,000 employees), United Tech, and the U.S. Navy. There are related support services, plus some high tech and light manufacturing. There is also some tourism along the coast. Areas away from the coast serve as bedroom communities for New York city workers. Incomes in the general population are high. In 1979 the median family income was $21,947, and per capita income was $8,330, ranking highest of the 6 ports.

§3E3 Fishing and Processing Employment by State

According to National Marine Fisheries Service statisticians, in 1984, Massachusetts dominated the industry in the New England region with 3,197 fishermen employed on 638 vessels over 5 tons rigged with otter trawls and 1,519 fishermen on 163 scallopers. Medium-size vessels predominate in the finfish industry (313 vessels carrying 1,793 fishermen are in the 51-150 ton class, but 234 draggers are in the 5-50 ton class carrying 705 fishermen). Ninety-one vessels with 699 crew members are in the over 150 ton class. Boats rigged with scallop gear tend to be larger (86 are in the over 150 ton class with 864 crew members, 70 are in the 51-150 ton range carrying 596 crew members, and 17 are in the 5-50 ton class with 59 crew members).

Rhode Island ranked second to Massachusetts with 930 fishermen on 202 otter trawl rigged vessels and 213 fishermen on 26 scallopers. As in Massachusetts, the medium-sized otter trawl rigged boat predominates with 130 in the 51-150 ton class carrying 649 fishermen. Forty-eight boats with 123 fishermen are in the 5-50 ton class and 24 boats with 158 fishermen are in the over 150 ton class. Unlike Massachusetts, the medium range scalloper is more common than the large in Rhode Island (18 vessels with 135 fishermen are in the 51-150 ton range, 7 boats with 76 crew members are over 150 tons, and 1 boat with 2 fishermen are in the 5-50 ton range).

Maine had 803 fishermen on 229 otter trawl boats in 1984 and 140 fishermen on 19 scallopers. A majority of the otter trawls are small (147 vessels with 345 crew members are in the 5-50 ton range). Fifty-nine boats with 277 crew members are in the 51-150 ton class and 23 vessels with 180 fishermen are over 150 tons. There are also more small scallopers than large ones in Maine (9 with 46 fishermen are in the 5-50 ton range; 6 with 52 crew members in the 51-150 ton range and 4 with 42 crew members are over 150 tons).

Massachusetts also dominates the processing industry with 101 plants employing 5,002 seasonally and 4,141 all year. Maine follows with 80 plants which employ 3,205 seasonally and 1,988 annually. Rhode Island has 30 fishery processing plants which employ 661 seasonally and 553 all year. New Hampshire's 10 plants employ 402 seasonally and 318 all year. Connecticut has 3 plants with 83 seasonal workers and 69 all year.

Out of 118 plants producing canned fish products, industrial fish products and fish fillets and steaks in 1984, New England had 97 plants producing fish fillets and steaks, the largest number of such plants in the nation. Of these 97 plants, 53 were in Massachusetts, thus ranking the state third in the nation behind Washington (81) and Alaska (76).

Since unemployment rates in a community indicate, in a very general way, the availability of work and thus the potential for alternative occupations, these rates have been noted for specific ports when the information is available. The 1980 census data indicates that Maine had the highest unemployment rate in New England at 7.7 percent among the general population and 9.8 percent among blue collar workers. Rhode Island had the second highest with 7.2 percent among the general population and 8.2 percent among blue collar workers. Connecticut followed with 5.9 percent and 7.3 percent respectively. Massachusetts had 5.6 percent and 7.5 percent unemployment, and New Hampshire had the lowest rates with 4.7 percent generally and 6.4 percent among blue collar workers.

SUBPART F: EXISTING MANAGEMENT ENVIRONMENT

§3F1 State Programs

Coordination with State and Local Statutes

The Council recognizes that the States' current regulatory regime may not be entirely consistent with certain provisions of this FMP, most particularly as those relate to minimum fish sizes. The specified minimum fish sizes in this FMP (see §7B1) were chosen with due consideration for the selection characteristics of the specified minimum mesh sizes and with the intent of discouraging fishing effort and fishing mortality on concentrations of juvenile fish, thus contributing to achievement of the plan objectives. The Council, however, is also cognizant of the fact that fish in coastal populations of certain of the regulated species (e.g. winter flounder) may, particularly in the more southerly waters, reach maturity at a smaller relative size thus lending support for existing relatively smaller regulated minimum fish sizes in those areas. Notwithstanding certain demonstrable variability in the size at maturity of the regulated species, the Council is concerned that the overall management program, in its application to the groundfish resources in the FCZ, not be jeopardized.

The Council believes the inconsistencies which may exist between the management program specified in this FMP and the regulatory regime currently in effect within the States may be resolved. This may be accomplished if vessel owners or operators are made to understand that as a condition of obtaining a permit to operate in the multi-species finfish fishery, their entire catch and all pertinent fishing gear will be subject to regulations implementing the management program specified in this FMP regardless of whether fishing takes place in the FCZ or the territorial sea. Coincidentally, all such fishing, catch, and gear will remain subject to any applicable State or local regulations. Where differences exist in the regulatory requirements, any vessel permitted to fish in the FCZ must comply with the more restrictive measure.

State Regulations

The species covered under this FMP are distributed within most of the New England and Mid-Atlantic states' territorial waters as well as within the FCZ. The management unit is considered to include the regulated species when they occur within the states' waters as well; and the management policies, measures and recommendations contained in the plan are appropriate for application in state waters. Therefore, the coordination of the states' policies toward the species contained within this plan is important to the implementation of an effective and sound regional multi-species management policy.

Massachusetts

Closed Areas:

A 1983 regulation provides a mechanism whereby the Director, with approval of the Marine Fisheries Advisory Commission, can close areas with high concentrations of fixed gear and/or molted lobsters. These closures, when enacted, will prevent gear conflicts between draggers and lobster pots, especially at night, and will protect soft lobsters susceptible to damage by mobile fishing gear.

Minimum Fish Sizes:

Summer Flounder	14 inches	Witch Flounder	12 inches
Yellowtail Flounder	11 inches	Winter Flounder	11 inches
Atlantic Salmon	15 inches	Eel	4 inches
Coho Salmon	15 inches	Striped Bass	24 inches
American Dab	12 inches	Haddock: Commercial	17 inches
Cod: Commercial	17 inches	Recreational	15 inches
Recreational	15 inches		

Mesh Sizes:

No mesh size regulations exist for trawls or gillnets used for the taking of groundfish with the exception of permitted gear in estuaries, embayments, salt ponds, tidal creeks or rivers.

The use of any type of net inside 70 estuaries, embayments, salt ponds, tidal creeks or rivers is prohibited in the State of Massachusetts. Nets can only be fished if a special permit is obtained from the Division of Marine Fisheries. If nets are 200 feet or less and are used to catch bait fish, no restriction applies (unless prohibited by a special act or regulation).

Use of gillnets for taking groundfish is not as restricted as use of trawls. Gillnetting for groundfish is allowed anywhere in state waters with the exception of Buzzard's Bay and Boston Harbor and the 70 defined estuaries, embayments, salt ponds, tidal creeks or rivers, where a special permit is required with conditions (i.e., mesh sizes and closed seasons). In addition, area/season closures do not pertain to gillnetting for groundfish.

<u>Connecticut</u>

Statutes in the State of Connecticut: (1) authorize the licensing of commercial fishermen; (2) prohibit trawling of any type inside the mouths of estuaries (pertinent to winter flounder as well as all other species); (3) require submission of catch reports by commercial fishermen (including trawlers); and (4) grant regulatory authority to the Commissioner of Environmental Protection over finfishing (sport and commercial).

Minimum Fish Sizes - Commercial:

Cod	17 inches
Haddock	17 inches
Yellowtail Flounder	11 inches
Winter Flounder	10 inches
Fluke	14 inches

Minimum Fish Sizes - Recreational:

Cod	15 inches
Haddock	15 inches
Yellowtail Flounder	11 inches
Winter Flounder	8 inches (10 inches as of January 1, 1985)
Fluke	14 inches

Mesh Sizes:

Gillnets must be 3 inches or more stretched measure.

Other regulations that also exist in the State of Connecticut:

Pound nets must be set at least one mile apart.

Prohibit landing an amount of a species managed by an FMP in excess of the amount specified in the plan, or the amount allowed by an adjacent state's regulations promulgated in support of the FMP, whichever is the greater amount.

<u>New Hampshire</u>

Minimum Fish Sizes - Commercial:

Cod	17 inches
Haddock	17 inches
Winter Flounder	11 inches

Minimum Fish Sizes - Recreational:

Cod	15 inches
Haddock	15 inches
Winter Flounder	11 inches

Mesh Sizes:

The taking, transporting or possessing of cod, haddock and yellowtail flounder shall be prohibited on board any boat rigged for gillnetting with any net with a mesh opening of less than 5-1/2 inches stretched mesh.

The taking, transporting or possessing of cod, haddock and yellowtail flounder (groundfish) shall be prohibited on board any boat rigged for mobile gear, including but not limited to, purse seine, Scottish seine, beam trawl, midwater trawl, otter trawl, pair trawl, or drag seine in any form with a mesh opening less than 5-1/2 inches stretched mesh.

Other regulations that also exist in the State of New Hampshire:

It shall be required of anyone taking crustaceans or finfish to identify all pots, traps or nets left unattended in the following manner:

1. All fixed gear shall have the name of the owner permanently affixed.

High flyer buoys, as customarily used on longline gear, shall be marked with the name of the owner;

2. Pot or trap trawls shall be marked with a single buoy made of highly visible material;

3. Gillnets and longline sets 6,000 feet or less shall be buoyed on each end to support a vertical shaft at least 5 feet high with a radar reflector of at least 100 square inches reflective area;

4. Flags and pennants affixed to buoys marking a string of gear as required by this section shall be of uniform color.

Any person who possesses a permit shall submit a report to the executive director by the 10th of each month for the month previous, whether or not fishing occurred. Said report shall contain the following information on a daily basis:

a. Precise area of fishing activity;

b. Number of gear units fished;

c. Hours or days gear was fished;

d. Size of gear;

e. Number of pounds by species of fish landed and/or discarded;

f. Month;

g. Signature of permittee.

Maine

Minimum Fish Sizes - Commercial:

Cod	17 inches
Haddock	17 inches
Yellowtail Flounder	11 inches

Minimum Fish Sizes - Recreational:

Cod	15 inches
Haddock	15 inches
Yellowtail Flounder	11 inches

Mesh Sizes:

In Maine territorial waters west of a line beginning where the shore intersects 69°20'W and ending where 69°20' intersects the outer limit of Maine territorial waters, vessels using otter trawls, pair trawls, beam trawls, Scottish seines, mid-water trawls or any other gear specified by the Regional

Director of the Northeast Region, National Marine Fisheries Service, must use nets having cod ends with a mesh of at least 5-1/2 inches, unless such vessels are exempted under the provisions of the optional settlement program. Vessels using gillnets within the area specified above must use nets having mesh of at least 5-1/2 inches.

Other regulations that also exist in the State of Maine:

Optional Settlement Program - A fisherman engaged in fishing with an otter trawl, pair trawl, beam trawl, Scottish seine, mid-water trawl or any other gear specified by the Regional Director of the Northeast Region, National Marine Fisheries Service, for silver hake, red hake, redfish, squid, northern shrimp, herring, mackerel, dogfish or any other species that the Regional Director shall specify as legitimately taken with small mesh gear, may register with the Regional Director his intent to fish for the above species for a specified period of time. During that period he may use mesh smaller than the legal size, provided that at least 50 percent of his total catch by round weight for the specified period consists of the above species and that no more than 15 percent (or any other percentage specified by the Regional Director) of his total catch by weight, consists of groundfish.

Documentation - Anyone engaged in fishing under the optional settlement program will be required to keep a record of his catch by species and by weight and surrender such a record to the National Marine Fisheries Service upon completion of the declared period. Documentation shall be submitted on NOAA form 88-153 or other forms specified by the National Marine Fisheries Service.

Fishing for Groundfish in the Optional Settlement Program - During the time he is in the optional settlement program, a fisherman may have his groundfish catch exempted from the 15 percent maximum catch limit set forth in the optional settlement program outlined above, if the fisherman complies with the following requirements:

a. The fisherman shall call the Chief of Marine Patrol, Department of Marine Resources, during normal business hours and give his name, the vessel name, permit number and state that he is in the optional settlement program and will fish with only the regular mesh described above for a specified number of days;

b. The fisherman shall, during the period specified above, have only the regulation mesh size described above on board between the time he leaves the dock and returns; and

c. The fisherman shall at the end of his optional settlement period, request that the Department send to the Regional Director a certification of the time period during which the fisherman should be exempted from optional settlement restrictions.

Department Records - The Department shall maintain a log of all optional settlement exemption requests from fishermen and send written confirmation of the requests to the requesting fishermen as soon as possible. The Department shall maintain a current list of fishermen exempted from optional settlement requirements. Names will be removed automatically from this list at the end of the exemption time period requested by the fisherman, unless the fisherman contacts the Department to request a modified exemption time period.

Enforcement - The Department periodically shall board vessels participating in the optional settlement program in order to ensure compliance with these regulations.

Rhode Island

Minimum Fish Sizes - Commercial:

Cod	17 inches Fork Length
Haddock	17 inches Fork Length
Yellowtail Flounder	11 inches Fork Length

Minimum Fish Sizes - Recreational:

Cod	15 inches Fork Length
Haddock	15 inches Fork Length
Yellowtail Flounder	11 inches Fork Length

Other regulations that also exist in the State of Rhode Island:

General State Marking, Setting and Tending - It shall be illegal to set, haul and/or maintain a gillnet within one-half mile of the Rhode Island coast which does not adhere to the following specifications:

1. Length: A single net or series of nets may not exceed maximum total length of six hundred feet.

2. Setting Pattern: All gillnets must be set perpendicular to the shore or nearest shore structure. Gillnets must be set in a straight line. Hook backs may not exceed one hundred feet from the seaward end of the gillnet.

3. Tending Requirements: Each gillnet set within the territorial waters of the State of Rhode Island must be hauled once each day (24 hour period).

4. Identification Requirements: It is illegal to set, haul or maintain a gillnet in the territorial waters of Rhode Island which is not clearly marked (buoys or netting) with the owner's/operator's name and/or commercial license number.

5. Distance from Fish Traps: It shall be illegal to set, haul or maintain a gillnet within 3,000 feet of a fish trap licensed by the Rhode Island Department of Environmental Management.

6. Marking Requirements: With the exception of a size one bait gillnet, the near shore end of all gillnets must be marked with a fluorescent

orange float with a minimum diameter of 10 inches. The offshore end of a gillnet must be marked with a fluorescent orange float with a minimum diameter of 20 inches. The midpoint and/or a hook back must also be marked with one fluorescent orange float.

§3F2 Canadian Management Program

Closed Areas

Each year from March 1 to June 1, haddock spawning areas are closed on Georges Bank and Browns Bank, a measure which both the U.S. and Canada have accepted since the early 1970's. Both countries have adhered to and patrolled these areas until the recent boundary decision reached by the World Court. The Canadians still consider the spawning closures an integral part of the management strategy for these areas.

Minimum Fish Sizes

There are no regulations for minimum fish sizes contained in Canada's 1984 Atlantic Groundfish Management Plan. Rather, they have introduced a much broader control of trying to encourage and counsel fishermen to fish for a more marketable (larger) fish.

Mesh Size

Although the present Canadian minimum mesh size regulation for groundfish is 5-1/8 inches, fishermen often use larger size mesh (6 inches), on an entirely voluntary basis, in order to cut down catch rates of cod on the Grand Banks in the wintertime, and in an attempt to generally increase the quality of fish caught.

Part 4

PART 4: THE MANAGEMENT UNIT

§4.1 Focus of Fishery Management

Truly effective management of the Northeast Region's multi-species finfish fishery requires that both the individual biological needs of numerous co-distributed stocks and the needs of an industry comprised of sectors with distinct resource dependencies and diverse fishing practices be simultaneously understood and addressed. This has been a longstanding goal of the New England Council, and a major accomplishment of the Interim Groundfish FMP has been to provide the opportunity to acquire the best data and information possible on the multi-species fishery absent major regulatory influence.

From a resource perspective and consistent with the Magnuson Act, the establishment of the fishery management unit requires consideration of two major factors: that to the extent practicable an individual stock of fish be managed as a unit throughout its range and that interrelated stocks be managed in close coordination. Further, the basis for selection of the management unit first involves consideration of the goals of the management program, and then focus is directed at the biologic, economic, geographic and other technical or social factors that compel the final decision.

The Management Policy presented in §1.2, which expresses the fundamental goals and values of this management program, sets forth two basic principles for management:

1) allow the multi-species fishery to operate and evolve with minimum regulatory intervention; and

2) adopt initial measures to prevent stocks from reaching minimum abundance levels (or stock conditions).

Consequently, the policy requires that the management program focus on the entire northeast multi-species finfish fishery (i.e., the combination of vessels and stocks), and be sensitive to unnecessary curtailment of fishing options within the overall fishery. This mandate necessitates an awareness that the character of the multi-species finfish fishery varies greatly among the Gulf of Maine, Georges Bank and Southern New England areas. The fishery encompasses many industry groups, stocks and patterns of fishing. A number of relatively unique sectors within the overall multi-species fishery can be identified and managed somewhat independently as "industry-resource systems." Characteristics which allow the identification of fishery sectors include:

- the species that are involved in the sector;
- the mode of fishing as it relates to gear, mesh, trip length or type, etc.;
- the similarity or lack thereof in the biological characteristics of the species taken in the sector, such as the size at maturity or the size at maximum yield per recruit;

- the effectiveness of certain kinds of management measures given the characteristics of the species involved and the consideration to not disrupt other fisheries within the overall fishery.

The fact that sectors within the overall multi-species finfish fishery can be identified provides managers with the opportunity to tailor the management program according to what is feasible and what will work best within individual sectors or across sectors.

§4.2 Definition of the Management Unit

Given the policy of this FMP and with full consideration of biologic, economic and other technical factors discussed in Parts 2 and 3 of this FMP, including the existence of functional sectors within the overall multi-species fisheries, the Council establishes the fishery management unit detailed below.

Management Unit

The management unit is the multi-species (finfish) fishery that occurs from Eastern Maine through Southern New England, encompassing all commercial and recreational harvesting sectors in New England and all fish species that factor into a fishery within a trip, from trip to trip and from season to season, except those species that are subject to other fishery management plans under the Magnuson Fishery Conservation and Management Act.

Multi-species fisheries management is inherently comprehensive in its scope and, consequently, cooperation from all relevant entities (state, regional, federal) is essential for effective achievement of this program's management objectives. Particular measures designed for the fishery (or sector thereof), which may require species regulations for one or more species of mutual interest to the Mid-Atlantic Council shall be determined in consultation with the Mid-Atlantic Council. It is necessary that each species specifically regulated under this FMP shall be regulated throughout its range.

Major species within the fishery that may be subject to specific regulation under this FMP include:

Cod (*Gadus morhua*)
Pollock (*Pollachius virens*)
Yellowtail Flounder (*Limanda ferruginea*)
Redfish (*Sebastes marinus*)
Haddock (*Melanogrammus aeglefinus*)
Witch Flounder (*Glyptocephalus cynoglossus*)
Winter Flounder (*Pseudopleuronectes americanus*)
White Hake (*Urophcis tenuis*)
American Plaice (*Hippoglossoides platessoides*)
Windowpane Flounder (*Lophopsetta omarulata*)

This listing is not exclusive. As conditions in the fishery change, other species may assume sufficient importance to also necessitate management measures and regulations directed specifically at such species. For example, species such as wolffish or cusk may at some future time require respecification of the management objectives under one or both of the criteria detailed in §6.3. The Councils intention is that species regulations for any and all species involved in the Northeast multi-species fishery will be possible when determined necessary under the criteria of §6.3 and in accordance with the continuing management/framework procedures specified in §7B4. An absolute listing of all species for which regulations may, at some time in the future, be necessary is not practical while the need for such flexibility is real given the multi-species approach, changing market circumstances, and other industry and fishery developments. This stated intention to establish flexibility within the management unit is qualified by the following exception.

Other species currently subject to regulation under other FMPs or for which FMPs may be under development, that will be considered when establishing management regulations for the fishery (or sector thereof), but will not be specifically regulated under this FMP, without a formal amendment, include:

Bluefish	Scallops
Butterfish	Sea Herring
Lobster	Squid
Mackerel	Summer Flounder
Red Hake	Tilefish
Scup	Weakfish
Sea Bass	River Herring
Shad	Dogfish
Silver Hake	Northern Shrimp
Striped Bass	

§4.3 Relationship to Other Federal Management Plans

Fisheries in the geographic areas covered by this Plan, which are currently under regulation by other fishery management plans include Atlantic Sea Scallops, Surf Clams and Ocean Quahogs, American Lobster, and Squid, Mackerel and Butterfish. Fishermen fishing for the species contained in this Plan are subject to these other plans if their activities are likely to result in the harvest of any of these other species. Similarly, fishing for any of these other species may subject a fisherman to the provisions of this Plan if his activities are likely to result in the harvest of species contained in this Plan.

Interim Groundfish Fishery Management Plan

The Interim Groundfish Fishery Management Plan was implemented on March 31, 1982, and currently regulates the fisheries for cod, haddock and yellowtail flounder. Regulations implementing the Interim Plan are scheduled to expire on April 15, 1985, but will likely be extended by the Secretary pending regulations implementing the Northeast Multi-Species FMP.

Preliminary Management Plans

Preliminary management plans (PMP's), developed and implemented by the Secretary of Commerce, permit foreign nations to fish in the fishery conservation zone (FCZ) in the absence of FMP's and remain in effect until replaced by approved fishery management plans developed by Regional Fishery Management Councils. A PMP must describe the fishery, provide a preliminary estimate of the optimum yield (OY), and determine the total allowable level of foreign fishing (TALFF), if any. In addition, PMP's contain permit requirements for foreign fishing vessels, as well as data reporting procedures. Regulations implementing PMP's do not affect domestic fishermen.

PMP for the Hake Fisheries of the Northwest Atlantic

Since 1977 this PMP has established the total allowable level of foreign fishing for both silver hake (whiting) and red hake. Amendments to this PMP since 1979 have reduced the levels of foreign fishing in recognition of the expansion of the domestic fishery. Although silver hake and red hake are integral and important components of the northeast mixed species fishery, the Council has decided that they should be managed under the existing PMP until domestic harvesting capacity (DAH) equals the accepted biological catch (ABC). At that time they will be added to the multi-species management unit through a regular plan amendment.

PMP for the Foreign Trawl Fisheries of the Northwestern Atlantic

The harvesting and retention of other finfish (other than finfish regulated under an FMP or PMP) caught incidentally by the foreign trawl fisheries in the Northwest Atlantic are regulated by this PMP. The other finfish group includes some 60 finfish species for which individual species assessments are either unavailable or are available only in preliminary form.

Currently, none of the species included in this other finfish category have been identified (§4.2) for specific regulation under the Northeast Multi-Species FMP. However, it is anticipated that this condition may change and that, as mentioned in §4.2, species such as wolffish, cusk and others may become important and require management attention under the Northeast Region Multi-Species FMP. Therefore, the Council's intention is that specific regulations for species currently included under the other finfish category of this PMP, with the exception of those finfish specifically excluded from management by §4.2 of this FMP, will be possible when determined necessary under the criteria of §6.3 and in accordance with the framework procedures specified in §7B4.

Part 5

§5.1 Conceptual Guidance

The policy statement, articulated by the Council as the overall management philosophy for the multispecies fishery, is concerned with promoting the continuation of sufficient spawning potential to preserve the multispecies character of the resource. One of the major strengths of the New England multi-species fishery is the diversity of important species which comprise the resource. The task of fishery management is to preserve that mixture of species at sufficient abundances possessing an adequate reproductive potential such that the capacity of the resource to recover from unfavorable circumstances may not be jeopardized. A responsive pursuit of that task may be expected to result in a long-term average optimum yield from the fishery which approaches, to the extent possible within the context of the multispecies character of the fishery, the maximum sustainable yield. It should be recognized, however, that the multispecies nature of the fishery may impose the necessity to manage certain minor components of the resource at less than optimal conditions in favor of the more economically important species.

Management efforts intended to assure sufficient spawning potential within the multispecies resource by preserving an adequate spawning stock are mediated through appropriate adjustment of the age at entry to the fishery and the fishing mortality rate. It is inappropriate to judge the adequacy of current or projected levels of spawning stock on the basis of a comparison with previously established minimum spawning stock constraints. The definition of a minimum acceptable spawning stock biomass may depend upon the long-range goals of management and the degree to which future stock sizes may be expected to be influenced by the management program designed to achieve those goals. Although the concept of a minimum acceptable spawning stock size may appear valid when viewed in the context of the management objective it may also be a conceptual trap which demands a wealth of largely unavailable information for proper evaluation. The imprecise nature of the stock-recruitment relationship among marine species demands a long-term view of that relationship in any application to fishery management. The very existence, however, of specified minimum stock size constraints may obligate fishery managers to adhere to those constraints on an annual basis, but such may incur unnecessary costs to the fishing industry.

The spawning potential of a stock of fish may be most appropriately assessed on the basis of the total fecundity of that stock under the prevailing conditions of mortality and age structure. Such a calculation is a relatively straight-forward biological problem. The maximum possible spawning potential is obviously embodied within the virgin stock (ie., the stock which existed prior to any fishing). Spawning potential should not be confused with recruitment. Recruitment is a highly variable parameter, but on the average, tends to be maximized at some intermediate stock level.

To maintain a constant stock size in the virgin condition, the required level of recruitment need only be high enough to replace individuals lost from natural mortality. With the introduction of additional mortality from fishing, more recruits are needed to replace total losses. But, at any constant level of fishing mortality, the stock size tends to stabilize at a lower level, relative to the virgin condition, since the stock can only partially compensate for the additional mortality.

As fishing mortality incrementally increases, the stock size will tend to stabilize at successively lower levels. But, with such a trend, the total fecundity of the stock becomes more and more concentrated in the younger age groups. Thus total fecundity (and subsequent average recruitment) is increasingly dependent upon the strength of recently recruiting year classes. Under all conditions, recruitment may be expected to exhibit fluctuations, but continued increases in fishing mortality will tend to reinforce that variability, finally leading to an unstable situation which jeopardizes the capacity of the stock to quickly recover from unfavorable circumstances.

§5.2 Current Stock Biomass

Two major considerations for guiding the design of the management program for econmically important species within the multi-species complex are the current status of the spawning stocks and the current trends in the stock sizes (i.e., whether the stocks are increasing, decreasing, or stable due to recent recruitment.

Graphic presentation of information concerning the current condition of important stocks appears in Figures 5.1-5.3. The individual bar graphs represent the range in the relative total stock size, by species, based upon a variety of assessment information typically spanning a period of about 20 years. The "preferred zone" delimits the range, with the year of observation, when the stock was not exhibiting obvious symptoms of recruitment overfishing. Relative total stock sizes at lesser levels have been variously categorized, "warning zone" or "danger zone" to denote zones of risk with respect to recruitment overfishing. Superimposed on each bar graph is a symbol indicating the current estimated total stock level which also depicts the current trend which is expected in the immediate future.

A variety of stock assessment data form the basis for Figures 5.1-5.3, ranging from relative abundance indices derived from research vessel survey results to fully developed stock assessments based upon virtual population analysis. Where a significant wealth of information is available relating stock and recruitment, such as in the case of haddock, a more precise definition of zones of risk is possible. In other cases, such as gray sole (witch flounder), the "preferred zone" simply represents the range of relative stock sizes which have been observed in the historic fishery. Any stock size at a lower level has been arbitrarily designated, "warning zone".

The following is a brief discussion of stock parameters for those species where assessment information is available and which have been illustrated in Figures 5.1-5.3. We may remind the reader that pertinent data were presented in Table 2A6.

As shown in Figure 5.1, the abundance of the Gulf of Maine cod stock is currently stabilized at near the highest level seen (1964) in the historic fishery. Similarily, the Georges Bank cod stock (Figure 5.2) is stabilized at a level only slightly less than was seen in 1978. In spite of high levels of fishing mortality (which is a source of concern since Fs currently range 0.6-0.8, substantially higher than F-max), all US stocks of cod appear to be very healthy as a result of a succession of good recruiting year classes, probably as a consequence of favorable environmental factors.

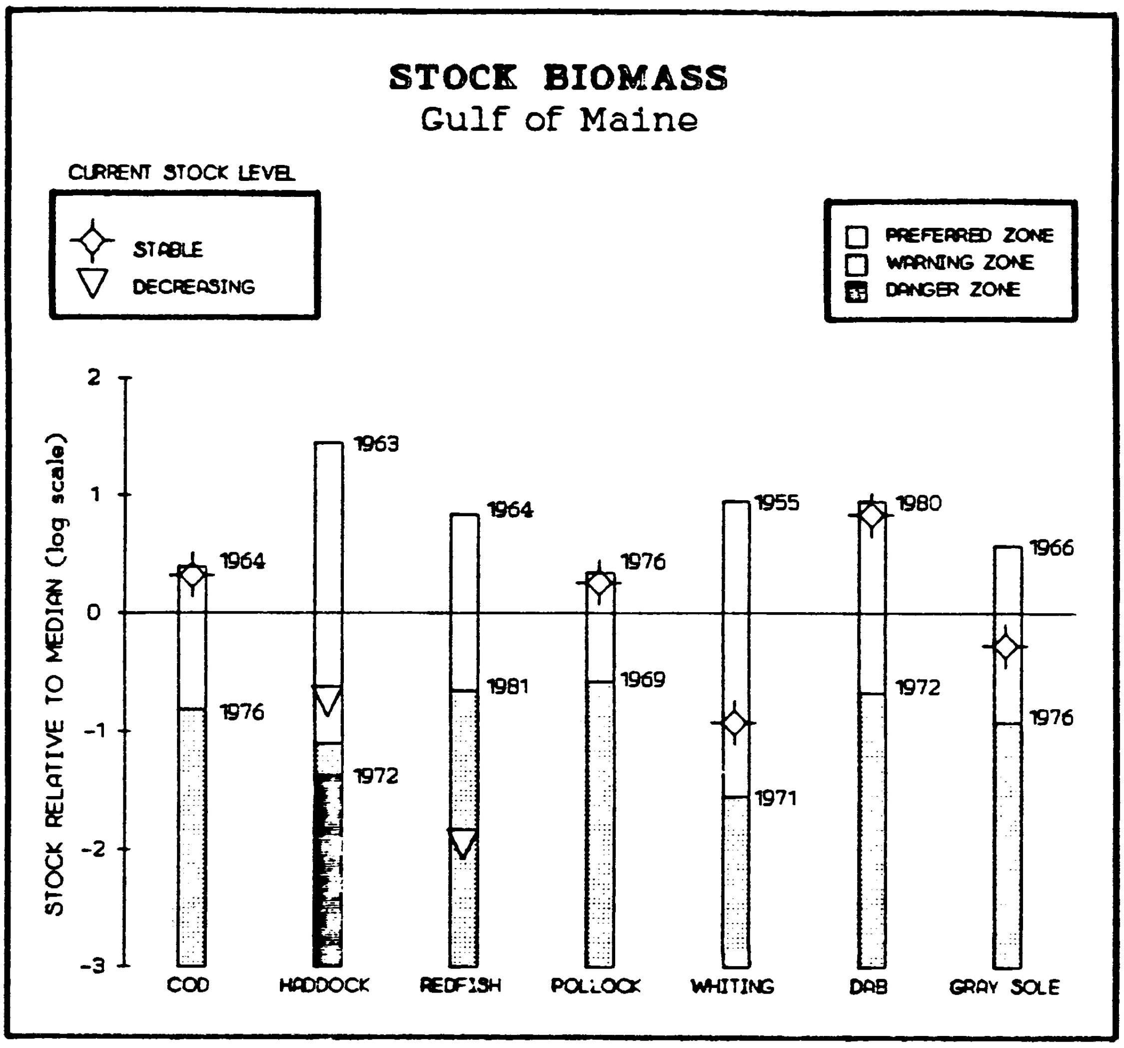


Figure 5.1. Total relative stock biomass for selected Gulf of Maine species. Histograms depict the range about the median preferred total stock biomass with the year of observation for the highest and lowest level seen - ie., the "preferred zone". Lower levels of stock size are depicted as either a "warning zone" or, where sufficient stock-recruit data are available, as a "danger zone" where there exists the risk of recruitment overfishing. The current stock level, together with an indication of whether it is increasing, decreasing, or presently stabilized, is superimposed on each histogram. Note that the vertical axis is a logarithmic scale.

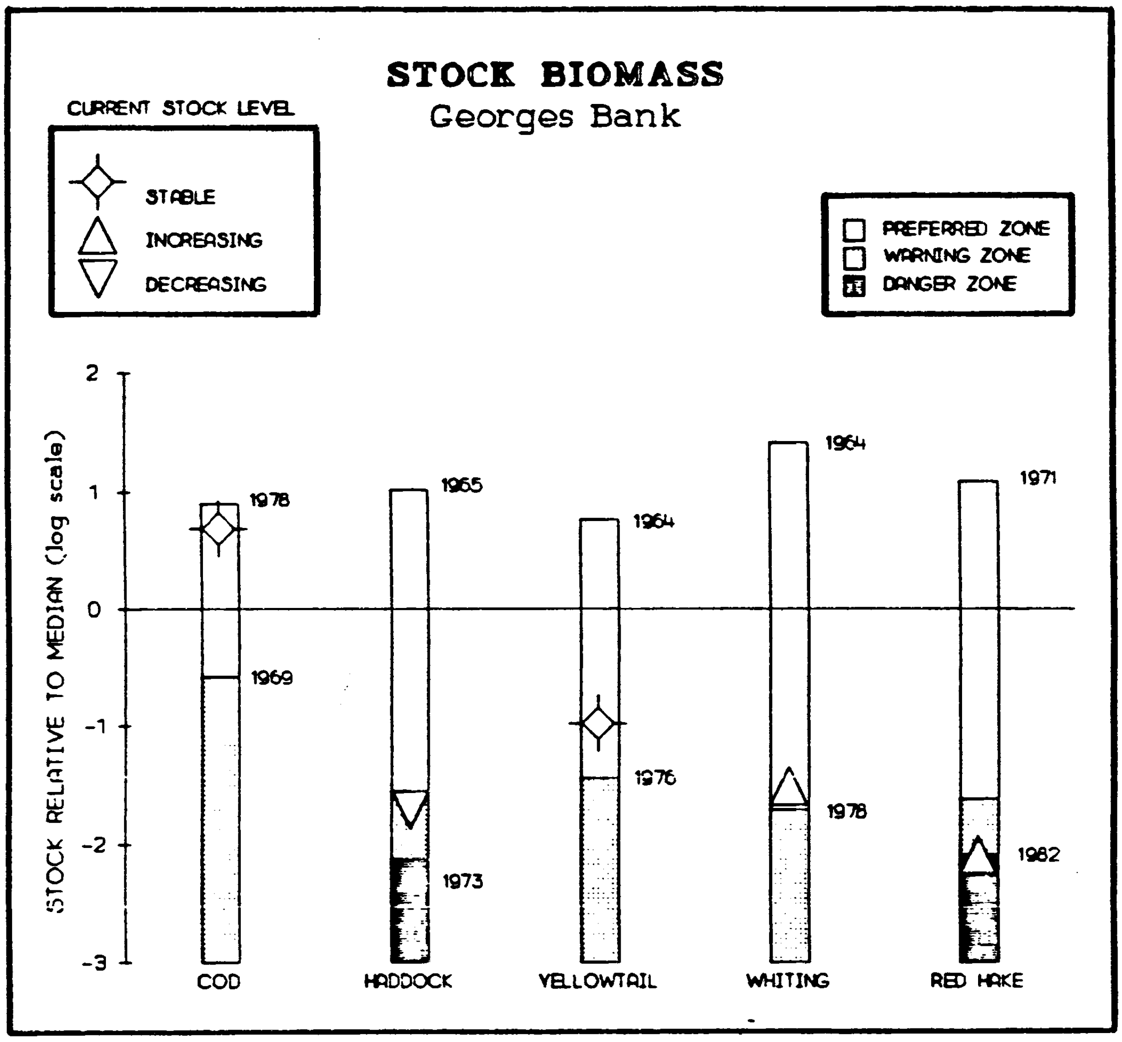


Figure 5.2. Total relative stock biomass for selected Georges Bank species. Explanation same as for Figure 5.1.

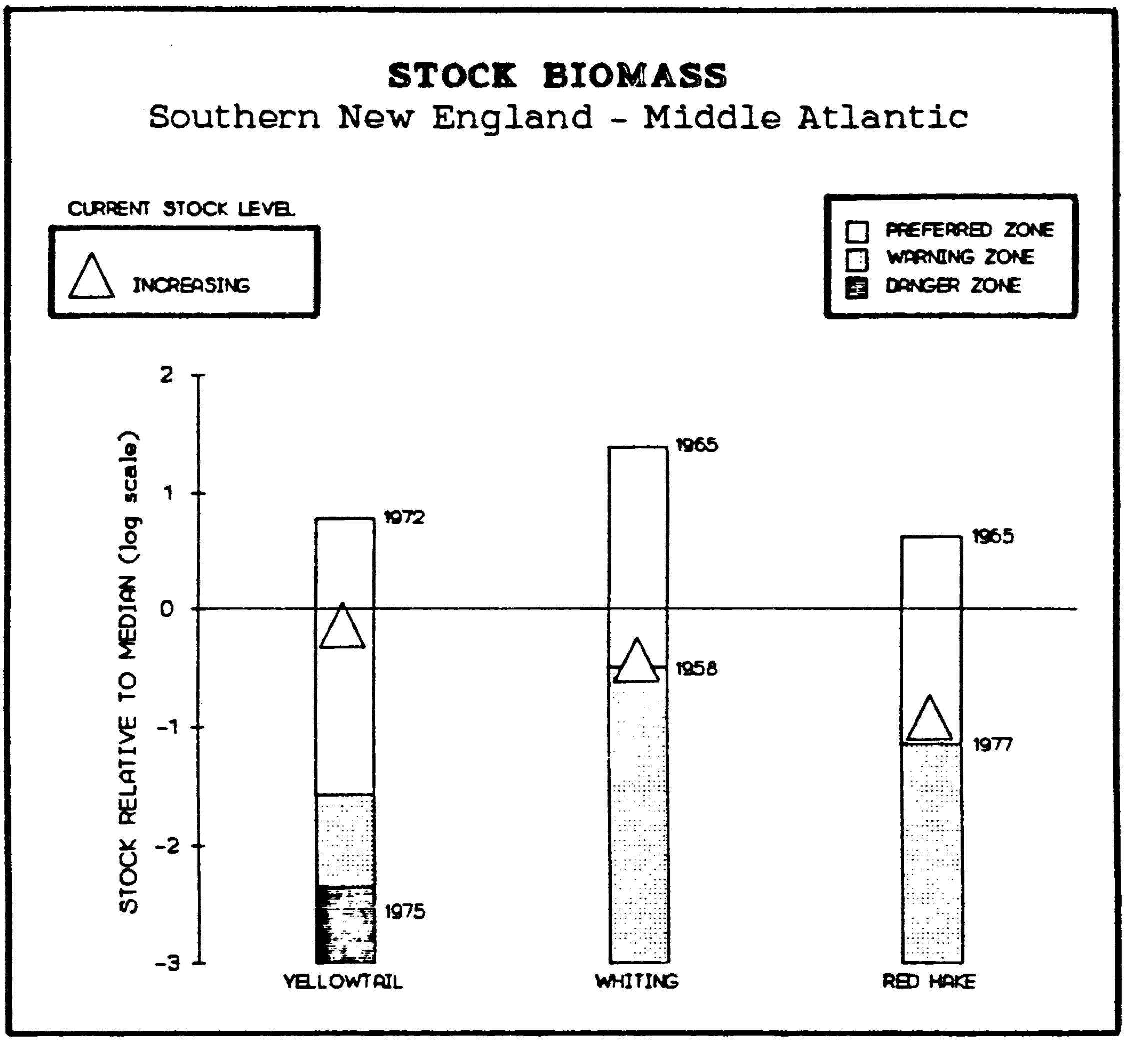


Figure 5.3. Total relative stock biomass for selected Southern New England - Middle Atlantic species. Explanation same as for Figure 5.1.

By contrast, all US stocks of haddock are currently in decline. The Gulf of Maine haddock stock size (Figure 5.1) is currently approaching a level which may incur the risk of recruitment overfishing, particularily with further increases in the fishing mortality which is already too high (higher than F-max). The current level of the Georges Bank haddock stock (Figure 5.2) is also low and continues to decline as a result of insignificant recruitment and high fishing mortality rates. In the short-term, the efficacy of any management action intended to rebuild the Georges Bank stock may be problematic. In the long-term, stock rebuilding will probably be contingent upon the appearance of extraordinarily strong recruitment, an event which has occurred in the past about once in every decade. Given the appearance of strong recruiting year classes, an effective strategy of stock rebuilding should include sharp reductions in mortality of juvenile fish relative to that which was imposed in past such events (for example, the 1975 and 1978 year classes). The probability that future, strong recruiting year classes may occur could be enhanced by conserving the residual spawning stock which still remains.

The Gulf of Maine redfish stock (Figure 5.1) is currently in a seriously depressed condition and is continuing to decline. In contrast to the other economically important species which broadcast millions of eggs into the water column at each spawning beginning at age 2 or 3, redfish require 7-9 years to reach sexual maturity and bear a limited number of their young alive, liberating them as larvae. With such physiological limitations on overall fecundity, the redfish stocks may be expected to require a protracted period of time to rebuild. Moreover, juvenile redfish typically migrate to more shoal waters incurring significant mortality as by-catch in the small mesh shrimp and whiting fisheries.

The 4VWX/SA-5 pollock stock (Figure 5.1) is currently in a very healthy condition by virtue of recruitment from a series of strong year classes (1975, 1976, and 1979) together with fishing mortality rates substantially below F-max, and may be expected to register future increases with growth of fish in the 1979 year class. With the prevailing low fishing mortality rates, a substantial proportion of the total stock reaches sexual maturity under the current mesh sizes used in the fishery. The current and projected state of health of the pollock stock suggests that it may be able to support a modest transfer of fishing effort from currently depressed stocks of other species.

Stocks of whiting in the Gulf of Maine (Figure 5.1), Georges Bank (Figure 5.2), and Southern New England - Middle Atlantic (Figure 5.3) are all near the lower range of historic fluctuations but generally appear to be slowly rebuilding. With current levels of fishing mortality uniformly below the F-0.1 index, it is likely that factors other than the directed fishery may be responsible for the low recruitment indices seen in recent years. For example, it is possible that discarding of juvenile whiting in the Western Gulf of Maine shrimp fishery may have contributed to the relatively depressed condition of the Gulf of Maine whiting stock. Also, the influence of unfavorable environmental conditions should not be discounted.

Among the true hakes, assessment information is available only for red hake. Although registering recent modest increases in stock size, red hake, particularily on Georges Bank (Figure 5.2), is currently exhibiting low stock levels. Despite low levels of fishing mortality, a wide range of age classes in the population, and no apparent significant discarding in the commercial fishery, red hake stocks remain in a depressed condition. It has been suggested that predator-prey interactions may have retarded red hake stock rebuilding following their decimation by the pulse fishing activity of the distant water fleets in the 1960's and early 1970's.

The Georges Bank stock of yellowtail flounder is currently stabilized near the lower range of the historic fluctuations (Figure 5.2), whereas the Southern New England - Middle Atlantic stock (Figure 5.3) is near the long-term median level and is currently exhibiting an increasing trend. Fishing mortality rates, particularily on Georges Bank, for fully recruited fish are in excess of F-max. Mortality among prerecruits through discarding, which may reach substantial proportions with the appearance of strong recruitment (as in the case of the 1980 year class), suggests the need for measures to augment the current mesh size regime. Although the historic record indicates that recruitment is strongly influenced by long-term cycles in water temperature, stability of the fishery could be enhanced by increasing the number of age classes in the population through reductions in mortality from fishing, including discard mortality.

The Gulf of Maine (Figure 5.1) and Georges Bank stocks of American plaice (dab) have benefited from a succession of strong recruiting year classes since the mid-1970's such that current stock sizes are at near record levels. No information exists with respect to fishing mortality rates, but the current mesh size regime appears to be appropriate in consideration of the size (and age) at sexual maturity.

Assessment information for witch flounder (gray sole) indicates that while the stocks are currently in good condition at near the median level (Figure 5.1), the potential exists for declines in abundance in the absence of remedial management action. The recent increased trend in landings to 5-6,000 mt is probably not sustainable in light of events in the historic fishery, particularily in the context of the probable existence of significant discards of juveniles in the small mesh shrimp and whiting fisheries.

§5.3 Stock and Recruitment

Among the population characteristics affecting reproduction and recruitment, abundance of mature spawners is often of sufficient importance to be of value for analysis and prediction. It has already been pointed out that a clear biological relationship exists between the reproductive potential as measured by total fecundity and the number of mature spawners. However, the translation of total fecundity into the number of recruits (ie., net reproduction) on an annual basis is not a straight-forward relationship since year to year differences in environmental characteristics usually cause fluctuations at least as great as those which may be associated with variations in stock size. Sometimes these fluctuations show significant correlations with one or more measured environmental variables (eg., yellowtail flounder, Sissenwine, 1974). Cannibalism of young by adults of the same species may occur in many cases, but the likely effect of parental stock density upon recruitment is probably exerted via the density of the eggs and/or larvae they produce. Survival of the latter is affected by density-dependent competition for food or space, compensatory predation, and density-independent effects (Ricker, 1975). (See §2A3 and §2A5 for additional discussion.)

A graph relating the spawning stock size to subsequent recruitment typically exhibits substantial dispersion of the data because of environmental effects. Consequently, attempts have been made to work out possible interactions between adults and their progeny, deducing average curves describing that interaction. The two most commonly used mathematical models were developed by Ricker and, alternatively, by Beverton and Holt (1957) (see Ricker, 1975). A substantial amount of information exists for some of the more important species within the multi-species complex. However, no attempt will be made to fit these data to such models. It is sufficient for the development of the management program to evaluate the data on the basis of broadly defined zones of risk to aid in establishment of appropriate levels of spawning potential such that the capacity of the resource to recover from unfavorable conditions may not be jeopardized.

Stock-recruitment data for a number of the more important species in the multispecies complex are depicted in Figures 5.4-5.9. Although the data in all cases exhibit considerable scatter, a few general principles are evident. In all cases, recruitment tends to fall towards zero at very low stock levels. In some examples, such as cod, there is an apparent tendency for recruitment to be maximized at some intermediate stock level, not implying that recruitment falls to zero at very high stock sizes. All of the proposed mathematical formulations for describing the stock-recruit relationship assume a curve which begins at the origin, rises rather quickly, but immediately begins to curve downward towards an asymptote such that recruitment never reaches zero at high stock levels. As noted, cod appears to exhibit some sort of dome-shaped distribution which is in accord with characteristics of one or more of the models which have been proposed to describe the relationship. On the other hand, despite the relatively small number of data points, redfish may be tentatively described by a relationship which curves <u>upward</u> over much of the lower range in observed stock sizes. Haddock may exhibit a similar pattern at low stock sizes. Thus, we may conclude that, whereas the commonly used stock-recruit models may be useful in aid of a general understanding of the relationship, their simplicity is inadequate for describing some of the important peculiarities in specific cases.

The stock-recruitment information, as depicted in Figures 5.4-5.9, was examined for the purpose of gaining some insight with respect to that level or range in spawning stock size which, on the basis of the historical perspective, may be expected to generate recruitment levels sufficient to sustain the fishery. For example, in the case of haddock (see Table 5.1) it is seen that when spawning stock sizes were less than 70,000 metric tons, then for 91% of the time, the resulting recruitment was less than 20 million fish at age 2. But when stock sizes were 70,000 tons or greater, recruitment was 20 million fish or higher 34 times out of 40 (85%), and was at least 60 million fish 15 times out of 40 (37% of the time).

The stock-recruit information for the Georges Bank cod stock is not as amenable to this sort of analysis since very few data points are at low stock sizes. The available information suggests, however, the existence of a markedly dome-shaped curve implying the risk of rapid stock collapse at low levels of spawning stock biomass.

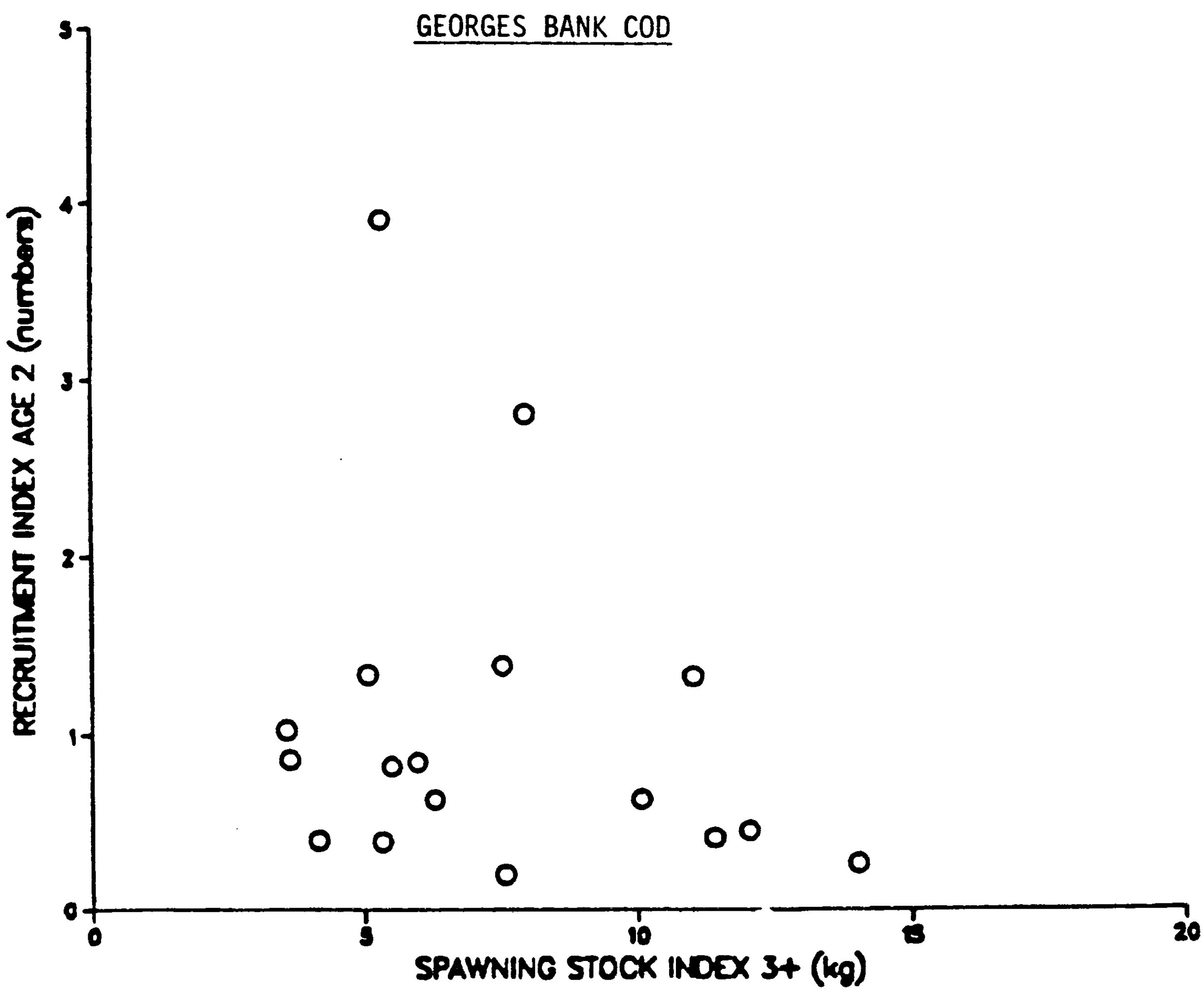


Figure 5.4. Stock-recruitment relationship for Georges Bank cod. Indices of spawning stock size (age 3+) and recruitment (at age 2) are based upon survey data.

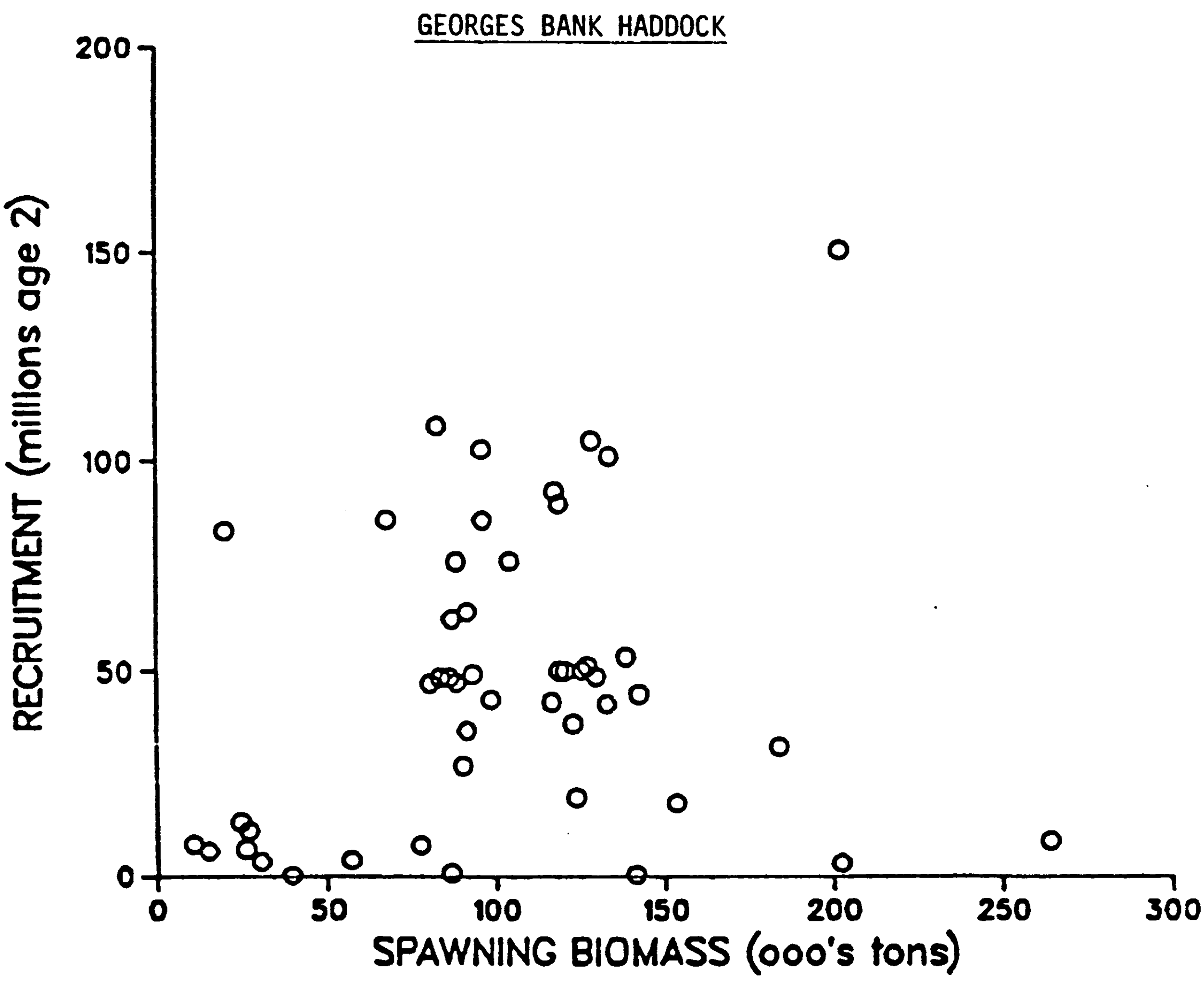


Figure 5.5. Stock-recruitment relationship for Georges Bank haddock. Spawning stock biomass (thousands of metric tons) and subsequent recruitment (millions at age 2) for the period, 1931-1979, based upon VPA. The data point for 1963 (194,700 tons, 368.8 million recruits) is off the scale and has been omitted for clarity.

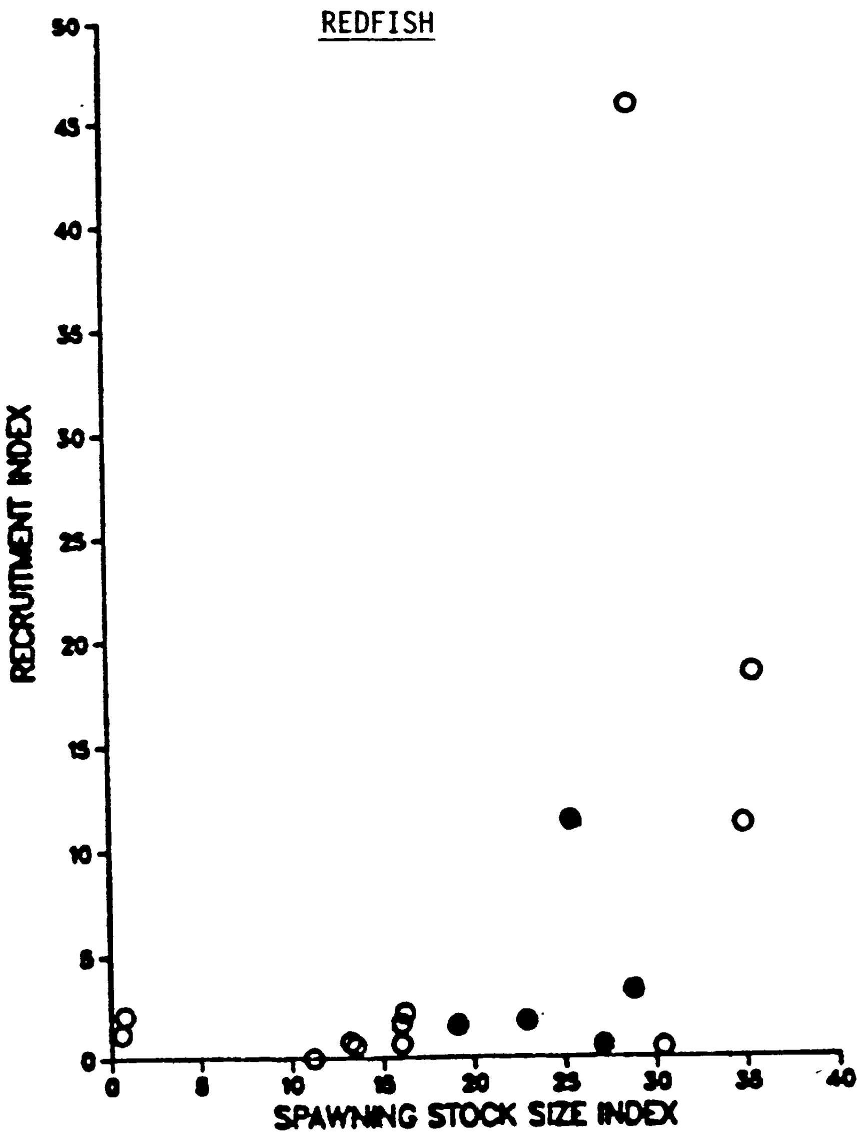


Figure 5.6. Stock-recruitment relationship for Gulf of Maine - Georges Bank redfish. Indices of spawning stock size (age 9+) and recruitment (at age 1) are based upon VPA (solid circles, ●) or linear regression of survey indices on VPA results (open circles, O).

SILVER HAKE

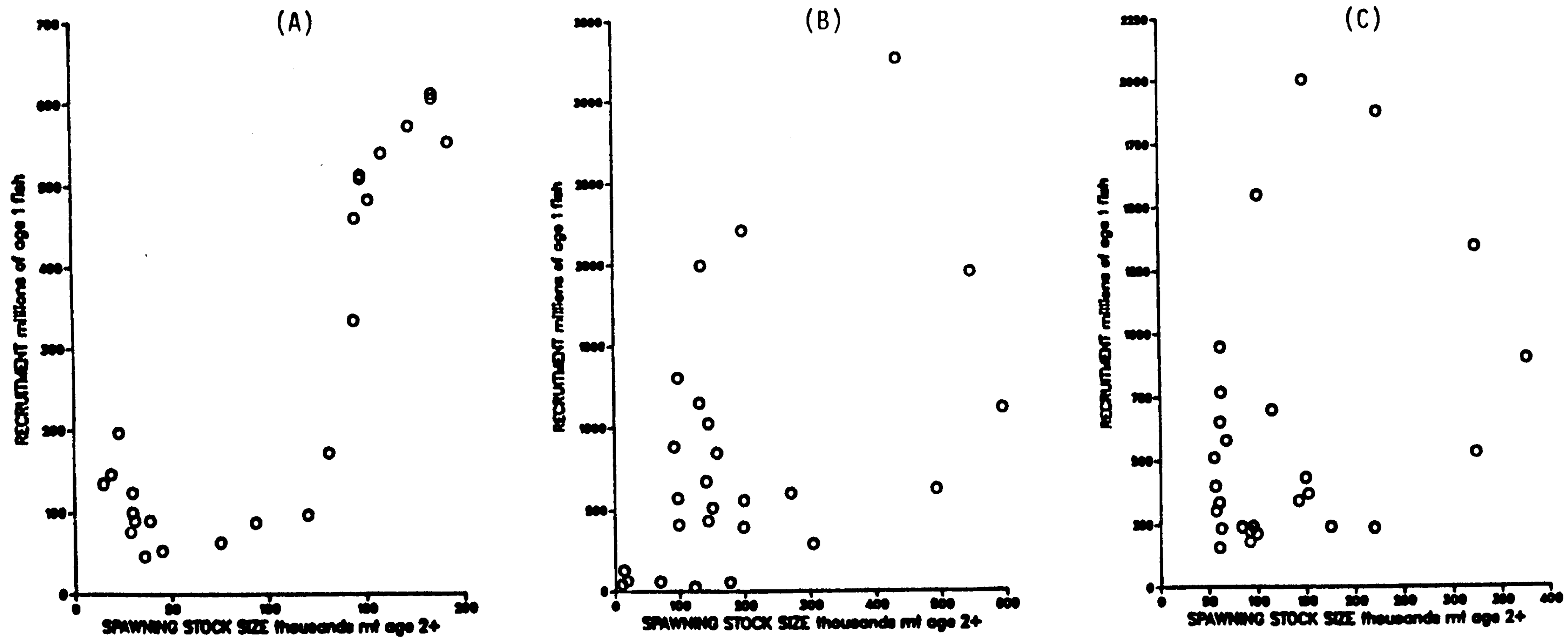


Figure 5.7. Stock-recruitment relationships for whiting (silver hake) by stock; (A) Gulf of Maine, (B) Georges Bank, and (C) Southern New England - Middle Atlantic. Spawning stock size (thousands of metric tons age 2+) and recruits (millions at age 1) are based upon VPA.

RED HAKE

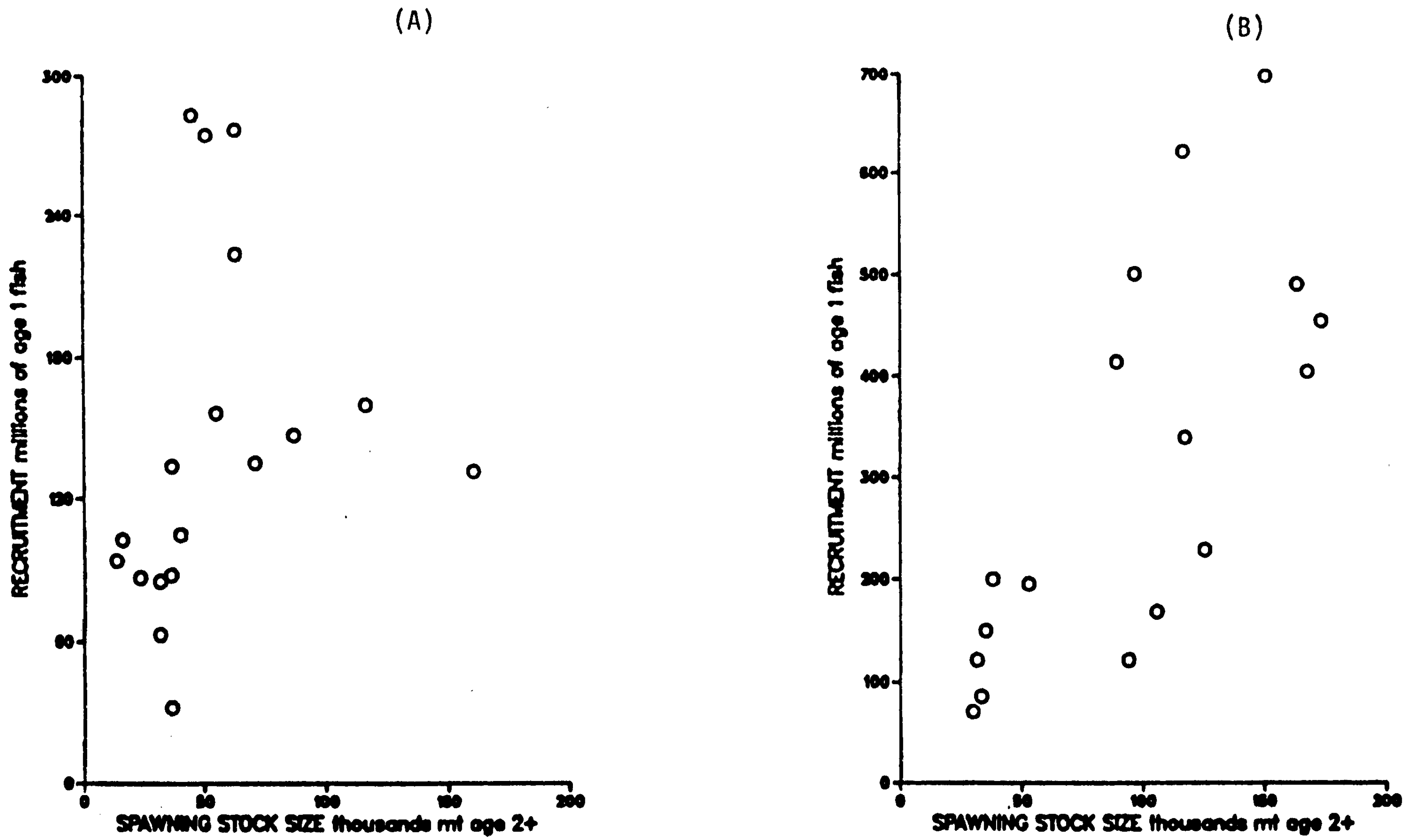


Figure 5.8. Stock-recruitment relationships for red hake by stock; (A) Georges Bank, (B) Southern New England - Middle Atlantic. Spawning stock size (thousands of metric tons age 2+) and recruits (millions at age 1) are based upon VPA.

YELLOWTAIL FLOUNDER

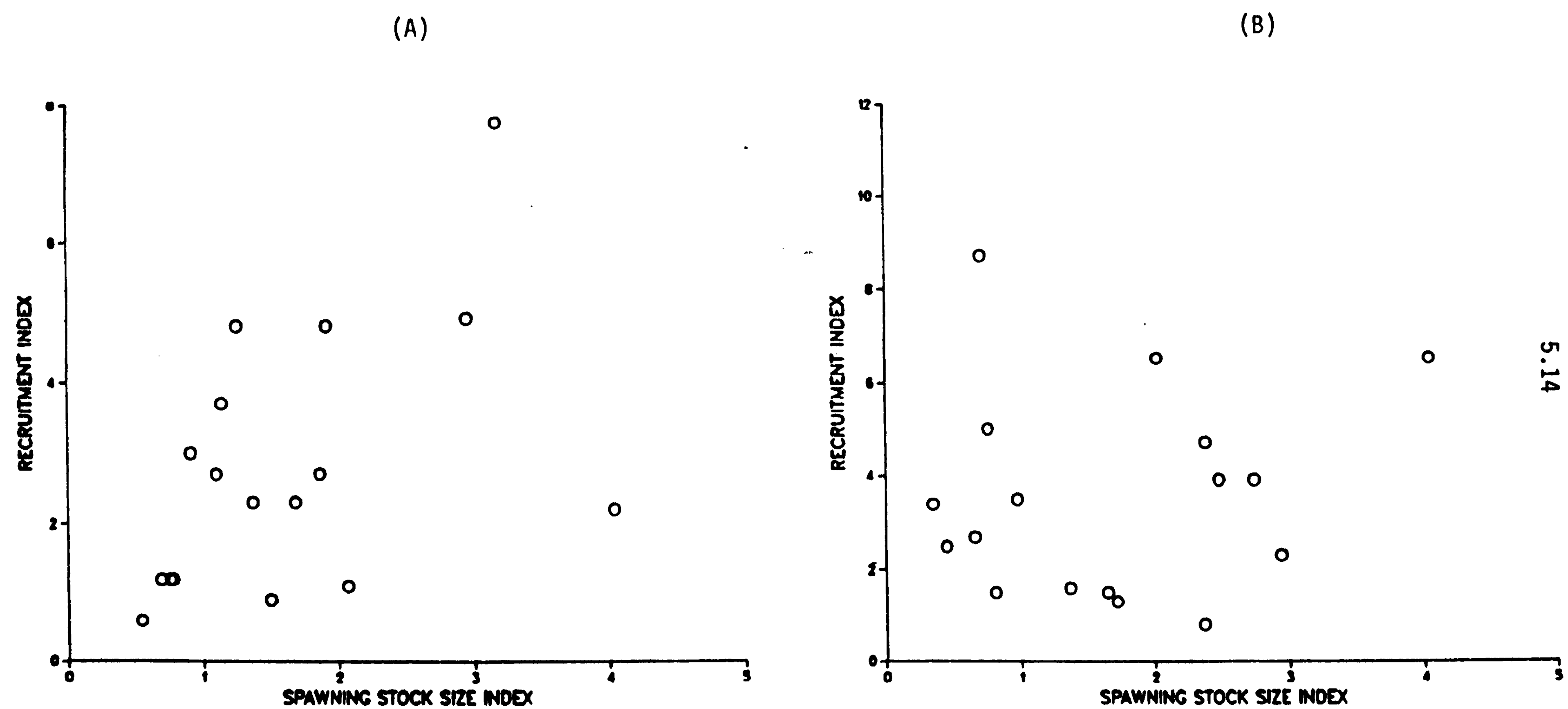


Figure 5.9. Stock-recruitment relationships for yellowtail flounder by stock area; (A) Georges Bank, and (B) Southern New England. Indices of spawning stock size (catch per unit of effort of age 3+ fish) and recruitment (catch per unit of effort of age 2 fish) are based upon commercial catch and effort data.

Gulf of Maine - Georges Bank redfish is another stock identified in §5.2 as currently being in a depressed condition. The available stock-recruit data indicate that at spawning stock sizes less than 200,000 fish, recruitment is uniformly low (less than 10,000 fish at age 1). At stock sizes greater than 200,000 fish, recruitment has exceeded 10,000 fish, 56% of the time, averaging about three times that level.

A stock-recruitment contingency tabulation for stocks of whiting (silver hake) is shown in Table 5.2. Referring to Figure 5.7, it is seen that recruitment has consistently remained relatively low when spawning stocks were at less than 30% of the highest observed level. More variability is evident when spawning stocks were high.

The stock-recruitment relationship for red hake also exhibits relatively low recruitment at stock sizes less than 30% of the highest observed. At spawning stocks less than 45,000 metric tons of age 2+ fish, recruitment to the Georges Bank stock was less than 100 million fish at age 1, 80% of the time. At stock levels greater than 45,000 tons, recruitment was high 100% of the time. In the Southern New England - Middle Atlantic stock, recruitment was always low when stocks were less than 60,000 tons.

Recruitment levels in yellowtail flounder have been shown to be significantly correlated with temperature (Sissenwine, 1974). The stock-recruitment relationships shown in Figure 5.9 (for all years' data combined) are based on commercial CPUE data. The stock-recruitment contingency tabulation for yellowtail shown in Table 5.3 combines indices based upon commercial CPUE and survey catch data, and has been categorized according to whether bottom water temperatures were cooler or warmer than the long-term average. In general, for both the Georges Bank and Southern New England stocks, low stock sizes generate low recruitment and high stock levels generate high recruitment, when water temperatures were higher than average. When water temperatures were cooler than average, there is much less consistency with the usual stock-recruit relationship.

Table 5.1

Stock-recruit contingency table for Georges Bank haddock.

	SPAWNING STOCK[1/]	
RECRUITMENT[2/]	LOW (0-70)	HIGH (70+)
Low (less than 20)	91%	15%
Intermediate (20-60)	0%	48%
High (greater than 60)	9%	37%

1/ Spawning stock biomass in thousands of metric tons.

2/ Recruitment in millions of fish at age 2.

Table 5.2

Stock-recruit contingency table for whiting (silver hake) stocks.

RECRUITMENT[2/]	SPAWNING STOCK[1/] LOW	SPAWNING STOCK[1/] HIGH
Gulf of Maine	(1-60)	(60+)
Low (1-250)	100%	29%
High (250+)	0%	71%
Georges Bank	(1-180)	(180+)
Low (1-1500)	94%	56%
High (1500+)	6%	44%
So. New England/Mid-Atlantic	(1-140)	(140+)
Low (1-800)	88%	60%
High (800+)	12%	40%

1/ Spawning stock biomass in thousands of metric tons age 2+.

2/ Recruitment in millions of fish at age 1.

Table 5.3

Stock-recruit contingency table for yellowtail flounder.

	SPAWNING STOCK LOW	SPAWNING STOCK HIGH
RECRUITMENT		
Georges Bank		
Cool Temperatures		
Low Recruitment	17%	43%
High Recruitment	83%	57%
Warm Temperatures		
Low Recruitment	71%	17%
High Recruitment	29%	83%
Southern New England		
Cool Temperatures		
Low Recruitment	60%	45%
High Recruitment	40%	55%
Warm Temperatures		
Low Recruitment	64%	0%
High Recruitment	36%	100%

Note: Data in each cell are based upon summed frequency occurrances of indices from survey results and from commercial CPUE.

§5.4 Year Class Replacement Analysis

The policy describes the minimum acceptable spawning stock size as that level of abundance which provides a long-term average level of recruitment just adequate to avoid an unacceptably high risk of recruitment failure. As discussed in §5.1, there are certain conceptual flaws associated with any possible definition of minimum acceptable stock abundances in this context. Translated into practical biological terms, however, the minimum acceptable spawning stock size may be thought of as that level of biomass which, on a long-term average basis, may be expected to continue to replace itself. Thus, if the stock is able to continue to replace itself, its capacity to quickly recover from unfavorable circumstances will not be in jeopardy.

The stock replacement linkage is through egg production by the spawners and the subsequent survival to new recruits, and thence to the new generation of mature fish. That linkage may be examined using stock-recruit data. Figure 5.10 illustrates the stock-recruit relationship for Georges Bank haddock. Superimposed on the scatter of stock-recruit data points are a number of straight lines drawn through the origin which are labeled "10%", "20%", etc., through "100%". These curves describe lines of constant relative potential egg production by the spawning stock to produce one unit of recruitment. For instance, the line labeled 10% results in all combinations of fishing mortality and age-at-entry which will result in 10% of potential egg production of any cohort entering the fishery. In analytical terms, the total potential egg production is assumed to be a direct function of the spawning stock size. Therefore, the exploited stock biomass per recruit may be calculated as a surrogate of egg production per recruit using yield per recruit analysis with appropriate specification of the parameters. The curve labeled "100%" represents the condition at zero fishing mortality. The remaining curves with increasing slope are consistent with conditions of increasing fishing mortality.

The value of the straight-line curves depicted in Figure 5.10 is their position relative to the scatter of points describing the stock recruitment relationship. Thus, considering all such points at stock sizes greater than 70,000 metric tons, it is seen that 18 points (including the point off scale at 194,700 tons and 368.8 million recruits estimated for 1963) lie above the 20% line and 20 points are below the line. Any point above the line has resulted from recruitment greater than that specified by the line. Such greater recruitment will tend to drive the stock to higher levels provided that the stock was at the 20% level. Conversely, with recruitment lower than that specified by the line, the stock will tend to be driven lower. The fact that the 20% line about evenly bisects the historical data at stock sizes above 70,000 tons indicates that such a level of potential egg production is an appropriate long-range goal for management of the Georges Bank haddock stock (after stock sizes have been rebuilt to 70,000+ tons).

Assuming that compensatory mortality is significant at high stock levels in haddock, the 20% level becomes even more appropriate. At stock sizes greater than 70,000 tons but less than 150,000 tons, it is seen that 16 points lie above the 20% line and 16 points are below the line. Thus, given a continuation of the historic variability of recruitment, the probability that the stock may increase would be equal to the probability that it may decrease, indicating that over the long-term it would tend to remain constant.

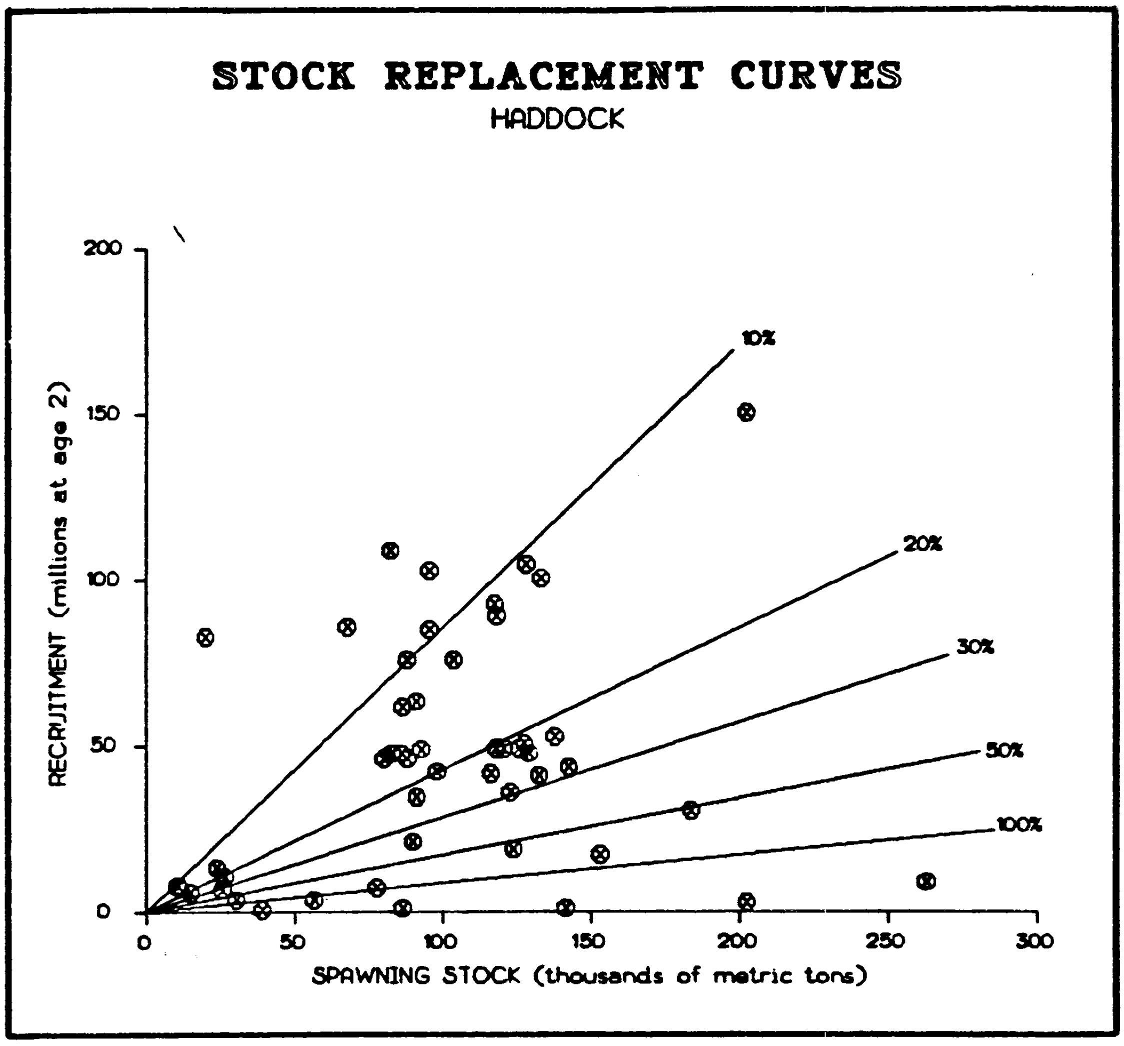


Figure 5.10. Lines of equal potential egg production per recruit superimposed on the stock recruitment relationship for Georges Bank haddock. The curves indicate that at intermediate stock levels, haddock may be most appropriately managed such that the spawning stock has 20% of the potential egg productivity of the unexploited (virgin) stock. At current low stock levels, the 30% level is most appropriate.

The current stock size of Georges Bank haddock is substantially less than 70,000 metric tons. Examining the distribution of data points in the lower range of stock sizes it is seen that the 30% curve is appropriate under current conditions.

This discussion of the replacement concept has been exemplified by the case of haddock. In a similar manner, the 20% level of potential egg production has been found to be most appropriate for management of most other stocks within the overall multispecies complex. In the case of Gulf of Maine-Georges Bank redfish, however, a similar situation exists as was found in the case of haddock. Thus, until stocks of redfish have been rebuilt to about 100,000 metric tons, the 30% level of potential egg production is the most appropriate basis for management.

The potential egg production of a stock of fish is maximized under conditions of zero exploitation. The maximum possible reproductive capacity is embodied in the virgin stock where the only source of mortality is from natural causes. The potential egg production, along with the stock size, is reduced with the introduction of fishing mortality (F), and at any given level of F, egg production is relatively lower (higher) as the age at entry to the fishery is reduced (increased). This relationship provides the operational link for effecting a desired level of potential egg production as a goal of management.

The relationship between the potential egg production, and the fishing mortality rate and age at entry (age at 50% selection) is illustrated for a number of important species in Figures 5.11-5.16. Where estimates are available, the current level of fishing mortality has been indicated. In addition, vertical accent lines have been included in each graph to denote the age (and average fish size) at 50% selection for a series of alternative cod end mesh sizes for trawl nets.

The two primary dimensions to the problem of achieving a desired level of total reproductive potential for the important stocks within the multispecies complex are the fishing mortality rates and the ages at 50% selection. Both have important ramifications with respect to the management program and are treated in the following sections. As noted above, the most appropriate level of total reproductive potential for haddock and redfish in the short-term is at the 30% benchmark and for all stocks in the long-term is 20%. The task of management of the multispecies resource will be to manipulate the fishing mortality rate and age at 50% selection such that those benchmarks will be achieved for the important stocks, thus implementing the overall policy guidance.

§5.5 Age at Entry to the Fishery

The policy guidance of this FMP is concerned that there be a continuation of adequate spawning potential in the multi-species fishery. One of the dimensions for accomplishing this is to control the age at which the fish enter the fishery. The age at entry varies with individual species (see Table 2A6) and may be manipulated both directly and indirectly. A direct means of affecting age at entry is to set minimum sizes for species in the fishery. This would take into consideration important factors such as the size at sexual maturity and the most appropriate market size as a basis for

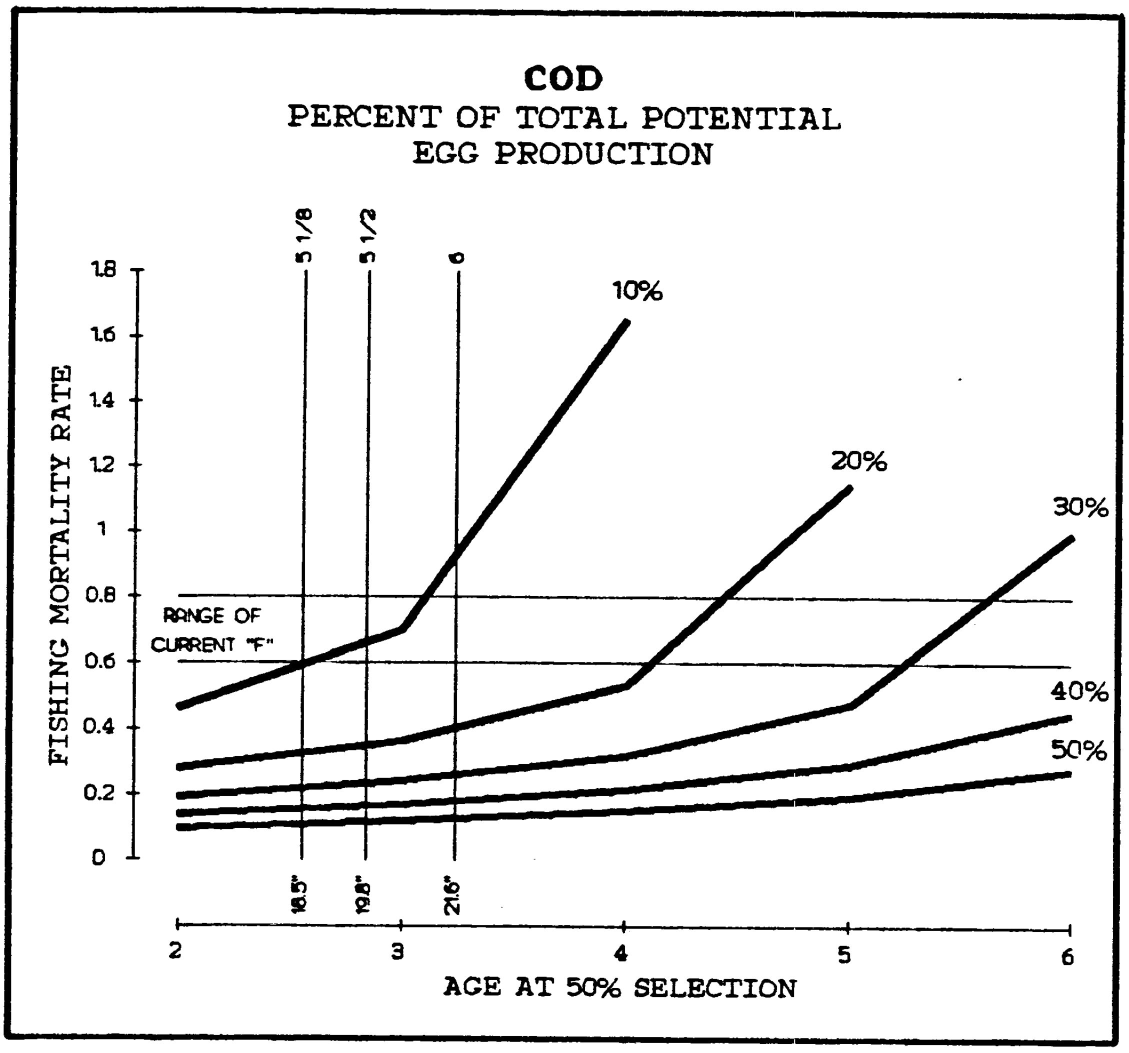


Figure 5.11. Isopleths of total potential egg production for cod. Horizonal accent line(s) indicate the estimated current level of fishing mortality, where available. Vertical accent lines indicate the age (and fish length) at 50% selection for a range of cod-end mesh sizes.

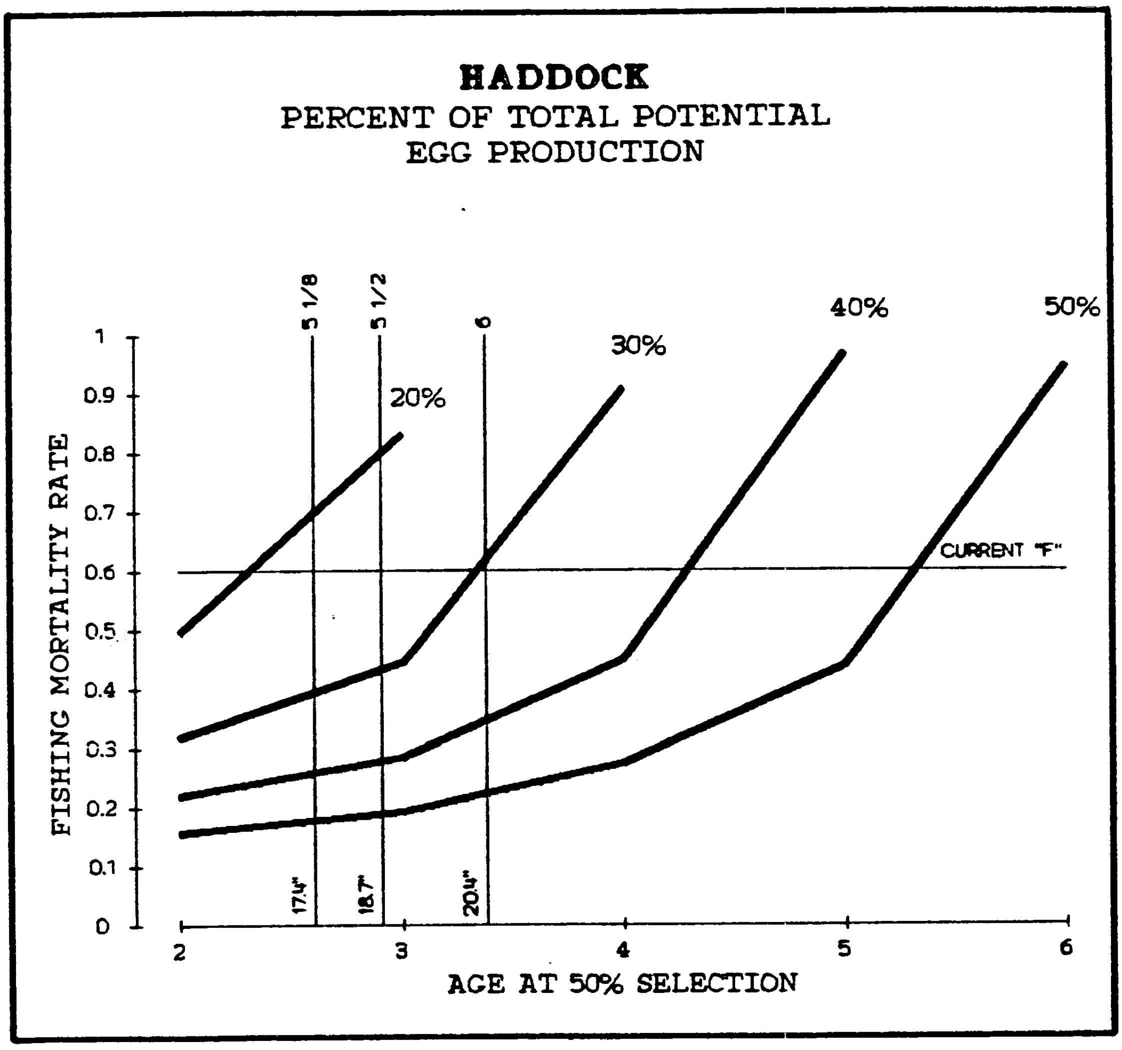


Figure 5.12. Isopleths of total potential egg production for haddock. Explanation same as for Figure 5.11.

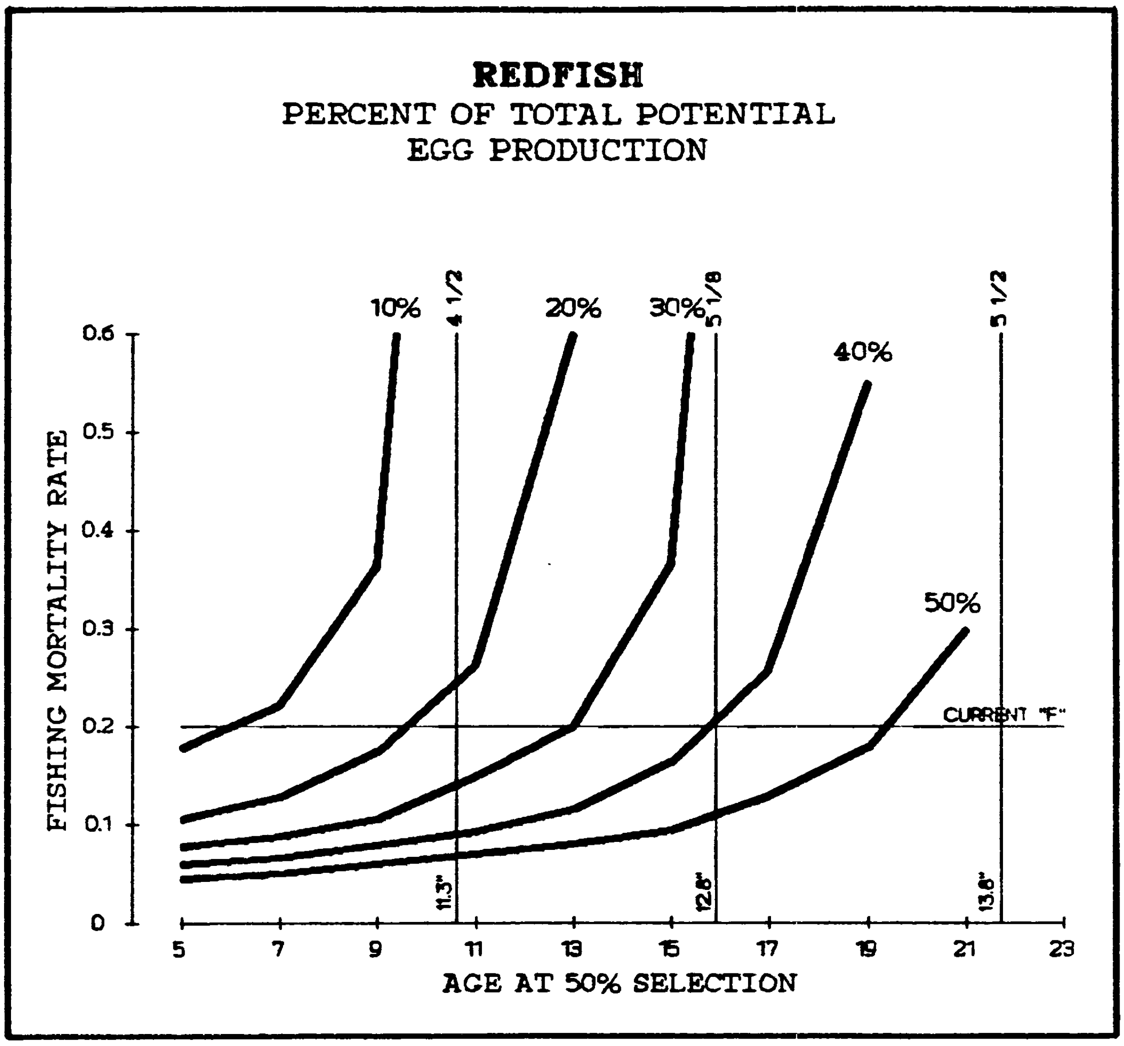


Figure 5.13. Isopleths of total potential egg production for redfish. Explanation same as for Figure 5.11.

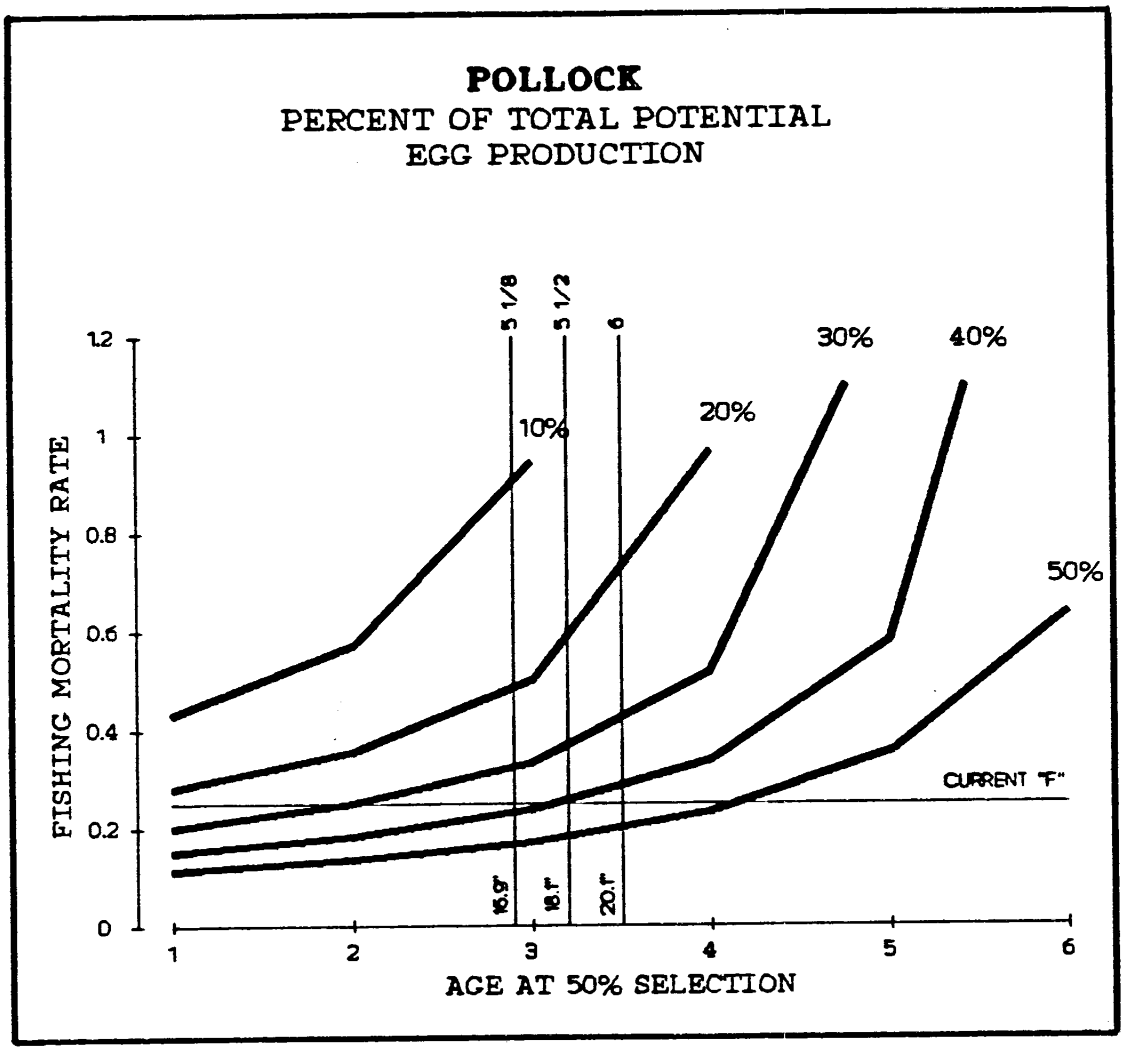


Figure 5.14. Isopleths of total potential egg production for pollock. Explanation same as for Figure 5.11.

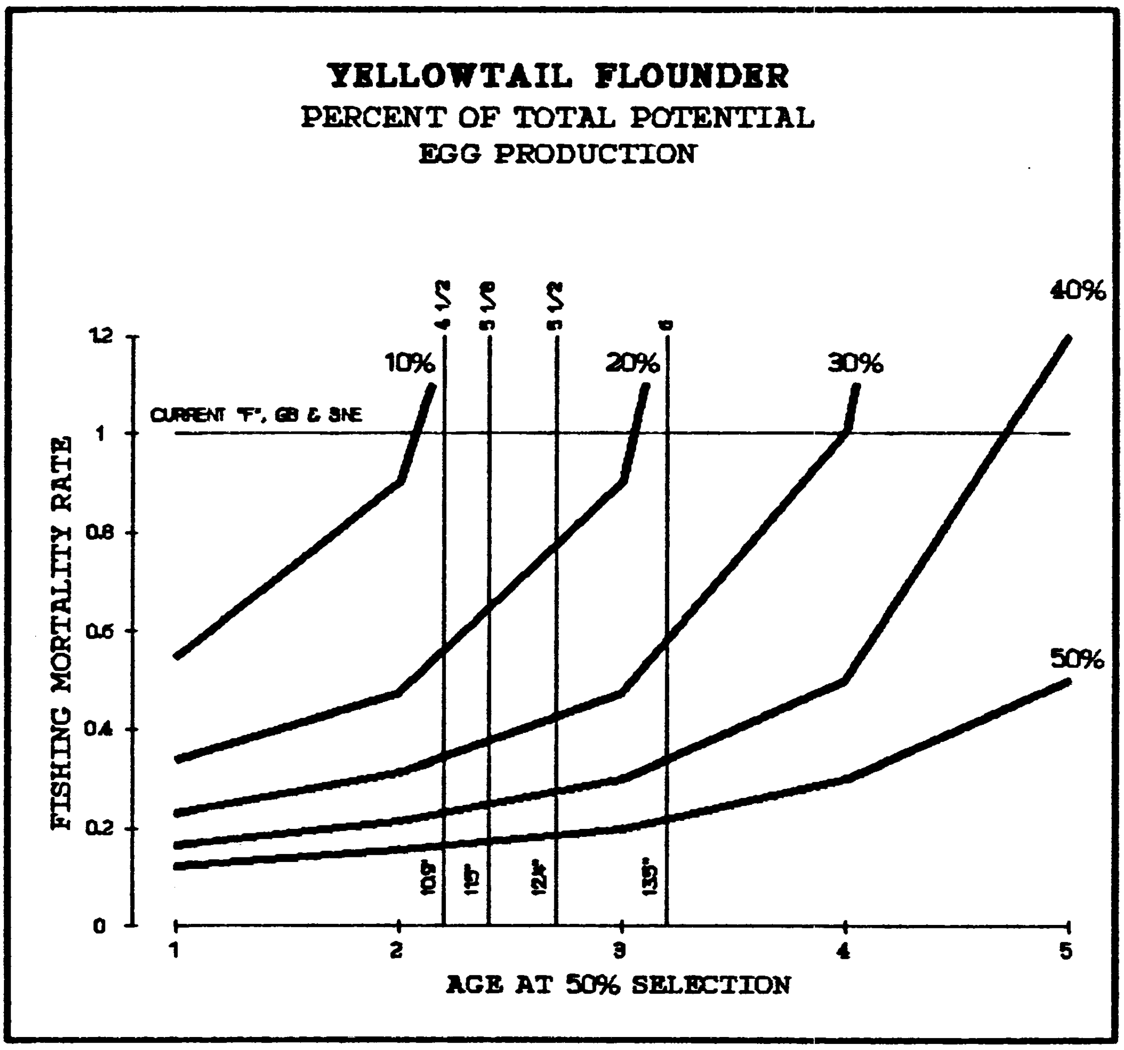


Figure 5.15. Isopleths of total potential egg production for yellowtail flounder. Explanation same as for Figure 5.11.

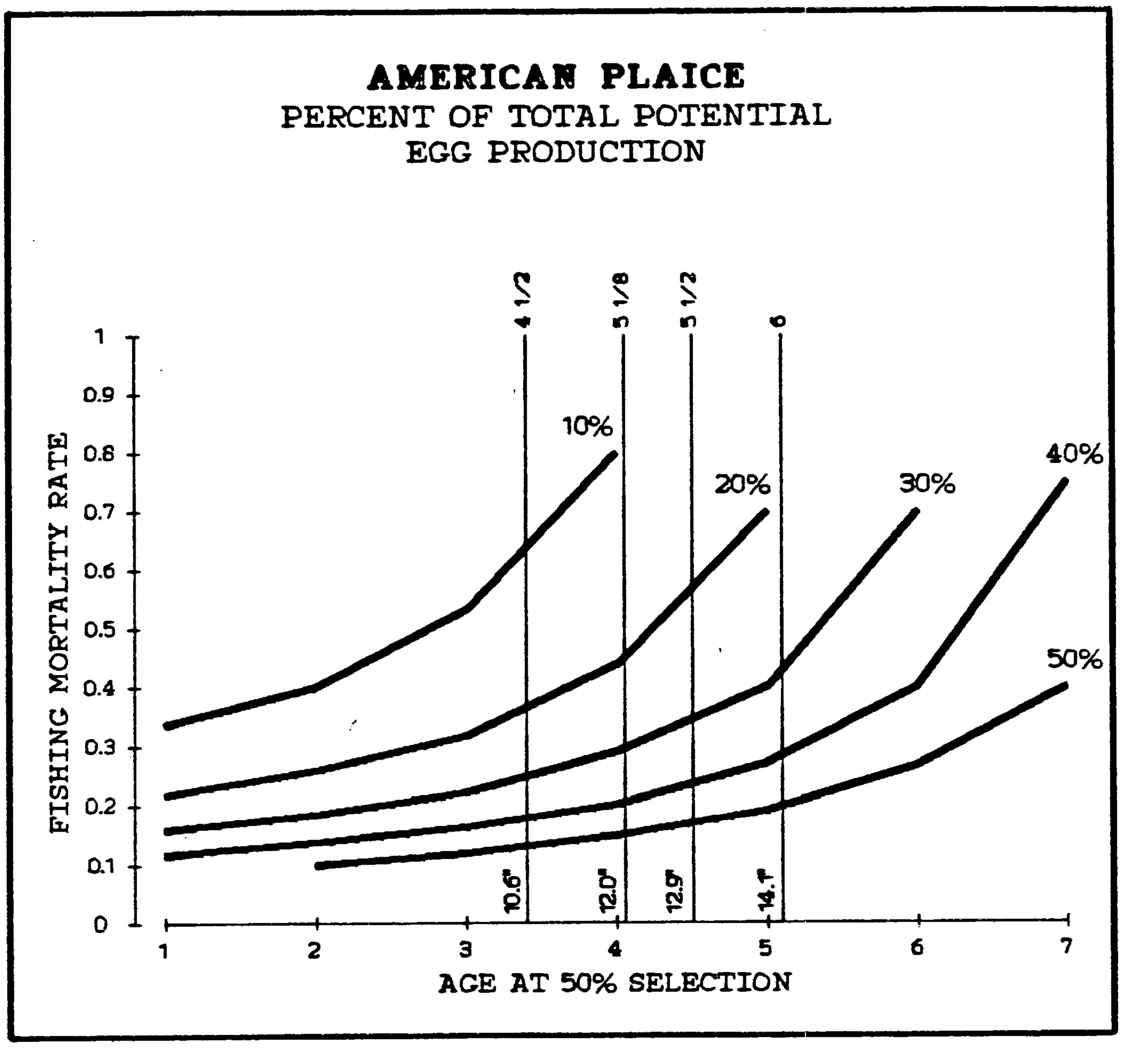


Figure 5.16. Isopleths of total potential egg production for American plaice (dab). Explanation same as for Figure 5.11.

determination of the minimum fish size for each species. An indirect means of controlling age at entry is through selection of an appropriate mesh size which targets fish of designated lengths. Controlling age at entry by manipulating the mesh size has certain advantages but may suffer inefficiencies depending upon fishing conditions.

Direct Methods - Minimum Size. Appropriate minimum sizes may be established based on the average length of fish at sexual maturity and other factors which may include commercial considerations. The size at 50% maturity of the mix of species in the Northwest Atlantic groundfish fishery varies with each species and stock. Control of age at entry by use of a minimum size has certain limitations. When catchs are culled aboard a fishing vessel, significant mortality may occur among undersized fish before they are discarded. This method for controlling age at entry is highly successful for crustaceans (eg., lobster) and shellfish (eg., sea scallops) but has limited usefulness, as a single measure, in most fisheries for finfish except in the case of the recreational fisheries.

Indirect Methods - Gear Control. The selection characteristics of fishing gear may be used to control the age at entry to the fishery. The three main types of gear used in the multi-species fishery include mobile trawls, gill nets, and long-lines (hooks). The selection characteristics of these types of gear depend upon the mesh size (trawls and gill nets) and the hook size.

Gillnets are known to be size selective. Depending upon the size range of available fish, gill nets usually select a relatively narrow range in fish lengths. Small fish avoid gilling in the meshes and may swim right through the net, whereas very large fish are unable to penetrate the net far enough to be caught. Hooks are also selective. Large hooks will not be swallowed by small fish, and small hooks will unlikely snag large fish.

Historically, the most significant type of gear used in the multi-species fishery is the mobile trawl. When fish enter the trawl net they are selected by size according to the measurement of the cod end mesh. Modification of mesh size is a relatively simple means of effecting a change in the size selection of fish. The use of mesh size as a management tool has been demonstrated to play a significant role in the goal of reducing discards of undersized fish. As the size of mesh increases, escapement of undersized fish increases, discard of undersized fish decreases and yield of the fishery may be maximized.

In the multi-species fishery, use of cod-end mesh size to select for age at entry has inherent limitations. While a specific mesh size may be appropriate for one species, it may not produce the results desired for other species in the combined catch. There are some additional problems of applying mesh size controls. Deformation of the geometry of ordinary diamond mesh in the extension piece ahead of the cod-end may occur when the trawl bag is full. This may have the effect of retaining more small fish.

Mesh Selectivity and Selection Factors. Mesh selection is a process which distinguishes a part of a larger population. Since populations of fish are heterogeneous in size, age, behavior, etc., they are not equally vulnerable to any specific mode of capture. Selection is a process which attempts to increase the chances of capturing fish of a specific characteristic, e.g. age or size. The expression "selectivity" is a qualitative expression of selection, and is usually a relative, not an absolute term.

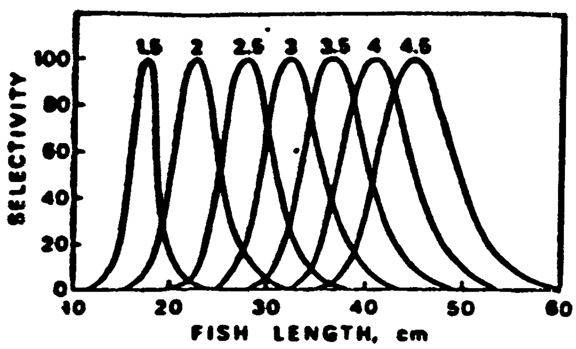
Gillnet selectivity exhibits a different pattern than trawl mesh selectivity. Normal probability curves may be used to describe the selectivity of gillnets (Figure 5.17). As mesh size increases, the curve becomes displaced such that the modal point corresponds to a longer length fish. The shape of the curve indicates that fish larger or smaller than the average sized fish sought are not likely to be caught. While it is known that gillnets are more selective with regards to size than mobile trawl nets, they are not selective with regards to species.

Selectivity in mobile trawl nets is quite different. The 50% retention point is commonly used to describe selectivity in such gear. This is the point at which half of the fish of a particular length are retained by a certain mesh size and the other half escape. The 50% point increases in direct proportion to the mesh size. There is a straight line relationship between the 50% release (retention) length (L) and the stretched length of the mesh (m), such that the selection factor, $C = L/m$. While in the past it has been termed the relative releasing effect, today we call it the selection factor (Smolowitz, 1983). This selection factor describes the capacity of fish to escape and varies from species to species and with the conditions of capture.

It may be demonstrated that the 50% retention length increases as the mesh size increases. Table 5.4 shows, for example, that 5-1/2 inch mesh retains 19.8 inch cod at the 50% point, while 6 inch mesh will retain 21.6 inch cod at the 50% point. The idealized nature of the change in selection which occurs through trawl mesh size changes is demonstrated through typical sigmoid selection curves illustrated in Figure 5.18 for cod with two different sized cod-end meshes. As shown, the 50% retention length increases with the larger mesh.

Smolowitz (1978) has suggested that increases in cod end mesh size may result in concurrent increases in trawl efficiency. When larger mesh sizes are employed large fish are often caught in greater numbers. But, not withstanding the possibly controversial nature of that claim, the relationship between the size and shape of the mesh and the shape of the fish affects the escapement rate, as does the behavioral response of fish species. Selection is largely determined by the physical feature of the fishing gear. Different types of gear, or modification in gear may produce catches of different species composition and affect the size composition of the catch of particular species.

(A)



(B)

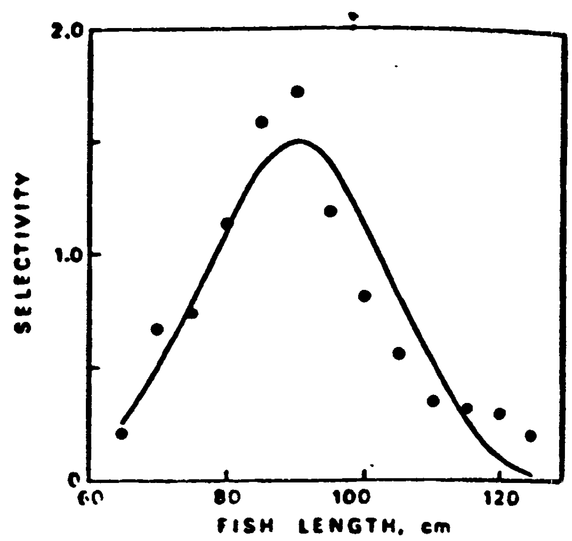


Figure 5.17. Selection curves for gill nets, based upon, (A) lake whitefish, and (B) cod.

SOURCE: Hamley, J.M., Review of gillnet selectivity. J. Fish. Res. Board Can. 32(11). 1975.

Table 5.4

Calculated rates of retension and escapement
for selected species at two mesh sizes.

COD (selection factor = 3.6)

	5 1/2" Mesh		6" Mesh	
Length (in.)	Retain (%)	Escape (%)	Retain (%)	Escape (%)
27	99.4	0.6	97	3
26	98.4	1.6	94	6
25	96.5	3.5	88	12
24	93	7	80	20
23	87	13	69	31
22	78	22	56	44
21.6	74	26	50	50
21	66	34	42	58
20	53	47	29	71
19.8	50	50	27	73
19	39	61	19	81
18	27	73	11	89
17	16	84	6	94
16	9	91	3	97
15	5	95	1	99
14	2	98	0.5	99.5

HADDOCK (selection factor = 3.4)

	5 1/2" Mesh		6" Mesh	
Length (in.)	Retain (%)	Escape (%)	Retain (%)	Escape (%)
26	99.7	0.3	98.3	1.7
25	99.2	0.8	96	4
24	98	2	92	8
23	95	5	84	16
22	90	10	73	27
21	81	19	59	41
20.4	74	26	50	50
20	69	31	44	56
19	55	45	30	70
18.7	50	50	26	74
18	40	60	18	82
17	26	74	10	90
16	15	85	5	95
15	8	92	2	98
14	4	96	0.8	99.2
13	1.6	98.4	0.3	99.7

REDFISH (selection factor = 2.5)

17	99.9	0.1	98	2
16	98.8	1.2	84	16
15	90	10	50	50
14	60	40	16	84
13.8	50	50	11	89
13	22	78	2	98
12	4	96	0.1	99.9

POLLOCK (selection factor = 3.3)

25	99.1	0.9	96.5	3.5
24	98	2	93	7
23	95	5	87	13
22	91	9	78	22
21	84	16	66	34
20	74	26	53	47
19.8	72	28	50	50
19	62	38	39	61
18.2	50	50	28	72
18	48	52	27	73
17	34	66	16	84
16	23	77	9	91
15	14	86	5	95
14	8	92	2	98
13	4	96	0.1	99.9

Table 5.4

(Continued)

YELLOWTAIL FLOUNDER (selection = 2.25)

	5 1/2" Mesh		6" Mesh	
Length (in.)	Retain (%)	Escape (%)	Retain (%)	Escape (%)
16	99.9	0.1	98.4	1.6
15	98.8	1.2	90	10
14	92	8	67	33
13.5	84	16	50	50
13	71	29	33	67
12.4	50	50	17	83
12	38	62	10	90
11	12	88	1.6	98.4
10	2	98		

AMERICAN PLAICE (selection = 2.35)

	5 1/2" Mesh		6" Mesh	
Length (in.)	Retain (%)	Escape (%)	Retain (%)	Escape (%)
18	99.9	0.1	99.3	0.7
17	99.5	0.5	96.5	3.5
16	97.5	2.5	89	11
15	91	9	72	28
14.1	77	23	50	50
14	75	25	47	53
13	52	48	24	76
12.9	50	50	23	77
12	28	72	9	91
11	11	89	2.5	97.5
10	3	97	0.5	99.5

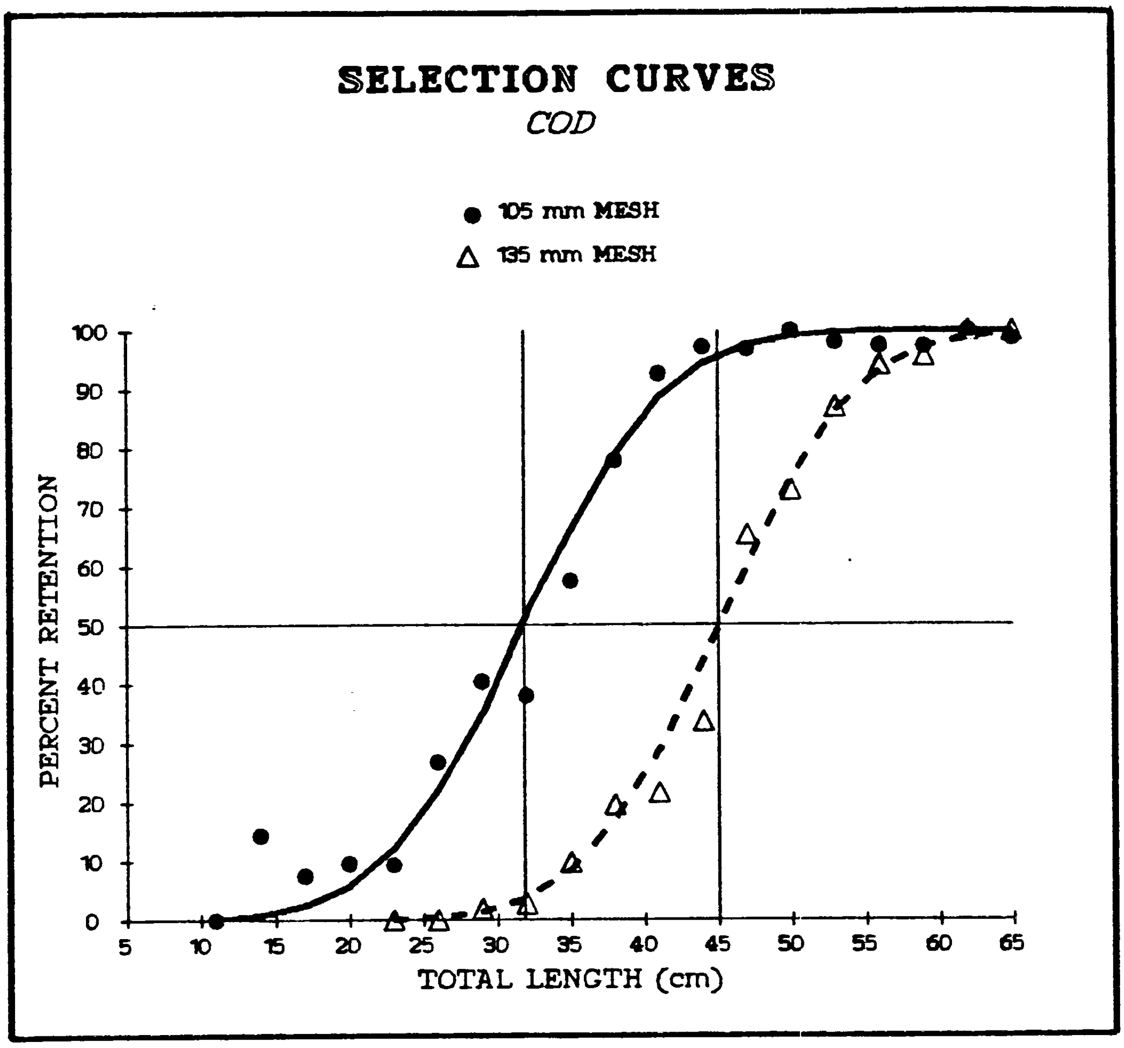


Figure 5.18. Selection curves for cod at two different cod-end mesh sizes.

Mesh Selection and Maturity

The classical approach to the problem of determining the most appropriate mesh size to be used in a commercial fishery, using biological criteria, has been to choose that mesh size which has a 50% selection length corresponding to or slightly longer than the fish size at 50% maturity. The conventional wisdom has been that, in the absence of a method for quantifying the minimum necessary number of spawners to assure continued recruitment, such a strategy assures that at least half of newly maturing fish will survive to spawn at least once thus providing a hedge against recruitment overfishing. The major weakness of the approach is that fishing mortality is not considered. Nevertheless, it has been valuable to fishery management and is useful for consideration here. As discussed in §5.5, minimum size may be an appropriate management measure in combination with mesh size (especially when applied to all segments of the fishing industry) if it discourages fishermen from setting on schools of predominantly small fish.

Illustrated in Figures 5.19-5.24 for a number of important species within the multispecies complex are curves describing the relative proportion of fish at size and age which have attained sexual maturity plus selection curves for a range of cod end mesh sizes. In addition, the selection curves indicate the relative proportion of the catch which is comprised of fish which are smaller than existing and/or proposed minimum sizes, thus representing the potential discard.

In the case of Georges Bank cod (Figure 5.19), it is seen that fish reach 50% maturity at a total length of 20-21 inches. With a 5 1/8 inch mesh (which may approximate the current operative mesh size), the 50% retention length is only about 18-19 inches when fish are less than 40% mature. Moreover, about 30% of the fish just below the current minimum size for cod (17 inches) are discarded. A cod end mesh of 5 1/2 inches has a 50% retention length of about 20 inches, near the size at 50% maturity, but a minimum size of 19 inches implies a substantial amount of discard. The 6 inch cod end mesh would result in a low discard level with the same minimum size, but a 50% retention length of 21-22 inches implies the greatest loss of marketable fish among the three alternatives.

For Georges Bank haddock (Figure 5.20), all three cod end mesh sizes examined (the 5 1/8 inch mesh approximates the current operative mesh) have 50% selection lengths which are greater than the size at 50% maturity (16-17 inches). However, the current seriously depressed haddock stocks indicate the need for a strategy of stock rebuilding rather than one of stock maintenance, implying the inadequacy of matching the 50% retention length with the size at 50% maturity. Consistent with that philosophy, the current 17 inch minimum size is also inadequate. But, of the mesh sizes examined, only the 6 inch mesh would <u>not</u> result in a substantial amount of discard.

GEORGES BANK COD

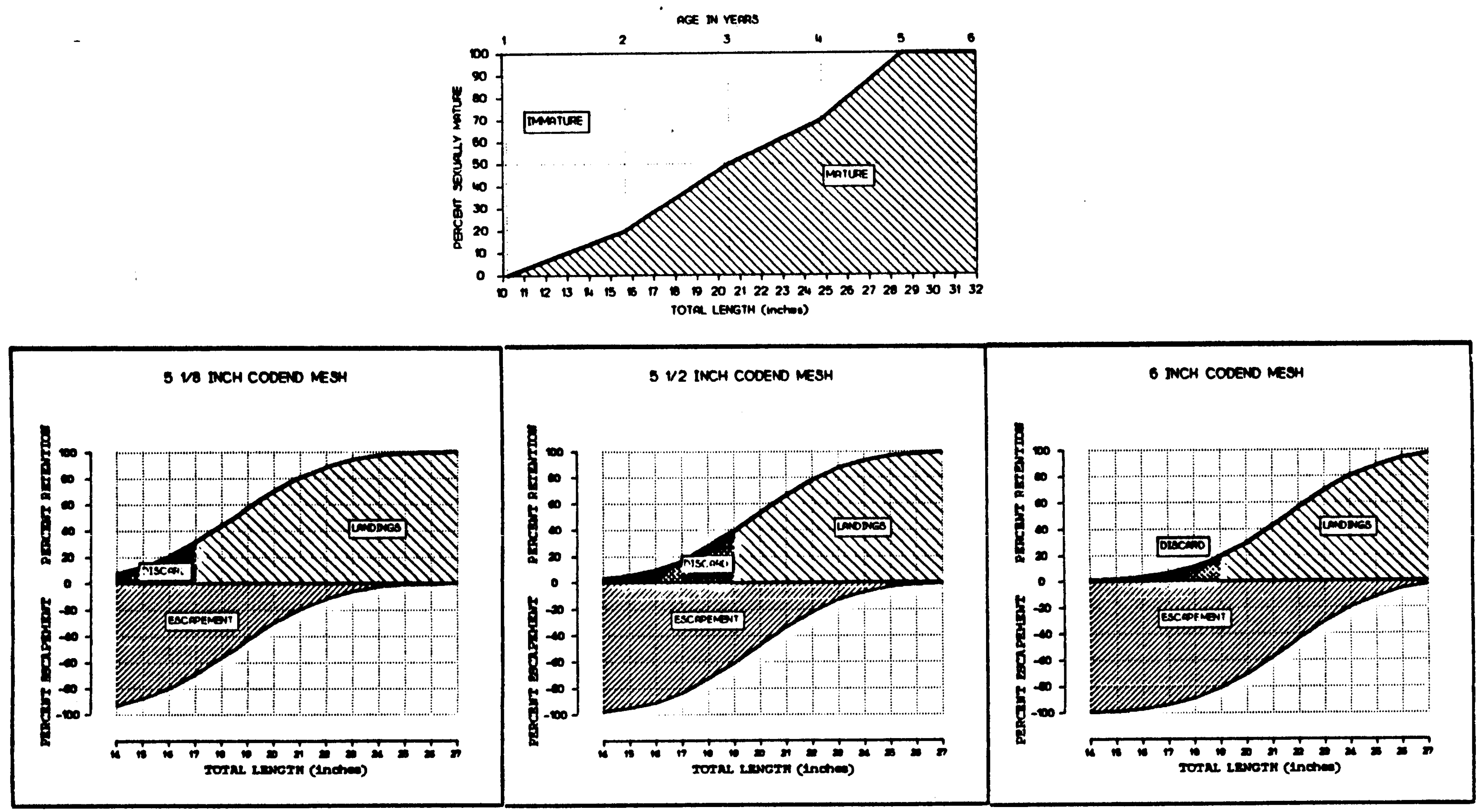


Figure 5.19. Selection and maturity in Georges Bank cod. The first selection curve represents the current operative mesh and the current minimum size. The other two panels indicate alternative meshes and minimum sizes.

GEORGES BANK HADDOCK

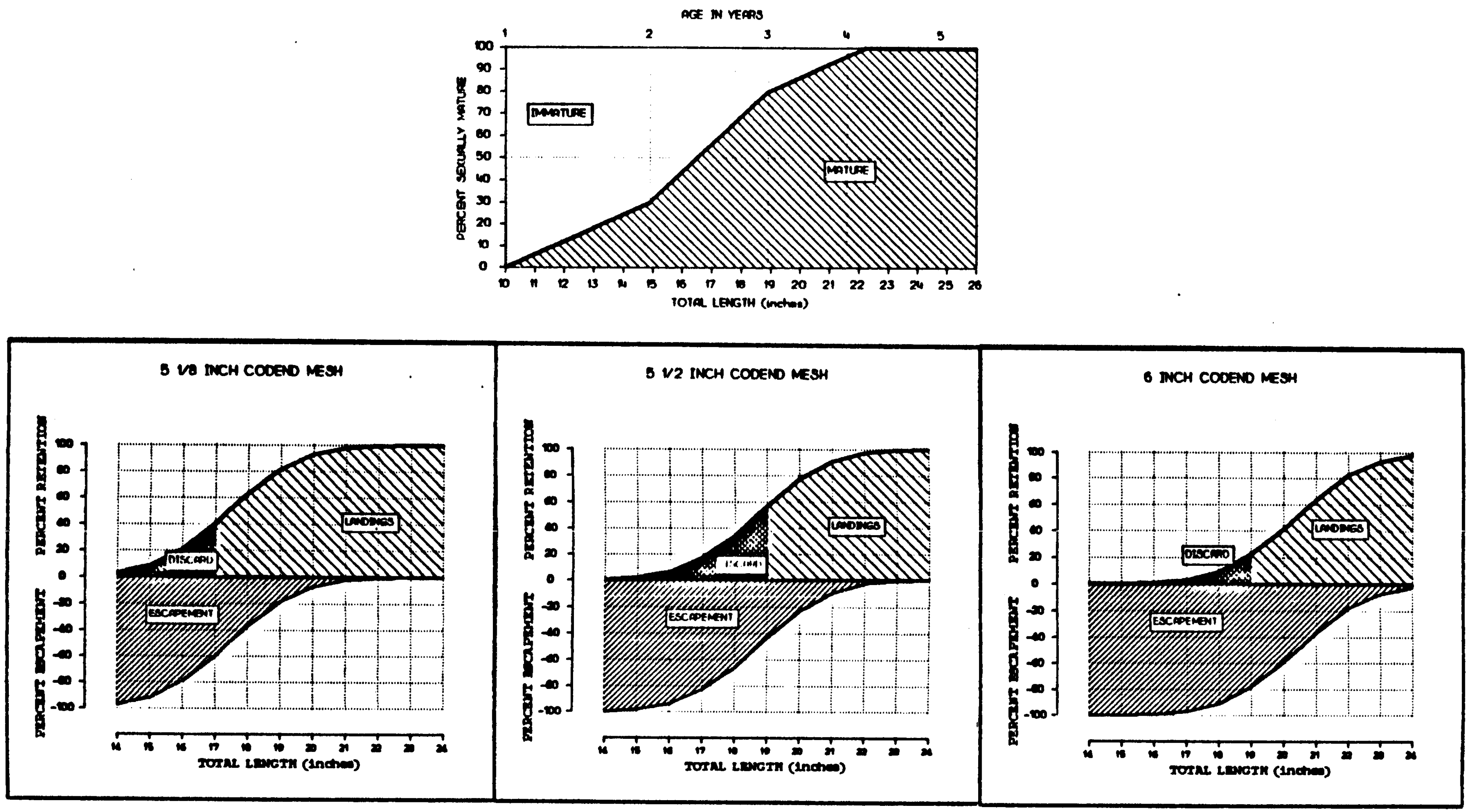


Figure 5.20. Selection and maturity in Georges Bank haddock. Explanation same as Figure 5.19.

With the exception of the current operative mesh size (approx. 5-1/8 inches), a similar relationship between the important parameters exists with respect to pollock as was the case with haddock. The 50% selection lengths for both of the larger meshes examined are larger than the size at 50% maturity (see Figure 5.21), but with a minimum size appropriate to the size at maturity, the discard level associated with 5-1/2 inch mesh is prohibitively high. these findings suggest the appropriateness of the 6 inch mesh.

Georges Bank yellowtail flounder (Figure 5.22) reaches 50% sexual maturity at age 2 (10-11 inches). All three mesh sizes examined have 50% retention lengths which are substantially larger. Therefore, the most appropriate mesh size is that which minimizes discards in consideration of an acceptable minimum size.

A virtually identical situation exists in the case of American plaice. As seen in Figure 5.23, the 50% selection length varies from 12 to 14 inches, uniformly at or above the size at 50% maturity (11-12 inches). Thus, the most appropriate mesh size is that which implies an acceptable level of discard given a minimum size which approximates the size at 50% maturity (i.e., about 12 inches).

On the basis of the size at 50% maturity for Georges Bank winter flounder (Figure 5.24), 12-13 inches, the most appropriate mesh size is between 5-1/2 and 6 inches. In consideration of coastal stocks of winter flounder which reach sexual maturity at smaller sizes and for economic reasons, a somewhat smaller minimum size may be appropriate (i.e., 11 inches). As in the case of the other flounders considered, the most appropriate mesh (in the range of 5-1/2 to 6 inches) is that which results in an acceptable level of discard.

<u>Square Mesh</u>. The closest approximation of a sharp cut off in the selection of fish below a certain size in a trawl catch would likely be accomplished through the use of square mesh cod ends. Comparison of retention curves for haddock and whiting using conventional diamond mesh vs. square mesh codends based upon Aberdeen, Scotland mesh selectivity studies demonstrate that retention curves for square mesh codends more closely approximate vertical "knife-edge" selection than do those for diamond mesh (Figure 5.25).

The geometric configuration of the square mesh allows for escapement of more juvenile round fish than the conventional diamond mesh. This has been documented through the above cited experimental work on whiting cod-end selectivity in Aberdeen (Robertson, 1983). Work is currently underway in the North Atlantic groundfish fishery comparing selectivity of square mesh cod ends with the conventional diamond mesh cod ends. Results, while preliminary, demonstrate the same conclusions as did the Aberdeen study.

Square mesh cod ends have a smaller selection range than conventional diamond mesh (Figure 5.25). The square mesh with the same 50% retention length as the conventional mesh retains fewer small fish and more large fish and the quality of fish caught in the square mesh cod-ends is likely to be superior to that caught by conventional mesh. In addition, less sorting time is required on deck, the workload may be considerably reduced, and less debris is retained by the square mesh cod-ends than with conventional diamond mesh. This may result in reduced costs in time, and effort, and lead to increased revenues.

POLLOCK

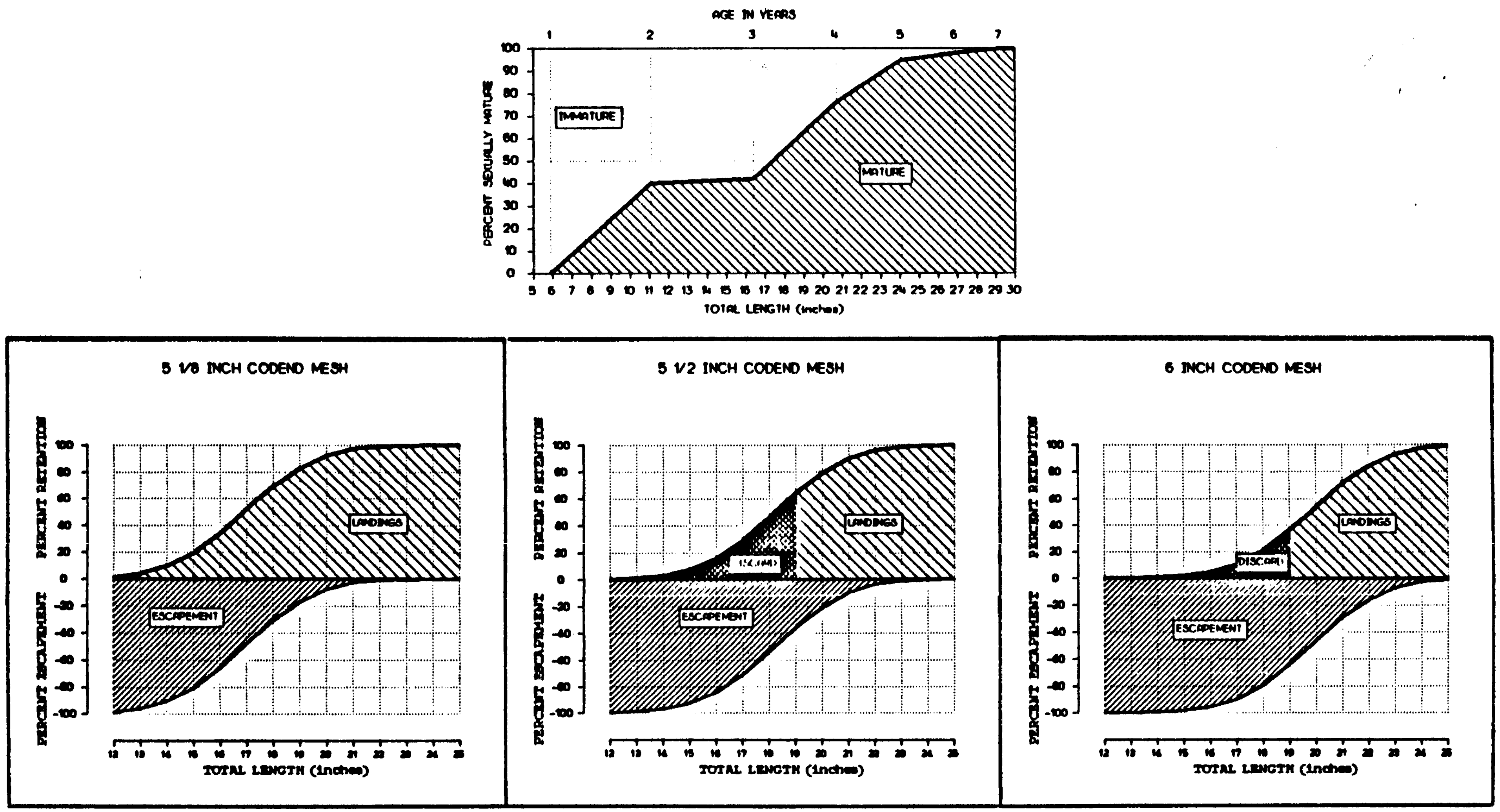


Figure 5.21. Selection and maturity in pollock. Explanation same as Figure 5.19.

GEORGES BANK YELLOWTAIL FLOUNDER

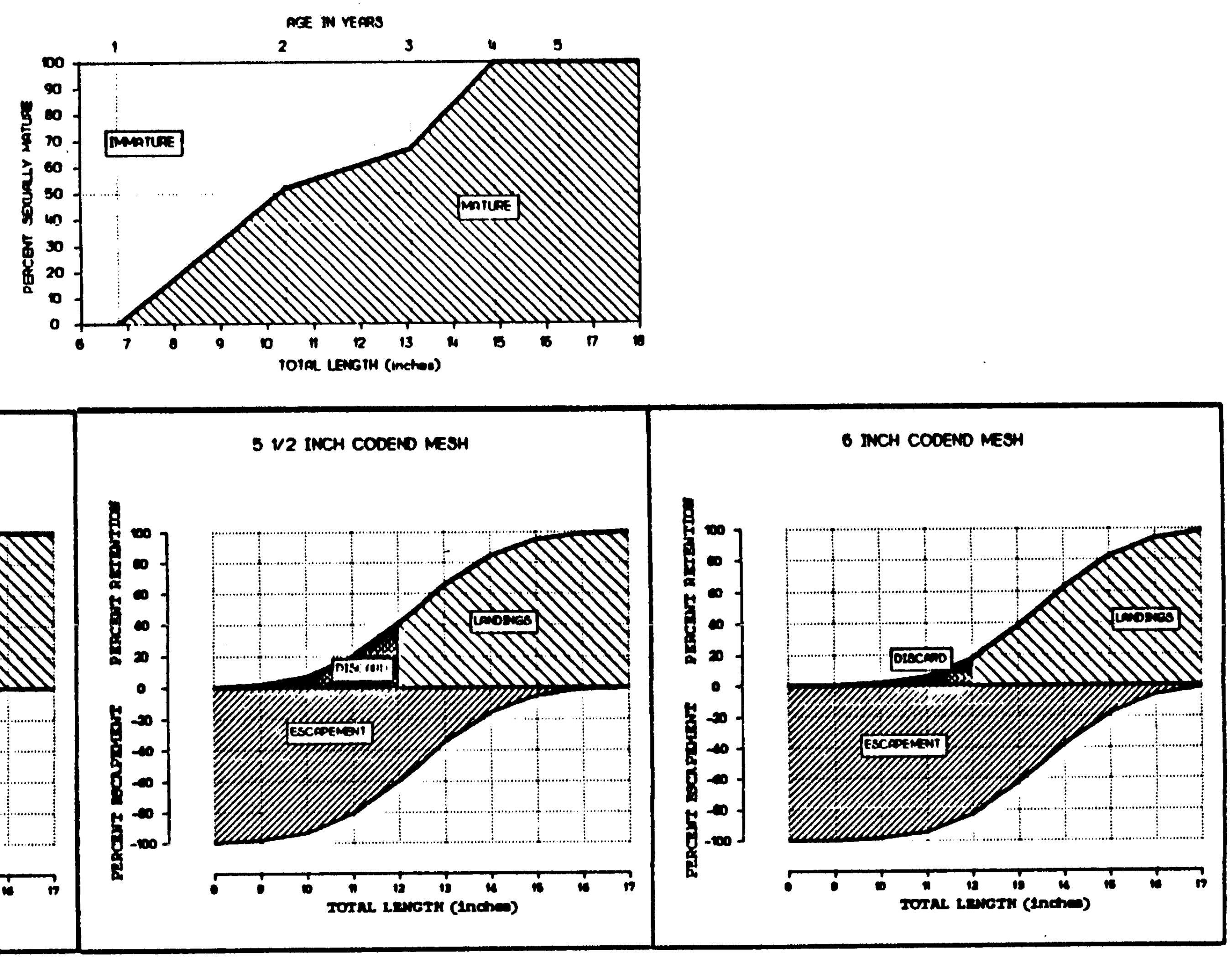


Figure 5.22. Selection and maturity in Georges Bank yellowtail flounder. Explanation same as Figure 5.19.

AMERICAN PLAICE

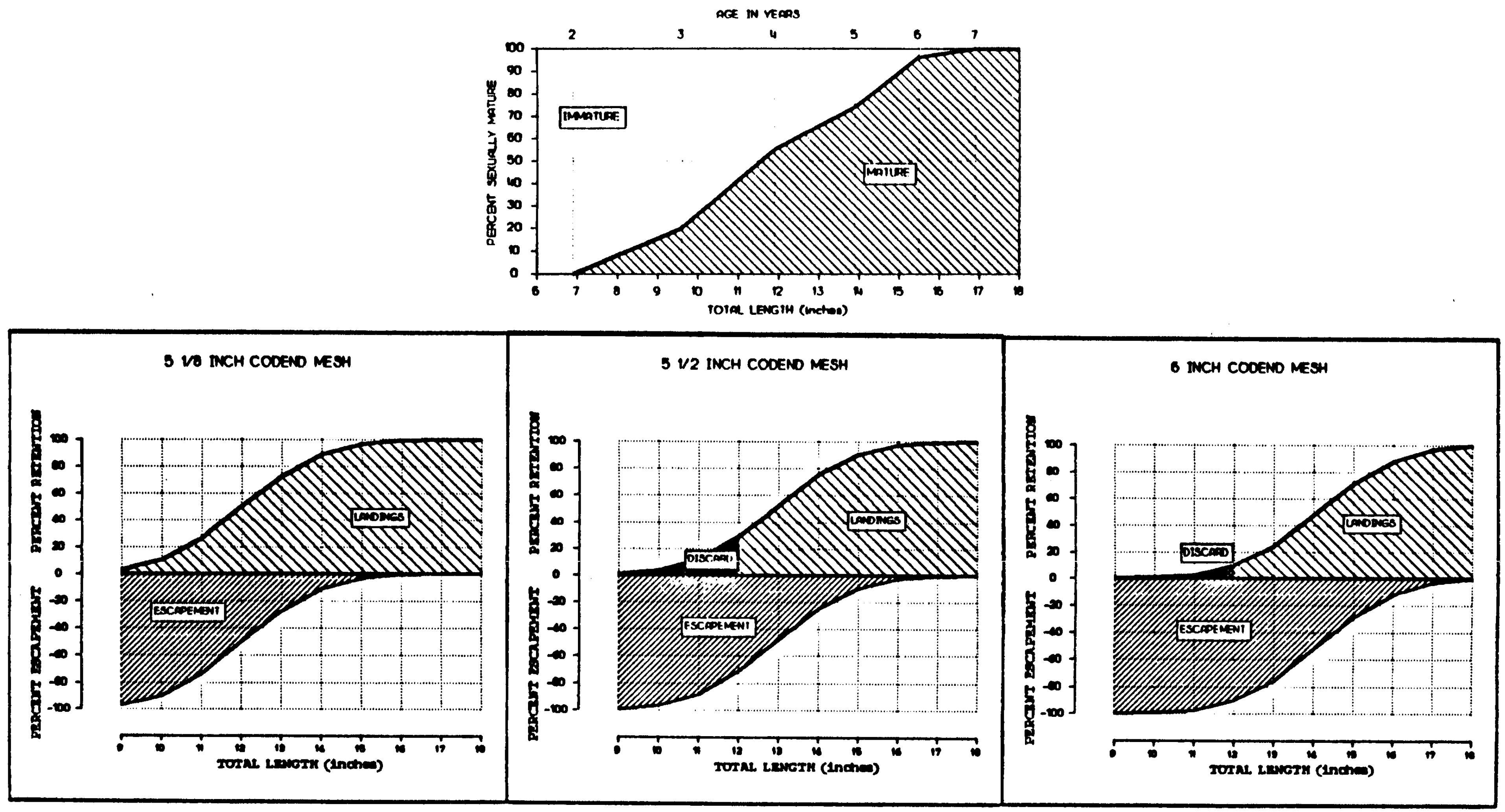


Figure 5.23. Selection and maturity in American plaice. Explanation same as Figure 5.19.

GEORGES BANK WINTER FLOUNDER

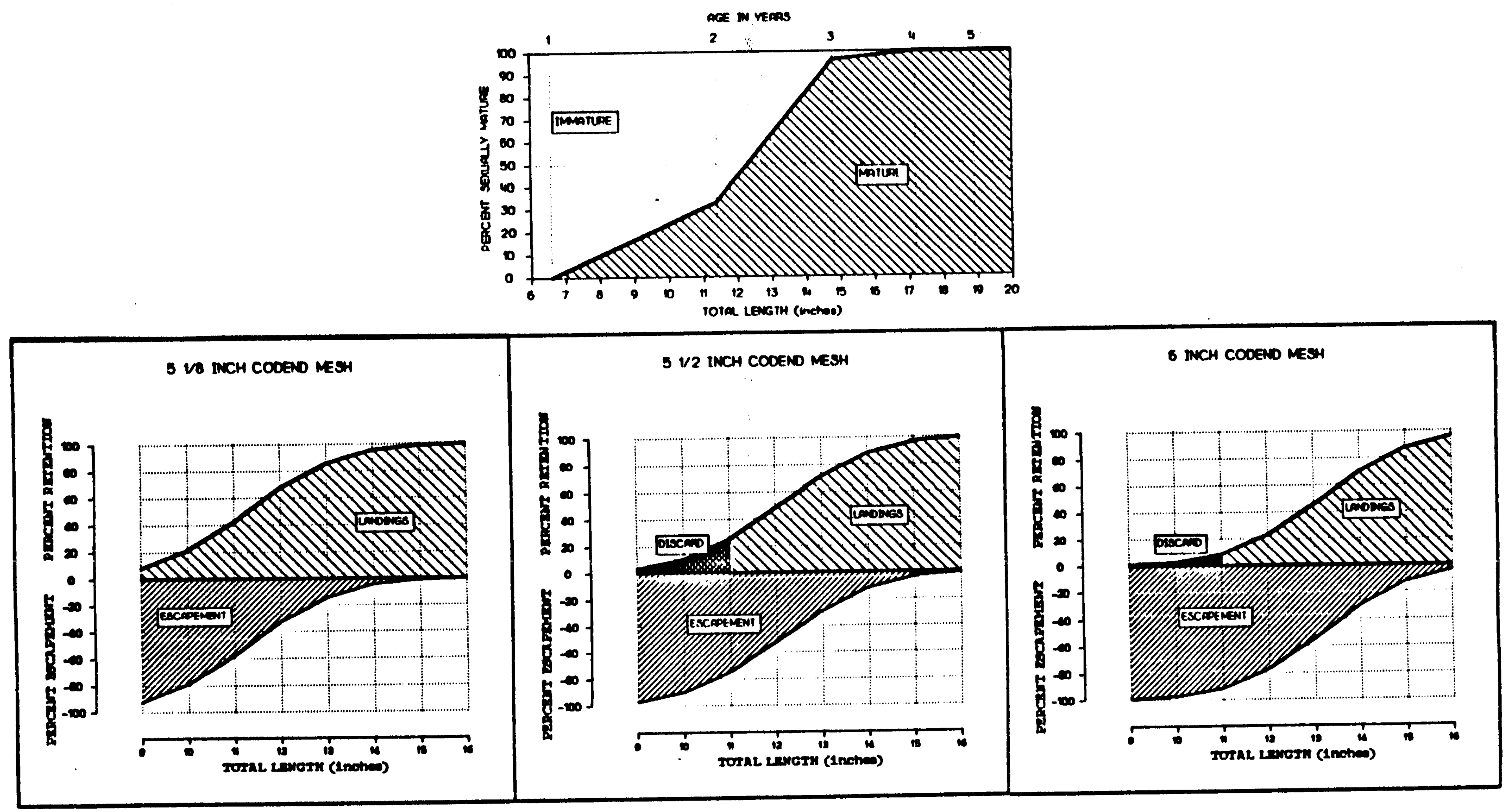


Figure 5.24. Selection and maturity in Georges Bank winter flounder. Explanation same as Figure 5.19.

Use of square mesh cod-ends allows for a greater escapement of juvenile roundfish, thus reducing the discard level. As illustrated in Figure 5.26, the square mesh allows for passage of a given sized roundfish at a slightly smaller mesh size than the diamond mesh. When the diamond mesh is contorted, as when added tension is placed on the mesh from the weight of a full bag, only small roundfish are able to escape through the mesh. By contrast, square mesh is not so distorted when under load. Thus, the retention characteristics of square mesh remains much more consistent. Preliminary results of experiments conducted by MIT Sea Grant indicate that conventional diamond mesh "necks down" in the wing and forward sections as well as the cod end when it is loaded with fish. Square mesh demonstrates less "necking down". An additional important feature of square mesh is that it will retain relatively smaller flatfish than similar sized diamond mesh (Figure 5.26).

It would appear, therefore, that use of square mesh similar in size to conventional diamond mesh may be very beneficial in reducing juvenile roundfish mortality in the fishery. However, the specification of an appropriate square mesh in regulating the fishery is premature at this time since comparative studies with conventional diamond mesh need to be done in local waters. Additionally, there is a need to complete data analysis for the retention of small flatfish in square mesh nets.

§5.6 Fishing Mortality

As discussed in §5.4, the two dimensions to the overall problem of achieving a desired level of total reproductive potential are fishing mortality rate and age at entry to the fishery. These two factors must be simultaneously considered in developing the management program. The concept of age at entry and the means by which it may be manipulated were discussed in §5.5. The following is a discussion of various aspects of fishing mortality.

The concept of fishing mortality rate, as used in this document, is the instantaneous rate of change in the size of the population as the result of fishing. The instantaneous fishing mortality rate (F) is a logarithmic function, but at low rates of F (ie., F = 0-0.3) it approximates the fraction of the fish population which is annually removed by fishing. Of course, not all deaths among fish populations are due to fishing activity. Death caused by predation, disease, accident, senility, etc., collectively comprises the natural mortality rate (M). As in the case of fishing mortality, M is calculated as an instantaneous rate using a logarithmic function. The sum of the two, F and M, is the total mortality rate (Z).

Robertson, J.H.B. Square mesh cod-end selectivity experiments on whiting (*Merlangius merlangus* (L)) and haddock (*Melanogrammus aeglefinus* (L)). ICES Fish Capture Committee, Working Group Meeting, Ijmuiden 1983.

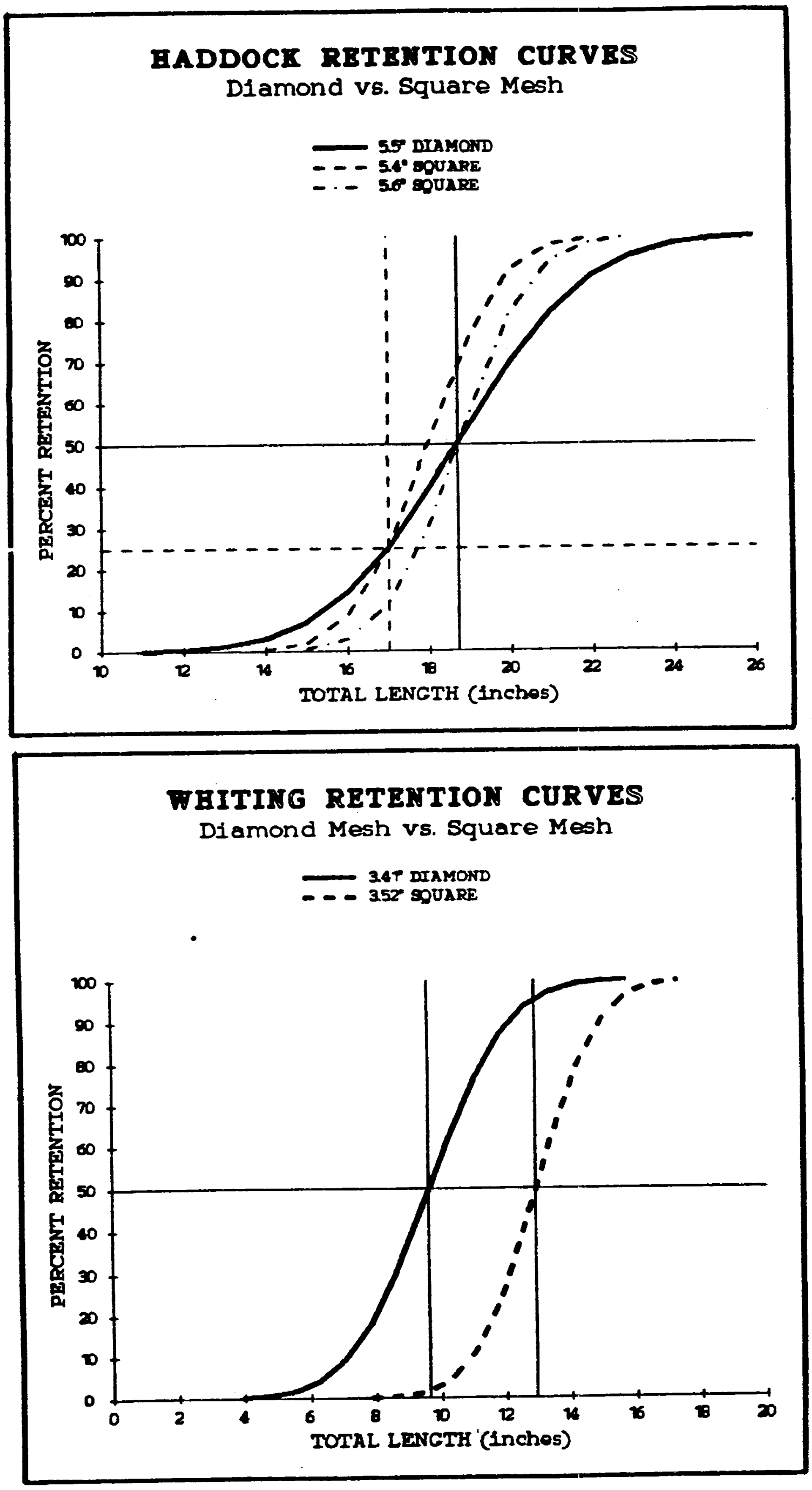


Figure 5.25. Comparative retention curves for haddock and whiting using square mesh versus diamond mesh cod-ends.

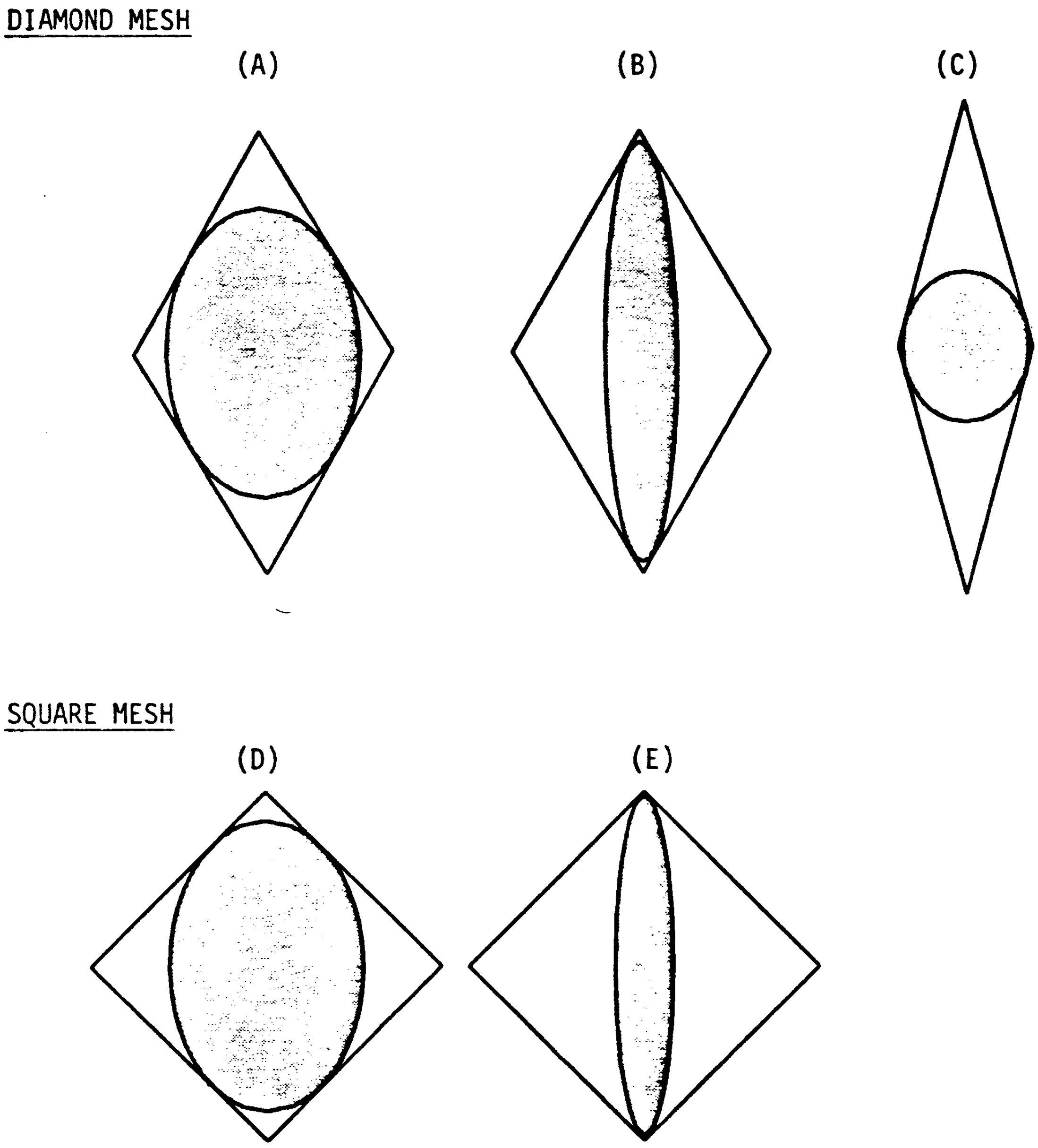


Figure 5.26. **Diagrammatic representation of cross-sections of fish able to pass through diamond mesh and square mesh.**
Diamond mesh: (A) roundfish, and (B) flatfish, (C) distortion of diamond mesh under heavily loaded conditions causes it to select for much smaller roundfish.
Square mesh: (D) same sized roundfish as in (A), and (E) flatfish. Note that the mesh bar is slightly shorter than that for the diamond mesh which will select for the same sized roundfish. Also note that the square mesh will retain smaller flatfish.

<u>Sources of Fishing Mortality</u> It is understood that fishing mortality is that portion of total mortality which is ascribable to fishing activity, but how does such activity translate to the observed level of F? The most obvious source of fishing mortality is from the operation of fishing gear with the intent to capture a specific species of fish. Such is a directed fishery which will exert a certain <u>directed mortality</u>. Only in very rare instances does fishing gear capture only those species which are specifically targetted. In the usual situation, other species of fish, not specifically sought, may also be captured. In such cases, the fishing mortality exerted on those other species comprises the <u>incidental mortality</u>. The fish captured in this fashion are often called "by-catch". In the "real world" operational sense, these two categories of fishing mortality may be interchangable with respect to a particular species, depending upon the specific intentions of the fisherman at any moment in time. In the ideal case, from the energetic standpoint of population dynamics, the only sources of fishing mortality would be directed and incidental, and in combination would be held constant at the optimum level which maximizes fish production. Various ramifications of that relationship may be examined using yield-per-recruit analysis.

Ordinarily, among those species of fish which have a commercial value and generate revenue in commercial enterprises, there is a minimum size for those fish of a particular species which enter into such commerce. Minimum sizes may be explicitly levied through regulations or they may be implicit in the size having acceptance by the fish processing industry. We have seen in §5.5 that fishing gear may be modified with the intent to target on specific sizes of fish, but the gear has inherent limitations in that regard. As a consequence, fish smaller than any specified minimum standard will be caught. In the case of the more hearty species, crustaceans and shellfish in particular, the undersize individuals taken in the catch may survive being culled out and returned to the sea. Among nearly all of the commercially important finfish, however, the discarded individuals do not survive. This exerts a certain <u>discard mortality</u>. Fish may be discarded from directed or incidental catches of important species or simply because they may be species with little or no economic importance. In the long-range perspective, it makes little sense to waste undersized individuals of the important species. Thus, again from that perspective, it is appropriate to reduce discards of such species to the maximum extent possible.

<u>Options for Limiting Fishing Mortality</u> A wide range of possible options are available for limiting the fishing mortality rate. Generally, these range from the more direct controls on total fishing effort, which are potentially the most intrusive in the conduct of fishing enterprises, to more benign measures which act in an indirect manner to effect changes in fishing mortality. The measures chosen should give fishermen the greatest possible freedom of action in conducting business and pursuing recreational opportunities while remaining consistent with ensuring wise use of the resource.

Direct methods for limiting the fishing mortality rate generally include any means for controlling the total amount of applied fishing effort. In operational terms, this means controlling the total number of fishing days at sea (or some other appropriate unit of fishing effort) by limiting the number of vessels which may participate in the fishery or the number of units of effort each vessel may be permitted to exert or a combination of both. Any predetermined level of fishing mortality (arrived at, for example, by yield-per-recruit analysis) may conceptually result from application of these types of measures. However, embedded within such an approach are certain disadvantages. The quantitative relationship between fishing effort and fishing mortality is well understood in only rare instances. Thus, only an approximation of the desired level of fishing mortality may ordinarily be achieved. Moreover, that relationship is subject to continuous change from technological improvements in gear and techniques. From an industry perspective a significant disadvantage may be that the benefits of unusually high levels of resource abundance cannot be fully captured as they occur.

Another direct method for limiting fishing mortality is the use of a regulated minimum size. In this case, the intent is to limit fishing mortality on a particular segment of the population, the juveniles and prerecruits. Such a measure may be very effective in limiting deaths from fishing among undersized individuals, particularily in the case of the heartier species which are able to survive being caught. In most finfish taken in commercial operations, however, such is not the case. If the minimum size measure is applied to all segments of the industry, then a certain benefit may result from an incentive to avoid concentrations of small fish when found.

Perhaps the most commonly used indirect method for limiting fishing mortality is through the imposition of catch quotas. For any given level of resource abundance, there is a calculable relationship between total catch and the fishing mortality rate. Given an adequate assessment of resource abundance, then an appropriate level of fishing mortality (in the context of the goals of management) may be achieved through proper specification of the total catch quota. This approach avoids many of the pitfalls of setting a direct cap on fishing mortality described above, but in operation is subject to two major disadvantages. Traditionally, there has been a dichotomy of interest between the fishing community and the management agency with regard to management goals in the short-term context. Management goals appropriate to quota management are typically oriented towards maintenance of spawning stocks. During periods of low resource abundance, the fishing community has an interest in exploiting those abundances at a level sufficient to preserve the integrity of the community. But that interest conflicts with the perceived responsibility of the management agency to maintain a long-term perspective in its approach to those management goals. The other major disadvantage to quota management is due to its reliance on quantitative stock assessments. The quantitative assessment of a stock of fish is not and never will be an exact science. Therefore, there will always be differing perceptions of resource abundance by the fishing community versus the assessment scientists such that the latter will be unable to categorically answer many of the objections raised by the former.

Another indirect approach to limiting the fishing mortality rate is through the use of closed seasons and/or areas. Such an approach may be effective provided that the availability of the resource or a segment thereof may be definable in terms of a specifiable time or space. Of course, it should be recognized that the overall impact upon fishing mortality will depend on the availability of fish at other times and in other areas. For example, the intent may be to reduce the fishing mortality on juveniles. Provided that certain areas may be definable as nursery areas, then those areas could be closed to fishing during the period of the year that concentrations of juveniles are in residence. The same approach could be applied in the case of known spawning areas with the intent of avoiding disruption of spawning activity. However, to the extent that a spawning closure corresponds in time and place to dense concentrations of spawners, it may represent to the industry a foregone opportunity to efficiently make good catches of fish.

Finally, it is possible to effect indirect limitations of the fishing mortality rate by controlling the kinds of fishing gear which may be employed. One approach is to specify certain types of gear which have inherent limitations in efficiency. A good example was the requirement, for many years, to use only sailing vessels in the Chesapeake oyster dredge fishery.

The more general approach, which has been applied in a wide variety of fisheries, is to specify certain minimum dimensions in the construction of the gear such that smaller individuals are less likely to be captured. A detailed discussion of the role that mesh size plays in the multispecies fishery appears in §5.5 of this document. A minimum mesh size may be specified with the intent to limit fishing mortality on juveniles and prerecruits within the multispecies resource. To the extent that the mesh size chosen is appropriate to a given species and, in fishing operations, is efficient in making a distinction between adults and undersized fish, this approach will meet that intention. It has been pointed out, however, that mesh size (particularily the commonly employed diamond mesh) has inherent limitations in making that distinction. The greatest difficulty in applying mesh size to the multispecies fishery with the intent to limit fishing mortality on undersized fish is the fact that each of the component species within that fishery may have its own unique (most appropriate) mesh size. This difficulty may be minimized if we consider only the most important species within the overall mixture. That compromise is a necessary precursor to the choice of standard mesh sizes, but it should be accompanied with the recognition that certain minor component species may be exploited at less than optimum conditions. A close examination of the important component species within the multispecies resource reveals that many of those species may appropriately be harvested with standardized, relatively large sized mesh, whereas a limited number of other important species require use of smaller sized mesh. Additional compromises are necessary to resolve these conflicting imperatives. Nevertheless, if mesh size is to be used as a management measure in the multispecies fishery to limit the fishing mortality on juvenile fish, then the small-mesh fisheries must be strictly limited in time and space to the minimum absolutely necessary to successfully prosecute those fisheries. The alternative is that mesh-size will be an ineffective measure in the prevention of recruitment overfishing.

Part 6

PART 6: MANAGEMENT OBJECTIVE

§6.1 Definition of the Management Objective

The preparation of a comprehensive fishery management plan for the multi-species finfish fishery off the Northeast coast of the United States represents the fulfillment of a committment to continuing management that was articulated in the Interim Groundfish FMP. The objectives contained in the Interim Plan were designed to be limited in scope, and those objectives are no longer sufficient for implementing Council policy in the context of the expanded management unit that was defined in §4.2 and the conditions of the relevant stocks that were described in §5.2.

The management objective of this multi-species fishery management plan is the practical expression of the intent of the Council's management policy. The objective is fully consistent with the current scientific thought and guidance regarding the long-term biological productivity of fishery resources (as discussed in §5.1), and is specific with regard to the factors in the fishery that must be addressed to affect that productivity. The objective also acknowledges the continuing need for data and information on the operation of the mult-species finfish fishery for plan refinement and further plan development purposes.

The objective of the Northeast Region Multi-Species Fishery Management Plan is:

> **to control fishing mortality on juveniles (primarily) and on adults (secondarily) of selected finfish stocks within the management unit for the purpose of maintaining sufficient spawning potential so that year classes replace themselves in the stock on a long-term average basis; and to similarly reduce fishing mortality for the purpose of rebuilding those stocks where it has been demonstrated that the spawning potential of the stock is insufficient to maintain a viable fishery resource; and further to promote the collection of data and information on the nature, behavior and activity of the multi-species fishery, and on the effectiveness of the management program.**

As discussed in §5.2, the specific minimum spawning stock abundance levels noted in the policy are not biologically defined for most stocks. Nevertheless, it is possible to evaluate the reproductive potential of many stocks, in relation to the pattern and intensity of fishing mortality (from discards and landings), and thereby determine the minimum conditions necessary for the replacement of year classes to occur in the stock on a long-term, average basis. To this end, management measures can be designed to modify the pattern or intensity of fishing mortality in such a way as to maintain desired stock conditions, but it is understood that these same measures, when applied across a multi-species fishery, may not be the most effective for the individual stocks within the fishery.

In effect, the objective calls for management action directed toward the <u>maintenance</u> (through mortality control) of those stocks that have sufficient spawning potential to be capable of replacing year classes with new recruitment on a long-term average basis, and the <u>rebuilding</u> (where mortality reductions are feasible) of those stocks that currently lack sufficient spawning potential to produce recruitment of sufficient strength or frequency to replace year classes in the stock on a long term average basis.

In the situation where the abundance of a stock may have been determined to be too low to permit the attainment of an acceptable level of spawning potential, and this situation has been remedied through management efforts to reduce fishing mortality, then the management emphasis shall shift from the reduction of fishing mortality to the control of fishing mortality.

§6.2 Initial Specification of Management Objective

The management objective of the Northeast Region Multi-Species FMP is intended to be specific enough to buffer the finfish resources against overfishing, yet robust enough to accommodate changing conditions and circumstances in the fishery. As discussed in Part 5, several of the major species within the management unit require specific action to achieve or maintain an acceptable level of spawning potential. These species, identified by fishery sector, include cod, haddock and various flounders in the Gulf of Maine; cod, yellowtail and other flounders on Georges Bank; and yellowtail and other flounders in Southern New England. In addition, two stocks have been identified as requiring specific efforts to achieve stock rebuilding. The latter include the Georges Bank haddock stock and the Gulf of Maine redfish stock. In all of the above cases, current conditions of fishing mortality on the stock and/or the age (size) at which fish are first recruited to the fishery jeopardize long-term maintenance of the required level of spawning potential.

The distinction that the objective draws among stocks is related to the severity of the deviation between the current stock condition and the desired stock condition. Severe circumstances, such as are judged the case for Georges Bank haddock and Gulf of Maine redfish, require direct action to reduce fishing mortality. Less serious circumstances, such as typify several other stocks, warrent action which controls mortality through direct or indirect means to maintain the desired stock conditions. Still other unspecified species/stocks in the fishery are potentially subject to destabilizing factors in the fishery which may jeopardize their long-term productivity. For these stocks, the appropriate management action will be to closely monitor shifts and trends in fishing mortality. Table 6.1 recapitulates the status of key stocks within the management unit.

With particular reference to the above species/stocks, the Council has identified particular levels of spawning potential as being required for their long-term biological productivity. Information derived from several sources, including observations of parental stock and subsequent recruitment, historic patterns of stock abundance under various exploitation regimes, or documented events in the dynamics of related stocks, have led the Council to conclude that spawning potential at the level of approximately 20% of the maximum (20% MSP) is appropriate for the stocks of specific concern to the Council. However, in the case of Georges Bank haddock, the Council has concluded that a target level of 30% MSP is necessary to promote an increase in stock abundance, and in the case of Gulf of Maine Redfish, the Council judges it necessary to achieve the largest feasible value of % MSP, given the constraints of the multi-species fishery. These specific target values of % MSP are subject to refinement as relevant data become available and further analyses are undertaken.

Therefore, the recommended initial application of the objective, which incorporates the above % MSP values for stocks of immediate concern within the various fishery sectors is as follows:

Table 6.1

Summary information on the condition of the stocks of important species within the multispecies complex with an indication of appropriate management action.

SPECIES	STOCK	STOCK SIZE	FISHING MORTALITY	APPROPRIATE MANAGEMENT ACTION
Cod	GM	Healthy-Stable	High	Control F
	GB/South	Healthy-Stable	High	Control F
Haddock	GM	Median-Declining	High	Control F
	GB	Danger Zone-Declining	High	Reduce F
Redfish	GM	Warning Zone-Declining	Above F-max	Reduce F
Pollock	GM	Healthy-Stable	Low	Monitor F
Yellowtail	GB	Lower Median-Stable	High	Control F
	SNE/MA	Median-Increasing	Above F-max	Control F
Am. Plaice	GM	Healthy-Stable	Unknown	Control F
Witch Fl.	GM	Median-Stable	Unknown	Control F
Winter Fl.	GM	No Current Information	Unknown	Control F
	GB	No Current Information	Unknown	Control F
	SNE/MA	No Current Information	Unknown	Control F
Whiting	GM	Median-Stable	Low	Monitor F
	GB	Lower Median-Increasing	Low	Monitor F
	SNE/MA	Lower Median-Increasing	Low	Monitor F
Red Hake	GB	Warning Zone-Increasing	Low	Monitor F
	SNE/MA	Lower Median-Increasing	Low	Monitor F

Gulf of Maine Sector

(1) Reduce fishing mortality on the redfish stock to achieve maximum feasible spawning potential.

(2) Control fishing mortality to achieve in excess of 20% of the spawning potential for haddock, and 20% of the spawning potential for cod, winter flounder, witch flounder and American Plaice.

(3) Monitor fishing mortality on other major stocks with specific reference to the maintenance of adequate spawning potential.

Georges Bank Sector

(1) Reduce fishing mortality on the haddock stock to achieve 30% of that stock's spawning potential.

(2) Control fishing mortality to achieve 20% of the spawning potential for cod, yellowtail flounder, winter flounder, witch flounder and American Plaice.

(3) Monitor fishing mortality on other major stocks with specific reference to the maintenance of adequate spawning potential.

Southern New England Sector

(1) Control fishing mortality to achieve 20% of the spawning potential for yellowtail and winter flounder.

(2) Monitor fishing mortality on other major stocks with specific reference to the maintenance of adequate spawning potential.

§6.3 Future Respecification of the Management Objective

Refinements to the specification of the management objective can be expected to occur as a consequence of two factors:

(1) The species explicitly identified in the objective may no longer warrant active management, whereas other species within the management unit may require management action at some level;

(2) Refinements in the basis for determining target levels of % MSP may change, necessitating a respecification in the actual target values, or the target values themselves are determined to be inadequate in consideration of other factors in the fishery.

In either case, a determination of the need for change in the specification of the objective will be made by the Council upon information prepared by a working group of scientists attached to the Council for FMP monitoring and analysis purposes. A specific description of this working group is contained in §7B4 of this FMP. A change in the specification of the FMP objective will likely be reflected in a corresponding change in some regulatory element of the managememt program. Procedures for handling such changes in the management program are also described in §7B4.

Part 7

PART 7: MANAGEMENT PROGRAM DEVELOPMENT

SUBPART A: IDENTIFICATION AND ANALYSIS OF MANAGEMEMT PROGRAM ALTERNATIVES

§7A1 Alternative Strategies For Achieving Objectives

The No Action Alternative

This management program differs both conceptually and substantively from its predecessor, the Interim Groundfish FMP. These differences are manifest in the multi-species fishery scope of the management program, the policy underlying the design of the program, the specificity of the management objectives, the range of stocks directly regulated, and the commitment to continuing management. The decision to embark on such an expansive management program represents, in part, a recognition that the management entity is the highly complex multi-species fishery that exists in the region, and that this fishery relies on fish stocks that, in many cases, are heavily exploited and in danger of being lost as productive, revenue-producing components of the fishery.

The purpose and need for management have been clearly established in §1.1 of this FMP. The Council has rejected the "no action" alternative as being inappropriate to the condition of the fishery, vis-a-vis the mandates of the MFCMA. Further, given that the Interim Groundfish FMP is scheduled to expire in April, 1985 (unless extended by the Secretary), failure to take action at this time would result in an unacceptable hiatus in the regulation of three economically important groundfish stocks that are key to the welfare of the multi-species fishery. Therefore, the major strategy alternatives considered in this FMP are those that relate to the achievement of the management objectives in the context of the management policy.

Alternative Strategies to Achieve Objectives

As discussed in §§5.1-5.4, the intent of the overall management program is to focus on the spawning potential of the stocks within the overall multi-species fishery so as to preserve within them the biological capacity to replace themselves over the long term, and thus be able to recover from adverse conditions of environment or exploitation. This biological capacity is understoood as the maintenance of adequate spawning potential. The objectives of this FMP refer to specific target levels of spawning potential for key groundfish species, which have been determined by the Council to be consistent with the long-term average replacement of year classes in the stock.

Section 5.4 identifies the major parameters affecting spawning potential as age-at-entry (age at 50% selection) and fishing mortality. In effect, the management program must employ a strategy (or method) that effectively manipulates these two parameters in such a way as to result in the simultaneous achievement of the management objectives stated in §6.2. In reality, the management policy adopted for the multi-species FMP serves as a constraint on the management method employed, requiring compatibility with the dynamics of the fishery and minimization of inadvertent and unnecessary regulation. Major strategies are defined in terms of the methods used to achieve the objectives. Because two parameters are involved, the strategies must relate to either control on age-at-entry or control on fishing mortality (or both). Three alternative strategies are defined below.

A. Operational Control

This general strategy has been employed by the Council in the management of groundfish, sea scallops and American lobster. This strategy focuses on how the fishery operates, employing methods that either selectively or generally reduce the vulnerability of the stocks within the multi-species fishery. Methods which are appropriate to this strategy include gear restrictions, area/time restrictions, and retention restrictions. The strategy does not directly limit the volume of fleet or vessel landings, nor does it directly limit effective fishing effort.

In relation to the maintenance of adequate spawning potential, as reflected in the objectives, this strategy is particularly effective for either direct or indirect control on age-at-entry. The methods that might be employed with this strategy to minimize the exploitation on certain age classes (e.g., immature fish) include specifying the legal minimum size that may be retained, or requiring various gear selectivity measures, such as mesh size. Minimum size has been used effectively in managing both lobsters and scallops, and mesh size has been used extensively over the past 15 years in management programs for cod, haddock, and yellowtail flounder. In addition to age-at-entry considerations, this strategy can be effective for enhancing spawning activities through area/season closures, thereby contributing to achievement of the objectives.

In relation to the parameter of fishing mortality, this strategy may be implemented through methods which limit discard mortality, close areas at times when stocks are particularly vulnerable, or limit fishing to areas where by-catch mortality is minimized. With respect to the overall exploitation of the stocks within the multi-species fishery resource, this strategy employs indirect methods (e.g., area closures to act as refugia) which are typically gross in their effect because effort can be physically displaced with uncertain results. However, in some specific situations, such as the recruitment of a new year class to the fishing grounds, closed areas/seasons may be very effective in minimizing mortality on juvenile fish.

In general, the methods appropriate to the strategy of operational control are well suited to the simultaneous achievement of the management objectives. They can be tailored to deal directly with the need to control age-at-entry over the range of stocks addressed in the objectives, with minimum disruption of the joint harvesting relationships that characterize the fishery. Coupled with a mechanism that allows the management program to respond to changes in effort, the general strategy satisfies the intent of the policy and is meaningful as the basis for a multi-species management program.

B. Effort Control

This general strategy has not yet been employed by the New England Council in the management of the FCZ fisheries. It has been used by the Mid-Atlantic Council in the management of the surf clam/ocean quahog fishery. The strategy focuses on the direct control of those factors in the fishery (e.g., vessels or days fished) that relate to fishing mortality. This strategy is distinguished here from the operational strategy which can be employed to have indirect control on fishing mortality. In effect, the effort control strategy ranges in effectiveness, depending upon whether the capabilities of individual vessels within the fleet are taken into consideration, particularly those associated with vessel size or equipment.

The methods used in effort control range from limited entry to days fished, but they all have as their basis a calculated relationship between units of effort and units of fishing mortality. In most single-species fishery management situations where an identifiable fleet is dedicated to the harvest of a particular stock (or species), it is often possible to determine the level of fishing mortality desired and derive the amount of effort (vessels or days fished) that will generate that mortality. These fishing mortality determinations are either predicated upon physiological growth considerations (yield per recruit or spawning stock biomass per recruit), or they are predicated upon considerations for the rate of stock exploitation (extraction), which will lead in either case to a target level of fishing mortality.

In the case of the multi-species fishery, where participating vessels are characteristically opportunistic, the available fishing mortality rate guidance is calculated on a stock-by-stock basis, but must be interpreted on a fishery-wide basis, because the same vessels are responsible for exploiting a wide range of stocks. The major obstacle to employing the effort control strategy is precisely the nature of the multi-species fishery and the attendant difficulty of relating a unit of effort to a unit of fishing mortality. Only if the fishery is treated as a static system, where the value and range of species options are assumed to be known, and a composite fishing mortality target can be derived, is it possible to calculate a desirable level of fishing effort and specify an effort control method. Given the impracticality of such a treatment, notwithstanding the lack of meaningful data on effective effort in the fishery, adoption of the effort control strategy would inevitably lead to fine-tuning, as is the case for the operational control strategy, but in this case at the expense of lost flexibility and freedom of participation in the fishery. Further, as has been shown in §5.5, control on effort may well have to be combined with complementary control on age-at-entry in order to satisfy the spawning potential objectives of this FMP. Failure to simultaneously address the latter might render this strategy insufficient.

There are other motivations for adopting the strategy of direct effort control in the multi-species fishery, namely the efficient use of capital in and the realization of profits (or rents) from the fishery. Inasmuch as it is the policy of this FMP to allow the multi-species fishery to operate and evolve with a minimum of fishery regulation or restriction of fishery options, while at the same time preserving the viability of the fishery resources, the use of the effort control strategy to achieve economic efficiency policy objectives is premature.

C. Catch Control

This general strategy has been previously used by the New England Council in the management of cod, haddock and yellowtail flounder, and has been used by the Mid-Atlantic Council in the FMP for Atlantic mackerel, squid and butterfish. This strategy typically employs a quota on the landings of a particular species. Quotas could be geared toward either: 1) achieving a desired harvest rate consistent with the long-term productivity of the species, or 2) achieving a desired stock level over time. In either case, quotas rely heavily on current stock assessment information in order to avoid unnecessary short-term costs to the industry; and in this way, quotas strain the limits of available, meaningful data and information.

Assuming that sufficient assessment data are available, the catch control strategy is most effective in the management of a single-species fishery. Where various species of fish are caught together or on the same trip, as in the multi-species fishery, species-specific quotas may artificially constrain the harvesting of associated species, keep other quotas from being reached, or prove to be ineffective in controlling species catch at any level. The New England Council found that quota management of cod, haddock and yellowtail flounder under the Atlantic Groundfish FMP produced undesirable results. For instance, the potential for fishery closures (as quotas are reached) encouraged vessels to "scramble" for shares. The scramble phenomenon resulted in operating inefficiencies, negative price effects and reduced revenues to the industry. Closures were characterized by product scarcity and elevated prices. In addition, concern for a pending closure lead to the misreporting of catch, discarding at sea and strained enforcement capabilities. The Council recognized that an individual vessel allocation system would mitigate some of the undesirable scramble effects of quota management, but the Council found that quota management at any level was not compatible with the mixed-trawl fishery of which cod, haddock and yellowtail flounder are a part.

In this FMP, the Council's concerns for quota management are magnified by the complexity of the fishery. Further, the catch control strategy would have to be combined with compatible age-at-entry control measures in order to be effective in achieving the spawning potential objectives discussed in §6.2. Finally, in consideration of the intent of the management policy, the catch control strategy does not appear appropriate for the development of the management program.

§7A2 <u>Selection of Strategy for Detailed Specification</u>

As discussed previously, the management strategy selected by the Council must be effective in manipulating the parameters of age-at-entry and fishing mortality in such a way as to result in the simultaneous achievement of the management objectives, while at the same time conforming to the intent of the management policy. The major strategy selected by the Council is that of <u>operational control</u>, because this strategy is judged to encompass methods which permit effective restraint without encumbering the flexibility and dynamics of the fishery.

In selecting this strategy alternative, the Council recognizes that operational control measures as a group may not be completely effective (in achieving the objectives) as they are initially specified and implemented, and that a feed-back process for making refinements in the management program must be an integral part of the strategy. Framework procedures, which enable the management program to respond to changing circumstances in the fishery or functional limitations on the effectiveness of the proposed management measures, are addressed in §7B4.

The Council has structured the management program around the methods of gear control, landed size and area control. In particular, the Council has selected minimum fish size and minimum mesh size as measures, which are effective in achieving age-at-entry control across the spectrum of stocks in the fishery (or geographic portion thereof), and time/area limitations, which can be used to partition the fishery in such a way as to provide opportunities for some species fisheries while minimizing the vulnerability of others. The Council believes that the current condition of the fishery is, in part, an artifact of a management system which has not been effectively implemented. Therefore, the Council is inclined to refine the application of these measures and is careful to avoid excessive application of these measures pending evidence of the need for it, which will come through the monitoring program (see §7B4, framework procedures).

The options for specifying the basic measures in the plan are identified in §7A3 and analyzed in §7A4. <u>In all cases, the options are designed to achieve the same spawning potential levels cited in the objectives, and differ principally with respect to how the measures are applied</u>. Further, the options reflect a component of subjectivity with respect to "what will work best" and "what is necessary", which is the prerogative of the Council and its advisors. Finally, the Council recognizes that selection of the operational control strategy implies a continued reliance on at-sea enforcement. The Council believes that effective at-sea enforcement can be achieved and has outlined a program to bring it about. The enforcement program is discussed below in §7B8.

§7A3 <u>Strategy Options Within the Management Program</u>

The major components of the management program, consistent with the adopted strategy of operational control, include the specification of minimum fish sizes, restrictions on the use of cod end and gillnet mesh by area and time, and spawning area closures. The management program is detailed below, including options for the specification of each control measure.

A. <u>Minimum Fish Size Options</u>

Minimum fish size is the principal management measure in the program. It is intended to direct the fishery away from immature fish and focus the catch on fish that have already contributed to the spawning potential of the stocks. In concert with other complementary measures, it is intended to ensure the long-term reproductive viability of the stocks. Justification for these minimum sizes is presented in §5.5. All minimum sizes would become effective upon implementation of the FMP and would be enforced on the basis of possession in or from the FCZ. In addition, no fish shorter than the prevailing commercial minimum size may be sold, and minimum sizes will apply to imported fish.

Commercial Fishery (total length)

Species	OPTION 1 Yr1	Yr2	Yr3	OPTION 2 Yr 1+	OPTION 3 Yr1	Yr2
cod, haddock, pollock:	19"	"	"	19"	17"	19"
witch flounder:	14"	"	"	14"	14"	14"
yellowtail, Am. plaice:	12"	"	"	12"	12"	12"
winter flounder:	11"	"	"	11"	11"	11"
redfish:	12"	13"	14"	none	none	

Recreational Fishery (total length)

Three options for minimum sizes in the recreational fishery are:

Option 1: The minimum sizes in the recreational fishery will be the same as for the commercial fishery (above), except that a total of 2 undersized fish per fisherman per day would be allowed.

Option 2: Minimum sizes will be established for cod and haddock only, and they will lag the corresponding commercial size as follows: year 1, 15 inches; years 2 and 3, 17 inches; year four and beyond, 19 inches.

Option 3: Same as option 2 except that, in addition, a total of 2 undersized fish per fisherman per day would be allowed in all years.

B. Minimum Mesh Size, Cod End and Gillnet Options

Gulf of Maine (area north of 42°20'N within the EEZ, including Mass. Bay)

Throughout the Gulf of Maine, the minimum cod end and bottom-tending gillnet mesh size will be 5-1/2 inches, with one exception, unless a vessel is participating in an exempted fishery where the use of smaller mesh is allowed (see part D, Exempted Fisheries, below). The singular exception to the general applicability of 5-1/2 inch mesh is within that portion of the area designated as the "redfish area", defined below, where the minimum cod end mesh requirement will not apply during the months of March through July or until the point in that time interval when 3500 mt of redfish have been landed within the calendar year. The "redfish area" is bounded by a line drawn from the intersection of 42°20'N latitude with 69°40'N longitude, northward along 69°40'W longitude to the intersection with line LORAN C 9960-X-25600; then northeastward along LORAN C line 9960-X-25600 to the intersection with 43°00'N latitude; then eastward along 43°00'N latitude to the seaward boundary of U.S. EEZ; then southward along the seaward boundary of the U.S. EEZ to the intersection with 42°20'N latitude; then westward along 42°20'N latitude to the point of origin.

Georges Bank (the area bounded on the north by 42°20'N, on the south by LORAN C lines 9960-Y-43500 and 5930-Y-30750, and on the west by the territorial sea above 41°35'N and by 69°40'W below 41°35'N)

Throughout Georges Bank, the minimum cod end and bottom-tending gillnet mesh size may be established in accordance with one of the three options below, unless a vessel is participating in an exempted fishery where the use of smaller mesh is allowed (see part D, Exempted Fisheries, below). The three cod end and gillnet mesh options are roughly equivalent in their long-term effectiveness for achieving the FMP objective.

Option 1: 6 inch mesh.

Option 2: 5-1/2 inch mesh when accompanied by an area/period closure to increase the spawning potential of haddock, cod and yellowtail flounder. Possibilities for such a closure are illustrated in Figure 7A1(a-c).

Option 3: 5-1/2 inch mesh in the first and second years of FMP implementation, followed by implementation of 6 inch mesh in the third year of FMP implementation.

In those parts of the Georges Bank area south of 42°20'N and east of 69°40'W not otherwise regulated for mesh, the mesh in bottom-tending gillnets would be equivalent to that in the regulated mesh area during the months of November through February when cod are prevalent in the catch.

Southern New England (west of 69°40'W within the New England Area)

In the Southern New England area indicated, two options for specifying cod end mesh are:

Option 1: No regulated mesh for mobile trawl gear.

Option 2: Regulated cod end mesh in the part of the Southern New England area east of 71°00'W, west of 69°40'W, and north of LORAN C 43500, consistent with the condition of the stocks and the character of the fishery in that area. However, exempted fishing would be permitted in accordance with part D, Exempted Fisheries, below.

The minimum mesh size for bottom-tending gillnets in an established regulated mesh area in Southern New England will be equivalent to that selected for cod end mesh (option 2). Where no minimum cod end mesh is established in Southern New England (option 1), or in portions of the Southern New England area outside of the regulated mesh area defined in option 2, bottom-tending gillnet gear will be regulated during the months of November through February in accordance with the Georges Bank area standard.

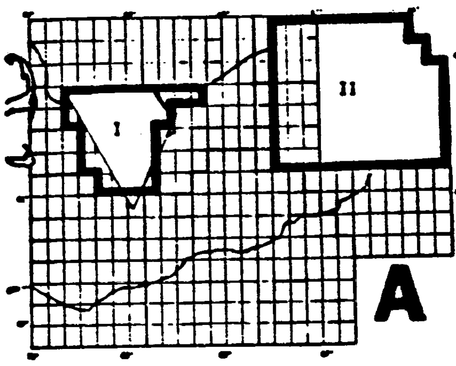
Figure 7A1 Three Georges Bank area/period closure options with impact analyses to complement 5-1/2 inch mesh.

AREA I
Closed February through June

AREA II
Closed February through June

POTENTIAL ANNUAL REDUCTION
in CATCH from GEORGES BANK

Cod - 18.3%
Haddock - 29.8%
Yellowtail - 9.9%
Blackback - 10.8%
Pollock - 20.9%
Dabs - 16.0%



PORT IMPACT

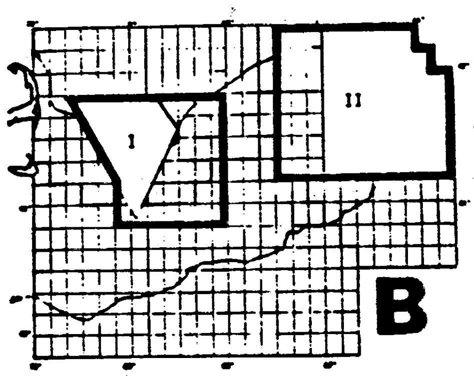
	PERCENT REDUCTION IN ANNUAL LANDINGS					
	COD	HAD	YT	BB	POL	DABS
POINT JUDITH	4	46	1	0	24	0
PROVINCETOWN	14	24	0	7	5	10
NEW BEDFORD	25	49	0	9	27	27
BOSTON	21	26	16	36	21	11
GLOUCESTER	10	22	6	6	12	7
PORTLAND	4	12	3	0	4	0

AREA I
Closed February through May

AREA II
Closed February through June

POTENTIAL ANNUAL REDUCTION
in CATCH from GEORGES BANK

Cod - 19.6%
Haddock - 31.3%
Yellowtail - 12.4%
Blackback - 16.0%
Pollock - 22.9%
Dabs - 17.5%



PORT IMPACT

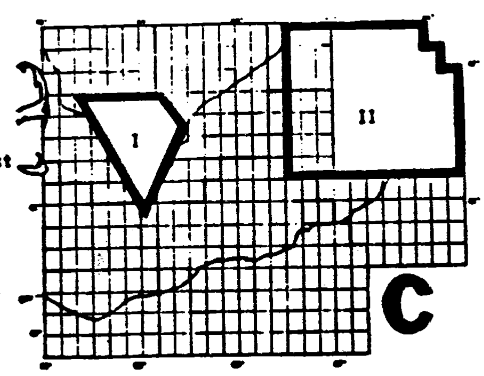
	PERCENT REDUCTION IN ANNUAL LANDINGS					
	COD	HAD	YT	BB	POL	DABS
POINT JUDITH	4	67	2	0	80	27
PROVINCETOWN	13	35	10	9	5	15
NEW BEDFORD	24	49	9	15	22	17
BOSTON	16	25	20	39	16	11
GLOUCESTER	15	21	7	15	10	7
PORTLAND	3	11	5	0	3	0

AREA I
Closed February through May

AREA II
Closed February through August

POTENTIAL ANNUAL REDUCTION
in CATCH from GEORGES BANK

Cod - 19.7%
Haddock - 33.0%
Yellowtail - 25.0%
Blackback - 13.2%
Pollock - 22.0%
Dabs - 10.8%



PORT IMPACT

	PERCENT REDUCTION IN ANNUAL LANDINGS					
	COD	HAD	YT	BB	POL	DABS
POINT JUDITH	4	46	4	0	21	0
PROVINCETOWN	14	37	9	9	7	14
NEW BEDFORD	27	50	21	14	30	18
BOSTON	21	31	26	45	22	19
GLOUCESTER	17	25	9	11	24	6
PORTLAND	4	12	11	0	3	1

C. Minimum Mesh Size, Body of Net

In all areas where cod end mesh is regulated, minimum mesh size may also be established for the body of the net as follows:

Option 1: Equivalent to the cod end as regulated.

Option 2: Some other minimum size.

Option 3: No regulated minimum mesh in the body of the net.

D. Exempted Fisheries

Exempted fisheries are limited opportunities to fish with mesh smaller than the established minimum size in the regulated mesh area for the purpose of harvesting species such as butterfish, dogfish, herring, mackerel, red hake, scup, shrimp, squid and whiting. Exempted fisheries are constrained to minimize the mortality of key groundfish species.

Because the purpose of exempted fisheries is to allow small mesh fisheries to take place in large mesh areas, if the prinicple management measure for regulated species is a closed area rather than a regulated mesh size, exempted fisheries are unecessary. Given that exempted fisheries may be put in place in either the northern or southern areas, or both, there are a number of options about how the exempted fisheries might be managed.

Area

Three options for specifying the area for exempted fisheries are:

Option 1: Vessels fishing in the exempted fisheries must fish within 25 miles from the territorial sea baseline.

Option 2: Vessels fishing in an exempted fishery must fish in the Gulf of Maine/Georges Bank areas illustrated in Figure 7A2 in order to reduce the by-catch impact on regulated species.

Option 3: Vessels fishing in an exempted fishery must fish in the Gulf of Maine/Georges Bank areas as well as in a Council-specified area in Southern New England shown in Figure 7A2.

Reporting Period

For a vessel participating in any exempted fishery, the landed weight of species directly regulated under this FMP may not exceed 10% of the landed weight of the species for which the exemption is granted (exempt species) over some reporting period. Two alternative reporting periods for NMFS verification of the 10% criterion are:

Option 1: Not to exceed 30 days.

Option 2: The length of the fishing trip, or one week, whichever is longer.

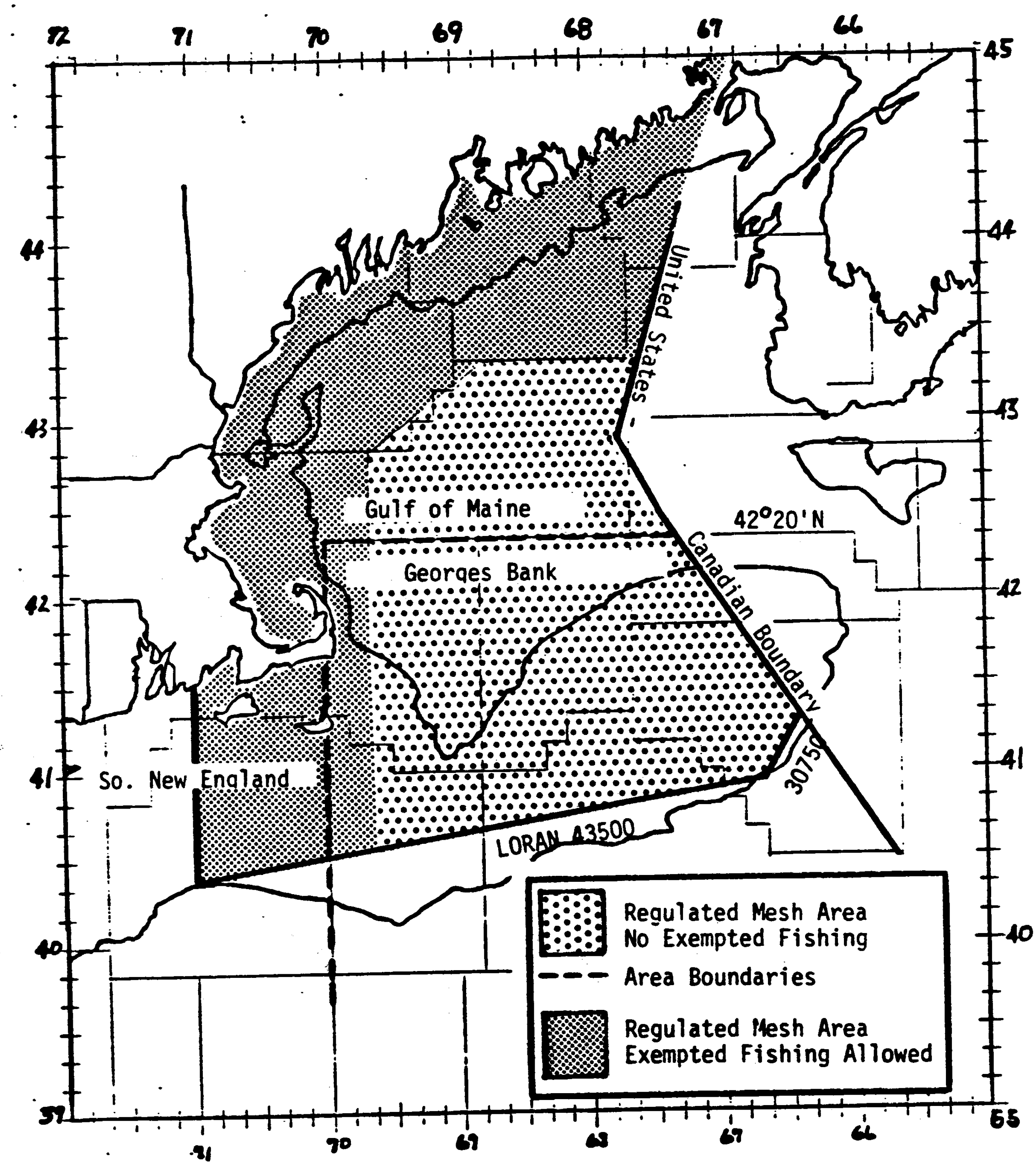


Figure 7A2. Proposed regulated large mesh area showing the part where exempted fishing can occur. Note that the Southern New England area east of 71 00'W remains an option for cod end mesh regulation.

Catch Reporting

Vessels participating in any exempted fishery must provide NMFS with catch records of sufficient detail to demonstrate that they have complied with the regulations for these fisheries. Two alternative methods for keeping these records are:

Option 1: A trip logbook must be kept and submitted by fishermen.

Option 2: An exempted fisheries reporting form, reflecting the aggregate catch over the period of participation, must be submitted by fishermen, and individual trip records must be maintained by fishermen for one year to corroborate the aggregate catch report.

Species Options for the Exempted Fisheries

Option 1 - Specific List

butterfish
dogfish
herring
mackerel
red hake
scup
shrimp
squid
whiting

Option 2 - Open List

Open, unrestricted to specific small mesh species

Seasonal Restrictions (Options) for Exempted Fisheries:

Period	Exempt Species	Comment
Northern area- June-November	Option 1 Species List	Regulated species may not exceed 10% of the total landings of all exempted species over the reporting period.
Southern area*- Mar 15 - Jan 15	Option 2 Open List	Regulated species (excluding winter flounder) may not exceed 10% of the total landings of all species (excluding winter flounder) over the reporting period.
Northern area- January-April or as specified by ASMFC	shrimp	Regulated species may not exceed 10% of the amount of shrimp landed over the reporting period.
Northern area- December-January	whiting	Regulated species may not exceed 10% of the amount of whiting landed over the reporting period; fishery will be subject to monitoring by sea sampling.

Southern area*- Jan 15 - Mar 15	whiting butterfish red hake squid	Regulated species may not exceed 10% of the total amount of whiting, butterfish, red hake and squid landed over the reporting period.
Northern area- Dec - May Southern area*- Jan 15 - Mar 15	herring mackerel	Regulated species may not exceed 10% of the amount of herring plus mackerel landed over the reporting period.

Pelagic Trawl Option

A fishery for herring, mackerel and/or squid may be conducted in the regulated mesh areas of Georges Bank and Southern New England throughout the year using small mesh cod ends subject to the stipulation that pelagic trawl gear be used and the by-catch of regulated species plus redfish be held to 1%.

E. Area Closures

Georges Bank

The spawning areas under the Interim Groundfish FMP will continue in force (see Figure 7A3a). In the event that one of the area/period closure options (shown in Figure 7A1 (a-c)) is selected for mesh regulation on Georges Bank, then the spawning area closures as currently defined (Figure 7A3a) will be effectively incorporated within the boundaries of those areas, and there would no longer be separate spawning closures.

The closure periods for both Spawning Areas I and II will be modified in order to protect fish during the time prior to spawning in addition to protecting them during the period of actual spawning. Three closure period options are:

Option 1: February 1 through May 31.

Option 2: February 1 through May 31 with an option for an opening after April 30, based upon the recommendation of the Regional Director.

Option 3: March through May (current) subject to later Council revision.

Southern New England/Mid-Atlantic

A portion of the New England/Mid-Atlantic area west of 69°40', illustrated in Figure 7A3b, could be seasonally closed to provide reduced mortality and enhanced spawning opportunity for yellowtail flounder. Various possibilities exist for establishing the starting and ending dates of the closure period within the area illustrated in Figure 7A3b.

*Contingent upon Council selection of the large mesh option for Southern New England.

Figure 7A3a Options for Closed Spawning Areas I and II

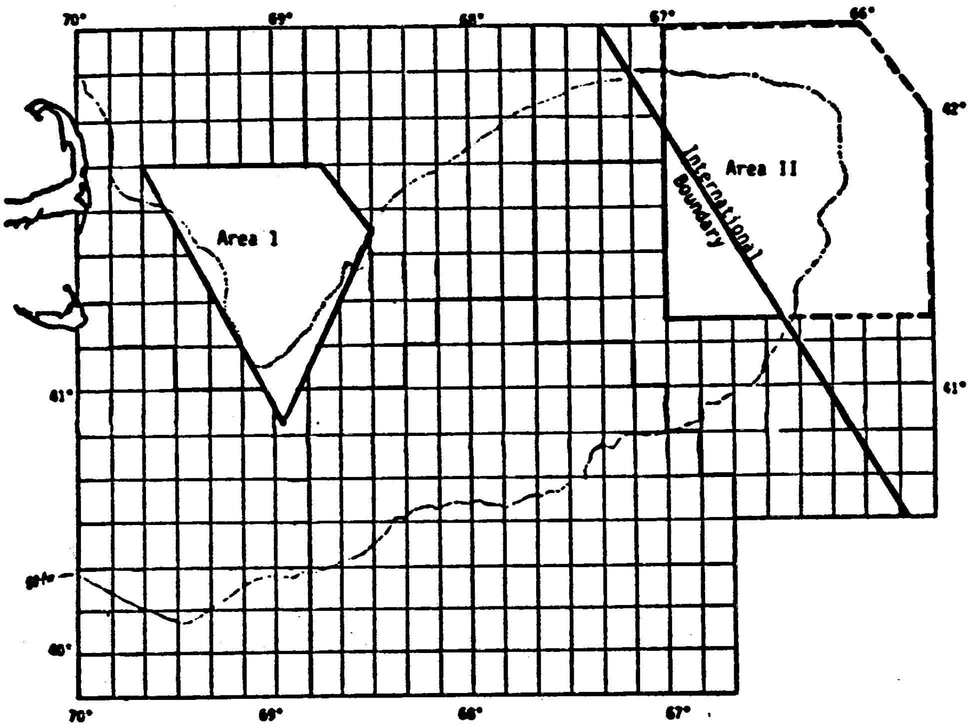
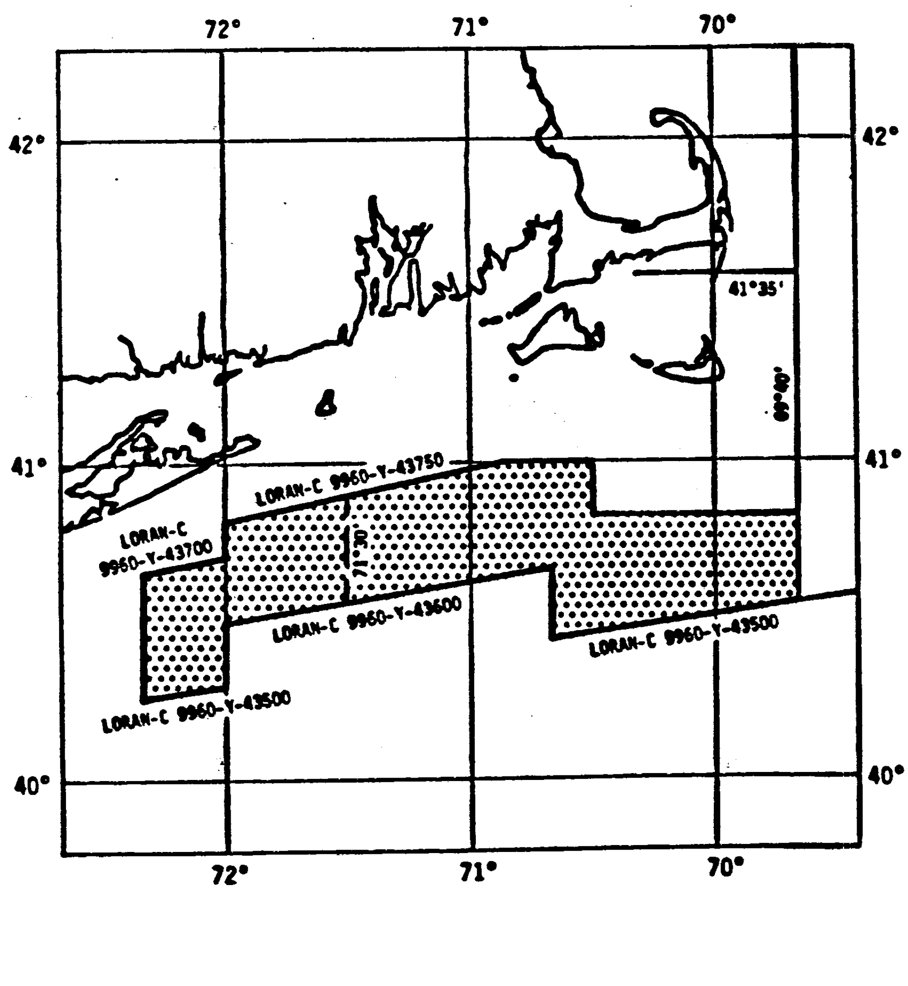


Figure 7A3b Southern New England Closed Spawning Area Option



F. Additional Measures

Additional measures may be adopted by the Council after the FMP has been in effect for a period of time if the initial measures above are not effective in achieving the management objective.

In the Gulf of Maine and the Georges Bank areas, if fishing mortality for haddock or other key species is determined to exceed that which is necessary to meet the objectives of the plan, or if the escapement of a new year class of haddock is jeopardized by factors in the fishery, then four possible options to further control fishing mortality will be considered for Council action using the regulatory amendment process:

Option 1: Make regulatory modifications promoting the effectiveness of existing measures.

Option 2: Establish further time/area restrictions on the fishery.

Option 3: Increase minimum fish size.

Option 4: Increase the mesh size in all or part of these sectors.

In the Southern New England area, if fishing mortality for yellowtail flounder, with the 12 inch minimum size (and mesh regulation as may be determined) in place, remains above that necessary to maintain adequate spawning potential, then three additional options to further curtail fishing mortality will be considered for Council action using the regulatory amendment process.

Option 1: Close key yellowtail grounds for limited periods of time until conditions change.

Option 2: Increase minimum fish size.

Option 3: Establish a minimum mesh size for all or part of the area on a seasonal basis.

Other options for further reducing fishing mortality in all areas, such as direct effort control, would require a formal FMP amendment.

G. Gear Marking Requirements

Since 1977, the New England Council has been involved in efforts to develop management measures to address or lessen specific gear conflict problems and incidents which occur in the fishery conservation zone and which are caused, in part, by poorly or inconsistently marked fixed gear.

The Council has decided to address gear conflict issues on an individual FMP basis; and, therefore, marking requirements are proposed for demersal finfish fixed gear deployed within the geographic area of New England Council jurisdiction. In all fishery areas, demersal finfish fixed gear apparatus must have the name of the owner or vessel, or the official number of that vessel permanently affixed. This includes affixing such markings to any buoys, gillnets and longlines employed to catch demersal finfish. The official number may be the vessel's federal fishery permit number or the vessel's state registration or Coast Guard documentation number. All identification markings must be in the Roman alphabet and in Arabic numerals and must be maintained to be clearly visible and legible.

Three alternative marking provisions are detailed below.

Option 1: Simple marking consistent with lobster gear:

In the Gulf of Maine, Georges Bank and Southern New England fishery areas, the marking requirement for gillnet and bottom-tending longline gear shall be as follows: the westernmost end (meaning the half compass circle from magnetic south through west to and including north) of a fixed gear trawl must display a radar reflector and flag (i.e., to make a double shape). The easternmost end (meaning the half compass circle from magnetic north through east to and including south) of a fixed gear trawl must display a single radar reflector.

Option 2: Simple marking with color coding for gillnets:

Same marking requirement as Option 1 except that the following further size specifications will be required:

1. The radar reflector on gillnets and longline gear shall consist of at least 100 square inches of reflective area and will be positioned on the staff at least 6 feet above the buoy.

2. The flag or pennant on gillnet gear only shall be of the color international orange.

Option 3: Option 3 is the same as option 2 with some or all of the following additional measures:

1. The distance between surface markers of continuous longline and gillnets shall not exceed 6,000 feet (note that intermediate markers must be uniquely identifiable).

2. The maximum length of continuous longline and gillnet sets shall not exceed 6,000 feet.

3. In the Gulf of Maine, sets of gillnet gear which are of an irregular pattern (non-linear and non-contour) or which deviate more than 30 degrees from the original course of the set would be marked at the extremity of the deviation with an additional marker which may be either independent or attached to the gear. Such marker would display a number of highly visible streamers sufficient to be distinguished from the flags or pennants of the end buoys.

H. Additional Options For Addressing Gear Conflicts

The Council has identified the following options to reduce the conflicts between groundfish gillnetters and recreational fishermen seeking cod, haddock, pollock and other groundfish:

Option 1: Appoint a Task Force to investigate the nature, causes and extent of conflicts which occur among fishery sectors, and to develop recommendations for measures to mitigate those conflicts. This Task Force will begin its investigation immediately and will report to the Council as soon as practicable. The Council will evaluate the recommendations and take appropriate action to amend the FMP, requesting use of the emergency authority of the Secretary as deemed necessary.

Option 2: Require gillnet fishermen to continually attend their gear in selected high recreational use fishing areas from April through October in the Gulf of Maine and from March through November in Southern New England.

Option 3: Require a minimum spacing of 3000 feet between sets of gillnet gear.

Option 4: In the Georges Bank and Southern New England areas, establish setting patterns for all fixed gear.

§7A4 Impact Analysis of Alternative Measures

§7A4.1 Introduction

The full range of management options which were considered as candidate management measures for the Northeast multi-species fishery are elaborated in §7A3. In support of the decision-making process leading to the choice of the preferred alternative management program, the candidate measures were subjected to a quantitative bio-economic impact analysis.

The parameters of the bio-economic analysis are initially defined in a biological frame of reference. The overall resource in support of the multi-species fishery is comprised of a series of separate fish stocks constituting the primary entities in the analytical framework. Analytical techniques of resource assessment and prediction, applied to each fish stock, are used to evaluate the effects of the alternative management measures on the stock and the fishery supported by that stock. The economic analysis then integrates the output from the biological analysis, casting it in terms of revenue accruing to the industry operating within the fishery management areas described in §7A3.

§7A4.2 Biological Impact Analysis of the Commercial Fishery

The biological analysis focuses upon those aspects of the proposed management program that incorporate options dealing with cod end mesh size, minimum fish size, and area/period closures in their application to the commercial fishery for the more important component species within the overall resource complex. The general approach taken in the analysis is to construct fishery simulations (again on a stock-by-stock basis) which are sensitive to changes in the specification of mesh size, fish size, and closures through modification of the operative parameters. Thus, major simulations of stock by area reflect differing assumptions of mesh sizes: current conditions, 5-1/2 inch mesh (with closures), 6 inch mesh and delayed implementation of 6 inch mesh.

Alternative mesh sizes, in conjunction with minimum fish size, are examined through appropriate changes in the selection coefficients at age. Three optional area/period closures (operating in conjunction with 5-1/2 inch cod end mesh in the large mesh area on Georges Bank) are identified in §7A3. Closure Option A, having been identified in the plan development process (including public hearings) as being the least objectionable to the industry, is analyzed as a generic example of the area/period closure concept. All three closure options were designed to achieve equal restrictions in the catch of haddock on Georges Bank, but also incorporate variable restrictions in the catch of other species taken in joint harvesting relationships. Consequently, from the standpoint of the major thrust of the management objectives, all three options are equivalent. Closure Option A (in conjunction with a 5-1/2 inch cod end mesh and the proposed minimum fish sizes) was analyzed through appropriate simulated reductions in the fishing mortality rates.

The types of general information necessary to develop the simulations include a knowledge of the current stock structure (numbers at age), recent levels of fishing mortality, the record of historic catch levels by stock, and the relative strengths of recently recruiting year classes with an indication of the likely trend in recruitment levels in the near future. Given that the simulation period commences in 1985, initialization of each simulation requires 1984 catch levels.

The methodology employed in the fishery simulations is not made sensitive to changes in recruitment levels which may result from increased or reduced spawning stock. Since recruitment and fishing mortality are held constant through the simulation period, the stocks are driven to equilibria. <u>This allows an evaluation of the relative impacts on expected catch and total revenues over time which are associated with alternative management programs, but it does not provide a true evaluation of the expected benefits in terms of spawning potential</u>. The results of the simulations typically show that with increased mesh size, the spawning stocks may be expected to exhibit significant increases even under the constraint of constant recruitment. Recruitment estimates are reflective of recent conditions which in some cases (notably haddock) is well below the historic average. If the analysis could be made sensitive to the expected augmentation in recruitment as spawning stocks increase, this would allow a true evaluation of the expected increased spawning potential. Such a refinement to the analytical approach, however, will require significant additional research of the recruiting behavior of the fish stocks which comprise the resource. <u>Therefore, the results of the simulation must be considered to be conservative, particularly in the years beyond 1987</u>. Figure 7A4(b) illustrates the kind of stock response that would typically be associated with a positive stock/recruitment relationship. This type of analysis is not realistic for most stocks, although the results can be generalized to most stocks.

In the case of haddock and pollock, recent stock assessments included estimates of numbers of fish at age based upon virtual population analysis. These assessment data are discounted using appropriate mortality rates to provide observed and projected catch levels through 1984 and updated with recent average recruitment levels to derive the beginning stock structure for 1985. Thereafter, through the duration of the simulation, levels of recruitment and fishing mortality are held constant. The alternative cod end mesh sizes are simulated through the use of symmetrical sigmoid mesh selection curves appropriate for each mesh size. Examples of symmetrical sigmoid selection curves are depicted in Figure 5.18. For most of the simulations, the beginning stock structure (numbers at age) was based upon relative numbers at age from survey data appropriately scaled to explain observed catch levels in the commercial fishery. In all cases, the resulting estimates of numbers of fish at age in the beginning 1985 stocks should not be construed as true stock assessments. They are, however, as reasonably accurate estimates of those stocks as is possible to derive given incomplete information.

Projected Catches Streams

The output from the fishery simulations are presented in Tables 7A1-7A10 as annual landings, by fish stock, with alternative cod end mesh sizes. Simulated landings, total stock sizes, and discard levels are depicted in Figures 7A4(a) and 7A5-7A10.

In all cases, only the U.S. commercial fishery for the specified stock has been simulated. The simulated option featuring delayed implementation of the 6 inch cod end mesh is not included in Figures 7A4(a) and 7A5-7A10 for reasons of clarity. Estimates of discard consist entirely of those expected catches (based upon a symmetrical selection curve) which are comprised of fish smaller than the existing and/or proposed minimum fish sizes. Of course, under actual operational conditions, the amount of discard will be affected by differences in fish behavior, the degree of loading of the trawl net (assuming that the cod end is of conventional diamond mesh), the relative size of the recruiting year class, as well as a number of other factors. But, this approach to the estimation of discards evaluates the relative effects of alternative mesh sizes in conjunction with proposed minimum fish sizes in a manner which is independent of these other considerations (which are beyond the scope of the proposed management program).

Given the (conservative) assumption that fishing mortality rates remain at or below current levels, implementation of a regulated cod end mesh of 5-1/2 or 6 inches will result in significant increases in total stock size relative to that under the current operative mesh. But in all cases, with constant fishing mortalities, an increase in the mesh size may be expected to result in a short-term reduction in landings.

As shown in Tables 7A1-7A10, the landed catch from Georges Bank with a regulated 5-1/2 inch mesh in combination with the proposed minimum fish sizes but without the proposed area/season closure may exhibit a persistent deficit with respect to current conditions. For cod, haddock, and yellowtail flounder, under this management option, the magnitude of the discard (up to about 17% of the landed weight of yellowtail) dissipates the benefits to the landed catch which should accrue with increased stock sizes. The proposed minimum fish sizes have biological significance in terms of the size at sexual maturity. That is, with minimum fish sizes at or near the size at 50% sexual maturity, spawning stock sizes will be enhanced, promoting adequate spawning potential to assure year-class replacement. Thus, from a biological perspective, long-term efforts to alleviate the disparity in the landed catches should focus on the mesh size.

The same management option (a 5-1/2 inch mesh with minimum fish sizes) but combined with the proposed area/season closure (i.e., reduced fishing mortality rates) may be expected to result in consistently reduced landings in the case of Georges Bank haddock, redfish, pollock, and Georges Bank yellowtail flounder. Moreover, the initial negative impact on landings immediately following implementation is expected to be the greatest among all options considered.

An additional option which was considered for management of the multi-species fishery in the Gulf of Maine stock concerned the provision for a limited, small mesh fishery for redfish within the large mesh (5-1/2 inch) area in the central Gulf of Maine between 42°20'N Lat and 43°00'N Lat during the months of March through July. NMFS interview catch information indicates that an average of 29.7% of the total annual U.S. catch of redfish is taken from the described area during the indicated period. Two simulations of the proposed mesh program in the Gulf of Maine, vis a vis redfish, are presented in Table 7A5. Alternative b assumes that 29.7% of the current catch taken with the currently used mesh would be taken in this exempted fishery. For the remainder of the year, the indicated area would revert to being part of the large mesh (5-1/2" mesh) area. It was also assumed that the remainder of redfish catches (i.e., excepting that taken under the time/area restrictions of the exempted fishery) would be taken with 5-1/2" mesh. Given these assumptions, it is seen from Table 7A5.b that a reduction of some 50% in total redfish catches may be expected with implementation of the exempted redfish fishery in combination with the large mesh (5-1/2") area in the central Gulf of Maine.

In all cases, simulated catches of groundfish were run assuming no increase in the current level of the fishing mortality rate. To the extent that Fs exhibit increases, perhaps as a result of increased effort in response to decreased catch rates which may, in turn, result from increased mesh sizes, then short-term losses may be minimized, but at the expense of projected long-term benefits. Conversely, recruitment was held constant despite long-term increased levels of stock size (in all cases except haddock) which may be expected to enhance average recruitment. These two assumptions, therefore, tend to be mutually counteractive in terms of the overall effect on the estimates of long-term average catches.

Table 7A1: GEORGES BANK COD

FISHERY SIMULATIONS: IMPACTS OF MESH CHANGES ON EXPECTED LANDINGS (mt)
INCLUDING ESTIMATES OF DISCARDS RESULTING FROM PROPOSED MINIMUM SIZES

Numbers in Brackets Indicate Percent Change
From Landings With Current Operative Mesh

YEAR	CURRENT 1/		5-1/2" 2/ MESH		5-1/2" 3/ (CLOSURE)		6" MESH		DELAYED 6" MESH	
	LAND-INGS	DIS-CARD	LAND-INGS	DIS-CARD	LAND-INGS	DIS-CARD	LAND-INGS	DIS-CARD	LAND-INGS	DIS-CARD
1985	23444	187	19729 (-15.8)	2250	16193 (-30.9)	1764	18642 (-20.5)	1024	19729 (-15.8)	2250
1986	22451	"	19727 (-12.1)	"	18078 (-19.5)	"	19519 (-13.1)	"	18082 (-19.5)	1024
1987	22753	"	21080 (-7.4)	"	20649 (-9.2)	"	22446 (-1.3)	"	21143 (-7.1)	"
1988	22908	"	21854 (-4.6)	"	22294 (-2.7)	"	24278 (+6.0)	"	23490 (+2.5)	"
1989	23073	"	22359 (-3.1)	"	23405 (+1.4)	"	25358 (+9.9)	"	24932 (+8.1)	"
1990	23206	"	22667 (-2.3)	"	24126 (+4.0)	"	25962 (+11.9)	"	25744 (+10.9)	"
1991	23287	"	22835 (-1.9)	"	24555 (+5.4)	"	26277 (+12.8)	"	26169 (+12.4)	"
1992	23331	"	22920 (-1.8)	"	24787 (+6.2)	"	26431 (+13.3)	"	26381 (+13.1)	"
1993	23366	"	22973 (-1.7)	"	24935 (+6.7)	"	26512 (+13.5)	"	26493 (+13.4)	"
1994	23366	"	22973 (-1.7)	"	24935 (+6.7)	"	26512 (+13.5)	"	26512 (+13.5)	"

1/ Current mesh scenario assumes a cod end mesh of approx. 5-1/8 inches and a 17 inch minimum size. All other scenarios assume a 19 inch minimum size to take effect upon plan implementation.

2/ Assumes that 5-1/2 inch mesh applies to all areas and times on Georges Bank except during the existing spawning closures.

3/ Assumes the 5-1/2 inch mesh option but with the proposed area closures on Georges Bank.

Table 7A2: GULF OF MAINE COD

YEAR	CURRENT LAND-INGS	CURRENT DIS-CARD	5-1/2" MESH LAND-INGS	5-1/2" MESH DIS-CARD	6" MESH LAND-INGS	6" MESH DIS-CARD	DELAYED 6" MESH LAND-INGS	DELAYED 6" MESH DIS-CARD
1985	12525	258	10905 (-12.9)	962	9842 (-21.4)	477	10905 (-12.9)	962
1986	12056	"	10838 (-10.1)	1174	10808 (-10.3)	498	9890 (-18.0)	494
1987	11891	"	11194 (-5.9)	"	11997 (+0.9)	"	11175 (-5.9)	498
1988	11680	"	11325 (-3.0)	"	12680 (+8.6)	"	12170 (+4.2)	"
1989	11708	"	11544 (-1.4)	"	13207 (+12.8)	"	12930 (+10.4)	"
1990	11760	"	11697 (-0.5)	"	13518 (+14.9)	"	13376 (+13.7)	"
1991	11779	"	11766 (-0.1)	"	13665 (+16.0)	"	13596 (+15.4)	"
1992	11769	"	11775 (0.0)	"	13699 (+16.4)	"	13677 (+16.2)	"
1993	11769	"	11780 (+0.1)	"	13707 (+16.5)	"	13706 (+16.5)	"
1994	11769	"	11780 (+0.1)	"	13707 (+16.5)	"	13707 (+16.5)	"

Note: Current mesh scenario assumes a cod end mesh of approx. 5-1/8 inches and a 17 inch minimum size. All other scenarios assume a 19 inch minimum size to take effect upon plan implementation.

Table 7A3: GEORGES BANK HADDOCK

FISHERY SIMULATIONS: IMPACTS OF MESH CHANGES ON EXPECTED LANDINGS (mt)
INCLUDING ESTIMATES OF DISCARDS RESULTING FROM PROPOSED MINIMUM SIZES

Numbers in Brackets Indicate Percent Change
From Landings With Current Operative Mesh

YEAR	CURRENT [1]		5-1/2" [2] MESH		5-1/2" [3] (CLOSURE)		6" MESH		DELAYED 6" MESH	
	LAND-INGS	DIS-CARD	LAND-INGS	DIS-CARD	LAND-INGS	DIS-CARD	LAND-INGS	DIS-CARD	LAND-INGS	DIS-CARD
1985	3689	Not Est.	3340 (-9.5)	134	2303 (-37.6)	84	3168 (-14.1)	25	3340 (-9.5)	134
1986	2435	"	2221 (-8.8)	"	1866 (-23.4)	"	2168 (-11.0)	"	2021 (-17.0)	25
1987	1965	"	1837 (-6.5)	"	1717 (-12.6)	"	1904 (-3.1)	"	1797 (-8.6)	"
1988	1703	"	1618 (-5.0)	"	1543 (-9.4)	"	1747 (+2.6)	"	1693 (-0.6)	"
1989	1654	"	1588 (-4.0)	"	1538 (-7.0)	"	1746 (+5.6)	"	1722 (+4.1)	"
1990	1641	"	1583 (-3.5)	"	1548 (-5.7)	"	1754 (+6.9)	"	1744 (+6.3)	"
1991	1640	"	1587 (-3.3)	"	1564 (-4.6)	"	1763 (+7.5)	"	1758 (+7.2)	"
1992	1640	"	1588 (-3.2)	"	1570 (-4.3)	"	1766 (+7.7)	"	1765 (+7.6)	"
1993	1640	"	1588 (-3.2)	"	1570 (-4.3)	"	1766 (+7.7)	"	1766 (+7.7)	"

Note: Footnotes same as in Table 7A1.

Table 7A4: GULF OF MAINE HADDOCK

YEAR	CURRENT		5-1/2" MESH		6" MESH		DELAYED 6" MESH	
	LAND-INGS	DIS-CARD	LAND-INGS	DIS-CARD	LAND-INGS	DIS-CARD	LAND-INGS	DIS-CARD
1985	5498	785	4305 (-21.7)	614	3161 (-42.5)	263	4305 (-21.7)	614
1986	5430	"	5428 (0.0)	475	5094 (-6.2)	199	4321 (-20.4)	194
1987	5133	"	5565 (+8.4)	"	5794 (+12.9)	"	5253 (+2.3)	199
1988	4953	"	5600 (+13.1)	"	5989 (+20.9)	"	5722 (+15.5)	"
1989	4860	"	5607 (+15.4)	"	6064 (+24.8)	"	5943 (+22.3)	"
1990	4810	"	5602 (+16.5)	"	6088 (+26.6)	"	6035 (+25.5)	"
1991	4801	"	5612 (+16.9)	"	6110 (+27.3)	"	6088 (+26.8)	"
1992	4781	"	5597 (+17.1)	"	6089 (+27.4)	"	6088 (+27.3)	"
1993	4781	"	5597 (+17.1)	"	6089 (+27.4)	"	6089 (+27.4)	"

Note: Current mesh scenario assumes a cod end mesh of approx. 5-1/8 inches and a 17 inch minimum size. All other scenarios assume a 19 inch minimum size to take effect upon plan implementation.

Table 7A5.a REDFISH

FISHERY SIMULATIONS: IMPACTS OF MESH CHANGES ON EXPECTED LANDINGS (mt)
IN THE TOTAL U.S. FISHERY FOR REDFISH
INCLUDING ESTIMATES RESULTING FROM PROPOSED AREA CLOSURES ON GEORGES BANK

YEAR	CURRENT MESH (mt)	5 1/2" MESH (mt)	PERCENT CHANGE	5 1/2" MESH (w/CLOSURES) (mt)	PERCENT CHANGE
1985	4477	1201	-73.2	1112	-75.2
1986	4203	1178	-72.0	1100	-73.8
1987	4093	1255	-69.3	1177	-71.2
1988	4121	1221	-70.4	1150	-72.1
1989	4175	1276	-69.4	1206	-71.1
1990	4330	1306	-69.8	1238	-71.4
1991	4479	1351	-69.8	1283	-71.4
1992	4656	1456	-68.7	1386	-70.2
1993	4838	1605	-66.8	1537	-68.2
1994	5011	1814	-63.8	1744	-65.2

Table 7A5.b REDFISH

FISHERY SIMULATIONS: IMPACTS OF PROPOSED EXEMPTED FISHERY
IN THE CENTRAL GULF OF MAINE IN COMBINATION WITH INCREASED MESH SIZE
FOR THE REMAINDER OF THE TOTAL U.S. FISHERY FOR REDFISH (mt)

YEAR	CURRENT MESH (mt)	EXEMPTED FISHERY + 5 1/2" MESH	PERCENT CHANGE
1985	4477	2174	-51.4
1986	4203	2076	-50.6
1987	4093	2098	-48.7
1988	4121	2082	-49.5
1989	4175	2137	-48.8
1990	4330	2204	-49.1
1991	4479	2280	-49.1
1992	4656	2406	-48.3
1993	4838	2565	-47.0
1994	5011	2764	-44.9

Table 7A6: POLLOCK

FISHERY SIMULATIONS: IMPACTS OF MESH CHANGES ON EXPECTED LANDINGS (mt) INCLUDING ESTIMATES OF DISCARDS RESULTING FROM PROPOSED MINIMUM SIZES

Numbers in Brackets Indicate Percent Change From Landings With Current Operative Mesh

YEAR	CURRENT 1/		5-1/2" 2/ MESH		5-1/2" 3/ (CLOSURE)		6" MESH		DELAYED 6" MESH	
	LAND-INGS	DIS-CARD	LAND-INGS	DIS-CARD	LAND-INGS	DIS-CARD	LAND-INGS	DIS-CARD	LAND-INGS	DIS-CARD
1985	16267	Not Est.	14825 (-8.9)	159	11729 (-27.9)	123	13797 (-15.2)	39	14825 (-8.9)	159
1986	17176	"	16152 (-6.0)	157	13412 (-21.9)	122	15493 (-9.8)	"	15139 (-11.9)	39
1987	18337	"	17792 (-3.0)	"	15277 (-16.7)	"	17561 (-4.2)	"	17129 (-6.6)	"
1988	19197	"	18998 (-1.0)	"	16706 (-13.0)	"	19059 (-0.7)	"	18760 (-2.3)	"
1989	20088	"	20122 (+0.2)	"	18050 (-10.1)	"	20380 (+1.5)	"	20180 (+0.5)	"
1990	20608	"	20811 (+1.0)	"	18940 (-8.1)	"	21213 (+2.9)	"	21066 (+2.2)	"
1991	20806	"	21128 (+1.5)	"	19389 (-6.8)	"	21631 (+4.0)	"	21528 (+3.5)	"
1992	21131	"	21534 (+1.9)	"	19935 (-5.7)	"	22107 (+4.6)	"	22036 (+4.3)	"
1993	21241	"	21699 (+2.1)	"	20167 (-5.1)	"	22317 (+5.1)	"	22270 (+4.8)	"
1994	21228	"	21691 (+2.2)	"	20157 (-5.0)	"	22310 (+5.1)	"	22308 (+5.1)	"
1995	21228	"	21691 (+2.2)	"	20157 (-5.0)	"	22310 (+5.1)	"	22310 (+5.1)	"

1/ Current mesh scenario (a simulation of the total US fishery for pollock) assumes a cod end mesh of approx. 5-1/8 inches with no minimum size. All other scenarios assume a 19 inch minimum size to take effect upon plan implementation.

2/ Assumes that 5-1/2 inch mesh applies to all areas and times in the total US fishery for pollock except during the existing Georges Bank spawning closures.

3/ Assumes the 5-1/2 inch mesh option but with the proposed area closures on Georges Bank.

Table 7A7: GEORGES BANK YELLOWTAIL FLOUNDER

FISHERY SIMULATIONS: IMPACTS OF MESH CHANGES ON EXPECTED LANDINGS (mt) INCLUDING ESTIMATES OF DISCARDS RESULTING FROM PROPOSED MINIMUM SIZES

Numbers in Brackets Indicate Percent Change From Landings With Current Operative Mesh

YEAR	CURRENT 1/		5-1/2" 2/ MESH		5-1/2" 3/ (CLOSURE)		6" MESH		DELAYED 6" MESH	
	LAND-INGS	DIS-CARD	LAND-INGS	DIS-CARD	LAND-INGS	DIS-CARD	LAND-INGS	DIS-CARD	LAND-INGS	DIS-CARD
1985	9368	180	7236 (-22.8)	1209	6549 (-30.1)	1059	6688 (-28.6)	728	7236 (-22.8)	1209
1986	10026	"	8613 (-14.1)	1231	8313 (-17.1)	1083	8615 (-14.1)	756	7940 (-20.8)	742
1987	10396	"	9566 (-8.0)	"	9550 (-8.1)	"	10186 (-2.0)	"	9655 (-7.1)	756
1988	10536	"	9950 (-5.6)	"	10108 (-4.1)	"	10855 (+3.0)	"	10617 (+0.8)	"
1989	10580	"	10081 (-4.7)	"	10324 (-2.4)	"	11088 (+4.8)	"	11003 (+4.0)	"
1990	10594	"	10124 (-4.4)	"	10403 (-1.8)	"	11166 (+5.4)	"	11137 (+5.1)	"
1991	10600	"	10138 (-4.4)	"	10432 (-1.6)	"	11191 (+5.6)	"	11183 (+5.5)	"
1992	10600	"	10139 (-4.3)	"	10433 (-1.6)	"	11193 (+5.6)	"	11192 (+5.6)	"
1993	10600	"	10139 (-4.3)	"	10433 (-1.6)	"	11193 (+5.6)	"	11193 (+5.6)	"

1/ Current mesh scenario assumes a cod end mesh of approx. 5-1/8 inches and a 11 inch minimum size. All other scenarios assume a 12 inch minimum size to take effect upon plan implementation.

2/ Assumes that 5-1/2 inch mesh applies to all areas and times on Georges Bank except during the existing spawning closures.

3/ Assumes the 5-1/2 inch mesh option but with the proposed area closures on Georges Bank.

Table 7A8: SOUTHERN NEW ENGLAND YELLOWTAIL FLOUNDER

YEAR	CURRENT		5-1/2" MESH		6" MESH		DELAYED 6" MESH	
	LAND-INGS	DIS-CARD	LAND-INGS	DIS-CARD	LAND-INGS	DIS-CARD	LAND-INGS	DIS-CARD
1985	9241	1205	5636 (-39.0)	758	5256 (-43.1)	444	5636 (-39.0)	758
1986	9452	"	7467 (-21.0)	978	7215 (-23.7)	587	6904 (-27.0)	580
1987	9582	"	9986 (+4.2)	"	10069 (+5.1)	"	9745 (+1.7)	"
1988	9579	"	11717 (+22.3)	"	12177 (+27.1)	"	11970 (+25.0)	"
1989	9628	"	12712 (+32.0)	"	13375 (+38.9)	"	13265 (+37.8)	"
1990	9699	"	13269 (+36.8)	"	14036 (+44.7)	"	13981 (+44.1)	"
1991	9700	"	13500 (+39.2)	"	14314 (+47.6)	"	14291 (+47.3)	"
1992	9700	"	13572 (+39.9)	"	14400 (+48.5)	"	14396 (+48.4)	"
1993	9700	"	13572 (+39.9)	"	14400 (+48.5)	"	14400 (+48.5)	"

Note: Current mesh scenario assumes a cod end mesh of approx. 4-1/2 inches and a 11 inch minimum size. All other scenarios assume a 12 inch minimum size to take effect upon plan implementation.

Table 7A9: AMERICAN PLAICE
FISHERY SIMULATIONS: IMPACTS OF MESH CHANGES ON EXPECTED LANDINGS (mt)
INCLUDING ESTIMATES OF DISCARDS RESULTING FROM PROPOSED MINIMUM SIZES

Numbers in Brackets Indicate Percent Change
From Landings With Current Operative Mesh

YEAR	CURRENT 1/		5-1/2" 2/ MESH		5-1/2" 3/ (CLOSURE)		6" MESH		DELAYED 6" MESH	
	LAND-INGS	DIS-CARD	LAND-INGS	DIS-CARD	LAND-INGS	DIS-CARD	LAND-INGS	DIS-CARD	LAND-INGS	DIS-CARD
1985	8825	Not Est.	8023 (-9.1)	164	6742 (-23.6)	134	7138 (-19.1)	33	8023 (-9.1)	164
1986	9008	"	8313 (-7.7)	"	7317 (-18.8)	"	7521 (-16.5)	"	7238 (-19.7)	33
1987	9403	"	8951 (-4.8)	"	8139 (-13.4)	"	8399 (-10.7)	"	8068 (-14.2)	"
1988	9789	"	9595 (-2.0)	"	8933 (-8.7)	"	9406 (-3.9)	"	9115 (-6.9)	"
1989	10101	"	10101 (0.0)	"	9573 (-5.2)	"	10239 (+1.4)	"	10022 (-0.8)	"
1990	10332	"	10470 (+1.3)	"	10056 (-2.7)	"	10838 (+4.9)	"	10686 (+3.4)	"
1991	10496	"	10729 (+2.2)	"	10409 (-0.8)	"	11254 (+7.2)	"	11152 (+6.3)	"
1992	10607	"	10902 (+2.8)	"	10656 (+0.5)	"	11531 (+8.7)	"	11464 (+8.1)	"
1993	10687	"	11024 (+3.1)	"	10835 (+1.4)	"	11719 (+9.7)	"	11676 (+9.3)	"
1994	10739	"	11102 (+3.4)	"	10955 (+2.0)	"	11840 (+10.3)	"	11813 (+10.0)	"
1995	10772	"	11150 (+3.5)	"	11032 (+2.4)	"	11914 (+10.6)	"	11898 (+10.5)	"
1996	10792	"	11180 (+3.6)	"	11080 (+2.7)	"	11958 (+10.8)	"	11950 (+10.7)	"
1997	10804	"	11195 (+3.6)	"	11105 (+2.8)	"	11979 (+10.9)	"	11967 (+10.8)	"
1998	10804	"	11195 (+3.6)	"	11105 (+2.8)	"	11979 (+10.9)	"	11979 (+10.9)	"

1/ Current mesh scenario (a simulation of the total US fishery for American plaice) assumes a cod end mesh of approx. 5-1/8 inches with no minimum size. All other scenarios assume a 12 inch minimum size to take effect upon plan implementation.

2/ Assumes that 5-1/2 inch mesh applies to all areas and times in the total US fishery for American plaice except during the existing Georges Bank spawning closures.

3/ Assumes the 5-1/2 inch mesh option but with the proposed area closures on Georges Bank.

Table 7A10: GEORGES BANK WINTER FLOUNDER

FISHERY SIMULATIONS: IMPACTS OF MESH CHANGES ON EXPECTED LANDINGS (mt) INCLUDING ESTIMATES OF DISCARDS RESULTING FROM PROPOSED MINIMUM SIZES

Numbers in Brackets Indicate Percent Change From Landings With Current Operative Mesh

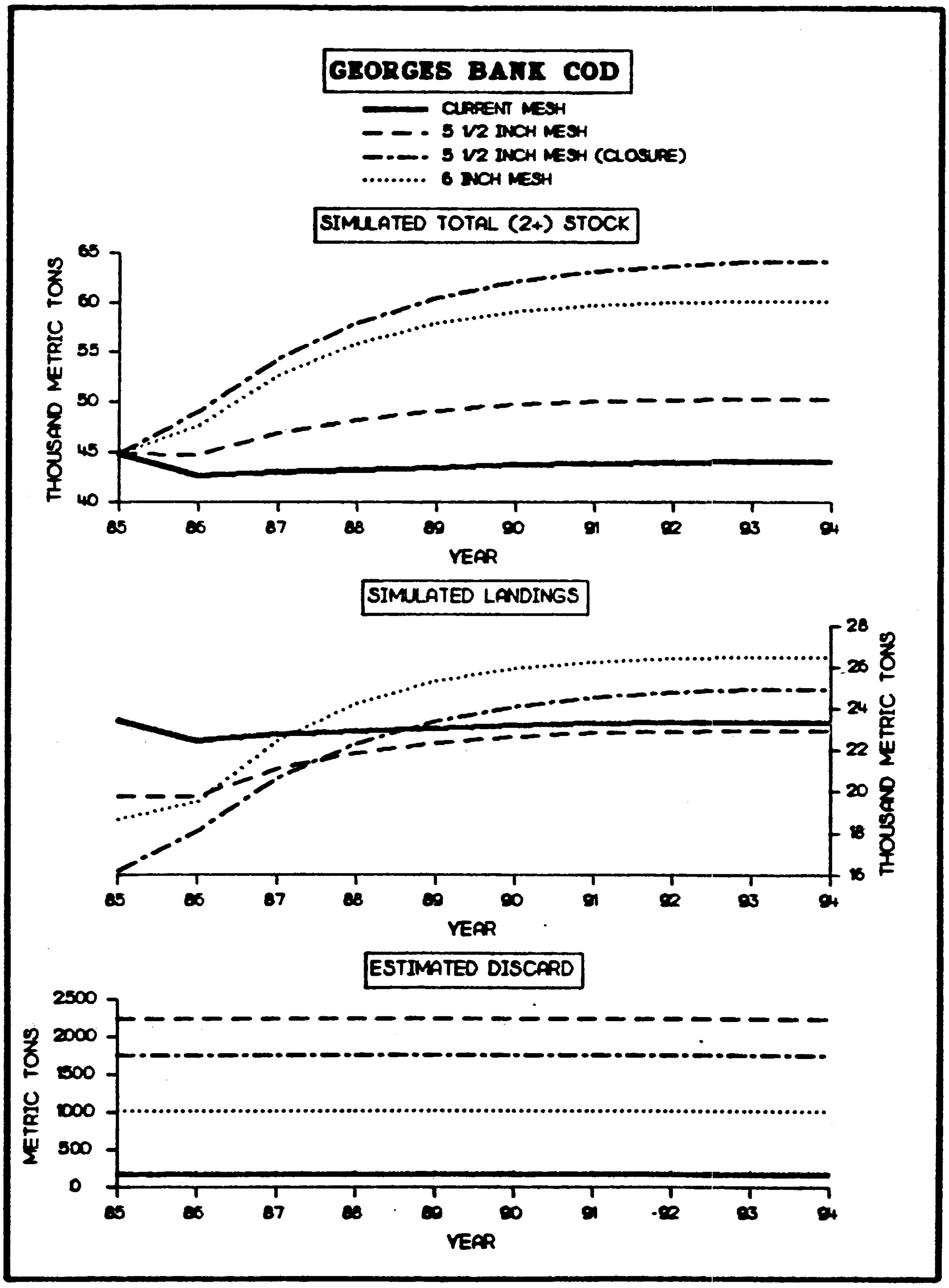
YEAR	CURRENT 1/		5-1/2" 2/ MESH		5-1/2" 3/ (CLOSURE)		6" MESH		DELAYED 6" MESH	
	LAND-INGS	DIS-CARD	LAND-INGS	DIS-CARD	LAND-INGS	DIS-CARD	LAND-INGS	DIS-CARD	LAND-INGS	DIS-CARD
1985	10004	Not Est.	9581 (-4.2)	86	8547 (-14.6)	76	9110 (-8.9)	45	9581 (-4.2)	86
1986	10239	"	9889 (-3.4)	105	9079 (-11.3)	93	9539 (-6.8)	54	9331 (-8.9)	54
1987	10689	"	10533 (-1.5)	"	9861 (-7.7)	"	10390 (-2.8)	"	10201 (-4.6)	"
1988	11085	"	11087 (+0.01)	"	10523 (-5.1)	"	11134 (+0.4)	"	10988 (-0.9)	"
1989	11391	"	11509 (+1.0)	"	11032 (-3.2)	"	11694 (+2.7)	"	11591 (+1.8)	"
1990	11611	"	11809 (+1.7)	"	11399 (-1.8)	"	12088 (+4.1)	"	12019 (+3.5)	"
1991	11760	"	12012 (+2.1)	"	11652 (-0.9)	"	12355 (+5.1)	"	12309 (+4.7)	"
1992	11858	"	12145 (+2.4)	"	11820 (-0.3)	"	12528 (+5.6)	"	12498 (+5.4)	"
1993	11921	"	12230 (+2.6)	"	11930 (+0.1)	"	12638 (+6.0)	"	12620 (+5.9)	"
1994	11960	"	12284 (+2.7)	"	11999 (+0.3)	"	12708 (+6.3)	"	12696 (+6.2)	"
1995	11985	"	12311 (+2.8)	"	12042 (+0.5)	"	12750 (+6.4)	"	12744 (+6.3)	"
1996	12000	"	12334 (+2.8)	"	12064 (+0.5)	"	12769 (+6.4)	"	12769 (+6.4)	"
1997	12000	"	12334 (+2.8)	"	12064 (+0.5)	"	12769 (+6.4)	"	12769 (+6.4)	"

1/ Current mesh scenario assumes a cod end mesh of approx. 5-1/8 inches with no minimum size. All other scenarios assume an 11 inch minimum size to take effect upon plan implementation.

2/ Assumes that 5-1/2 inch mesh applies to all areas and times on Georges Bank except during the existing spawning closures.

3/ Assumes the 5-1/2 inch mesh option but with the proposed area closures on Georges Bank.

Figure 7A4 (a)


GEORGES BANK COD
CURRENT MESH
5 1/2 INCH MESH
5 1/2 INCH MESH (CLOSURE)
6 INCH MESH
SIMULATED TOTAL (2+) STOCK
THOUSAND METRIC TONS
65
60
55
50
45
40
85 86 87 88 89 90 91 92 93 94
YEAR
SIMULATED LANDINGS
28
26
24
22
20
18
16
THOUSAND METRIC TONS
85 86 87 88 89 90 91 92 93 94
YEAR
ESTIMATED DISCARD
METRIC TONS
2500
2000
1500
1000
500
0
85 86 87 88 89 90 91 92 93 94
YEAR

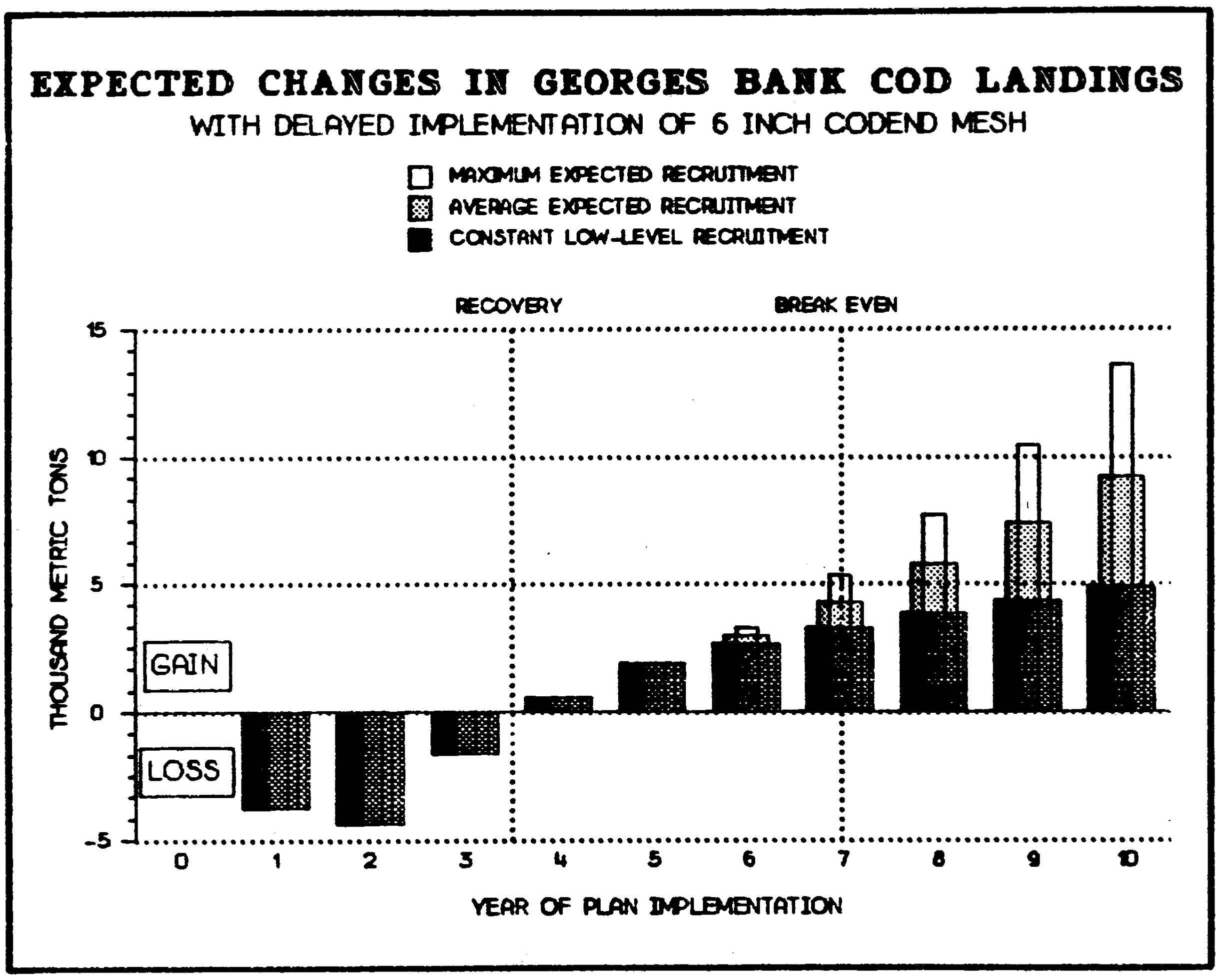


Figure 7A4(b). Expected short-term losses and long-term gains in Georges Bank cod landings. The potential long-term gains may be substantial given expected improvement in recruitment levels.

Figure 7A5

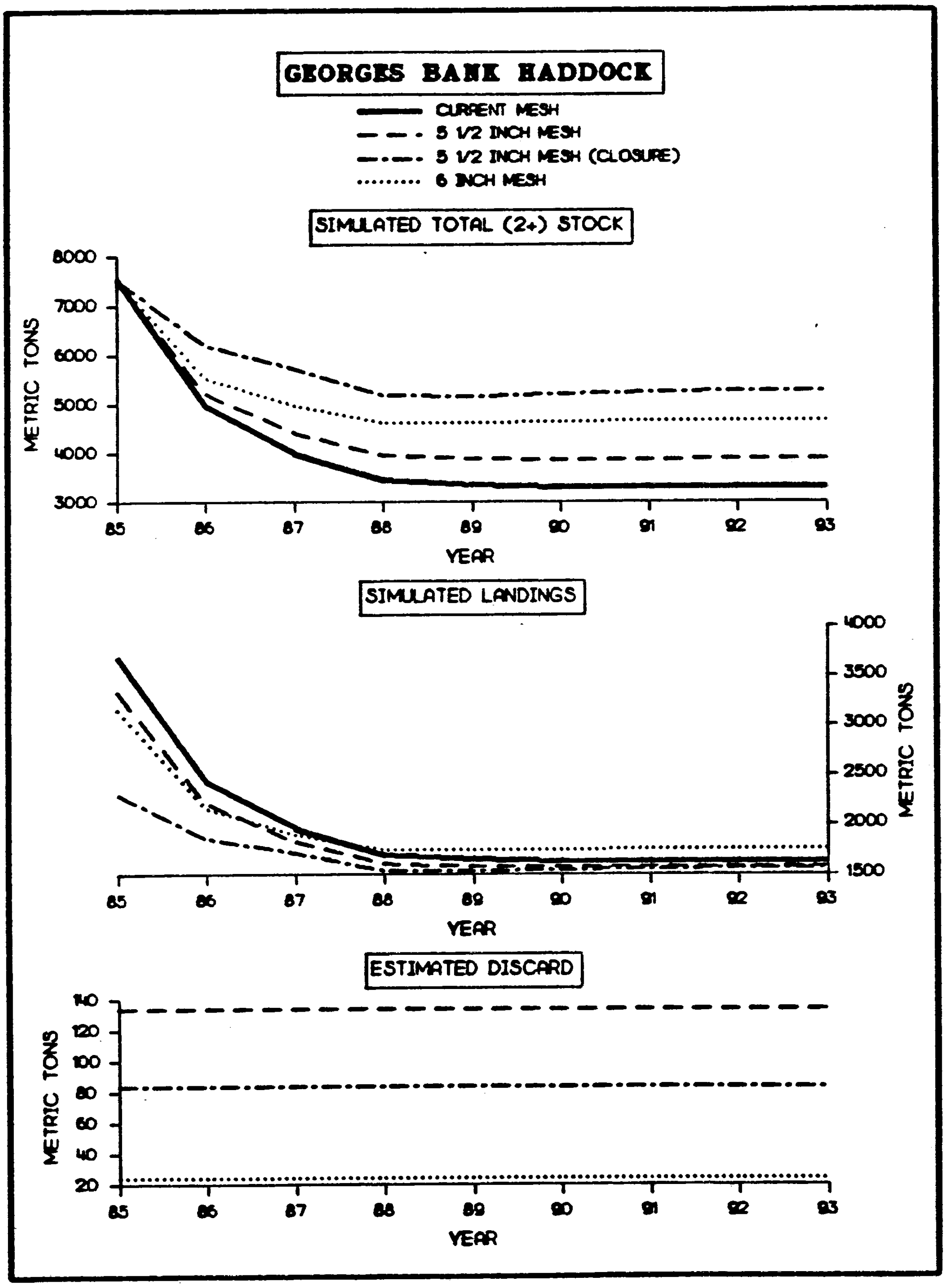

GEORGES BANK HADDOCK
CURRENT MESH
5 1/2 INCH MESH
5 1/2 INCH MESH (CLOSURE)
6 INCH MESH
SIMULATED TOTAL (2+) STOCK
METRIC TONS
8000
7000
6000
5000
4000
3000
85
86
87
88
89
90
91
92
93
YEAR
SIMULATED LANDINGS
4000
3500
3000
2500
2000
1500
METRIC TONS
85
86
87
88
89
90
91
92
93
YEAR
ESTIMATED DISCARD
METRIC TONS
140
120
100
80
60
40
20
85
86
87
88
89
90
91
92
93
YEAR

Figure 7A6

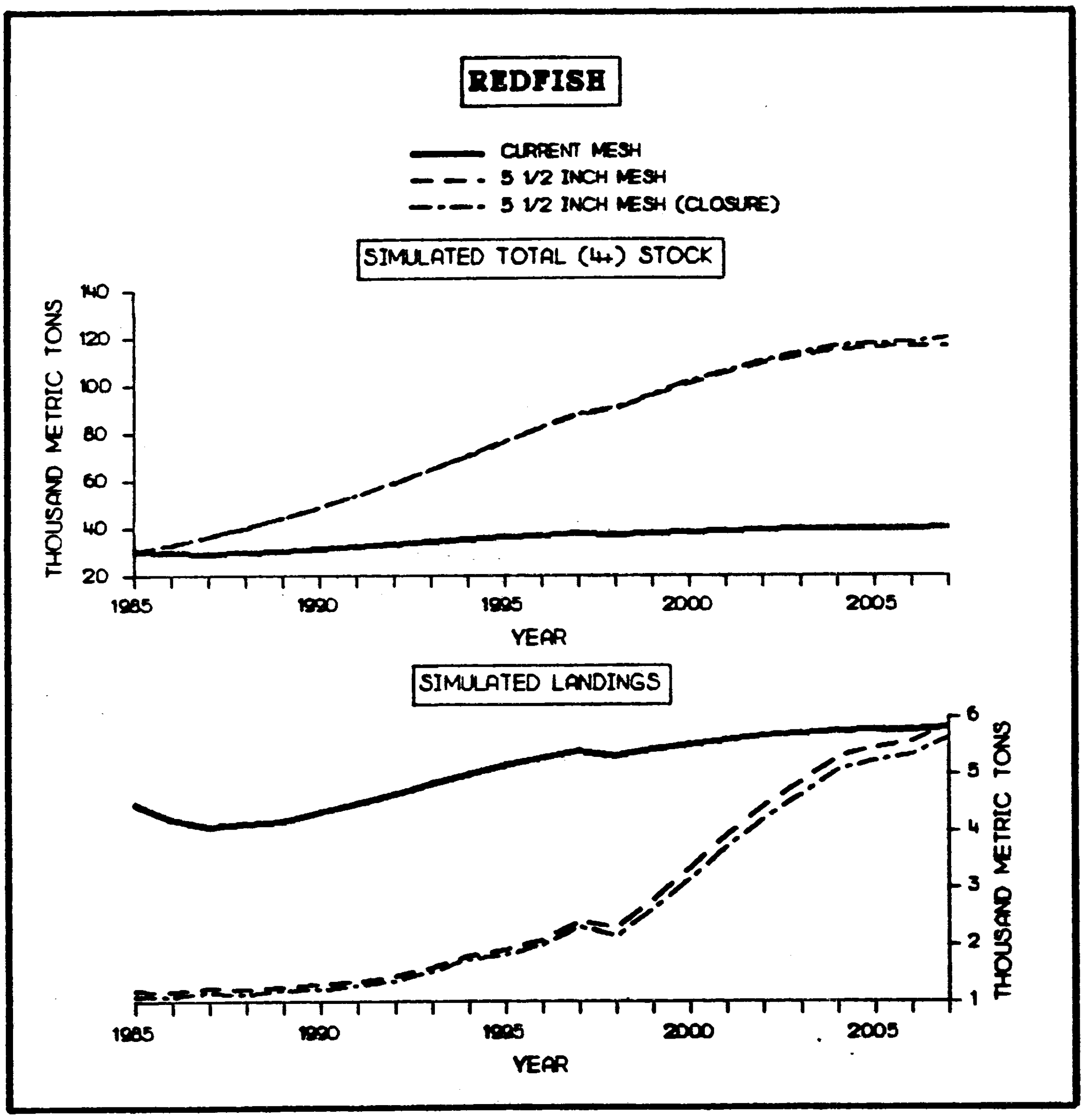

REDFISH
CURRENT MESH
5 1/2 INCH MESH
5 1/2 INCH MESH (CLOSURE)
SIMULATED TOTAL (4+) STOCK
THOUSAND METRIC TONS
140
120
100
80
60
40
20
1985
1990
1995
2000
2005
YEAR
SIMULATED LANDINGS
6
5
4
3
2
1
THOUSAND METRIC TONS
1985
1990
1995
2000
2005
YEAR

Figure 7A7

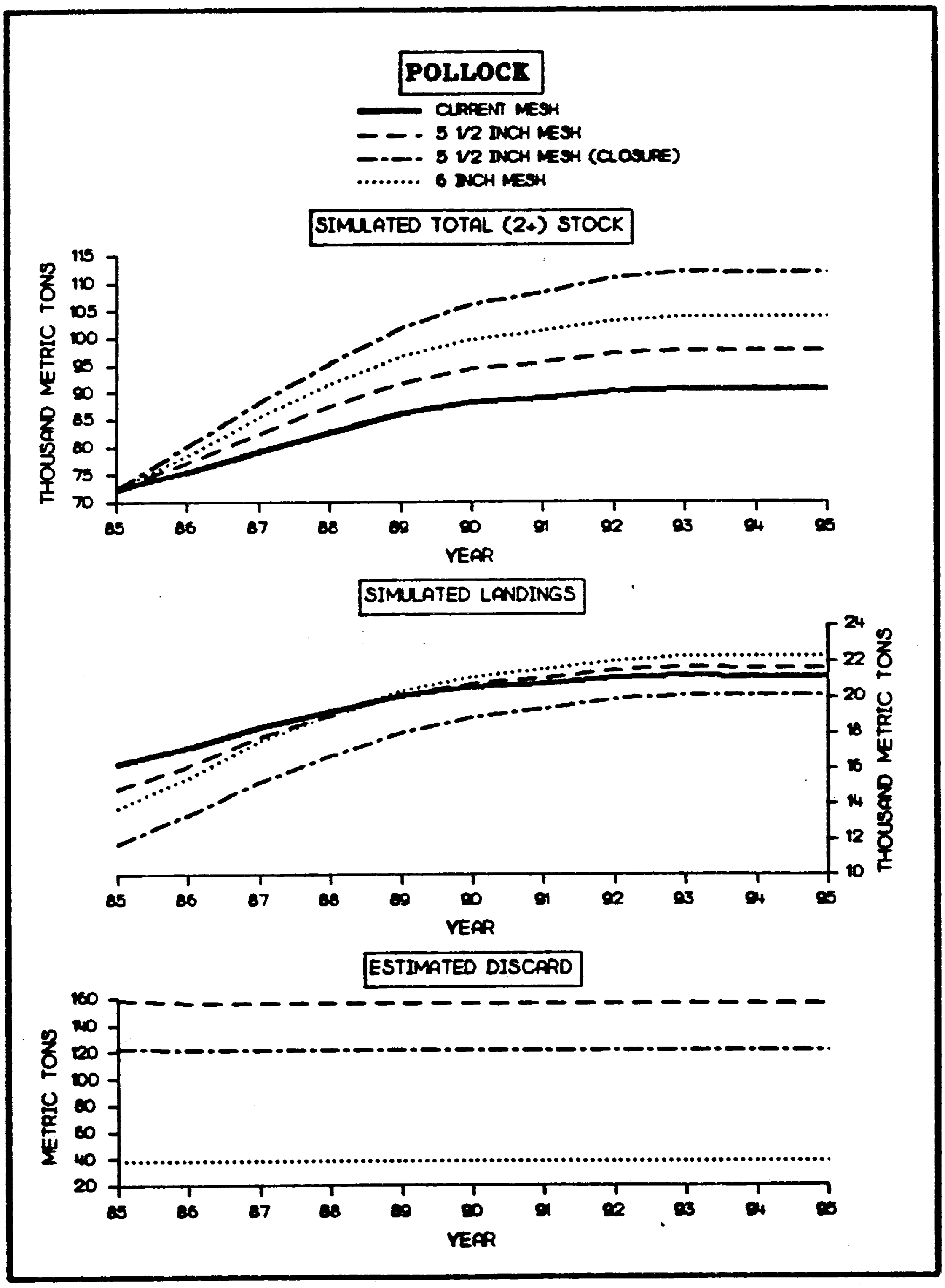

POLLOCK
CURRENT MESH
5 1/2 INCH MESH
5 1/2 INCH MESH (CLOSURE)
6 INCH MESH
SIMULATED TOTAL (2+) STOCK
THOUSAND METRIC TONS
115
110
105
100
95
90
85
80
75
70
85
86
87
88
89
90
91
92
93
94
95
YEAR
SIMULATED LANDINGS
24
22
20
18
16
14
12
10
THOUSAND METRIC TONS
85
86
87
88
89
90
91
92
93
94
95
YEAR
ESTIMATED DISCARD
METRIC TONS
160
140
120
100
80
60
40
20
85
86
87
88
89
90
91
92
93
94
95
YEAR

Figure 7A8

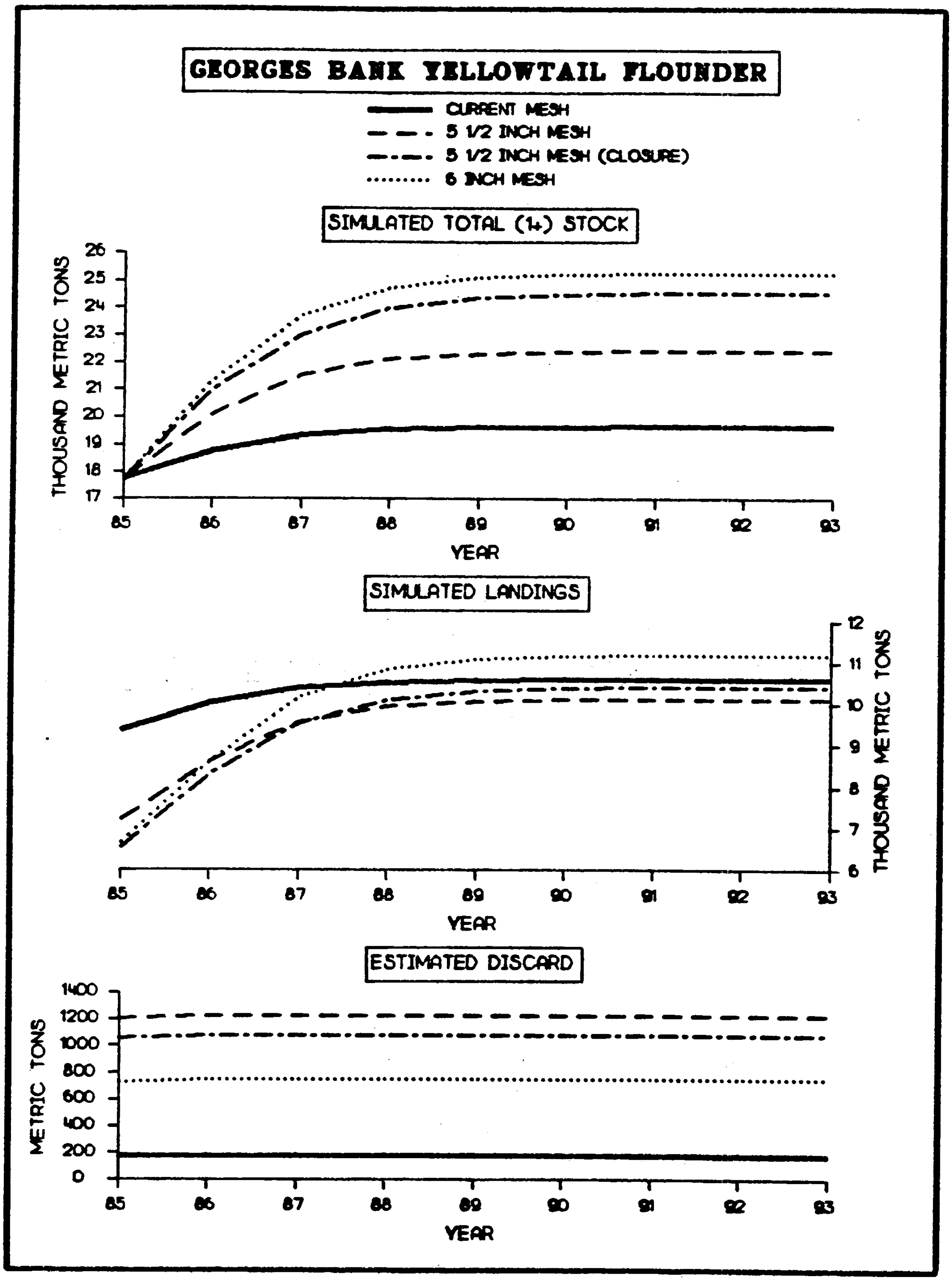

GEORGES BANK YELLOWTAIL FLOUNDER
CURRENT MESH
5 1/2 INCH MESH
5 1/2 INCH MESH (CLOSURE)
6 INCH MESH
SIMULATED TOTAL (1+) STOCK
THOUSAND METRIC TONS
26
25
24
23
22
21
20
19
18
17
85
86
87
88
89
90
91
92
93
YEAR
SIMULATED LANDINGS
12
11
10
9
8
7
6
THOUSAND METRIC TONS
85
86
87
88
89
90
91
92
93
YEAR
ESTIMATED DISCARD
METRIC TONS
1400
1200
1000
800
600
400
200
0
85
86
87
88
89
90
91
92
93
YEAR

Figure 7A9

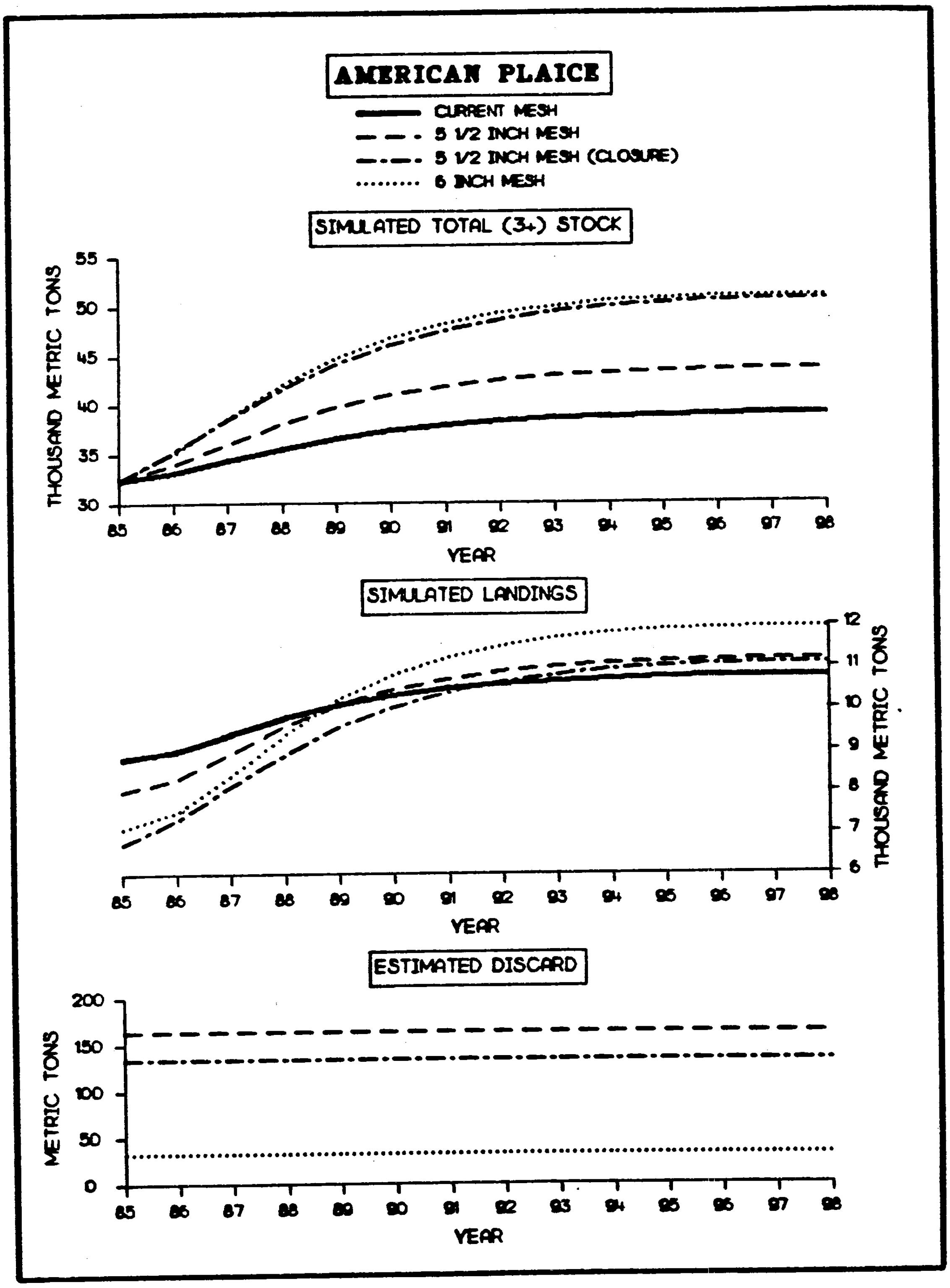
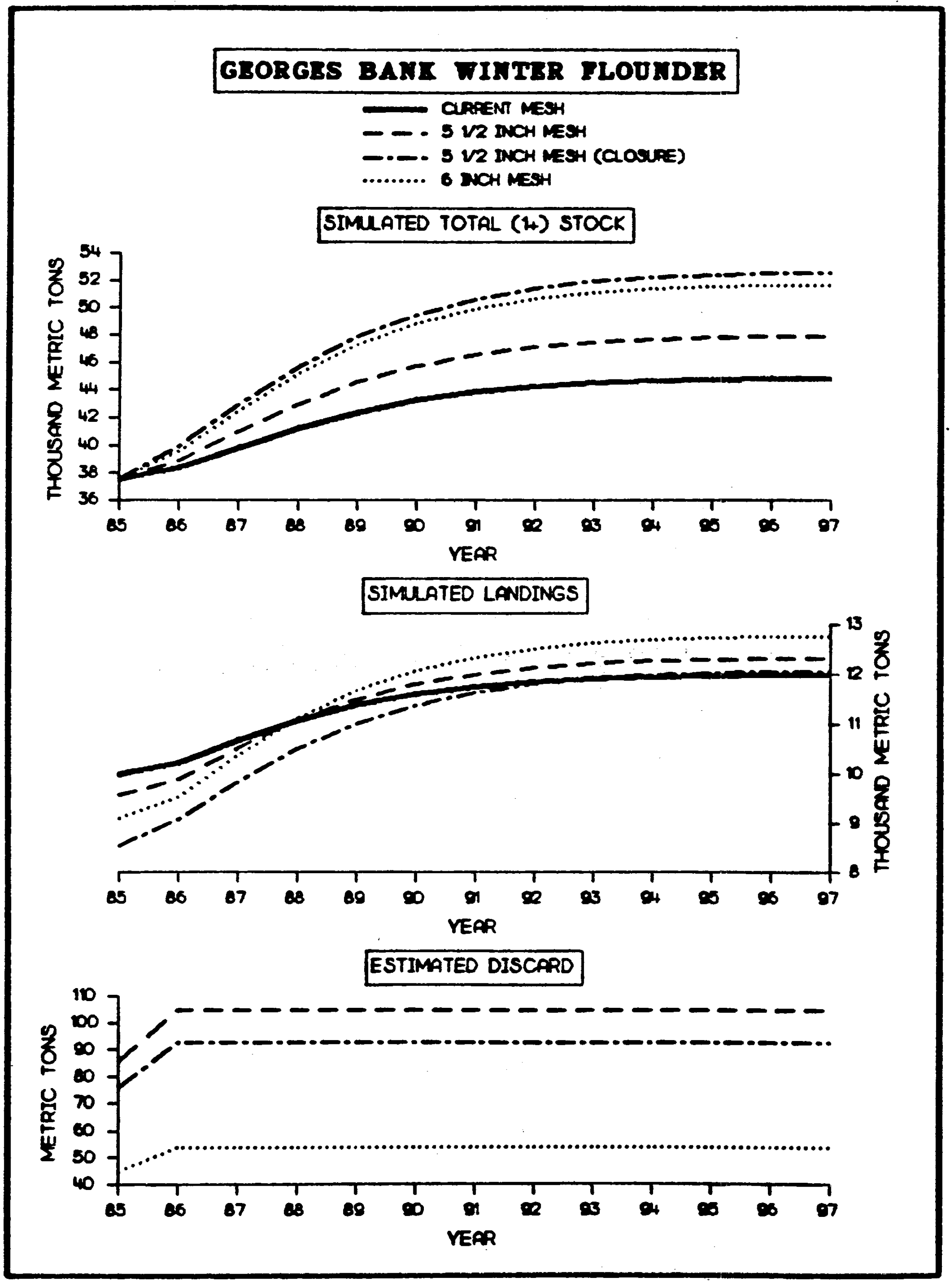

AMERICAN PLAICE
CURRENT MESH
5 1/2 INCH MESH
5 1/2 INCH MESH (CLOSURE)
6 INCH MESH
SIMULATED TOTAL (3+) STOCK
THOUSAND METRIC TONS
YEAR
SIMULATED LANDINGS
THOUSAND METRIC TONS
YEAR
ESTIMATED DISCARD
METRIC TONS
YEAR

Figure 7A10


GEORGES BANK WINTER FLOUNDER
CURRENT MESH
5 1/2 INCH MESH
5 1/2 INCH MESH (CLOSURE)
6 INCH MESH
SIMULATED TOTAL (1+) STOCK
THOUSAND METRIC TONS
YEAR
SIMULATED LANDINGS
THOUSAND METRIC TONS
YEAR
ESTIMATED DISCARD
METRIC TONS
YEAR

Spawning Potential

The thrust of the management objectives of this FMP is in terms of promoting adequate spawning potential among the important species within the overall resource such that those important fish stocks may not be placed in serious jeopardy and that year classes may continue to replace themselves. As discussed in Part 5, the analytical basis for assessing the spawning potential of a fish stock is the relative spawning stock biomass under the conditions of the fishery as compared to that biomass in the virgin (unfished) stock. The fishery simulations provide estimates of the equilibrium stock sizes which may result under alternative mesh regimes. From data describing the relative proportion of fish which are sexually mature at age (W. L. Gabriel, et al, 1984), total equilibrium stock sizes are converted to equilibrium spawning stock sizes in weight. These data, présented in Table 7A11, have also been exprcssed in terms of the percentage of the maximum spawning stock biomass per recruit (%MSSB/R). It is important to recognize, however, that these are minimum estimates of the actual spawning potential which may ultimately be realized as enhanced spawning stocks generate increased recruitment leading, in turn, to even higher stock sizes. For the same reason, the calculated long-term benefits in term of yield to the fishery are probable underestimates of the actual benefits which may accrue.

Among the seven species analyzed, it is seen that only cod and yellowtail flounder may not be expected to achieve at least 20% MSSB/R under a regulated 5-1/2 inch cod end mesh at the current high fishing mortality rates or with the same mesh size at slightly reduced fishing mortalities associated with the proposed area/season closure. Noting that a 20% level is probably the minimum necessary for long-term year class replacement among most species, then a somewhat larger mesh may be appropriate from an analytical perspective, barring substantial reductions in fishing effort. The management objectives specifically identify Georges Bank haddock, targeting a 30% MSSB/R level. Such is achievable with a 6 inch mesh, provided that fishing mortality rates not exceed the current level. Alternatively, a 5-1/2 inch mesh in combination with the proposed area/season closure may be expected to result in at least a 30% level. A regulated 5-1/2 inch mesh, either with or without the area/season closure, is apparently adequate to assure about 50% MSSB/R for redfish.

Impacts on Sustainable Yield

The fishery simulations given in Tables 7A1-7A10 may be used to provide an approximation of the long-term changes in total sustainable yield which may be associated with alternative increased mesh sizes (relative to the current operative mesh). Each scenario was driven to an equilibrium such that the total yield (landings plus discard) represents the sustainable yield under the changed fishery conditions. The following tabulation gives the percent change in total yield associated with effective implementation of 5-1/2 inch and 6 inch cod end mesh relative to the current operative mesh size.

	5-1/2 inch	5-1/2 inch (CLOSURE)	6 inch
Georges Bank Cod	+7.1	+13.4	+16.9
Georges Bank Haddock	+5.0	+0.9	+9.2
Redfish	+0.9	-3.0	-
Pollock	+2.9	-4.5	+5.3
Georges Bank Yellowtail Fldr	+5.5	+6.8	+10.8
American Plaice	+5.1	+4.0	+11.2
Georges Bank Winter Flounder	+3.7	+1.3	+6.9

As noted previously, these long-term gains have likely been underestimated simply because recruitment was held constant for the analysis. Moreover, the analytical procedure used has probably underestimated the likely gains, especially in those cases where low fishing mortality rates were assumed (redfish, pollock, American plaice, and winter flounder). In particular, in the simulation of the redfish fishery, substantially fewer age classes were subject to the gear in the simulation of 5-1/2 inch mesh than was the case with the current mesh. Thus, the long-term gains in yield of redfish associated with a 5-1/2 inch mesh have probably been substantially underestimated. Nevertheless, discounting redfish, the 5-1/2 inch mesh may be expected to result in a weighted average long-term gain in yield for the overall resource of at least 5% either with or without the area/period closure while that associated with 6 inch mesh probably exceeds 11%. Gains of this magnitude are significant steps in the direction of achieving a maximum long-term average yield from the total resource. With reductions in the fishing mortality rates, particularly for cod, haddock, and yellowtail flounder, even greater gains may result.

Impacts on Marine Mammals

The following are descriptions of potential biological impacts that the proposed Multi-Species Fisheries Management Plan may have on the protected marine mammal and endangered species that are found in both the inshore and offshore waters of the western North Atlantic.

It is known that the marine mammals, including the endangered whales, that occur in the Northeast Region may consume as much marine biomass as man harvests in a year. The commercially and recreationally valuable fish species managed by this plan often consume the same prey species utilized by marine mammals and endangered species. Therefore it is possible that a certain degree of indirect competition exists between these two user groups (man & whales). This competition is unquantified at present but efforts are underway to describe its magnitude and thus understand the consequences of certain management measures.

Table 7A11: Simulated spawning stock size and relative spawning potential associated with alternative cod end mesh sizes.

MESH OPTION	1985 SPAWNING STOCK (mt)	EQUILIBRIUM SPAWNING STOCK (mt)	PERCENT[1/] MAXIMUM SSB/R
Georges Bank Cod			
Current	40,524	30,161	10
5-1/2"	40,524	35,494	12
6"	40,524	41,185	15
5-1/2"(CLOSURE)	40,524	48,660	17
Georges Bank Haddock			
Current	6,718	2,493	21
5-1/2"	6,718	3,071	26
6"	6,718	3,777	32
5-1/2"(CLOSURE)	6,718	4,390	37
Redfish			
Current	22,071	25,732	15
5-1/2"	22,071	102,131	57
5-1/2"(CLOSURE)	22,071	103,840	59
Pollock			
Current	56,370	73,275	32
5-1/2"	56,370	79,867	35
6"	56,370	85,622	37
5-1/2"(CLOSURE)	56,370	93,970	41
Georges Bank Yellowtail Flounder			
Current	11,481	12,978	13
5-1/2"	11,481	15,355	15
6"	11,481	17,855	18
5-1/2"(CLOSURE)	11,481	17,390	17
American Plaice			
Current	26,682	31,471	27
5-1/2"	26,682	35,683	31
6"	26,682	42,665	37
5-1/2"(CLOSURE)	26,682	42,575	37
Georges Bank Winter Flounder			
Current	33,180	39,817	34
5-1/2"	33,180	42,817	37
6"	33,180	46,554	40
5-1/2"(CLOSURE)	33,180	47,450	41

1/ Percent maximum spawning stock biomass per recruit, the variable describing relative spawning potential. As a rule, 20% MSSB/R should be adequate for year classes to replace themselves. However, the current seriously depressed condition of haddock and redfish indicate appropriate levels for these two species to be 30% and up to 50%, respectively.

Direct conflict between marine mammals and fishermen are known to occur within the region's waters. This conflict usually takes the form of accidental entanglement of a marine mammal in fishing gear during fishing operations. This is termed the incidental take of a marine mammal. The non-endangered marine mammal species most likely to be taken incidentally to commercial fishing operations are the harbor porpoise, Atlantic white-sided dolphin, pilot whale, and harbor seal. These species have the potential to be taken in gillnetting, trawling and fixed trap operations.

A 1981 amendment to the Marine Mammal Protection Act (MMPA) of 1972, allows exemptions to be granted for the incidental take of small numbers of non-depleted species or stocks of marine mammal during the course of commercial fishing operations. This exemption to the prohibition of take can be obtained only if the total number of each species taken will have a negligible impact on that species or stock involved, and if a reporting system has been established to monitor all taking. The NMFS published the final regulations in December 1983, governing the small take exemption for marine mammals taken incidentally to commercial fishing operations. In February 1984, a 5-year Letter of Exemption was issued to the New England groundfish gillnetters to take up to 180 harbor porpoise and 50 harbor seals during groundfish gillnetting operations in the Gulf of Maine. The letter of Exemption has recently been modified and now allows for a cumulative annual incidental take totalling no more than 50 individuals for the grey seal, Atlantic white-sided dolphin, common dolphin, white beaked dolphin, and pilot whale.

The Division of Wildlife at the University of Maine at Orono, Maine is the recipient of any reports of marine mammal taken under this exemption. Through this procedure the NMFS has determined that the taking of small numbers of the above mentioned species will not significantly affect the marine mammal populations or stocks involved. Therefore, even though marine mammals may be taken during fishing operations, the Letter of Exemption should preclude the proposed management plan from adversely impacting the marine mammal species involved in the Gulf of Maine.

The NMFS Northeast Fisheries Center is funding studies to determine the extent and impact of marine mammal fisheries interaction on both the mammal populations and the fisheries involved. These studies are examining the distribution, abundance, habitat use patterns and population characteristics of harbor seals and harbor porpoises, and the fisheries interaction problem for other marine mammal species in the area. Preliminary analyses of data suggests that the total take of marine mammals in gillnet fishing operations in the NER is not significant and does not seriously threaten the marine mammal populations involved.

The Endangered Species Act of 1973, as amended (ESA) does not provide for the taking of an endangered species incidental to commercial fishing operations. However, some conflict between the large whales that frequent the coastal and offshore fishing grounds waters is inevitable. The endangered species most likely to be involved in fisheries interactions are the humpback whale, fin whale and, very rarely, the right whale. Interactions are more likely to occur with fixed gillnet or trap gear than with mobile trawling gear. There have been no reported incidences of live endangered species being taken incidentally to trawling operations, although whale carcasses are occasionally netted. However, incidental take of endangered species does occur in fixed gear. Since 1979, fourteen incidences of incidental take of endangered species have been reported. Of those, only a few involved gillnets. The majority of cases involved whales getting entangled in lobster gear. Attempts made to release the gear from some of the whales were often sucessful. A few mortalities have occurred, but their deaths have not been clearly shown to be caused by the fishing gear in which they were entangled.

In 1984, four incidents were reported involving humpback whales that were seen dragging gillnet gear. None of the whales involved have been reported dead, and two were later seen swimming free of the gear. In one case, an animal with gear on its body for over one month was released unharmed. The gear involved was recovered and identified as a bottom gillnet. These more recent reports may either be a result of increased gillnet effort or a result of an increased interest among scientists, naturalists, and the general public to investigate and report these entanglements. It is not known what effect that this take has on these species. However, it is probable that should larger numbers of endangered species (especially the right whale), become entangled in fishing gear, that the continued existence of some of these species may be jeopardized.

The FMP recommends a closure of an area in the Great South Channel (Area I) to mobile and fixed gear during the spring. This closure coincides, temporally and spatially, with the movement of right whales into the Great South Channel area. These severely depleted animals tend to aggregate in this area in the spring, presumably to feed, before continuing to northern waters. Therefore, with seasonal closures in this area it is unlikely that interactions will occur between this species and fishing gear. In addition, other management measures recommended by this FMP require the marking of gillnet gear, a measure that will allow for identification of gear and perhaps reduce the amount of lost gear in the area.

§7A4.3 Economic Impact Analysis

§7A4.31 Management Options for Analysis

The biological impact analysis above presents the expected changes in landings of seven of the eight regulated species, resulting from various mesh and minimum sizes (Tables 7A1-10). These expected landings reflect the initial losses and subsequent gains in the landed weight from restricting the catch to larger size fish, but do not include the expected increases from enhanced recruitment and the accompanying gain in stock biomass. <u>Because the goal of the management measures is to improve or maintain spawning potential and the expected impact of improved spawning potential cannot be quantitatively assessed, the regulatory impact analysis uses the cost-effectiveness rather than the cost-benefit framework to identify the most efficient way of achieving the predetermined objective</u> (NOAA Directive 21-24, page 24).

The expected landings above represent fish stocks which transcend the boundaries of fishery management sectors established in section 7A3 (see Figure 7A2). These fish stock landings have been apportioned into the appropriate sector: for instance, part of the Southern New England yellowtail flounder stock comes under Georges Bank management. Additionally, the spawning area closure has been extended into February for all options. Management options analyzed are as follows:

Table 7A12: Stock Streams Converted into Options for Analysis

Option	Spawning Closure	Gulf of Maine	Georges Bank	Southern New England	Minimum Size
OPTION 1 (base)	MAR-MAY	current	current	current	17-17-11
OPTION 2	FEB-MAY	5-1/2 ex. Redfish	5-1/2 Closure Option A	Closure 2	19-19-12
OPTION 3	FEB-MAY	5-1/2 ex. Redfish	6	Closure 2	19-19-12
OPTION 4	FEB-MAY	5-1/2 ex. Redfish	5-1/2 - 6	Closure 2	19-19-12
OPTION 5	FEB-MAY	5-1/2	5-1/2 Closure Option A	5-1/2	19-19-12
OPTION 6	FEB-MAY	5-1/2	6	6	19-19-12
OPTION 7	FEB-MAY	5-1/2	5-1/2 - 6	5-1/2 - 6	19-19-12

Option 1, the baseline from which all the other options are measured, is simply the continuation of the current situation. The minimum sizes shown in the last column are for cod, haddock, and yellowtail respectively. Minimum sizes for Options 2 through 7 also include minimums of 19 inches for pollock, 14 inches for witch flounder, 12 inches for American plaice, and 11 inches for winter flounder (not shown), and are to be implemented during the second year for all options except Options 3 and 6. Notice that the minimum sizes are consistent with Georges Bank mesh sizes. The mesh sizes associated with each option help to mitigate losses, from discarding of undersized fish, which differentiate the options. That is, the higher the mesh size the lower the amount of discarding expected, and the greater the benefits to spawning potential.

Mesh sizes proposed for the Gulf of Maine are 5-1/2 inches for all options other than the baseline (Option 1), except for the deep-water redfish area for Options 2-4. Also, these three options require a closed area rather than a minimum mesh size in part of the Southern New England sector. The last three options (Options 5 through 7) require a minimum mesh size in the Southern New England sector equivalent to that in the Georges Bank sector. The Georges Bank sector minimum mesh size drives the system with three basic options: a 5-1/2 inch minimum mesh with Closure Option A described in Section 7A3 (Options 2 & 5), a blanket 6 inch mesh size (Options 3 & 6), or a 5-1/2 inch minimum (without a closure) during the first two years of implementation followed by a 6 inch minimum thereafter (Options 4 & 7). Exempted fisheries described in §7A3(D) are associated with each mesh size option and are also reflected in the quantitative analysis of Options 1 through 7 below.

§7A4.32 Exempted Fisheries

The minimum fish and mesh size options are designed to achieve certain levels of spawning potential for key regulated species: cod, haddock, pollock, redfish, American plaice, witch flounder, winter flounder, and yellowtail flounder. These species are well suited to mesh size as a control; however, other small mesh species are generally caught in conjunction with the regulated species and these include butterfish, dogfish, herring, mackerel, scup, shrimp, squid, and whiting. Thus, restrictions on the use of small mesh nets may preclude some of these fisheries; and exempted fishery conditions have been defined in §7A3 to accommodate these small mesh fisheries while protecting the regulated species to the greatest extent possible.

For the regulated species seasonal exemptions from the large mesh measures may result in less protection and therefore less spawning potential than was planned. Exemptions are restricted to times and fishing areas which minimize these potent,al losses. The degree to which each of the regulated species is strictly protected, i.e., the amount of historical landings that come from areas and during times when no exemptions are allowed, is as follows:

COD	84.2%	AMERICAN PLAICE	68.9%
HADDOCK	95.1%	WITCH FLOUNDER	67.0%
POLLOCK	62.3-71.0%	WINTER FLOUNDER	64.1%
REDFISH	40.0-69.7%	YELLOWTAIL FLDR	72.9%

The two percentages for pollock and redfish represent no deep-water Gulf of Maine large mesh area (Options 2-4), and with the deep-water Gulf of Maine included in the large mesh area (Options 5-7). If redfish landings from Canadian waters are not included, then the amount of redfish that is strictly protected is 48-84%. In general, the minimum sizes for the regulated species will be enforced as a possession limitation (landings of regulated species from exempted fisheries are expected to be of at least minimum sized fish), and the quantitative impacts presented below are not adjusted for the above degrees of protection. Minimum fish and mesh size options are expected to impact 100% of the regulated species landings within the large mesh area, except for redfish where 70.3% of the stock is protected with Options 2 through 4.

Exempted fisheries species may be examined conversely, for example, to determine what amount of whiting landings cannot now be caught because of restrictive exemptions. Exempted fisheries are designed to allow for the maximum amount of small mesh species to be caught. The degree to which each of the exempted species is lost as potential landings, i.e., the amount of historical landings that come from areas and during times when no exemptions are allowed, is as follows:

BUTTERFISH	2.5-4.1%	SCUP	0.8-5.2%
HERRING	0.1%	SQUID	0.4-19.2%
MACKEREL	0.1%	WHITING	11.4-9.2%

The two percentages represent a closed area in Southern New England (Options 2-4) and with Southern New England included in the large mesh area (Options 5-7). The exempted fishery for shrimp is exactly the same as ASMFC regulations, thus the shrimp fishery is not affected by this FMP. Likewise, the herring and mackerel fisheries are virtually unaffected. Insufficient data are available to assess the economic impacts on the dogfish fishery; however, dogfish are a very low-value species: at 7¢ per pound total landings were worth 1.1 million dollars in 1983. The squid fishery is also unaffected by Options 2-4 (a Southern New England closed area); however, it is quite heavily impacted by Options 5-7 (a Southern New England large mesh area) but demand models are unavailable for the economic impact analysis. At the 1983 price of 30¢ the 19.2% potential loss in squid landings for Options 5-7 is worth 1.9 million dollars; this may be mitigated by the special exemption for squid (and herring and mackerel) fishing with pelagic trawl gear. Butterfish, scup, and whiting are included in the economic impact analysis below and are adjusted with the percentages shown above to reduce landings for the three species. Red hake landings are also included but are not adjusted because they are not impacted by the large mesh restrictions (red hake are caught as a by-catch of other exempted species and the regulated species). All of the impacts on revenues and landings of the exempted species represent a worst case scenario: harvesters may be expected to continue to fish outside the spatial and time boundaries of the non-exempted large mesh area but with less efficiency.

§7A4.33 Spawning Areas

Spawning area closures are extended to include the month of February. Information available for six of the regulated species suggests that landings losses will not be very great except for cod. The percent of landings lost during February (percent of annual landings in parenthesis) is as follows:

COD	70.0% (4.9%)	AMERICAN PLAICE	12.0% (0.6%)
HADDOCK	18.8% (1.7%)	WINTER FLOUNDER	15.6% (0.6%)
POLLOCK	28.8% (1.4%)	YELLOWTAIL FLDR	7.2% (0.4%)

February landings are reduced by these percentages in the economic impact analysis below for Options 2 through 7.

§7A4.34 Gear Marking Alternative

Since 1977 the New England Council has examined with industry advisors, Coast Guard and NMFS officials various gear marking systems for fixed gear to reduce inadvertent gear conflicts which result in costly gear loss and lost fishing time. In 1979, an elaborate set of detailed gear marking measures were presented to the public at a series of hearings from North Carolina to Maine. During the Northeast Multi-Species Plan development process three gear marking alternatives were identified for public review and Council analysis. In essence, these three marking systems, although greatly simplified from the 1979 proposals, span a continuum from the most simplified and basic markings possible to more rigorous marking standards to serve additional management purposes. The estimated costs of three gear marking alternatives are provided below. The total cost estimates assume a "worst case scenario" of all fixed gear operators possessing none of the gear marking materials required under each of the alternatives. All three alternatives are examined using the information found in Table 7A14.

Table 7A14: Major Marking Gear Costs* (11/84)

15 foot pole/staff	9-inch radar reflector	12-inch radar reflector	buoys (8"/15")	flags/pennants
$13.25	$7.00	$9.25	$4.75	$1.75

	Number of Gillnet Tonnage Vessels	Potential Number of Gillnet Undertonnage Vessels	Average Total Length of Gear Employed**	Assumed Number of Strings Employed***
1983	130	137	10,314 feet	3.44

* Costs were provided by two major New England (Chatham, Gloucester) gillnet gear suppliers. Where prices for equivalent gear elements varied an approximate average of the two is used.

** Based on 1978 operating unit information for tonnage vessels.

*** Industry advisors report that a common practice is to employ 4 sets each of 10-50 fathom gillnets to a string (i.e., 3,000 foot sets). Costs of the marking requirements to individual fishermen will be lower or higher depending on whether they use longer (less sets) or shorter (more sets) sets respectively.

These estimates reflect an initial one-time cost to industry and do not include replacement cost resulting from losses due to weather or conflicts. Gillnet fishermen consistently report to the Council that little or no gear is lost due to weather. Most gear losses are attributed to conflicts, either deliberate or inadvertent, with mobile gear operations (i.e., incidents that these marking requirements are intended to prevent or reduce). Obviously, there will be some level of annual replacement costs which will probably vary among operators as is the current situation. The marking costs prescribed herein in no case amount to more than 5% of the total cost of rigging a set of gillnets in a typical gillnet industry manner. Should the trend of a declining number of gillnetters continue beyond 1983, the total cost estimates for all the alternatives will obviously be less.

Cost to Gillnet Vessels

Alternative A:

In the Gulf of Maine, Georges Bank and Southern New England fishery sectors, the marking requirement for gillnet and bottom-tending longline gear shall be as follows: the westernmost end (meaning the half compass circle from magnetic south through west to and including north) of a fixed gear trawl must display a radar reflector and flag (i.e., to make a double shape). The easternmost end (meaning the half compass circle from magnetic north through east to and including south) of a fixed gear trawl must display a single radar reflector.

This alternative would presumably require gillnet and longline fishermen to have two poles, two buoys, two radar reflectors (9 inch) and one flag per set of gear. With no further marking or size specifications, this alternative presents minimum guidance to industry; and for purposes of this analysis it is assumed that fishermen would meet the requirement by acquiring commercially available gear. It is understood that the cost estimates of all of the alternatives are likely to be high in instances where fishermen use non-standard or make-shift materials which would meet the specifications.

Tonnage gillnet vessel costs:	$51.75 x 3.44 = $178.02 x 130 =		$23,142.60
Undertonnage gillnet vessel costs:	$51.75 x 3.44 = $178.02 x 137 =		$24,388.74
		Total Cost	$47,531.34

Alternative B:

Same marking requirement as Alternative A except that the following further size specifications will be required:

1. The radar reflector on gillnets and longline gear shall be a standard 12 inch tetrahedral corner reflector or larger and will be positioned on the staff at least 6 feet above the buoy.

2. The flag or pennant on gillnet gear only shall be of the color international orange.

This alternative will require the use of a 12 inch radar reflector (which is the current preference of many fishermen using reflectors) which increases the cost of this alternative over Alternative A. In addition, with the use of a larger reflector many fishermen will double up on the standard 8"/15" buoy. Assuming this would be the common industry practice, the costs would be as follows:

Tonnage gillnet vessel costs:	$65.75 x 3.44 = $226.18 x 130 =		$29,403.00
Undertonnage gillnet vessel costs:	$65.75 x 3.44 = $226.18 x 137 =		$30,986.66
		Total Cost	$60,389.66

Alternative C:

1. The maximum length of continuous gillnet sets shall not exceed 6,600 feet.

2. In the Gulf of Maine, sets of gillnet gear which are of an irregular pattern (non-linear and non-contour) or which deviate more than 30 degrees from the original course of the set would be marked at the extremity of the deviation with an additional marker which may be either independent or attached to the gear. Such marker would display a number of highly visible streamers sufficient to be distinguished from the flags or pennants of the end buoys.

3. Radar reflectors on gillnets shall be of the color black.

Cost estimates for Alternatives A & B are based on the common industry practice of fishing 10-50 fathom gillnets to a string (i.e., 3,000 feet). For fishermen employing sets of 6,000 or 6,600 feet, the marking costs will approximate one-half those estimated under Alternative B, assuming the same average total length of gear is used.

Should all sets of gillnet gear require a mid-gear marker due to a 30 degree deviation marking requirement and assuming that this requires an additional buoy, staff and the equivalent costs of two flags in lieu of streamers, the following higher costs may be imposed:

Tonnage gillnet vessel costs:	\$87.25 x 3.44 = \$300.14 x 130 =	\$39,018.20
Undertonnage gillnet vessel costs:	\$87.25 x 3.44 = \$300.14 x 137 =	\$41,119.18
	Total Cost	\$80,137.38

Cost to Longline Vessels

The Council is aware of four vessels (three vessels under construction for Maine-based Sea Bank Industries, one vessel (F/V CREST) belonging to High Seas Corporation, MA) currently under construction or conversion to fish groundfish using automated longline technology. Three of these vessels are 76 feet in length, while the fourth is 147 feet. It is reasonable to assume that the maximum amount of hooks employed by any of these vessels will be approximately 35,000 and that these would be distributed over a maximum of 10 sets of potentially varying lengths (personal communication with W. Whipple, High Seas Corporation). Another automated longline vessel of 54 feet (SEA DOG V), currently not involved in the groundfish fishery, fishes considerably less hooks but may employ as many sets as the larger vessels. Potential "worst case" marking costs, using the same gear price information found in Table 7A14, for these vessels under the alternatives is found below:

Alternative A: \$51.75 x 10 = \$517.50 x 4 = \$2,070.00
Alternative B: \$65.75 x 10 = \$657.50 x 4 = \$2,630.00
Alternative C is not applicable to longline gear.

Aside from the vessels which may be involved in automated longlining, the Council is aware that in 1983 a maximum of 33 vessels may at some time during the year use longline gear (tub trawls) from various ports throughout New England. It is not likely that any of these vessels would employ more than 8 sets - 6 is a more likely maximum (personal communication with Charles Sheldon) of longline gear at any given time. Therefore, the alternative marking requirements could have the potential costs illustrated below:

Alternative A: \$51.75 x 8 = \$414.00 x 33 = \$13,662.
Alternative B: \$65.75 x 8 = \$526.00 x 33 = \$17,358.

Gear Marking Impact Summary

The following summarizes the impacts of gear marking measures.

Gear Marking Impact Summary
\$1000

Alternative	Gillnet	Line Trawl	Total
A	47.5	15.7	63.2
B	60.4	20.0	80.4
C	80.1	20.0	100.1

§7A4.35 Results of Analysis

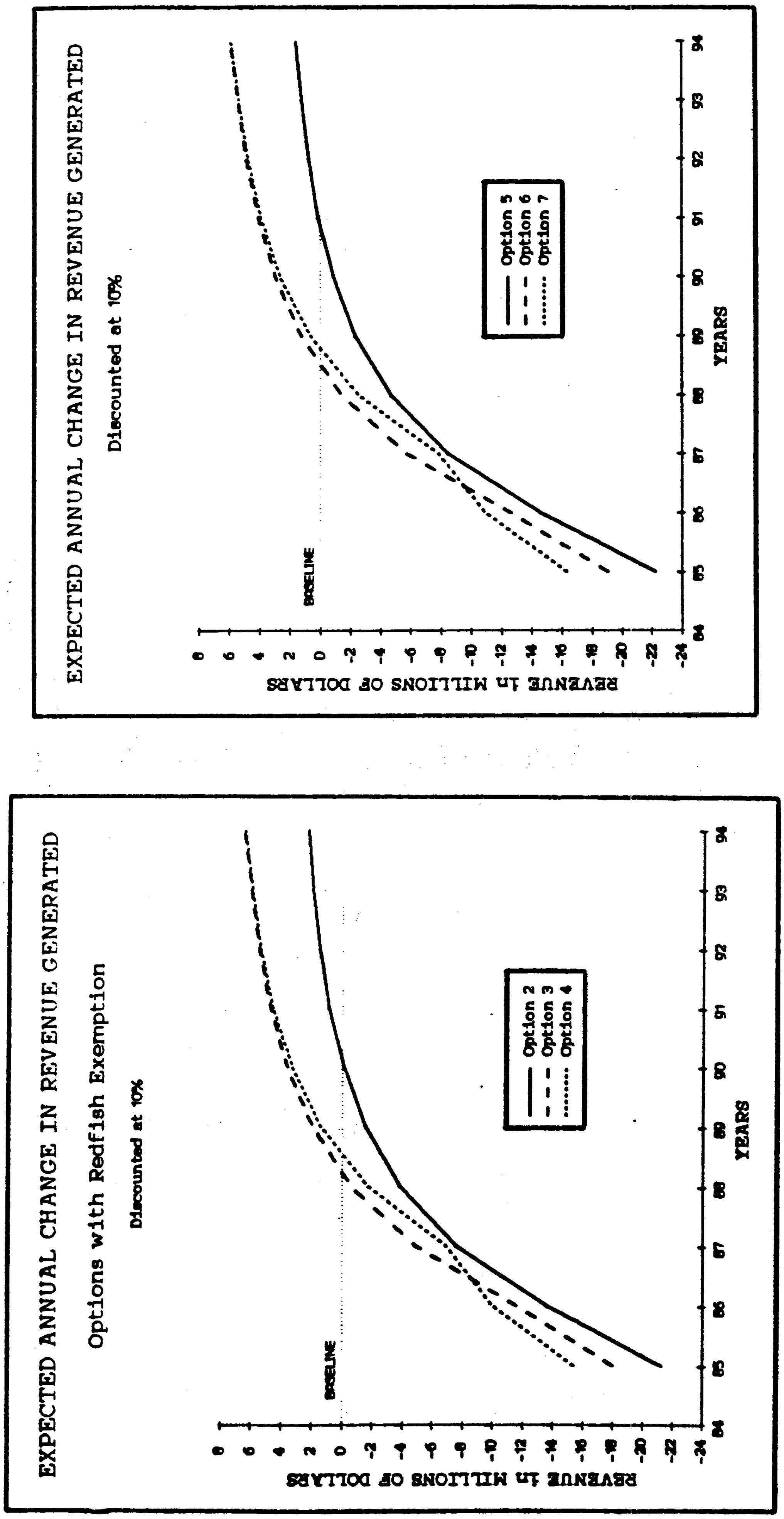
A bio-economic analysis is used to assess the impacts of seven management options on the commercial finfishing sector. A socio-cultural impact analysis (§7A4.4) follows immediately from this bio-economic analysis. Analyses of the gear marking requirements (§7A4.34) above and the recreational finfishing sector (§7A4.5) below are presented, however, the estimated impacts are independent of the level of landings expected.

As described above, the economic impact analysis consists of seven options for minimum fish/mesh size, exempted fishery conditions, and spawning area closures in the Gulf of Maine and Southern New England (Table 7A12). Option 1 is used as the baseline because it represents the do-nothing alternative. All other options are presented as changes from this baseline. The analysis includes all of the regulated species, all of the relevant exempted species except dogfish and squid, as well as white hake, windowpane flounder, summer flounder, and cusk. The difference between Option 2 through 7 and the baseline for each regulated species results from the estimated annual minimum fish/mesh size effects (from the biological analysis at the beginning of this section) and the landings lost in the spawning areas (which is a constant percentage from year to year). For each exempted species, the 1983 landing level is held constant over the ten-year period adjusted for the lost landings in the non-exempted large-mesh area (a constant percentage each year). For the other species, witch flounder (a regulated species), red hake (an exempted species, see subsection above), white hake, summer flounder, windowpane flounder, and cusk, the 1983 landing level is an unadjusted constant over the ten-year period. The selection of a constant level of landings for the exempted and other species is intuitively appealing in that the projected landings of the regulated species over the ten-year period assume constant recruitment and fishing mortality at the 1983-1984 levels. All options will actually show further increases in stocks and landings over the baseline (Option 1) because of improved recruitment although this cannot be quantified, and other changes (increases or decreases) in stocks and landings will assuredly occur but will not change the relative standing of the seven options. Three basic options: 5-1/2 inch with closures, 6 inch, and 6 inch delayed, are designed to achieve the same general recruitment benefit. The difference between Options 2-4 and Options 5-7 is that more stocks (deep-water the Gulf of Maine redfish and pollock) receive protection and improved recruitment in the latter case. Witch flounder landings are not included in the biological analysis because adequate assessment information are not available. However, species such as witch flounder, red hake, and the other species are included in the economic impact analysis because they are a part of a system of price equations used for this analysis.

Having the expected landings for each option during the ten-year period 1985-1994, a groundfish demand model is used to derive prices and revenues associated with each landing stream. The methodology used to estimate the demand model is described in Wang (1984). Price equations of the demand model generally depend on species landings, landings of the other species in the system, imports of all species in the system, consumer income, general price movements, lagged species price, and seasonal factors. Imports of each species or group are held at 1983 levels, similar to some landings as described above. Both consumer income and the general price index are projected using ARIMA time-series models. Lagged price is the predicted price from the previous period.

Expected changes in prices and landings for each of the regulated species are presented in Appendix 7. In general, all 6 inch options (immediate or delayed) result in smaller initial losses and greater equilibrium gains (higher landings and lower prices) compared to 5-1/2 inch options. This is expected because the 5-1/2 inch options include area closures which build inefficiency into the harvesting operation. Including the deep-water Gulf of Maine in the large-mesh area (Options 5 through 7) increases initial losses of redfish. Long-term equilibrium gains from redfish do not accrue for almost 25 years. From the landing and price streams expected species revenues are easily derived and are then summed to show total revenue impacts for each option (Figures 7A11 and 7A12) as compared to the baseline at zero. Changes in revenue paint the same picture as prices and landings, with 6 inch options being preferable to 5-1/2 inches. This conclusion holds when recruitment benefits are also considered, because all options are constructed to achieve the same improvements with respect to recruitment and resultant stocks and landings.

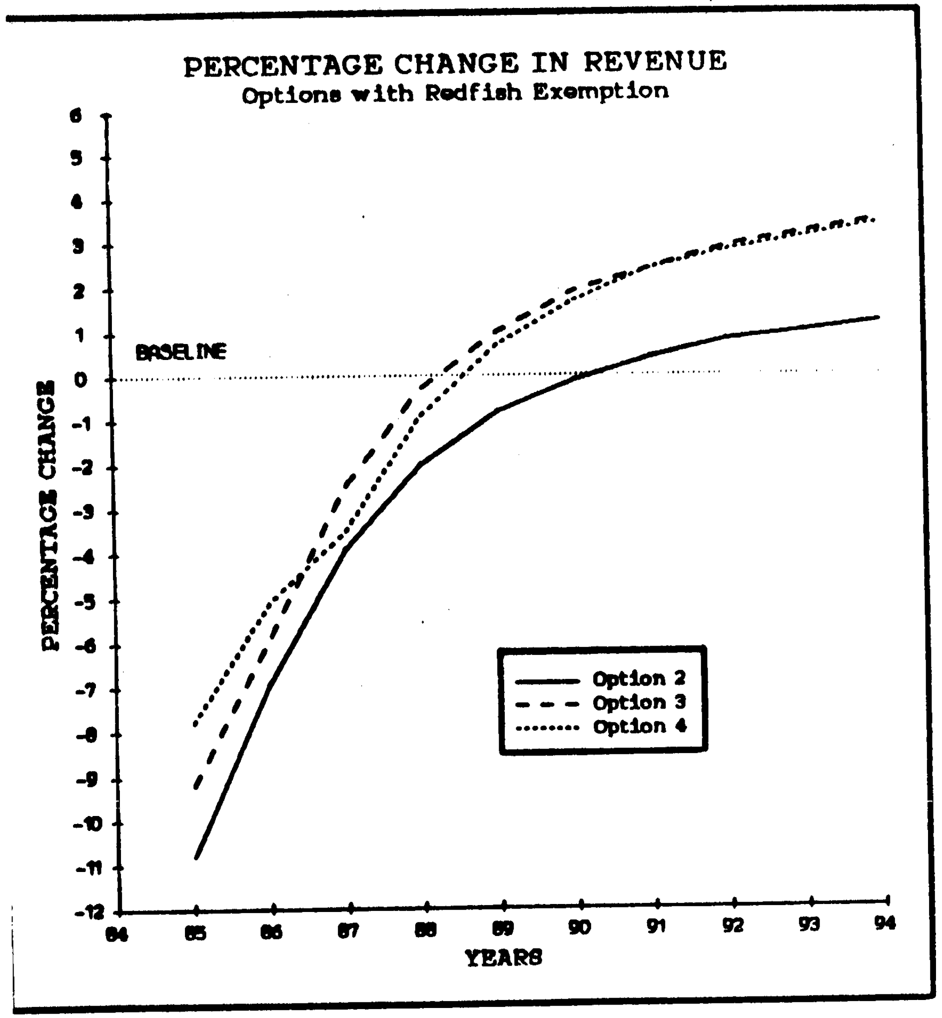
To determine whether an immediate or delayed 6 inch mesh, for example, provides the greatest net benefits or least costs, the streams of revenue for each option may be discounted and summed to one number for comparison. Table 7A13 presents the discounted cash flows for the regulated species (flounders includes American plaice, witch, and winter), the subtotal of the regulated species, and the overall total including exempted fisheries effects. All of the discounted cash flows reflect the spawning area closure effects in February in the Gulf of Maine. Gear marking, recreational fishing, and administrative (enforcement) costs are not included in these numbers, but all of these costs are constant across the particular options analyzed here and are treated below. Revenue streams are discounted with a rate of 10% in Table 7A13; Option 1 is reported in thousand dollars, whereas Options 2 through 7 are differences (in $1000) from this baseline. Again the most obvious result is that greater net benefits (i.e., lower negative benefits, measured as discounted cash flows) are expected with any 6 inch measure as compared with 5 1/2 inches. The discounted cash flow method also shows that the net benefits to the redfish fishery are consistently greater when deep-water Gulf of Maine is excluded from the large mesh area: -47.3% versus -70.1% for the 5-1/2 inch with closure (Option 2 versus Option 5), -47.8% versus -68.7% with both 6 inch options (Options 3&4 versus Options 6&7). Overall the most cost effective option is Option 3, a 6 inch mesh, slightly better than Option 4, a delayed 6 inch mesh, both excluding the deep-water Gulf of Maine redfish fishery. The reason that the two options are basically equivalent is because discounting reduces the value of years 3 through 6, when option 3 has relatively higher benefits (see Figures 7A11 & 7A12), more than for years 1 and 2 when the delay obviously produces relatively higher benefits (lower losses). The primary reason why all of the options show negative discounted cash flows relative to the baseline is because of an approximately 50-70% loss in the redfish fishery, and the fact that expected improvements in recruitment and subsequent landings are not included.



EXPECTED ANNUAL CHANGE IN REVENUE GENERATED
Discounted at 10%
BASELINE
Option 5
Option 6
Option 7
REVENUE in MILLIONS OF DOLLARS
YEARS
8
6
4
2
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
-22
-24
84
85
86
87
88
89
90
91
92
93
94
EXPECTED ANNUAL CHANGE IN REVENUE GENERATED
Options with Redfish Exemption
Discounted at 10%
BASELINE
Option 2
Option 3
Option 4
REVENUE in MILLIONS OF DOLLARS
YEARS

Figure 7Ai1

Figure 7A12


PERCENTAGE CHANGE IN REVENUE
Options with Redfish Exemption
PERCENTAGE CHANGE
BASELINE
Option 2
Option 3
Option 4
YEARS
6
5
4
3
2
1
0
-1
-2
-3
-4
-5
-6
-7
-8
-9
-10
-11
-12
84
85
86
87
88
89
90
91
92
93
94

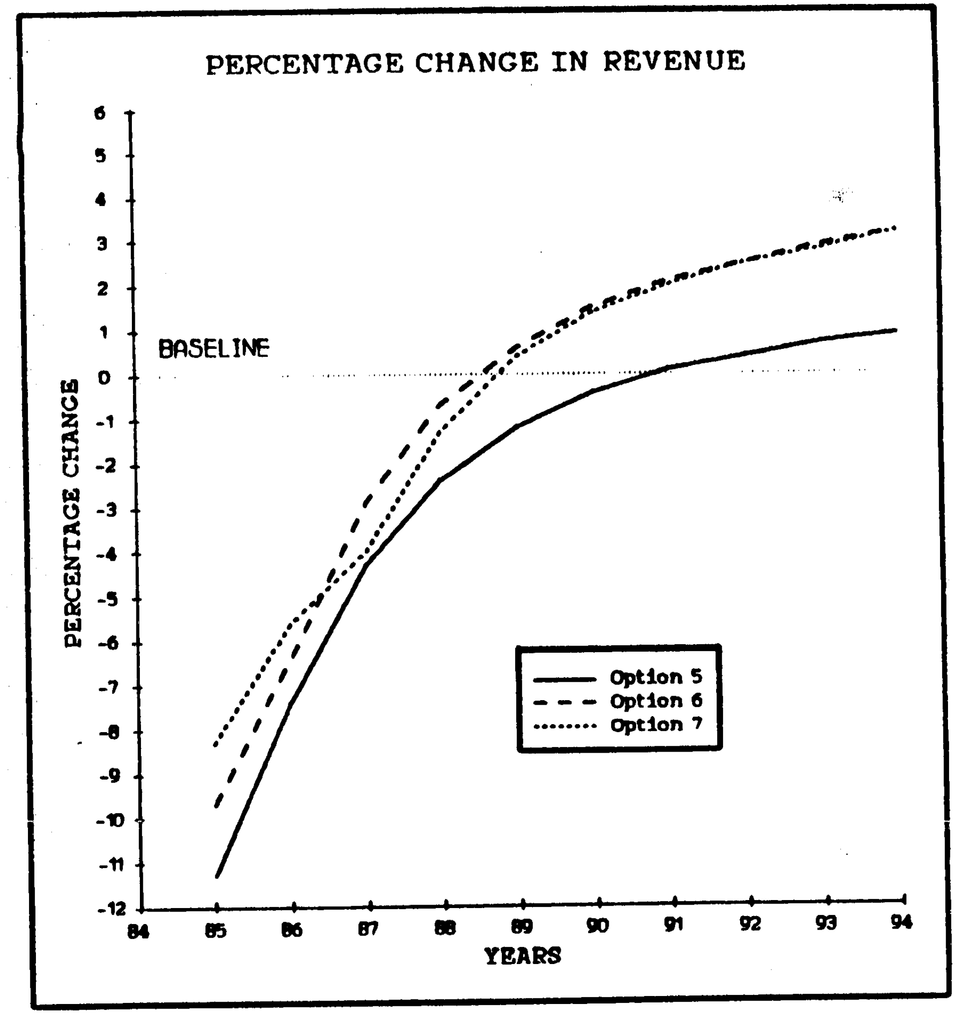

PERCENTAGE CHANGE IN REVENUE
PERCENTAGE CHANGE
BASELINE
Option 5
Option 6
Option 7
YEARS
6
5
4
3
2
1
0
-1
-2
-3
-4
-5
-6
-7
-8
-9
-10
-11
-12
84
85
86
87
88
89
90
91
92
93
94

TABLE 7A13:[1/]
Comparison of Revenue Streams ($1000), 1985-1994,
Discounted at 10%,
for Various ADF Mesh Size Options

	Option 1	Option 2	%	Option 3	%	Option 4	%	Option 5	%	Option 6	%	Option 7	%
COD	$324,821	-23,781	-7.3	-11,851	-3.6	-12,883	-4.0	-23,782	-7.3	-11,853	-3.6	-12,887	-4.0
HADDOCK	$106,781	865	0.8	4,494	4.2	4,542	4.3	865	0.8	4,494	4.2	4,542	4.3
POLLOCK	$69,804	-4,301	-6.2	-2,135	-3.1	-2,015	-2.9	-4,302	-6.2	-2,140	-3.1	-2,022	-2.9
YELLOWTAIL	$426,622	7,568	1.8	20,907	4.9	21,253	5.0	7,560	1.8	20,876	4.9	21,219	5.0
FLOUNDERS	$531,071	-5,951	-1.1	-1,366	-0.3	-812	-0.2	-5,767	-1.1	-859	-0.2	-252	-0.0
REDFISH	$26,371	-12,486	-47.3	-12,596	-47.8	-12,594	-47.8	-18,494	-70.1	-18,107	-68.7	-18,106	-68.7
SUB-TOTAL	$1,485,469	-38,087	-2.6	-2,547	-0.2	-2,510	-0.2	-43,920	-3.0	-7,589	-0.5	-7,506	-0.5
TOTAL	$1,935,433	-41,357	-2.1	-6,838	-0.4	-6,912	-0.4	-49,368	-2.6	-14,062	-0.7	-14,097	-0.7

1/ A description of costs and benefits of management options considered by the Council is given in Section 7B2.

§7A4.4 Socio-Cultural Impact Analysis of Alternative Measures

Total Employment Effects

The most striking and quantifiable impacts of the six management alternatives may be found in the area of employment, and in this section the changes in regional employment will be analyzed and other likely social cultural impacts noted. In the Northeast, since fishing is often a family tradition with each employed member of the family involved in some aspect of the industry, employment loss could have severe repercussions on whole families and, in some cases, whole communities. Since success in fishing has little correlation with years of education and, consequently, fishermen are generally not formally educated, even where alternative employment is available in a community, fishermen are less likely to be qualified for jobs in other sectors. In addition, their social networks tend to be limited to others in the fishing industry; thus, access to and familiarity with employment in other sectors is also limited.

Besides the obvious impacts on employment, the proposed management actions could have less quantifiable but significant effects on such social cultural considerations as life-style, job satisfaction, family and community orientation.

Nevertheless, on a port-by-port basis the socio-cultural costs of the management program delineated in this plan would be calculably less than the short-term socio-cultural costs of a restrictive effort control program or, conversely, the long-term impact of no management at all. Indeed, market forces may mitigate impacts of the proposed plan. If prices of fresh groundfish reflect a quality (size) premium, the actual returns to fishermen and others in the industry might lessen the expected negative impacts suggested by employment statistics based on current landings and prices.

In the case of an effort control program, the short-term socio-cultural costs might be far greater than with the proposed management program since the opportunity for fishermen to participate might be directly affected. There is evidence that fishermen do not fish simply for financial rewards. Researchers have found that fishing is intrinsically rewarding as an occupation. Participants mention freedom and independence, adventure and challenge, fellowship and tradition as benefits of their occupation. Those people who could not obtain licenses or who could not fish at accustomed times might be forced out of the profession and be required to physically relocate in order to find alternative employment. If fishing as an occupation were effectively restricted, the impact would be significant even if alternative employment were available. Furthermore, effort restrictions often have a greater negative impact on small, day boats. This in turn can have negative consequences for consumers since day boats as a whole may provide higher quality fish.

Under no management at all the short-term socio-cultural costs would not be as high as those under the proposed scheme, while the long-term costs would be far greater. This trend would likely prove devastating to the industry in the long run. As the resource becomes increasingly overexploited, fishing could lose its viability as an occupation for a majority of participants. In some ports, traditional family occupations would be lost. Fishing jobs lost through overexploitation could only be regained by allowing the stocks to recover, which may require a long time, impose high social costs and lead to more restrictive management measures than the ones proposed in this FMP.

Increases or decreases in employment opportunities, due to government regulatory action which affects finfish harvesting revenues, may be described using input-output analysis. In such analysis one may examine the direct, indirect and induced employment effects of that action, if one presumes an average output per employee measured in total man-years. The graphic representation (Figure 7A13) of the employment impact of the six management alternatives relative to the first option (the baseline) is considered a 'worst case' analysis. That is, the employment effect of the six management options takes into account all possible marine-related impacts including the induced change in consumer demand. It is based on the 'worst case' revenue projections discussed in §7A4.34.

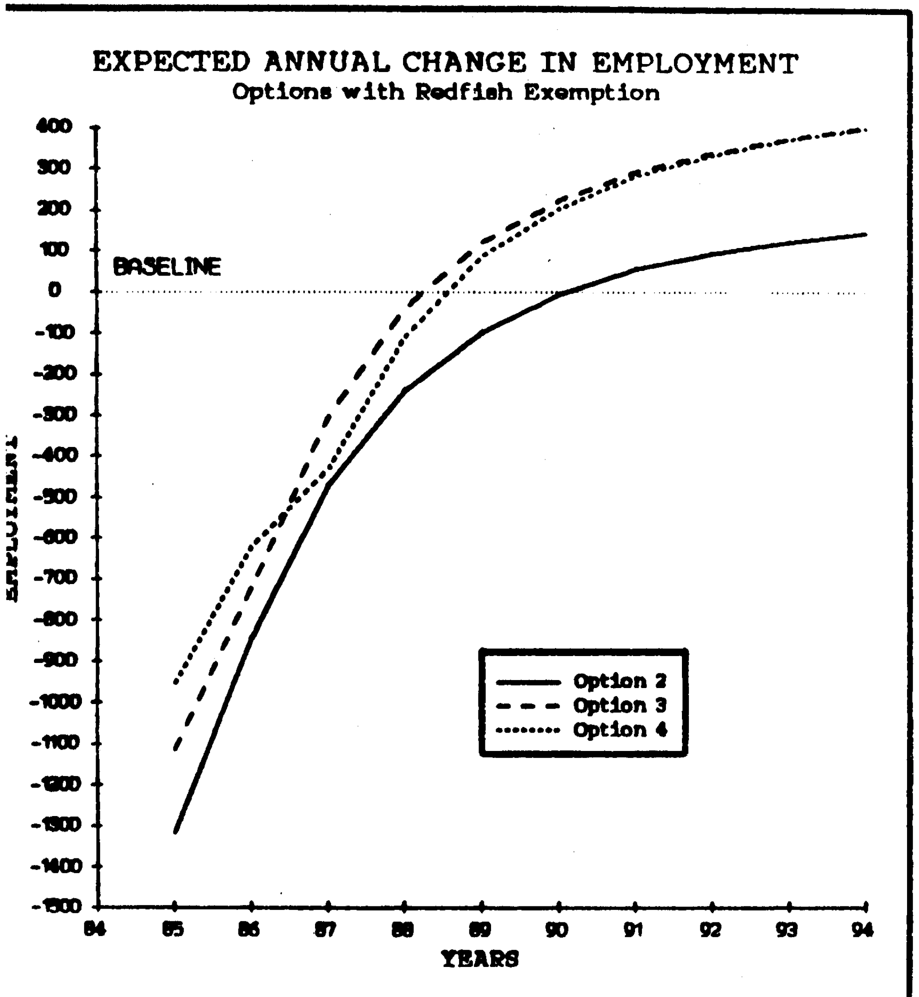
A coefficient which computes employment based on ex-vessel revenues was derived through input-output analysis. This was used to describe the impact of various management options on a number of marine affiliated industries. These industries included the commercial finfish industry, processing, wholesale and retail fishing industries, marine recreation and tourism (e.g., hotels, motels, marinas, charter fishing, etc.), marine manufacturing, marine military, marine research and education, and other industries such as marine construction, water transportation, marine finance and insurance. All of these affiliated industries would be affected at some level if regulatory action curtailed fishing activity. If net revenues from the industry are lowered, the impact would be reflected first in direct job losses in the harvesting sector, then in indirect but related job losses, and finally through induced effects and changes in consumption patterns in all other sectors ("Estimation of Income and Employment Multipliers for Marine-Related Activity in the Southern New England Marine Region" URI 80-10).

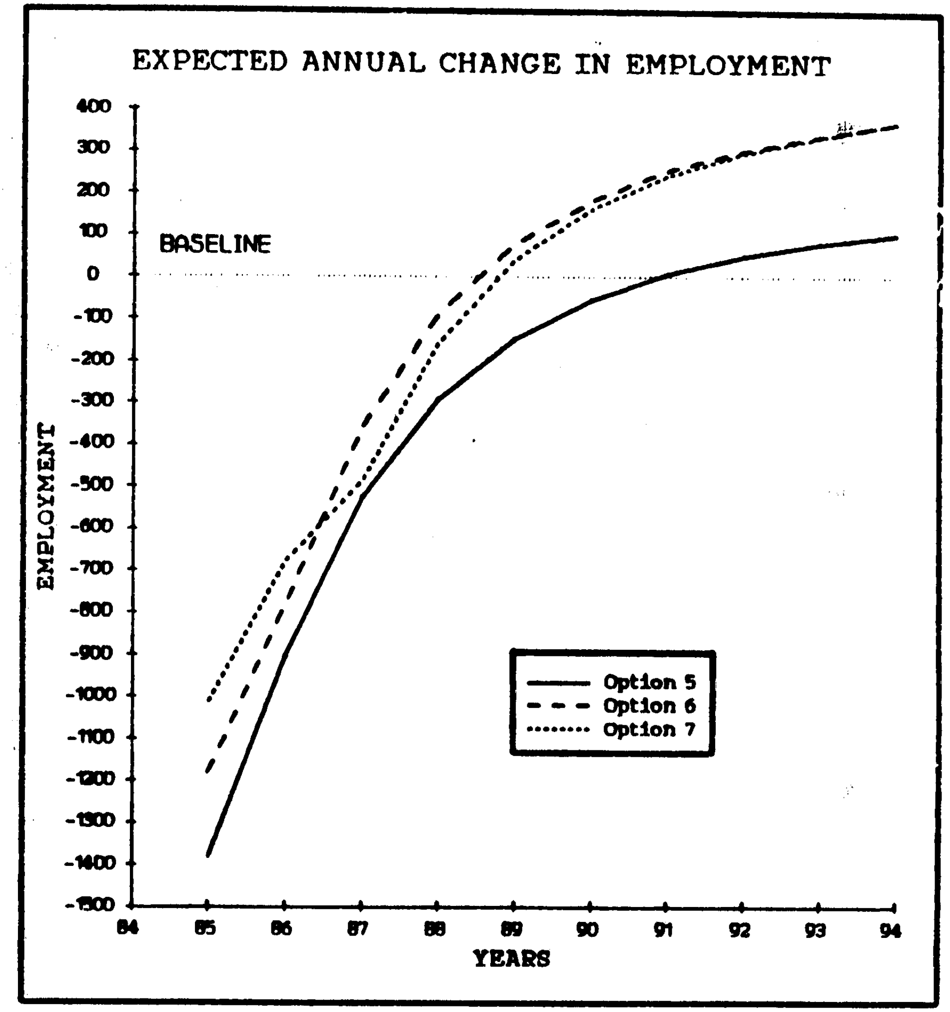
As graphically represented, all management options result in an initial employment displacement. The magnitude of that displacement varies from a low of 952 jobs lost with option 4 to a high of 1381 jobs lost with Option 5. Twenty-seven percent, or 257 jobs with Option 4 and 372 jobs with Option 5, would be in the harvesting sector. Initial losses range from 7.8 - 11.3% of the labor force. In each case, after the first year there is a net gain over jobs lost the previous year (although still a loss from the baseline values until year five). In particular, Option 4 shows a gain of 334 (90 fishermen) in year two after the initial loss.

The break even relative to the baseline occurs for options 3 and 4 by 1989, or year five. By 1994, or year ten, there is a relative gain of some 400 (108 fishermen) jobs for these options. Option 2 results in an overall relative loss during the tenth year of 142 (38) jobs.

The management options which include mesh regulation for deep water Gulf of Maine show a break-even point just prior to 1989, or year five, in the case of Options 6 and 7, while Option 5 breaks even closer to year seven, or 1991. The net gain by 1994, year ten, for Options 6 and 7 is 370 (99) jobs, while 101 (27) jobs are gained after ten years for Option 5. Thus, forgoing more jobs initially, results in a higher employment level overall.

Figure 7A13


EXPECTED ANNUAL CHANGE IN EMPLOYMENT
Options with Redfish Exemption
BASELINE
EMPLOYMENT
YEARS
Option 2
Option 3
Option 4


EXPECTED ANNUAL CHANGE IN EMPLOYMENT
BASELINE
EMPLOYMENT
YEARS
Option 5
Option 6
Option 7

The graphic representation of this data shows employment in man-years. The impact would clearly be less severe if employment were part time or seasonal. That is, the impact might be mitigated if one man-year output were performed by two part-time employees. Likewise, if one man-year were made up on a seasonal basis, and employment elsewhere was normally sought during the remainder of the year, the impact might be lessened. Part-time or seasonal employees would more likely have other ready employment options than would permanent full-time employees.

The impact differential between the various options during the ten-year period changes. It is clear that the options which represent the highest net employment gain after ten years are Options 3 and 4. The rate of net job gain from the initial job loss is greater and more consistent with Option 3, particularly in the first year. With mesh regulation in deep water Gulf of Maine, the rate of employment gain and the net increase of jobs is highest with Option 6. The difference between options without or with deep water Gulf of Maine mesh regulation is approximately 64 man-years for each option (i.e. Option 2 vs. Option 5).

Port Specific Impacts

According to the 'worst case' analysis conducted for the mesh management regime, the social costs of the management options considered would be high in most New England ports during the first year of implementation. The net benefits of this management program are allocated evenly throughout New England for Options 5, 6, and 7. Options 2, 3, and 4 distribute benefits somewhat less evenly, in that there is no mesh regulation in the Southern New England region. Since this management plan does not call for effort control, vessels in any port would be free to continue fishing in compliance with mesh, minimum size, and spawning area closure regulations.

Given that the management alternatives would impact the industry region-wide, it is difficult to predict the individual port impact with accuracy. However, the overall impact on the larger ports may be generally assessed. In a port such as Gloucester, where 40-45% of the community's employment and revenue is dependent on the fishing industry (See Section 3E2), the socio-cultural impact of management alternatives which resulted in job losses would be substantial. Alternative employment would be difficult to rely on in this port. Whereas the community is largely an ethnic, family oriented one, loss of fishing jobs with no alternative employment might result in severe socio-cultural dislocation and family break-ups.

In New Bedford, fishing-related employment represents close to 1/3 of the city's economic base. Changes in fishing regulations would most likely redistribute the fishing effort into other fisheries. Fishing effort is currently concentrated on species which bring high prices. Changes to other fisheries would be likely to decrease income for time or effort expended. Lower returns would negatively impact related industries, but direct job loss, i.e., loss of fishing sites, might be minimal. If the management regime and related regulations are overly restrictive, and if the opportunities in other fisheries are limited, there will likely be a loss of jobs in the fishing industry. This loss in the marine sector might be made up in other non-marine fields in New Bedford or outlying towns. Thus, the socio-economic impact in New Bedford might be less severe than the impact in Gloucester due to alternative fisheries and non-marine employment opportunities.

The impact of the management measure alternatives on smaller ports such as Provincetown is somewhat more difficult to project. Tourism is the dominant industry in Provincetown, although the potential of the fishing industry has been revived in recent years. Restrictive management regulations could result in limiting this development. Provincetown's fishing fleet is also made up primarily of relatives carrying on family traditions, so job loss and dislocation would affect whole families. Non-fisheries employment options would be available, although largely seasonal.

The impact of the management options with Southern New England mesh or closure regulations would be significant on Point Judith, which has never before had to contend with either regulation. If regulation in the groundfish fishery resulted in job displacement, it would most likely result in switchover to other fisheries where opportunities continue to exist. It could also result in a switch in effort to fishing further south. Newport on the other hand will be impacted regardless of Southern New England regulations, because vessels from this port tend to work Georges Bank waters.

In Portland, Maine, the impact would be significant. While the port is the home of a substantial lobster fleet, any displacement of the groundfish fleet could not be totally offset by the lobster fishery. The inshore scallop fishery would provide some alternative opportunity if the management regime resulted in groundfish employment loss. Non-marine employment is available, although tourism related employment is seasonal.

A mesh management regime could have severe impact in Rockland, Maine, where the alternative fisheries, redfish and herring, are in serious decline and the loss of traditional waters to Canada further limits the opportunities. However, Options 2 through 4 which allow for a deep-water Gulf of Maine exception to the mesh size would mitigate this impact. While fishing is thought to make up a major part of the town's economic base, there are some non-marine employment opportunities if fishing employment becomes limited.

While it is difficult to assess the real impact of a mesh management program on various ports it can be conjectured that if unemployment results from such a program some ports would be better able to provide alternative employment than others. The socio-cultural impact could be greater in cases where entire families are involved in the fishing industry and where lack of formal education stands in the way of alternative employment.

§7A4.5 <u>Impacts of Minimum Sizes on Recreational Fisheries</u>

Minimum fish size is the only measure in the proposed action which would have a direct impact on the recreational fisheries included in the management unit. Three alternatives have been identified and analyzed regarding minimum sizes for the recreational fisheries:

<u>Alternative A</u>:

The minimum sizes are the same as for the commercial fisheries (see §7A3), except that a total of 2 undersized fish per fisherman per day would be allowed.

Alternative B:

The minimum sizes for cod and haddock will be 15 inches in the first year, 17 inches in the second and third years, and will increase to 19 inches at the beginning of the fourth year of plan implementation.

Alternative C:

The minimum sizes for cod and haddock will be 15 inches in the first year, 17 inches in the second and third years, and will increase to 19 inches at the beginning of the fourth year of plan implementation. Also a total of 2 undersized fish per fisherman per day would be allowed in all years.

General Comments

Several factors which affect the size distribution of the recreational catch include population age structure, mode of recreational fishing, distance from shore, migratory patterns and distribution, fishing tackle and commercial and recreational effort levels. The size distribution of the recreational catch can vary greatly as a result of any combination of these factors. For example, the results of two sea sampling trips aboard party boats from Newburyport and Gloucester fishing different areas known as Old Scantum and Middle Bank are shown below.

Table 7A15: Length/Frequency Results of Party Boat Sea Sampling*

BOAT	PERCENT OF FISH > 19 IN.		SAMPLE SIZE	
	COD	HADDOCK	COD	HADDOCK
CAPT. RED (Newburyport) 7/30/78	27%	63%	45	232
YANKEE CAPT'S (Gloucester) 6/10/78	82%	86%	28	22

* Data provided by Dr. Fred Serchuk, NEFC.

The analysis of the 3 alternatives is limited to an examination of the potential total recreational catch precluded (Alternative B only) and number of trips affected by the proposed minimum fish sizes. The relative share of the total impacts among the four recreational modes (party/charter, private boats, beach/bank, and pier/jetty/bridge) is assessed with regard to the potential number of trips affected. Time and data constraints did not permit an examination of the size distribution of recreational catch by mode. However, because they fish farther from shore, the catch of cod, haddock and pollock by party/charter and large private boats will be reduced less than the catch of shore-based anglers. National Survey data shows that party/charter boats in the North Atlantic and Mid-Atlantic regions catch fewer and larger fish (see §3D2). This generalization may be less true with respect to the recreational catch of winter flounder.

All of the alternatives except B provide for a two-fish exemption from the minimum size which is intended to minimize the impact on the recreational fisheries. Tables 7A16, 7A17 and 7A18 provide information on the success and number of recreational fishing trips, and on the number of cod, pollock and winter flounder caught in the New England area (the National Survey does not list catches of haddock). Table 7A19 presents information on the percentage of fishing trips on which Atlantic cod and pollock were the primary species sought. This information is examined for each of the alternatives. Table 7A16 indicates that alternatives A and C would have no impact on 71% of all recreational fishing trips from bridges, jetties, etc.; no impact on 48% of all party/charter trips; no impact on 53% of private/rental trips; and no impact on 82% of all beach/bank fishing trips based on four-year averages of all trips on which less than two fish were caught by anglers. In contrast, New Hampshire Fish & Game data (personal communications Robert Fawcett) for 1982 indicates that alternatives A and C would have no impact on 93% of all shore-based trips; no impact on 60% of all party/charter trips; and no impact on 67% of all private boat trips taken by New Hampshire based anglers.

Table 7A16: Percent of All Fishing Trips Taken Where 2 or Less Fish Were Caught

North Atlantic	Bridges, Jetties, Piers	Party/ Charter	Private/ Rental	Beach/ Bank
1979	70.4%	61.5%	54.0%	-
1980	68.9	36.4	50.3	77.7%
1981	66.2	46.0	53.3	83.1
1982	78.1	48.2	52.9	85.7
Average	70.9%	48.0%	52.6%	82.2%

National Survey (DOC)

Table 7A17: Number of Fishing Trips by Mode (thousands)

North Atlantic	Bridges, Jetties, Piers	Party/ Charter	Private/ Rental	Beach/ Bank
1979	1,493	561	3,897	1,304
1980	1,782	777	3,676	1,534
1981	1,083	2,133	2,409	932
1982	1,752	1,509	3,069	1,342
Average	1,090	1,245	3,262	1,278

National Survey (DOC)

Table 7A18: Total Number of Cod, Winter Flounder and Pollock Caught by Mode (thousands)

North Atlantic	Bridges, Jetties, Piers	Party/ Charter	Private/ Rental	Beach/ Bank
1979				
Cod	96	777	2,213	5
Winter Flounder	3,005	603	27,935	1,212
Pollock	1,101	654	1,721	172
1980				
Cod	7	1,023	979	429
Winter Flounder	1,871	469	15,322	1,062
Pollock	768	592	2,565	507
1981				
Cod	8.5	3,141	1,875	8.5
Winter Flounder	2,976	811	14,581	646
Pollock	644	824	1,021	161
1982				
Cod	29	1,711	1,267	-
Winter Flounder	826	1,167	16,847	472
Pollock	830	222	526	73

National Survey (DOC)

Table 7A19: Percent of Fishing Trips on Which Atlantic Cod and Pollock were the Primary Species Sought as Reported by Fishermen in the Intercept Survey

North Atlantic	1979	1980	1981	1982	Average
Cod and Pollock	8.2	4.7	8.7	7.1	7.2
Cod (alone)	6.8	3.4	7.2	6.3	5.9

National Survey (DOC)

Impacts of Alternative A

There are no substantial recreational fisheries for redfish, witch flounder, yellowtail flounder and American plaice and, therefore, a minimum size for these species will have negligible impacts, particularly with a two-fish exemption provision.

The two-fish exemption limits the total number of recreational trips for cod, haddock and pollock that will be affected by the minimum sizes. Trip success data demonstrates that anglers frequently do not catch more than two fish. Table 7A20 shows the average number of trips from 1979-1982 on which three or more fish were caught and on which anglers seeking cod and pollock might have been impacted under this alternative.

Table 7A20: Number of Recreational Trips by Mode on Which Cod and Pollock Were Sought by the Angler and Where 3 or More Fish Were Caught

Mode	1979-1982 Average Trips	Percent of Total Trips*
Bridges, Jetties, Piers	22,805	2.1
Party/Charter	46,530	3.7
Private/Rental	111,124	3.4
Beach/Bank	16,402	1.3

Derived from National Survey Information (DOC)

* % trips 3 or more fish, Table 7A16, times % trips cod and pollock sought, Table 7A19.

The impact in terms of fish lost to the recreational fishery is likely to vary by mode. The loss will depend on the proportion of the total catch which is undersize and which is caught on trips on which 3 or more fish are caught. With a higher percentage of trips with 3 or more fish caught, the party/charter mode would seemingly be in a position to lose more fish yet it is known that, in general, this mode catches larger fish.

Data is not currently available to the Council on the amount of, or size distribution of the recreational catch of haddock on trips where three or more haddock are caught.

The potential impacts of an 11 inch minimum size on winter flounder would vary by state. Virtually all (98% in 1982) of the recreational catch of winter flounder comes from the territorial sea or inland waters. Massachusetts and New Hampshire currently have an 11 inch minimum size on winter flounder (effective 1984). Connecticut will have a 10 inch recreational minimum size effective January 1, 1985. In those states which currently have an 11 inch minimum size, this alternative would have no negative impact. Table 7A21 presents the catch of winter flounder by state for 1982.

Table 7A21: Number of Winter Flounder Caught by Recreational Anglers by State in 1982 (thousands)

State	Number of Winter Flounder
Maine	48
New Hampshire	40
Massachusetts	11,872
Rhode Island	748
Connecticut	1,164
New York	3,009
New Jersey	2,430
Total	19,311

National Survey (DOC)

Substracting from the total the catch from those states which already have an 11 inch minimum size leaves a catch of 7,399,000, or 38% of the total winter flounder subject (assuming worst case scenario) to the proposed minimum size. For 1982, the State of New Hampshire estimates (Personal communication Robert Fawcett, New Hampshire Fish & Game) that 26% of its catch of winter flounder were below 11 inches. Assuming the size distribution information from New Hampshire is representative, then 1,924,000 winter flounder or about 10% of the total catch would be affected (i.e., lost to the recreational fishery).

Impacts of Alternative B

Since this alternative does not provide any exemption for undersized fish, it potentially could impact on all fishing trips on which cod and haddock are caught. Adjusting the four-year average number of total fishing trips by mode presented in Table 7A17 by the four-year average percentage of trips where cod is the primary species sought (Table 7A19) provides an indication of the likely maximum number of trips potentially affected by this alternative. Table 7A22 presents an estimate of the average maximum number of recreational trips which could be impacted by minimum sizes on cod.

Table 7A22: Average Number of Trips by Mode Where Cod is the Primary Species Sought by Anglers

Mode	1979-1982 Average Number of Trips where Cod are Sought
Bridges, Jetties, Piers	64,746
Party/Charter	73,953
Private/Rental	193,763
Beach/Bank	75,913

National Survey (DOC)

If the 1982 length/frequency recreational catch data from the New Hampshire fishery (Table 7A23) is representative of the region-wide catch across all modes, the number of cod which would have been lost to the fishery in 1982 under a 17 inch and 19 inch minimum size can be compared with the total shown in Table 7A18. The number of pollock is presented for exposition purposes.

Table 7A23: Number of Fish Which would have been Lost to the Fishery in 1982 1/ Under a 17 and 19 inch Minimum Sizes

	COD 2/		POLLOCK 2/	
Mode	17 inch	19 inch	17 inch	19 inch
Bridges, Jetties, Piers	10,530	15,146	770,157	818,712
Party/Charter	621.264	893,655	205,944	218,981
Private/Rental	460,048	661.754	488,075	518,846
Beach/Bank	-	-	67,737	72,007
Total	1,091,842	1,570,555	1,531,913	1,628,546

1/ No adjustment made for fish <15 already lost due to Interim Plan.

2/ Based on 1982 New Hampshire Length/Frequency Data:

	<17	<19
Cod	36.31	52.23
Pollock	92.79	98.64

National Survey data on the size distribution of the recreational catch of cod by party/charter and private recreational boats suggest that close to 24% and 50% of the catch in 1982 and 1983 could have been affected by an absolute minimum size of 17 and 19 inches respectively.

Finally, there will probably be no impact during the first year because the 15 inch minimum size is currently in force in the EEZ and all coastal New England states. The negative impact of this alternative would be greatest in the second year of the plan, and would moderate in years three and four with the growth of sublegal fish to legal size.

Impacts of Alternative C

The difference between Alternatives A and C is the exclusion of pollock and winter flounder from the minimum size regulations. Table 7A24 shows the reduced impacts of this alternative on fishing trips.

Table 7A24: Number of Recreational Trips by Mode on Which Cod was Sought by the Angler and Where 3 or More Fish Were Caught

Mode	Average Trips	% of Total Trips
Bridges, Jetties, Piers	18,841	1.7
Party/Charter	38,440	3.1
Private Rental	91,804	2.8
Beach Bank	13,550	1.1

Derived from National Survey data (DOC)

Summary

Table 7A25 summarizes the impacts of recreational minimum sizes.

Table 7A25: Recreational Minimum Sizes; Expected losses as either % trips or % catch. $1000

Alternative	Cod	Haddock	Cod&Pollock	Winter Fl.
A	NA	Unk.	2.6% trips	10% catch
B	36-52% catch 5.9% trips	Unk.	NA	NA
C	2.2% trips	Unk.	NA	NA

§7A4.6 Impact Expected from the U.S. - Canadian Boundary Decision

The International Court of Justice decision on October 12, 1984 established a boundary through the Gulf of Maine and Georges Bank between the 200-mile limits of the U.S. and Canada. This new boundary cuts off access to a substantial portion of the fishery resource area by fishermen of both countries. The effects of this decision on domestic fishermen has not been included in the regulatory impact analysis (Section 7A4) because the analysis preceded the decision, and more importantly, because the impacts of the proposed management program are independent of those which result from the I.C.J. decision. Nevertheless, both the management program and the new boundary will affect the industry simultaneously and it is prudent to be aware of these circumstances.

Currently, data on the impacts of the decision are only available for U.S. participation in the Georges Bank fishery area. The immediate impact of the boundary decision on U.S. fishermen will be a complete loss of Georges Bank landings from east of the new international boundary, and a concurrent gain in landings roughly equivalent to historical Canadian landings west of the boundary. This displaced fishing effort is expected to be more inefficient for both countries than the status quo prior to the decision. Lacking elaborate quantitative models to estimate the degree of switching from fishing area to area and information on Canadian landings, it is still possible to estimate the new mix of species caught by U.S fishermen on Georges Bank. The percent of total species landings from the now Canadian portion of Georges Bank were as follows:

	1982	1983
COD	6.5%	8.8%
HADDOCK	17.2	19.5
YELLOWTAIL	3.8	7.2
WINTER FL.	1.5	3.3
AM. PLAICE	1.6	1.8
WITCH FL.	0.4	1.4
POLLOCK	6.5	12.0
REDFISH	6.8	5.1
WHITE HAKE	2.7	3.6
SWORDFISH	11.2	14.9
SCALLOPS	15.1	7.4

Other species such as fluke, whiting, red hake, scup, butterfish, squid, and lobster sustain less than 1% losses. Again, U.S. fishermen are expected in the short-run to simply intensify effort and landings west of the boundary in an attempt to make up these losses with reduced Canadian competition west of the boundary.

Using 1982 landings per fishing trip data from the Northeast Fisheries Center, the mix of species caught by eight major New England ports are shown in Table 7A27, and the percent loss of total port revenue is shown in Table 7A28. The expected loss from the boundary decision are also shown. It should be noted that these estimates are based on 1982 landings and are "worst case" estimates in that they do not take into account the likelihood that the displaced effort will be re-deployed in other areas. The ports most affected include Boston, Gloucester, New Bedford, Portland, and Rockland; all of which generally concentrate on cod, haddock, pollock, and redfish. Boston is perhaps the most severely impacted, especially in terms of the percent of loss. Flounder landings as a group appear to be only slightly affected by the boundary decision, with the exception of yellowtail in New Bedford. The final impacts and a determination of whether any port will benefit monetarily from the decision will depend on the actual level of landings realized once former Canadian landings are netted in.

Using 1983 monthly landings data from the Northeast Fisheries Center, the mix of species caught by the six major New England ports which are mnost affected are shown in Figures 7A14 through 7A19. These ports include Newport, New Bedford, Boston, Gloucester, Portland, and Rockland. Newport monthly landings are shown in Figure 7A14, with actual 1983 landings on the left and losses expected from the boundary decision on the right. The most notable impact for all of the ports in the following figures is a general reduction in peak monthly landings; from 1.5 million pounds to 1.4 million pounds for Newport. The reduction is mainly in yellowtail landings from June to August and somewhat from cod landings in May (see arrows). New Bedford monthly landings (Figure 7A15) are lowered by almost a million pounds, also by yellowtail and cod from June to August. Boston (Figure 7A16), similar to Newport, losses about 100 thousand pounds in monthly landings, mostly cod throughout the year and pollock during the last half of the year. Gloucester losses February-March cod landings; Portland, cod-haddock landings in June; Rockland, cod-haddock-pollock from June to September.

The overall impacts of the boundary decision coupled with the proposed management program should be evaluated with respect to immediate or delayed implementation of the 6 inch mesh size. The alternative with either the highest quantitative net benefit or the least cost is not always the preferred solution (ND 21-24, page 25).

TABLE 7A27: IMPACTS OF CANADIAN BOUNDARY SETTLEMENT ON GEORGES BANK BY PORT & SPECIES

(Thousand Pounds)

	Portland			Rockland			Provincetown			Newport		
	Total	Loss	%	Total	Loss	%	Total	Loss	%	Total	Loss	%
Cod	6269	423	7	2088	308	15	3839	4	0	2363	181	8
Haddock	4466	726	16	4086	911	22	143	12	8	826	19	2
Yellowtail	83	14	17	11	2	16	2810	90	3	8646	462	5
Fluke	11	0	0	+	0	0	146	+	0	1453	2	0
Blackback	572	12	2	200	+	0	1605	3	0	1909	6	0
O. Flounder	9253	106	1	4508	13	0	1998	5	0	1134	38	3
Pollock	7206	316	4	2674	384	14	1169	0	0	153	13	9
Redfish	3913	343	9	6450	204	3	4	0	0	3	0	0
Whiting	691	0	0	77	0	0	1539	0	0	1108	59	5
Red Hake	82	0	0	0	0	0	954	0	0	56	1	2
White Hake	3728	70	2	2195	53	2	92	1	1	59	2	3
Scup	0	0	0	0	0	0	1	0	0	2632	0	0
Butterfish	+	0	0	+	0	0	34	0	0	2171	6	0
Squid	2	0	0	0	0	0	87	0	0	639	0	0

	New Bedford			Gloucester			Boston			Pt. Judith		
	Total	Loss	%	Total	Loss	%	Total	Loss	%	Total	Loss	%
Cod	31243	1546	5	33040	2456	7	12682	2330	18	762	14	2
Haddock	6300	1003	16	18344	2514	14	5636	2048	36	92	0	0
Yellowtail	24519	1501	6	2209	83	4	343	26	8	8128	0	0
Fluke	382	2	1	259	2	1	2	1	55	2104	0	0
Blackback	11762	234	2	900	83	9	822	35	4	5310	0	0
O. Flounder	3870	80	2	12038	403	3	1094	58	5	683	0	0
Pollock	950	35	4	11270	431	4	3116	881	28	24	+	2
Redfish	1	0	0	5537	221	4	2236	467	21	+	0	0
Whiting	2	0	0	6808	10	0	2	+	22	11795	0	0
Red Hake	2	+	22	1316	8	1	0	0	0	771	0	0
White Hake	17	1	3	3117	136	4	597	110	18	47	0	0
Scup	30	0	0	0	0	0	0	0	0	3041	0	0
Butterfish	254	0	0	50	0	0	1	0	0	11387	0	0
Squid	300	0	0	81	0	0	0	0	0	3004	0	0

+ Indicates an amount less than 1,000 pounds.

Source: NMFS, 1982 Interviewed Trip Data

TABLE 7A28: IMPACTS OF CANADIAN BOUNDARY SETTLEMENT ON GEORGES BANK BY PORT & SPECIES

Percent Reduction in Total Port Revenues

	Portland	Rockland	Provincetown	Newport
	%	%	%	%
Cod	0.8	1.0	0.0	0.4
Haddock	2.2	4.2	0.1	0.1
Yellowtail	0.1	0.1	0.8	1.1
Fluke	0.0	0.0	0.0	0.0
Blackback	0.1	0.0	0.0	0.0
O. Flounder	0 3	0.0	0.0	0.1
Pollock	0.3	0.7	0.0	0.1
Redfish	0.5	0.5	0.0	0.0
Whiting	0.0	0.0	0.0	0.1
Red Hake	0.0	0.0	0.0	0.1
White Hake	0.1	0.1	0.1	0.1
Scup	0.0	0.0	0.0	0.0
Butterfish	0.0	0.0	0.0	0.0
Squid	0.0	0.0	0.0	0.0
	4.4	6.6	1.0	2.1

	New Bedford	Gloucester	Boston	Pt. Judith
	%	%	%	%
Cod	0.7	1.8	6.5	0.1
Haddock	0.6	2.9	8.6	0.0
Yellowtail	0.9	0.1	0.1	0.0
Fluke	0.1	0.1	0.1	0.0
Blackback	0.2	0.1	0.1	0.0
O. Flounder	0.1	0.4	0.3	0.0
Pollock	0.1	0.2	1.7	0.1
Redfish	0.0	0.1	1.1	0.0
Whiting	0.0	0.0	0.1	0.0
Red Hake	0.1	0.1	0.0	0.0
White Hake	0.1	0.1	0.3	0.0
Scup	0.0	0.0	0.0	0.0
Butterfish	0.0	0.0	0.0	0.0
Squid	0.0	0.0	0.0	0.0
	2.9	5.9	18.9	0.2

Source: NMFS, 1982 Interviewed Trip Data

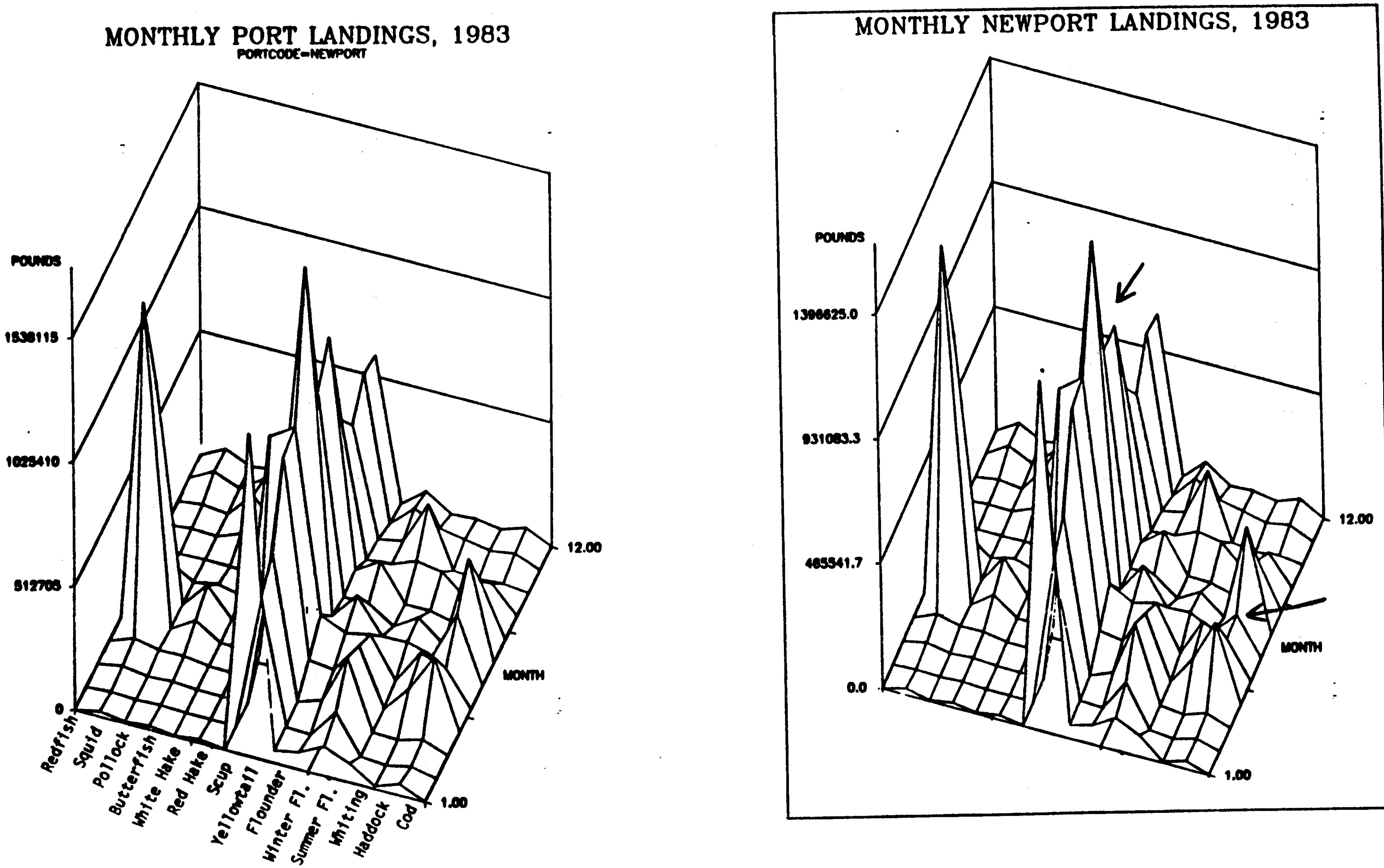
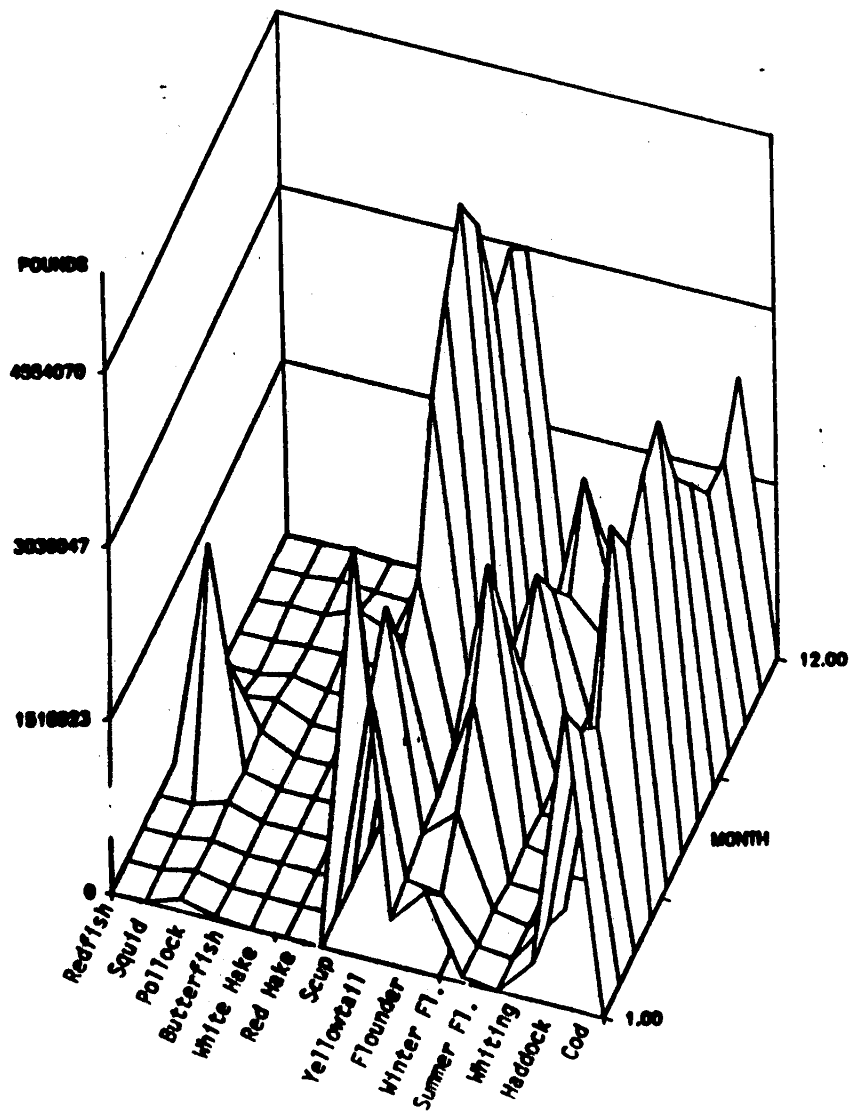

MONTHLY PORT LANDINGS, 1983
PORTCODE=NEWPORT
POUNDS
1538115
1025410
512705
0
Redfish
Squid
Pollock
Butterfish
White Hake
Red Hake
Scup
Yellowtail
Flounder
Winter Fl.
Summer Fl.
Whiting
Haddock
Cod
1.00
MONTH
12.00
MONTHLY NEWPORT LANDINGS, 1983
POUNDS
1396625.0
931083.3
465541.7
0.0
1.00
MONTH
12.00

Figure 7A14

MONTHLY PORT LANDINGS, 1983
PORTCODE=NEW BEDFORD



MONTHLY NEW BEDFORD LANDINGS, 1983

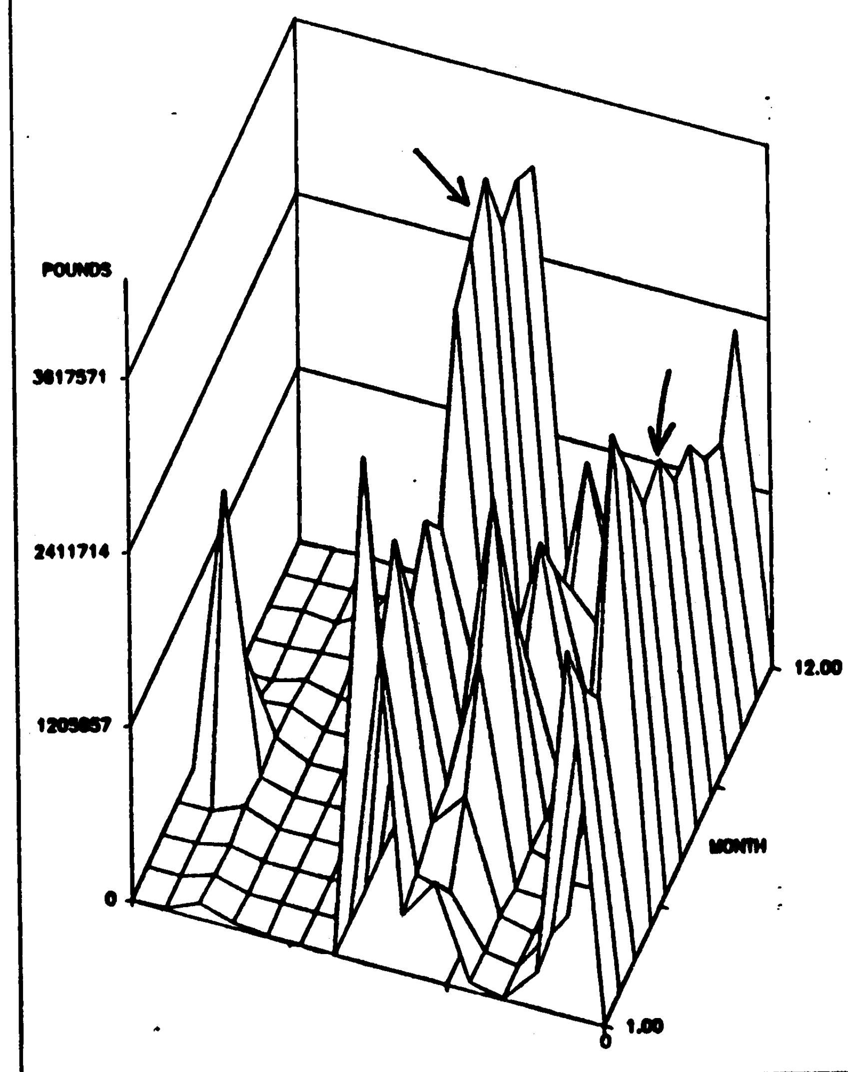
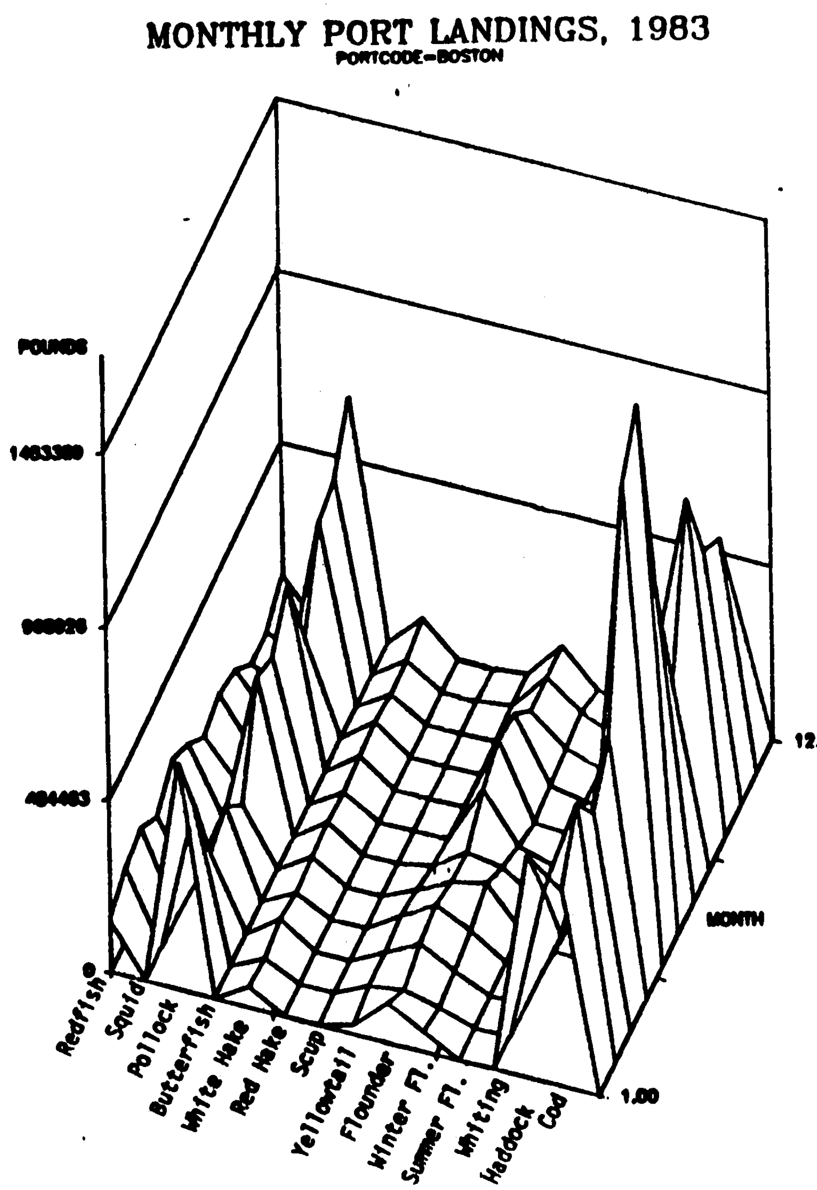
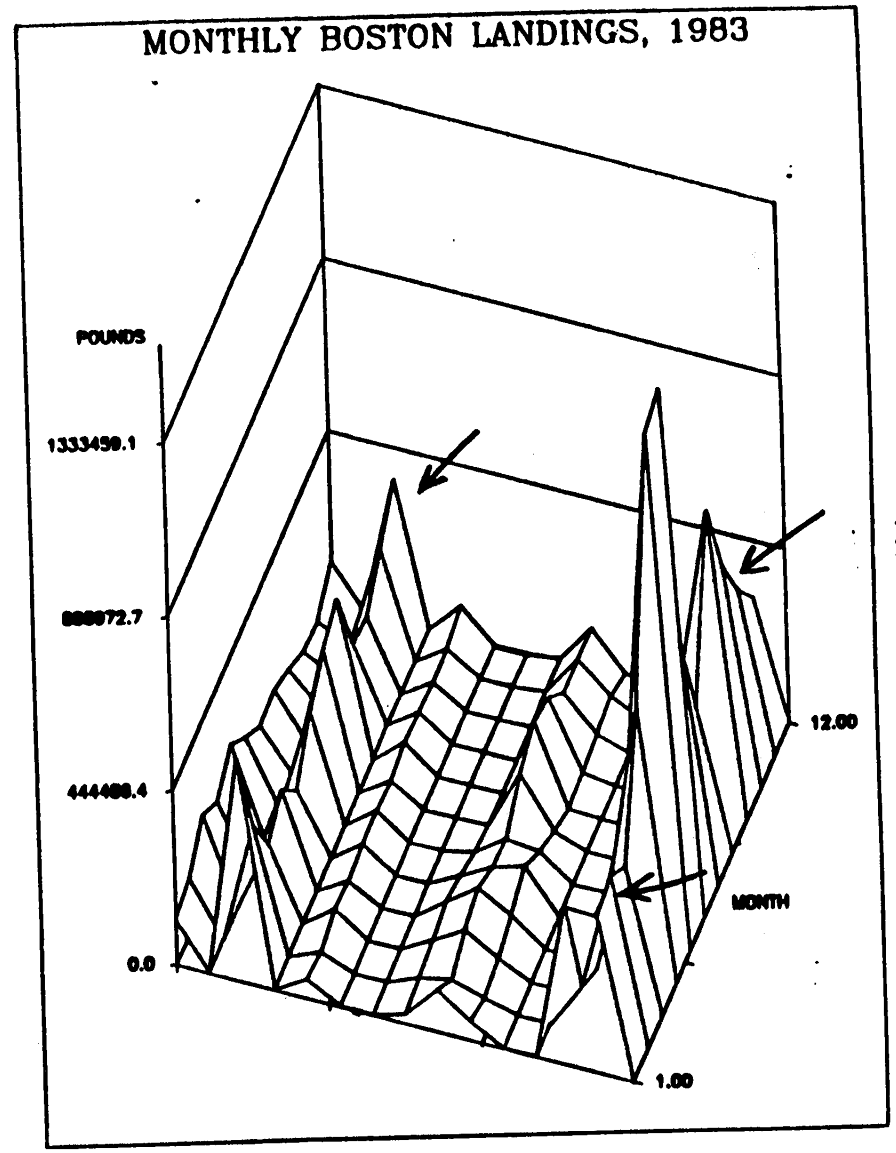


Figure 7A15

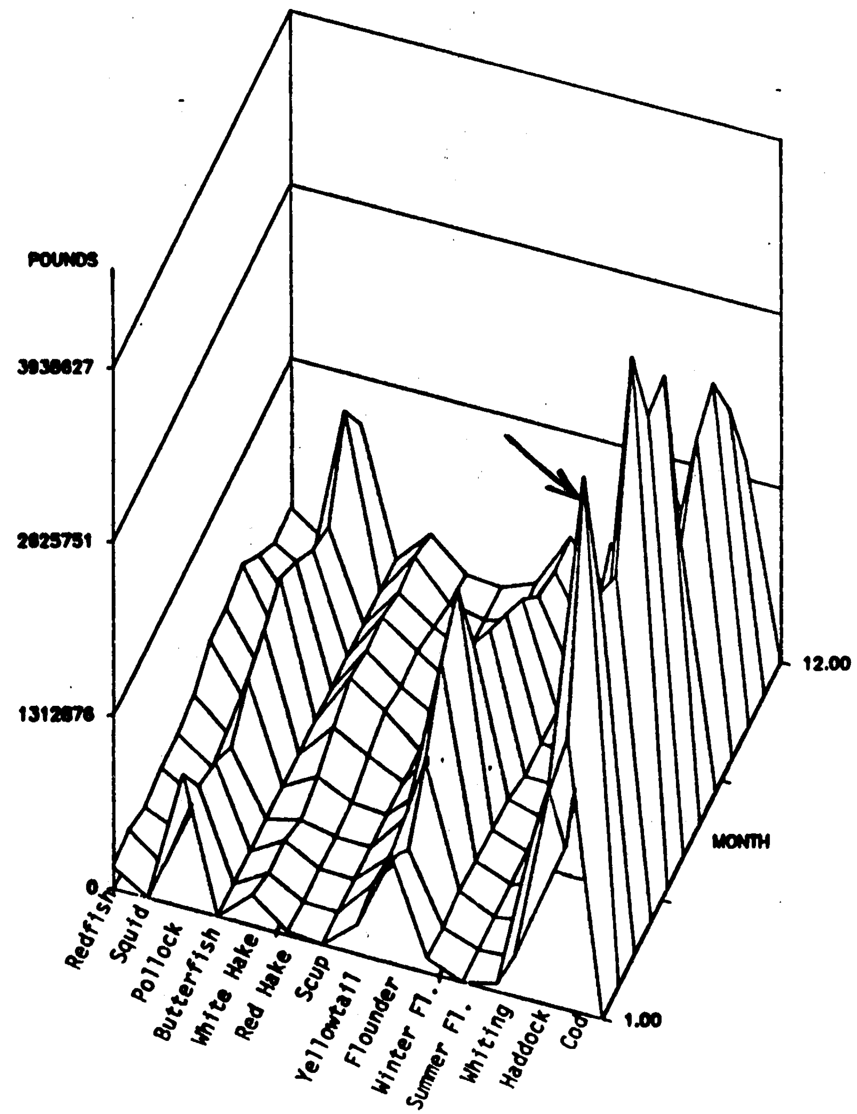




8/30/85

Figure 7A16

MONTHLY PORT LANDINGS, 1983
PORTCODE=GLOUCESTER



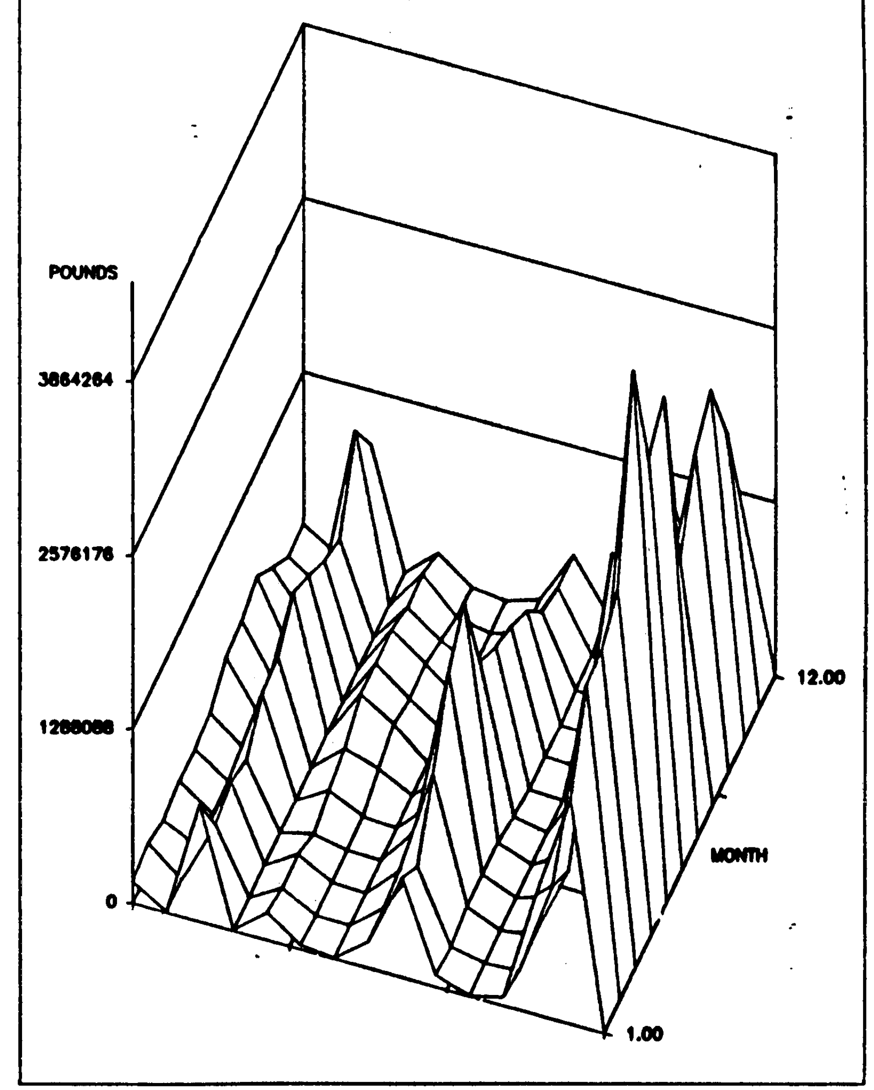
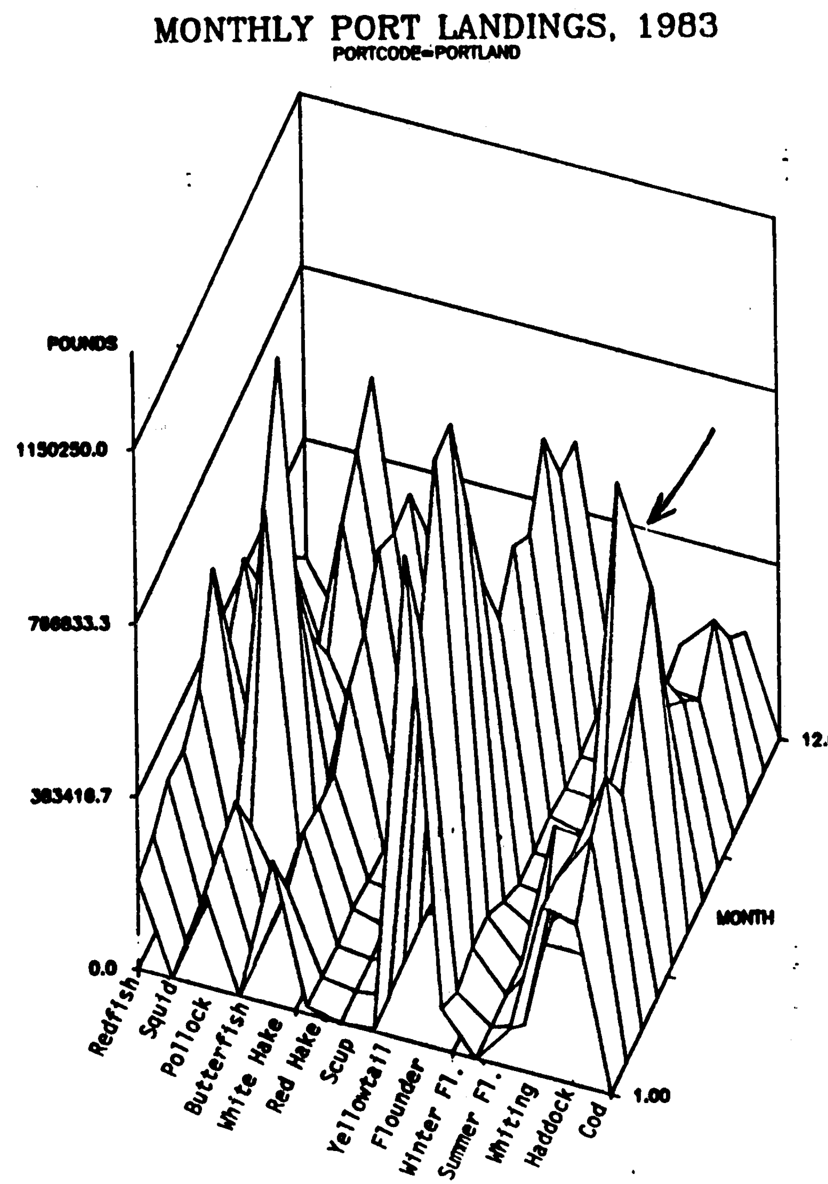


Figure 7A17

8/30/85


MONTHLY PORT LANDINGS, 1983
PORTCODE=PORTLAND
POUNDS
1150250.0
766833.3
383416.7
0.0
MONTH
12.00
1.00
Redfish
Squid
Pollock
Butterfish
White Hake
Red Hake
Scup
Yellowtail
Flounder
Winter Fl.
Summer Fl.
Whiting
Haddock
Cod

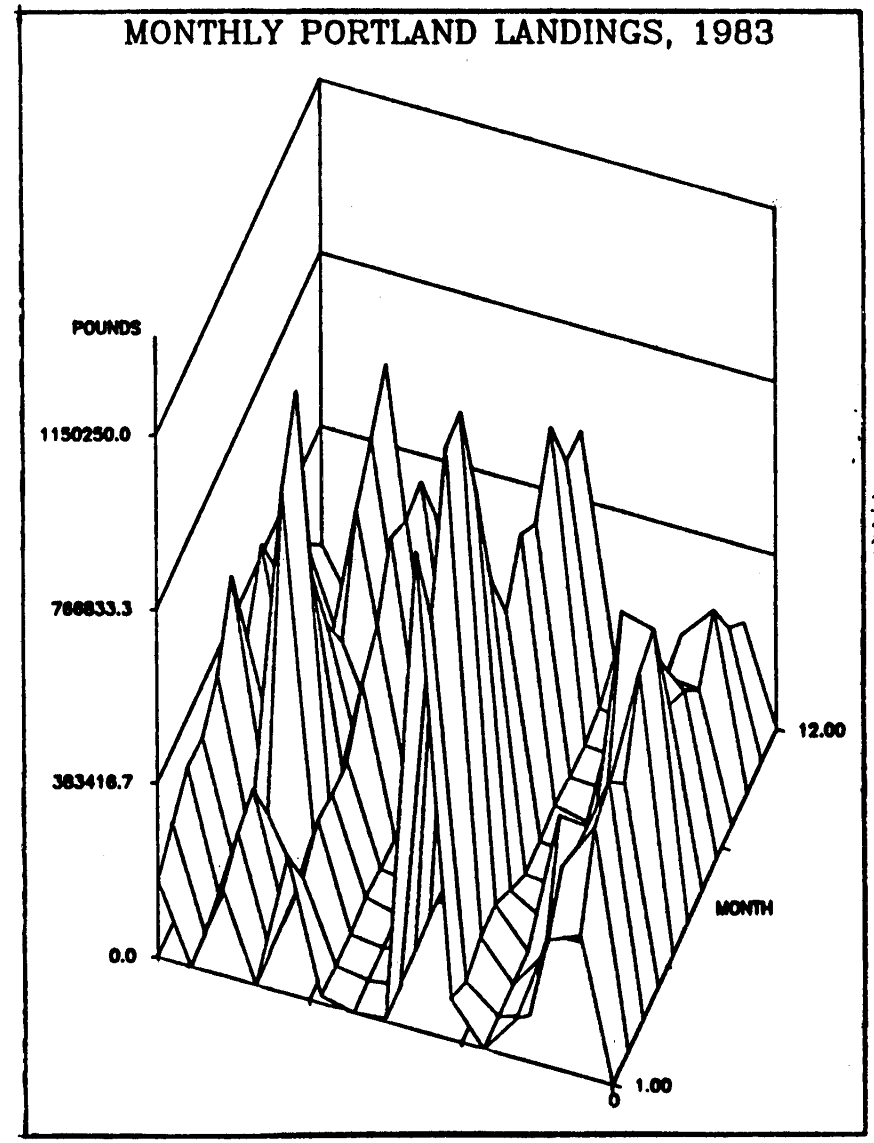
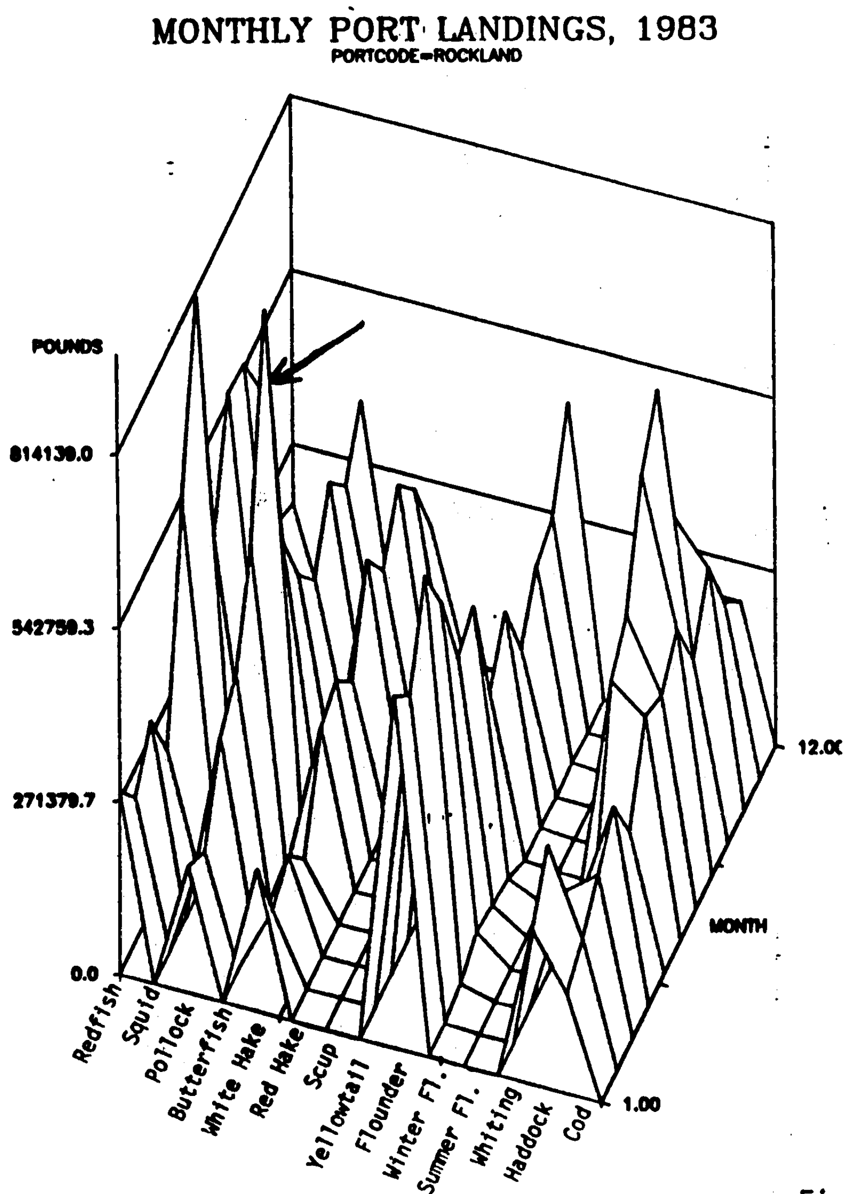

MONTHLY PORTLAND LANDINGS, 1983
POUNDS
1150250.0
766833.3
383416.7
0.0
MONTH
12.00
1.00
0

Figure 7A18


MONTHLY PORT LANDINGS, 1983
PORTCODE=ROCKLAND
POUNDS
814139.0
542759.3
271379.7
0.0
Redfish
Squid
Pollock
Butterfish
White Hake
Red Hake
Scup
Yellowtail
Flounder
Winter Fl.
Summer Fl.
Whiting
Haddock
Cod
1.00
MONTH
12.00

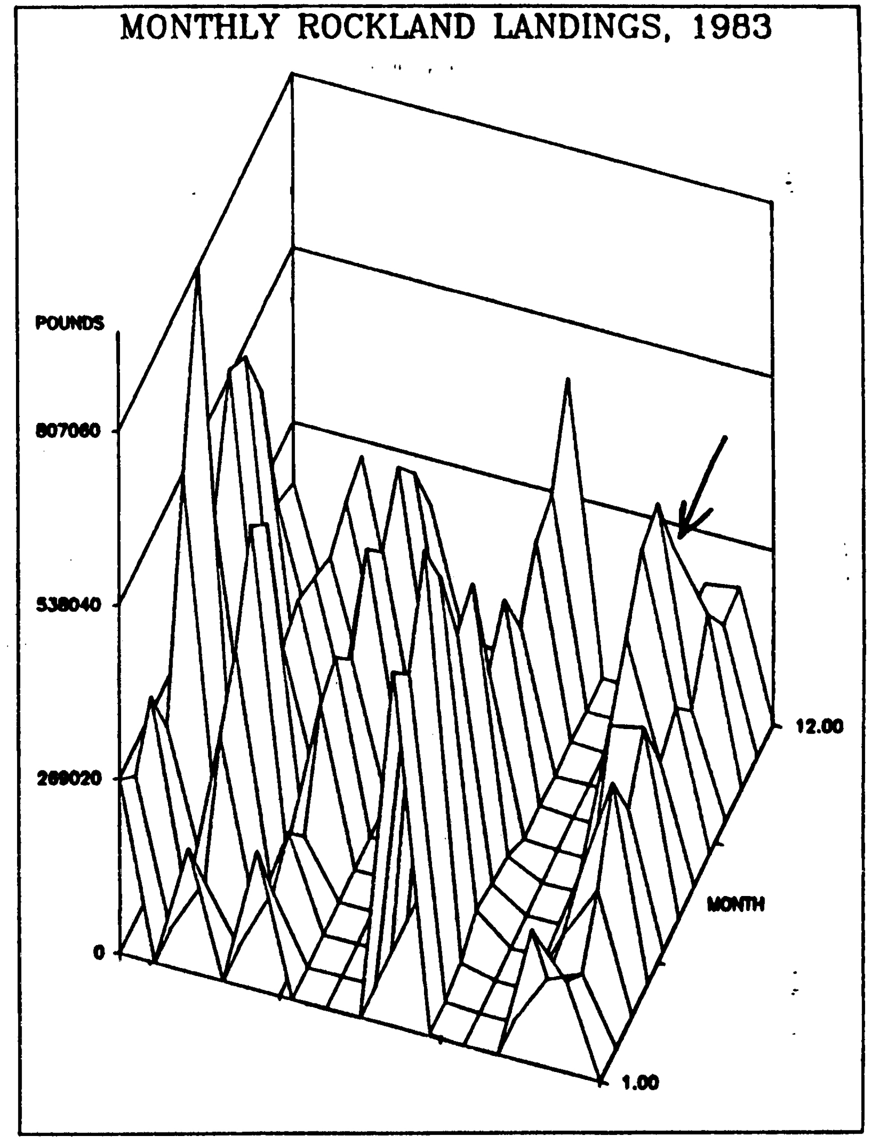

MONTHLY ROCKLAND LANDINGS, 1983
POUNDS
807060
538040
269020
0
1.00
MONTH
12.00

Figure 7A19

SUBPART B: STRUCTURE OF THE MANAGEMENT PROGRAM

§7B1 Proposed Management Program (Preferred Alternative)

The management program consists of three parts: 1) operative measures to achieve the management objectives, 2) administrative measures to promote both monitoring/enforcement of the FMP and provide for continued industry access to the resources, and 3) procedures to provide an effective basis for continuing management. Any fisherman holding a federal multi-species fishery permit must operate in accordance with federal regulations implementing this FMP even when fishing in state waters. However, where more stringent measures than those proposed in this FMP exist to regulate state landings, the more stringent measures shall prevail.

Operative Measures

1. Minimum Fish Size:

		Year 1	Year 2+
Commercial: (total length)	cod, haddock, pollock . . .	17 inches	19 inches
	witch flounder	14 inches	14 inches
	yellowtail, Am. plaice . . .	12 inches	12 inches
	winter flounder	11 inches	11 inches

All sizes are effective upon implementation of the FMP and will be enforced on the basis of possession in or from the EEZ. In addition, no fish taken subject to this FMP that are smaller than the prevailing commercial size limit may be sold, and minimum sizes will apply to imported fish.

Recreational : (total length) cod, haddock: 15 inches (year 1); 17 inches (year 2 & 3)
19 inches (year 4 +)

Recreational fishermen are not subject to minimum size in possession requirements for pollock, American plaice, or yellowtail, winter and witch flounders. Each recreational fisherman may have in his possession a total of two undersized fish (cod and/or haddock).

2. Minimum Mesh Size: The Council presumes the initial use of cod end mesh attached in a diamond configuration, and has specified the minimum cod end mesh accordingly, the Regional Director is authorized to permit the use of smaller cod end mesh so long as it is attached to the net in a square configuration and he finds that it achieves the same level of selectivity relative to haddock retention as is achieved with the mesh as specified herein.

Gulf of Maine In the area bounded on the north and west by the territorial sea, the east by the limits of the EEZ and on the south by Mass Bay and 42° 20'N (east of 70°00'W), cod end and bottom-tending gillnet mesh shall be as follows::

- Regulated minimum mesh in cod end . . . . 5-1/2 inches
- Regulated minimum mesh in bottom-tending gillnets . . 5-1/2 inches

- Exceptions - 1) within the exempted fishing area illustrated in Figure 7B1, the conditional use of cod end mesh smaller than 5-1/2 inches is allowed as described under Exempted Fishery Regulations below; and 2) within the area designated as the "redfish area" in Figure 7B1, the minimum cod end mesh requirement will not apply during the months of March through July or until the point in that time interval when 3500 mt of redfish have been landed within the calendar year.

Georges Bank In the area of the EEZ bounded on the north by 42°20'N, on the south by LORAN C lines 9960-Y-43500 and 5930-Y-30750, and on the west by the territorial sea above 41°35'N and by 69°40'W below 41°35'N, except as provided under Exempted Fishery Regulations below, cod end and bottom-tending gillnet gear mesh shall be as follows:

- In years 1 and 2 of FMP implementation, the minimum mesh in cod end and bottom-tending gillnets shall be 5-1/2 inches

- Within the third year of FMP implementation, the minimum mesh in cod end and bottom tending gillnets shall increase to 6 inches subject to the Regional Director's determination, made in consultation with the New England Council, that the Canadian management program for Georges Bank stocks is substantially consistent with the conservation objectives of the FMP.

Other New England: In those parts of the New England Area not otherwise regulated for mesh, the minimum mesh in bottom-tending gillnets must be equivalent to that in the Georges Bank area during the months of November through February.

3. Exempted Fishery Regulations

- Opportunities to fish with small mesh cod ends in the regulated mesh areas are provided for the exempted fishing area shown in Figure 7B1.

- Exempted fisheries for commercially valuable species, which require the use of mesh smaller than the regulated mesh size, will be allowed as specified below. Exempted fisheries must be applied for independently and may not be granted for more than one exemption at a time.

- Regulated species include cod, haddock, pollock, redfish, Am. plaice, and yellowtail, winter and witch flounders.

- Exempted fishery options:

Period	Exempt Species	Comment
June - November	open	Regulated species may not exceed 10% of the total landings of all species during the reporting period.

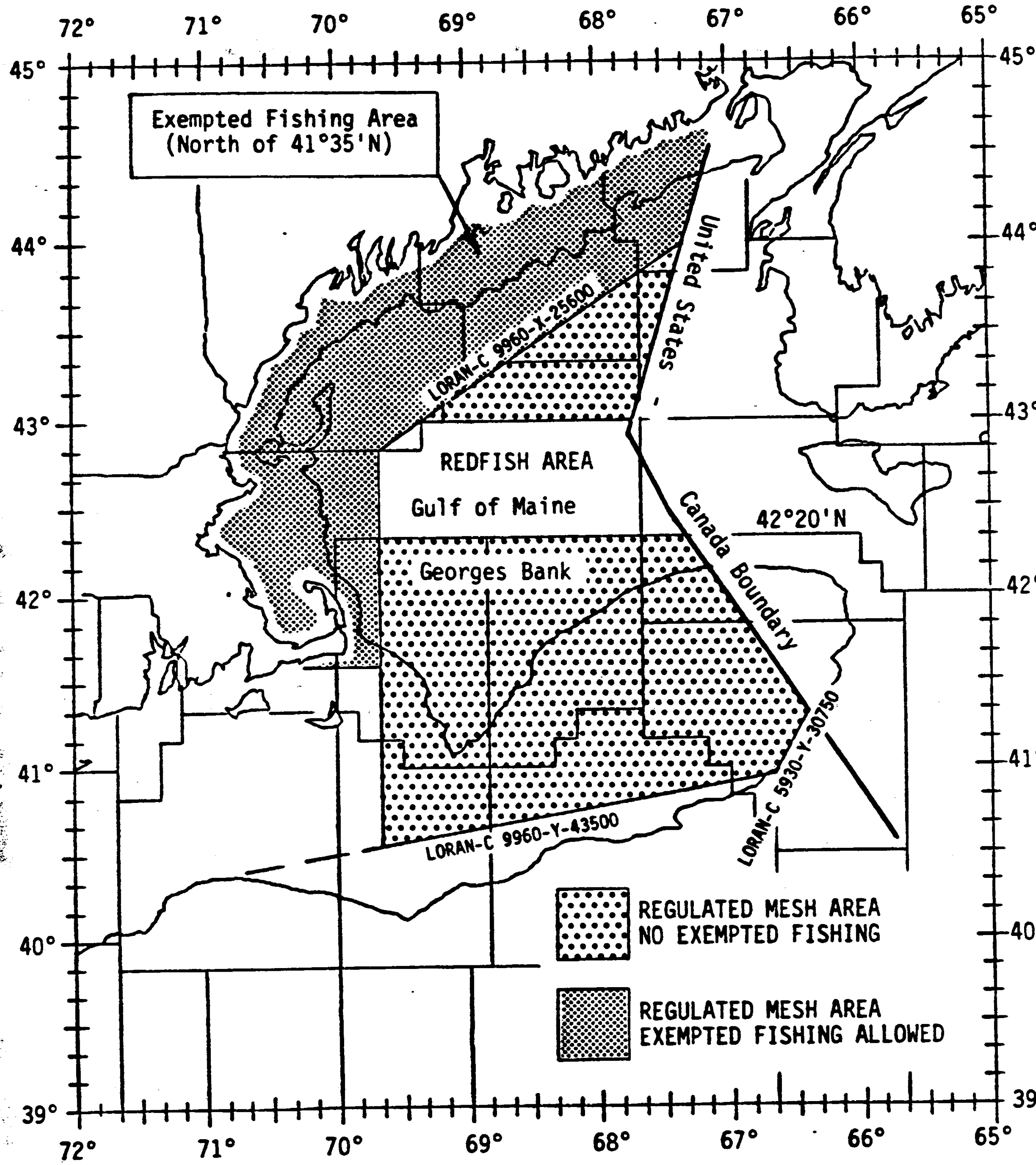


Figure 7B1 New England regulated mesh area illustrating areas of exempted and non-exempted fishing and the redfish exception area. See text for details.

- Exempted fishery options (continued):

Period	Exempt Species	Comment
December-January	whiting	Regulated species may not exceed 10% of the amount of whiting landed over the reporting period; the fishery will be monitored by sea sampling.
January - April or as specified by ASFMC	shrimp	Regulated species may not exceed 10% of the amount of shrimp landed during the reporting period.
December-May	herring mackerel	Regulated species may not exceed 10% of the amount of herring plus mackerel landed over the reporting period.

- Area exception- a fishery for herring, mackerel and/or squid may be conducted in the regulated mesh area of Georges Bank throughout the year using cod end mesh less than the regulated minimum subject to the stipulation that mid-water trawl gear be used and the by-catch for regulated species be held to 1%.

- Reporting period- The reporting period for the exempted fisheries shall be 30 calendar days or until withdrawal of the vessel from the exempted fishery, whichever is the shorter period.

- Report form - existing federal reporting form submitted by each participating fisherman at the end of the reporting period. Individual trip records that are verified by the dealer(s) handling each trip or part thereof must be retained by participating fishermen to corroborate compliance data over the reporting period.

4. Area Closures

Spawning areas

Spawning areas, principally designed for haddock, will be seasonally closed to fishing with all mobile or fixed gear except with scallop dredge gear and hooks having a gape not less than 1.18 inches (30 mm.).

- Spawning areas to be closed include traditional areas I and II shown in Figure 7B2(a). It is recognized that only a small part of Area II is under U.S. control.

- The closure period in Area I will be from February 1 through May 31, except that each area (or relevant portion thereof) may be opened after April 30, upon the authority of the NMFS Regional Director. The closure period in Area II will be determined in consideration of Canadian management regulations.

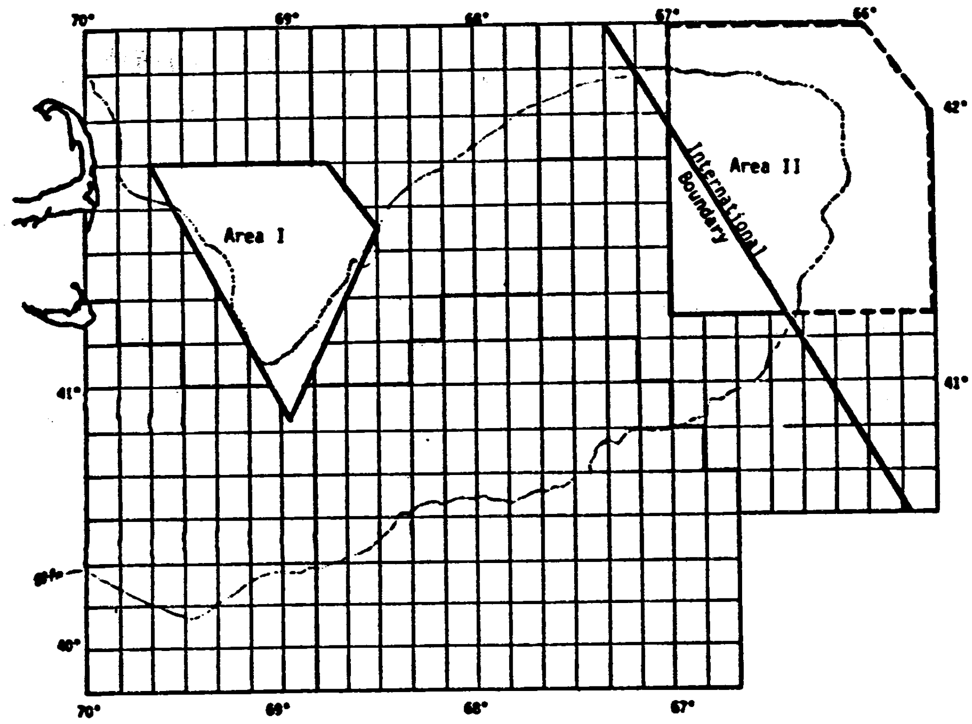


Figure 7B2.a Georges Bank spawning area closures I and II.

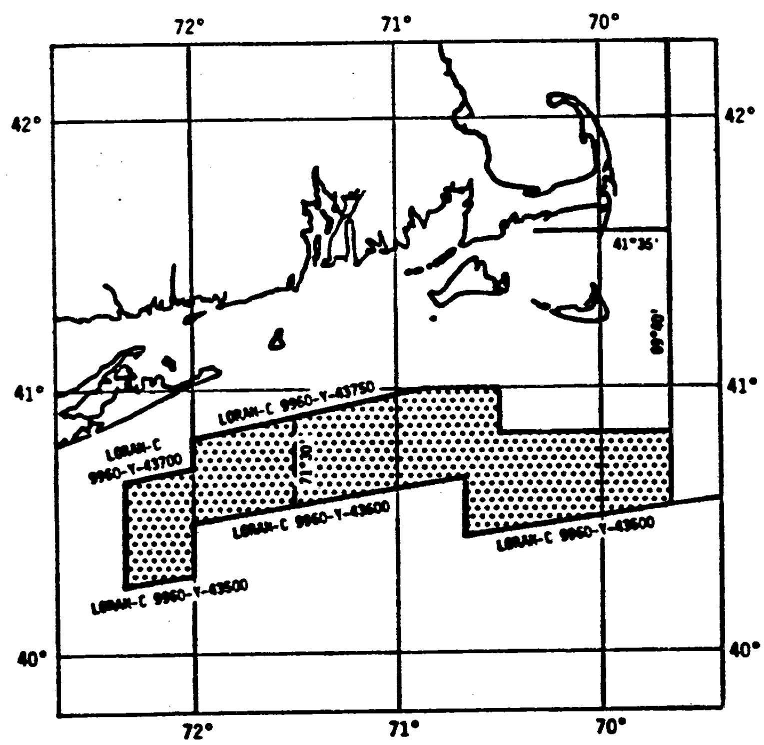


Figure 7B2.b Southern New England-Middle Atlantic area closure.
See text for details.

Other areas:

A portion of the New England/ Mid-Atlantic area west of 69°40', illustrated in Figure 7B2(b), is defined as an area to be seasonally closed to provide reduced mortality and enhanced spawning opportunity for yellowtail flounder. This closure is compatible with management efforts for yellowtail stocks in other resource areas.

The portion of this area east of 71°30'W longitude will close on March 1; whereas the portion west of 71°30'W will close on April 1. The total area will remain closed as far into May as the Council determines appropriate to achieve the objective of the FMP relating to Southern New England yellowtail flounder, at which time notice of reopening will be published in the Federal Register.

This area will be closed to all mobile gear fishing with the following exceptions: a) mid-water gear operating with a permit issued by the Regional Director and subject to the restriction of a zero by-catch of regulated species, and b) sea scallop or surf clam/ ocean quahog dredges subject to the Regional Director's specification of by-catch reporting requirements. The Council may specify by-catch limits to sea scallops or surf clam/ocean quahog operations in the closed area after a careful review of by-catch information.

5. Additional Measures[1/]

Regulated Mesh Area

If fishing mortality for key species is determined to jeopardize achievement of the management objectives, or if a new year class of haddock is jeopardized by overfishing, then four options to further control fishing mortality will be considered for Council action using the regulatory amendment process (public hearings will be held):

- Make regulatory modifications promoting the effectiveness of existing measures.
- Establish other time/area restrictions on the fishery.
- Increase minimum fish size.
- Increase mesh size.

Non-regulated Mesh Area

If fishing mortality for key stocks not adequately protected by the regulated mesh area remains too high to achieve the plan objectives, then three additional options to further control fishing mortality will be

1/ The decision to proceed with additional measures that will impose area or gear restrictions in the Mid-Atlantic area will require joint Council concurrence before a regulatory change process can be utilized.

considered for Council action using the regulatory amendment process (public hearings will be held):

- Close key grounds for limited periods of time until conditions change.
- Increase minimum fish size.
- Establish a minimum mesh size for all or part of the area during some or all of the year.

Other

The Council may, in addition, take action as warranted to ease or remove regulations, authorize experimental fishing, or modify regulations to accommodate advanced gear technology.

6. Administrative Measures

Gear Marking Requirements

Throughout the New England area, bottom-tending fixed gear must have the name of the owner or vessel, or the official number of that vessel permanently affixed to any buoys, gillnets or longlines. In addition:

- Bottom-tending gillnet or longline gear must be marked as follows: the westernmost end (meaning the half compass circle from magnetic south through west to and including north) of the gear must display a standard 12" tetrahedral corner radar reflector and a pennant positioned on a staff at least 6 feet above the buoy. The easternmost end (meaning the half compass circle from magnetic north through east to and including south) of the gear must display only the standard 12" radar reflector positioned in the same way.
- The maximum length of continuous gillnet sets shall not exceed 6,600 feet between end buoys.
- In the Gulf of Maine, sets of gillnet gear which are of an irregular pattern or which deviate more than 30° from the original course of the set shall be marked at the extremity of the deviation with an additional marker which must display a number of highly visible streamers and may either be attached or independent of the gear.

Data Reporting Requirements

This FMP establishes no new data reporting requirements other than those required under the exempted fishery regulations. Reports for the exempted fisheries are expected to use forms and procedures used in the Interim Groundfish FMP and already approved by OMB. The New England Council does require that NOAA/NMFS retain the identification number of vessels on data records acquired through the Three-Tier Data Collection System and maintained or archived as part of the commercial fisheries database in the Northeast Region, unless otherwise directed by a vessel owner to delete the identification code from records pertaining to his particular vessel.

Permit Requirement

Any vessel wishing to participate in the Northeast multi-species finfish fishery, regardless of species sought, must obtain an annual permit. This permit does not supplant the permitting requirements of any other FMP.

Experimental Fishing

The Council may request that the Regional Director issue a permit for vessels to operate in a manner contrary to the requirements of the FMP for the explicit purpose of either gathering information on or demonstrating the feasibility of some fishing activity that may provide an economic opportunity for the fishing industry and that may be conducted without detriment to the achievement of the FMP objective. Experimental fishing would be recommended by the Council based upon an evaluation of its justification and operational design. The experimental fishing activity would be conducted under the close, operational supervision of the Regional Director, who could withdraw the permit in the event that the fishing activity was not meeting its objectives.

§7B2 Rationale for Adoption - An Analysis of Costs and Benefits

The purpose of management plan is to achieve increased biological benefits in terms of increased spawning potential for the commercially most important stocks of fish. Some of the management measures, such as minimum fish size, mesh size and protected spawning areas, directly contribute to acheiving this goal while others, such as the exempted fishery program, contribute indirectly by providing fishermen the opportunity to use small mesh nets in a way that is less harmful to the regulated species than under the existing optional settlement program.

Unfortunately, it was not possible to quantify the major expected benefit of increased spawning potential to be gained by increases in either mesh or minimum fish sizes. It was only possible to estimate the benefits that these measures would have by increasing the yield per recruit and their costs in terms of the amount of fish lost in the short-term. Consequently, the economic impact analysis shows only negative results for the different alternatives, yet the Council and those familiar with the fishery are confident that the economic impacts of increases in mesh and minimum size will be positive.

1. Minimum Size Regulations

Economic Costs and Benefits

The net economic impacts of the proposed increases in minimum sizes for certain regulated species are included in the economic analysis of Options 2 through 7. These regulations are not analyzed separately from the minimum mesh size options because they are so interdependent. Although the economic benefit of the proposed increase in minimum sizes cannot be analyzed separately nor can they be quantified because of a lack of available data, the minimum size increase would decrease the per unit cost of fresh fish fillet production. Larger fish lower the labor costs of hand filleting because it takes fewer large fish have to be filleted to produce the same yield from many smaller fish. In addition, a higher price is generally paid for fish larger than the minimum sizes of cod, haddock and flounders which are currently harvested. Unfortunately, there is not enough data available to accurately quantify the benefits of an increase in minimum sizes, however, they are probably very large.

Biological Benefits

The proposed increases in minimum size are necessary to acheive the plan's objective.

Social Costs and Benefits

The main social benefit of the proposed minimum size regulations is that they are simple, readily understood by fishermen and enforceable both at sea and at the dock.

Administrative Costs

There would be a negligible increase in enforcement costs from extending minimum size requirements to pollock, witch flounder, American plaice and winter flounder. Since minimum size regulations already exist for cod, haddock and yellowtail flounder, these additional minimum sizes would not require any additional enforcement coverage. In addition, some of these minimum size regulations are already enforced at the state level.

2. Mesh Size Regulations

Economic Costs and Benefits

The major management measures, the minimum sizes for the commercial fishery and mesh size Option 4, the preferred alternative, were shown in §7A4 to have the second lowest (to Option 3) expected long-term costs among the seven alternatives considered. This alternative proposes the phased-in implementation of a 6 inch minimum cod end mesh size for the large mesh area on Georges Bank, a closed area in Southern New England, and a 5-1/2 inch minimum mesh size in the Gulf of Maine except for the deep-water redfish fishery there. In addition to producing the second lowest expected long-term costs, this alternative has the lowest negative impacts during the first two years of implementation.

Biological Benefits

The preferred alternative, delayed implementation of the 6 inch mesh option, provides for the greatest possible long-term biological benefits for the fishery by providing the greatest increase in spawning potential, yield per recruit and protection from stock collapse. In addition, this alternative, if effectively enforced, is more certain to achieve the biological objectives than options 2 and 5 which rely on closed areas on Georges Bank. Options 2 and 5 would cause an undetermined fishing effort to be displaced from the closed areas into other areas and, therefore, would not be as effective in controlling fishing mortality. Conversely, the analysis in section 7A4 shows that closed areas in the Southern New England region are preferred to a large mesh area (see Table 7A13). Thus options 3&4 provide greater net benefits than options 6&7 because the large mesh area in Southern New England adjacent to Georges Bank infringes on many inshore small-mesh fisheries (i.e., scup and squid) which the more offshore closed area does not.

Social Costs and Benefits

Some of the major social benefits to be derived from a fishery management plan are long-term increased employment in the fisheries, job satisfaction, acceptance by fishermen and fairness in any redistribution of benefits caused by the plan.

The major social benefit provided by this management plan is continued employment opportunities in fishing communities. According to the analysis presented in §7A5, the preferred alternative is expected to provide for one of the greatest long-term increase in the amount of employment in the fishery and fishing-related industries. After an initial decrease, the increased employment is conservatively estimated to be at least 400 man years by 1994. It is important to remember that this estimate represents a permanent increase in employment due to the stabilization of fish abundance at a higher level given current rates of fishing mortality, fishing technology and fish prices. The social cost of this alternative is an immediate, short-run decrease in employment of up to 950 man years in the fishery and fishing related industries. The relative merits of the preferred alternative in terms of its ultimate effects on employment are the same as its relative merits in terms of its overall economic impact. The preferred alternative results in the lowest first year decrease in employment, and would not impose any more operational costs upon the fishing community than any of the other six alternatives considered.

Another major social benefit provided by the preferred alternative is that it minimizes discarding of undersized fish caught by trawlers. Fishermen have strongly objected to any management measures which increase the level of discarding because they find it illogical to kill valuable fish and not be able to sell them. This benefit comes under the category of management regulations which fishermen can understand and accept.

Administrative Costs

Administrative costs include all the costs, such as monitoring, legal and enforcement costs, of implementing a management program. All the alternatives have substantially the same administrative costs because they are similar in the type of management measures they contain. Options 2 through 5 would probably have higher administrative costs than the other alternatives because in addition to enforcing mesh size regulations these would require an increase in enforcement effort to police the large increase in the duration and amount of closed fishing areas.

3. Exempted Fishery Regulations

Economic Costs and Benefits

Bearing in mind that the exempted fisheries potentially lessen the beneficial effects of the plan on the regulated species, the principal economic benefit of the proposed exempted fisheries regulations is that it provides opportunities to fish for small mesh species. Rather than sacrifice or severely restrict the small mesh fisheries in order to safeguard the major commercial, large mesh species, this program attempts to give fishermen the maximum flexibility in fishing for small mesh species consistent with sound management of large mesh species. Unfortunately, this benefit cannot be quantitatively measured, however, to the extent possible, the other impacts of the exempted fishery regulations, such as the increased protection of regulated species, are included in the economic analysis of the major management options in §7A4.

These regulations are expected to have a positive economic impact in that they help ensure compliance with the major management measures by reducing the opportunity to catch undersized regulated species with small nets. Currently an undetermined but significant amount of immature cod, haddock, flounder and redfish are caught both legally, under the optional settlement program, and illegally with small mesh nets. Of principal concern are the illegal and unreported landings of immature fish. The exempted fishery regulations are designed to reduce this shortcoming of the optional settlement program by reducing bycatch levels for regulated species and the area and seasons in which small mesh nets can be used.

The only negative impact of these regulations will be the potential reduction in the catch of certain species with small mesh nets by bottom-tending gear. The greatest impact will be a potential reduction of 9% in the landings of whiting, 0.8% of scup, 2.5% of butterfish, and 0.4% of squid, depending on whether a closed area or large-mesh area is selected in the Southern New England region. The reduction in landings of herring and mackerel will be less than 1%. Based on the value of landings in 1983, the maximum amount of this negative impact could be about $3 million. As pointed out earlier, this is an unlikely, worst case estimate because the vessels affected by these reductions will fish for these species in other areas; and some of them will be able to continue to fish year-round for mackerel and herring in exempted fishing areas, provided they use pelagic gear.

Biological Costs

The biological costs of the exempted fishery regulations are virtually the same as the economic costs: the reduction in the harvest of immature fish is not fully achieved, but greater compliance with the major management regulations is expected.

Social Benefits

The major social benefit of the exempted fisheries regulations are that they allow the fishery to be managed in a manner which is least disruptive to the traditional, opportunistic nature of the multi-species fishery. The exempted fishery regulations should also provide major social benefits in that they encourage compliance with fishing regulations by reducing the opportunity to illegally catch regulated species with small mesh. The alleged lack of compliance with the mesh regulations in the Interim Groundfish Management Plan has caused a large number of fishermen to become disenchanted with the fisheries management process and has reduced the incentive for fishermen who would otherwise obey fishing regulations to do so. Fishermen who abide by regulations are at a competitive disadvantage with fishermen who do not. In the Northeast multi-species fishery, which has recently experienced large declines in the profits of individual vessels and has had a growing number of business failures, the loss of any competitive advantage by any fishing vessel is a very serious problem. Even if they provided no improvement in the biological condition of the regulated fish species, the exempted fishery regulations are neccessary to improve the effectiveness and, therefore, the fairness of existing regulations.

Administrative Costs

The exempted fishery regulations should reduce enforcement costs from current levels because they reduce the amount of time during which restrictions on fishing with small mesh nets must be enforced. In addition, the amount of area where small mesh nets may be used in the Gulf of Maine has been substantially reduced.

The costs of administering a reporting system for vessels participating in the exempted fisheries should not be substantially greater than the cost of administering the existing optional settlement reporting system.

4. Increased Spawning Area Closures

Economic Costs and Benefits

The analysis of the economic effects of the increased spawning area closures, in both Georges Bank and Southern New England, is included in the overall economic impact analysis for the major management options.

Biological Benefits

This management strategy was included in the plan in order to help acheive the plan's main objective of providing for a certain level of spawning potential per recruit.

Social Costs and Benefits

The proposal to extend spawning area closures into February and to replace a large-mesh area in Southern New England were made in response to the comments from many fishermen that the extension would better protect spawning aggregations of haddock and yellowtail respectively; however, the measure may have a negative effect on employment. This is a management measure which reduces fishing mortality and which fishermen can understand.

Administrative Costs

Because NMFS personnel are already familiar with enforcing area closures, no administrative costs other than those for increased surveillance should be incurred. The cost of increased surveillance by a medium-endurance coast guard cutter is estimated to be $1.924 million (74 days x $26,000 per day) and the cost of increased aircraft surveillance is estimated to be $207,000 (90 days X $2,300 per day). The total estimated cost is $2.131 million. Given the likelihood that no additional funds will be available for enforcement in either the NMFS or Coast Guard budgets, the increased closed areas will have to be monitored with existing resources and therefore will not increase enforcement costs.

5. Redfish Management Regulations

Economic Costs and Benefits

The analysis of the economic effects of redfish management measures are contained in the economic impact analysis of the preferred management alternative. Given the 5-1/2" mesh size requirement without any mesh size exemption for redfish and the change from the optional settlement to the exempted fisheries program, the catch of redfish would be reduced 73% and the revenue would be reduced 68 to 70%. The reduction in landings and revenues for redfish under the preferred management alternative would be substantially more than it would be for any other species.

Biological Costs and Benefits

This measure meets the plan's objective of substantially increasing the spawning potential for and eventually the landings of redfish. The biological cost implementing this alternative is that allowing the use of small mesh gear to catch redfish will increase the bycatch of small pollock and thereby reduce the spawning potential for these species.

Social Costs and Benefits

Although the redfish managment measures decreases the opportunity to catch redfish in order to improve the spawning potential for this stock, they still provide some opportunity to catch redfish. The opportunity to catch redfish is important to a number of Maine fishermen who derive a substantial part of their revenues from redfish and who can not readily switch to other groundfish species such as cod, haddock and flounder because of their low availability in the Gulf of Maine.

Administrative Costs and Benefits

These measures are expected to cause a slight increase in administrative costs because the catch from this area needs to be monitored. After the exempted fishery has closed, there should be no additional administrative burden.

6. Gear Marking Requirements

Economic Costs and Benefits

Although the costs of the different gear marking alternatives are explained in §7A4, it is not possible to quantify the benefits because there is no data on specific conflicts involving gillnets and longline gear. However, recreational and some trawl fishermen have stated at public hearings that better and more consistent gear marking would reduce their gear conflicts with gillnetters, decrease the cost of gear replacement and increase their fishing time and catch. Many gillnetters have acknowledged the potential of the marking measures to reduce conflicts with other fishermen. It is important to note that the initial version of fixed gear marking measures were developed, in part, by gillnet industry advisors to the Council. The Council has been advised that many gillnetters already mark their gear in a manner which largely complies with the proposed marking requirements.

Both gillnetters and recreational fishermen have agreed that the benefits from the selected alternative, C, outweigh its costs. Council advisors have indicated that this alternative would provide for the minimum level of gear marking which would be effective under the range of weather conditions experienced at sea. Because alternatives A and B do not sufficiently improve the visibility of fixed gear or help to indicate the direction in which it is set, they are less cost effective than alternative C despite their lower absolute cost.

The overall cost of the proposed gear marking requirements will be less than that estimated in §7A4 ($60-100 thousand) because many gillnetters, as mentioned above, already mark their gear in accordance with the proposed marking requirements with the exception of mid-markers on sets having a deviation greater than 30° from the initial direction of the set.

Biological Benefits

None of the gear marking alternatives which have been considered will provide any quantifiable biological benefits. However, it is known that lost gillnet gear continues to cause some level of fish mortality. To the extent that the proposed marking requirements reduce lost gillnets, they will achieve some biological benefits.

Social Costs and Benefits

Both gillnetters and charter and party boat operators have stated at public hearings and at Council meetings that their working and social relations have been strained by recent gear conflicts. Many recreational anglers have also notified the Council that they have lost a substantial amount of fishing time and recreational benefits because their hooks and jigs have become entangled in poorly marked gillnets. Consistently marked gillnet gear should provide benefits to anglers by reducing the number of inadvertent drifts into and entanglements with poorly marked and defined sets of gillnet gear. Any management regulations which lessen gear conflicts would also reduce the social tension between these groups and improve their ability to communicate and, therefore, to operate more efficiently on the fishing grounds.

Administrative Costs

The selected gear marking alternatives are not expected to cause any significant increase in enforcement costs. Gillnetters have indicated that they would have a strong incentive to abide by a practical and consistent gear marking system in order to reduce gear conflict and loss.

Gillnet fishing areas are fairly well concentrated and known. Random inspections for compliance on routine, multiple mission patrols by Coast Guard vessels should be adequate to accomplish the goals of the Council. Further, the Council anticipates that if there are fishing areas with high rates of non-compliance, they will be quickly discovered and remedied.

7. Recreational Fishing Regulations

Economic Costs and Benefits

Among the four alternatives for minimum sizes for the recreational fishery, alternative D allows for the greatest recreational fishing opportunity. It imposes the lowest cost on recreational fishermen in that it places the fewest number of restrictions on recreational fishing. The ability to catch fish in the recreational fishery has a large economic value because increasing the likelihood of catching fish increases the value of each recreational fishing trip.

This alternative has only a small negative impact on the average recreational angler because of the allowance of two fish below the minimum size per fisherman. As stated in §7A4, this alternative is thought to have no impact on 71% of shore-based trips, on 48% of party/charter boat trips, on 53% of all private boat trips and no impact on 82% of all recreational trips from beaches and banks along the New England coast.

Biological Benefits

The primary biological benefit of increasing the minimum size for the recreational fishery is that it is a component in the overall strategy to increase spawing stock biomass per recruit; and, therefore, it will help increase the amount of fish available to recreational anglers in the future. The proposed recreational minimum sizes do not strictly conform to the proposed commercial minimum sizes because of the very high value per fish of recreationally caught fish and because recreational fishing is a relatively small part of total fishing mortality.

Social Costs and Benefits

The main social benefit of this management alternative is the eventual availability of more large fish to recreational anglers. Further, it keeps recreational fishermen on a more or less equal footing with commercial fishermen in terms of the minimum size regulations for cod and haddock. It is not possible to increase the minimum size for fish caught by commercial fishermen and not recreational fishermen without causing commercial fishermen to feel that they are being unfairly restricted.

Administrative Costs

There should be no increase in administrative costs because there are already minimum size regulations for cod and haddock in the recreational fishery.

8. Annual Permit System

Economic Benefits

The benefits of an annual permit system will be more accurate information about the number of vessels which are actively fishing for groundfish, and a reduction in the amount of government notices to permit holders not actively fishing.

Administrative Costs

The costs of requiring annual permits were estimated by NMFS to be about $4.40 per permit. There are currently about 5,000 groundfish permit holders, however, this number may decrease by about one third with the initiation of an annual permit system. The cost of administering this system may therefore range from about $14,700, if the expected decrease in the number of permit holders occurs, to $22,000 if there is no decrease in the number of permit holders.

Social Costs and Benefits

The Council does not anticpcipate that the permit requirement will impose any social costs or create any social benefits.

9. Other Measures

The actitivity of the Technical Monitoring Group and the retention of vessel identification numbers as part of the NMFS Northeast fisheries data base are not expected to add to the present cost of fisheries management.

§7B3 Determination of "Major Rule" under E.O. 12291, or "Significant" Impacts under the Regulatory Flexibility Act

This section provides the information necessary for the Secretary of Commerce to address the requirements of Executive Order 12291 and the Regulatory Flexibility Act. The purpose and need for management (statement of the problem) as well as a description of the Council's efforts to minimize the regulatory impact of managment are described in section 1.1. The management objectives are in sections 6.1 and 6.2. The alternative management measures are described in sections 7A1, 7A2 and 7A3. The economic and social impact analysis for these alternatives are in section 7A4 and is summarized below. The proposed managment program is explained in 7B1. The rationale for the choice of the proposed regulatory action and the benefits and costs of the action are described in 7B2. Other elements of the Regulatory Impact Review and the Regulatory Flexibility Act are included below.

Regulatory Impact Review

Because the goal of the management measures is to improve or maintain spawning potential and the expected impact of improved spawning potential cannot be quantitatively assessed, a cost-effectiveness rather than a cost-benefit framework is used to identify the most efficient way of acheiving the objective (NOAA Directive 21-24, page 24). Additionally, the expected impact of improved spawning potential cannot be quantitatively measured. Costs are measured in terms of foregone revenues, assuming that operational costs remain unchanged (an increase in operational costs would lessen the amount of foregone revenues).

Focusing upon the regulatory impact analysis in Section 7A4, which presented long-term impacts on ten-year flows of ex-vessel landings, prices, and revenues, this section concentrates on the initial first year changes in these same variables. In addition, the one year impacts on the squid fishery (a $1.1 million loss in 1983) may be added to the impacts for Options 5-7, and the one year impacts associated with the gear marking requirements ($0.06-0.1 million) may be added to all of the options. It should be clear from the analysis in Section 7A4.5 that first year losses (lower landings and revenues, higher prices) constitute the worst one-year losses for every option relative to the baseline (see for instance Figures 7A11 and 7A12). The expected revenues, and derived total employment impacts, for 1985 from Figures 7A11 and 7A12 are shown below:

Change in Total Revenues & Employment, 1985

	BASELINE	$MILLION	$CHANGE	PERCENT	MAN-YEARS
Option 2	196.301	176.046	-21.255	-10.8	-1317.8
Option 3	196.301	178.300	-18.001	-9.2	-1116.1
*Option 4	196.301	180.934	-15.367	-7.8	-952.7
Option 5	196.301	174.023	-22.278	-11.3	-1381.2
Option 6	196.301	177.254	-19.047	-9.7	-1180.9
Option 7	196.301	179.989	-16.311	-8.3	-1011.3
Squid	5.73	4.63	-1.1	-19.2	

*Council preferred option.

As explained in detail in Section 7A4, all options are presented as differences from the baseline (Option 1), and the first three options (Options 2 through 4) are the same as the last three options (Options 5 through 7) in terms of mesh size, except that the former include a Southern New England closed area instead of the large mesh area, and also include a deep-water Gulf of Maine redfish exception. The 6 inch mesh options (3 & 4) show lower negative impacts relative to the 5-1/2 inch with a Georges Bank closure (Option 2), and to their counterparts which include the Southern New England large mesh area (Options 6 & 7). This is the same result as when looking at the present values for the ten-year period described in the regulatory impact analysis (Table 7A13). The same story is told looking at landings and prices in Appendix 7. For example, the preferred option 4 has lower ex-vessel price increases and landing decreases than Options 2 or 3 for each species in 1985 and 1986, except for redfish which is the same for all three options. Redfish losses (and higher prices) in 1985 are much lower for Options 2-4 (-51% landings) than for Options 5-7 (-73% to -76% landings). This relationship continues to hold in 1994 except that both 6 inch options 3 & 4 are equivalent. Thus, exclusion of the deep-water Gulf of Maine from the large mesh area results in greater benefits in the short-term and near future. The conclusion then is that the preferred option is Option 4 when looking at the first year costs, and when considering the overall impacts for the ten year period, while achieving the biological benefits of spawning potential, yield per recruit, and protection from stock collapse.

Employment impacts follow directly from ex-vessel revenues and include impacts on finfishermen, processing employees, lumpers, etc., and even include the induced employment impacts resulting from changes in consumption patterns (see Section 7A5, Socio-Cultural Impact Analysis). Percent changes in expected employment and total ex-vessel revenues are identical, because employment is calculated as a function of revenues. Models for final consumption demand (retail price) are unavailable, but assuming a simple mark-up relationship, the changes in consumer costs are expected to be about the same across options as for ex-vessel prices and revenues, albeit at slightly lower percentages. The ex-vessel price model used in this analysis contains consumer income, imports, and the consumer price index as explanatory variables, which are generally associated with retail demand. Analysis of profits in the industry is also not available because models which determine costs as a function of changes in landings (the primary impact of this program) are not available. Models which incorporate costs as a percentage of gross revenue will not show percent changes different from those for revenue. There currently are not any sizeable exports of the regulated fish species in question, and the level of change in landings for any option is not expected to impact greatly the import market (see Section 7B7, Assessment and Specification of DAH, DAP, JVP, and TALFF). Changes in landings, prices, and revenues from the proposed management program are not expected to have differential effects on vessel size groups within gear classes per se. Individual vessels may indeed be differentially impacted, but our knowledge is insufficient to assess those impacts. The program is designed to affect all users equally, is not expected to hamper anyone's competitive position, and is expected to promote investment and innovation in more selective gear types. Although recreational costs cannot be assessed in dollars an overall reduction in catch of cod and haddock of about 6% is expected in the first year.

Compliance costs and reporting burdens are identical for all user groups. The cost of new, larger size nets is not an additional burden on the industry, because a number of nets are purchased throughout a year of normal operation. Likewise, operating and maintenance costs should remain relatively unchanged. Reporting forms for the exempted fisheries are existing federal reporting forms and constitute no additional burden. Administrative costs should be very similar to those now being used to administer the Interim Groundfish FMP and also result in no change. Enforcement costs are required to increase (see Section 7B8) because the current level of enforcement is insufficient to achieve the objectives of either the Interim Groundfish or Northeast Multi-Species Plans, and NOAA/NMFS should conduct an analysis to determine the amount of increase necessary. The cost of gear marking requirements is estimated at $0.1 million and, being independent of landings levels, may be added to any option.

Initial Regulatory Flexibility Analysis

If, based upon the information presented in this FMP, the Administrator is unable to certify that the proposed action will not have a significant economic impact on a substantial number of small entities, then an Initial Regulatory Flexibility Analysis must be prepared by the Administrator and provided to the Council for inclusion in the Final EIS (NOAA Directive 21-24, page 8). The regulatory impact analysis above provides the industry-wide impacts, and the resultant processing and consumer impacts, expected with the seven options considered, as well as the preferred option. All of the vessels and processors involved in the New England multi-species fishery are considered to be small businesses, that is, none is dominant in the Atlantic demersal finfish industry. The costs of compliance are shown in the table above and in Table 7A13 for the industry. NOAA/NMFS can determine that all small businesses directly impacted (fishing vessels) are equally affected or, alternatively, may develop specific analysis of individual vessels. The Council is unable to conduct the latter because information identifying individual vessels is not available to the Council for the relevant time period (1982-1983). Likewise, the costs of completing paperwork and the effects on competitive position, cash flow, and ability to remain in the market of each individual small entity are best determined with the appropriate detailed analysis. The New England multi-species fishing industry directly affected by this management program is composed of all small entities operating in primarily New England waters (small portions operate in Mid-Atlantic waters south of Long Island). The number of units operating, provided by the Northeast Fisheries Center, is given below.

	OTTER TRAWLERS	GILLNETTERS	LINE TRAWLERS
1982	1148	169	48
1983	1174	129	33

§7B4 Continuing Management, Framework Procedures

Introduction

The proposed management program includes a commitment to plan monitoring and timely Council action to make such modifications to the plan as may be necessary and appropriate to achieve the FMP objective. There are two key aspects to the adopted management process that assure efficient continuing management: 1) a monitoring panel to assess the effectiveness of the management program and make appropriate, specific recommendations for further action, and 2) a set of additional measures that have been preliminarily reviewed by the public and may be implemented without formal FMP amendment. In addition, given the complexity of the FMP, it is reasonable to conclude that the objective of the plan may need to be changed or augmented as stock or fishery conditions change. These various aspects of continuing management are discussed in more detail below.

Multi-Species FMP Technical Monitoring Group

The Council shall empanel a Technical Monitoring Group (TMG) of assessment scientists and fishery experts to evaluate both current conditions within the fishery and the status of implementation of the management program in relation to the achievement of the FMP objective. The TMG shall report to the Council on these matters at least annually and, as the need arises, make recommendations for program modifications or changes appropriate to the quality or significance of the information available. In making its recommendations, the TMG shall provide the Council with a full range of options, including those which are amenable to implementation through regulatory amendment, as well as those which follow from other management strategies than that adopted in this FMP, and which would require formal FMP amendment.

The TMG shall be composed of six members, including three analysts working directly in related fishery assessment activities:

- designee of Northeast Fisheries Center Director;
- qualified technical staff member, New England Council;
- qualified technical staff member, Mid-Atlantic Council;

and three biologists working directly in marine fishery management activities:

- designee of New England Council Chairman;
- designee of Mid-Atlantic Council Chairman;
- designee of Northeast Regional Director.

Other experts could be called upon or co-opted by the TMG, and the staffs associated with TMG members would be available for analytical support or consultation.

In practice, the Working Group will report at least annually to the Council through its Multi-Species FMP Committee. The Committee will review the findings and recommendations of the Working Group, consult with its advisory panel as to the practical implications of the Working Group's recommendations and make its own specific recommendations to the Council.

<u>Changes in the Management Program</u>

The FMP contains a specific set of measures which may be used to change or modify the FMP, as required, using a 60 day regulatory amendment process. These additional measures are listed in §7B1. It is anticipated that the Working Group will consider this set of measures as the principal means for correcting deficiencies in the management program, and will make recommendations to the Council regarding their use. The Working Group, however, is not constrained to consider only that set of measures detailed in §7B1; it may additionally consider measures which follow from other management strategies, including effort control or catch control. The Council will consider the complete range of options presented by the Working Group, and will include formal public input in that consideration process. The Council will take whatever action it deems necessary and appropriate to restore or maintain the FMP's ability to achieve the management objective. The Council may either initiate a regulatory amendment process, based upon the implementation of the additional measures listed in the FMP, or initiate a formal plan amendment process to consider the implementation of measures which are not immediately consistent with the management strategy of this FMP.

Discretionary Actions by the Regional Director

Currently, the Regional Director is empowered to evaluate the time frame for the haddock spawning closures on Georges Bank and make certain modifications using a field order process. In particular, the proposed management program calls for spawning areas I and II to be closed to fishing from February 1 through May 31 each year. Because the purpose of the closure is to enhance spawning activity, it may be unnecessary to continue the closure beyond April 30. The decision to open one or both of the spawning closed areas on May 1 is left to the Regional Director, who is expected to consult with the New England Council prior to taking action.

Reconsideration or Augmentation of the Management Objective

The management objective of the plan is reflective of current and anticipated conditions in the fishery. It is reasonable to expect that refinements to the objective may become appropriate as described in §6.3. As noted in the latter section, a change in the specification of the objective will be accomplished without a formal plan amendment.

§7B5 Other Management Options

Future Consideration of Gear Conflict Reduction Measures

The FMP establishes marking requirements for gillnet and longline gear (see Sec.7B1) in an attempt to reduce the occurrence of inadvertent gear conflicts between mobile gear and fixed gear and between recreational user groups and gillnetters. The Council is aware that these marking requirements will not address all dimensions of the problem between recreational users and gillnetters. This problem stems from both user groups competing for access to the same bottom areas at key times during the year while using seemingly incompatible fishing methods. This management program does not currently contain any management objectives to justify remedial actions for what, in essence, is a difficult political resource allocation issue. Consideration of a measure requiring gillnetters to continually attend their gear was dropped for this and other reasons.

However, the Council believes that it is appropriate to provide a forum for a thorough examination of the causes and impacts of these conflicts with participants from both sides. Advisors to the Council from the gillnet industry and party boat industry agree that a significant component of the problem stems from a lack of communication and working relationships. To this end, the Council has charged its Enforcement, Regulations and Gillnet Committee to meet with advisors and develop specific recommendations for solutions to this problem by April of 1985. At that time, a formal amendment to the FMP will be considered, if the Council decides that the Committee's recommendations so warrant.

§7B6 Optimum Yield

The Magnuson Act requires that any fishery management plan must assess and specify the optimum yield (OY) from the fishery. The Act defines the term optimum, with respect to the yield from a fishery, as that amount of fish (A) which will provide the greatest overall benefit to the nation, with particular reference to food production and recreational opportunities; and (B) which is prescribed as such on the basis of the maximum sustainable yield from such fishery, as modified by any relevant economic, social or ecological factor.

Guidance prepared by NOAA states that "the determination of OY is a decisional mechanism for resolving the Act's multiple purposes and policies for implementing an FMP's objectives, and for balancing the various interests that comprise the national welfare." In the preparation of this Northeast Multi-Species FMP, the Council has endeavored to satisfy the intent of the Act with respect to the sustained productivity of the fishery resources, while at the same time determining what constitutes the nation's greatest overall benefit from the fishery.

Fundamentally, this FMP addresses the conservation and productivity of the fishery resources up-front in the management policy and the management objective. The biological principle that is employed in the FMP is that of maintaining sufficient spawning potential in each stock to provide for the replacement of year classes on a long-term average basis. Given the uncertainties of the environment, application of this principle provides, over the long term, for a condition which is recognized to be MSY. The parameters that are manipulated through the measures of this plan, namely age-at-entry and fishing mortality, are the same ones that correspond to more traditional approaches to achieving MSY, such as fishing at Fmax or $F_{0.1}$. By effectively employing the spawning potential/ year class replacement concept, this FMP assures that MSY will be achieved over the same time frame for which it is defined. The maintenance of sufficient spawning potential for individual stocks is not compatible with overfishing, and thus the approach is entirely consistent with National Standard #1.

The management program adopted in this FMP is carefully tailored to be as compatible as possible with the traditional nature of the multi-species fishery. The strategy employed by the plan works in harmony with the industry to preserve both fishing opportunities and the freedom and flexibility for fishermen to choose among those opportunities according to the natural stimuli of the market. The management policy of this FMP embodies those attributes of the fishery which allow it to continue to function in a way which generates benefits to the region and the nation, both in terms of revenue and employment. The management program also address the need for continued recreational opportunity by promoting abundant, healthy resources, and access to the fishing grounds.

Because of the comprehensive nature of this FMP, the achievement of optimum yield from the fishery necessitates trade-offs among the stocks upon which it depends. As natural variations in stock abundance and market conditions occur to influence the yield from the fishery, some stocks will necessarily be exploited more than others. Nevertheless, the structure of the proposed management program, incorporating a formal monitoring process, will produce an environment of continuing management that will preserve long-term benefits from the overall multi-species fishery.

Therefore, optimum yield from the Northeast multi-species fishery is defined as that level of yield which results on an annual basis from implementation of the management program over time. As a consequence, optimum yield is firmly based on the long-term viability and productivity of the species resources that collectively support the fishery, and further reflects considerations for the economic, social and ecological factors in the fishery, which have been important considerations in the design of this management program, and which are instrumental in generating the greatest overall benefit to the nation.

§7B7 Assessment and Specification of DAH, DAP, JVP AND TALFF

Proposed Levels for DAH, DAP & TALFF

Table 7B1: Proposed Levels for DAH, DAP & TALFF (Metric Tons)

Species	OY	1983 Catch	DAH	DAP	TALFF
Cod	ns	51,638	= OY	-	-
Haddock	ns	14,756	= OY	-	-
Pollock	ns	13,486	= OY	-	-
White hake	ns	6,410	= OY	-	-
Total	ns	86,290	= OY	150,000	-
Flounders	ns	77,900	= OY	95,000	-
Ocean perch	ns	6,028	= OY	13,100	-
Other Species	ns	na	= OY	-	-

- "ns" indicates that there is no specific level of OY. Instead, the OY is the level of harvest that results from the management plan.
- Cod, haddock, pollock, and white hake are readily substituted for one another in the production of fresh fillets and, therefore, are grouped together in calculating processing capacity for roundfish fillets.
- Flounders include yellowtail, American plaice, winter flounder, witch flounder and fluke.
- The DAH for whiting may be underestimated for 1985 in view of potential joint venture activity. For the same reason the TALFF may be overestimated.
- DAPs for cod, haddock, pollock, white hake, flounders and ocean perch were estimated by Georgianna (1984) using a modified peak-to-peak method.

Rationale for Recommended Levels of DAH and DAP

Cod, Haddock, Flounders, Pollock, Redfish

Because domestic processors already import large quantities of whole fish of these species, it is clear that domestic annual fish processing capacity (DAP) exceeds domestic harvesting capacity for these species. Imports of whole fresh cod, haddock and flounder have increased dramatically since 1978, as shown in Table 7B2

Although redfish is not imported in whole form, it is imported in the form of fresh as well as frozen fillets. The existence of these imports indicates that the domestic demand for redfish exceeds the domestic harvest. Domestic processing capacity for redfish is constrained by the available harvest.

Except for a small quantity of pollock which is shipped to Canadian producers of salted fish products, there are no exports of whole fish of the species regulated under this plan.

Table 7B2: Imports of Fresh, Whole Cod, Haddock and Flounder

Year	Million Pounds	Metric Tons
1978	10.893	4,941
1979	14.787	6,707
1980	15.451	7,008
1981	30.372	13,777
1982	40.686	18,455
1983	53.690	24,353

Source: U.S. Customs data, Georgianna (1984)

The existence of excess processing capacity for groundfish products has been well documented by Georgianna (1984) and Smith & Peterson (1978). Figures 7B3-5 (taken from Georgianna's study) show production and capacity graphs for the relevant groups of these species. In all cases the annual average capacity as measured by the area under the capacity line exceeds production, although there are some months when production has exceeded capacity. It should be noted that capacity as shown in these graphs has been conservatively estimated by using an economic definition of processing capacity which systematically understates physical processing capacity. In this instance, capacity has been defined as the quantity of output that can be produced in the short run before per unit cost of production rises sharply exclusive of the cost of fish inputs. Production levels include fresh, whole imported fish as well as domestically caught fish.

Estimates of annual processing capacity assume that full capacity can be used twelve months of the year. As can be seen from Figures 7B3-5, monthly production levels are rarely greater than estimated capacity levels because of the great variability in the monthly supply of fresh fish inputs. As a result, annual capacity estimates greatly exceed annual production levels.

Other Species

For all other species included within the management unit of this management plan, DAH is assumed to equal OY; and, therefore, TALFF is equal to zero.

Figure 7B3

PRODUCTION AND CAPACITY

COD, HADDOCK, POLLOCK, WHITE HAKE

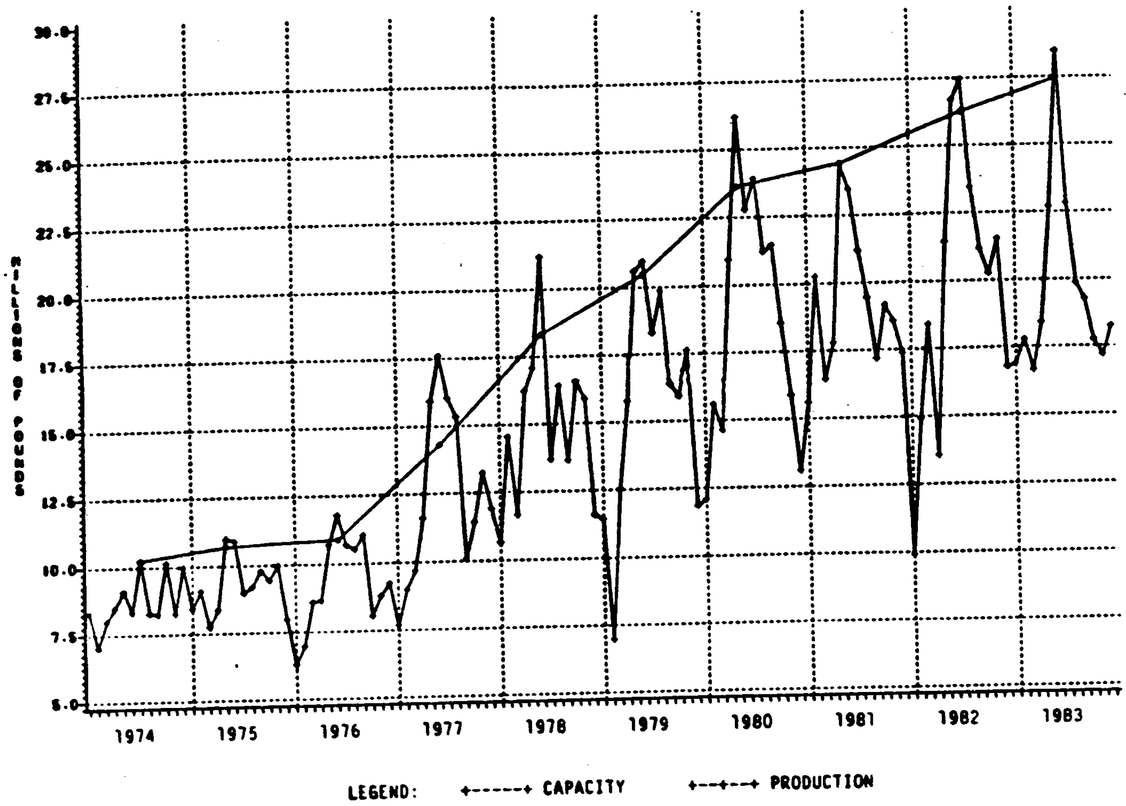


Figure 7B4

PRODUCTION AND CAPACITY

FLOUNDERS

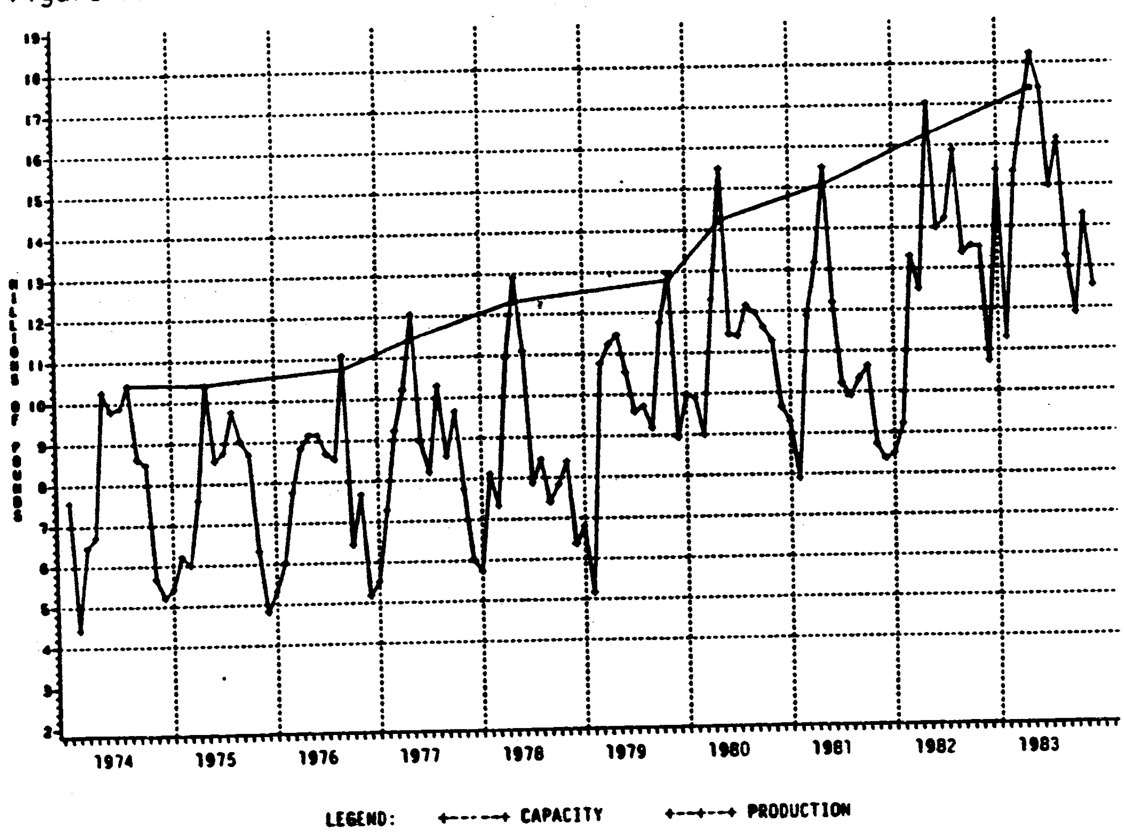
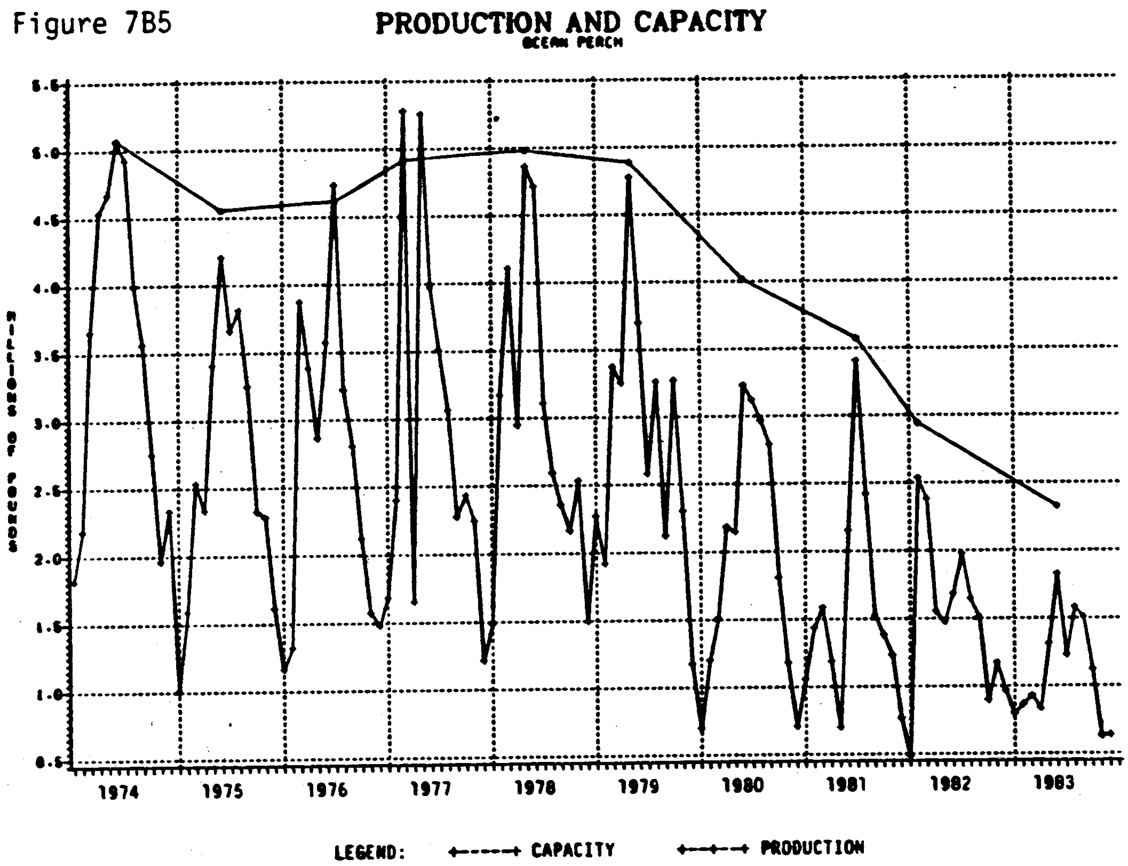


Figure 7B5


PRODUCTION AND CAPACITY
OCEAN PERCH
MILLIONS OF POUNDS
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
LEGEND: CAPACITY PRODUCTION

§7B8 Enforcement Program Considerations

The New England Fishery Management Council recognizes that the management measures of the Interim Groundfish FMP, which are essentially similar to those adopted for this FMP, have not proven to be as effective as anticipated, primarily due to industry non-compliance. The Council believes that restrictions on fishing practices, such as minimum mesh restrictions and closed areas, can be effective if the proper incentives for compliance exist. In most cases, regulations are not adhered to because of four factors: 1) the economic cost of compliance is significant; 2) the perception of unfair treatment; 3) the risk of receiving a citation is low; and 4) the cost of receiving a citation is low. All of these factors are related to individual perceptions of how one's operation is affected by management relative to others, and whether or not expected penalties can be subsumed within the cost of doing business.

In the development of any FMP, the Council may adopt only those management measures which can be shown to be necessary and appropriate to achieve the management objectives, and which, in relation to other equally effective measures, result in the least regulatory burden. Therefore, apart from convincing the industry of the merits of the management program, the Council must accept that the sacrifices which individual fishermen must suffer will lead invariably to some level of non-compliance. As a result, the areas in which the Council can be effective in mitigating the potential for non-compliance are related to factors 2, 3 and 4.

Factor 2 is the perception that the proposed management measures are not being applied fairly to all user groups. The Council has made every effort in the development of this FMP to devise management measures which treat the problems as they exist. That is, if the condition of the Georges Bank stocks warrants more restrictive management intervention than the Southern New England stocks, then the measures have been designed accordingly, and always with a view toward eliminating unjustifiable regulatory burdens. Still, those sectors of the industry most dependent upon the Georges Bank fishery, and thus most impacted by Georges Bank management measures, may perceive that they are bearing an excessive share of the burden. The Council has justified its management program in relation to its objectives and management policy for the regions' multi-species fishery, and is prepared to similarly justify any future actions that may prove necessary.

Factors 3 and 4 relate to the risk that an individual violator will be caught and the price that the violator will pay, either in terms of a cash penalty (immediate or deferred) or in terms of lost revenue (as a consequence of impeded or lost access to the fishery). Multiplied together, the result gives a fisherman the expected cost of his non-compliance, which can be compared directly with the expected benefit from his engaging in an illegal fishing activity. Because there are two factors in the equation, either one or a combination of both can be adjusted in such a way that the expected cost will be perceived to outweigh the benefits. That is, either the frequency of contact between fishing and enforcement vessels (or boardings) can be increased, with a concommitant perception of increased risk of being cited for a violation, or the penalty can be increased to the point where even the remote possibility of a boarding poses an unacceptably high risk. In practical terms, the best solution probably results from a combination of increased contacts and penalties.

The Council believes that the reliance of the Magnuson Act on the Coast Guard to conduct at-sea enforcement results in a mis-match of capability and need. Most vessel fishing days are spent relatively close to shore, probably within 30-40 miles. In most cases, fishing vessels are concentrated on fairly well-defined grounds in close radio contact with one another. Coast Guard vessels are well suited to far-ranging, all-weather operations where speed and endurance are critical to search and rescue operations. The available Coast Guard vessels are few in number, easily identifiable, fully committed and awkward for routine fisheries boarding operations. Their utility in fisheries enforcement clearly falls in the off-shore areas where larger trawlers operate under a broad spectrum of weather conditions. Coast Guard vessels are not the best choice for conducting near-shore fisheries enforcement operations because contacts are infrequent and geographically spotty, and in many cases violators have ample opportunity to avoid or elude citation.

The Council believes that some means must be found to substantially increase the visibility of enforcement personnel in the areas of concentrated fishing activity. The enforcement presence must be highly maneuverable and unpredictable by time or area so as to maximize (from the fishermens' perspective) the risk of being boarded. It is conceivable that this task can be accomplished in near-shore areas at minimal additional cost by taking advantage of existing state resources through improved cooperative arrangements with the National Marine Fisheries Service. It is also possible that substantial funds will have to be re-deployed or appropriated to provide the means for effectively enforcing this and other FMPs at sea.

It is universally accepted that the purpose of a civil penalty is to discourage further violation of the applicable regulation. In producing the desired effect, two aspects of the penalty process are relevant: 1) the penalty should be applied as close to the point of violation as possible; and the amount of the penalty should be in keeping with the nature and severity of the transgression. The Council is aware that the time required to administratively process a citation cannot be significantly shortened, so in many cases the penalty is applied well after the violation occurs. Such timing has more the effect of an irritant than a disincentive, and habitual violators may continue their practice to the chagrin of law-abiding fishermen. Penalties that cost the fishermen time, catch or fishing opportunity are more effective than fines. They have the effect of an immediate cost rather than a deferred cost, they affect the current trip's cash flow position and they change the fisherman's perception of risk.

The Council is very aware that non-compliance, even at a relatively low level, will weaken the adopted management measures and lead to more restrictive methods and measures. Therefore, the Council believes that violations of the <u>operative</u> measures in this FMP should draw severe penalties. The Council ranks violations of minimum size, by-catch in exempted fisheries, area violations and mesh violations as warranting immediate and severe penalties. Procedural and administrative measures of this FMP would warrant lesser penalties. The Council supports penalties up to and including, in some cases, permit sanctions in order to achieve the desired level of compliance. Severe penalties, including the denial to operate in the multi-species fishery, are justified by the potential negative effect of non-compliance on the revenue derived by the many fishermen who wish to continue to operate in and derive the benefits from a well managed fishery

Therefore, the Council intends that the major aspects of the enforcement issue shall be addressed through a program involving the New England and Mid-Atlantic Councils, NOAA General Counsel, the Northeast Regional Office of NMFS, the Coast Guard and the relevant state enforcement agencies. This program, begun by the New England Council's Committee on Regulations and Enforcement, places emphasis on discussions in the following three areas:

1. A revised penalty structure and streamlined administrative procedures that will be appropriate to the importance of the management program and that will promote compliance. On May 21, the Council approved a proposed penalty schedule that defines simple and flagrant violations and incorporates permit sanctions and vessel seizures as appropriate penalties under well-defined circumstances.

2. Development of a near-shore enforcement capability that has the attributes of frequent contacts, wide coverage and unpredictable behavior, and enhancement of the existing shoreside and off-shore enforcement capability. Various institutional arrangements, incorporating available state and federal personnel and physical resources, should be explored. Also, any institutional or funding impediments to efficient enforcement structures should be identified.

3. Identification of sources of funds to generate and support the level of at-sea and shoreside enforcement that is critical to the success of the management program. Such funds may flow from new appropriations, reprogramming within agencies or efficiencies of scale.

The Council will strive to assure that the participants in the program identify an agenda and a timetable that will produce recommendations and actions in a time frame appropriate to the implementation of this FMP.

SUBPART C: RELATIONSHIP OF THE MANAGEMENT PROGRAM TO THE NATIONAL STANDARDS, OTHER APPLICABLE LAW, AND OTHER STATE/FEDERAL MANAGEMENT PROGRAMS

§7C1 Compliance With the National Standards

All fishery management plans and amendments to plans must be consistent with seven National Standards established by Section 301(a) of the Magnuson Act. The following is a discussion of the provisions of the Northeast Multi-Species Fishery Management Plan (Plan) in light of the National Standards.

<u>National Standard No. 1</u>: Conservation and management measures shall prevent overfishing while achieving, on a continuing basis, the optimum yield from each fishery.

As explicitly stated in the management objective for the Plan, the formulation of the proposed management measures has been for the purpose of maintaining sufficient spawning potential among the important fish stocks within the overall multi-species complex such that year classes of fish may continue to replace themselves on a long-term average basis. Overfishing is understood as that level of fishing activity that jeopardizes the capacity of a stock to recover to a level at which it is capable of producing the maximum biological yield. The concept of year-class replacement, as focused by the management objective and embodied in the management program, secures the long-term viability and productivity of the fish stocks, as reflected in the concept of MSY, and insulates the stocks against overfishing. In this multi-species fishery context, Optimum Yield is defined in consideration of the simultaneous maintenance of the productivity of the resource complex.

Consistent with the policy statement guiding FMP development (see §1.2) that seeks to provide an environment in which the multi-species fishery can operate and evolve with a minimum of regulatory intervention, Optimum Yield is defined in terms of that harvest which will result with effective implementation of the overall management program, including those aspects relating to continuing management. As such, it is expected that Optimum Yield will be a variable quantity reflecting the application of the management program in a dynamic resource environment. Notwithstanding the expected variability of yield, results of the biological impact analysis (§7A4) indicate that effective implementation of the management program should lead to a long-term average Optimum Yield which approaches the maximum biological yield, subject to the constraints imposed by the multi-species character of the fishery (see §5.1 for additional discussion).

<u>National Standard No. 2</u>: Conservation and management measures shall be based upon the best scientific information available.

The most recent scientific information has been used in the preparation of the Plan. The descriptive and analytical sections of the Plan pertaining to the fishery resources are based upon published NOAA/NMFS stock assessment and information, and have further benefited from results of ongoing research activity within the Northeast Fisheries Center. In particular, the contribution by NMFS/NEFC is acknowledged in developing the analytical basis for analyzing the reproductive capacity of key fish stocks and assessing the effectiveness of candidate management measures in promoting the attainment of that capacity. The Northeast Fishery Center additionally provided much of the fishery data upon which the regulatory impact analysis has been based, and NMFS/NERO has provided technical input to the same analysis. In addition, the FMP includes substantial information on the social-cultural context of the fishery, which has been lacking in previous documents of this nature.

In sections dealing with possible future management actions (§6.3, §7B4), the FMP mandates activity, subject to certain criteria, which are expected to be supported by information supplied by the NMFS three-tier data collection system.

National Standard No. 3: 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.

In keeping with the policy statement and in full recognition of the biologic and economic environment, the Council has embarked upon a comprehensive approach to management of the northeast fishery resource which has been dictated by the joint-harvesting relationships among the component species within the overall complex. Notwithstanding this approach, each species directly regulated under the aegis of this FMP shall be regulated throughout its range, necessitating consultations with the Mid-Atlantic Fishery Management Council in cases where a mutual interest exists. As a further consequence of the FMP's fishery-wide approach, the Council urges that the States adopt complimentary management measures applicable to those components of the resource which may be found in state waters.

National Standard No. 4: Conservation and management measures shall not discriminate between residents of different States.

Management measures proposed in this FMP are applicable to all particpants in the Northeast multi-species finfish fishery. The policy statement which guided the development of the Plan is very specific in mandating a minimum of regulatory intervention or restriction of fishery options. The proposed management program reflects a clinical treatment of the problems as they exist in the fishery. Therefore, the management program is the minimum necessary to achieve Optimum Yield. Finally, the policy specifically discourages unnecessary interference with access to the resource by individual fleet sectors.

National Standard No. 5: Conservation and management measures shall, where practicable, promote efficiency in the utilization of fishery resources; except that no such measure shall have economic allocation as its sole purpose.

The management measures incorporated in the Plan, focusing on enhancement of the long-term reproductive capacity of the resource, are expected to improve the long-term average productivity of the fishery such that harvests may approach the maximum biological yield. Thus, relative to the current fishery, the management measures move the fishery toward the point of maximum economic efficiency, yet do not achieve that level for very real operational and political considerations. Corresponding to increased productivity from the overall fishery is the preservation of the extraordinary species diversity which characterizes the northeast multi-species resource. The latter will act to preserve and enhance the range of options available to participants in the fishery, thus improving the efficiency in utilization by providing a more stable resource base and reducing the dependency on one or more key components of that resource. The management measures chosen represent the most cost effective approach to achieving that long-term goal consistent with the adopted management strategy. None of the management measures chosen have implications with regard to resource allocation.

National Standard No. 6: Conservation and management measures shall take into account and allow for variations among, and contingencies in, fisheries, fishery resources, and catches.

The initial management measures adopted by this Plan were formulated on the basis of the best scientific information available with full recognition of the historic variability that has existed in those data. Most particularily, the target level in the reproductive capacity for the important fish stocks was chosen in light of clear recognition of the extreme variability of the typical stock-recruitment relationship (see §5.3 and §5.4). The management measures adopted by the Council do not directly control the amount of fish landed, and thus do not impose costs on the industry as a consequence of natural variation in the resource complex.

In mandating a response to future significant unforseen variations in the important fishery parameters, the Plan establishes a Working Group which, in consideration of information routinely collected by the Council, the NMFS Northeast Fishery Center and the NMFS Northeast Regional Office, will provide advice to the Council in its continuing efforts to manage the fishery.

National Standard No. 7: Conservation and management measures shall, where practicable, minimize costs and avoid unnecessary duplication.

As exemplified by the currently depressed condition of a number of economically important fish stocks within the overall northeast multi-species fishery resource, prior management efforts for a narrow range of stocks have been generally unsuccessful in conserving the stocks and preventing overfishing, which has been due in part to a lack of enforcement. To conserve and rebuild the resource, the Council has found it necessary to embark on the new approach to fishery management, which is embodied within this Plan. The management strategy and measures that have been chosen to achieve the FMP objective were designed to give fishermen the greatest possible freedom of action in conducting business and pursuing recreational opportunities that is consistent with ensuring the conservation and wise use of the resource. The preferred management program represents the least-cost approach to achieving that end.

§7C2 Conformance with Other Laws and Management Programs (PMP's, FMP's, State Regulations, ASMFC Programs, CZMP's, MMPA and PRA)

Preliminary Management Plans and Other Fishery Management Plans

Discussion on the relationship of this plan to Preliminary Fishery Management Plans and Other Fishery Management Plans can also be found in section 4.3.

Fisheries in the areas covered by this plan, which are currently under regulation by other fishery management plans include Atlantic Sea Scallops, Surf Clams and Ocean Quahogs, American Lobster, and Squid, Mackerel and Butterfish. Fishermen fishing for the species contained in this plan are subject to these other plans if their activities are likely to result in the harvest of any of these other species. Similarly, fishing for any of these other species may subject a fisherman to the provisions of this plan if his activities are likely to result in the harvest of species contained in this plan.

Preliminary management plans (PMP's) are put into place by the Secretary of Commerce to permit foreign nations to fish in the fishery conservation zone (FCZ) and remain in effect until superceded by approved fishery management plans developed by the Fishery Management Councils. Regulations implementing PMP's may be promulgated by the Secretary as interim measures pending regulations promulgated by the Secretary from Council plans.

A PMP must describe the fishery, provide a preliminary estimate of the optimum yield (OY), and determine the total allowable level of foreign fishing (TALFF), if any. In addition, the preliminary plan should contain permit requirements for foreign fishing vessels, as well as data reporting procedures that must be met during fishing activities.

Preliminary Fishery Management Plan for the Hake Fisheries of the Northwest Atlantic

Harvesting of red and silver hake off the northeastern United States was, until January 1, 1977, regulated under the International Commission of the Northwest Atlantic Fisheries (ICNAF) and ssubsequent agreements between the 18 signatory nations. In January 1977 the National Marine Fisheries Service submitted a PMP for these hake fisheries to the Secretary of Commerce. The PMP was approved in February 1977.

THE Hake PMP recommended the following for the 1977 fishing season:

Species	ICNAF Subdivision	Optimum Yield (metric tons)	USA Fleet Capacity (metric tons)	Total Allowable Level of Foreign Surplus (metric tons)
Silver Hake	5Ze	70,000	15,000	55,000
	5Zw+SA 6	45,000	14,500	30,500
Red Hake	5Ze	16,000	1,500	14,500
	5Zw+SA 6	28,000	7,600	20,400

ICNAF subdivision 5Ze is Georges Bank; subdivision 5Zw is southern New England; and SA 6 extends from Long Island to North Carolina and eastward. Time, area and gear limitations were also placed on foreign states to minimize conflict with the US offshore lobster pot fishery, the recreational fishery and to minimize by-catch.

An amendment to the Hake PMP was later made which:

1. Reduced the silver hake optimum yield for Georges Bank from 35,000 mt to 25,000 mt and for the Southern New England/Mid-Atlantic area from 55,000 mt to 30,000 mt.

2. Reduced the total allowable level of foreign fishing for silver hake from 26,000 mt to 10,000 mt on Georges Bank and from 34,400 mt to 9,400 mt for the Southern New England/Mid-Atlantic area.

3. Established reserves for Georges Bank of 6,000 mt for silver hake and 3,000 mt for red hake.

4. Increased optimum yield and domestic annual harvest for red hake in the Southern New England/Mid-Atlantic area from 11,000 mt to 16,000 mt and from 8,000 mt to 13,000 mt, respectively.

5. Reduced the TALFF for Georges Bank red hake from 5,500 mt to 2,500 mt.

Preliminary Fishery Management Plan for Finfish Caught Incidental to the Trawl Fisheries of the Northwest Atlantic

Harvesting of finfish caught incidental to the trawl fisheries of the Northwest Atlantic off the Northeastern United States was, until January 1, 1977, regulated under terms of ICNAF and subsequent agreements between the 18 signatory nations. In January of 1977 the National Marine Fisheries Service submitted to the Secretary of Commerce a PMP for Finfish Caught Incidental to the Trawl Fisheries of the Northwestern Atlantic which was subsequently approved on February 4, 1977.

The PMP for other finfish proposed the following:

Species or Stock	Maximum Sustainable Yield (metric tons)	Optimum Yield (metric tons)	Estimated US Capacity (metric tons)	Total Allowable Level of Foreign Surplus (metric tons)
Butterfish1/	20,000	18,000	12,500	5,500
River Herring2/	25,000	10,000	9,500	5003/
All Other Finfish	247,000	247,000	187,000	60,000

1/ Butterfish is currently managed under the Atlantic Mackerel, Squid and Butterfish FMP
2/These data apply to the stocks of the Mid-Atlantic.
3/Reserved for unallocated incidental catches.

Further, the Other Finfish PMP proposed that the foreign incidental by-catch of each of the species listed below be limited individually to one percent of all other fish on board the vessel or 2,500 kg, whichever is greater and that the catch of all these species be limited to seven and one-half percent of all other fish on board or 12,000 kg, whichever is greater.

1. Bluefish
2. Scup
3. Sea Bass
4. Weakfish
5. River Herring
6. Croaker
7. Spot
8. American Shad
9. Tautog

A very small incidental by-catch of river herring is allowed by foreign vessels so as not to totally disallow directed fisheries for herring, mackerel, squid and the hakes. No foreign incidental catch of striped bass is permitted.

The other finfish group includes some 60 finfish species within ICNAF SA5 and 6 for which individual species assessments are either unavailable or are available only in preliminary form. Specifically, this category excludes tunas, billfishes, large sharks and menhaden (which are captured primarily inshore in the southern portion of SA6) as well as cod, haddock, redfish, silver hake, red hake, pollock, sea herring, mackerel and flounders.

State Regulations

The species covered under this FMP are distributed within most of the New England and Mid-Atlantic states' territorial waters as well as within the FCZ. The management unit is considered to include the regulated species when they occur within the states' waters as well; and the management policies, measures and recommendations contained in the plan are appropriate for application in state waters. Therefore, the coordination of the states' policies toward the species contained within this plan is important to the implementation of an effective and sound regional multi-species management policy.

In general, it is concluded that this management program is consistent with the approach taken by the various states for regulating their marine fisheries; and the only deviations with the states relate to specific measures which will need to be reconciled or accommodated for effective implementation of this plan. Further details of individual states' regulations can be found in §3F1.

ASMFC - Northern Shrimp Section

This FMP does nothing to usurp the prerogatives of the Northern Shrimp Board with the exception that if the Northern Shrimp Board allows the shrimp fishery to open prior to January 1, or to stay open beyond April 30, we would request that the gear used be separator trawls due to the possible negative impacts on the harvest of small flatfish.

Coastal Zone Management Programs

Most of the states in the areas affected by this plan have approved Coastal Zone Management Programs. Since this fishery management plan does not specifically authorize any physical change in the coastal zone, it will not have any direct impacts to measure against standards set in the various state programs. Nonetheless, these programs have been reviewed, and no inconsistencies between them and the measures, policies and provisions of this plan have been found.

OCS Leasing

The Council is on record as having commented unfavorably on numerous occasions on the inclusion of certain tracts into the lease sale offering. The tracts that the Council has objected to are areas of high biological activity, spawning areas, areas of significant fishing activity or sensitive habitats. The Council will continue to monitor all exploratory drilling that may be undertaken pursuant to tracts which have already been leased under lease sales 42 and 52 and tracts which may be sold under area-wide lease sale 82.

Marine Mammals Protection Act

This management program is not believed to have any adverse affect on the marine mammals that occur in the waters of the northeast coast of the United States, which include endangered and threatened sea turtle species and endangered fish species which have been identified in §2B5.

Paperwork Reduction Act

This FMP requires no new data collection information or recordkeeping beyond that which is already in place as part of the regional data collection program.

§7C3 Relationship to Prevailing Canadian Management Program

As noted in §3F2, the major management approach to the stocks within the management unit of this FMP has been to support spawning area closures and to establish a minimum mesh size. As a consequence, it appears that the management program proposed is generally consistent with the Canadian management program with respect to its reliance on spawning area closures, but may be deleteriously affected by a failure of the Canadians to adopt consistent mesh or minimum fish sizes.

Part 8

§8.1 Gear Development Research Needs

In view of the Council's selection of operational control as the management strategy for this plan, ongoing gear development and analysis are important for continued effective implementation of the multi-species management program. Accordingly, mesh selectivity and trawl design research require support at realistic levels in order to most effectively attain the FMP plan objectives. Comparative evaluation of mesh size in existing gear, as well as the design of new, more selective gear for use in the multi-species fishery, is of great interest to the Council.

Of current interest to the Council would be testing and comparative analysis of conventional vs. square mesh cod ends in both large and small mesh fisheries. As noted in Section 5.5, the use of square mesh cod ends may result in reduced levels of groundfish discard mortality, an important consideration in fishery management. Determination of the correspondence between square and conventional diamond mesh for specific species in the fishery is an area of needed research. Comparative studies of conventional vs. square mesh is currently being conducted in inshore waters by the Commonwealth of Massachusetts to a limited extent. There must be a more complete testing program and analysis of the benefits and limitations of the use of square mesh before its use as a management tool can be seriously considered. A cooperative testing program with the states, NMFS, and Sea Grant is strongly urged.

In addition to research on square mesh, testing and analysis of the use of separator trawls in the small mesh fisheries for whiting or shrimp would be of significant value in relation to the Council's interest in providing fishing opportunities, while minimizing undesirable impacts on associated species. It has been demonstrated in other regions of the country, most notably the Gulf of Mexico, that separator trawls may minimize by-catch. In the groundfish fishery, this technique may reduce the by-catch of juvenile flounder or redfish.

Another area where research could be called for is relative to recent developments in automatic longlining or auto-lining fishing techniques. Of particular interest would be analysis of the comparative efficiency of these methods relative to others in the fishery for the purpose of management. If management measures restrict the use of some gear types, alternative fishing methods such as auto-lining must be carefully evaluated.

Establishment within the Northeast Fisheries Center of a fully-funded, adequately-staffed research program to evaluate the functional attributes of gear commonly used as well as new gear types used in the multi-species fishery is recommended. The objectives of such a program would be to suggest limitations on the use of gear, and appropriate modifications or useful gear design changes. While it appears that the Center is a logical funding source for such research, conducted internally or contracted out, there are several other funding options.

Sea Grant has demonstrated a capability in the area of gear development. Continued effort by Sea Grant would serve to contribute to the overall fishery management process through making useful data available to managers and user groups. It is recommended that research programs such as the M.I.T. Sea Grant Fisheries Technology Center be adequately supported and that its effort be directly linked to Council efforts at fisheries management.

Potential funding sources for the research at the M.I.T. Center for Fisheries Engineering, the Northeast Fisheries Center, the Massachusetts Commercial Fisheries Extension Service and the Maine Fishery Technology Service could include the National Marine Fisheries Service, Sea Grant, the Saltonstall-Kennedy Program (S-K funds) and the Wallop-Breaux Program, all of which could support a management effort promoting development of the fisheries.

§8.2 Economic Data & Research Needs

The Council has initially determined that the NMFS Three-Tier Data Collection Program is currently sufficient for continuing management under the Multi-Species FMP given three provisions: (1) an expansion of the collection base; (2) improvements of the type indicated below for Tier Two and as may be suggested by the FMP Monitoring Group; and (3) maintainance of all data including vessel identification numbers. Notwithstanding this initial determination, the FMP Monitoring Group may indicate a need for additional data or a new data collection system after periodic review of the current system. Expansion of the NMFS weigh-out landings data collection system in Connecticut and New York are highly recommended for effective implementation and updating of the FMP. In addition, it is suggested that NMFS continue to improve the coverage of this data collection system in the Mid-Atlantic region.

Trip interviews (Tier Two) have proven to be an effective way of assembling data about the fisheries and should be continued. This method of data collection might be more useful if it included information on the number of crew members on each trip. The data is important for estimating the input of labor in the production process for these fisheries, which can be determined if vessel identifiers are maintained. Trip interview data, in order to be most useful to the Council, should be assembled in a consistent manner and distributed on a regular basis to the Council.

The Council requires that any data respecting a fishing vessel's operations, including the vessel's identification, that may be voluntarily supplied by fishermen through the NMFS Three-Tier Data Collection Program shall be retained in the data base, in strict confidence, for management analysis purposes only, unless removed or deleted at the specific request of an individual vessel owner. If the FMP Monitoring Group finds that such data are not being adequately maintained or that a sufficient number of vessel owners do not allow such data to be maintained, then a new data collection system which does provide the necessary data will be considered.

Vessel cost data should continue to be collected by NMFS. These data are necessary for updating the management plan and achieving its explicit management goals and objectives.

Production models of the fisheries need to be improved and expanded, including cross-sectional analysis, which requires identification of vessels by NMFS to assess the IRFA requirement. Modeling of the financial performance of major New England fleet sectors should continue. Application of this research data to the management effort would serve to enhance the overall management effort.

Standardization of fishing effort data in order to quantify changes and identify trends in fishing effort by different gear types and size classes should be pursued. It is important for managers to know how their policies are affecting fishing effort or whether changes in effort are caused by other factors such as changes in technology, interest rates, government construction subsidies, etc. Market models which include the international economy should be developed in order to broaden the understanding of market interdependence of fishery products under management. Work on imports which has been completed by the Analytical Services Branch of the Northeast Fisheries Center should be expanded to include explicit import equations. The Council will continue to develop the short-run supply model which will be of importance in updating the management plan.

Economic impact analysis of the Gulf of Maine Boundary settlement on the New England industry should be provided by NMFS to the Council for incorporation of relevant information into fishery management plans.

To the extent possible, NMFS should undertake the tasks described above because NMFS personnel have the most direct access to the data and tend to have a better understanding of the management environment than private or academic researchers. However, additional avenues of support to complete the research and data needs which are important to the effective implementation of the management program might include Wallop-Breaux or S-K funding sources. While these monies are primarily aimed at development projects, management and development of the resource are closely related; and support from these programs could easily be justified.

§8.3 Other Areas for Research and Data Needs

Other areas where data needs exist include updating of relevant socio-cultural information on New England ports. A thorough socio-economic analysis of the impact of the FMP is warranted. Information is also lacking in the area of habitat protection. There are serious gaps in the information pool with regard to the effects of certain activities on fish habitat and the resultant impact on fisheries productivity and marketability.

In the area of recreational fisheries, information on the catch and effort of recreational anglers has improved substantially since the inception of the National Survey in 1979. While data from this source provides an indication of the biological impact of recreational fishing on groundfish stocks, this source is not adequate to assess the economic impact of recreational fishing. Other existing national and regional studies on the economic impacts of recreational fishing have not specifically focused on recreational groundfish fishing. Studies which provide comprehensive information on the economic structure and importance of recreational fishing in New Engalnd are needed. This information is necessary for the determination of net social benefits from recreational fishing and to understand in advance how commonly used management measures and techniques might affect participation in the fisheries and industries dependent on the recreational fisheries.

Part 9

PART 9: EIS COMPLETENESS INFORMATION

§9.1 List of Preparers

This draft Fishery Management Plan, Environmental Impact Statement, Regulatory Impact Review and Initial Regulatory Flexibility Analysis were prepared by:

Douglas G. Marshall Executive Director	Overall responsibility for FMP development.
Guy Marchesseault, Ph.D. Deputy Executive Director Fishery Science	Principal responsibility for FMP development, including policy, objectives, management program and all supporting analyses.
Howard J. Russell, Jr., M.S. Fishery Analyst Marine Fishery Biology	Responsible for resource condition analysis and resource impact analysis of the management program and its alternatives.
Louis Goodreau, M.S. Fishery Analyst/ Marine Resource Economics	Responsible for fishery operation analysis and economic impact analysis of the management program and its alternatives.
Richard Ruais, M.P.A. Fishery Analyst/ Public Policy	Responsible for policy development, recreational fishery analysis, and user group interactions.
Christopher Kellogg, M.A. Fishery Specialist/ Marine Resource Economics	Responsible for industry analysis, including processing, marketing and foreign trade.
Ann Hochberg, M.S. Fishery Specialist/ Resource Management	Responsible for research and data needs and assisted in socio-economic, resource and industry impact analyses.
Sharon E. Lake Fishery Specialist	Responsible for FMP consistency with other laws and applicable statutes.
Madeleine Hall-Arber, M.A. Anthropologist	Responsible for socio-cultural description of the industry and identification of management impact criteria.

Overseeing and guiding the development of the Northeast Multi-Species Fishery Management Plan and its associated environmental, economic and regulatory impact analyses was the Council's Multi-Species FMP Oversight Committee, composed of: Chairmen James Salisbury and Robert Jones, and members Spencer Apollonio, Joseph Brancaleone, James Costakes, John Cronan, Herbert Drake, Thomas Fulham, Robert Smith, Anthony Verga and Barbara Stevenson (MAFMC).

In addition, the following individuals contributed to the overall formulation and preparation of the Northeast Multi-Species Finfish Fishery Management Plan:

Peter Colosi, Northeast Regional Office, NMFS.

Joel MacDonald, Northeast Regional Counsel, NOAA

Dr. Michael Sissenwine, Dr. Wendy Gabriel, Dr. Steve Murawski, Dr. William Overholtz, Joan Palmer, and other staff of the Northeast Fisheries Center, NMFS.

Editorial and production assistance was provided by Laurie Gronski and Marjorie Rose of the Council staff.

§9.2 Distribution List

A. Federal Agencies

U.S. Environmental Protection Agency (Regions I, II, III)
Department of State
U.S. Coast Guard
Department of Interior
- Bureau of Land Management
- Fish and Wildlife Service
- Bureau of Indian Affairs

Department of Commerce
- NOAA, Office of Coastal Zone Management

U.S. Army Corps of Engineers
Marine Mammal Commission
Mid-Atlantic Fishery Management Council
South Atlantic Fishery Management Council
Atlantic States Marine Fisheries Commission

B. State Agencies

Maine Department of Marine Resources
Maine State Planning Office (Maine Coastal Program)
New Hampshire Dept. of Fish and Game
Massachusetts Division of Marine Fisheries
Massachusetts Office of Coastal Zone Management
Rhode Island Dept. of Environmental Management - Div. of Marine Fisheries
Rhode Island Statewide Planning Program
Connecticut Dept. of Environmental Protection
New York Division of Marine and Coastal Resources
New Jersey Division of Fish, Game and Shellfisheries
Pennsylvania Fish Commission
Maryland Department of Natural Resources
Virginia Marine Resources Commission
Delaware Division of Fish and Wildlife
North Carolina Division of Commercial and Sport Fisheries

§9.3 Response to Public Comments Received

The Council received comments on the proposed Fishery Management Plan for the Northeast Multi-Species Fishery at three sets of public hearings held in August 1984, February 1985, and April 1985. Although comments on the draft EIS accompanying this FMP were only solicited at the April hearings, the Council has nonetheless responded herein to all written comments received. The format that has been followed in this section is to provide responses, both general and specific, to the various comments. Recognizing that there was extensive repetition of concerns and observations across those comments, the numbering that is associated with each of the responses can be cross referenced back to the specific written comments which follow.

General Categories

1. Minimum Fish Size

The basic measures which will enable the plan to achieve its objectives are the minimum fish size regulations. In order to enforce these regulations, the same minimum size for any species must exist throughout its range. Unfortunately, because fish of the same species may mature at different sizes throughout their range, minimum fish size regulations often represent a compromise among the biological and economic objectives of different regions. Through the public hearing process, the Council has arrived at the minimum fish sizes which it believes are the best compromise between biological and economic considerations for a number of species. This is particularly true for winter flounder, summer flounder and yellowtail flounder.

The plan includes a different timetable for increasing the minimum size for recreationally caught cod and haddock and an allowance of two undersized fish per recreational fishermen for several reasons. (1) The minimum sizes for recreationally caught cod and haddock are currently less than the commercial minimum size. If recreational fishermen faced the same minimum size increases as the commercial fishermen, they would lose a much greater proportion of their catch. (2) Recreational fishing mortality is much less than commercial fishing mortality. (3) Recreational fishermen have much less control over the size of fish they catch than do commercial fishermen. (4) The allowance of two undersized fish per fishermen recognizes the fact that it is very difficult to enforce minimum sizes on the recreational fishermen and that most recreational fishermen do not catch more than two fish per trip.

2. Mesh Size

The mesh size regulations contained in the plan are intended to reduce the at-sea discard of juvenile fish. They are not a substitute for the minimum size measures but were designed to make the minimum size regulations more effective. Even if they are difficult to enforce, they are valuable in setting a guideline for fishermen to allow adequate escapement of juvenile fish.

The correspondence between fish size and mesh regulations will never be perfect because nets, especially trawl nets, do not have "knife edge" fish retention characteristics. In other words, even the optimum size mesh will catch many fish that are smaller than the minimum size in order to efficiently catch fish larger than the minimum size. In a multi-species fishery this problem is compounded by the number of different species that must be considered in setting appropriate sizes for both the net and the fish.

Together with fisheries scientists from the Northeast Fisheries Center, the Council has determined that a six inch minimum size for diamond shaped cod-end mesh (or equivalent measures) would meet its objectives for the cod, haddock and yellowtail stocks on Georges Bank. If it can be adequately determined that a square mesh cod end of a smaller size provides for the same level of escapement for juvenile haddock as the existing diamond mesh size, and is consistent with the overall objective of the FMP, then the Council will allow the smaller square mesh cod end to be used.

Recognizing that many fishermen will face great difficulty in making the change to a larger mesh size because they will suffer intitial decreases in landings and revenues, the Council has decided to phase-in any increases in these measures over several years.

The Council has decided that it would be inappropriate to establish minimum mesh sizes for small mesh species because, with the exception of redfish, there is insufficient evidence that such measures are needed to protect these species. It is too difficult to determine or enforce an optimum mesh size for these species, because the exempted fisheries regulations should adequately prevent the catch of a large amount of regulated species and because such regulations would impose inefficiencies on the fishing industry.

3. Regulations and Enforcement

The plan includes a new permit system which requires all commercial fishermen to annually renew their permits for operating in the multi-species fishery. The penalty schedule has been substantially revised and penalties have been increased to include higher fines, the revocation of fishing permits and the seizure of vessels in some instances. Under existing and proposed regulations, both the captain and the owner of a vessel are responsible for any fishing violation. In addition, the Council, in cooperation with the National Marine Fisheries Service and the Coast Guard, is working to improve enforcement programs for current and future fishing regulations.

4. Measures Concerning Gear, Gear Marking and Gear Conflicts

The Council's policy is to impose the least possible amount of regulatory interference in the fishery. Only gear regulations which have demonstrable biological impact have been considered in order to meet biological objectives. Gear regulations whose main purpose is to resolve conflicts have been considered in a different light. The Council has intentionally rejected gear restrictions which severely limit any individual group's access to the fishery, which arbitrarily lessen the efficiency of any fishing method or which do not adequately solve conflicts between different groups of fishermen.

The Council considered the possiblity of requiring gillnet fishermen to continually tend their gear in response to assertions from recreational fishermen that this measure would reduce gear conflicts and minimize wasteful fishing mortality caused by lost or infrequently tended gillnets. The Council ultimately decided against this measure for a number of reasons.

First, there is no clear conservation-related reason why gillnetters alone should reduce their fishing effort because gillnetters alone do not catch enough cod and haddock to account for the low abundance of these species. Therefore the only basis for requiring gillnetters to reduce their fishing effort would be to resolve the conflict between gillnetters and recreational fishermen over access to certain fishing grounds.

Second, the Council learned that it was impossible for a large number of gillnet fishermen to tend their gear, because their vessels are not physically capable of carrying both the fishing gear and the amount of catch necessary for profitable operation. Fishermen from many of the smaller gillnet vessels convincingly explained that such a measure would force them out of business.

Third, the Council views the conflict between gillnetters and party and charter boat operators as stemming from intense competition for limited productive fishing areas and recognizes that allocating fishing bottom is the most practical solution in the event that non-regulatory efforts fail to resolve the conflict. The Council has initiated and is sponsoring a major effort involving party and charter boat representatives and the New England Gillnetter's Association to seek a non-regulatory solution to the conflict. At present, a Council imposed allocation of fishing privileges would be inconsistent with its stated policy for managing the multi-species fishery.

Finally, there is no statistical evidence to indicate that the level of mortality caused by lost or infrequently tended gillnets is excessive in comparison with mortality caused be other fishing gear. Preliminary findings from a major gillnet study by the research vessels Seward Johnson and the Johnson Sea Link do not indicate that fishing by "ghost gillnets" is a serious problem in the the Gulf of Maine.

Certain gear marking requirements, such as the gillnet marking regulations, which do not impose a high cost on any single group, and for which there is an industry consensus, are contained in the plan.

5. Technical Monitoring Group

The technical monitoring group is designed to provide timely scientific and technical information directly to the Council for the purpose of evaluating the effectiveness of the plan. Before the Council implements any changes, whether or not they originate from the recommendations of the Technical Monitoring Group, it will consult industry advisors and the affected public. This process should provide the commercial fishing industry with ample opportunity for input at the Council, committee and advisory level, as well as at public hearings.

6. Data Reporting and Analysis Requirements

The plan makes many recommendations for improving data from the multi-species fisheries. The recommendations include: (1) the improvement of the existing three-tier data system by expanding the NMFS weigh-out landings data collection system in Connecticut and New York; (2) the collection of information about the number of crew members on each trip; (3) the asssembly of fishing trip interview data in a consistent manner and its distribution to the Council on a regular basis; (4) the retention of vessel identification numbers along with a vessels landings data on a strictly voluntary and confidential basis; (5) the continuation of a NMFS program to collect vessel cost data; (6) the improvement of production and financial models of the fisheries; (7) the standardization of fishing effort data in order to quantify changes and identify trends in fishing effort by different gear types and size classes; and (8) the development of market models which include the international economy in order to broaden the understanding of market interdependence of fishery products under management.

Other information which is needed includes better socio-cultural information on New England ports, information about the socio-economic impact of the FMP, information about the effects of certain activities on fish habitats, and comprehensive information about the economic importance of recreational fishing in New England.

7. Best Available Data

The plan has made use of the most up-to-date data available. As a result, some parts of the plan may contain more recent information than other parts.

8. Management of Yellowtail Flounder

The Council selected the measures for managing yellowtail flounder in order to meet the objectives for the yellowtail stocks and to be as responsive as possible to the needs of the fishermen, as described by their comments in many public meetings held during the last two years. The result of this process is that there are different management measures for yellowtail in each of the three major fishing areas (Georges Bank, the Gulf of Maine and Southern New England).

Mesh regulations are more appropriate for yellowtail flounder on Georges Bank and in the Gulf of Maine than for Southern New England yellowtail because the complex of species in the Gulf and on the Bank (typically large roundfish and flatfish of commercial importance) lends itself more appropriately to large mesh management. In Southern New England, however, the lack of haddock, the small amount of cod and the dependence on small mesh fisheries makes broad-based mesh management inappropriate. For the Georges Bank yellowtail stock the Council decided to implement a phased-in six mesh requirement, and for the Southern New England stock, a closed area to provide protection for spawning yellowtail and reduce fishing mortality. Because the closed area measure was designed to achieve the Council's objective for the whole Southern New England stock, it is not appropriate to geographically expand the closure area.

9. Experimental Whiting Fishery

In the FMP the Council has provided for experimental fishing under the supervision of the Regional Director, which could permit an experimental fishery for whiting on Cultivator Shoal. The rationale for allowing experimental fishing to take place is to provide fishermen with an opportunity to catch small mesh species such as whiting where it is abundant in the large mesh area. Without careful monitoring, these fishermen might have the incentive to catch regulated species with whiting nets. In recommending that experimental fishing be allowed, the Council recognizes that there are a lot of operational details that must still be worked out on an experimental basis and that cannot be adequately accounted for in advance. The Council has therefore decided that it is sufficient to describe the general purpose and nature of such a program. It expects that, in cooperation with the National Marine Fisheries Service, it can work out the operational details in a satisfactory fashion in the future.

Other Comments

10. Figure 3.6A indicates that most yellowtail caught in Southern New England and on Georges Bank are caught in a directed fishery for yellowtail.

11. Figure 5.4 is based on the latest available assessment information and indicates that only Georges Bank cod is above the long-term median level. All other stocks, including yellowtail, are substantially below their median level.

12. The catch of regulated species was limited to 10% of the total catch instead of 10% of the catch of only exempted species. The reason for the choice of this less restrictive measure was to allow fishermen to earn more revenue from the bycatch of regulated species and have more flexibility in determining their mix of catch. Because of other seasonal and geographic restrictions on the exempted fisheries, the Council does not believe that allowing this type of flexibility will cause a substantial amount of undersized fish of the regulated species to be caught with small mesh nets.

13. The Council decided on the timetable for the mesh size measures on Georges Bank after much debate and consultation with the fishing industry. Although, the Council would ideally like to implement these measures as soon as possible and with perfect compliance from the fishing industry, it recognizes that this is an unrealistic expectation. The Council has heeded the advice of fishing industry representatives that compliance with existing regulations is poor and needs improvement before more restrictive measures are adopted. The Council is also aware that many fishermen could not survive the sudden decrease in revenues that would be caused by an immediate implementation of the proposed mesh size measures on Georges Bank. The phased-in implementation will additionally provide an opportunity to coordinate bilateral management efforts for key Georges Bank stocks.

14. The annual renewal requirement for multi-species permits will not only provide a more accurate estimate of the number of active fishermen but will also reduce administrative costs and paperwork by reducing the number of notices must be sent to permit holders. There are currently thousands of permit holders that are not actively fishing but which must be notified every time there is a change in fishing regulations.

15. The management unit now reflects what was agreed upon between the New England and Mid-Atlantic Councils.

16. The reporting period for fishermen participating in the exempted fisheries is the lesser of 30 days or the length of time they are fishing for exempted species. The exempted fishery reporting regulations do not require fishermen to submit information on their catch from each fishing trip; however, they will be required to maintain their own dealer verified records

for each trip. They may be requested to provide this information to substantiate the more aggregated information they provide the National Marine Fisheries Service on the exempted fisheries reporting form.

17. The plan does not make any recommendations with respect to the National Marine Fisheries Service's Fishery Obligation Loan Guarantee Program or the Capital Construction Fund.

18. The plan does not accommodate the needs of any individual group over any other. All groups affected are represented in an advisory capacity to the Groundfish Committee. While it may be true that longline vessels do not disrupt spawning fish, longline gear will catch fish capable of spawning and the Council believes that allowing longliners into spawning areas would make it very difficult to get other fishermen to agree to extending the duration of the closed spawning areas as a management measure. At a time when the groundfish industry is undergoing many economic problems, and when the Council is having difficulty in getting fishermen to agree on and comply with management measures to reduce fishing mortality, allowing longline vessels, all of which are new to the New England fishing industry, to fish in spawning areas would create such a perception of unfairness, that the Council would lose the willingness of the other fishermen to comply with the management program in general.

19. The redfish area was designed so that fishermen would have a limited opportunity to catch redfish in the most efficient manner and with as little bycatch of the regulated species as possible. Industry advisors have told the Council that using mesh size to control the size of redfish is very difficult because small redfish are so easily emeshed in all but small mesh nets. Given the recent low catches of redfish, the seasonal limitation on the proposed directed fishery for redfish will be more restrictive than the 3500 ton quota.

A minimum mesh size of 4 inches for redfish would create inefficiencies in the harvest of redfish, would not provide adequate protection for juvenile redfish and would increase the catch of juvenile fish of the regulated species.

20. The Council does not have the authority to do anything about this issue.

21. The Council does not have the authority to compensate fishermen for the impacts of its management measures. However, it has carefully considered the management measures proposed in this plan and believes that they will benefit the whole of the fishing industry in the long run.

22. The spawning areas on Georges Bank will close on February 1.

23. In the public hearings held during August 1984, the majority of fishermen opposed any major expansion of closed areas for Georges Bank. In Southern New England, most fishermen preferred having a closed area to protect yellowtail to having mesh regulations and exempted fisheries.

24. The issue raised by this comment is more pertinent to species managed under a fishery management plan other than this one.

25. Closed area boundaries follow LORAN lines where possible. In cases where the boundaries have been established for some time, the Council has been reluctant to change them for fear of causing unnecessary confusion at a time when many other regulations will be changed. However, the Council will continue to consider these type of comments for possible future modifications to the FMP.

26. Although the plan contains an analysis of the World Court's Canadian boundary decision, it did not include an analysis of how fishing effort will be displaced by the the new boundary because models to predict shifts in fishing effort are not available. In the absence of information on displaced effort, the economic impact data is still useful in helping to evaluate the relative merits of the different management alternatives. Part of the reason the increased mesh size for Georges Bank is being phased-in over several years is to avoid compounding problems caused by the boundary decision.

27. In the past, quotas for major commercial species (cod, haddock and yellowtail flounder) were very difficult to enforce. The only species in the plan which now has a quota is redfish and this quota is a secondary measure which will probably not be triggered to limit the amount of redfish caught.

28. The allegation that the Multi-Species FMP fails to achieve the National Standards by not providing the basis for a regulatory solution to the gillnet/recreational access conflict is unfounded. There are few user group issues which have been more difficult and can rival this issue in terms of Council, Committee and staff efforts to seek an effective and acceptable resolution. Intense competition for limited fishing space and fish, which often leads to conflict, is not unique to the groundfish fishery nor to the New England region. Such competition and conflicts have been in existence for centuries and currently face management agencies throughout this Nation.

The Council is aware that the conflict between primarily commercial party and charter boats and commercial gillnet fishermen over access to prime hard fishing bottom could be technically resolved through several measures including a direct recreational allocation of fishing bottom. Such a resolution would require major modification to the Council's policy not to directly (actively) allocate either resource or ocean bottom to competing user groups. The management measures contained in the FMP were developed to achieve primarily biological objectives and they neither have economic allocation as their sole purpose nor do they discriminate between residents of different states. A number of potential measures have been carefully analyzed and could be implemented should a majority of Council members believe that failure to do so would result in unacceptable impacts on the recreational fishery.

Currently, the Council acknowledges that the presence of gillnets on commonly used fishing grounds creates an inconvenience to party boat operators and recreational fishermen and can result in lost recreational fishing gear and time. The Council is not aware of any data which would indicate a reduction in the number of anglers utilizing party or charter boats or other substantial loss of revenue resulting from occasional conflicts with gillnet gear. (The Council is assisting both user groups to develop a system for the return of recreational jigs fouled in gillnet gear.) Direct observation of fishing grounds used by both fishing groups during the spring season did not indicate a situation where recreational opportunities are substantively precluded due to the presence of gillnet gear. The Council understands the physical incompatibility of recreational angling in a drifting mode in the immediate area of fixed gillnet gear. In the Council's judgement however, fishing areas are available even at the peak of the inshore season.

Because the Council is purposefully not supporting direct allocation of resources in this FMP, the particular solution to the gillnet/recreational access conflict of allocating resource <u>areas</u> is not appropriate at this time. Instead, the Council has initiated and is sponsoring meetings between party and charter boat representatives and the New England Gillnetter's Association to find a non-regulatory solution to the conflict. There are no objectives within the plan to support allocation of fishing privileges to any users. Free market forces, open competition, fishing skills, efficiency, and resourcefulness will determine user group shares.

29. Any language referring to the application of the fish size regulations and license requirements throughout the range of a species is not intended to imply that the Council is preempting the states' authority to manage fisheries in the territorial sea or inland waters, but instead describes the general purpose of this measure. The responsibilities of fishermen who have a federal permit and catch regulated species in either state and federal waters are explained in detail in the regulations.

30. By trying to protect fish stocks against possible stock collapse, enhancing spawning stock biomass per recruit and by increasing yield per recruit, this plan does take into account the economic condition of the fishing industry. The plan recognizes that the major stocks of cod, haddock and flounder are subject to very intensive fishing pressure and that steps must be taken to ensure adequate spawning potential for these species. Unfortunately, it is nature of the fisheries management process that such measures are usually needed when the fishing industry is in poor economic condition. Because the Council is aware that many fishermen could not survive the sudden decrease in revenues that would be caused by an immediate increase in the minimum mesh size to 6 inches, it has decided to delay the implementation of the mesh size increase until after the second year the plan is implemented. However, if no steps were taken ensure adequate spawning potential for these species, the condition of these stocks will probably not only fail to improve, but will worsen. Ultimately, the well-being whole fishing industry including wholesalers and marine equipment manufacturers depends on the condition of the major fish stocks.

New York State Department of Environmental Conservation
Division of Marine Resources
Bldg. 40, SUNY
Stony Brook, New York 11794

Henry G. Williams
Commissioner

22 April 1985

Mr. Douglas G. Marshall
New England Fishery Management Council
Suntang Office Park
Route 1
Saugus, Massachusetts 01906

Dear Doug:

I am writing on behalf of the New York State Division of Marine Resources to comment on the full Draft Fishery Management Plan for the Northeast Multi-Species Fishery. Please include this information as a part of the official record. We have waited until this time to comment on the Draft FMP since we were aware of many points which were not included in the February 1985 public hearing draft which we knew your Council was considering and which we felt needed comment.

First, I should like to express our appreciation for the New England Council's willingness to try to work together to improve this FMP and solve problems of mutual concern. We are pleased to see the removal of a size limit requirement on the recreational catches of winter flounder. This was of real concern to New York as we expressed at the previous hearing. We are also pleased to see that you have designed the regulatory amendment process to ensure that public hearings will be held along with Mid-Atlantic Council concurrence.

As for the new recommendations of your Council's Oversight Committee, we would like to indicate to the New England Council that we beleive most of these are in the best interest of a workable management plan. We support the removal of managment of the hakes from this FMP, thus allowing them to continue under the existing PMP for the time being. The hakes are becoming such an important issue that we really must take the time to look at them separately. We also strongly support the new recommendation for the Southern New England/Mid-Atlantic area west of 69°40'W. As was expressed to you in my letter of April 15, 1985, we believed that in working together with the fishermen, we could come up with a workable management regime for this area. The motion passed by your committee on April 18, 1985, does just that in our opinion. The closed area concept proposed and adopted by the Demersal Finfish Oversight Committee from 69°40'W to 72°20'W, meets all the desires of those involved and because with the division of this area at 71°30'W, we have the support of the fishermen concerned, it stands the best chance of being workable. It also makes enforcement much easier and removes all the complex problems which have been recognized for the exempted fishery previously proposed for this area. Along with this recommendation, we support the recommendation of your committee to now have the Monitoring Group evaluate the effectiveness of the 5½" minimum mesh size in the Georges Bank and South area before going to 6" mesh. We believe that the alternative of the Group's being able to propose equivalent alternative measures if the mesh size is not working, will make the entire plan much stronger in the long run. Finally, as also stated in my April 15 letter, we agree that the retention of the vessel identification numbers in the data file is necessary.

Please recognize that we realize all of the above is predicated on the Council accepting the Committee's recommendation. Were this not to occur, we would be back to an exempted fishing area south of 41°35'N and west of 69°40'W. If this does occur, winter flounder needs to be excluded from the regulated species list for calculating the 10% exemption in the northern area throughout the year. In addition, for the March 15 to January 15 time period, it should be 10% of landings of all species excluding winter flounder. I would like to point out again, however, that the new closure proposed for the area is far superior to the exempted fishery option.

Finally, concerning the minimum fish sizes, it is our policy to not allow retention of undersized fish in New York's marine waters. We believe the minimum sizes selected for cod and haddock are appropriate for the entire fishery and were based on reasonable data. The allowance of retention of undersized fish by recreational fishermen could defeat the purpose of the size limit and we are opposed to it. In addition, for enforcement purposes it is best just to set the limit and use it since it must have originally been arrived
1 at for management.

I am very concerned how the final regulations will be structured to cover your intent that no fish taken subject to this FMP that are smaller than the prevailing commercial size limit may be sold. We must allow for fish which can be lawfully harvested in State waters to continue to be harvested and sold.

We do not believe it is appropriate at this time, to comment on the proposed rule since it cannot yet reflect the actual plan which your Council has yet to finalize. The draft of April 18, 1985, does have some changes which are beneficial. The definition of multi-species finfish is now an appropriate one. The description of vessel permits in section 651-4 makes things much clearer as to your intent. Lastly, the description of the regulatory amendment process clarifies many earlier concerns.

We hope your Council will endorse the recent actions of the Demersal

Mr. Douglas G. Marshall 22 April 1985

Oversight Committee because it appears to us that, with these changes, this plan is now ready for submission to the Secretary.

Sincerely,

Gordon

Gordon C. Colvin
Director
Division of Marine Resources

GCC/pj

April 18, 1985

New England Fisheries Management Council
Sontaug Office Park
5 Broadway (Route 1)
Saugus, Mass. 01906

Gentlemen:

I read with difficulty the Draft Fishery Management Plan, [illegible] and E.I.S. for Northeast Multi Species Fishery prepared February, 1985 by N.E.F.M.C. and wish to submit to council the following comments regarding said plan and portions therein.

First, my qualifications for commenting on the plan. I am a graduate Industrial (Management) Engineer with significant course work and experience in statistics. Second, I have written planning schemes such as proposed for industrial projects and know of the difficulty involved (and the types of inconsistencies which can creep into studies of this nature). And third, I have worked as a deckhand on large offshore trawlers in at least one of the fisheries considered for regulation under the plan and came very close to purchasing one of the "Jackson Seafood" fleet of DECO style trawlers recently for sale.

As a deckhand my intimate knowledge of various bottoms, etc. is limited. As a management engineer my ability to spot inconsistencies in data is much more refined. I will attempt to limit my comments, where possible, to the Georges Bank Yellowtail Fishery, as a complete review of all species is beyond the scope of time available for plan scrutiny.

I agree with the council's management policy (p.1.3) most wholeheartedly if followed in its entirety. It should provide a workable plan with minimum pain for all concerned.

Particular emphasis should be paid to council's policy of using the best
7 data available. 1982 data seemed to have been used for part of the draft, 1983 for some other parts, when neither was accurate for the present or even presents the same general picture. From data presented one would assume cod stocks are in great condition yet my personal opinion is that MSY was exceeded in late 1984 and will continue.

26 Nowhere within the plan did I notice the simulation or even the mention of effort displacement due to world court decision or due to F.M.P. for N.E. Multi Species Fishery.

Discussions with former crewmates and owners indicate their feelings that due to two topics mentioned above, effort will be displaced from the Golf of Maine Georges Bank to Southern New England Northern Mid-Atlantic regions.

This factor alone makes the proposed economic impact data meaningless for the various ports listed. My guess is that the more northern the port, the greater the loss to shore-based value added industries while there will be greater growth to the south.

8 The lack of a specific plan of attack for management of yellowtailed flounder south of the 43,500 line is of particular significance to the success or failure of the Yellowtail plan and council's expressed policy (p. 1.3, item 3a, 1b) (p. 4.2). With there being little movement of GB/SNE yellowtail stocks (p. 2.61) and no mesh size limit in effect south of 43,500, these stocks are sitting ducks (for a short time) for 5" or 4½" mesh. When the increased retention factor takes its toll (p. 5.31) the fishery becomes totally dependent upon recruitment of a reduced juvenile population (due to discards, retention curve, tec.) and "scratch that fishery." ?

With F exceeding F max (p. 2.28) for yellowtail in SNE, protection must be given to SNE/MA yellowtail stocks. In this area I feel the proposed plan is deficient and needs work for redefinition of objectives to meet stated policy. Furthermore, it does not even address economic effects of effort displacement in relationship to stock mortality.

10 I take exception to data (p.3.8) that approximately 47% of yellowtail from GB/SNE is by-catch. The catch in large volume yellowtail ports (New Bedford, Pt. Judith, Newport), shows it to be of such magnitude that it cannot be by-catch and these ports represent 20,000 tons plus of total 27,182 catch. Any philosophy/conclusion based on this by-catch notion should be seriously questioned by council.

7 The graphs of port landings (p. 3.12 - 3.14) do not do justice to council's lofty goal of <u>best</u> data to be used (p. 1.3, #2a).

3 No relevant discussion seems to be present on the effect of usurping states rights to regulate within the 3-mile limit of state territoriality and yet, the council expects states to cooperate more fully (than they now do) with N.E.C. on these regulations. Somehow, I feel that a potential loophole may exist within the State-Federal jurisdiction and smaller fish maybe taken if care is not fully excercised by N.E.C. in drafting <u>exact</u> regulations.

11 The Chart 5.4 is perhaps the most misleading I have seen in some time. From it one could infer that YT/GB (1982?) stocks are in fair shape, yet true data from log scale shows current biomass to be less than 10% of median, perhaps 1% of 1964 peak. Does graph need AXES relabelled?

8 Page 7.33 shows YT/GB yield to increase under any management scheme, with significant discard potential in future. Is it feasible to go with large mesh, keep 11½" YT, to reduce waste of usable fish (dead anyway)?

2 The discussion of square versus diamond mesh is a very logical piece. I question the allowance of square mesh, the same size as diamond. The retention factor for smaller yellowtail will be greater, decreasing escapement and forcing more discard of pre-recruits, and in essence, allowing a more deadly net. I believe the council should specifically address the square versus diamond mesh issue with all relevant facts and effects before including both under one blanket statement.

The discussion of impacts leave much unsaid. Who is going to enforce final regulation, under who's direction, with costs to be paid by whom? I would assume that the U.S. Coast Guard will be involved, along with the State Conservation departments. Who pays? Who runs the show?

5 The technical monitoring group (p. 7.83) seems to be something that the council has high hopes for. Obviously, I am biased, but I believe that when proposing regulations which effect the livlihood of thousands of people and deployment of many millions of dollars of capital assets that some voice should be given to those with most at stake. The council should give serious consideration to appointment of other than analysts and biologist (fishcrats) to this group.

In regard to enforcement of regulations, experience with previous plans should have made the council fully aware of the devices a person will go to make a living.

Call me a strict "constructionist" if you will, but I believe that if you break the law (regulation) and get caught, the penalty should be so severe that you wish you had never thought about breaking the law.

In the case of the F.M.P. I believe that there can be two types of violations - accidental and purposeful. Accidental violations should not be free but should not unduly penalize the violator. Purposeful violations should create such risk that compliance becomes a given.

3 It is my feeling that the major violations will be mesh size. This is premeditated stealing from all others involved in the fishery and the penalty should reflect the potential gain. Using small mesh should result in a fine of at least twice the gross stock of the privious two documented trips. Repeated violations should be at least double the previous fine. I believe that a bond should be posted of at least twice the potential fine before an accused violator is allowed possession of vessel and re-entrance to regulated fishery.

Since the gains of a "big trip" can be substantial, using a small net really amounts to grand theft or grand larceny, a felony, which if convicted, "brings hard time in the slammer." Since we are dealing in civil court, make the penalties appropriately big.

I realize that fish size may be a subjective issue; it must be treated with care. Is 2% of the total catch (by number) of small fish a major violation? I am not sure but I know 10% is purposeful violation and should be subjected to penalties as previously noted.

I believe council should set limits (and appropriate penalties) on what constitutes a major or minor violation and "hang" major violators while not significantly hurting minor violators.

Agreements between State and Federal agencies and N.E.C. should be drawn up with published policies regarding enforcement factors and policies and reporting.

Yours truly,

William Miller

William Miller
2606 Jefferson Ave.
Claymont, Delaware 19703

MID-ATLANTIC FISHERY MANAGEMENT COUNCIL

ROOM 2115 FEDERAL BUILDING
300 SOUTH NEW STREET
DOVER, DELAWARE 19901-6790

TELEPHONE: 302-674-2331

ROBERT L. MARTIN
Chairman

RICKS E. SAVAGE
Vice Chairman

JOHN C. BRYSON, P.E.
Executive Director

12 March 1985

NEW ENGLAND REGIONAL FISHERY
RECEIVED
MAR 1 [illegible]
MANAGEMENT COUNCIL

Mr. Douglas G. Marshall, Executive Director
New England Fishery Management Council
Suntaug Office Park
5 Broadway (Route 1)
Saugus, MA 01906

RE: Multi-Species FMP

Dear Doug:

At its regular March 1985 meeting the Council passed a motion to:

a. accept the minimum fish size and minimum mesh size provisions of the hearing draft of the New England Multi-Species FMP with the following exceptions:

1 1. that the minimum length in the recreational fisheries should be the same as in the commercial fisheries, that is, in particular, that the cod and haddock minimum length should be 17" in year one and 19" in year two, and further, that there should be no allowance for possession of undersized fish in the recreational fishery;

23 2. that the regulated mesh area should be extended south to a new southern limit generally parallel to Loran 43500 and drawn so as to incorporate, essentially, the entire yellowtail fishery, and

13 3. that the Council express its opinion that it is important that the FMP be finalized with management measures sufficient to accomplish its objectives and conform to National Standards and be approved and implemented as soon as possible and recommends implementation of all measures necessary to insure expeditious FMP approval and implementation, including consideration of accelerating the phase-in of the proposed final management measures.

12 b. recommend that the exempted fisheries in the Southern New England area only include the specific species that are mentioned and regulated species can only come in at 10% of the exempted species caught, excluding winter flounder, and not 10% of the total species caught which would go back to the original list which is butterfish, dogfish, herring, mackerel, red hake, scup, squid, and whiting.

c. accept Item 4 as it appears in the hearing draft which reads "The closure period in Area 2 will be determined in consideration of Canadian management regulations."

d. accept Item 5 as its appears in the hearing draft which provides for further measures to be imposed by using the regulatory amendment process and public hearings being held.

e. recommend that reporting requirements in the FMP for the exempted
fishery be on a monthly or bimonthly basis, whichever is most suitable to
the fishermen and NMFS, but that each trip's catch be logged and reported
in this report and each trip, as a separate entity, is recorded in this
6 report.

f. endorse incorporation of retention of vessel identifiers in the
6 FMP in accordance with the continued support and cooperation between the
New England and Mid-Atlantic Councils on this issue.

g. endorse the concept of taking appropriate action in plan
development to insure that the list of participants in the fishery is
4 current but that measures be explored to minimize paperwork both on the
part of the fishermen and NMFS in meeting that objective.

h. maintain its previous position with respect to the composition of
5 the technical monitoring group which is there be two fishermen included.

i. recommend that, under Option 2, the exempted fishery for redfish
be that redfish be under the same conditions as any other exempted fishery
19 and that the regulation be limited to 10% of the redfish catch if Option 2
is allowed;

j. endorse the concept of the conduct of an experimental fishery on
Georges Bank provided that the concept be defined in much greater detail
than appears in Option 3 and that it include carefully constructed
experimental design with objectives that are related to the experimental
9 purpose only and with clearly defined time limits related to that design
with the expectation that it could lead to the development of an exempted
fishery proposal, if feasible, based on experimental results providing
consistent provisions with the other exempted fishery provisions of the
proposed FMP; and

k. recommend that the definition of multi-species finfish should read
15 as per the agreed upon management unit's specified species exemptions.

If you have any questions, please contact me.

Sincerely,

John

John C. Bryson

JCB/DRK

Atlantic Trawlers Management & Supply Inc.
P.O. Box 65 DTS
Portland, Maine 04112

February 22, 1985

New England Fishery Management Council
Suntaug Office Park
5 Broadway (Route 1)
Saugus, MA 01906

RECEIVED
FEB 2

Re: PROPOSED RULES

Dear Director Marshall,

I believe to make the proposed plan work, their should be some
provision in it to make the Skipper of each vessel responsible
for each violation. Their are a lot of vessels in the fisheries
today, where as the Skipper does not own the vessel. By fin-
3 ing the owner or taking the owner's permit does not make a
Skipper comply with the laws. I think you would find that the
bigest violators of the rules would be Skippers who do not have
a lot at risk by a violation. I think that if the Skipper shared
some of the risk you would see a lot more compliance with the law.

Their are a lot of ways in which this could be accomplished. Such as, spliting the fines between the owner and the captain. Also, the possibility of having the captain have to have a license permit. If the captain had a number of violations, he would lose his license and or permit to fish for a period of time. I feel this type of plan in one form or another would greatly enhance th compliance of all the rules, such as mesh regulators-liners-closed areas, ect.

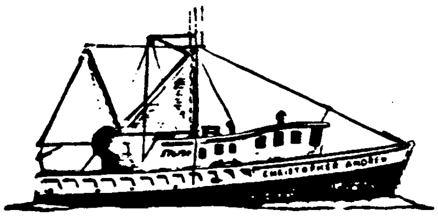
I feel in the past the owner has had most of the burden in the way of fines, and risk of vessel secures. I hope that in the future these may be shared with the Skipper, because once a vessel leaves the wharf the owner does not have that much control over the way the vessel operates.

Sincerely,

James A. Odlin

James A. Odlin

JAO/bh



BOAT KATHLEEN A. MIRARCHI, INC.
67 CREELMAN DRIVE
NORTH SCITUATE, MASSACHUSETTS 02060
(617) 545-3231
F.V. CHRISTOPHER ANDREW

2-17-85

MR Doug. Marshall
NERFMC

Doug: The enclosed letter was written prior to the ADF Public hearings. At the time when it was written I erroneously thought that you were still intending immediate imposition of 6" mesh. I was relieved to learn otherwise at the New Bedford hearing.

2 I am ~~still~~ sending my written comments as the points on enforcement and present levels of mesh compliance are still valid. Moreover I still believe we must bring the operative mesh size to something approximating the legal minimum and assess the results before proceeding with any major increases

Thanks,

Frank Mirarchi.

NEW ENGLAND REGIONAL COUNCIL

February 13, 1984

My name is Benjamin Chianciola the Captain of the fishing vessel Serafina II out of Gloucester, Mass. I'm a member of the Gloucester Fisheries Commission; I have also been an advisor to the Regional Fisheries Management Council. In the past couple of years I haven't attended any meetings of the Council because I find that I can't afford to lose a days fishing without adequate compensation; especially when one finds that most everyone else there is either backed by some company or organization, so they are able to wait until their particular subject comes up on the not necessarily in order agenda.

2 We are here tonight to discuss yet another mesh regulation plus closures. I remember a few years back we were told "Gentlemen we have to find a way to have escapement of 17" fish so as to have a first year spawning." We got nothing in return but we went along with the 5½" cod end. As you have seen with Mr. Parisi's presentation, Lost Initiary Not only 17" fish but also 19" fish pass through this size cod end therefore, I would assume that if a 17" fish is in it's first spawning then a 19" fish is going on it's 3rd spawning. If that mesh size didn't do any good and you the Council are recommending a 6" mesh how do we know we won't be back here again discussing a 7" mesh.

I believe part of the problem has been that the only thing the Council has considered is management. I believe that it is way past the time to give us something in return, you can't take all the time and not come up with something substantial to offset what we lose.

For many years before the 200 mile laws; vessels from this section would go wherever for whatever in order to get a trip of fish. We have lost the wherever because of the greediness of certain factions (some people even blame the State Dept. and mineral rights.)

9 For years our vessels would fish alongside of Canadians in each others water's, now it can't be done. I believe we should get this back even if it calls for permits. Another thing that should be done is to find a way to bring back the whiting industry as a means of diversifying. We used to do this before when other fish were scarce, or the prices were down.

20 A market for mackerel and herring and other species of fish should be exploited. The price of fuel should be compensated in some way because the larger the mesh the longer the trip. Don't just give us a promise make it something substantial, in most all negations there is usually a compromise. As I have mentioned at other meetings I don't believe that there are two ports with the same problems and fishing habits so, I don't see how you can set up a rule and expect it to apply to all, you more or less agree to this in your exception to mesh restrictions to the Rhode Island and southern areas. We also have here some of their same fishing efforts.

I still believe the best plan is a percentage rule such as the old Icnaff plan. I repeat you can't take all the time. You also have to give and before you enforce a 6" cod end. What are you going to give us?

Benjamin A Chianciola

Benjamin Chianciola
Captain

Gloucester Fisheries Association
POST OFFICE BOX 839
GLOUCESTER, MASSACHUSETTS 01930

February 13, 1985

TO THE ~~NEW ENGLAND~~ FISHERY MANAGEMENT COUNCIL

Dear Mr. Chairman and Councilors:

My name is Salvatore (Sam) Parisi, I am part owner of the stern trawler Boat Gloucesterman, Executive Director of the Gloucester Fisheries Association and the Cape Ann Vessels Association.

On February 24th, at your meeting at Kings Grant, I submitted to you a petition with 200 signatures, representing the fishing industry in Gloucester, opposing the change in the mesh size from 5½" to 6" mesh, and the closure of small mesh gear on George's Bank and Cultivator Shoal. including the Gulf of Maine.

The petition offered an alternative of 6" to 5½" mesh and the optional yield regarding Whiting Fisheries.

The Whiting Fisheries is very important to our vessels. If you close this fishery on George's Bank, you are putting <u>more</u> pressure on Haddock, Cod, and Flounder stocks.

If you prohibit boats to fish for whiting in this area, then they will be forced to fish for Groundfish during a time that they would be fishing for whiting. Therefore putting a greater strain on our Haddock, Cod and Flounder stocks. You would be defeating your original goal of conserving the groundfish speicies of fish. Because our boats will be fishing for Haddock, Cod and Flounder when they should be fishing for whiting.

The Whiting Fisheries on Georges Bank and Cultivator Shoals is a CLEAN FISHERIES. In the past 2 years our vessels have only caught 1% of Haddock, Cod and Flounder while fishing in these areas for Whiting. There has also been no discard of small fish while fishing in these areas.

To support our claim, I have attached boat slips from my boat Gloucesterman, when he was fishing for whiting in these areas during July and August.(see attached boat slips). As you can see in July the boat Gloucesterman landed 160,000 lbs of whiting and only 300 lbs of haddock, 2400 lbs. of cod and 3000 lbs. of mixed flounder. This amounts to less than 3% of the total catch and no discard of small fish.

In August we landed 200,000 lbs. of whiting, with only 100 lbs. haddock, 1900 lbs. cod and zero flounder. this amounted to only 1% of the total catch, with no discard of small fish.

Other vessels that fished in these areas landed about the same amount of groundfish as we did. A very small amount compared to the whiting that was caught.

I hope that you will now beable to understand that this is a clean fishery. Our boats would also be willing to have someone to oversee our whiting fishery, provided that they provide their own insurance.

I am confident that this council will make the right decision, by allowing our fishermen to make a living by allowing us to fish on George's Bank and Cultivator Shoals for whiting and not change the mesh size to 6", and at the same time conserve our Haddock, Cod and Flounder stocks.

Sincerely,

Sam Parisi

Salvatore (Sam) Parisi
Executive Director
Gloucester Fisheries Association
Cape Ann Vessels Association

CITY OF GLOUCESTER

GLOUCESTER · MASSACHUSETTS · 01930
Fisheries Commission

February 13, 1985

New England Fishery
Management Council
Suntaug Office Park
5 Broadway (Route 1)
Saugus, Massachusetts 01906

Council Members,

The Gloucester Fisheries Commission has been recorded in opposition to the proposed 6" cod-end mesh size and continues to be opposed to it.
2 We feel however, that a 5½" cod-end mesh size is more acceptable and wish to see the 5½" as an alternative.

The Commission also feels the Whiting Fishery on Cultivator Shoal be encouraged not prevented. The Whiting Fishery however minimal it
9 may seem, would take some fishing effort off the groundfish.

On the matter of the exempted fishery for Redfish, rather than the use of a 3" mesh size, we recommend a 4" mesh size. We feel the 4" size
19 would give better selectivity to the Redfish size and eliminate the taking of Pinheads. We also object to the 3500 metric ton quota.

Inevitably, any plan is only as good as its strength of enforcement, so we feel that stricter enforcement is absolutely necessary to accom-
3 plish these goals.

Respectfully,

Francis Lewis

Francis Lewis
Chairman

February 13, 1985

Mr. Doug Marshall, Executive Director
New England Regional Fishery Management Council
Suntaug Office Park
5 Broadway
Saugus, MA 01906

Dear Mr. Marshall,

My purpose in writing is to comment on the proposed Atlantic Demersal Finfish FMP. I am submitting my comments in writing as I may be unable to attend the forthcoming public hearings on this plan.

For the purpose of inclusion in the record I am submitting the following biographical data: My name is Frank Mirarchi. I live at 67 Creelman Drive, North Scituate, MA 02060. I am 41 years old and have been a full time commercial fisherman for twenty years. Presently, I own and operate the Christopher Andrew, a 62 foot dragger, from Scituate, Mass.

Over the years I have been actively involved in cooperative work with both state and federal fisheries agencies. In 1978 I participated in mesh selectivity trials sponsored by NMFS. In 1982 I worked with the Mass. Division of Marine Fisheries on an investigation of square mesh netting.

I have been a member of the Mass. Marine Fisheries Advisory Commission since 1978. I presently serve as president of the Mass. Inshore Draggermen's Association and the Scituate Commercial Fishermen's Association.

My comments in this letter are in no way intended to represent positions of any of these groups. These comments reflect only my personal opinion.

Since the inception of federal fishery management in 1977, I have frequently spoken on the public record as being in favor of operational controls, as characterized by the proposed A.D.F. measures. I did, and still do, feel that catch and effort controls are inappropriate to a multi species fishery. On that basis I fully endorse the philosophy underlying the proposed A.D.F. plan.

2 However, I disagree with the plan's intent to immediately implement a six inch minimum cod end mesh size. I take this position for the following reasons:

As you are aware the 'interim' groundfish plan, which has been in effect since 1982, is based on three management measures; minimum fish size, minimum mesh size and time-area closures. In my opinion this plan has failed to protect groundfish stocks. I believe this plan has failed due

Mr. Doug Marshall, Executive Director
New England Regional Fishery Management Council
Page 2
February 13, 1985

to at least two fundamental deficiencies: 1) The plan addresses only three species, and 2) The plan has been so poorly enforced that a virtual open fishery prevails today.

I am aware that A.D.F. encompasses more species and I am confident that this change will improve control over the fishery. Unfortunately, I have no confidence that enforcement will improve under the new plan.

3 Since 1977 I have spent an estimated 1,600 days at sea. During those days I have been boarded exactly twice for purposes of fishery enforcement. One boarding was by the Coast Guard, the other by the Massachusetts Division of Natural Resources Law Enforcement. I have never been inspected at dockside for compliance with any fishery law except for those pertaining to lobsters. Other fishermen report similar low levels of enforcement activity. In view of the widely expressed concern over non-compliance with fishery law I consider these observed levels of enforcement to be totally inadequate.

One result of this lax enforcement has been a steady decline in cod end mesh size. Faced with keen competition from their neighbors and diminishing fish sizes, many fishermen, who often wish they could do otherwise, are being forced to reduce their mesh size.

2 I am concerned that an immediate increase from 5 1/2 inches to 6 inches minimum mesh size will only serve to exacerbate disrespect for management authority while leading to even higher levels of non-compliance.

I question the need for an immediate increase in mesh size. In my opinion there is a serious flaw in your analysis of how mesh selection relates to present day levels of fish mortality. In Section 5.7 (page 5.41) of the A.D.F. draft dated December 4, 1984, there is frequent reference to an assumption that today's operative mesh size is 5 1/8 inches. I believe that this assessment is inaccurate and highly optimistic.

Due to the fact that most illegal meshes are deployed in the form of "liners," consideration must be made for the masking effect of multiple layers of netting. Moreover, substantial activity is taking place as an inappropriate application of the optional settlement program using meshes in the 2 1/2 inch to 3 1/2 inch range. Considering these points it is my guess that the operative mesh ranges from 4" to 4 1/2" rather than 5 1/8 inches.

Full compliance with 5 1/2 inch mesh should, in fact, bring about a 1 inch increase in the operative mesh size. This corresponds to an approximately 2 1/2 inch increase in the 50 percent retention length of most fish.

Mr. Doug Marshall, Executive Director
New England Regional Fishery Management Council
Page 3
February 13, 1985

On the other hand, due to the reduced average size of most groundfish today, an immediate change to 6 inch mesh will increase the 50 percent retention length of most species, particularly flatfish, to the point where the majority of marketable fish will escape. This situation will not be tolerated by fishermen. It will serve to fortify the notion that "the government knows nothing about management" and will lead to higher levels of non- compliance than we now have.

The majority of fishermen today acknowledge that fish stocks are in bad shape. They want to see the imposition of meaningful and effective conservation measures that will allow stocks to rebuild. However, they cannot compete on an uphill playing field which unenforced or unenforceable regulations grant to the scofflaws.

I urge you to direct your efforts toward bringing the effective mesh size to 5 1/2 inches as quickly as possible. Once widespread compliance is achieved you will be in a much better position to assess the need for additional increases in mesh size or the imposition of any additional measures.

I appreciate your consideration in this matter.

Sincerely,

Frank Mirarchi

Frank Mirarchi

cc Mr. Phil Coates

Dear Sir

I did not attend the hearing the other night in New Bedford, but I would like give my view on the matter. First of all conservation has got to be a national effort to succeed otherwise we are defeating the purpose. Mesh size and the size of fish have got to hand & hand with one or other. It is ridiculous to have fish and lobsters one size in one state and a diffent size in in the next. Thats not conservation That my friend is Politics. Anybody That understands mesh sizes knows very well that you cannot catch 200-230 count yellow Tail in a legal size cod end, yet very often you see this size fish on the Auction Board in New Bedford The fish dealer gets away scottfree while the boat gets penalize. Another case of 'Politics! I'm afraid this industry has reached the point of no return, unless something meanfull is not done very soon. I'm afraid were looking at a ghost town in New Bedford as far has the Fishing Industry is concernd. I give it 2 more years

As far has Tariff is concernd we should have had that years ago and not being Talking about it Today. There is enough tax dollars going into the treasury without some con lawyers trying to fatten their pocket books at the expense of a industry thats gasping for air. I think Mr. Kennedy and Mr Studd and any other Senators & Congressman on the East Coast better start getting their Act together before its too late.

FISHERMAN'S WHARF OF GLOUCESTER, INC.
Fresh Fish Packed At Sea - The Finest Kind
R 37 ROGERS STREET
GLOUCESTER, MASSACHUSETTS 01930
TELEPHONE 283-6190

January 23, 1985

Dear Sirs:

2 The Fisherman's Wharf Inc., it's Board of Directors, and it's stockholders wish to be recorded in opposition to the proposed 6" cod end plan.

9 We also request that the cultivator shoals whiting fishery not be included in the large mesh area, but be included in the optional settlement program.

Respectfully submitted,

Thomas Aiello

Thomas Aiello
Clerk

Your Comments:

$5\frac{1}{2}$ inch Cod-End are too large to make a living - 5 inch is plenty

Thomas Jordon owner + Captain of F.V. Ellen J.

Thomas F. Jordan
61 U.S. RTE #1
FALMOUTH ME. 04105

Your Comments:

The mesh regulations are not reasonable. Further study should be done on square mesh cod ends. It has been proven that square mesh has better escapement and maintains it throughout the tow. If the square mesh was
1 of a reasonable size, more fisherman would get off the optional plan which is generally abused. The square mesh allows good escapement of round fish and maintains a legal size flounder.

It is very easy to say 5½ or 6" cod ends, but it is very diffucult to buy one, or after you buy one, to keep it the right size. Most twines shrink or stretch.
3 Too many laws are unenforceable. The jails are full so lets come up with laws that we can make a living with..

Thank you for listening to my gripes.

Sincerely,

Captain Sebastian J. Frontiero
50R Witham Street
Gloucester, Ma. 01930

Name of boat — Cigar Joe II Inc.

Your Comments:

I am a Gloucester gillnetter who is responding in regards of the Enforcement of Fisheries Regulations. I personally feel that the F.M.B. is for conservation with which I agree.

Responding to the following:

4 Gear marking requirements:

Every boat that I know of in section 1 & 2 have their own buoy design. If all gillnet gear was of the international orange it would only cause more confusion to the recreational fishermen.

Gear conflicts:

Staying with gillnets continuously and at a minimum of 3,000 ft is completely out of the question. This has nothing to do with the conservation.

I agree with Robert Jones, " Were in the business to protect and conserve the fishery for the fishing industry.

Naomi Bruce III

Peter M. SHOARES
13 Highland St
Gloucester, MA
01930

Peter M. Shoares Capt.

Your Comments:

3 Some of these Questions miss the point. IF NMFS can get the Funds, then it should expand its enforcement both on shore and at sea. As for the state, they have enough problems enforcing state ~~regul~~ Regulations and probably would be unable to assist much with Federal Reg's. As for some of the proposals;

23 A closed area is probably much more effective than just a 6" mesh restriction mainly because it is so much easier to enforce. For me plan B would be the best. Plan A the boundaries of area I are too complicated and Plan C would meet too much opposition from off shore boats. Also on the seasons for Exempted species; The season for butterfish end about a month and a half too soon.

22 As for the spawning Areas, if they are not included in another Plan, the should definetly be closed on Feb 1st.

Thank You for the opportunity to comment.

Box 318
W. Chathom, MA
02669

Peter S. Horner
owner/operator F/V Foxy Lady II

MICHAEL POLISSON
F/V BLACK MAGIC
P.O. BOX 600
PIGEON COVE, MA 01966

Your Comments:

24 Shrimp mesh size should be increased to 2" to improve quality and therefore price to fishermen

2 Whiting nets should be regulated at 3" min. these nets also cause great mortality in regulated species by being fished long past the whiting season.

3 Increased law enforcement will surely curtail or greatly help in gear conflicts between lobstermen and draggers.

4 All offshore & inshore draggers lobsters should be tested from time to time with dye to catch those who brush eggers. (75% of all draggers)

I am owner operator of F/V Black Magic 648845 presently fishing Coastal lobster. Michael Polisson

Fred Bennett
54 Valley Rd
Chatham Ma
02633

Your Comments:

25 R.E Closed Areas - To avoid confusion closed areas should follow specific loran c lines. For instance westen side area 1 follow, 13690 line. To N+S use 43 lines.

Cod ends size - Suggest we go to square mesh cod ends size to be determined by NMFS

Gill nets should be no less than 6½" preferably 7" and should be attended from October thru April. I was a gillnetter for four years.

Black back size - raise to 13"

24 Determine a minimum size cod end for scup + seabass

Your Comments:

Mr. Marshall: I, for one, am behind any and all reasonable(?) efforts to bring back the ever increasingly scarce fish of our North East fisheries. I am writting this during a trip while fishing to the East and South of Cape Cod. In 24 hours we have put less than 1000 lbs. of mixed fish in the boat. 1 year ago we were doing 7,000 lbs. in 12 hours; I only hope you are not too late. In the limited time I have been a commercial fisherman (10 years) and of that time, a draggerman, (2 years) I've been shocked by the decline in 1st Haddock, then cod and now yellowtail and Black backs. We are fishing in August where we would otherwise be in December because there are simply no fish left in our traditional areas. Our average tow time is 5 hours. this fishery is but a shadow of its former self. I feel your regulations do not go far enough to do anything but band-aid cure unless you really show force in closure enforcement and Cod-end size, which should be of the SQUARE-MESH style to allow good and undamaged escapement.

I love this industry - I do not want to see it die for too many reasons to list here. I'll do anything I can to help*. (continued)

WILLIAM AMARY
ORLEANS, MA

#236926 F/V Joanne-A III
William Amaru
65 Uncle Israels Rd.
Orleans, Mass. 02653

Mr. Marshall:

There is one thing I would ask of you and the powers that be:

25 would it be possible to change the Western side of closed area I (Haddock Spawning Ground) from its present Lat-Long location to Loran C. line 13700? As is the closed zone very nearly parallels the 700 line and if it could be used it would be easier and faster to patrol and to fish. The change would effect an area of width less than 1,000 yds. average out of an area of some 50 miles in breadth average.

I encourage this modification because it simplifies both the enforcement and ability to obey a rule that is paramount to the recruitment aspect of the FMP.

The process by which we will rebuild our desimated fish stocks will be a long and difficult one. However if there is evidence that Management ideas and fishermans input directly effect one another, the process will be smoother and more likely to succeed.

Sincerely,

William H. Amaru
Captain-Owner
F/V. Joanne-A III

Your Comments:

IN MY AREA (MASS. COAST NORTH OF CAPE COD TO 25 MI OFFSHORE) MESH SIZE REGS. HAVE ~~NEVER~~ BEEN ENFORCED. CONSEQUENTLY ALMOST ALL BOATS ARE USING COD ENDS IN THE 4"-4 3/4" SIZE RANGE FOR GROUNDFISH. THE RESULT OF THIS PRACTICE IS THAT FISH SIZES HAVE DECLINED TO THE POINT WHERE A 5 1/2" OR GREATER MESH
2 REQUIREMENT WOULD SUBSTANTIALLY REDUCE FISHERMEN'S CATCHES. IF ENFORCEMENT HAD REQUIRED A GRADUAL (4 1/2" → 5 1/8" → 5 1/2") INCREASE IN MESH SIZE OVER THE YEARS WE WOULD NOT FACE THIS PROBLEM TODAY. MESH SIZE COMPLIANCE WILL BE A MAJOR OBSTACLE TO THE SUCCESS OF THE ADF PLAN.

MANY FISHERMEN ARE UNHAPPY ABOUT HAVING TO USE SMALL MESH ON GROUNDFISH SPECIES. HOWEVER THEY MUST DO IT TO STAY COMPETITIVE. IF STRICTER ENFORCEMENT WERE TO BRING
3 MOST FISHERMEN INTO COMPLIANCE. THE TIDE OF OPINION WOULD PROBABLY TURN AGAINST VIOLATORS. AS IT STANDS NOW WE ALL MUST VIOLATE MESH SIZE REGS. IN ORDER TO SURVIVE, IN THIS ATMOSPHERE REPORTS OF VIOLATIONS BY OTHER FISHERMEN SHOULD NOT BE EXPECTED

FRANK MIRARCHI
F.V. CHRISTOPHER ANDREW
67 CREELMAN DRIVE
N. SCITUATE MA 02060
(617) 545-3231

Shinnecock Marlin & Tuna Club, Inc.
P. O. BOX 9
HAMPTON BAYS, NEW YORK 11946

February 23, 1985

Mr. Douglas G. Marshall
Executive Director
New England Fishery Management Council
Suntaug Office Park
5 Broadway (Route 1)
Saugus, Massachusetts 01906

Dear Mr. Marshall:

We would like to make the following comments on the summary for public hearings of the Draft Northeast Multi-Species Fishery Management Plan and the Proposed Rule (50 CFR PART 651) for this plan.

On page 2 of the summary under number 1 in the Operative Measures section it states, "Each recreational fisherman may have in his possession a total of two undersized fish (cod and/or haddock)." No where in the proposed rule does it stated recreational fisherman can possess the fore mentioned undersized cod and/or haddock.

3 In the recreational cod fishery the fish are caught in water deep enough to cause the bends. These fish undersized or not returned to the water are dead or will die. We feel without the two undersized fish in the proposed rule you can not justify the Management Policy and Objectives on page 1 of the summary for the recreational fishery.

In section 651.2 Definitions of the proposed rule we object to the definition of recreational fishing. Every management plan has a different definition of recreational fishing. We feel NMFS's definition of recreational fishing is a valid one for what is going on out here in the real world.

Under your definition there is no such thing as recreational fishing. At one time or another every recreational fisherman gives a fish to a friend and while at his friend's home he excepts anything like a glass of water, a beer, or a jar of jam. Our recreational fisherman is no longer a recreational fisherman as he has just bartered or traded his fish.

For our files please send us a copy of the FMP, the final environmental impact statement, and the draft regulatory impact review/initial regulatory flexibility analysis. Thank you.

Yours truly,
Capt. Floyd Carrington
Chairman
Regulations and Laws Committee

NATIONAL COALITION FOR MARINE CONSERVATION

December 13, 1984

RECEIVED

Mr. Alan Guimond, Chairman
New England Fishery Management Council
Suntaug Office Park
5 Broadway (Rt 1)
Saugus, MA 01906

Dear Al:

Further to my undated letter to you delivered December 12 I was somewhat enlightened by the discussion of the Council's intentions with respect to the Demersal Finfish FMP and the gillnet issue, but I do not feel that there was a meeting of the minds.

If I understood Bob Jones correctly, the Council will complete the public hearing process as quickly as possible, address public comments as necessary and submit the FMP to the Secretary. I further understand him to say that if no solutions to the gillnet problem emerged from the meetings or if the factions failed to find a modus vivendi prior to the completion of the public review process, the dispute would be submitted to the Gear Conflict Committee with instructions to find a solution that will be written into the FMP in a subsequent amendment. Bob seemed to be telling us that (1) this is not the equivalent of a recommendation to study the problem further, Les Smith's strong assertions to the contrary notwithstanding; (2) even though no dates for the completion of this procedure were set, this is not the equivalent to ducking the question altogether and (3) by implication at least, resolution of the gillnet question is not central to the plan development process.

28 The point which I raised in my letter to you and by commenting at the meeting is that unless the Plan addresses the gillnet issue fully and fairly, consistent with Standard 4 as described by the Guideline relating to Standard 4, the Plan is deficient and must be rejected by the Secretary because it fails to comply with the National Standards. If I am correct in my analysis, resolution of the gillnet problem is not an ancillary issue that can be dealt with by amendment at some unspecified time in the future. Resolution of the gillnet problem is a central issue

Mr. Alan Guimond, Chairman
New England Fishery Management Council
December 13, 1984
Page 2

that the Council simply must face up to now.

Sincerely yours,

Christopher M. Weld

CMW/nc

cc: Mr. Rip Cunningham
Mr. Doug Marshall

Interstate Party Boat Assoc.
founded in 1957

December 12, 1984

Mr. Alan D. Guimond, Chairman
New England Fishery Management Council
Suntaug Office Park
Saugus, MA

Mr. Chairman:

The Interstate Party Boat Association strongly protests the weak and vacillating manner in which the NEFMC handled the gill net gear tending proposal at the November meeting..

4 This issue has been before the Council for many years and both sides of the issue should be well known by any interested Council members. The reason for the inclusion of the tending measure was well presented by Mr. Pat Carroll on the day the Council voted 11 to 2 to include it in the plan.

The tending measure had been derived from a long and agonizing process of gear conflict committee meetings with both sides represented. The measure had also gone through the public hearing process as a possible amendment to this plan with both written and oral comments presented from both sides. All this was available to the Council and should have been known by any responsible member before the favorable vote.

The intense high pressure mob condition that existed in the hearing room on the day of the reversal did not allow for a fair or equitable debate on a most important issue. The Chair had continuously informed the growing audience throughout the morning that the Council had already made its decision on the tending requirement, and the measure was going to public hearing. That hearing would be the proper forum to present their feelings on this issue. The Council's reversal of its position allowed another "might is right" decision.

The IPBA is dismayed and alarmed at the Council's sudden reversal of its position. In the eyes of the recreational community, the creditability of the Council process was severely damaged.

Sincerely,

Walter Hynes

Walter T. Hynes, Jr.
Executive Director

WH:mh

cc: Mr. William Gordon

THE NATIONAL COALITION FOR MARINE CONSERVATION
ONE POST OFFICE SQUARE
BOSTON, MASSACHUSETTS 02109

Dec. 12, 1984

Alan Guimond, Chairman
New England Fishery Management Council
Sauntag Office Park
Route 1
Saugas, MA

Dear Al:

What I remember best about the first council meeting that I ever attended was the chairman angrily berating the council for its failure to face up to the gillnet issue in the course of trying to develop a management plan for cod, haddock and yellowtail flounder. That was nearly eight years ago.

28 Having missed most of the debate on the gillnet issue this time around, I have no idea which aspects of it were discussed and which were not. Therefor, I am curious to know if anyone raised the issue whether failing to deal with gillnets might result in the FMP being judged to be not in compliance with the National Standards, particularly Standard 4.

You will recall that in the Guidelines promulgated by the Secretary there is a discussion of what constitutes an "allocation", as that word is used in Standard 4. The Guidelines state that any management measure has incedental allocative effects, but only those measures which result in direct distributions of fishing privileges will be judged against Standard 4. The Guidelines then go on to say that " adoption of an FMP that merely perpetuates existing fishing practices may result in an allocation, if those practices directly distribute the opportunity to participate in the fishery."

By way of illustration the Guidelines cite the assignment of ocean areas as an example of a direct allocation. When trawler, partyboat and charter boat operators complain to the council that gillnetters are preempting prime fishing areas, they are raising a Standard 4 issue. Ignoring it wont make it go away because according to the Guidelines a plan that preserves the status quo makes an allocation just as much as a plan that changes the status quo, if it results in a distribution fishing rights. The Guidelines also note that inherent in an allocation is the "advantaging of one group to the detriment of another." Interestingly, the Guidelines continue, "The motive for making a particular allocation should be justified in terms of the objectives of the FMP; otherwise the disadvantaged user groups or individuals would suffer without cause.

For instance, an FMP objective to preserve the economic status quo cannot be achieved by excluding a group of long-time participants in the fishery."

Obviously not everyone will agree that this specific language is directly applicable to the issue of whether or not gillnets should be marked, tended or restricted in size or area of deployment. Nevertheless, one thing should be clear, and that is that the Guidelines require that decisions which result in distributions of fishing privileges (whether the council faces up to the issue or ducks it altogether) must be fair and eqitable to all fishermen. Again, not having been present when this matter was debated by the council, I have *no idea* whether the record will show that the council gave due consideration to the question of fairness and equity. On the basis of what I have been told, however, it seems unlikely.

I served on this council long enough to know that no member deliberately sets out to deprive one individual or one user group in order to enrich another. That this is frequently the perceived result of the councils actions is a truth we are all unhappily aware of. For this reason alone, regardless of what the Guidelines say, it is important that the council carefully consider the public record developed by the hearings as well as the probable result of its actions. The council should also be aware that if I have considered the implications of Standard 4 as they relate to this issue, it is quite unlikely that the same implications will be overlooked by the Secretary.

In the broader context of the anticipated debates in connection with the reauthorization of the MFCMA, it will be argued again, as it has been argued before, that the councils are ducking the hard questions; that there is too much self interest represented on the councils; that councils should be consolidated, reduced in number or terminated entirely as an interesting but unsuccessful experiment. Given the current budgetary environment, these arguments may be pressed with greater determination than ever before. You may be sure that they will be raised again in debates concerning council funding. Trial balloons are already being floated to see who will oppose cutting back council staffs; eliminating salaries for council members; reducing the number of council meetings; and doing away with the councils altogether. There are a lot of disaffected fishermen who will not rise to the councils' defence. It seems like a poor time to create a lot more dissatisfaction among groups who have historically been the councils' strongest supporters.

With warmest personal regards for the Holiday Season,

Sincerely yours,

Chris

Christopher M. Weld

SaltWater
SPORTSMAN

The Voice of the Coastal Sport Fisherman/186 Lincoln St., Boston, Ma. 02111 (617) 426-4074

December 11, 1984

Mr. Douglas R. Marshall, Executive Director
New England Fishery Management Council
Suntaug Office Park
5 Broadway
Saugus, MA 01906

Dear Mr. Marshall:

4 We feel that the New England Fishery Management Council's reversal of the gillnet gear tending amendment in the current Management Plan demonstrates a total disregard for the recreational fishing community and industry. The Council has consistently evaded the problems of gear conflict and equitable allocation of the resource, which raises serious questions as to the Council's effectiveness in representing all user groups, as well as the future of the fish stocks off our coast.

In upcoming issues of Salt Water Sportsman, we intend to inform our half-million readers of the actions of this council, and we are currently working with journalists in local and regional media to help them make their audiences aware of the proceedings as well.

Finally, we intend to fully cooperate with those organizations that are currently looking into methods of restructuring the council so that representation will be equitably divided among all recreational and commercial user groups and interests.

Sincerely,

Rip Cunningham

Rip Cunningham
Associate Publisher

RC/LMA

cc: Bill Gordon, NMFS

THE PORT AUTHORITY OF NY & NJ

One World Trade Center
New York, N.Y. 10048
(212) 466-7000
(201) 622-6600

November 16, 1984

Mr. Doug Marshall
Executive Director
New England Fishery Management Council
Suntaug Office Park Building
5 Broadway
Route One
Saugus, Mass 01906

NEW ENGLAND REGIONAL FISHERY
RECEIVED
NOV 1 1984
MANAGEMENT COUNCIL

Dear Doug:

As you approach another round of hearings on the difficult groundfish management issue I would like to offer a suggestion for the Council's consideration.

4 The closure of eastern Georges will increase fishing pressure elsewhere. Areas previously "free" from effort will now be fished. Of special concern will be increased gear conflicts between mobile and fixed gear operators. Traditionally fixed gear operators have favored the harder bottom areas difficult to tow. With less area available to mobile gear operators we are likely to see much increased use of so-called "roller gear" on this harder bottom. The rapid growth of roller gear in recent years by certain fleet sectors will now expand to the fleet as a whole.

I suggest that as a conservation, gear conflict-avoidance, and enforcement matter you consider imposing a regulation limiting the use of net rollers above a certain size (say, six inches diameter).

This regulation will be first and foremost easy to enforce. A vessel using large rollers can be quickly spotted, either from the air or the water. The rollers are easily seen if the net is wound onto a net reel. They are also easy to spot when on deck. It would be difficult and awkward to hide such equipment.

This regulation would reduce gear conflicts greatly by preventing mobile gear operators from fishing on bottom favored by fixed-gear fishermen. There would be less occasion for mobile operators to move through fixed gear areas; they could do so only at the price of extensive lost fishing time mending twine.

This regulation would serve as a conservation measure by assuring that some portions of the fishing grounds were limited to highly selective gear, reducing fishing mortality. This measure may also, de-facto, avoid your possible need to impose area closures along with the six-inch mesh, which I believe is a possibility once NMFS examines the conservation effects of open fishing with the larger mesh.

4 I finally suggest you impose a requirement that the headline of all gillnets be natural manila, which would soon rot if gear were lost. This measure is a requirement elsewhere in the North Atlantic.

Yours sincerely,

Charles Sheldon
Fisheries Manager

Writer's direct dial telephone: 212-466-4795

NATIONAL COALITION FOR MARINE CONSERVATION

RECEIVED
OCT 0 2 1984

September 28, 1984

Alan D. Guimond, Chairman
New England Fishery Management Council
Suntaug Office Park
5 Broadway
Saugus, MA 01906

Dear Al:

4 I am much concerned over lack of action on the part of New England Fishery Management Council members concerning control of gillnets in the FCZ. Not only are interests of recreational fisherman apparently ignored at meetings and public hearings concerning this problem, but also provisions of the Magnuson Fishery Conservation and Management Act (MFCMA) are also ignored in direct contravention of the law.

As you know, I served for three years on the Council and was its first Chairman, so I am fully aware of the problems involved in drawing up a Fishery Management Plan. However, until recently, the Council has listened to and acted upon recommendations from all those involved in any specific fishery. At the last Council meeting during which gillnet problems were to be discussed while considering the Demersal Finfish FMP, several representatives of recreational fisheries, after sitting through hours of presentations by commercial fisheries interests, were not allowed to testify.

The reasons given apparently were that they would contribute nothing new and that Council members had "heard it all before." When it was brought to the attention of Council members that several letters had been written by those representing recreational fisheries, including myself, it was implied that the quantity of such letters was unimportant, but that their quality was. Just how quality is judged, I do not know, but can only say that my own experience in marine fisheries matters has extended for approximately 40 years, and that my testimony, verbal or written, has at least been considered by various bodies dealing with fisheries managemant. Today the Council apparently is not interested in my comments nor in those of others in this segment of the fisheries industry.

28 Ignoring recreational interests flies in the face of the MFCMA as set forth in Section 2(b)(3) which clearly states that one purpose of the Act is "to promote domestic commercial and recreational fishing under sound conservation management principles." In my opinion, the Council's emphasis while considering the FMP has been weighted heavily in favor of the economic hardships that might follow if gillnets are controlled in any way. Little or no attention has been paid to destruction of the stocks or to pre-emption of the ocean floor. Here again, Section 301(a)(5) reads in part: "...except that no such measure shall have economic allocation as its sole purpose."

24th Floor • One Post Office Square • Boston, MA 02109 • (617) 338-2909

It is my understanding that a lawsuit is being prepared by a group of charter and party boat operators in New England against the Council to draw attention to the unfair and unbalanced approach Council members have taken concerning the operation of gillnetters. I assure you that the National Coalition for Marine Conservation is taking further action, namely by drafting a bill to be introduced in the U.S. Congress to overcome this inequity.

7 Before Council members claim that there is no proof that gillnets damage the stocks and that all must wait until present research efforts have been completed perhaps two years hence, let me point out that under Section 301(a)(20) of the MFCMA: "Conservation and management measures shall be based upon the best scientific information available." No provision is made for delay until a specific research program has been completed. Right now, information indicating through underwater photography that gillnets continue to "ghost fish" after they have been lost or abandoned is available. In addition, a wealth of information on damage to stocks done by gillnets right now is available from Canadian sources. The Canadians as Council members should know, have instituted strict regulations concerning use of gillnets. This 180 degree reversal of previous policy in Canada was based upon several resource problems caused by unrestricted gillnet fishing. The Council should take similar action since fisheries in waters of the Maritimes and New England are very similar.

I realize that the Demersal Finfish FMP as previously written was voted down by the Council recently. This letter is for the record to be submitted at the October 10 meeting when the FMP will be discussed further. The stand of the Coalition on this matter was expressed in my letter of September 4, 1984, to Doug Marshall, and a copy of that letter is attached.

Sincerely yours,

Hal Lyman

Henry Lyman
Chairman of the Board

HL/LMA
Enclosure

cc: W. Gordon
R. Schaefer
A. Peterson

New York State Department of Environmental Conservation
Bldg. 40, SUNY
Stony Brook, New York 11794

Henry G. Williams
Commissioner

NEW ENGLAND FISHERY MANAGEMENT COUNCIL
RECEIVED
OCT 0 2 1984

September 27, 1984

Mr. Douglas G. Marshall
Executive Director
New England Fishery
Management Council
5 Broadway (Route 1)
Saugus, Ma. 01906

Dear Doug:

Please find enclosed a written copy of the statements made by the New York State Division of Marine Resources at the ADF public hearing in Riverhead, New York, August 21st. Please make this a part of the official record to support our comments which your staff noted at the hearing itself.

Thank you for considering our concerns.

Sincerely,

Gordon

Gordon C. Colvin
Director of Marine Resources

GCC:pd
Enc.

Testimony of New York State
Division of Marine Resources
Concerning the New England Fishery Management
Council's Multi-Species Fishery Management Plan

The Division of Marine Resources of the New York state Department of Environmental Conservation offers the following comments on the proposed FMP for the multi-species finfish fishery occurring off the northeast coast of the U.S.

Our comments are based on the New England Fishery Management Council's Committee Draft Revision #9 "Possible Management Program Alternatives for Multi-Species FMP" of 7/27/84. Subsequent revisions to this draft have been provided too recently to review them for comment at this hearing.

1. Minimum Size Restrictions

The winter flounder fishery in New York State is a very important one. In 1983 it was the 6th leading finfish in New York's commercial landings records at 1,450,000 lbs. Since 1956 landings averaged 1.5 million lbs. Recreationally it is one of the most popular species ranking 3rd behind bluefish, and scup in the preliminary 1980 results of the recreational anglers survey in our state. Catches in this fishery appear to be fairly stable since work done in the early 1960's by Briggs (1965) showed an average catch of 2,665,619 winter flounder per year in the inshore bays of Long Island. The total catch records demonstrate a stable population of winter flounder over the long term in New York waters.

Winter flounder are very localized in their movements (Klein-MacPhee, 1978)
1 and generally are composed of local populations which do not exhibit long migrations or significant mixing (Howe and Coates, 1975; Weber, 1984). Fish tagged off New York remain in the local area as shown in tag returns of flounder tagged and recaptured in Long Island Sound in 1981-83 (Weber, 1984). There is no reason to believe that populations in Long Island Sound and the inshore bays mix with offshore stocks especially on George's Bank.

In addition to the lack of migratory evidence there are different bio-logicial characteristics which indicate different subpopulations throughout the range of the winter flounder. Maturity data for winter flounder indicates that in New York fish are entirely mature by age 3 (Weber and Zawacki, 1983), and that 50% are mature at age 2 or 8" in size. Growth rates change from one area to another over the range of the species (Howe and Coates, 1975) and the age at which winter flounder reach maturity varies considerably (Weber and Zawacki, 1983) with the northern flounders older at maturity than the more southerly forms (Kennedy and Steele, 1971). Proposed management measures do not seem to consider the range of the species and the effects of an action on all portions of the population.

The rationale for the management measures proposed in draft #9 is not specified so it is difficult to understand the reasoning behind the recommended 11" winter flounder size limit. Based on our meetings with the New England Council we believe there are 2 major reasons for the proposal:

1. The George's Bank population of winter flounder is declining and needs stabilization, and

2. An 11" size limit in that area would ensure a greater degree of spawning on George's Bank.

1 We do not feel the 11" size limit is appropriate over the range of the species as it does not recognize the changing conditions throughout this range previously discussed.

In New York waters fish of this size are not usually found, particularly in Long Island Sound and in the inland bays. Length frequency data collected in our area (Briggs, 1965; Weber and Zawacki, 1983) shows that the vast majority of flounder taken are less than 28cm or 11 inches. The impacts of an 11 inch size limit on New York's recreational fishery would be significant and have not been considered in the present plan.

In addition since fish off New York mature at a much smaller size than those on George's Bank (Weber and Zawacki, 1983) and there is no evidence of any mixing of these groups, the 11 inch size limit is not biologically necessary - either for the inshore New York portion of their range, or to manage the George's Bank stock. A population showing stability over 30 years certainly does not need an excessive size limit as an initial management measure.

Because of the differences pointed out above, we do not believe any size limit on winter flounder is appropriate throughout is range. In fact, due to the other management measures recommended for the George's Bank area - minimum mesh sizes and spawning area closures - which will in effect avoid flounder smaller than 11 inches the size limit itself serves no additional purpose in meeting the plan objectives and is detrimental over some portion of the range of the species. We recommend no size limit be adopted for winter flounder.

2. Southern New England Management

The management proposal for the Southern New England area which entails only species size limits on mobile trawl operations and a 5 1/2" mesh restriction on bottom-tending gillnets during November through February appears adequate. Our fishermen have indicated a sincere interest in the resource off our coast and a willingness and ability to avoid sub-legal fish. We agree with the plan's recognition of the mixed species nature of our trawl fishery which makes a mesh size restriction inappropriate (Andersen etal, 1983).

8

The major species of concern in the Southern New England area appears to be yellowtail flounder and we agree with our fishermen that the size limit restriction will adequately address these concerns. The plan, however, does not provide the rationale for the measures proposed.

The yellowtail population in the Southern New England area appears to be revived according to the latest NMFS report (McBride and Clark, 1983). Since this stock of fish has been recognized as one of the somewhat distinct units of this population, we believe the increased biomass for this area indicates adequate recruitment to this stock of fish.

Based on the above, we would not wish to see additional management measures enacted in the Southern New England area as a result of circumstances occurring in the George's Bank area. We recommend that the National Marine Fisheries Service continue reviewing differences in the Southern New England and George's Bank units of yellowtail and collect additional data as needed to clarify this important issue.

3. Other Measures

5

The draft plan calls for a Working Group to determine the need for additional management measures and lists the options they may consider. We do not believe this list should be closed to additional management options nor do we see where the various socio-economic impacts of the proposed options have been examined or evaluated to determine the effects of the use of one or another of the recommendations on the various fisheries. It is also not clear what mechanism the Council intends to use to implement any of these actions. Some of the proposed alternatives such as minimum mesh have potential significant impacts on the New York mixed trawl fishery and are unacceptable. Such changes in this plan must only be considered after full opportunity for public comment and must be based on incontrovertable scientific justification.

In light of the proposed measures we believe a change in the composition of the working group is necessary. It should include an additional biologist designated by the MAFMC chairman and 2 fishermen, 1 each from New England and the Mid-Atlantic.

The need for a biologist is based on the need to ensure a balanced consideration of the Southern New England stock differences mentioned earlier.

The fishermen will insure expert input on the workability and impact of management measures. In addition they will enhance the credibility of the working group in the fishing community. We believe this credibility is critical for such an important plan as this.

Any changes to this plan recommended by the Working Group should only be imposed thru FMP amendment or by regulatory amendment with specific requirements in the regulations for sonsultation with NEFMC, MAFMC and adequate public hearings. It is necessary to ensure that opportunities for council and public input to the decision making process are preserved.

29 4. Preemption: The proposed size limits and license requirements in Draft#9 appear to be applicable "throughout the species range." This implies the territorial sea, inland waters of a state and intra-and-inter-state commerce. No regulations or other description of implementing mechanisms or legal rationale have been prepared. Such action is totally unacceptable as presented.

Applying such measures in the territorial sea is pre-emptive of a state's regulatory authority. The pre-emption provisions of Sec. 306 of the FCMA have not been followed in this plan. Finally there is no legal basis whatsoever for applying such measure to internal waters of a state.

There are other issues that we feel are problems with this plan but the correspondence from the Mid-Atlantic Fishery Management Council regarding the Council's position on the Multi-Species FMP covers our concerns. The gear marking section and the exempted fisheries section are two specific examples of this concern. In this regard, for the record, the New York Division of Marine Resources concurs with the entire position of the Mid-Atlantic Fishery Management Council concerning the NEFMC's draft FMP for the Multi-Species Fishery of the Northeast.

Literature Cited

Anderson, E.D., J.M. Mason, A.M.T. Lange and C.J. Bryne. 1983. Codend mesh selectivity in the Long Island spring trawl fishery for summer flounder and associated species. Woods Hole Lab. Ref. Doc. No.83-33, 65 p.

Briggs, P.T. 1965. The sport fisheries for winter flounder in several bays of Long Island. New York Fish and Game Journal, V-12, No.1: 48-70.

Howe, A.B. and P.G. Coates. 1975. Winter flounder movements, growth and mortality off Massachusetts. Trans. Am. Fish. Soc. 104(1):13-29.

Kennedy, V.S. and D.H. Steele. 1971. The winter flounder (Pseudopleuronetes americanus) in Long Pond, Conception Bay, Newfoundland. J. Fish. Red. Bd. Canada 28:1153-1165.

Klein-MacPhee, G. 1978. Synopsis of biological data for the winter flounder, Pseudopleuronectes americanus (Walbaum). NOAA Tech. Rep. Cir. 414, 190 p.

McBride, M.M. and S.H. Clark. 1983. Assessment status of yellowtail flounder (Limanda ferruginea) stocks off the northeast United ates, 1983. Woods Hole Lab. Ref. Doc. No. 83-32, 50 p.

Weber, A.M. 1984. Winter flounder in western Long Island Sound: Preliminary results of the 1981-1983 tagging projects. N.Y.S. Dept. of Environmental Conservation Unpublished report, 34 p.

Weber, A.M. and C.S. Zawacki. 1983. Winter flounder in western Long Island Sound. Age, length-weight and maturity data. N.Y.S. Dept. of Environmental Conservation. Unpublished report, 30 p.

MARTIN STILLUFSEN
1203 COMANCHE AVENUE
POINT PLEASANT, NEW JERSEY 08742

NEW ENGLAND REGIONAL FISHERY
RECEIVED
SEP 17 1984
MANAGEMENT COUNCIL

Sept. 14, 1984

Executive Director
Doug Marshall

Dear Sirs,

Your plan for 1985 seems to have incorporated sound tactical methods. Strategically it is difficult to separate 'economic criteria (page 1) and'reproductive capability' also on page 1.

Tactically, minimum fish size is useful however more
emphasis should be place on minimum <u>mesh</u> size of gillnets
and otter trawl codends. Codends should be 5½" when fishing
for non exempt species and also hung so the bag fishes square
i.e. fastened to the extention on three legged knots. When fishing
for exempt species (namely whiting) minimum mesh size should be
2 3" also hung square. This would enable longer tows and a more
effieient and profitable trip. Gillnetters would also benefit
from a minimum mesh size of 6" when fishing for non exempt
species; however a mandatory formula of 80% of mesh size for
hanging the net should also be imposed. These ideas would automatically help regulate fish size and eliminate a lot of unnecessary
work on deck.

Brief mention is given to Yellowtail Flounder. Your
alternative on P.11 V B #3 seems to warrent the most merit.
8 As a stronger measure, a weekly limit of 5,000 lbs. per boat
for the spawning period should be considered. During 1982
when this was in effect, smaller boats did well on a weekly basis.
27 Larger boats could cover their trip expenses the first day or so
and continue fishing for other species for the remainder of the week.
By having the poundage limit, increased dollar value supported the
above situations, and conservation of the Yellowtail population
was achieved.

MARTIN STILLUFSEN
1203 COMANCHE AVENUE
POINT PLEASANT, NEW JERSEY 08742

Summer flounder (fluke) should also be considered a
1 non- exempt species and limited to a 14" minimum -- throughout the eastern seaboard for both commercial and sport fishermen. This size is now incorporated into many eastern state conservation laws already and should be overshadowed by Federal Legislation-- similar to the federal lobster plan.

Lobster gear should be should be marked as section VI P.11 outlines except a double pennant on the western side and a single pennant on the eastern side. (Owners colors optional). This would assist vessels without radar insofar as they could see the easterly
24 end more easily than if it were only to have a single radar reflector on its easterly end. Gear conflict is a difficult issue however in many locations a alternating closure of the grounds may be in order. I'll outline a suggestion for the New Jersey area in a following letter. By each captain knowing his responsibilities a problem could be delt with.

A added suggestion is that <u>all</u> fishboat captains be licensed by the Coast Guard. Licensing should include rules of the road, rescue at sea, first aid, seamanship, fire protection, and most
3 importantly, a special endorsement i.e. draggerman, lobsterman, scalloper, gillnetter... one or all of the above. This would create a more respected, efficient , profitable, safer, and most important ; <u>resourceful</u> industry to manage.

Concluding, at our present technology, we can certainly catch fish faster than they can grow. When fish is thrown out for want of customers; no one benefits. By gradually putting the breaks on and easing up occassionally, we can enhance ourselves and our customers and at the same time not do a dis-service to our free enterprise system.

Truly Yours,

Martin Stillufsen

Capt. Martin Stillufsen
Trawler 'Big Red'

Copy: Atlantic Offshore Fishermen Association

Al Gauron Deep Sea Fishing, Inc.
State Pier
Hampton Beach, NH 03842

Douglas Marshall
Executive Director
N.E. Fisheries Management Council
5 Broadway
Saugus, MA 01906

Dear Sir:

4 We, the undersigned, are in favor of net tending and the 3,000 ft. spacing between nets. I feel there is no need to bore you with details of the reasons for our thinking, as these items have been discussed for some time now.

1 Increasing the size from 15" to 19" seems unfair to recreational fisherman and it doesn't seem necessary to include pollack. It seems more sensible to us old time fishermen to approach the future fish depletion problem by concentrating on the protection of spawning areas.

Capt. Gregg Gauron — Capt. Steve Parker
Capt Robert Hall — Capt. Al Gauron
1st Mate Charles E. Crocker — Capt Peter Lagerstrom
Capt Edmund Gauron — Capt. Mark Gauron
Capt. John Lagerstrom

RECEIVED
SEP - 7 1984
NEW ENGLAND REGIONAL FISHERY MANAGEMENT COUNCIL

NATIONAL FISHERIES INSTITUTE, INC.

2000 M STREET, N.W., STE. 580 ■ WASHINGTON, D.C. 20036 ■ (202) 296-5090

September 6, 1984

Mr. Douglas G. Marshall
New England Fishery Management
Council
Suntang Office Park
5 Broadway (Route 1)
Sangus, Massachusetts 01906

RE: Northeast Multi-species FMP Comments

Dear Doug,

The National Fisheries Institute, representing approximately 1,300 companies involved in the harvesting, processing, and marketing of fish and fish products nationwide, would like to submit the following comments on the proposed Northeast Multi-species Fishery Management Plan.

Multi-species fisheries management is an attractive alternative to single stock-oriented strategies. Its implementation, however, creates a new set of problems and challenges that must be considered. For example, as the proposed plan points out, the use of uniform mesh sizes has inherent limitations. A specific mesh size may be appropriate for one species, but not for another. In this regard, NFI is concerned over the application of the 5½ inch mesh size regulation to the redfish fishery.

2 Several of our members have indicated that the large mesh size will not work well in this fishery. According to one fleet manager and processor, the 5½ inch mesh will still gill a 12 inch fish, and as the net fills there will be no escapement of undersized fish. The mesh size regulation will result in high discards and a waste of the fishery resource.

19 NFI also is concerned over the proposed size limit for redfish. We have been advised that a 14 inch redfish is 16-17 years old. Several of our members feel the size limit is unnecessarily large, especially since redfish begin spawning at age 7 and have had many opportunities to reproduce before harvest.

The redfish fishery is different from the other New England groundfish fisheries. Mature redfish stay in deep water, are hard to catch, and normally are harvested without a big by-catch of other species. Because of these characteristics, some NFI members have suggested that a small mesh area for redfish be allowed within the Gulf of Maine. Therefore, instead of using large size limits and large mesh sizes in redfish management, the Council should limit the use of small mesh gear for redfish to deepwater areas only to protect juvenile redfish that migrate into shoal waters.

1 NFI also is concerned over the proposed size limit for pollock. Since the plan recognizes that the pollock stocks are currently in a healthy and stable condition, we would encourage the Council not to overly restrict the development of this fishery with a large size limit.

In conclusion, it is important that the Council not lose sight of the individual needs and differences within each fishery. Consideration must be given to the impact these regulations will have on each fishery and on the current overall social and economic conditions within the New England industry.

I look forward to our continued dialogue on this issue. Please call if you have any questions.

Sincerely,

Thor Lassen
Government Relations Representative

TL/pcf

APRIL thru OCTOBER
P. O. BOX 589 or
75 ESSEX AVE.
GLOUCESTER, MASS. 01930
617—283-0313

THE YANKEE FLEET

GLOUCESTER, MASS.
&
KEY WEST, FLA.

NOVEMBER thru MARCH
P. O. BOX 4068
KEY WEST, FLA. 33040
305—294-7009

NEW ENGLAND REGIONAL FISHERY
RECEIVED
SEP 10 1984
MANAGEMENT COUNCIL

September 6, 1984

Mr. Douglas Marshall
Executive Director
New England Fishery
Management Council
5 Broadway
Saugus, MA

Dear Sir:

4 Please accept my comments on the proposed changes in the FMP. I strongly disagree with a greater burden on the recreational angler by an increase in fish size for recreational fishermen. To try to meet your overall objectives by treating all users as the same by impact, is grossly unfair. The recreational angler has had to make do with scrod catches as their staple catch as the commercial effort has increased in areas to which they have access. To now place additional restrictions on his rights as a truly clean fisherman with no bi-catch is an injustice to all concerned. In particular, the pollock size would be a particular problem, because they are dependent on the large schools of 15 to 20 inch fish that other fishermen do not target, due to low market value, but present excellent angling and food for the table.

I strongly agree with Alternative C on page 11. This would only replace an impossible situation that exists today in many areas with some sort of order that other users would have a chance of dealing with. In addition, I would strongly advocate all fishermen stand by their gear while it is fishing. To be an absentee landlord in such an important resource is not an acceptable sharing of the responsibility that is required of all fishermen. It has been my experience on our offshore trips to Cashes and the Great South Channel that your proposals would be effective in resolving many of the problems we now face. In these areas, to a large extent, they follow setting guidelines and tend their gear, and I can see this working in all areas. We have success in working in these areas so long as a window is left between sets as proposed. To believe that offshore fishermen can tend their gear while day fishermen contend they cannot, is suspect to say the least.

In closing, I strongly urge the Council to assess the user on an impact basis. To manage the users as one not only flies in the fact of logic, but does nothing to encourage the clean user of the resource.

Fair Winds,

Thomas Hill

Capt. Thomas Hill
F/V Yankee Capts.

High Seas Corporation

Phone:
(617) 675-1551

State Pier
Fall River, MA 02721

September 6, 1984

Douglas G. Marshall, Executive Director
New England Fishery Management Countil
Suntaug Office Park
5 Broadway, Route 1
Saugus, Massachusetts 01906

Dear Doug,

18 The Northeast Multi-Species Fishery Management Plan understandably gives very little consideration to the problems and potentials of longlining for groundfish. For the past thirty years there has been little large-scale offshore longlining activity.

However, with the advent of reliable mechanization and automation, 100' class longline vessels now have the potential of competing economically with comparable-sized otter trawlers. Furthermore, longlining inherently brings to any groundfish fishery the benefits of very desirable size selectivity, absence of associated mortality or habitat damage, and opportunity for superior product quality. Accordingly, there are now over two hundred automatic longliners operating, most of them over 80' in length. The majority of these vessels are in the Norway-Iceland-Faeroe Islands area. Management plans for groundfish where these vessels operate have for several years given consideration to the unique benefits of longlining. Even spawning and nursery areas closed to mobile gear are left open for longliners, and special care is taken to avoid regulations which would directly or indirectly inhibit the development of economically successful longlining operations. From a marketing point of view, prices paid for longline fish are in some areas literally double those paid for dragger-caught fish.

Recently there have been efforts to introduce automatic longlining to the Gulf of Maine--Georges Bank fisheries. SEA DOG V began the trend in 1981. The expenditure of $250,000 on the Saltonstall-Kennedy automated longline demonstration project (1980-1982) indicated government recognition of the importance of the technique and helped focus attention on its potentials. Several mechanized Canadian longliners have routinely reported high catch rates on Georges Bank. Sea Bank, Ltd. has three Mustad autoliners under construction. My company, High Seas Corporation, is well along, at a cost of about three quarters of a million dollars, in the conversion and outfitting of a 147' vessel with a Mustad autoline system.

Because of a lack of general understanding of the autoline technique, its relationship to management objectives, and its possible importance in the Gulf of Maine-Georges Bank groundfisheries, I have written, from a longliner's perspective, a reasonably comprehensive set of comments on the Northeast Multi-Species Fishery Management Plan and included an introduction explaining the relevance of autolining to present concerns of those responsible for developing the Plan. These comments accompany this letter. I have also taken the liberty of delivering to the Management Council office twenty-five copies of the comments, which you can use as you see fit. Depending on the availability of further information, I may wish to amend the comments.

I would like to request that there be representation by automatic longliners on the groundfish advisory committee, and on other committees or at appropriate meetings where the formulation of policy relating to offshore longlining takes place.

Thank you for your consideration.

Sincerely,

Bill Whipple

William D. Whipple
President

WDW/hmw

Enclosure

cc: Richard H. Schaefer
Frank Grice

September 6, 1984

Douglas G. Marshall
Executive Director
New England Fishery Management Council
5 Broadway (Route 1)
Saugus, Massachusetts 01906

RE: Northeast Multi-Species Fishery Management Plan

Dear Mr. Marshall:

I would like to state first that I feel that most fishermen would like to see measures of conservation enacted that would ensure that fish will be there to catch for years to come. I think too, however, that, for them, economic factors must be considered. Fish prices are too low and expenses too high to expect support for programs which will limit their catch. Having said this, I offer the following:

1. As a conservation measure, I agree that the increase in
mesh size is a good step. In order for it to be a
21 viable method though we must ensure that prices for
the legal catch will make it worthwhile for the fisher-
men to pass over the illegal catch.

2. With the use of the increased mesh size, I do not think
that it is acceptable to have a minimum fish size
stipulated. The reason is this: If a lobsterman catches
an undersized lobster, he can throw it back and that
1 lobster will mature...However, if he brings an undersized
cod up in his net, he can't throw it back to mature be-
cause it is undoubtedly dead or going to die. The Council
will have to count on the mesh size to limit the number
of small fish caught and leave it at that. The fish is
going to die so why throw it back!

3. Under the section on "Catch Reports", I would like to
suggest that the processors rather than the fishermen
keep the necessary records. Processors have access to
the necessary information and could provide reports
either on an overall or boat by boat basis. I do feel,
16 also, that all such reports should be submitted on an
overall - total catch basis unless there is some prob-
lem or a significant number of small fish show up on any
one report. Then the records could be checked by indi-
vidual boat. Keeping the reports as general and im-
personal as possible might make this section more
acceptable to fishermen.

4. Lastly, I would like to strongly emphasize that I do
4 not feel that fishermen should have to make concessions
or alter their fishing methods <u>at all</u> to accomodate

the recreational fishermen. Asking a gillnetter, for
instance, to put his strings of gear at least 3,000 feet
apart is asking him perhaps to cut his catch in half.
Many times the fish are only in a very small area and
4 asking him to leave more than half a mile between strings
for the sake of the recreational fishing industry is to-
tally unfair. Fishermen have enough restrictions (price,
expenses, length of season, etc...) without having to
give way to weekend vacationers.

I sincerely hope that these comments are helpful and that they will be seriously considered in making your decision. If you have any questions or would like any additional information, please contact me.

Sincerely,

Pat B.

Pat Schroeder
F/V Patricia Ann (lost at sea)
Box 342
Boothbay, Maine 04537
(207) 633-4059

Interstate Party Boat Assoc.
founded in 1957

September 5, 1984

Mr. Douglas G. Marshall
Executive Director
New England Fishery
  Management Council
5 Broadway
Saugus MA

Dear Mr. Marshall:

The IPBA would like to make the following comments on sections of the new Groundfish Plan:

1 On Page 3, the proposed increase in fish size from 15 to 19 inches would impose an unfair burden on the recreational fisherman. It would, by recent survey data, eliminate from 60 to 99 percent of the present catch. The 15 inch no-sale limit, already in effect, accomplishes the Council's intent for a 20 percent reduction on juvenile fish. We feel that because of our 0 percent discard and clean hook fishery, we should not have the same size limit as a high discard net fishery.

4 On Page 11, the Gear Marking Requirements: Proposal VI, we agree with the gear marking recommended by the Council and support the proposed marking requirements and the 6000 feet maximum length for a gillnet.

On Page 12, Proposal VII, the Additional Alternatives for Addressing Gear Conflicts, Option A (to create a Task Force), we believe the problem of gillnets has already been studied. Options B, C and D were developed from this study. We believe these options should be included in the plan NOW! To wait and further study the problem is a delaying tactic.

Option B, requiring gillnetters to tend their gear in high recreational use areas, would help relieve the intense pressure on the resource in four ways:

1. It would reduce the potential of lost and damaged gear; i.e. If the boat is on its gear, a dragger is less likely to run through it.

4

2. It would prevent the present practice of farming gear in separate areas and hauling gear every second or third day. This is a great resource-wasting practice because the only marketable fish are those caught in the last 12 hours. The rest are "scalers", sandflea-infested rotten fish which are picked from the nets and discarded overboard.

3. By bringing gear home with them, it would give the resource a chance to migrate and move in a more normal pattern, rather than a net continuously blocking a piece of bottom for months at a time.

4. It would be an effective way to limit effort in a fishery that has seen a dramatic increase in the past few years.

On Option C, requiring 3000 ft. spacing between nets, this spacing (which is only a half net length) would allow a hole in the wall for the fish to pass through, rather than the current situation of mile after mile after mile of continuous nets, causing an impossible wall for a resource which must migrate to survive.

The general feeling for the complete document is that it is going to meet with much resistance and general non-compliance from the commercial sector. We find nothing in the plan that makes it any more enforceable than the interim plan. The result being a higher discard rate than the already criminal discard rate currently being practiced.

Very truly,

Capt Wally Hynes

Walter T. Hynes, Jr.
President

WTH:mh

SEABANK INDUSTRIES LIMITED
One Devonshire Place - Suite 3215
Boston, Massachusetts 02109
(617) 227-9415

Sept. 5 1984

Mr. Douglas G. Marshall
Executive Director
NEFMC
5 Broadway
Saugus MA 01906

Dear Doug,

Further to our June 7 letter concerning the hook fishery and the Council's invitation to comment on the draft Multi-species Fishery Management Plan we would like to re-emphasize our verbal views expressed at the recent Hyannis hearing.

This company anticipates deploying 3 highly mechanized longline vessels in the fishery in the near future. Their operating methods in scope and scale will be unlike any previous similar efforts in these waters. The company goal is to produce the highest quality fresh groundfish possible. Also, the resource conservation sensitivity of this fishing method is well documented and known.

Concerning the mechanized long-line position in the fishery our observations are as follows:-

18 We prefer a 6" mesh and the retention of the existing nursery areas, and to leave as much hard bottom free as possible for long-liners even to the extent of enabling them to fish in the expanded areas of the suggested new sanctuaries during periods of possible closure.

As our fishery relies greatly on winter productivity we would like to leave as much hard bottom area free during the entire winter-spring season, a maximum closure being the present.

SEABANK INDUSTRIES LIMITED
One Devonshire Place - Suite 3215
Boston, Massachusetts 02109
(617) 227-9415

4 Although we appreciate the reasons for the 6000 foot buoy placement and continuous gear sets, this restriction would severely hamper the efficiency of our fishery and inhibit the attainment of our quality goals. The larger size fish at which our fishery is directed very often inhabit areas where it would be impossible to set as the draft plan alternatives recommend.

17 Eliminating the 'Federally Subsidized Effort' as applied to the investment in more efficient fishing methods and 'development' fisheries would in Seabank's view greatly inhibit our ability to attain the productivity and quality standards the Marine Fisheries Services has spent so much time and effort in encouraging and promoting.

In conclusion we suggest again (our June 7 letter refers) most strongly that representatives of the mechanized long-line segment of the fishery be invited to participate in the long and tedious process of formulating the most workable plan possible under the circumstances. We believe our comments indicate the necessity for this.

Yours sincerely,

G.B. Charles

Director
New England Fisheries Management Council
5 Broadway (Route 1)
Saugus, Mass. 01906

Sept. 5, 1984

Dear Sir,

I own and operate a charter boat out of Menemsha on Martha's Vineyard Island. I am licensed to carry six passengers on the waters between Race Point and Montauk, N.Y. I am therefore directly concerned with any proposed fisheries management plan insofar as it might effect the fish I pursue for my clients.

4 I have a few observations about the recently published Public Hearing Summary. I am concerned about the wildfire proliferation of gillnets along the Massachusetts coast. I understand they are all over the place north of Cape Cod and I have seen some and heard about many more south of the Cape. Gillnetters aren't going to go away - nor should they - but they should at least be held responsible for their gear and what it can do to fishery stocks.

I think gillnets should be tended at all times. This to decrease the danger of the nets becoming lost and going on to fish forever. I also think gillnets should be clearly marked at both ends so that other vessels fishing in the area won't hang up in them. In addition, a substantial distance should be maintained between one gillnet and another so that at least some fish will have a chance to make it through the picket line. I feel that 3,000 feet between nets would be a reasonable distance, but 6,000 feet would be better.

Thank you in advance for considering my opinions.

Sincerely,

Whit Griswold

Capt. Whit Griswold
RFD #340
Chilmark, MA 02535

Cape Oceanic Corp.
41 Rosary Lane
Hyannis, MA 02601
617-775-8693

4 September 1984

New England Fishery Management Council
Suntaug Office Park
5 Broadway
Saugus, MA 01906

Dear Chairman,

After reviewing the latest Northeast Multi-Species Fishery Management Plan, I was quite shocked. In general, the proposals that have been made are extreme to say the least.

Due to the lack of fish stocks of all species, the plan cannot possibly go into effect and still allow the fisherman to maintain himself at a reasonable economic level. In my opinion, a sporadic plan such as the proposed management plan, would devastate the majority of commercial fishermen.

Conservation of multi-species that lie off the New England
coast is necessary at this date. However to expect an extreme
30 plan to be fair and just, and attain the goals of all interested
parties, much more time and consideration certainly must be
given to the situation from an economic point of view. The
econmic effect not only to the fisherman, but also to other
immediately related producers and suppliers would be substantial.

In the latest management plan, section IX plans to
eliminate federally subsidized effort. To do away with the
Capital Construction Fund or other tax support programs, you
may as well do away with the private fishing industry in our
country. Is this want you want to do? The vessel guarantee
loan program, which represents the second part of IX in the new
17 plan, could possibly be eliminated without a great effect on the
existing successful fishermen.

From the section of IX, specifically the Capital Contruction Fund, from my experience as a multi-boat owner, producer, and fisherman, it is safe to say that 60% to 80% of all money used for new construction, re-construction, and maintenance and upkeep (specifically being the most important in this situation), stems from the use of the Capital Construction Fund. To do away with the Capital Construction Fund essentially would do away with the fishing fleet.

Haste makes waste. Let's give more time and consideration to management plans concerning fish stocks. The consequences are much too great if mistakes are made due to lack of experience in the fishing industry.

Sincerely,

James Spalt

James Spalt

Capt. Edward F. 'Spider' Andresen
Stormy Petrel Fish Co.
Flanders Lane
Chilmark, Mass. 02535
617/645-9668

NEW ENGLAND REGIONAL FISHERY
RECEIVED
SEP - 6 1984
MANAGEMENT COUNCIL

September 4, 1984

Mr. Douglas G. Marshall, Executive Director
New England Fisheries Management Council
5 Broadway - Route 1
Saugus, MA 01906

Dear Mr. Marshall:

I would like to add my comments to the official record on the current
hearings on gillnets. First, under subhead B, I feel that it is extremely
important that all fishermen tend their gillnets at all times. This would
eliminate a great deal of lost gear and the ghost-fishing that results from it.
In all other phases of both recreational and commercial fishing, the fisherman
4 must tend his gear. Why should it be any different for gillnetters?

Under subhead C, I think that a minimum of 6,000 feet should be mandatory between gillnets. Lastly, I would just like to say that any further study and any additional task force would be a waste of everyone's time at this point in history. The facts are that gear conflicts exist, overfishing is currently a problem and that continued indiscriminate use of gillnets is detrimental to the fishery and unacceptable.

It seems to me that the council has been ducking this issue long enough. It is time to come to grips with the problem and deal with it.

Thank you for your consideration.

Sincerely,

E. F. Andresen

Captain Edward F. Andresen

EFA/nsm

NATIONAL COALITION FOR MARINE CONSERVATION

September 4, 1984.

Mr. Douglas G. Marshall
Executive Director
New England Fishery Management Council
5 Broadway (Route 1)
Saugus, MA 01906

Dear Doug:

As you know, I personally have been concerned about the proliferation of gillnets, particularly those operated by part time fishermen, along the coasts. This concern has also been expressed by the National Coalition for Marine Conservation's officers, directors and members. Publication of the Public Hearing Summary on the Northeast Multi-Species FMP by the New England Fishery Management Council gives me an opportunity to go on record formally on this matter as Chairman of the Board of the Coalition.

4

Under section VI of the Summary concerning gear marking requirements, we endorse Alternative C, which includes limitations of 6000 feet net length and uniquely identifiable marking of each net. Item C under section VII, which requires a minimum spacing of 3000 feet between gillnets, we also endorse, but would prefer a limit of 6000 feet, the standard length of such nets. This would allow greater escapement of passing fish.

Again under section VII concerning alternatives for addressing gear conflicts, we are strongly opposed to Alternative A, which would appoint a Task Force to investigate the nature, causes and extent of conflicts. Over recent years, these conflicts have become self-evident. Naming a Task Force would simply delay any action -- and action is needed right now. Many now exploiting the resources would be delighted to have such a delay so that uncontrolled fishing could be continued for another season.

Key to the whole problem we feel is expressed in item B of section VII, namely to require gillnet fishermen to continually attend their gear in selected high recreational use fishing areas. Frankly, we would prefer to have this requirement extended to all gillnets. Other commercial operators, such as draggers, must attend their gear at all times and there is no reason why gill-netters should not do the same. The argument against such a provision has been that the gillnetters might be endangered from the safety point of view in foul weather. During such weather is the very time when gillnets break loose and then continue ghost fishing. If weather conditions are such that danger is involved, the gillnetters should retrieve their gear and head for port. Full time fishermen realize this, but many part time operators are willing to take their equipment losses at the expense of the resources of the future.

24th Floor • One Post Office Square • Boston, MA 02109 • (617) 338-2909

Note that recreational fishermen obviously tend their gear at all times when fishing. Unmarked and unattended gillnets have caused trouble to party, charter and private recreational fishing boats as well as to the resources. Action is needed immediately to correct this problem. Note also that "high recreational use fishing areas" often change during any given season. To define such areas exactly would simply mean that the gillnets would be set elsewhere and that the problem would continue. It might well be compared to the old days of ICNAF when the Soviets engaged in pulse fishing, shifting from one stock to another as the supply warranted.

I would be glad to elaborate on the above statements at any time.

Cordially,

Hal

Henry Lyman
Chairman of the Board

HL/bk
cc: NCMC list

9.78

APRIL thru OCTOBER
P. O. BOX 589 or
75 ESSEX AVE.
GLOUCESTER, MASS. 01930
617—283-0313

NOVEMBER thru MARCH
P. O. BOX 4068
KEY WEST, FLA. 33040
305—294-7009

THE YANKEE FLEET

**GLOUCESTER, MASS.
&
KEY WEST, FLA.**

September 2, 1984

Chairman
New England Fisheries Mgt. Council
Suntaug Office Park
5 Broadway
Saugus, MA 01906

Dear Sir:

In 1984, Yankee Fishing Fleet vessels will have provided over thirty thousand (30,000) individual fishing days to Anglers from all across the U.S.A.. Unfortunately, on many of these days, access to the fisheries was largely denied to our vessels and these Anglers by the usurpation of ever larger areas of the ocean by bottom tending gill nets. Further, by the very fact of this increasing burden of preclusion upon <u>all</u> other fisheries participants, an esculating rate of conflict between these users and gill net users has been created. Coupled with the "walling off" of a considerable portion of the Bay of Maine by an unbroken "lead", or wall of nets from Cape Cod to Cape Elizabeth on occasion, plus an increasing incidence of lost gill nets that we encounter, we believe that an emergency situation has been created by the bottom tending gill net fishery in New England.

4 Therefore, having polled all of the Captains of the passenger fishing vessels listed below for their approval, I ernestly solicit your Councils favorable response and prompt implementation of Option B and Option C of Proposal VII of the Northeast Multi-Species Fishery Management Plan, I.E. - (require gill net users to tend their nets in areas of high conflict. Note: We believe they should at <u>all</u> times.), and Option C (require a 3000 foot spacing between nets). We request your action as the minimum response we believe is necessary to address the Emergency that exists as a result of gill net fishery practices; practices that are both damaging to the resource, and guarantee esculating conflict as equal access rights are further denied by "might makes right", the usurpation of the sea by bottom tending gill nets.

Very truly yours,

Captain Alan G. Hill

Subscribing to this request for emergency action:

M.V. Yankee Patriot - Capt. Phil Hoysradt
M.V. Yankee Capts - Capt. Tom Hill
M.V. Dolphin - Capt. Dan Courtemanche
M.V. Yankee Spirit - Capt. Tom Orrell
M.V. Yankee Pride II - Capt. Tom Lukegord
M.V. Middlebank - Capt. Tom Cain
M.V. Wejack - Capt. Joe Arsenault
M.V. Nautibuoys - Capt. Al Magliozzi
M.V. Miss Gloucester II - Capt. Mark Cunningham
M.V. Island Queen - Capt. William Cunningham
M.V. Miss Cape Ann - Capt. Steve Sears

National Party Boat Owners Alliance, Inc.

EXECUTIVE OFFICE
181 Thames Street
Groton, CT 06340
Phone: (203) 535-2066

OFFICE OF SEC'Y.–TREAS.
1010 Long Cove Road
Gales Ferry, CT 06335
Phone: (203) 464-2412

Sept. 1,1984

Douglas G. Marshall,
Executive Director
New England Fishery Management Council
Suntaug Office Park
5 Broadway (Route 1)
Saugus,MA 01906

Dear Sir:

In regard to the proposed Northeast Multi-Species Fishery Management Plan,we wish to submit the following comments for the record:

1

1. Re: The proposed increase in the minimum size of cod,pollack and haddock from the present 15" to 17",18" and 19".

The consensus amongst NPBOA members directly affected by this proposal indicates that we could live with a 17" minimum size,but not with a program that would escalate to 19 inches in subsequent years.

3

2. Re: Limit of 2 undersize fish per angler per day.

a. We feel that this proposed limit is quite restrictive, especially in view of the proposed 2" jump in minimum size. A limit of 4 would be preferable.

b. As in the past,charter/party boats would post minimum size limit placards and also have markers indicating minimum size placed at various locations around the boat. Again,responsibility for complying with minimum size regulations must rest with the individual angler;the captain cannot enforce the regulation.

4

3. Gillnet regulations

We wish to reiterate our position on the urgent need for effective gillnet regulations.

a. The minimum mesh size requirements for gillnets must be extended from the proposed period of Novem ber through February to at least the first week in June. For our members who fish the FCZ area off Block Island,we must emphasize that those waters provide the very basis of the spring fishing business for the charter/party boat fleets from Montauk,Eastern Connecticut and Rhode Island.

NPBOA Comments
Re: Northeast Multi-Species Fishery Management Plan

b. The area designated as #3 (Pg. 13, Figure 6, Block 3), indicates proposed boundary for gillnet area in which attendance upon gear would be required. However, the northern boundary of this area falls far short of an area that needs protection. We refer you to our previous letter to you in which we proposed the following LORAN coordinates: 14450W to 14600 and everything North of 43800.

And in that same letter, we had proposed that this same area be CLOSED to gillnetting from March 15th through June 1st.

4 c. We recommend that the length of continuous gillnet sets be no longer than 1500'. The idea of letting one gillnetter lay claim to a nautical mile of bottom fishing territory per one continuous set is hardly equitable, vis-a-vis the hardship such operators have imposed upon our segment of the fishing industry. We further recommend that gillnets shall not be set in a square, rectangular, triangular or similar conformation that would basically close off an area to other vessels.

d. We are opposed to alternative VII A., that is, appointing a "Task Force" to investigate the gillnetting problems. There has already been an Ad Hoc Gillnet Committee studying the problem; and the Council staff has already been onscene, courtesy of the Yankee Fishing Fleet, to observe at first hand how gillnetters usurp entire productive fishing grounds.

The time to checkrein the indiscriminate use of that type of gear is NOW. Council action to curb gillnetting abuses must be taken right away.

17 4. Proposal to elimante Federal Vessel Obligation Loan Guarantee/ Capital Construction Fund programs (Pg. 14 IX). This is akin to throwing the baby out with the bathwater. Limited entry could be achieved in a different way if that is the goal of the proposal. However, we oppose cutting off these two programs as a means of achieving such an end.

Sincerely yours,

George F. Glas

Capt. George F. Glas,
Executive Director

SaltWater
SPORTSMAN

The Voice of the Coastal Sport Fisherman/186 Lincoln St., Boston, Ma. 02111 (617) 426-4074

August ~~31, 1984~~

Mr. Douglas G. Marshall
Executive Director
New England Fishery Management Council
5 Broadway (Route 1)
Saugus, MA 01906

Dear Mr. Marshall:

I have several comments to make concerning Sections VI and VII of the Multi-Species Fishery Management Plan that stem from last Wednesday's hearing in Gloucester.

Several gillnetters who got up to speak against the idea of marking their nets with anything other than end buoys explained that there was no need to do so because a recreational fisherman or party boat operator need only to call the gillnetter on the radio and ask what sort of pattern his nets were set in so that he (the hook-and-line fisherman) would not get tangled up in it.

4 Our feeling is that this places an unfair burden on the recreational angler or skipper. Granted communication between users is good and should be encouraged, but it would be so much simpler if the netter would adequately mark his gear, ending the problem once and for all and eliminating the need for radio communication. Furthermore, gillnetters often make sets ten or more miles apart (by their own admission last Wednesday night and which should be on your tape). If a gillnetter is more than a mile away from any given set of nets, how is the angler or party skipper to identify the boat if he can even see it at all? This, as far as I can see, throws the "radio communication" method right out the window anyway. You can't talk to a boat that isn't there. Many days I have been off Boothbay Harbor and have seen dozens of gillnet sets but not a boat in sight.

It would seem, therefore, that the netter would either have to adequately mark his gear as proposed in Subhead C of Section VI, #'s 1, 2 and 3 inclusive, or tend it all the time to prevent conflict, loss and damage of equipment, his and other users'. If it comes to a choice of one or the other, we definitely favor the tending of gear. This is the fairest, most equitable solution for the prevention of conflict between all users -- recreational, trawlers and gillnetters themselves. Many serious and successful gillnetters tend their gear as a matter of choice, so there is little truth to the argument that it would put some netters "out of business."

4 In closing, I would stress that the 3000' spacing of nets -- as a bare minimum with 6000' recommended -- is absolutely essential to allow all users of the resource a chance to catch fish. If this particular item is not incorporated, the currently smoldering emotion concerning pre-emption of the bottom by one user group is sooner or later going to burst into flame. The gillnetter must make a living, but so must the party boat operator and the dragger skipper -- and the 12 million salt water anglers in this country have a right to share in the resource as well.

Sincerely,

Barry Gibson

Barry Gibson
Editor
Charter Boat Owner/Operator

August 29, 1984

Douglas Marshall
Executive Director
New England Fishery Management
5 Broadway
Saugus, Mass 01906

Dear Mr. Marshall,

I am opposed to Section IX (Federally Subsidized Effort) of Northeast Multi. Specs Fishery Plan of August, 1984.

17 U.S. Fisheries are competing against foreign vessels that are completely subsidized by governments.

The capitol Construction Fund was started to insure the U.S. fishing fleet stayed in good repair and the fleet was kept modern to compete.

The U.S. Government does little as it is to help fishermen.

Sincerely,

Don MacPhee

Don MacPhee
P.O. Box 212
Rye, N.H. 03870

August 29, 1984

To: New England Fishery Management Council

Refrence: Northeast Multi-Species Fishery Management Plan

My name is Salvatore A. Parisi, I am a native of Gloucester, am part owner of the F/V Gloucesterman and own and operate a Ship's Chandler PARISI PLASTIC FISHING GEAR, INC.

I appreciate the time and dedication you have spent this past year drafting this plan. I also realize your obligation to conserve fishing stocks as your main objective.

It is very easy for us to come here toninght and reject part
or your whole plan. I realize that your sole source of information
is based upon the information you receive from biologist from Woods
Hole, who work for the federal government. I do not feel that this
7 source of information is enough for you to make recommendations -
to a plan that will work. I perfer that you seek a second opinion
from an unbiased biologist, that is not paid by the government. With
no offense to the biologist of Woods Hole. I think a second opinion
is necessary in order for you to have the necessary information for
you to put forward a plan that would be benificial to the industry
as a whole.

At this time I would like to be more specific as to the plan that is being presented tonight.

Refrence will be given to the Cod End size of 5½" mesh that
is presently required. I have before me a sample of Cod End of 5½"
2 mesh, and will demonstrate that a 19" Cod Fish and Haddock will beable
to pass through the 5½" mesh Cod End regulation that is now in effect.

I intend to show that the present $5\frac{1}{2}$" mesh Cod End is sufficient
and is within conservation measures. I am not without an alternative
2 plan to your goals of preserving fishing stocks.

PLAN A: I suggest that we respect the spawning areas
rather than increase the mesh size to 6". I
would also recommend to the council that they
consider the scallop fleet who is now allowed
in spawning areas, while our dragger are restricted.
Please restrict everyone from these areas. Upon
24 these measures I beleive that you can fullfill your
obligation of preserving fishing stocks.

Respectfully submited,

Salvatore A. Parisi

Dear Sirs.

Apon reading my latest issue of The Fisherman magazine.
Pending regulations on gill netting where brought to my attention.
These regulations include, a 3,000 foot spacing between nets,
netters to stand by their gear in areas of conflict with rod and reelers.
Netters would be required tomark their gear better so private boats
and charter vessels can tell which way the gear is running.
A 6,000 foot limit on individual nets.
4 As an avid sport fisherman and curent world record holder i must voice my
support in favor of these mesures.
Although i am still concerned with the problem of lost gear,
wich continuse to fish at no ones gain and every ones loss.
I still feel these regulations are a step in the wrigth direction
and strongly urge there adoption by the fisheries councle.
Although i respect the rites of comercial fishermen to make a living,
the fishery must be proserved and protected for all of us and generations,
to come.

sincerly

Donald FX Angerman.
11 Pleasant St.
Wayland MA 01778

(603) 532-4471 / Telex: 953021

MONADNOCK FOREST PRODUCTS
Prescott Road / Jaffrey, New Hampshire 03452
Manufacturers / Exporters / Wholesalers

Brian E. Rohde
President

Norman S. Hansen, Jr.
Treasurer

NEW ENGLAND REGIONAL FISHERY
RECEIVED
AUG 2 9 1984
MANAGEMENT COUNCIL

August 28, 1984

Chairman
New England Fisheries Council
Suntag Office Park
5 Broadway
Saugus, MA 01906

Dear Chairman:

I have read an article on the proposed regulations on the use of gill nets and would like to express my opinion as being in favor of the following regulations:

4

1. Netters should be required to stand by their gear in areas of conflict with rod and reelers.

2. Netters would be required to better mark their gear so private boats and charter vessels could tell which way the gear was running.

3. There should be a 6,000 foot limit to individual nets.

I hope the New England Fisheries Council will seriously consider passage of these proposed regulations.

Sincerely,

Brian Rohde

Brian E. Rohde
President

BER/ac

Salt Water
SPORTSMAN

The Voice of the Coastal Sport Fisherman/186 Lincoln St., Boston, Ma. 02111 (617) 426-4074

28 August, 1984

Mr. Douglas G. Marshall
Executive Director
New England Fishery Management Council
5 Broadway (Route 1)
Saugus, MA 01906

Dear Mr. Marshall:

Those of us on the home staff of Salt Water Sportsman, a 45-year-old national sport fishing publication with a readership of over 400,000, have been following the development of the Northeast Multi-Species Fishery Management Plan with interest for some time now. We have gone over the August, 1984 Public Hearing Summary and feel compelled to comment on several items contained therein insofar as they pertain directly to the recreational sport fishery. We are primarily concerned at this time with Section VII, "Additional Alternatives For Addressing Gear Conflicts."

First, under Subhead A, we feel that the appointment of a Task Force to investigate the nature and extent of gear conflicts would be, at this point in time, somewhat redundant and a waste of time and effort. We feel that the nature of the conflicts are readily apparent and have been documented, and that further "study" will simply prolong any sort of resolution. Let's address the problems now, not six months or a year hence.

4

Under Subhead B, we feel that it is mandatory that gillnet fishermen continuously attend their gear, and should do this at all times and in all areas. "High Recreational Use" areas can change from year to year, even month to month, and recreational fishermen should have the option of being able to fish anywhere with the knowledge that the gillnet operator is nearby so that any conflict or incident can be resolved on site. After all, the recreational fisherman continually attends his gear, as does the trawler operator. It is only fair that the gillnet fisherman be required to do so too.

Under Subhead C, we feel that the 3000-foot spacing between gillnets is an absolute minimum, and that 6000 feet would be far more beneficial to other gear type users. Note that 6000 feet is only the length of a maximum single gillnet set. One net -- and then a spacing of the same distance as that set -- does not seem to us to be at all unreasonable and will allow the recreational fisherman as well as the dragger operator a chance to fish some productive bottom along with the gillnetter.

Under Subhead D, setting patterns should be established and adhered to in all water off New England, not just Georges Bank and Southern New

England. Setting patterns are mandatory in order that damaging and costly contact between gear types may be prevented.

Gear conflict between resource users is a problem that cannot be resolved by continued studies and investigations. The problems exist now and are going to increase in the forseeable future if action that allows equitable access to the resource is not implemented quickly.

Sincerely,

Barry Gibson

Barry Gibson
Editor

Rip Cunningham

Rip Cunningham
Associate Publisher

Beach Cliff BRAND
Sea Products from Maine
CANNED/FRESH/FROZEN

STINSON CANNING CO. Prospect Harbor, Maine 04669 - (207) - 963-7331
Telex 950002 - Answerback STINCANCO PRHA

August 27, 1984

New England Fisheries Management Council
5 Broadway, Route 1
Saugus, MA 01906

Attention: Mr. Douglas G. Marshall, Executive Director

Dear Doug:

Just a few brief comments on the multi-species Fishery Management Plan.

The more zones and mesh areas for the various mesh sizes, the more difficult and costly it becomes to enforce and the mortality of the undersized fish increases.

A 5½" mesh in the cod end is far too small. There still will be far too many fish 19" in length and under that will be caught and thrown back dead into the sea. At the present time, these fish have been taken to shore and sold in many cases because of lack of enforcement both at sea and on shore. Personally, I feel the cod end should be at least 6" which would allow the major part of the smaller fish to go free. If the mesh in the large mesh area should go to 6" in the cod end, it would be very interesting to see, after three years, the difference in the large mesh area compared to the small mesh area. Of course, the proper enforcement would be necessary. I have always found it very difficult to accept the fishermen's position in regards to the small mesh area when fishing for the same specie.

Spawn enclosures are absolutely a must in the rebuilding of any fishery. This is where enforcement at sea becomes very important.

2 Just to summarize my position, a simplified management plan is preferred, making enforcement more enforceable. The increased mesh size in the cod end to at least 6", spawn closures and the proper enforcement both at sea and on shore.

The fewer fish there are, the more money the fishermen need for their catch to pay their operating costs. The end result, making it very difficult to sell their catch at such high prices because of competition. Furthermore, the market will not accept such prices. It is, therefore, very essential that strong conservation measures be taken to rebuild this multi-specie fishery. Otherwise, the New England fishing industry could end up looking like a ghost town.

I haven't forgotten the New England Fishery Management Council still exists. It is certainly my intention sometime not in the too distant future to attend one of the meetings.

Best regards,

STINSON CANNING COMPANY

Charles Stinson

Charles B. Stinson, President

CBS/as

RECEIVED
9.92
AUG ... 1984
MANAGEMENT COUNCIL

40 Ridge Drive
Old Saybrook, Conn. 06475

August 27, 1984

Chairman, New England Fisheries Council
Suntag Office Park
5 Broadway
Saugus, Mass. 01906

Dear Sir:

I would like to voice my opinons, on your proposed Gill Net Regulations.

I fish with rod and reel for codfish at least 2 days a week, nine months of the year, mostly off Block Island and four or five times a year in Kennebunk Port, Maine. In Maine, we have whole prime fishing areas totally blocked off by poorly marked gill nets in huge squares as to block off the entire ledges.

Off Block Island, they fish their nets in tiers and layers, again poorly marked and in such length as to almost totally block off access to ledges and prime areas.

I would like to suggest that you refer to some of the information available from Canada such as:

4

1) make each skipper responsible for each net, with assigned numbers on each net for verification.

2) Find some way to penalize skippers for losing nets (same as Canada)

3) Use penalty money to pay searching and dragging operations for ghost nets.

4) Set up much tighter regulations (like Canada) to cut down size and number of gill nets.

5) Set adequate spacing requirements on distance between nets so as to allow reasonable amounts of fish to reach the ledges.

6) Require gill netters to stand by nets, so they couldn't lose them in storms or strong tides.

7) Require netters to mark nets to tell which way they are running.

Thank you for your attention in this matter.

Sincerely,

Robert E. Cobb

Robert E Cobb

9.93

648-3858

Windings by "Bert" Sweetland

Custom Rod Building and Repairing

32 Foster Street
Arlington, Mass. 02174

Aug 26, 1984

New England Fisheries Council
Sungtag Office Park,
5 Broadway
Saugus, Mass. 01906

NEW ENGLAND REGIONAL FISHERY
RECEIVED
AUG 28 1984
MANAGEMENT COUNCIL

Attn: Chairman,

Dear Sir:

This letter is in regards to the need for regulations for the use of the gill-nets that have been plaguey to the party boat, charter boat, and the sport fishermen for the past few years.

I have been fishing off the New England coast for many years as a sportfisherman, (registered tuna tournaments) and party boat fishing.

I fish out of Kennebunkport Me., we go out to the gulf of Maine and everywhere you look there are gill net markers and sometimes we find one that isn't marked, which results in a loss of a lot of fishing tackle.

4 We go out of Gloucester to Jefferies or Middlebank or whereever and it is a job to find a spot where you can fish with out getting involved with nets. I sincerely request that the regulations as stated in the article in the N.E. Fisherman, Aug 23, be adopted and put into use as soon as possible.

Yours for better fishing

Sincerely,
"Bert" Sweetland

Aug. 25. 84

Sir,

This writer respectfully requests your council, to give favorable consideration, to the new regulations on gill-netters.

The decline of fish, that we, the sports fisherman have encountered over the past seven years, is very noticeable.

The cost of lost equipment to gill nets is also very costly.

The time that is spent going from fishing area to fishing area, trying to avoid gill-nets, cuts our fishing time in half in the spring months.

4 This writer feels that something has to be done, with the gill-net problem, before the whole ocean is littered with active and gill nets that have been lost on the bottom.

Thank you,
Robert E. Hughes Jr.

23 WARREN ST.
ARLINGTON MASS.
02174

Aug 25, 1984

DEAR SiR:

4 I am in Favor of the New Reg. For Gill Nets. It is Tough Fishing Rod & Reel on The Three Places Mentioned.

Nelson Dionne
Westfield, Mas

NELSON R. DIONNE
27 1ST St.
WESTFjeld, MA.
01085

NEW ENGLAND FISHERY MANAGEMENT COUNCIL RECEIVED
AUG 27 1984

NELSON R. DIONNE
27 1 STREET
WESTFIELD, MASS.
01085

AUG 24. 1984

4 Dear Chairman:
I am in favor of your proposal on your spacing of nets

Truly yours
Fred Krowchenko

Fred Krowchenko
110 Yale Ave.
Middlebury, CT 06762

New

Part 10

PART 10: REFERENCES

Acheson, J., Acheson A., J. Bart, J. Lello, J. Poggie, R. Pollnac, J. Wilson. 1981. Study of social and cultural aspects of fisheries management in New England under extended jurisdiction, final report to National Science Foundation. Volumes I, II and III. University of Rhode Island, University of Maine.

Almeida, F.P. and E.D. Anderson. 1980. Discriminant function analysis of morphometric characters from silver hake in the New England - Middle Atlantic area. NMFS Woods Hole Laboratory Ref. Doc. No. 80-36.

Beverton, R.J.M. and S.J. Holt. 1957. On the dynamics of exploited fish populations. Fishery Investigations Series II, Vol XIX.

Boehm, P. D. and P. Hirtzer. 1980. Gulf and Atlantic Survey for Selected Organic Pollutants in Finfish. NOAA Tech. Mem. NMFS-F/NEC-13.

Boehm, P. D., W. Steinhauer, and J. Brown. 1984. Organic pollutant Biogeochemistry studies in the Northeast U.S. marine environment. Final Report, contract no. NA-83-FA-C-00022, to NOAA, NMFS.

Burnett, J. and S.H. Clark. 1983. Status of witch flounder in the Gulf of Maine - 1983. NMFS Woods Hole Laboratory Ref. Doc. No. 83-36.

Centaur Associates, Inc. 1980. Economic activity associated with marine recreational fishing in 1980. Prepared for the Sport Fishing Institute. Washington, D.C.

Clark, S.H., M.M. McBride, and B. Wells. 1984. Yellowtail flounder assessment update - 1984. NMFS Woods Hole. Lab. Ref. Doc. No. 84-39.

Collie, J.S. and M.P. Sissenwine. 1982. Estimating population size from relative abundance measured with error. ICES C.M. 1982/G: 34.

Domanevsky, L. N., and Y. P. Nozdrin. 1963. Silver and Red Hakes. Fishery Resources and Reproduction of Fish Stocks. Atlantic Research Institute for Marine Fisheries and Oceanography. Kaliningrad. USSR. Fish Husbandry 9(50):10-13.

Dow, R.L. 1977. Effects of climatic cycles on the relative abundance and availability of commercial marine and estuarine species. J. Cons. int. Explor. Mer, 37(3): 274-280.

Economic Research Associates. 1983. The coordinated marketing of New England seafood: opportunities and constraints. Prepared for the National Marine Fisheries Service. Washington, D.C.

Edwards, R.L. 1965. Relation of temperature to fish abundance and distribution in the southern New England area. ICNAF Spec. Pub. No. 6.

Edwards, R. L., R. Livingstone, Jr., and P. E. Hamer. 1962. Winter Water Temperatures and an Annotated List of Fishes - Nantucket Shoals to Cape Hatteras. ALBATROSS IV Cruise No. 126. U.S. Dept. Int. Fish & Wildl. Serv. Spec. Sci. Rep. - Fisheries 397.

Flowers, J.M. and S.B. Saila. 1972. An analysis of temperature effects on the inshore lobster fishery. J. Fish. Res. Board Canada, 29(8): 1221-1225.

Gabriel, W.L. Personal communication.

Gabriel, W.L., W.J. Overholtz, S.A. Murawski, and R.K. Mayo. 1984. Spawning stock biomass per recruit analyses for seven Northwest Atlantic demersal finfish species, Spring, 1984. NMFS Woods Hole Laboratory Ref. Doc. No. 84-23.

Georgianna, D. L. and W. V. Hogan. 1983. Production costs in Atlantic fresh fish processing. Unpublished manuscript. Department of Economics. Southeastern Massachusetts University. N. Dartmouth, MA.

Government of Canada, Fisheries and Oceans. 1955-1979. Annual statistical review of Canadian fisheries. Vols. 9-12. Ottawa, Canada.

Government of Canada, Fisheries and Oceans. 1980. Canadian exports of fishery products (monthly). Ottawa, Canada.

Grigalunas, T.A. and C.A. Ascari. 1980. Estimation of income and employment multipliers for marine-related activity in the southern New England marine region. Rhode Island Agricultural Experiment Station, Contribution No. 1985. University of Rhode Island. Kingston, R.I.

Grosslein, M.D., R.W. Langton, and M.P. Sissenwine. 1980. Recent fluctuations in pelagic fish stocks of the Northwest Atlantic, Georges Bank, in relationship to species interactions. Rapp. P.-v. Reun. Cons. int. Explor. Mer, 177: 374-404.

Grosslein, M.D. and T.R. Azarovitz. 1982. Fish Distribution. MESA New York Bight Atlas. Monograph 15.

Gulland, J.A. 1965. Estimation of mortality rates. Annex to Arctic Fisheries Working Group Report. ICES CM 1965, Doc. No. 3. 9p.

Hanley, J.M. 1975. Review of gillnet selectivity. J. Fish. Res. Board Canada, 32(11).

Hart, Kathy. 1985. Shunned Fish Shake Poor Image. Coastwatch. University of North Carolina Sea Grant. March, 1985.

Hennemuth, R.C., J.R. Palmer, and B.E. Brown. 1980. A statistical description of recruitment in eighteen selected fish stocks. J. Northw. Atl. Fish. Sci., Vol 1: 101-111.

ICNAF Statistical Bulletin, 1975-1978.

KCA Research, Inc. 1983. Socioeconomic aspects of marine recreational fishing. Prepared for NOAA/NMFS. Contract No. 80-ABC-00152. Alexandria, VA.

Longwell, A. C. 1977. A genetic look at fish eggs and oil. Oceanus 20:46-58.

Klein-MacPhee, 1978. SEE SPRAGUE AND CARSON BELOW.

Malins, D., B. McCain, M. Myers, D. Brown, A. Sparks, J. Morado, and L. Hodgins. 1984. Toxic Chemicals and Abnormalities in Fish and Shellfish from Urban Bays of Puget Sound. Mar. Env. Res. 14:527-528.

Marine Group, Development Sciences, Inc., in association with Robert J. Harmon and Associates, Inc. 1980. Mid-Atlantic fishery conservation zone: fisheries socio-economic inventory. Prepared for the Mid-Atlantic Fishery Management Council. Volumes I, II and III.

Massachusetts, Commonwealth of, Office of Coastal Zone Management. June 1982. PCB Pollution in the New Bedford, Massachusetts Area: A Status Report. 60 pp. Unpublished.

Maurer, R. 1976. A preliminary analysis of interspecific trophic relationships between the sea herring and mackerel. ICNAF Res. Doc. 76/121.

Mayer, 1982. SEE SINDERMANN BELOW

Mayo, R.K. and S.H. Clark. 1984. An assessment of the pollock (Pollachius virens L.) stock in the Scotian Shelf, Gulf of Maine, and Georges Bank region, 1984. NMFS Woods Hole Laboratory Ref. Doc. No. 84-13.

Mayo, R.K., U.B. Dozier, and S.H. Clark. 1983. An assessment of the redfish, Sebastes fasciatus, stock in the Gulf of Maine - Georges Bank region. NMFS Woods Hole Laboratory Ref. Doc. No. 83-22.

McBride, M.M. and S.H. Clark. 1983. Assessment status of yellowtail (Limanda ferruginea) stocks off the Northeast United States, 1983. NMFS Woods Hole Laboratory Ref. Doc. No. 83-32.

Miller, Marc and John Van Maanen. 1979. Boats don't Fish, People do. Essays on Social and Cultural Aspects of New England Fisheries: Implications for Management. Final Report to the National Science Foundation. Vol. II.

Murawski, S.A., A.M.Lang, M.P. Sissenwine, and R.K. Mayo. 1981. Definition and analysis of otter trawl fisheries off the Northeast coast of the United States based on multi-species similarity of landings. ICES C.M. 1981/G: 63.

Murchelano, R. A. and Wolke, R. E. 1985. Epizootic Carcinoma in the Winter Flounder, Pseudopleuronectes americanus. Science, Vol. 228, pp. 587-589.

NAFO Nom. Catches, NW Atl. 1979. NAFO SCS Doc. 80/IX/27.

NAFO Nom. Catches, NW Atl. 1980. NAFO SCS Doc. 80/VI/15 (Rev. 6 July 1981).

NAFO Nom. Catches, NW Atl. 1981. NAFO SCS Doc. 82/VI/7.

NAFO Nom. Catches, NW Atl. 1982. NAFO SCS Doc. 83/IX/22.

NAFO Nom. Catches, NW Atl. 1983. NAFO SCS Doc. 84/VI/22.

Newick, C. 1982. The capital sector of the New England fishing fleet: an inventory. Complex Systems Research Center. University of New Hampshire. Durham, NH

Nicholson, L.E. and R.P. Ruais. 1979. Description of the recreational fisheries for cod, haddock, pollock, and silver hake off the Northeast coast of the U.S. Report to the New England Fishery Management Council. Saugus, MA. 118p.

Nusck, J. A. 1969. The comparative biology of two American hakes, Urophycis rhuss and U. tenuis (Pisces, Gadidae). Ph.D. thesis. Harvard Universiy,Cambridge, Massachusetts.

Overholtz, W.J., S.H. Clark, and D.Y. White. 1983. A review of the status of the Georges Bank and Gulf of Maine haddock stocks for 1983. NMFS Woods Hole Laboratory Ref. Doc. No. 83-23.

Peterson, Susan and Leah Smith. 1979. New England Fishing, Processing and Distribution. Woods Hole Oceanographic Institution Technical Report. WHOI 79-52.

Reed, M. and M. Spaulding. 1984. Response of Georges Bank Cod to Periodic and Non-periodic Oil Spill Events. Envir. Mgt. 8:67-74.

Ricker, W.E. 1958. Handbook of computations for biological statistics of fish populations. Bull. Fish. Res. Board Canada, 119: 300p.

Robertson, J.H.B. 1983. Square mesh cod-end selectivity experiments on whiting (Merlangius merlangus L.) and haddock (Melanogrammus aeglefinus L.). ICES Fish Capture Committee. Working Group Meeting, Ijmuiden.

Segner, H. and H. Moller. 1984. Electron Microscopical Investigations on Starvation-induced Liver Pathology in Flounders Platichthys flesus. Mar.Col. Prog. Ser. 19:193-196.

Serchuk, F.M., R.S. Rak, and J. Penttila. 1982. Status of the Georges Bank and Gulf of Maine Atlantic cod stocks - 1982. NMFS Woods Hole Laboratory Ref. Doc. No. 82-33.

Sindermann, C. J., S. C. Esser, E. Gould, B. B. McCain, J. L. McHugh, R. Morgan II, R. A. Murchelano, M. J. Sherwood, and P. R. Spitzer. 1982. Effects of Pollutants on Fishes. In: Ecological Stress and the New York Bight: Science and Management, G. F. Mayer, ed., pp. 23-38.

Sissenwine, M.P. 1974. Variability in recruitment and equilibrium catch of the southern New England yellowtail flounder fishery. J. Cons. int. Explor. Mer, 36(1): 15-26.

Smith, L. and S. Peterson. 1977. The New England fishing industry, a basis for management. Technical Report. Woods Hole Oceanographic Institution. Woods Hole, MA.

Smolowitz, R.J. 1983. Mesh size and the New England groundfishery - application and implications. NOAA Tech. Rep. NMFS SSRF-771. 60p.

Smolowitz, R.J., D. Arnold, and F. Mirarchi. 1978. New England mesh selectivity studies. Experiment one, inshore groundfish. NMFS Woods Hole Laboratory Ref. No. 78-12. 44p.

Sprague, J. B. and W. B. Carson. 1970. Toxicity Tests with Oil Dispersants in Connection with Oil Spills at Chadabucto Bay, Nova Scotia. Fish. Res. Board Can., Tech. Rep. 201, 30 pp.

Sutcliffe, W.H. Jr., K. Drinkwater, and B.S. Muir. 1977. Correlations of fish catch and environmental factors in the Gulf of Maine. J. Fish. Res. Board Canada, 34(1): 19-30.

Task Force on Atlantic Fisheries - Michael J. Kirby, chairman. 1983. Navigating Troubled Waters: A New Policy for the Atlantic Fisheries. Minister of Supply and Services Canada. Ottawa, Canada.

Topp, R. W. 1968. An Estimate of Fecundity of the Winter Flounder, Pseudopleuronectes americanus. J. Fish. Res. Board Can. 25:1299-1302.

U.S. Department of Commerce. NMFS. Basic economic indicators: Atlantic and Pacific groundfish, 1930-1972 (CFS No. 6127). Washington, D.C.

U.S. Department of Commerce. Census of Population, Characteristics of the Population, general social and economic Characteristics. Vol 1, Chapter C. 1980.

U.S. Department of Commerce. NMFS. Fishery statistics of the United States. 1952-1975. Washington, D.C.

U.S. Department of Commerce. NMFS. Fisheries of the United States. 1976-1983. Washington, D.C.

U.S. Department of Commerce. NMFS. Marine recreational fishery statistics survey, Atlantic and Gulf coasts, 1979-1982. Washington, D.C.

U.S. Department of Commerce. NMFS. State landings data file for Maine, New Hampshire, Massachusetts, Rhode Island, New York, New Jersey, Maryland, Virginia and North Carolina, Annual Summaries (or December issues). 1976-1983. Washington, D.C.

U.S. Department of Commerce. NMFS. Status of the fishery resources off the Northeastern United States for 1982. NOAA Technical Memorandum NMFS-F/NEC-22. 128p.

U.S. Department of Commerce. NMFS. U.S. production of fillets & steaks, annual summary, 1981. Washington, D.C.

U.S. Department of Commerce. NMFS. Unpublished data. Analytical Services Branch, Gloucester, MA.

U.S. Department of Commerce. NMFS. Unpublished data. Northeast Fisheries Center, Woods Hole, MA.

Wang, D.H. 1984. Unpublished manuscript. Analytical Services Branch. NMFS. Northeast Regional Office. Gloucester, MA.

Welch, W.R. and L.U. Churchill. 1983. Monthly and annual means of sea surface temperature. Boothbay Harbor, Maine. 1905 through 1983. Maine Dept. Mar. Res. Research Ref. Doc. No. 84/3.

Wise, J.P. 1962. Cod groups in the New England area. Fish. Bull., 63(1): 189-203.

Ziskowski, J., L. Despres-Patanjo, R. Murchelano, D. Ralph, and A. Howe. In Prep. (1985) Disease and Environmental Stress in Commercially Valuable Fish Stocks in the Northwest Atlantic.

Part 11

RECORD OF DECISIONS FOR MULTI-SPECIES FISHERY MANAGEMENT PLAN

DATE	MEETING	ISSUES DISCUSSED
06/26/83	Demersal Finfish Committee	Policy development
08/09/83	Demersal Finfish Committee	Policy development
08/10/83	Council Meeting	The Council voted to adopt the ADF policy statement as presented by the Demersal Finfish Committee
09/07/83	Demersal Finfish Committee	Policy development; management unit
11/08/83	Demersal Finfish Committee	Organization of plan document; Review of Part II
12/01/83	Demersal Finfish Committee	Review of Parts I and II
01/05/84	Demersal Finfish Committee	Review of Parts I and II; recreational fishing issues; definition of management unit
01/04/84	Advisory Committee	Management unit; management measures
01/10/84	Council Meeting	Discussion of management objectives
01/18/84	Managment Unit Subcommittee	Management unit
01/31/84	Demersal Finfish Committee	Management unit; minimum acceptable abundance
02/14/84	Demersal Finfish Committee	Approval of Parts II and III; management objectives
02/08/84	Objectives Subcommittee	Management objectives
02/22/83	Council Meeting	The Council voted to adopt the definition of the management unit recommended by the Demersal Finfish Committee
03/05/84	Objectives Subcommittee	Management objectives
03/14/84	Demersal Finfish Committee	Management objectives
03/22/84	Demersal Finfish Committee	Management objectives
04/02/84	Demersal Finfish Committee	Management unit
04/03/84	Council Meeting	After considering comments about the management unit received from the Mid-Atlantic Council, the Council agreed that the Demersal Finfish Committee be allowed to modify the definition of the Management Unit
04/19/84	Demersal Finfish Committee	Management unit; objectives; measures; square mesh
04/24/84	Advisory Committee	Small mesh fisheries; enforcement; optional settlement system; square mesh codends; management of gray sole
04/26/84	Alternatives Subcomittee	Management alternatives for haddock, redfish, flounders and whiting
05/01/84	Alternatives Subcomittee	Minimum sizes for major commercial species, mesh regulations, Southern New England management alternatives
05/09/84	Demersal Finfish Committee	Objectives; management unit; management alternatives; square mesh; Advisory Committee recommendations
05/10/84	Council Meeting	The Council voted to adopt a revision in the definition of the management unit recommended by the Demersal Finfish Committee. The Northeast Fisheries Center made a presentation on the scientific basis for identifying alternative managment strategies.
05/29/84	Demersal Finfish Committee	Management alternatives
06/06/84	Alternatives Subcomittee	Management alternatives
06/14/84	Demersal Finfish Committee	Management measures; exempted fisheries regulations
06/20/84	Demersal Finfish Committee	Gear conflict measures; minimum sizes; closed areas; mesh regulations exempted fisheries; objectives
06/26/84	Council Meeting	The Council voted to to take to public hearings the definition of the management unit and, with minor modifications, the managment strategies recommended by the Demersal Finfish Committee.
08/08/84	Demersal Finfish Committee	Objectives; minimum sizes; management options for Georges Bank; exempted fisheries

RECORD OF DECISIONS FOR MULTI-SPECIES FISHERY MANAGEMENT PLAN (Continued)

DATE	MEETING	ISSUES DISCUSSED
08/10/84	Council Meeting	The Council voted to approve, with minor modifications, the Public Hearing Summary Document prepared by the Demersal Finfish Committee.
08/20/84	Public Hearing Toms River, NJ	Draft FMP, EIS, RIR, IRFA
08/21/84	Public Hearing Barnstable, MA	Draft FMP, EIS, RIR, IRFA
08/21/84	Public Hearing Riverhead, NY	Draft FMP, EIS, RIR, IRFA
08/22/84	Public Hearing Portland, ME	Draft FMP, EIS, RIR, IRFA
08/22/84	Public Hearing Plymouth, MA	Draft FMP, EIS, RIR, IRFA
08/23/84	Public Hearing Wakefield, RI	Draft FMP, EIS, RIR, IRFA
08/28/84	Public Hearing Ellsworth, ME	Draft FMP, EIS, RIR, IRFA
08/30/84	Public Hearing Fairhaven, MA	Draft FMP, EIS, RIR, IRFA
08/29/84	Public Hearing Gloucester, MA	Draft FMP, EIS, RIR, IRFA
09/11/84	Demersal Finfish Committee	The Committee recommended a number of managment measures in response to comments received at the public hearings
09/18/84	Council Meeting	The Council did not approve the Demersal Finfish Committee's recommendations for management measures.
10/10/84	Council Meeting	The Council voted to approve the Demersal Finfish Committee's recommendations with the following major exceptions: 1) The minimum mesh size for Georges Bank and Southern New England would be 6 inches. 2) Gillnetters would be required to tend their gear in certain areas and during certain months in the Gulf of Maine and in Southern New England.
10/30/84	Council Meeting	The Council voted to reverse the proposed measure requiring gillnetters to tend their gear.
12/06/84	Demersal Finfish Committee	Plan document; recreational fishery management measures; exempted fisheries program; regulations
12/11/84	Council Meeting	The Council voted to not include in the plan any recommendations regarding the future of industry support programs such as the Capital Construction Fund and the Fishery Obligations Guarantee Program and to include Section 788 entitled "Enforcement Program Considerations". The Council discussed managment measures for Southern New England, redfish and gear conflicts.
01/18/85	Advisory Committee	Southern New England mesh regulations; closed area for Southern New England yellowtail; phase-in of mesh size increases; exempted fisheries regulations; experimental fishery for whiting; square mesh; exclusion of winter flounder from exempted species calculations; exempted fisheries for whiting and butterfish in Southern New England
01/21/85	Demersal Finfish Committee	Advisory Committee recommendations; public hearing summary document; draft regulations; Mid-Atlantic recommendations; recommended changes to management measures
01/24/85	Council Meeting	The Council voted to adopt the Demersal Finfish Committee's recommended changes to management measures, with minor modifications. The Council also voted to approve the public hearing summary document and the draft FMP/EIS for submission to the Secretary of Commerce and filing with the EPA.
02/06/85	Public Hearing Riverhead, NY	Draft FMP
02/07/85	Public Hearing Galilee, RI	Draft FMP
02/12/85	Public Hearing Fairhaven, MA	Draft FMP
02/13/85	Public Hearing Gloucester, MA	Draft FMP
02/14/85	Public Hearing Portland, ME	Draft FMP
03/06/85	Demersal Finfish Committee	Minimum size for recreational fishery; exempted fisheries regulations for Southern New England; exempted fishery reporting period; annual permit system; exempted fishery for redfish; experimental fishery for whiting; management unit definition

RECORD OF DECISIONS FOR MULTI-SPECIES FISHERY MANAGEMENT PLAN (Continued)

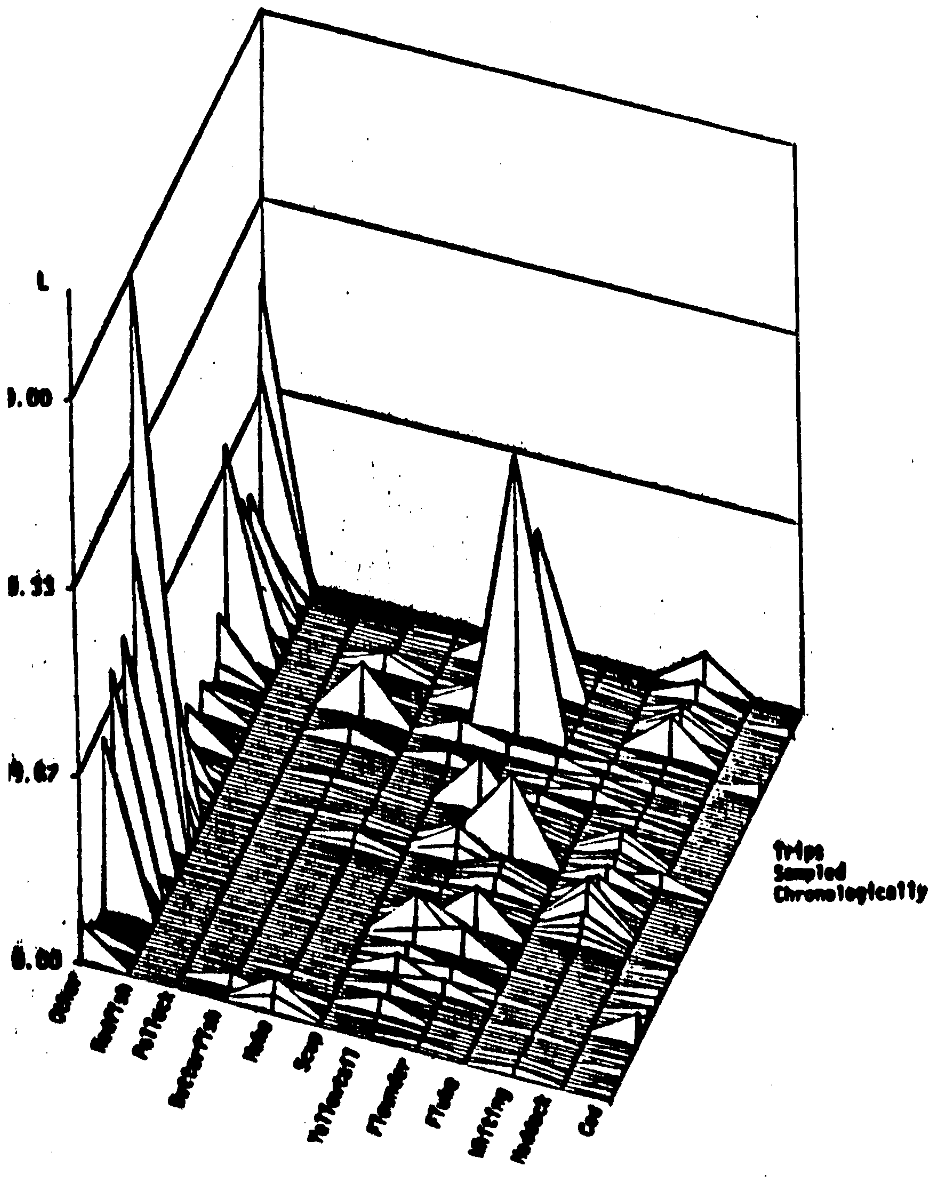
03/05/85	Council Meeting	The Council voted that the plan should include the voluntary retention of vessel identification numbers in the multi-species data base.
04/03 - 04/04/85	Demersal Finfish Committee	Public hearing comments; other comments; status of the hakes; data needs; yellowtail management; redfish management
04/08/85	Public Hearing Riverhead, NY	Southern New England closed area option; data collection
04/09/85	Public Hearing Galilee, RI	Southern New England closed area option; data collection
04/10/85	Public Hearing Fairhaven, MA	Southern New England closed area option; data collection
04/23/85	Council Meeting	Review of public hearing comments. The Council voted to: 1) adopt a three year phase-in of the 6" minimum mesh size for Georges Bank provided that the Canada takes similar action in the Canadian area of Georges Bank; 2) substitue closed areas for minimum mesh size requirements in Southern New England; 3) to allow a small mesh fishery for redfish in the the Gulf of Maine; 4) to exclude red and silver hake from the managment unit until the domestic processing capacity equals the acceptable biological catch. Other issues voted on were exempted fisheries reporting requirements, an experimaental fishery for whiting, vessel identification numbers and habitat recommendations. The Council voted to approve the draft FMP for final submission to the Secreatry of Commerce.

APPENDIX 3A.1

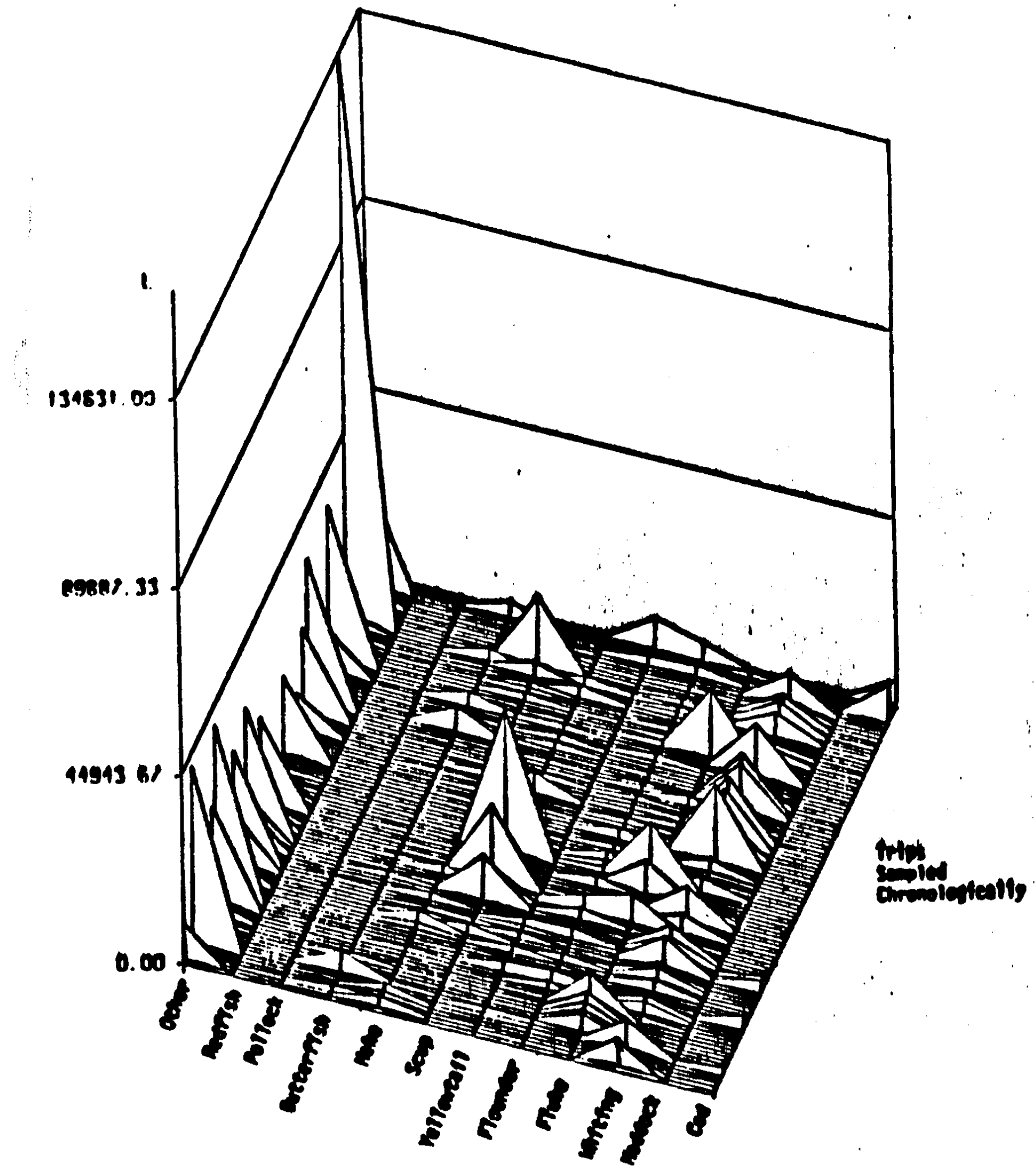
TRIP CATCHES BY OTTER TRAWLS, 1973-1976-1979-1982

Point Judith
Gloucester
New Bedford
Portland
Rockland
Provincetown
Boston
Newport

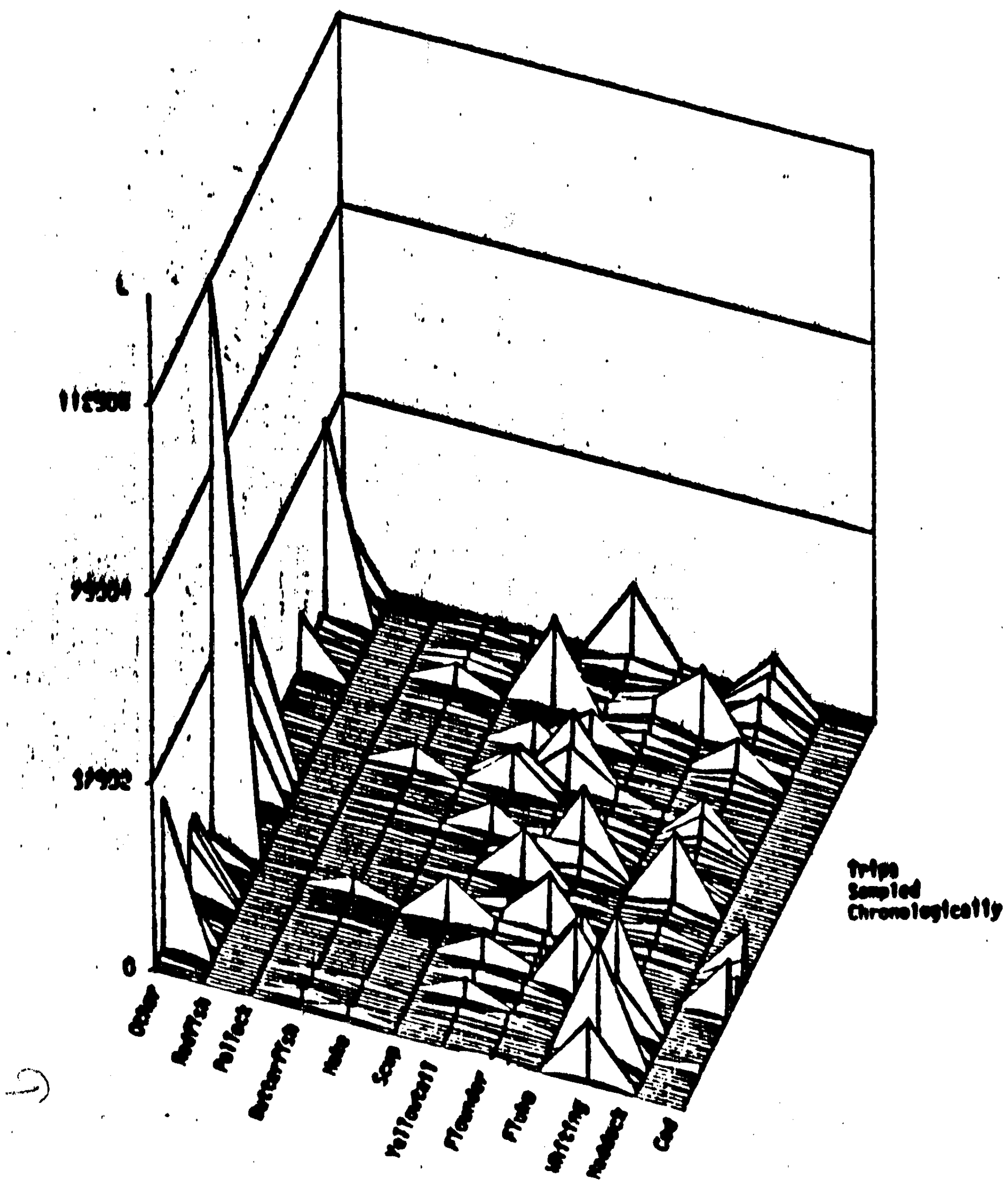
RAPH OF OTTER TRAWL TRIP CATCHES 1973
PORT=POINT JUDITH



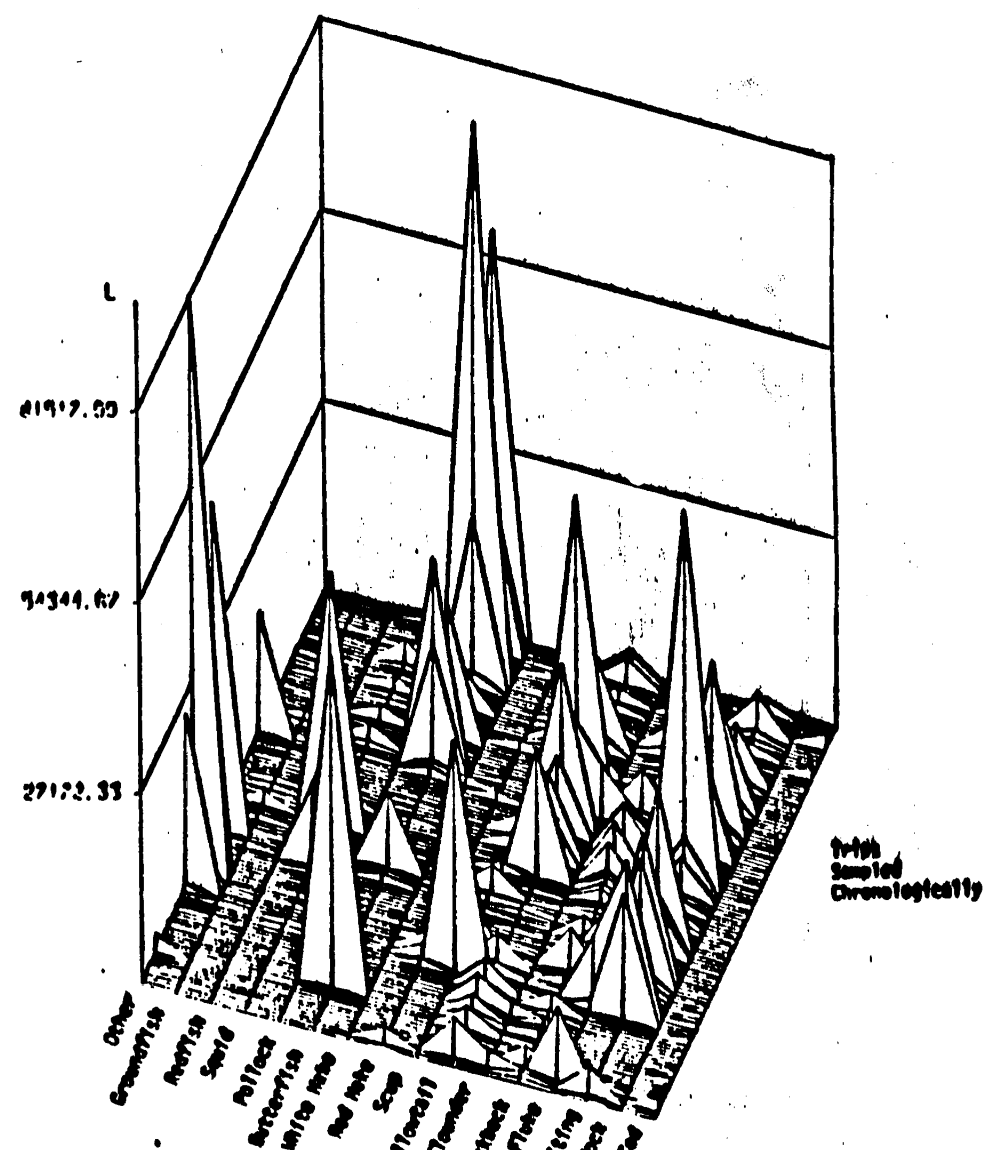
GRAPH OF OTTER TRAWL TRIP CATCHES 1976
PORT=POINT JUDITH



GRAPH OF OTTER TRAWL TRIP CATCHES 1979
PORT-POINT JUDITH

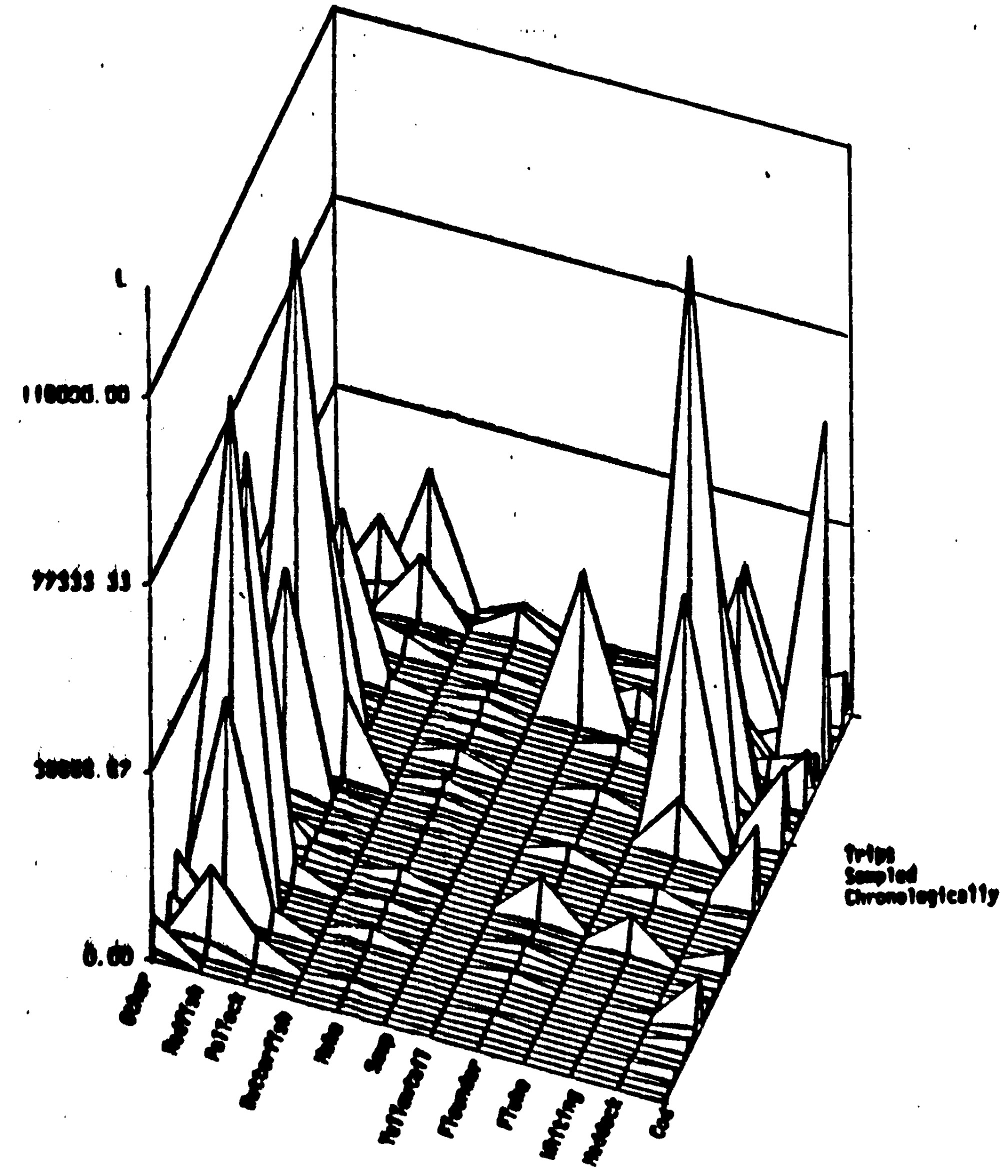


GRAPH OF OTTER TRAWL TRIP CATCHES 1982
PORT-POINT JUDITH



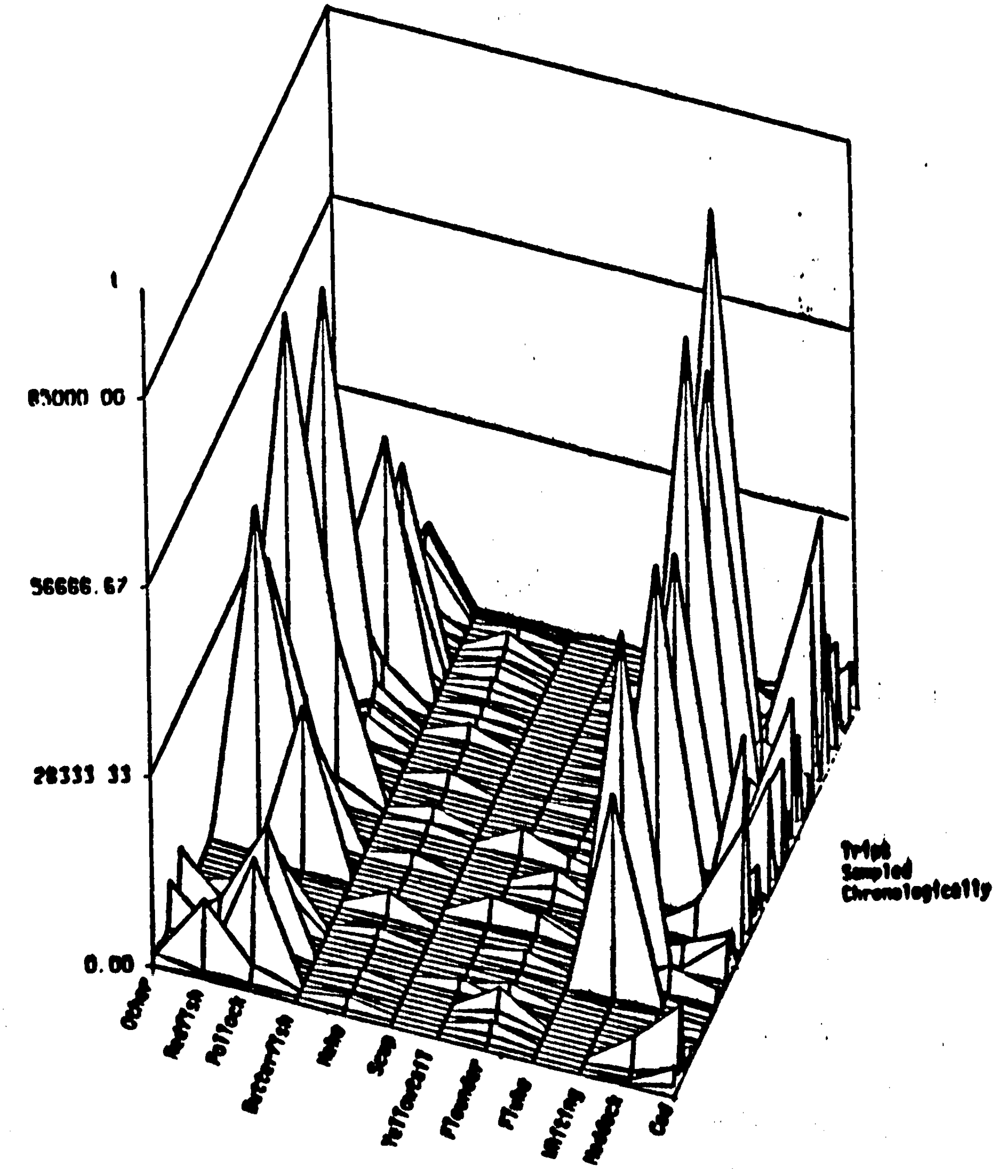
GRAPH OF OTTER TRAWL TRIP CATCHES 1973

PORT=GLOUCESTER

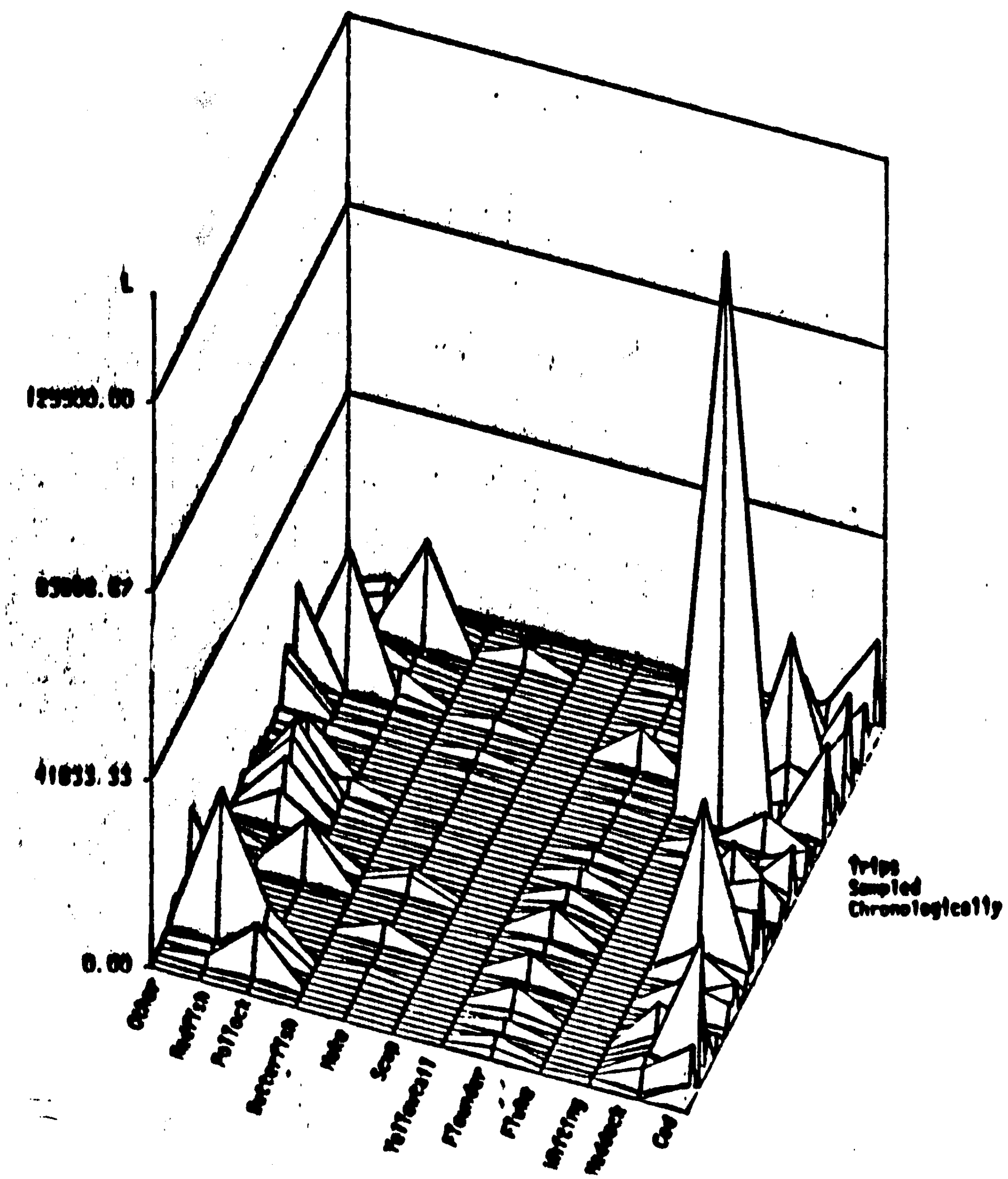


GRAPH OF OTTER TRAWL TRIP CATCHES 1976

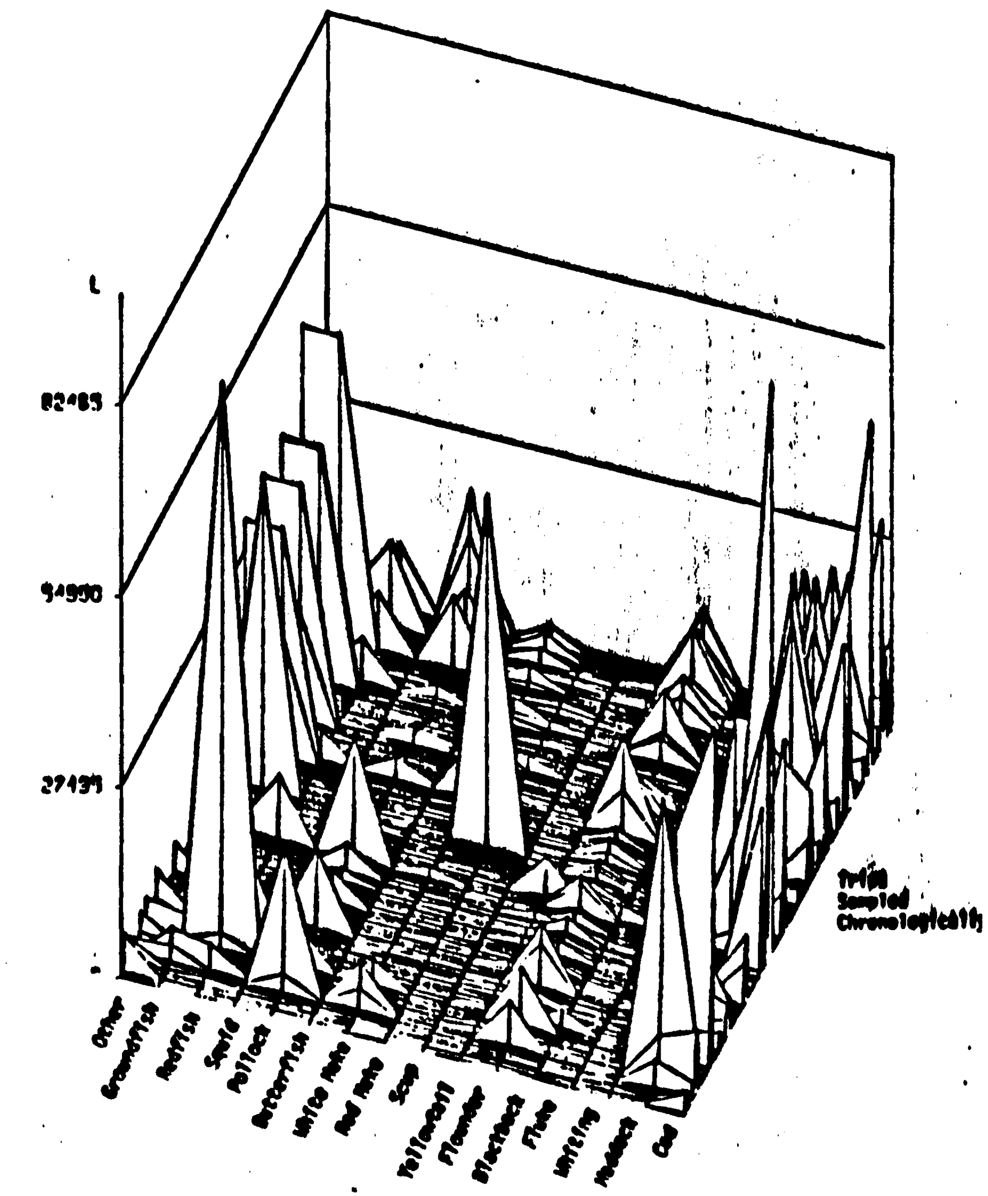
PORT=GLOUCESTER



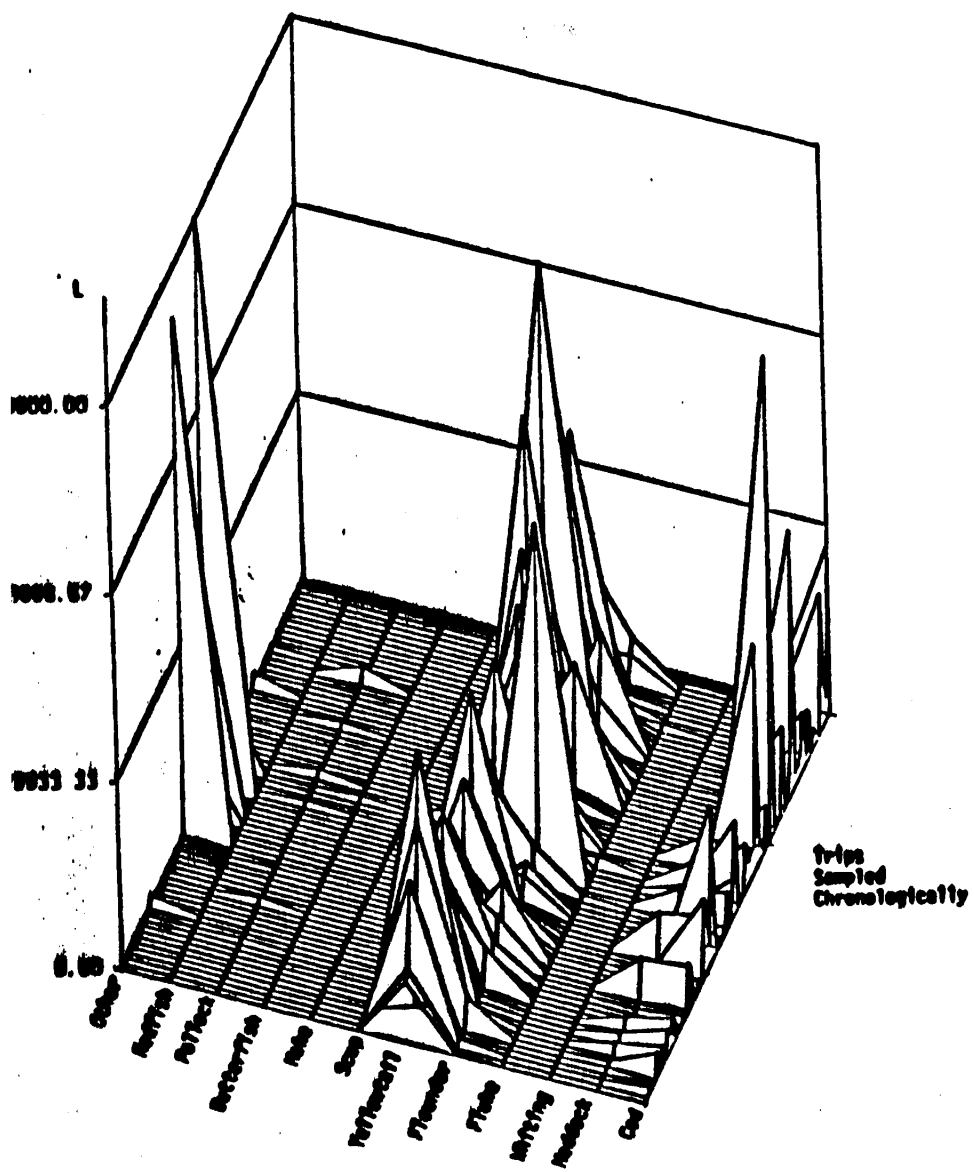
GRAPH OF OTTER TRAWL TRIP CATCHES 1979
PORT=GLOUCESTER



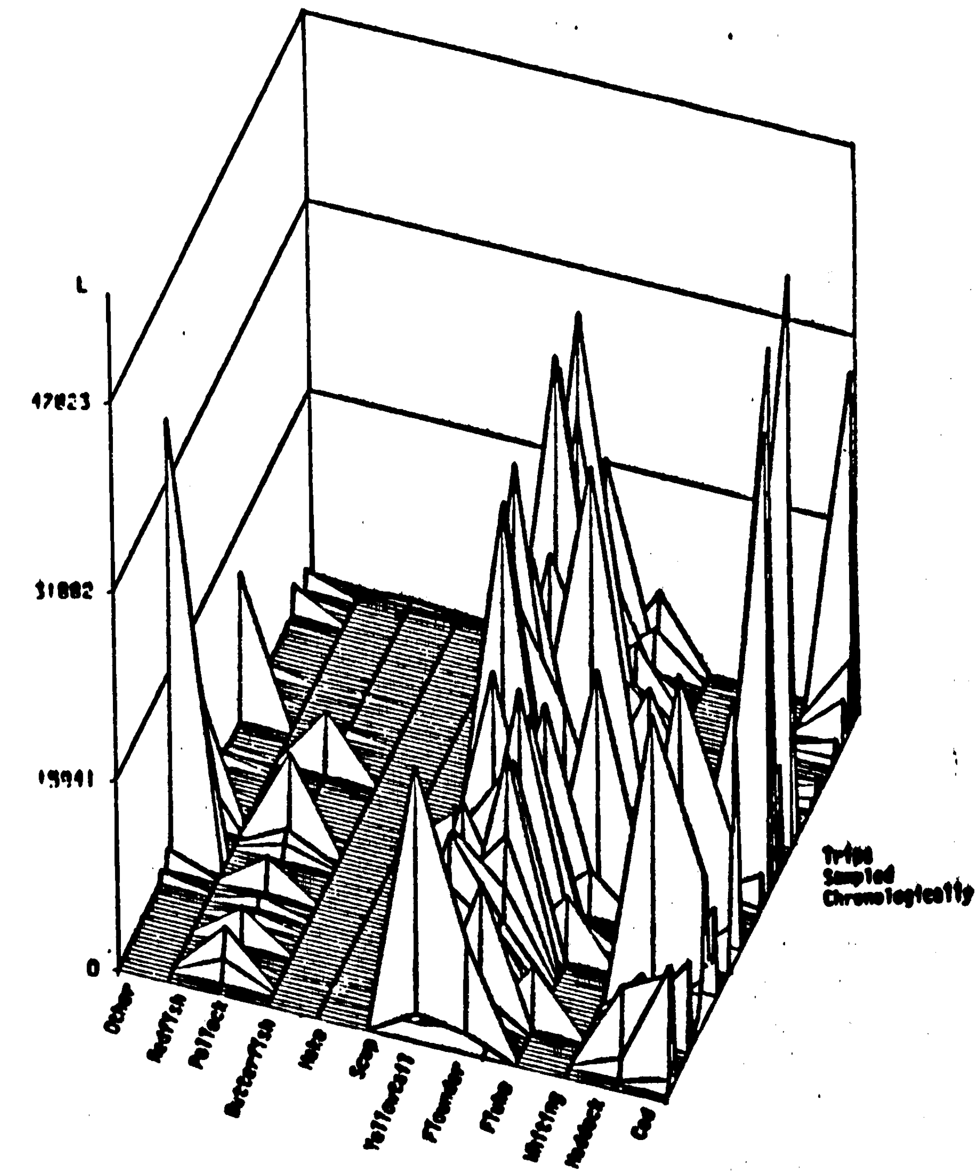
GRAPH OF OTTER TRAWL TRIP CATCHES 1982
PORT=GLOUCESTER



GRAPH OF OTTER TRAWL TRIP CATCHES 1973
PORT=NEW BEDFORD

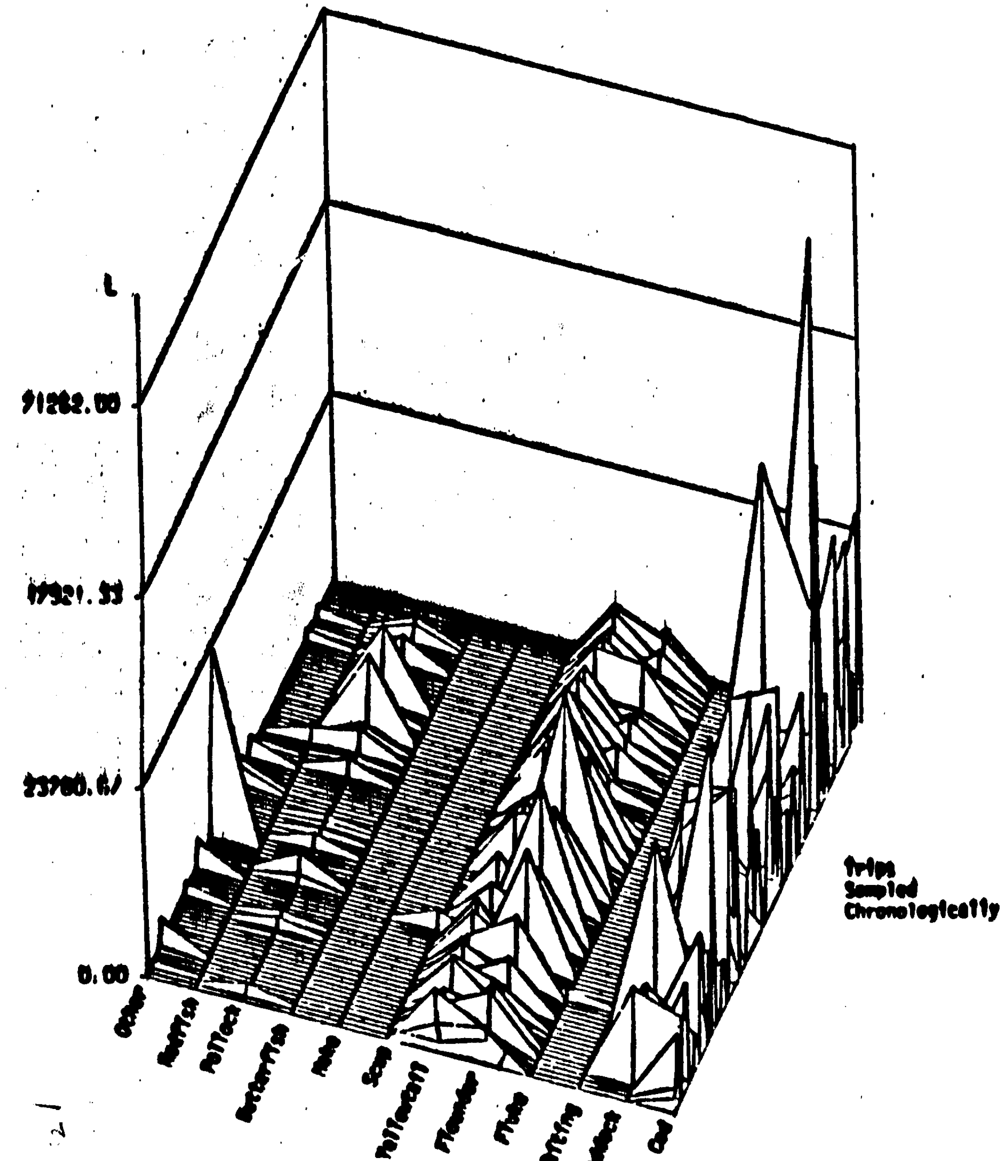


GRAPH OF OTTER TRAWL TRIP CATCHES 1976
PORT=NEW BEDFORD



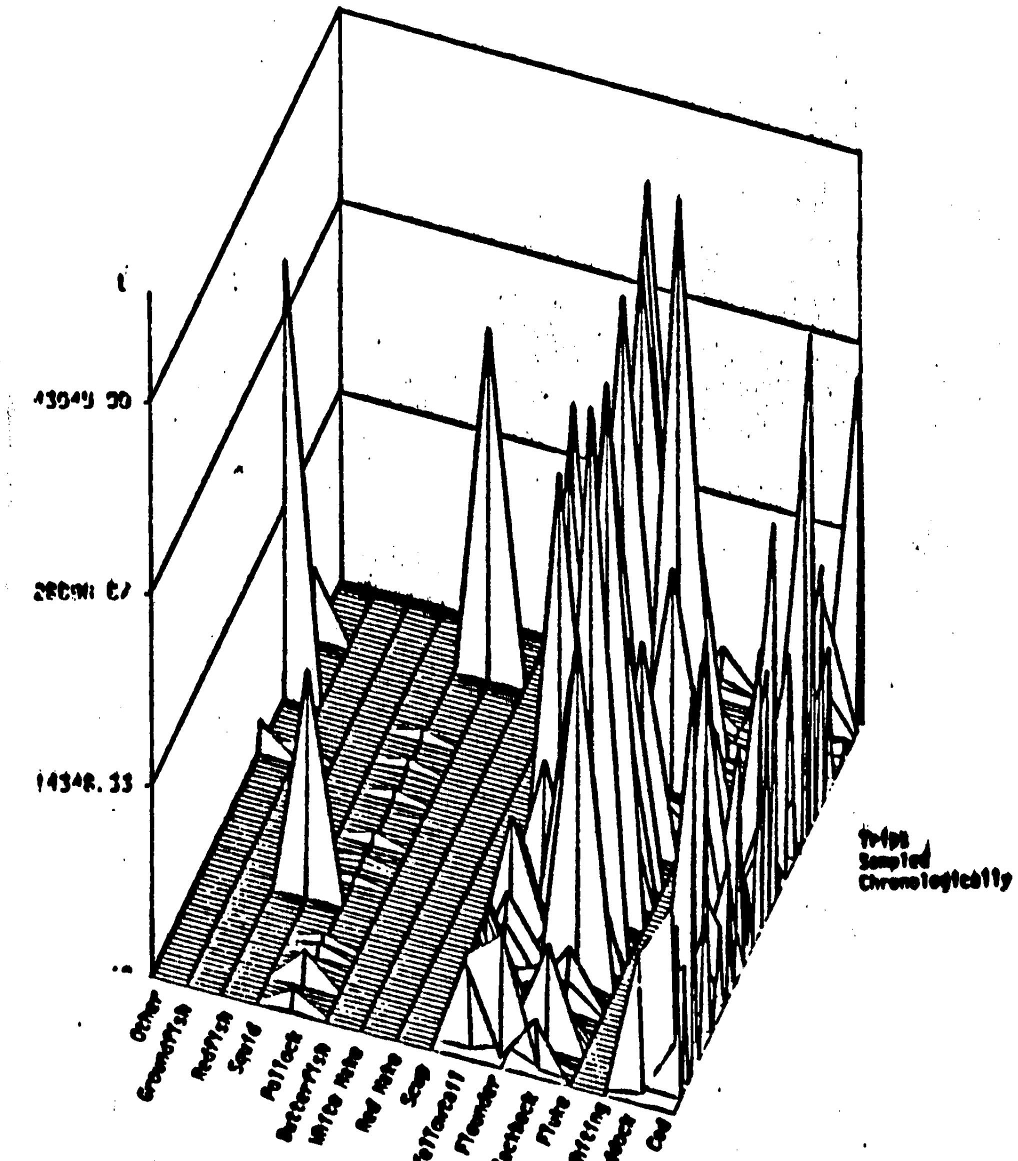
GRAPH OF OTTER TRAWL TRIP CATCHES 1979

PORT=NEW BEDFORD

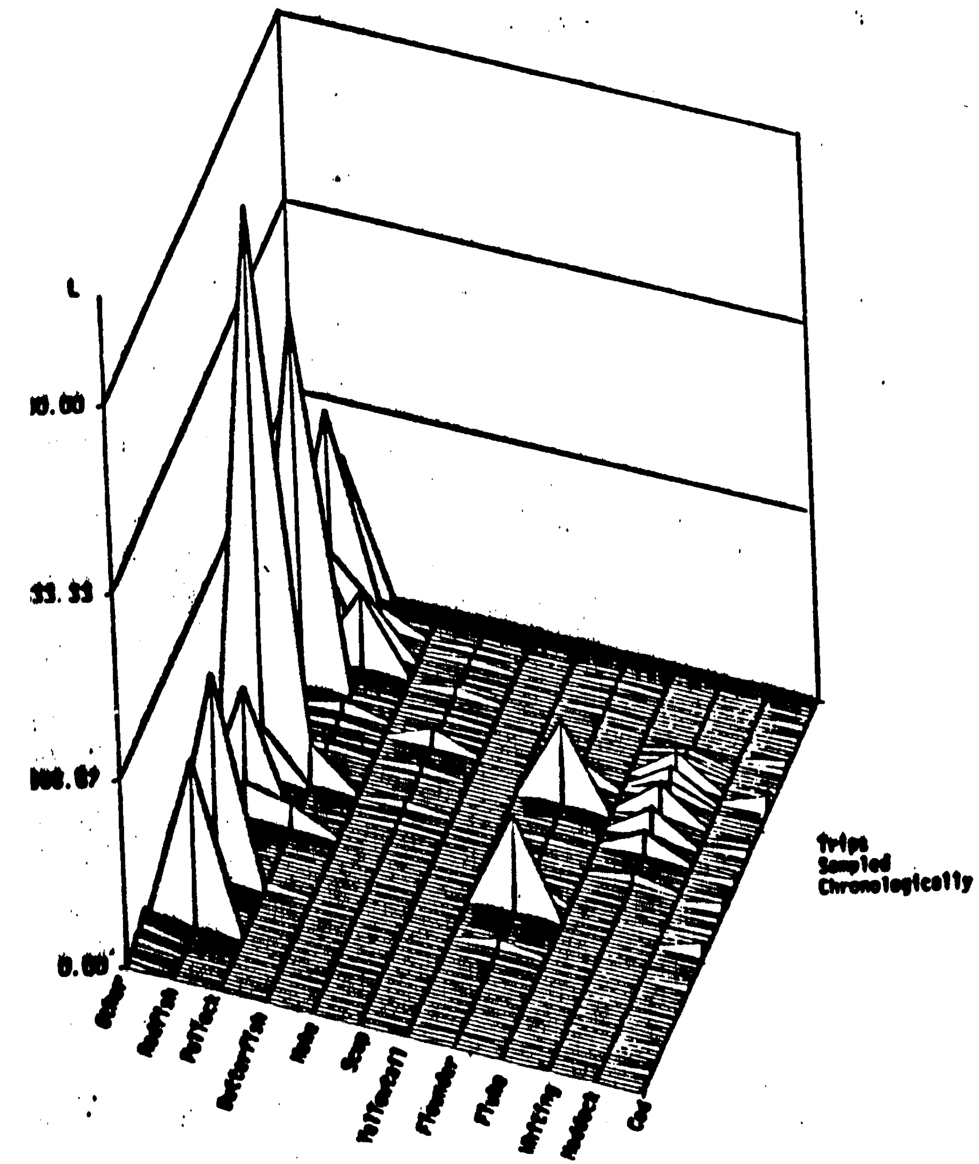


GRAPH OF OTTER TRAWL TRIP CATCHES 1982

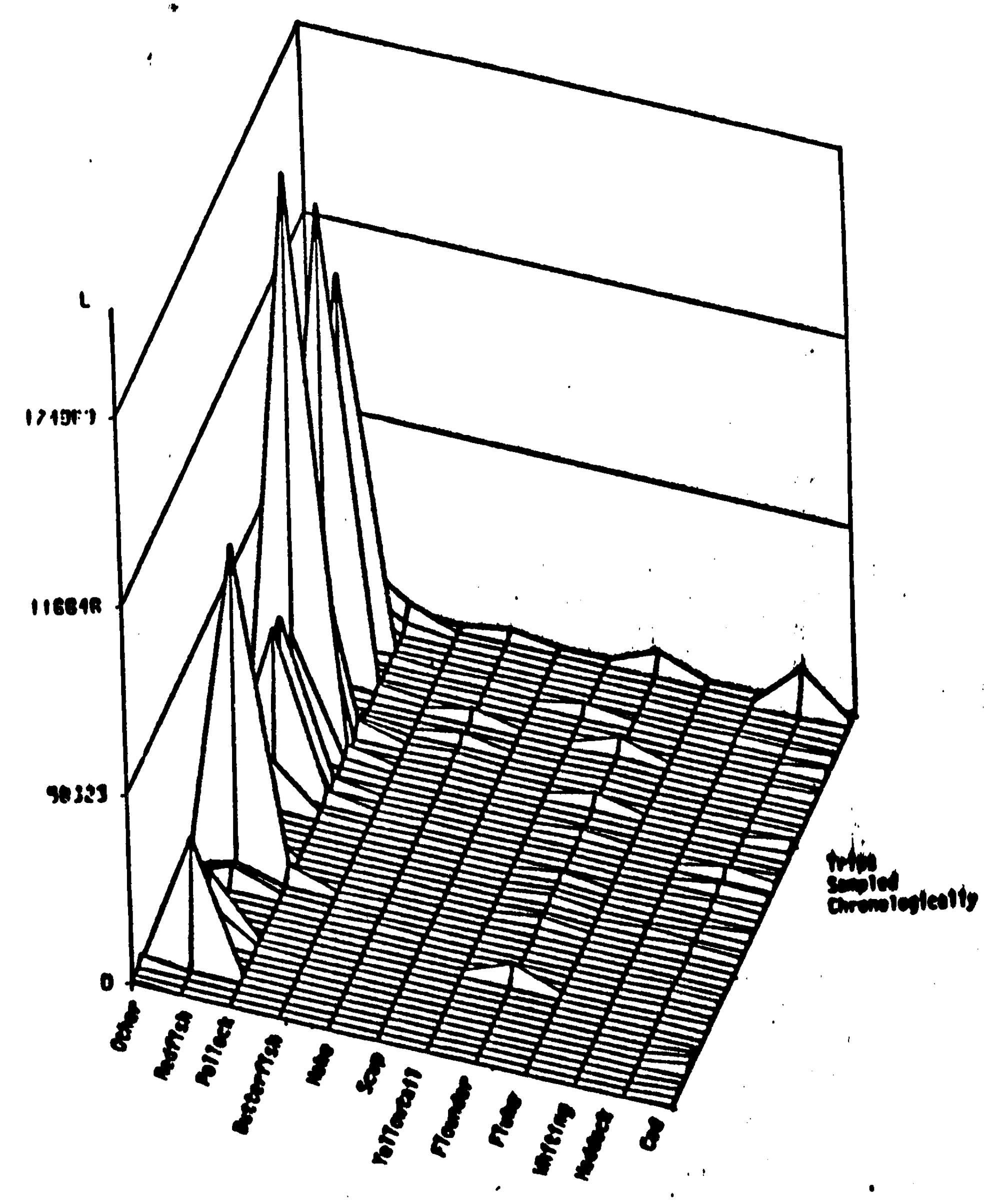
PORT=NEW BEDFORD



ʀAPH OF OTTER TRAWL TRIP CATCHES 1973
PORT=PORTLAND

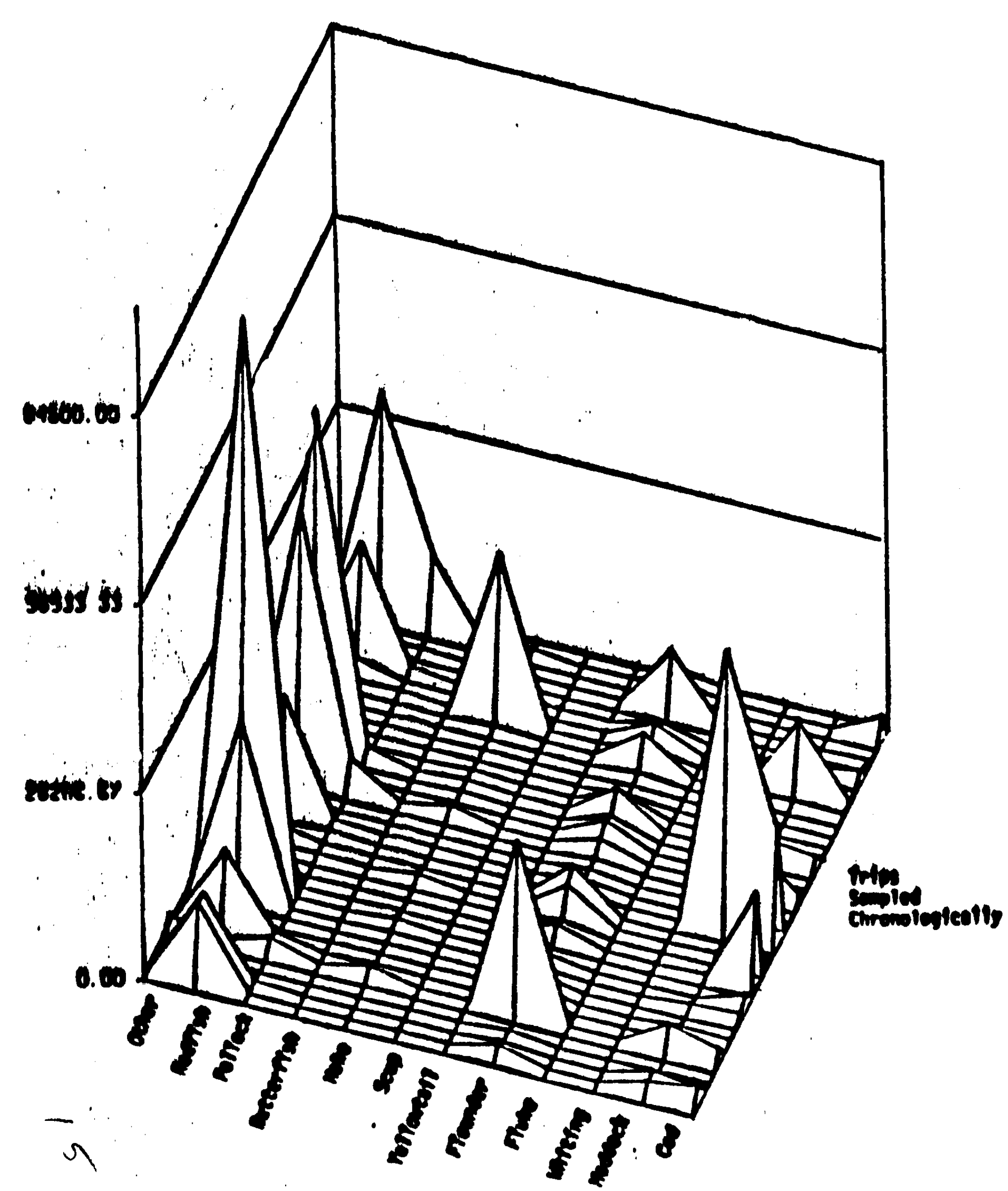


GRAPH OF OTTER TRAWL TRIP CATCHES 1976
PORT=PORTLAND



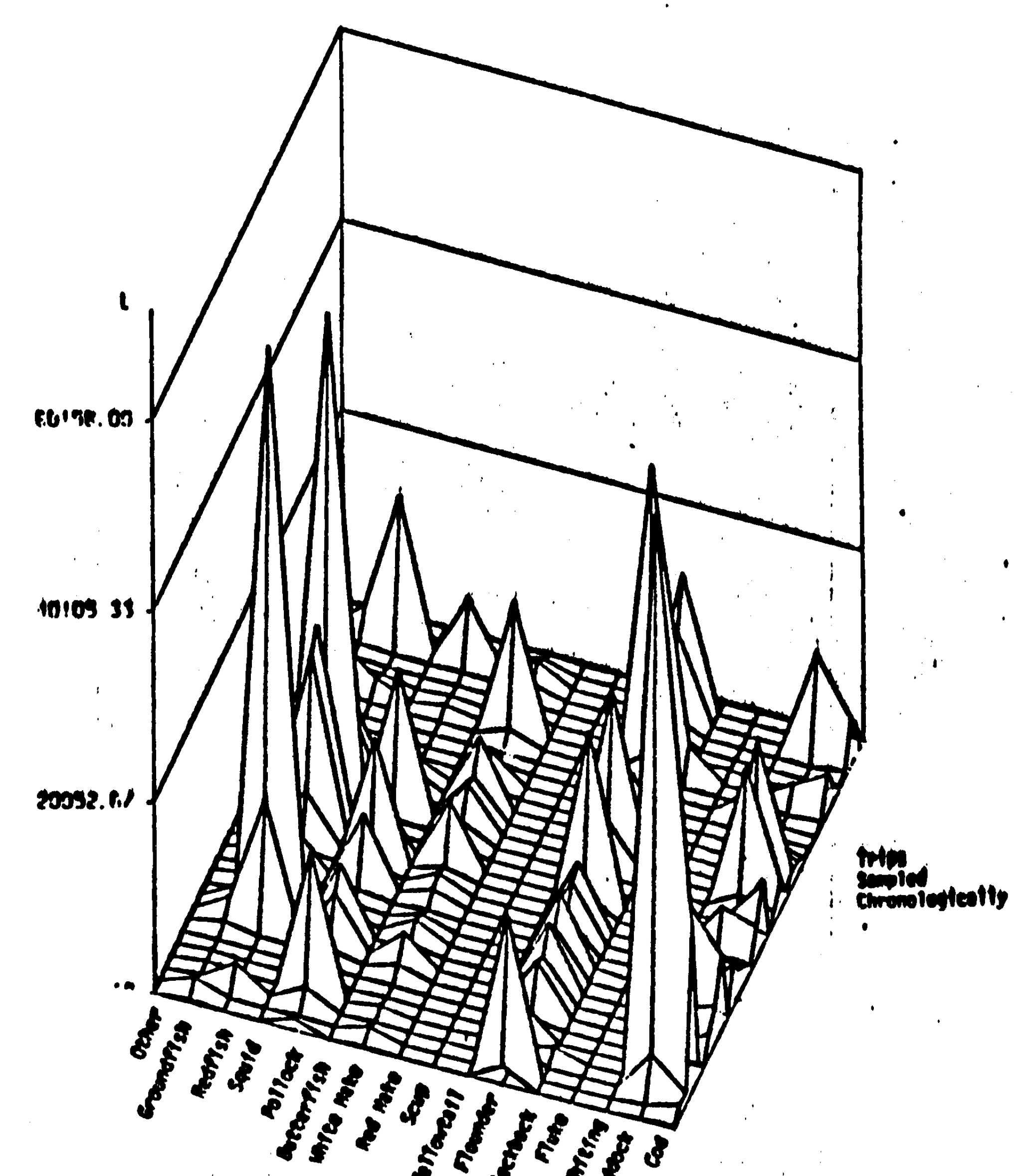
GRAPH OF OTTER TRAWL TRIP CATCHES 1979

PORT=PORTLAND

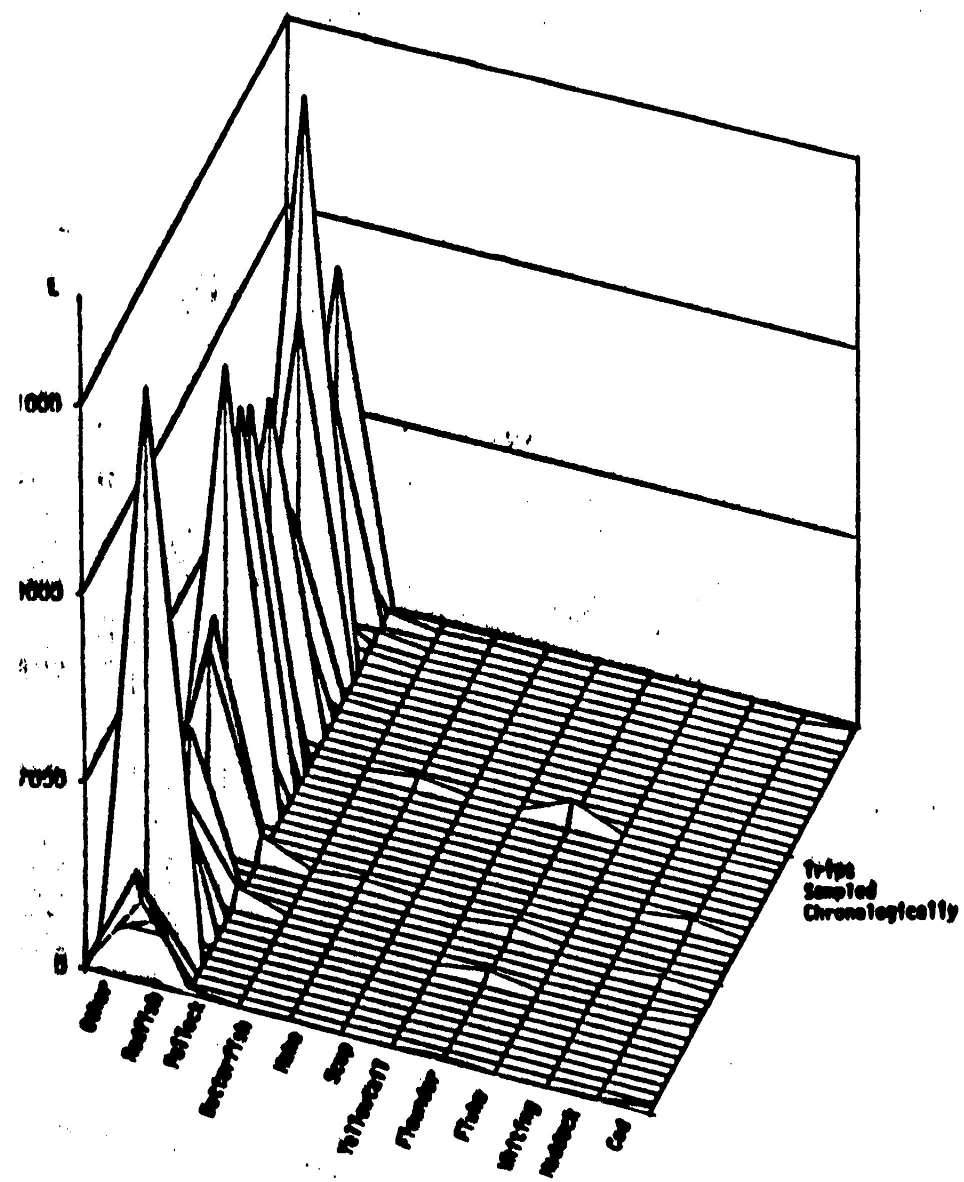


GRAPH OF OTTER TRAWL TRIP CATCHES 1982

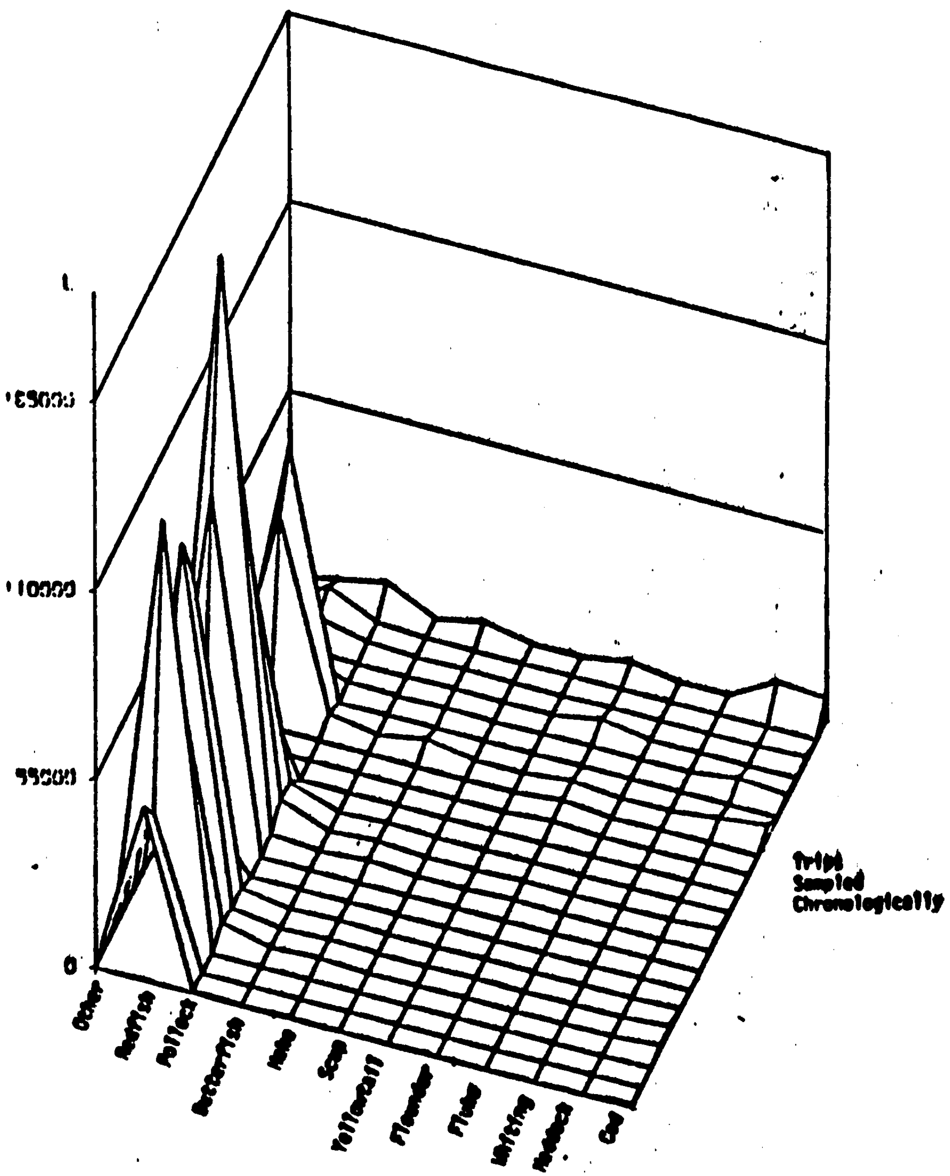
PORT=PORTLAND



GRAPH OF OTTER TRAWL TRIP CATCHES 1973
PORT=ROCKLAND

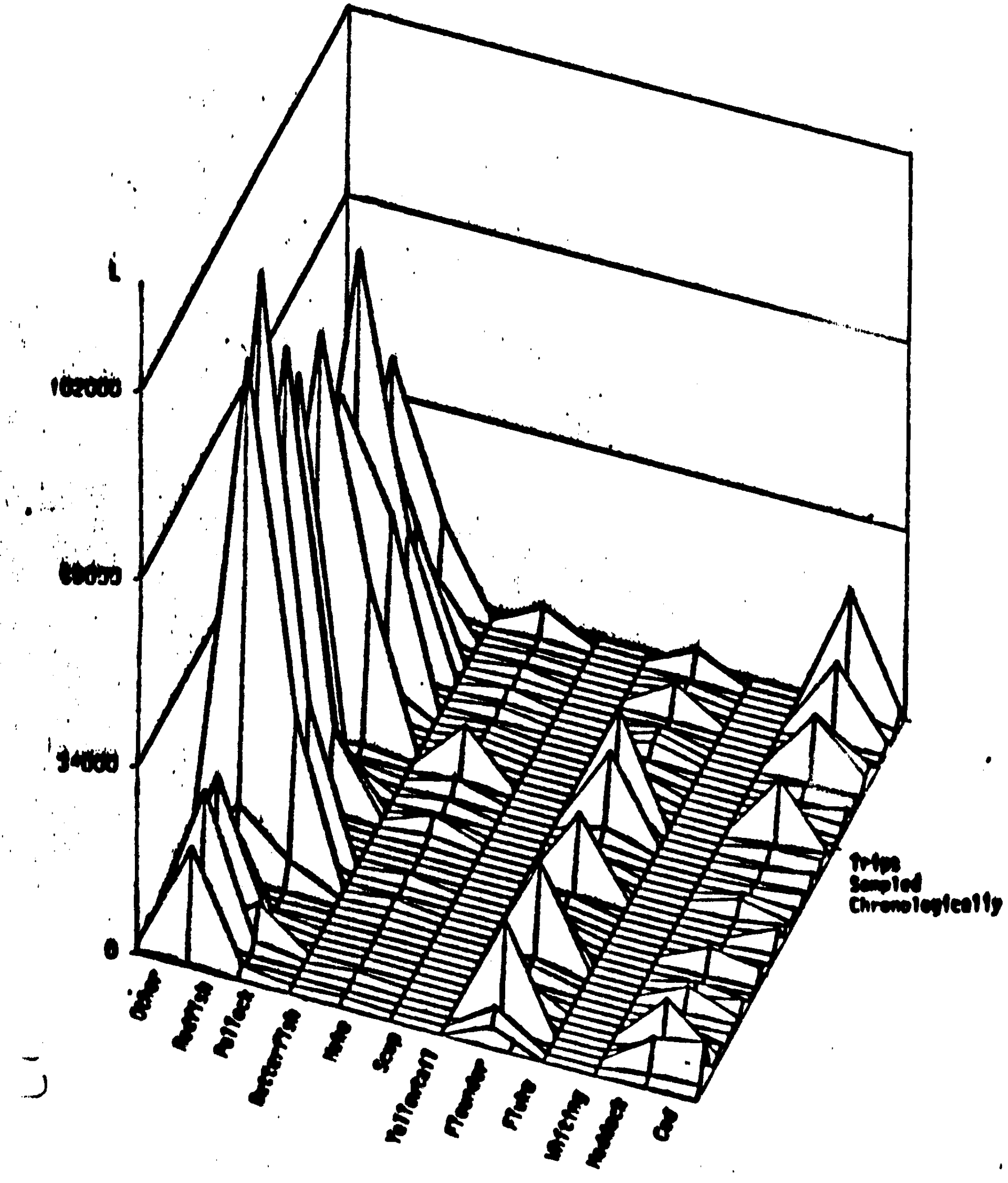


GRAPH OF OTTER TRAWL TRIP CATCHES 1976
PORT=ROCKLAND



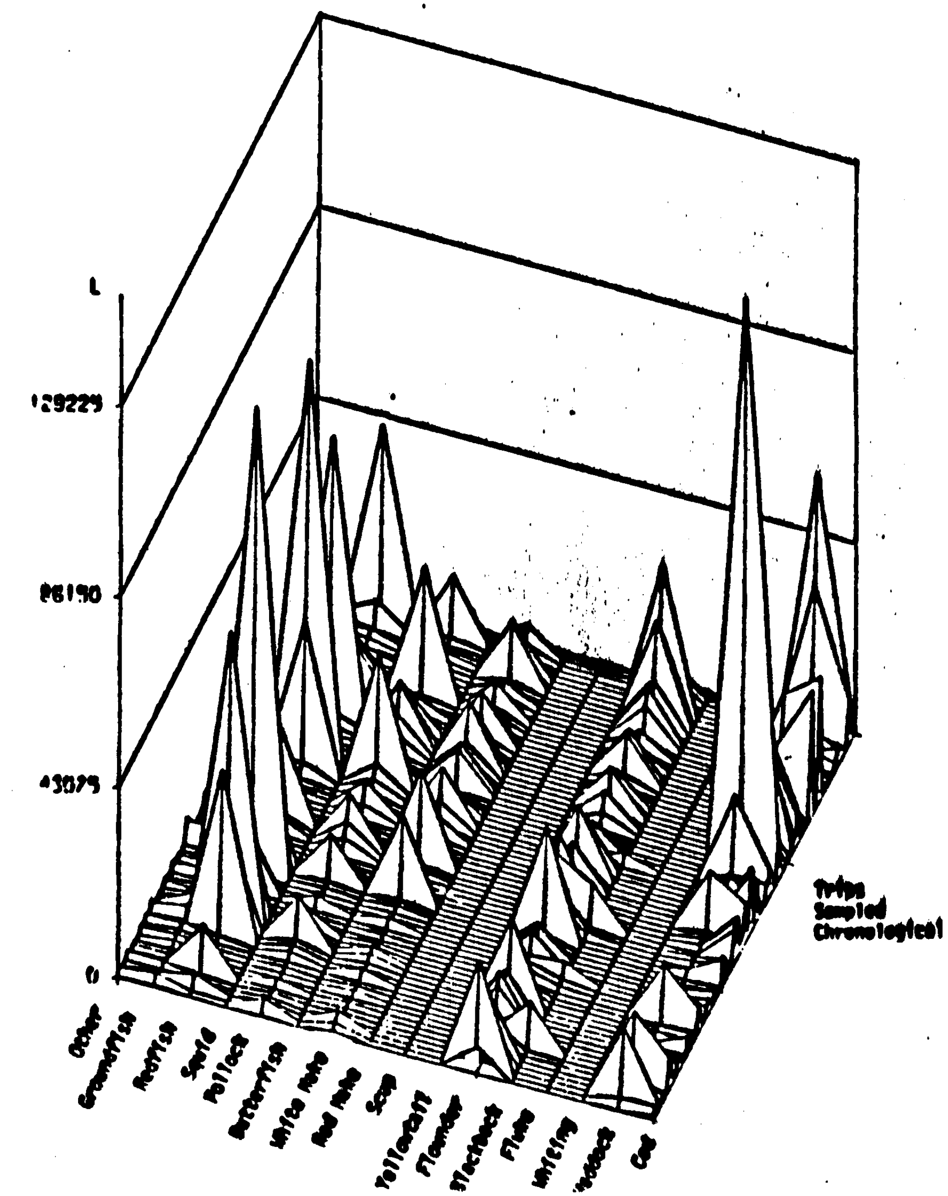
GRAPH OF OTTER TRAWL TRIP CATCHES 1979

PORT=ROCKLAND

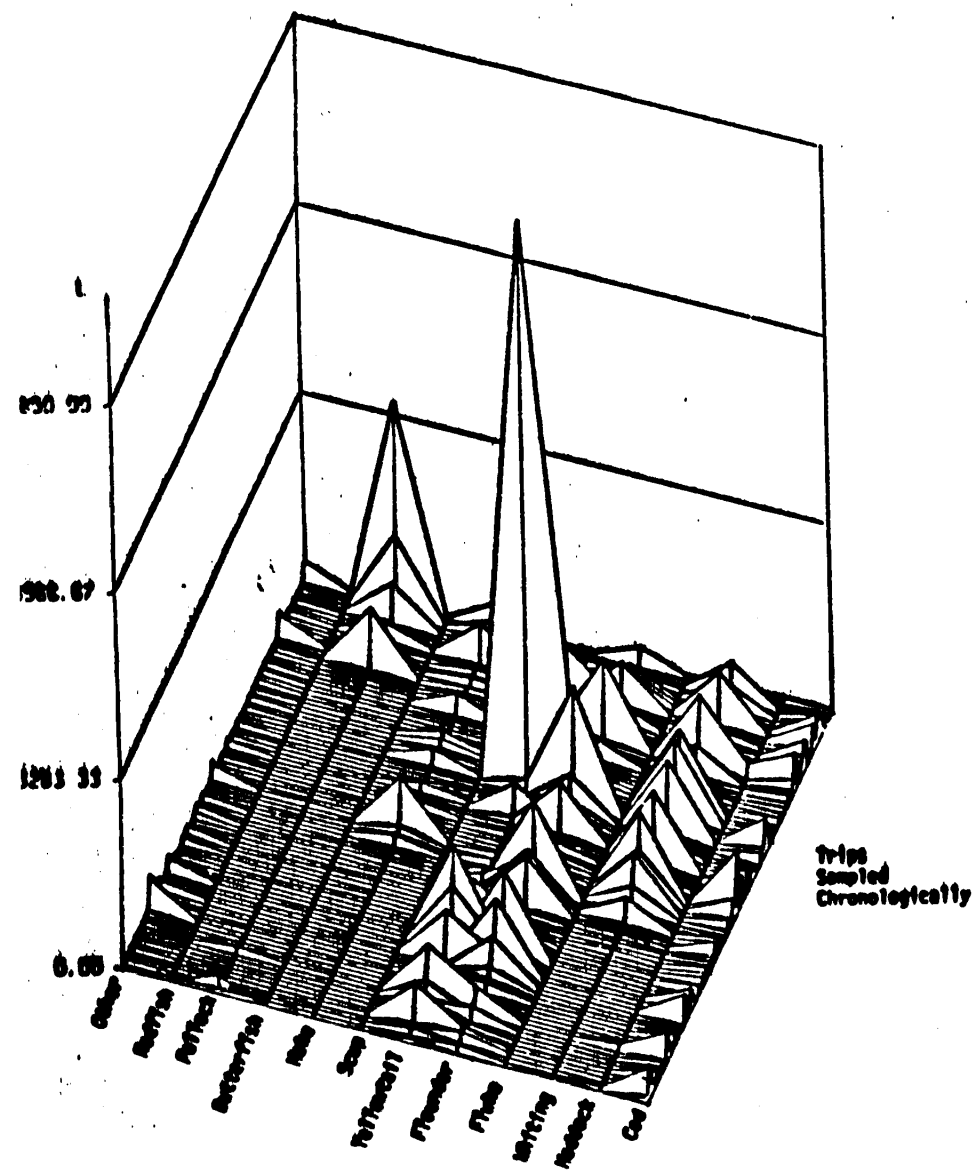


GRAPH OF OTTER TRAWL TRIP CATCHES 1982

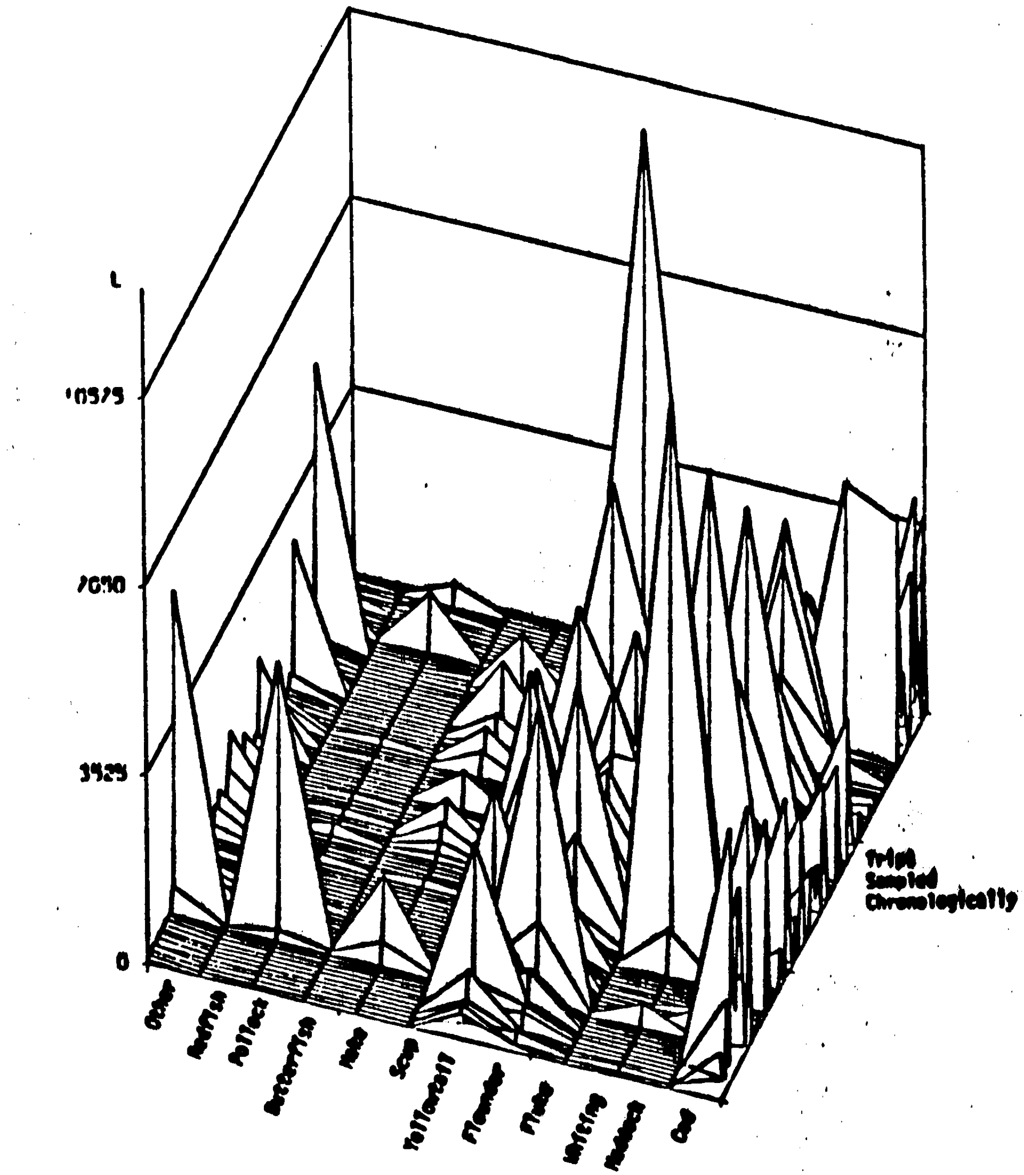
PORT=ROCKLAND



GRAPH OF OTTER TRAWL TRIP CATCHES 1973
PORT=PROVINCETOWN

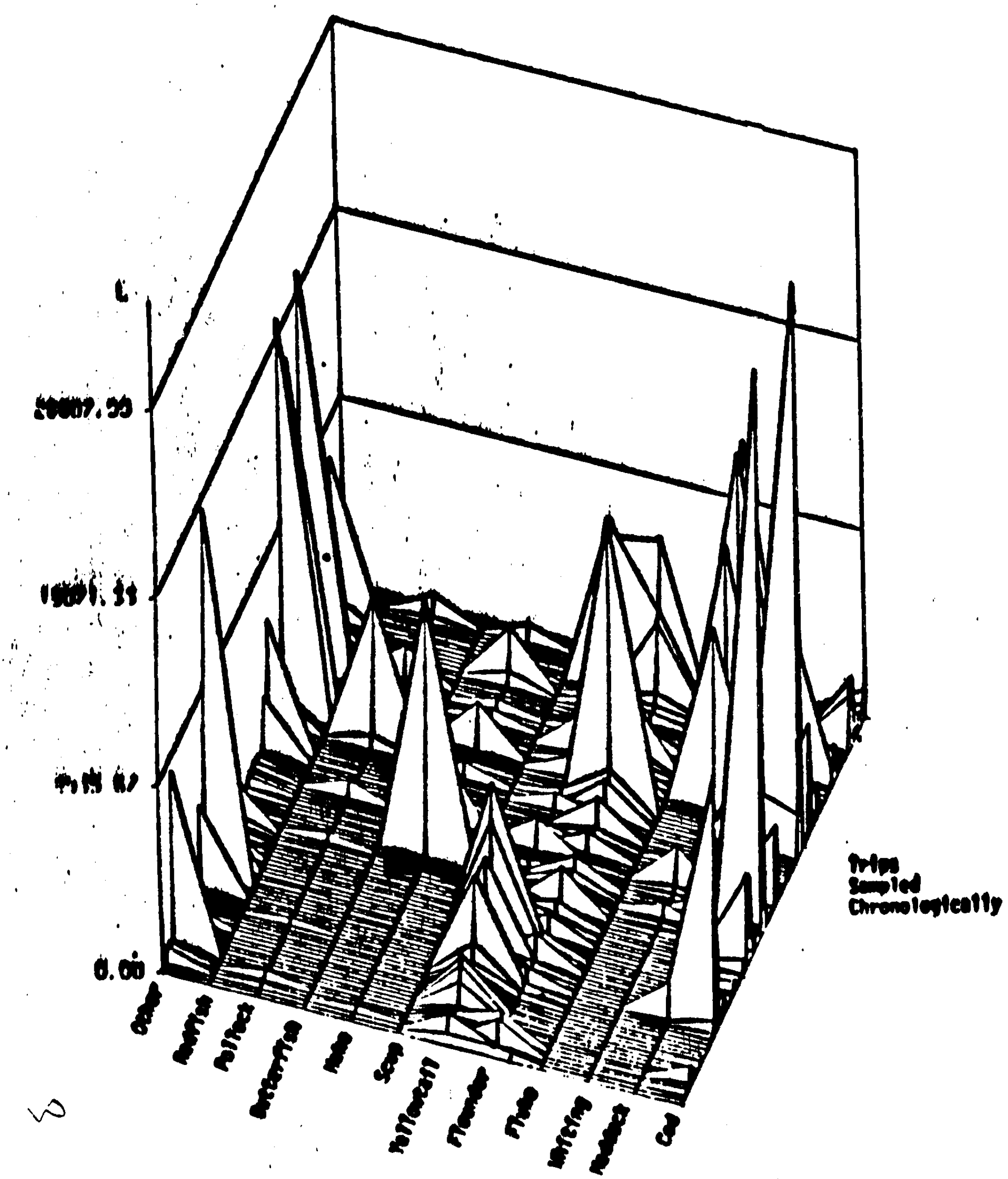


GRAPH OF OTTER TRAWL TRIP CATCHES 1976
PORT=PROVINCETOWN



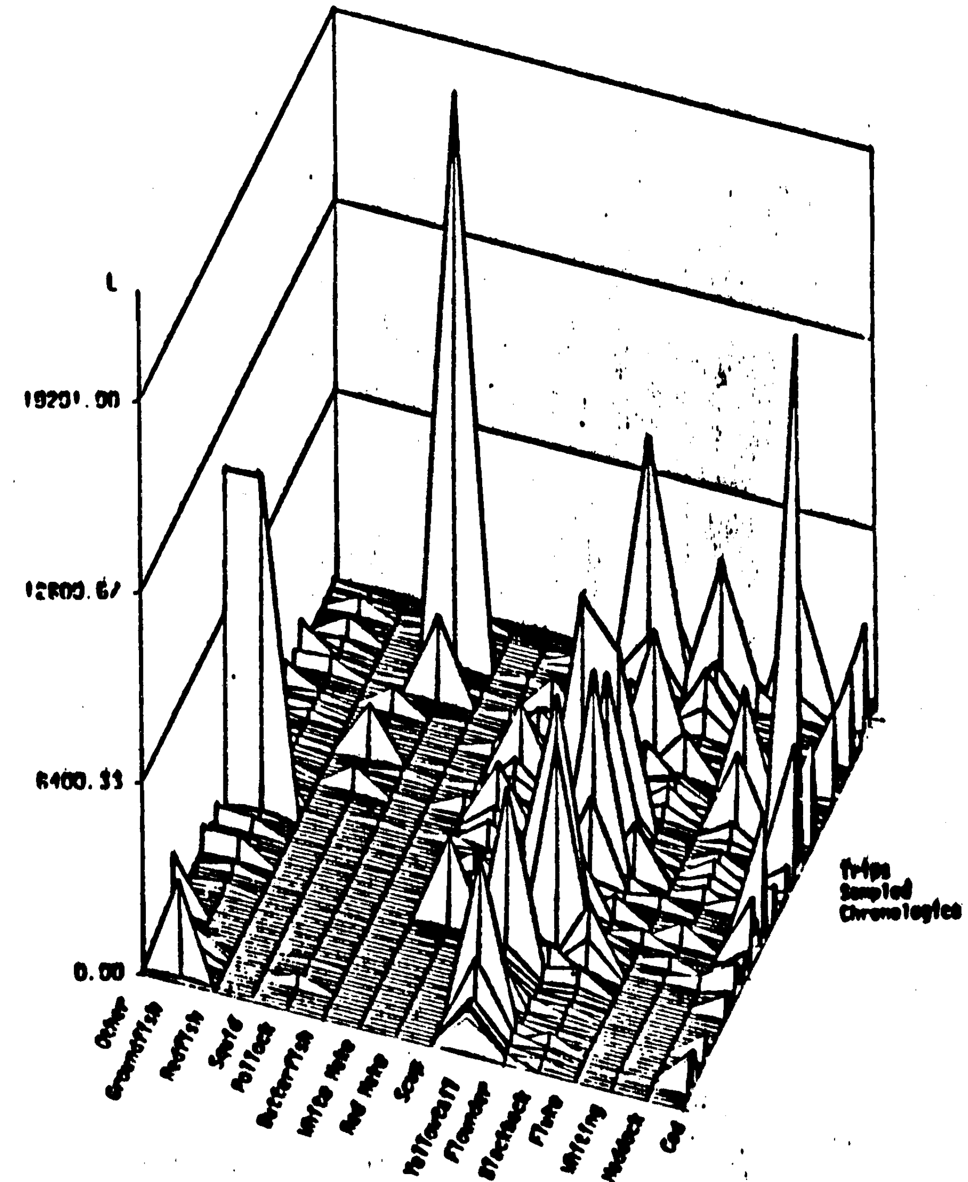
GRAPH OF OTTER TRAWL TRIP CATCHES 1979

PORT=PROVINCETOWN



GRAPH OF OTTER TRAWL TRIP CATCHES 1982

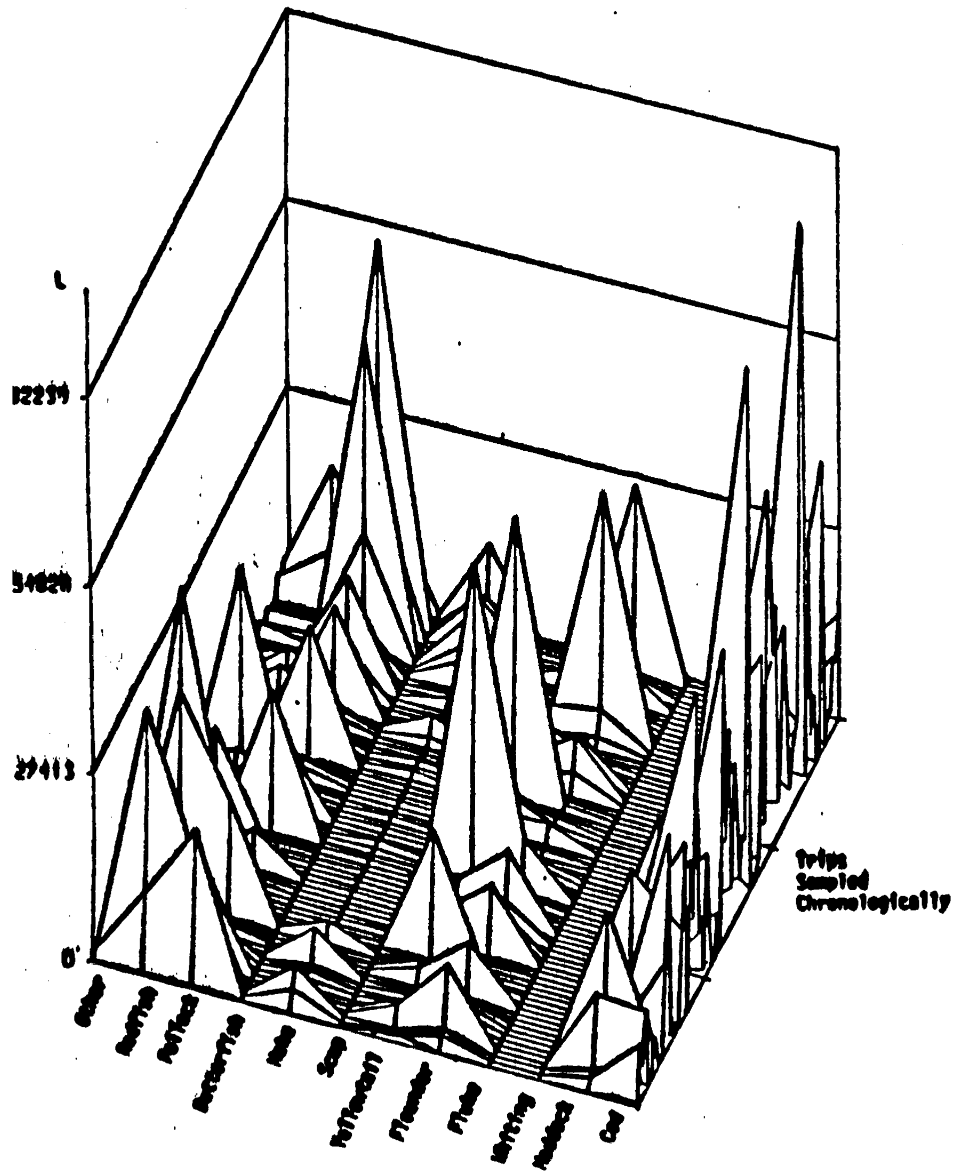
PORT=PROVINCETOWN



3

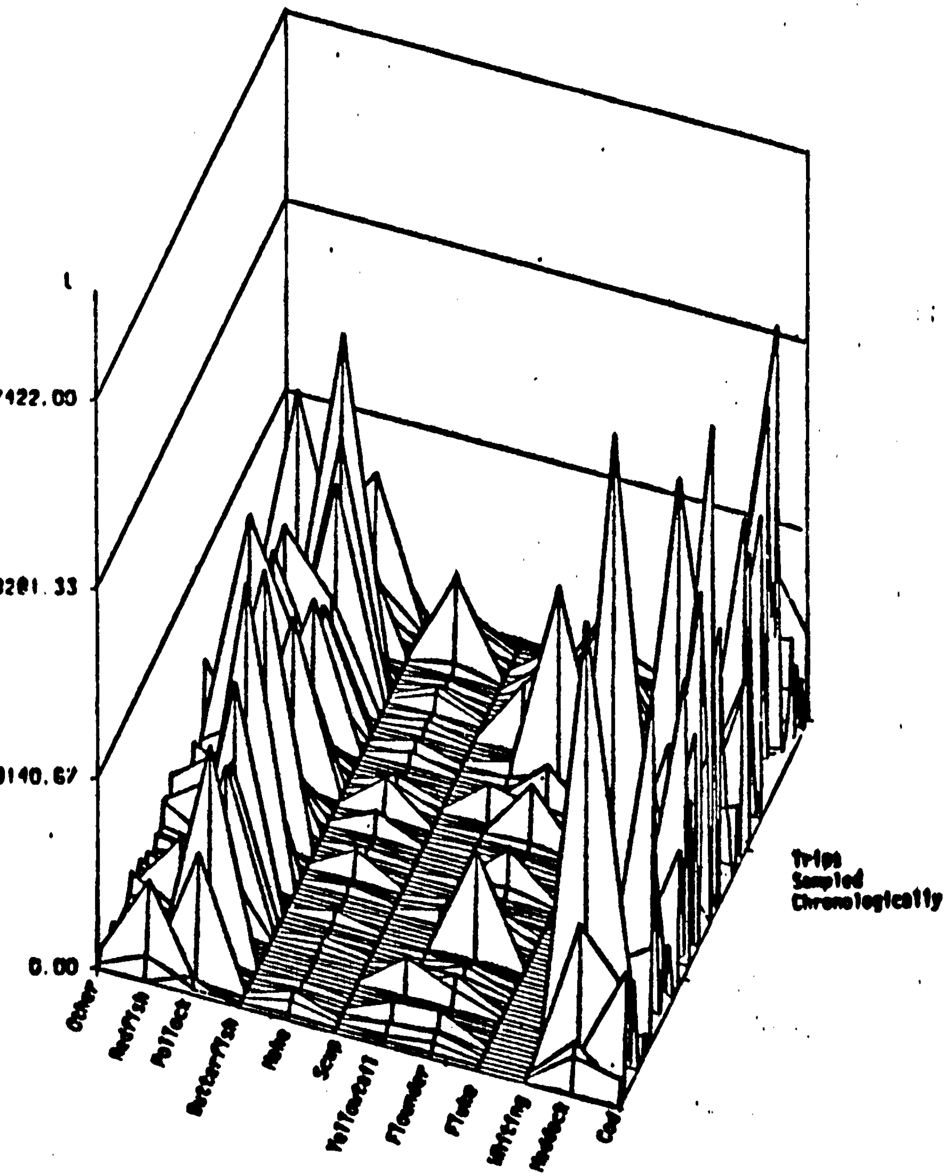
GRAPH OF OTTER TRAWL TRIP CATCHES 1973

PORT=BOSTON



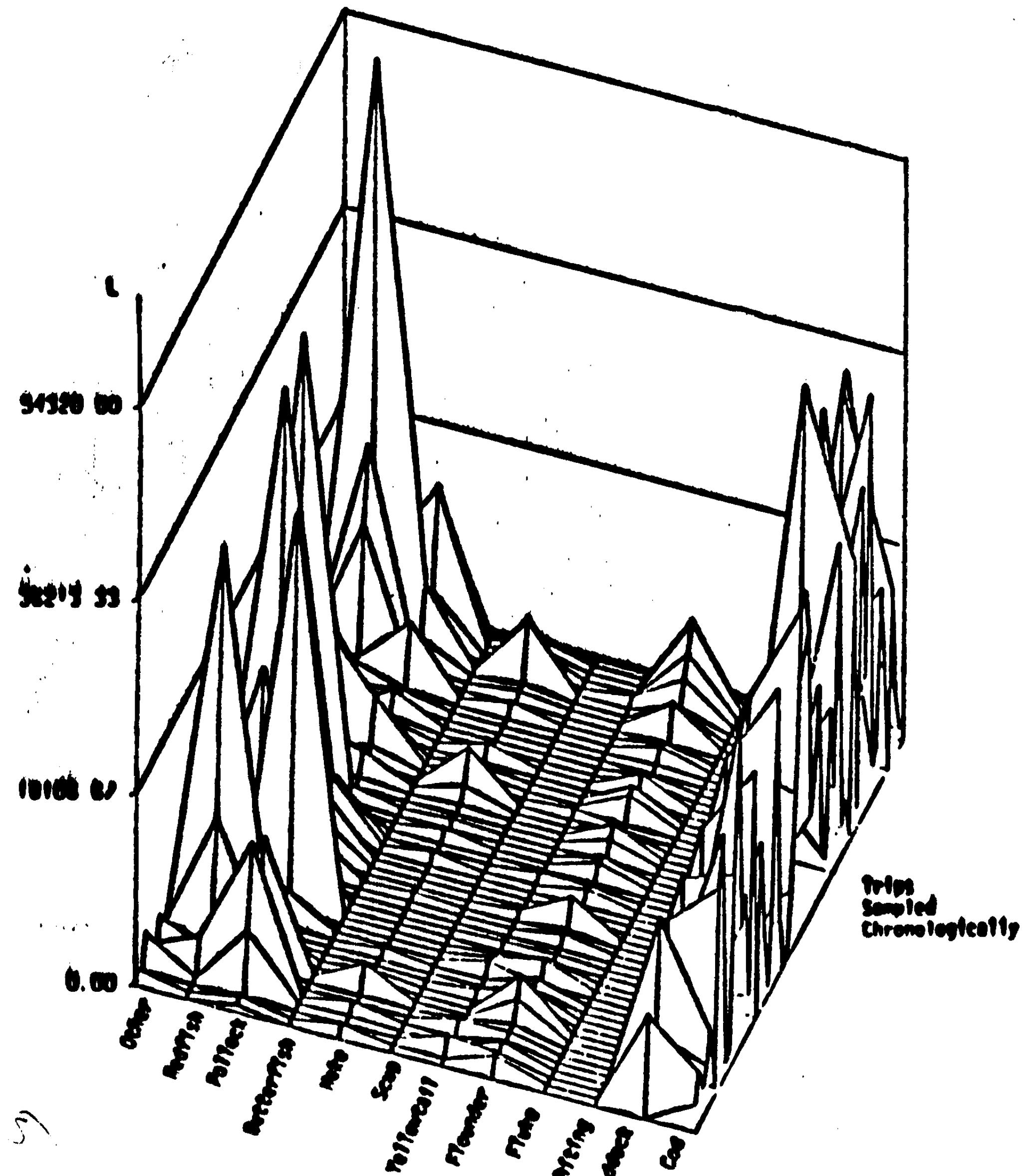
GRAPH OF OTTER TRAWL TRIP CATCHES 1976

PORT=BOSTON



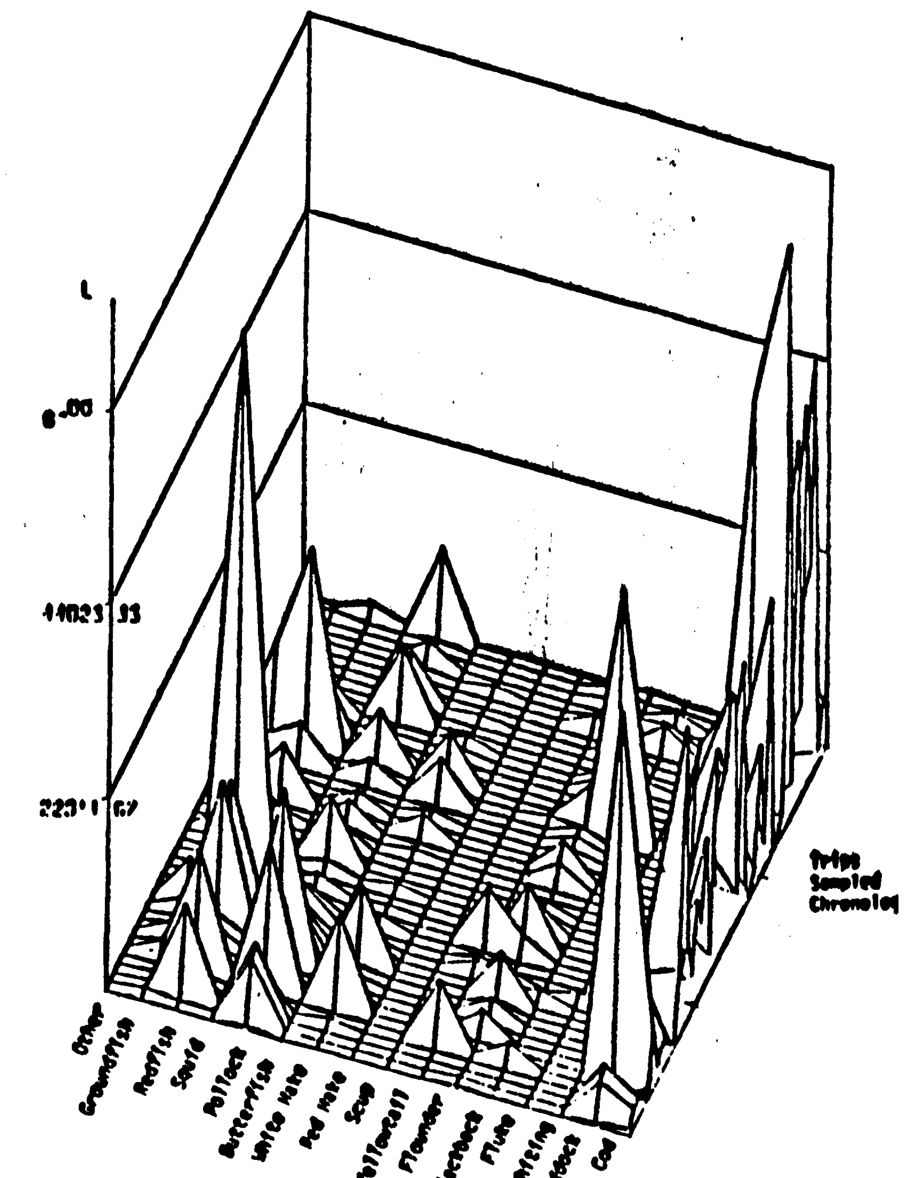
GRAPH OF OTTER TRAWL TRIP CATCHES 1979

PORT=BOSTON



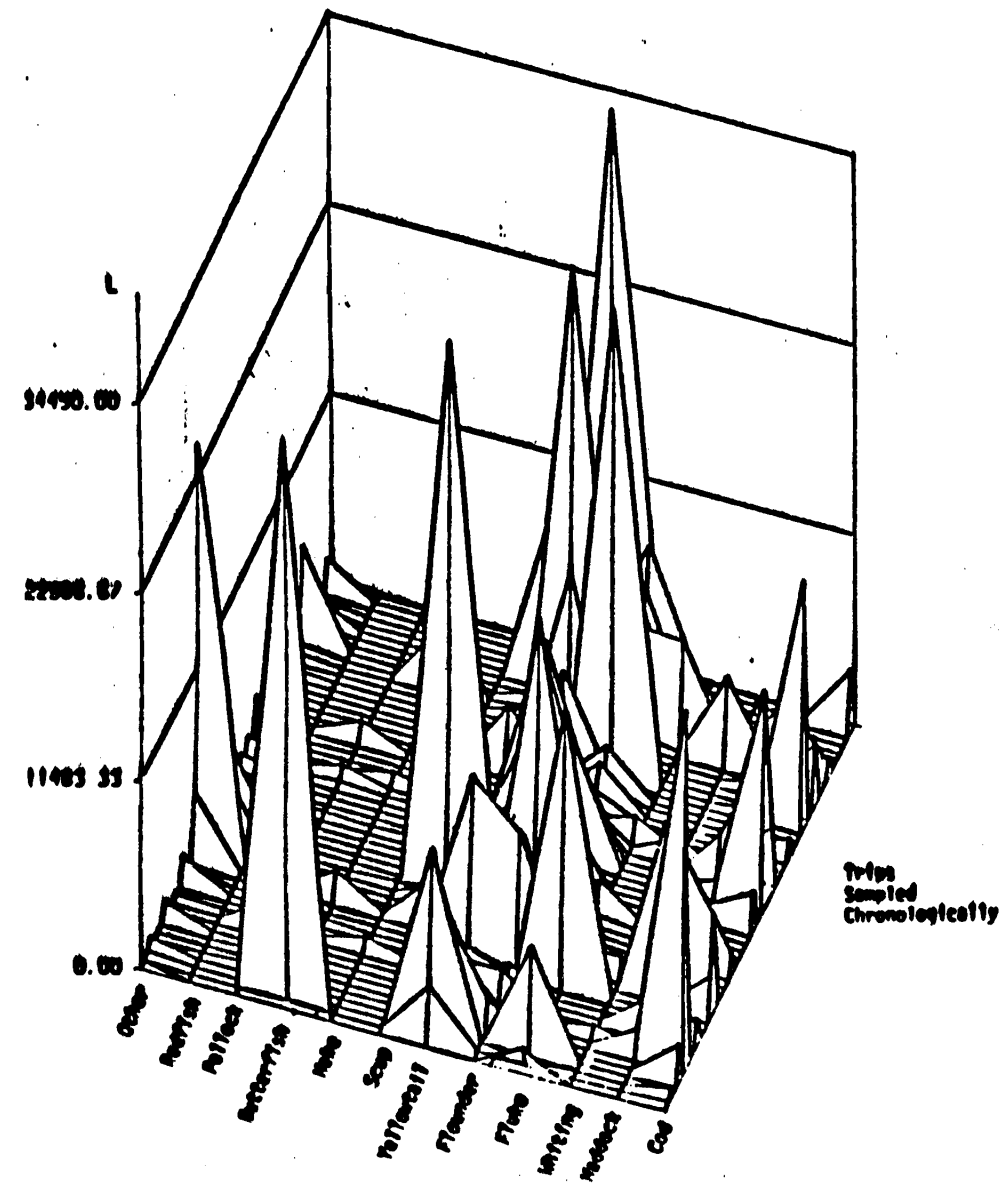
GRAPH OF OTTER TRAWL TRIP CATCHES 1982

PORT=BOSTON



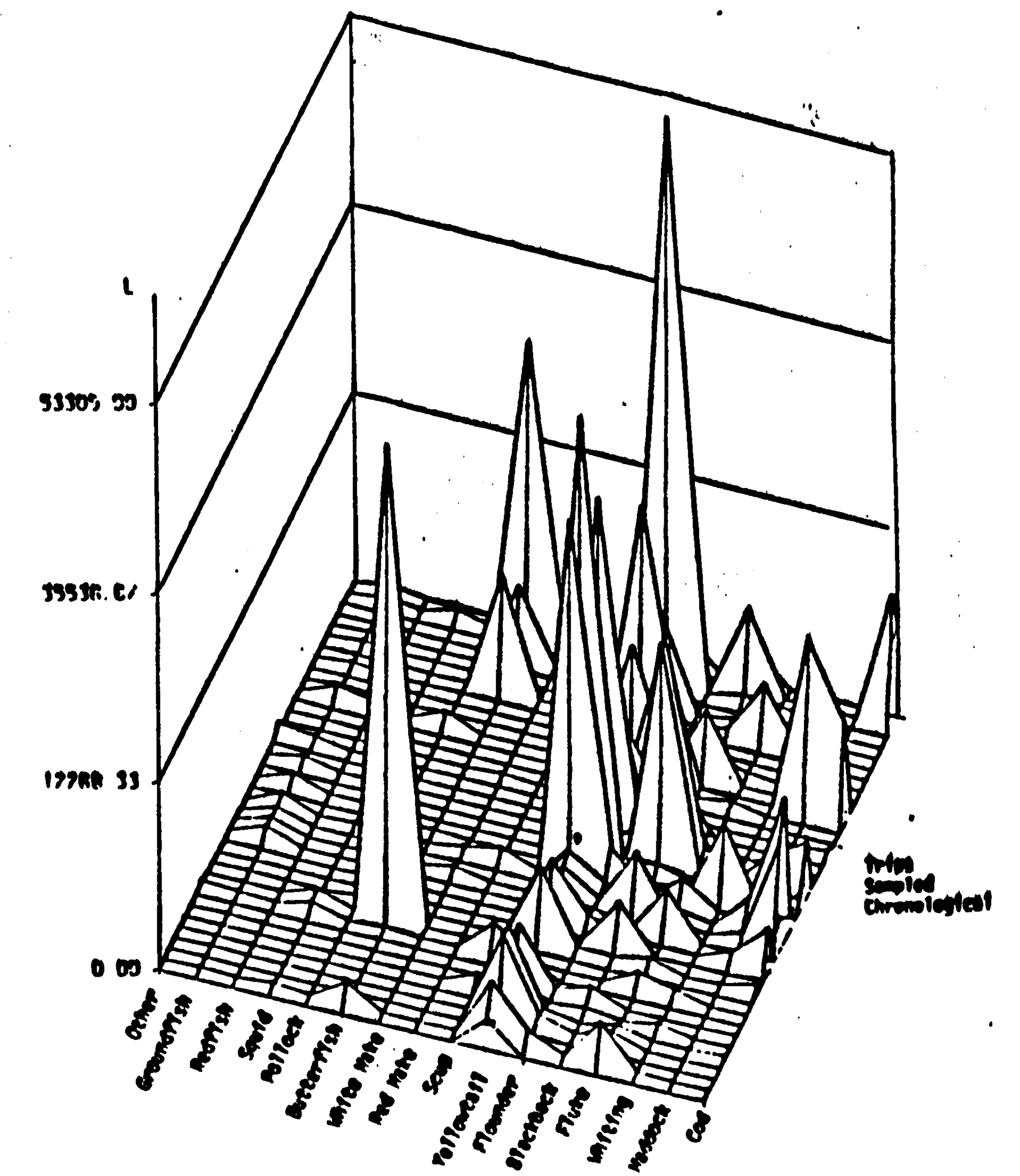
GRAPH OF OTTER TRAWL TRIP CATCHES 1979

PORT=NEWPORT

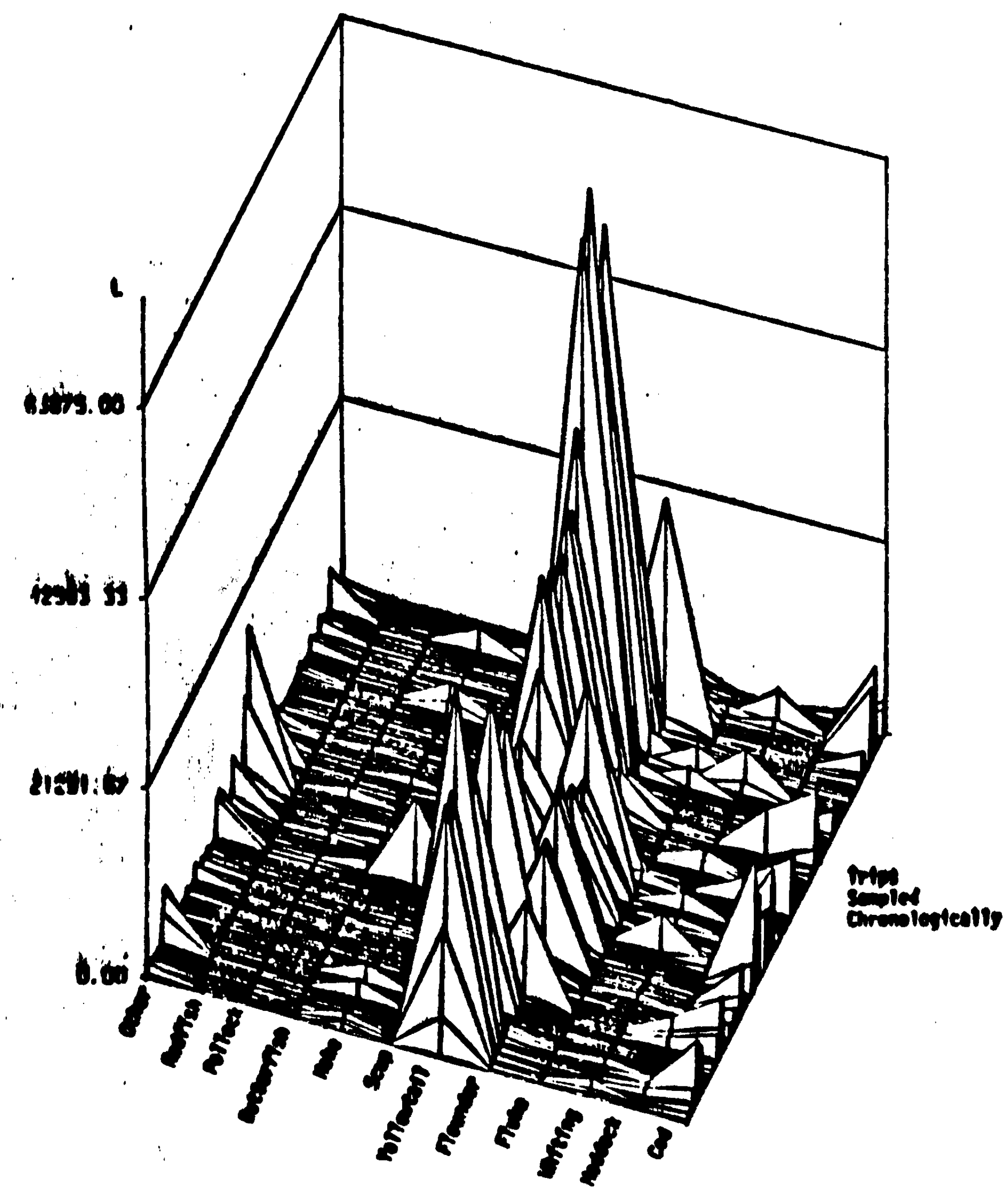


GRAPH OF OTTER TRAWL TRIP CATCHES 1982

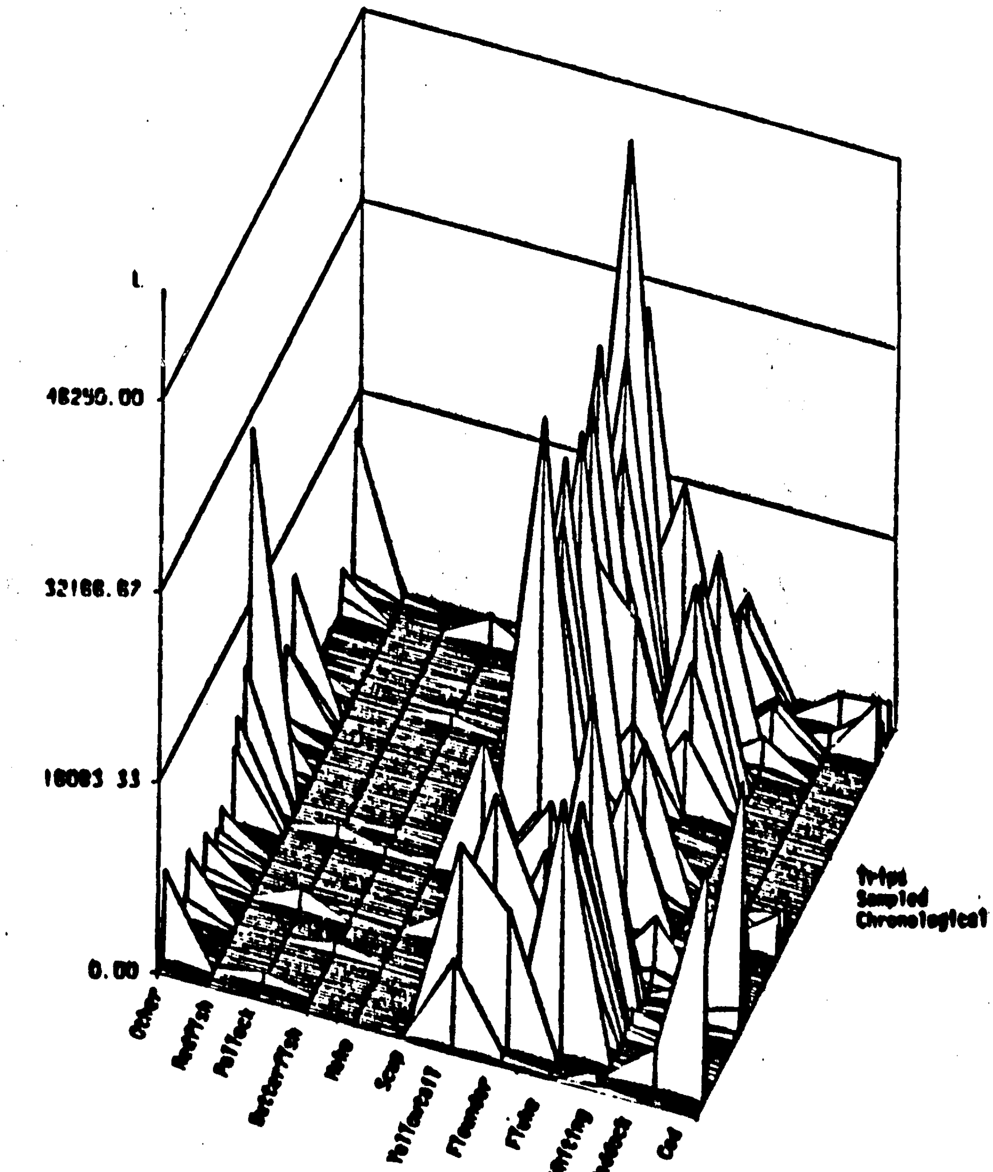
PORT=NEWPORT



GRAPH OF OTTER TRAWL TRIP CATCHES 1973
PORT=NEWPORT



GRAPH OF OTTER TRAWL TRIP CATCHES 1976
PORT=NEWPORT

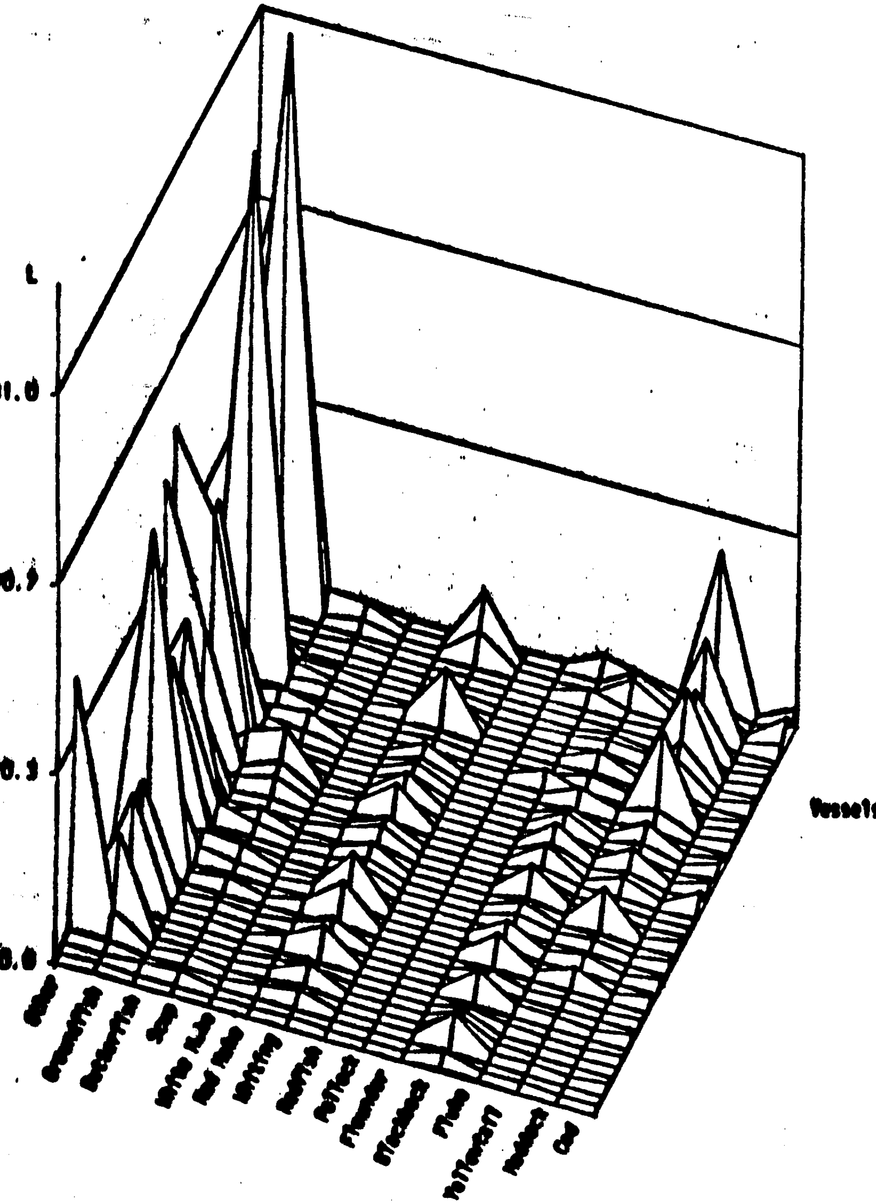


APPENDIX 3A.2

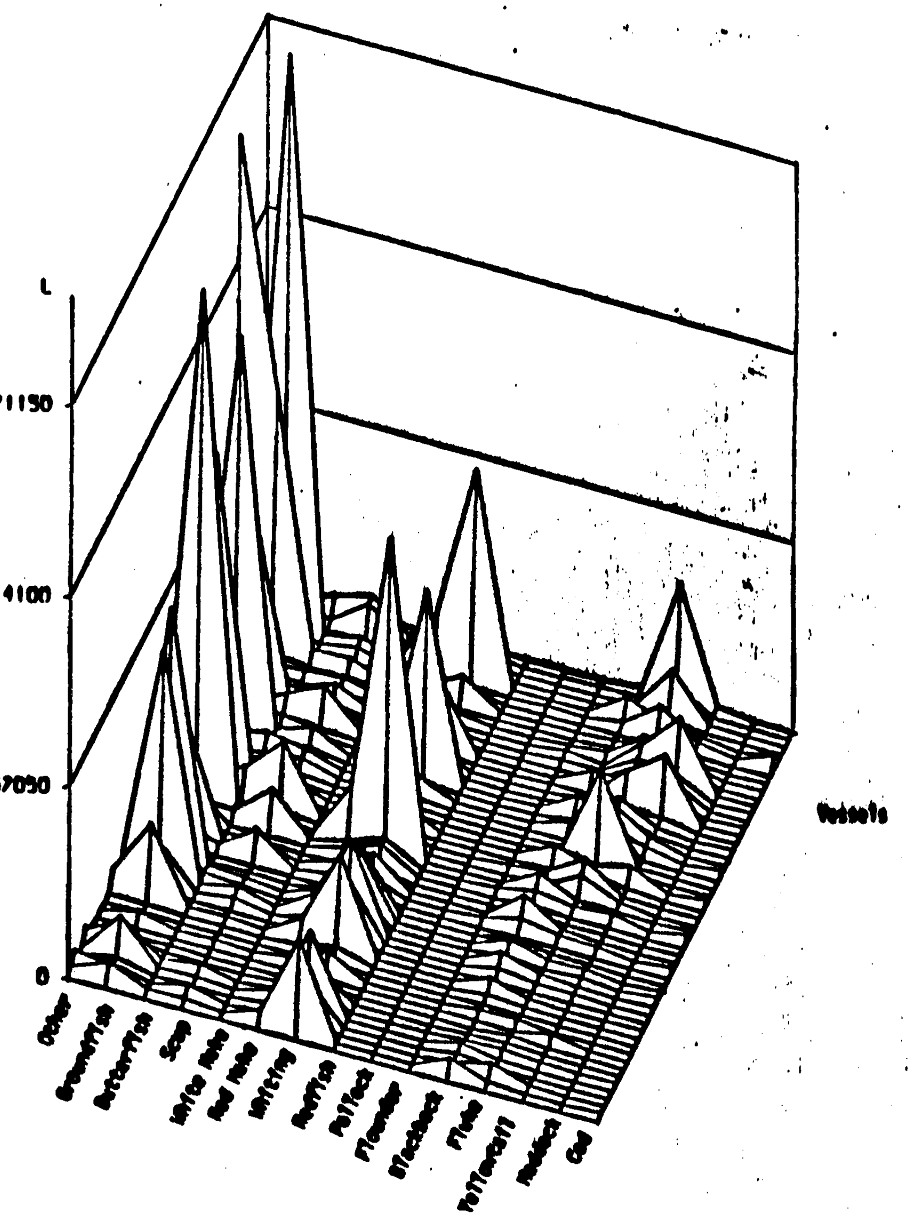
ANNUAL LANDINGS OF OTTER TRAWL VESSELS,
1973-1976-1979

Point Judith
Gloucester
New Bedford
Portland
Rockland
Provincetown
Boston
Newport

GRAPH OF OTTER TRAWL VESSEL LANDINGS 1973
PORT=POINT JUDITH

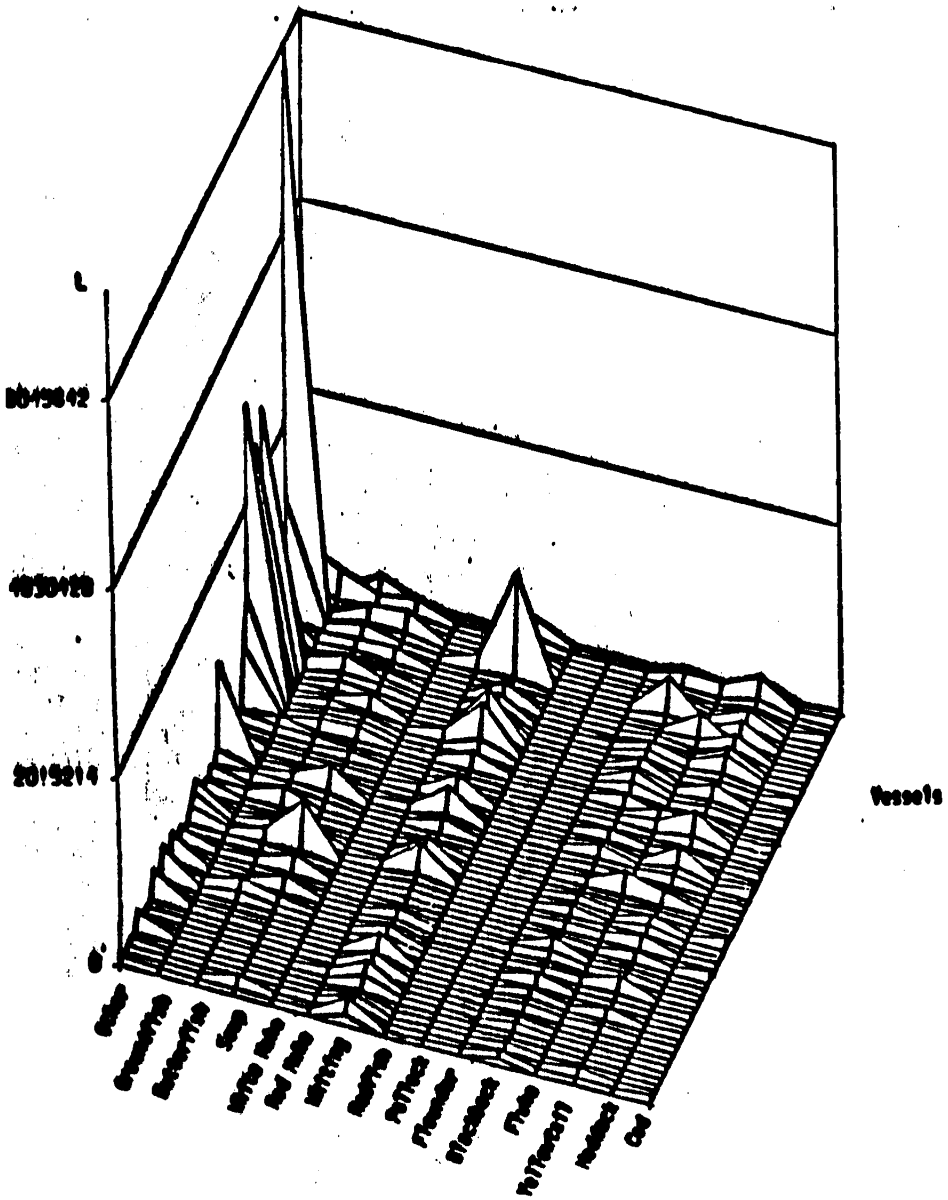


GRAPH OF OTTER TRAWL VESSEL LANDINGS 1976
PORT=POINT JUDITH



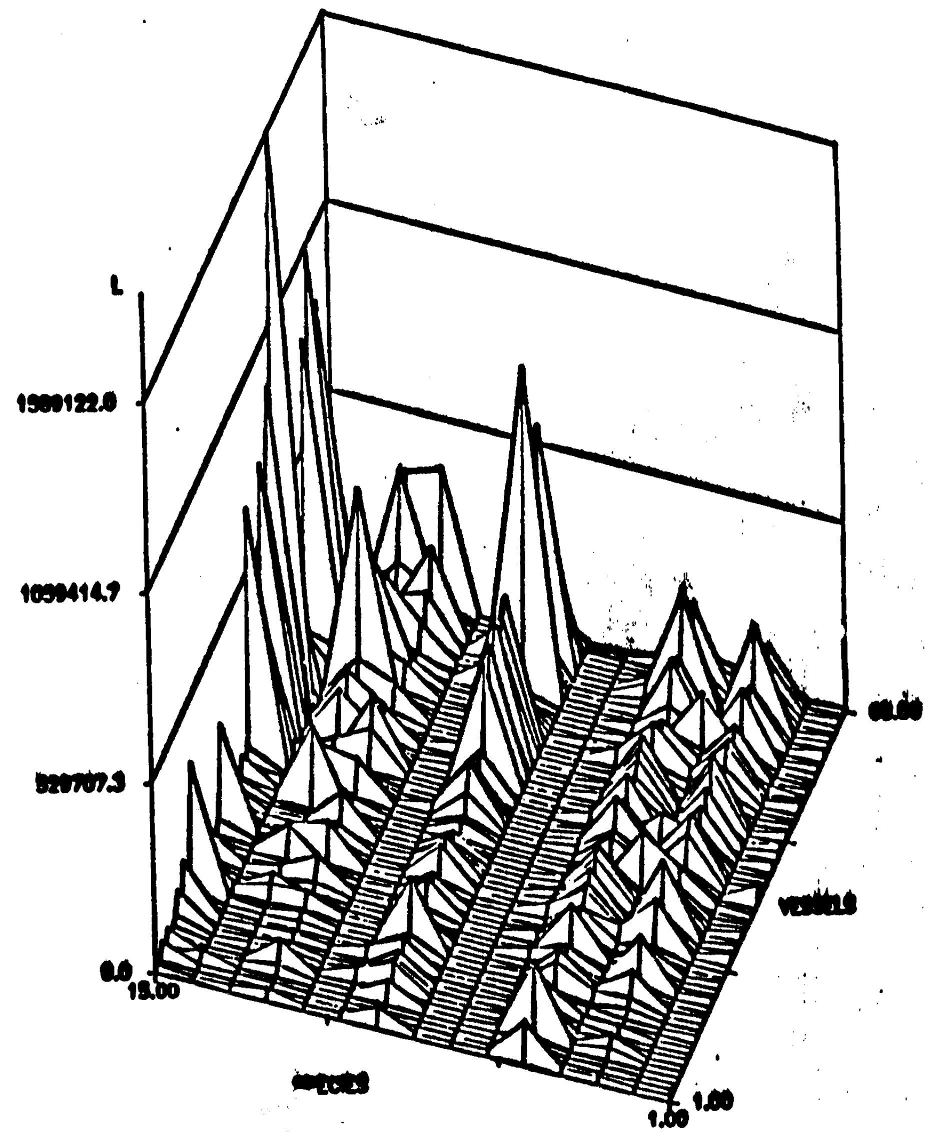
GRAPH OF OTTER TRAWL VESSEL LANDINGS 1979

PORT-POINT JUDITH



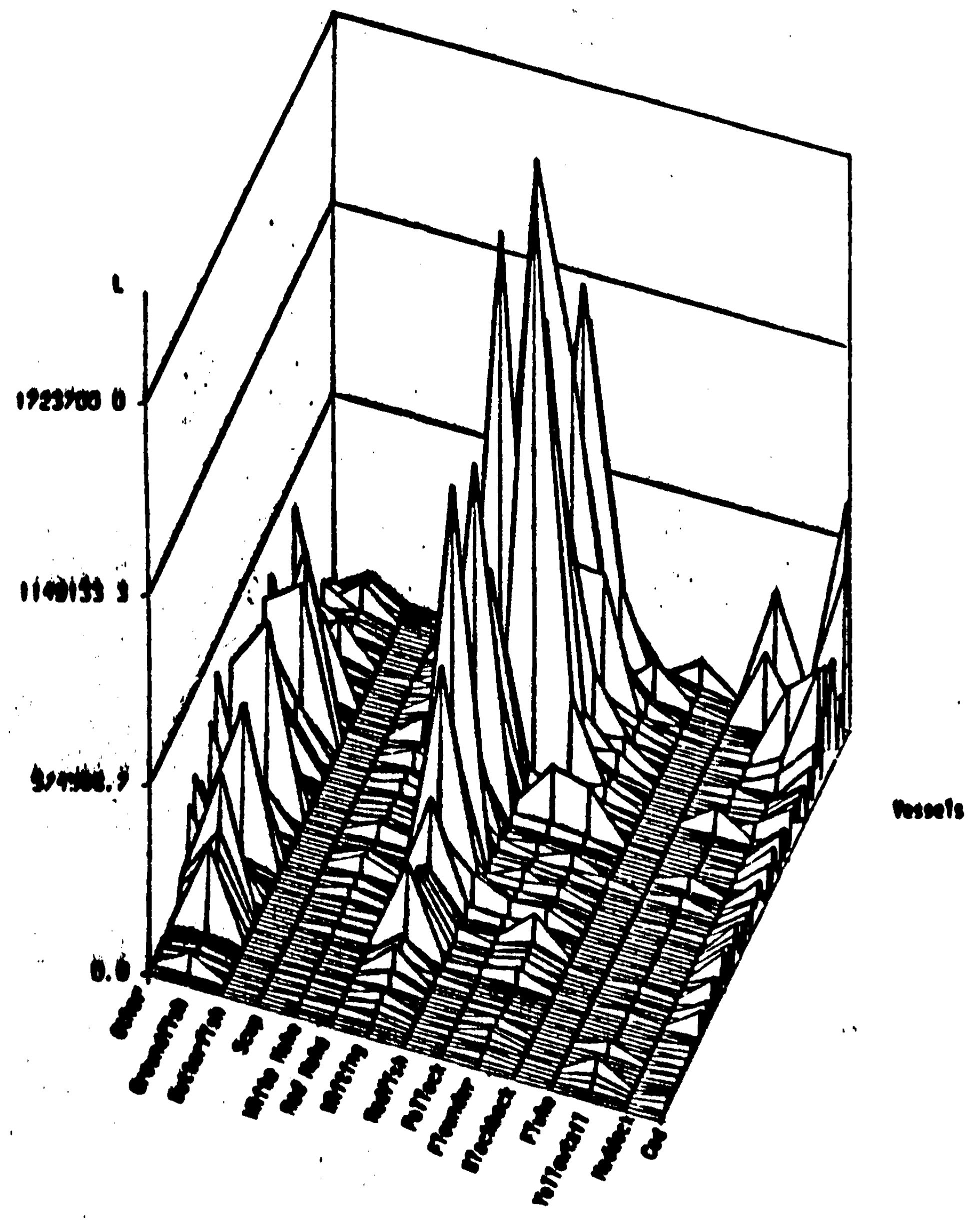
OTTER TRAWL VESSEL LANDINGS 1981

PORT-POINT JUDITH



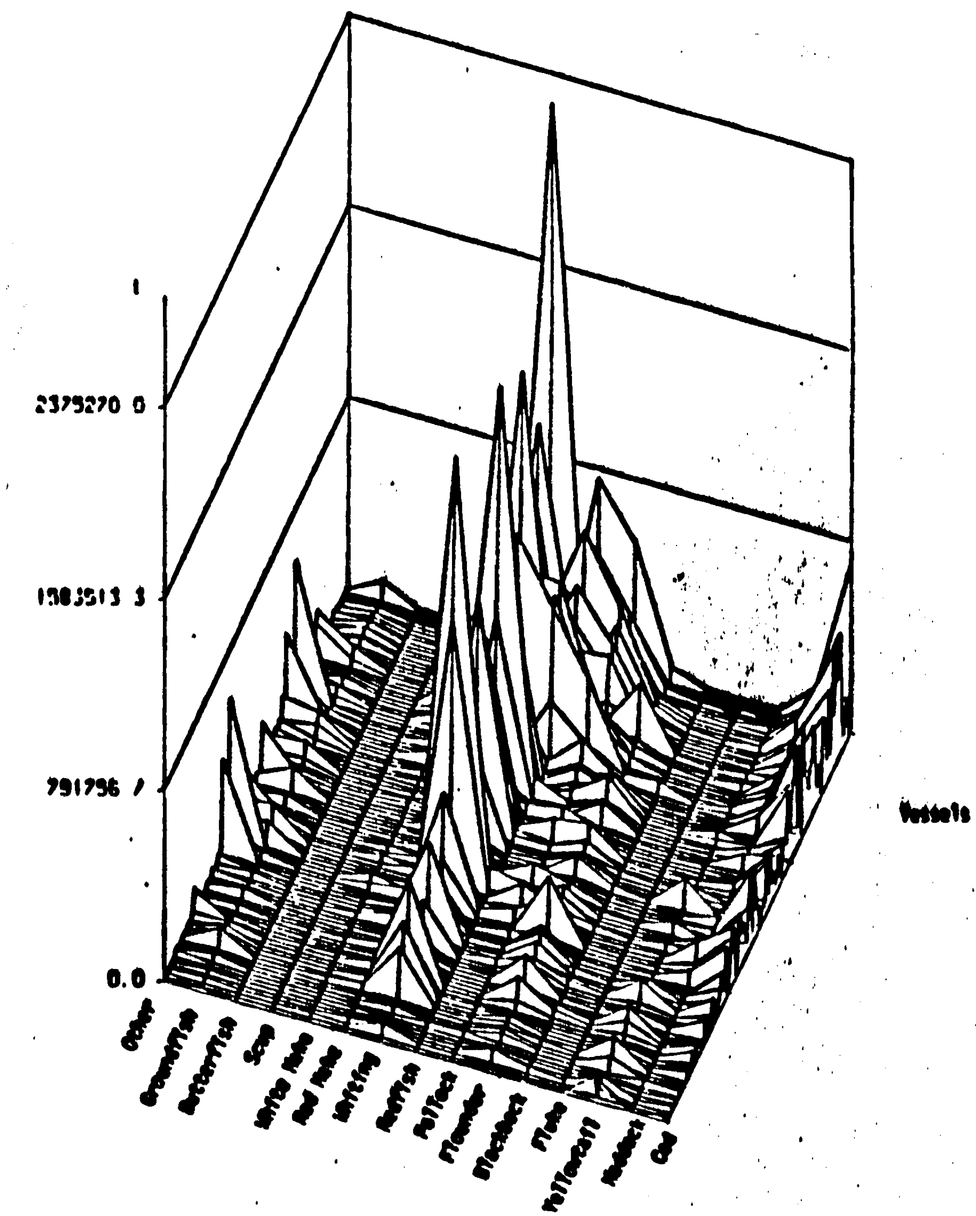
GRAPH OF OTTER TRAWL VESSEL LANDINGS 1973

PORT=GLOUCESTER



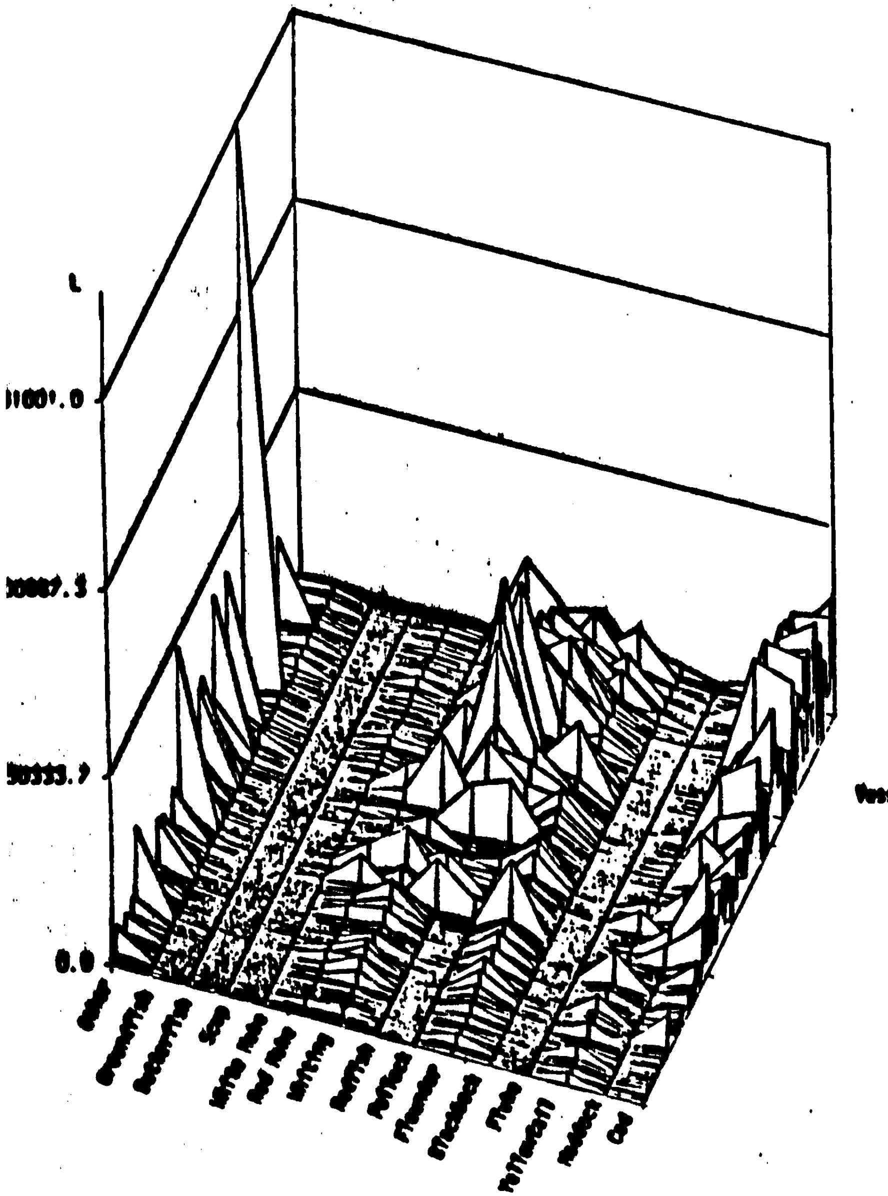
GRAPH OF OTTER TRAWL VESSEL LANDINGS 1976

PORT=GLOUCESTER



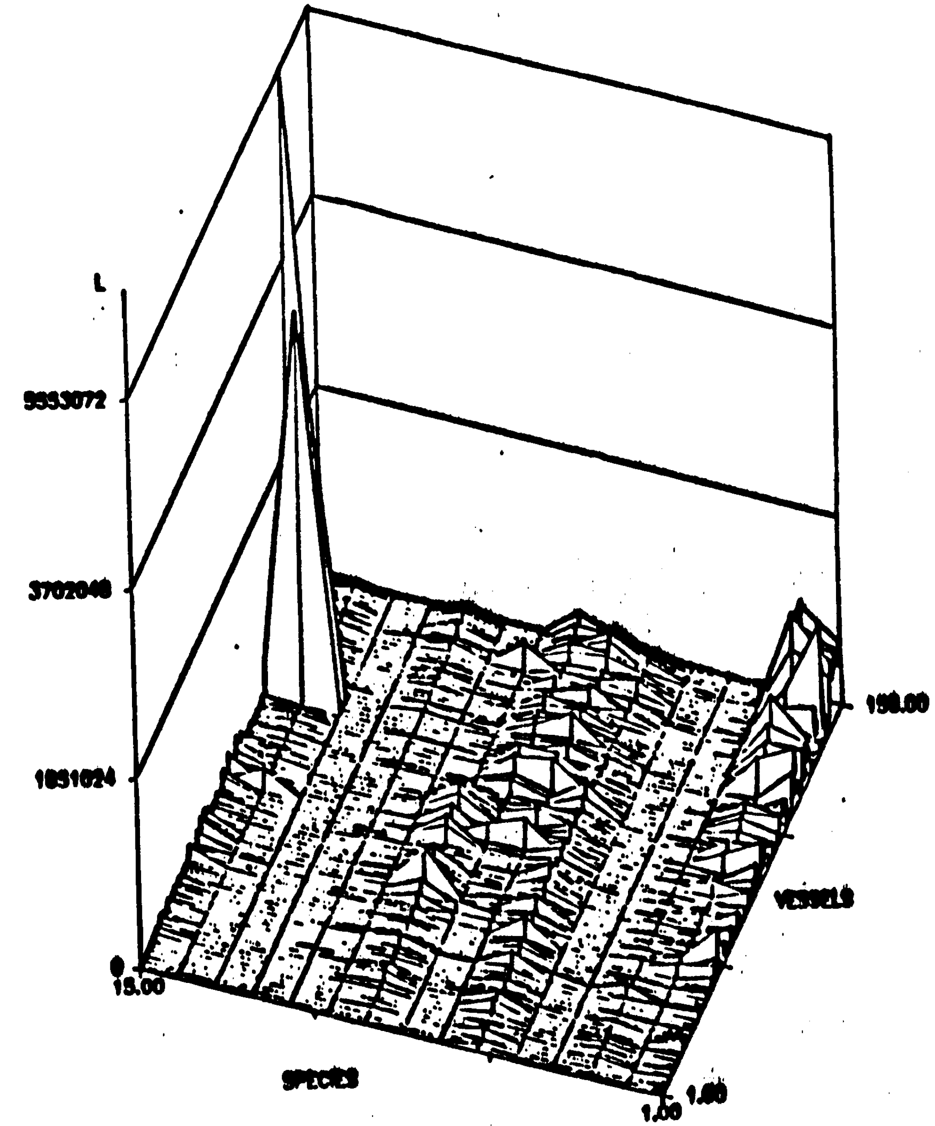
:RAPH OF OTTER TRAWL VESSEL LANDINGS 1979

PORT=GLOUCESTER

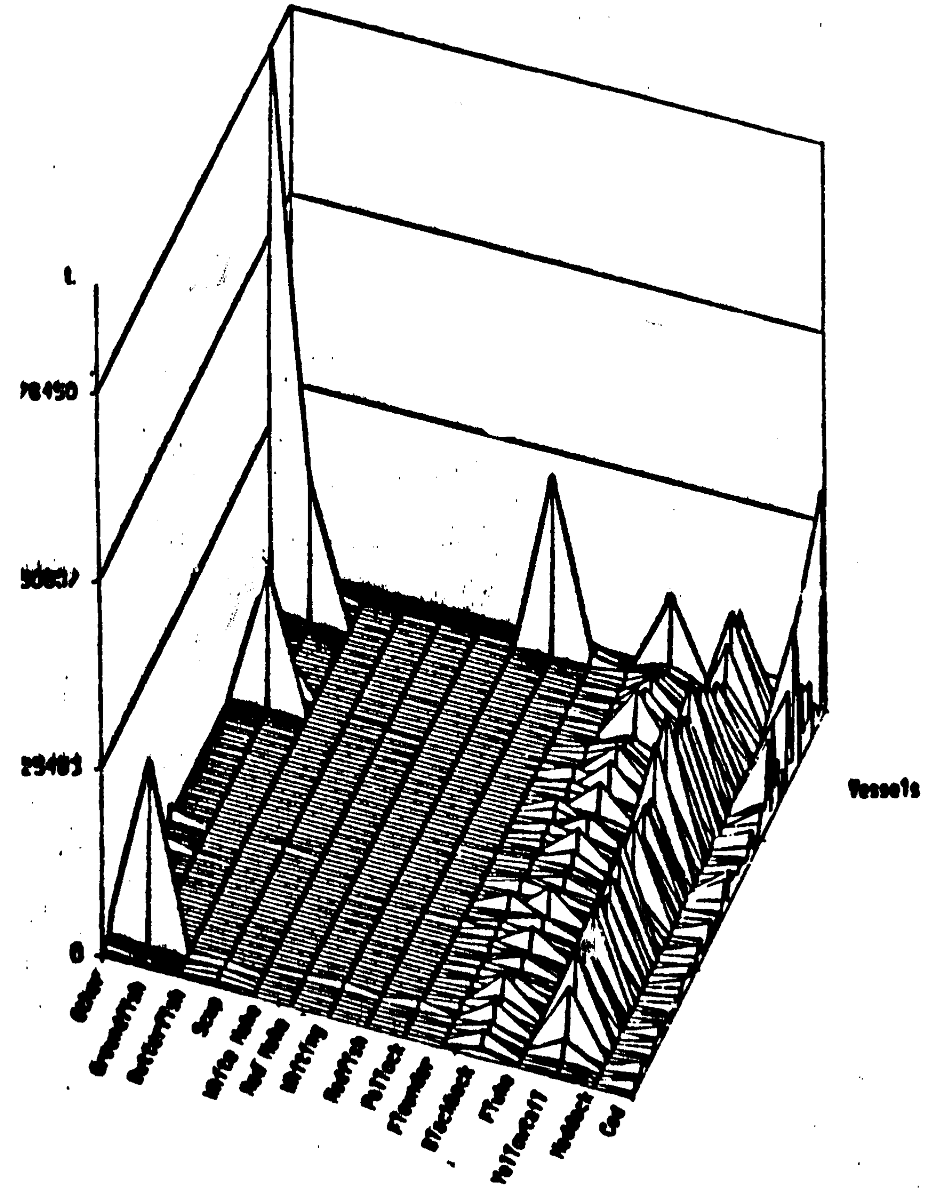


OTTER TRAWL VESSEL LANDINGS 1981

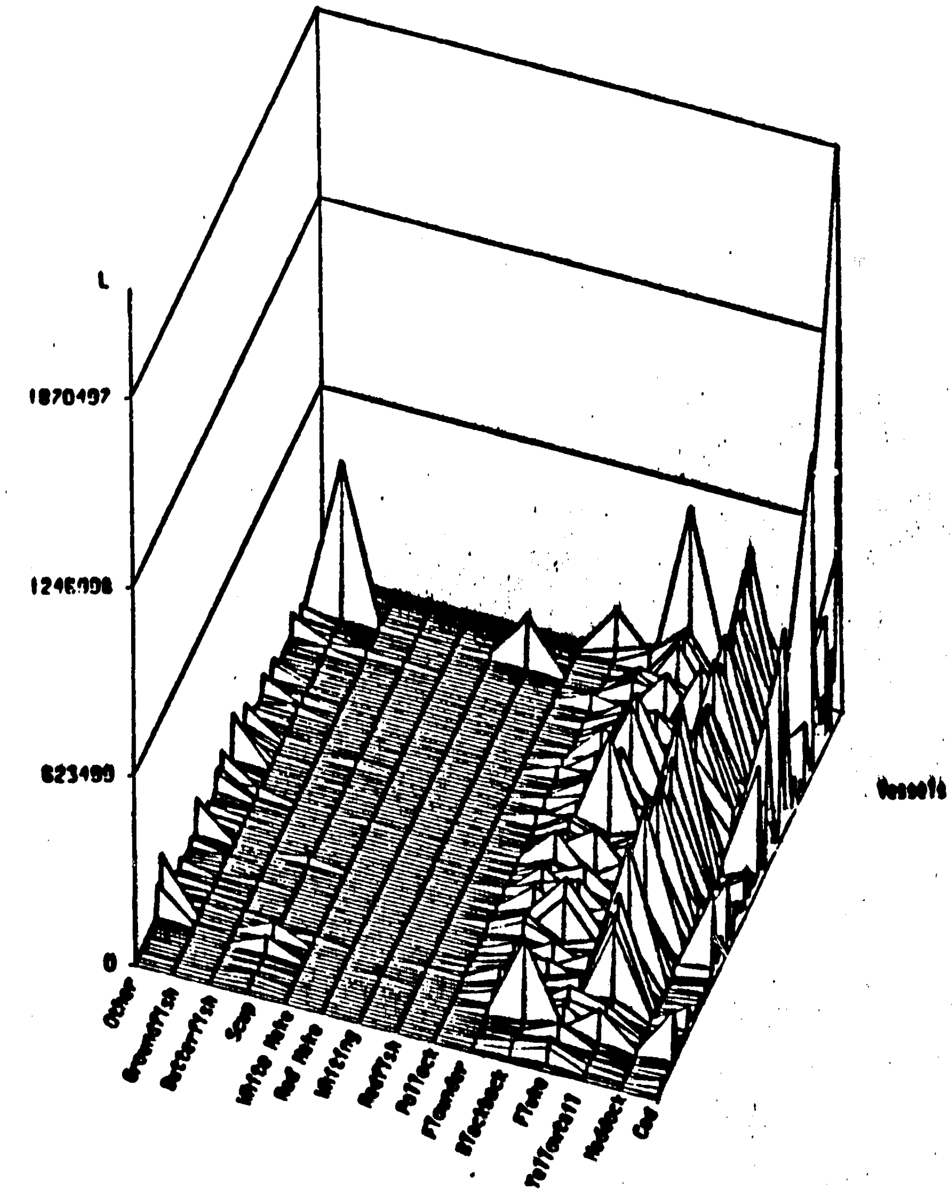
PORT=GLOUCESTER



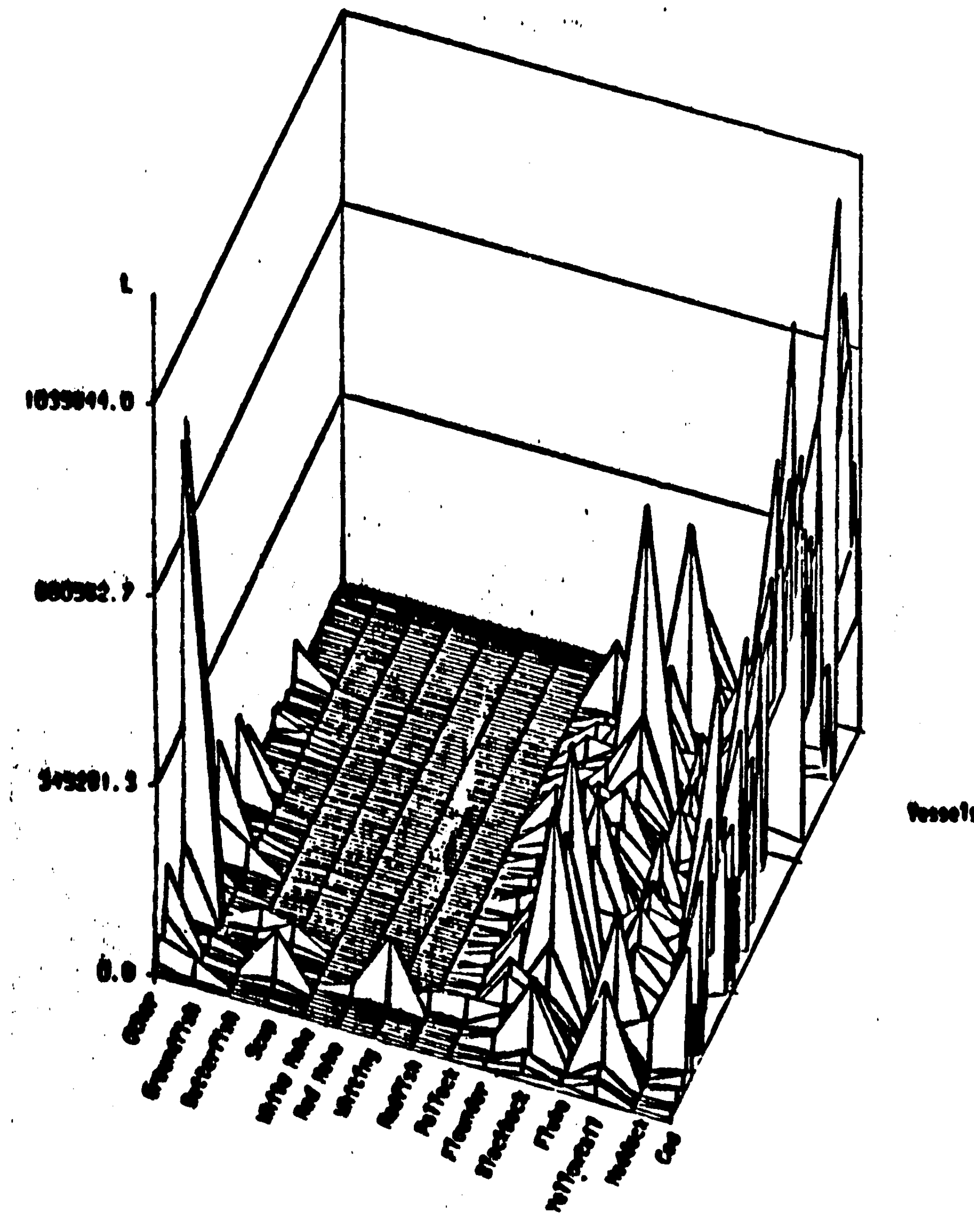
GRAPH OF OTTER TRAWL VESSEL LANDINGS 1973
PORT=NEW BEDFORD



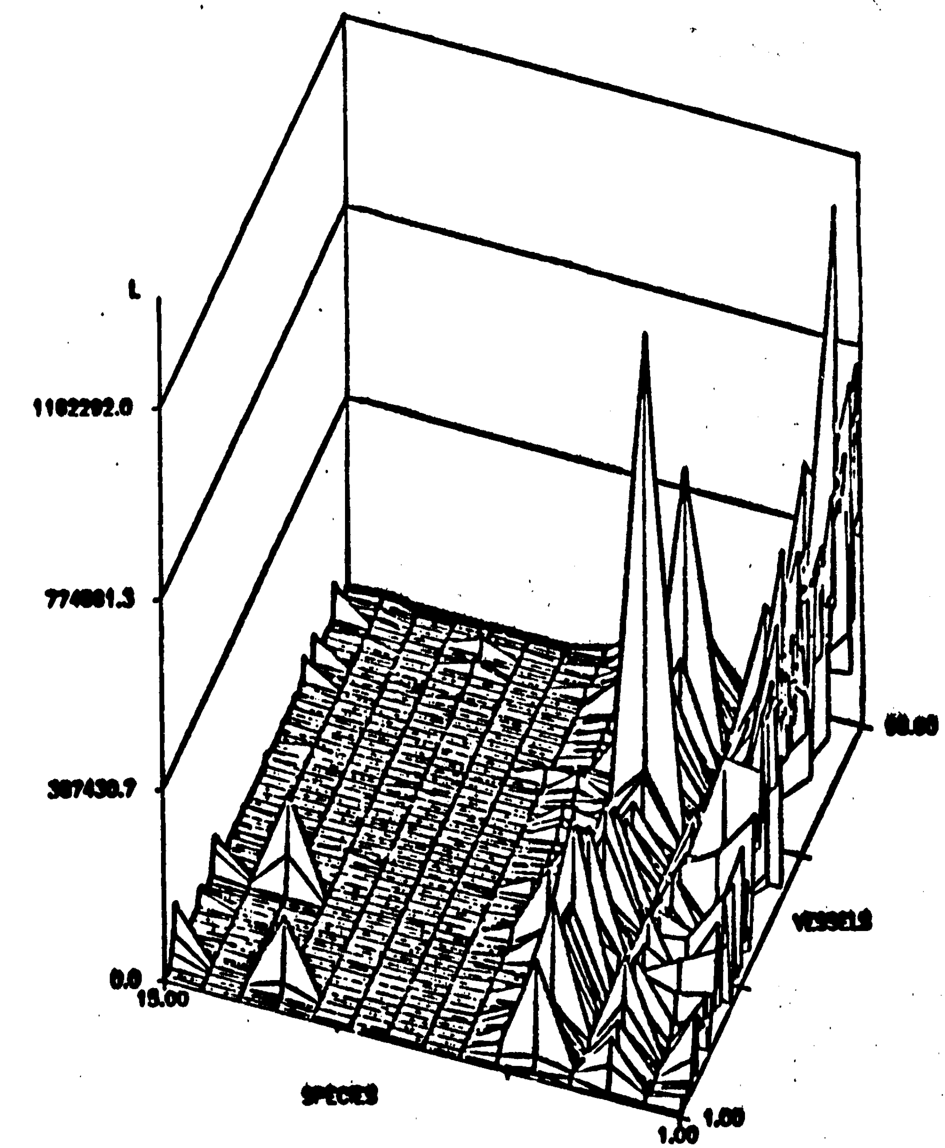
GRAPH OF OTTER TRAWL VESSEL LANDINGS 1976
PORT=NEW BEDFORD



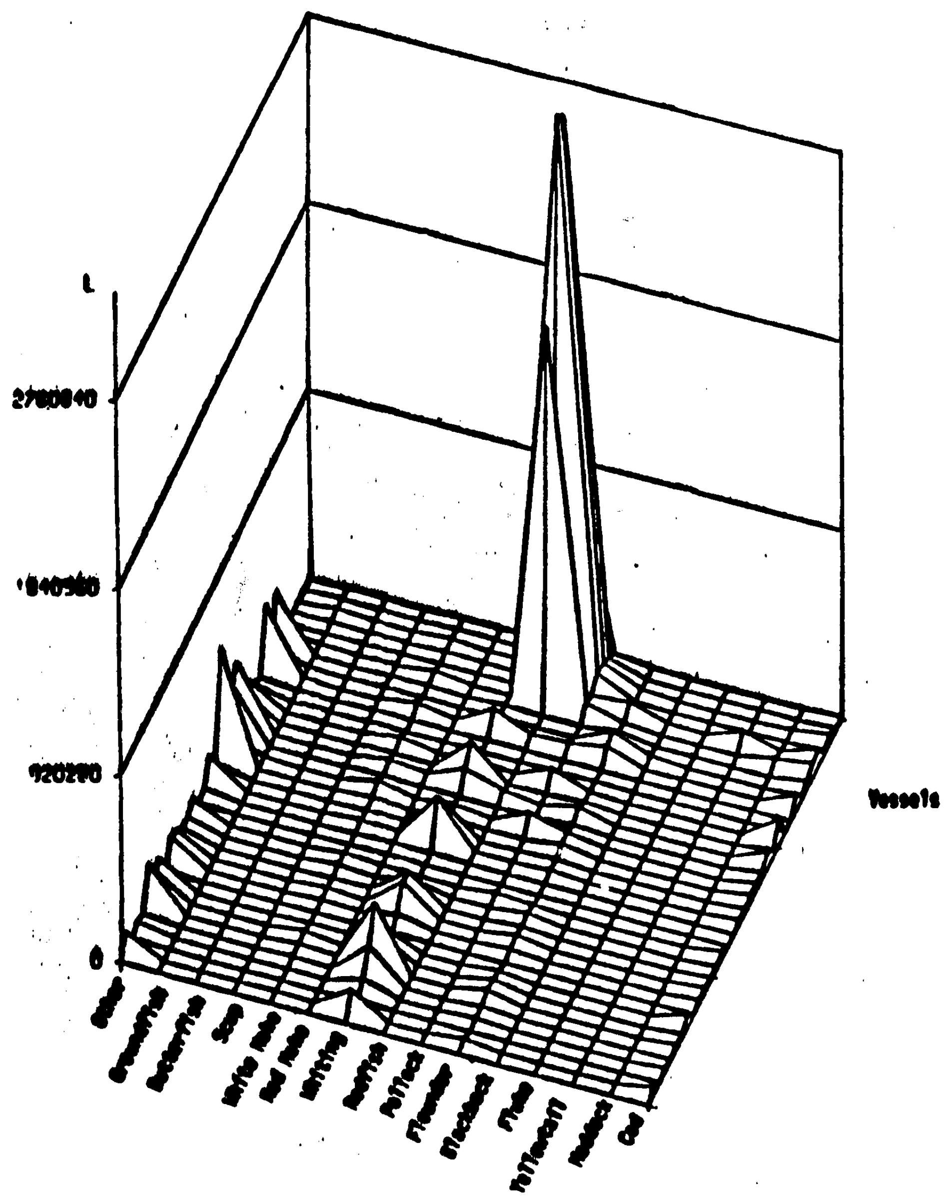
GRAPH OF OTTER TRAWL VESSEL LANDINGS 1979
PORT=NEW BEDFORD



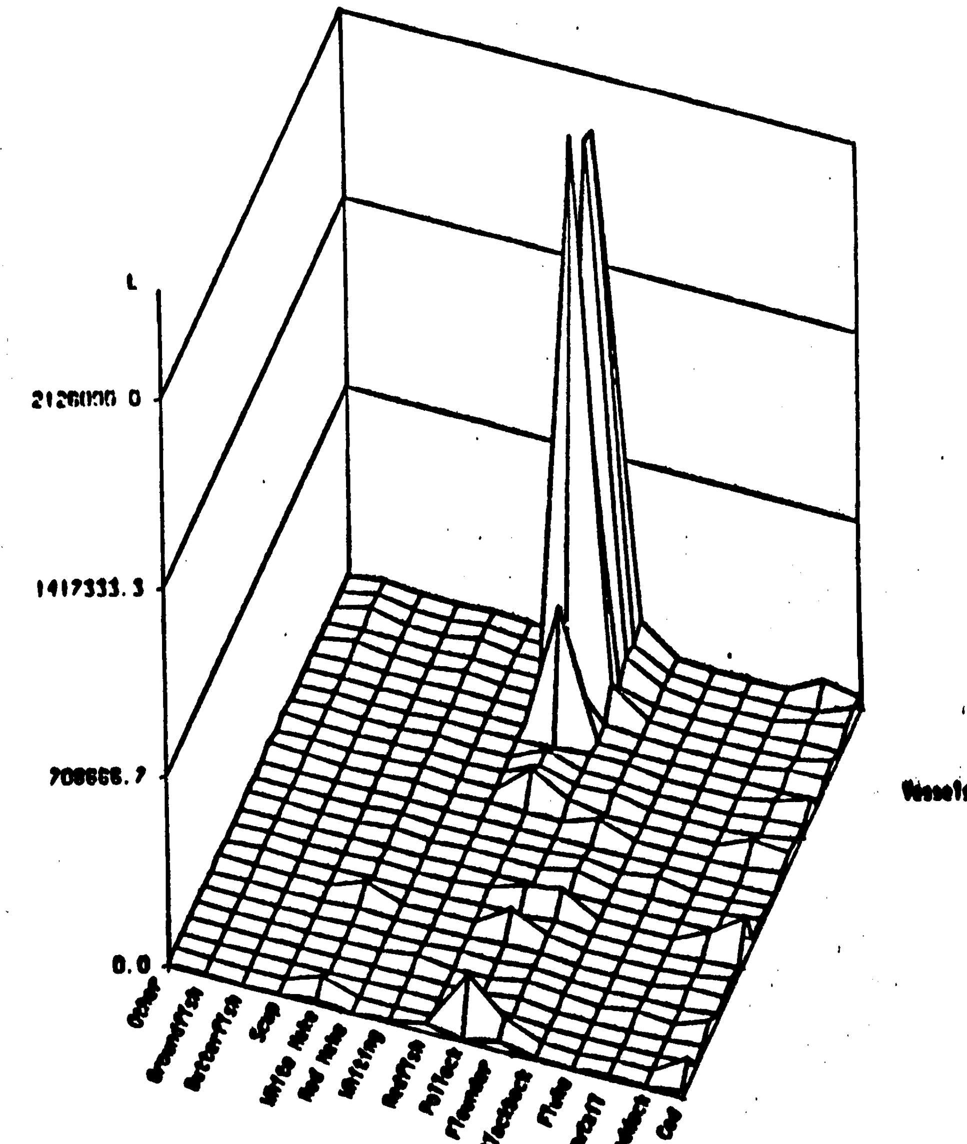
OTTER TRAWL VESSEL LANDINGS 1981
PORT=NEW BEDFORD



GRAPH OF OTTER TRAWL VESSEL LANDINGS 1973
PORT=PORTLAND

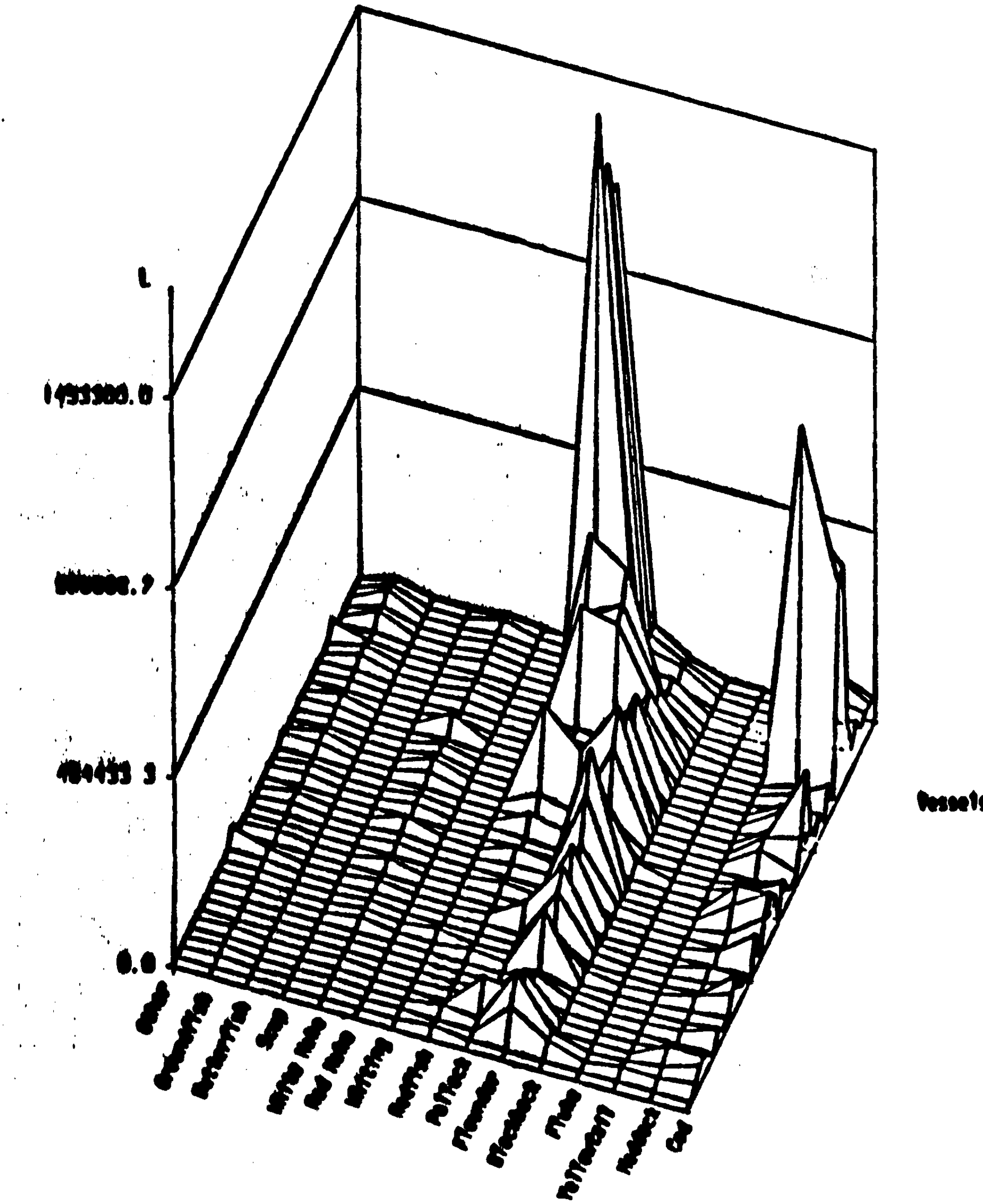


GRAPH OF OTTER TRAWL VESSEL LANDINGS 1976
PORT=PORTLAND



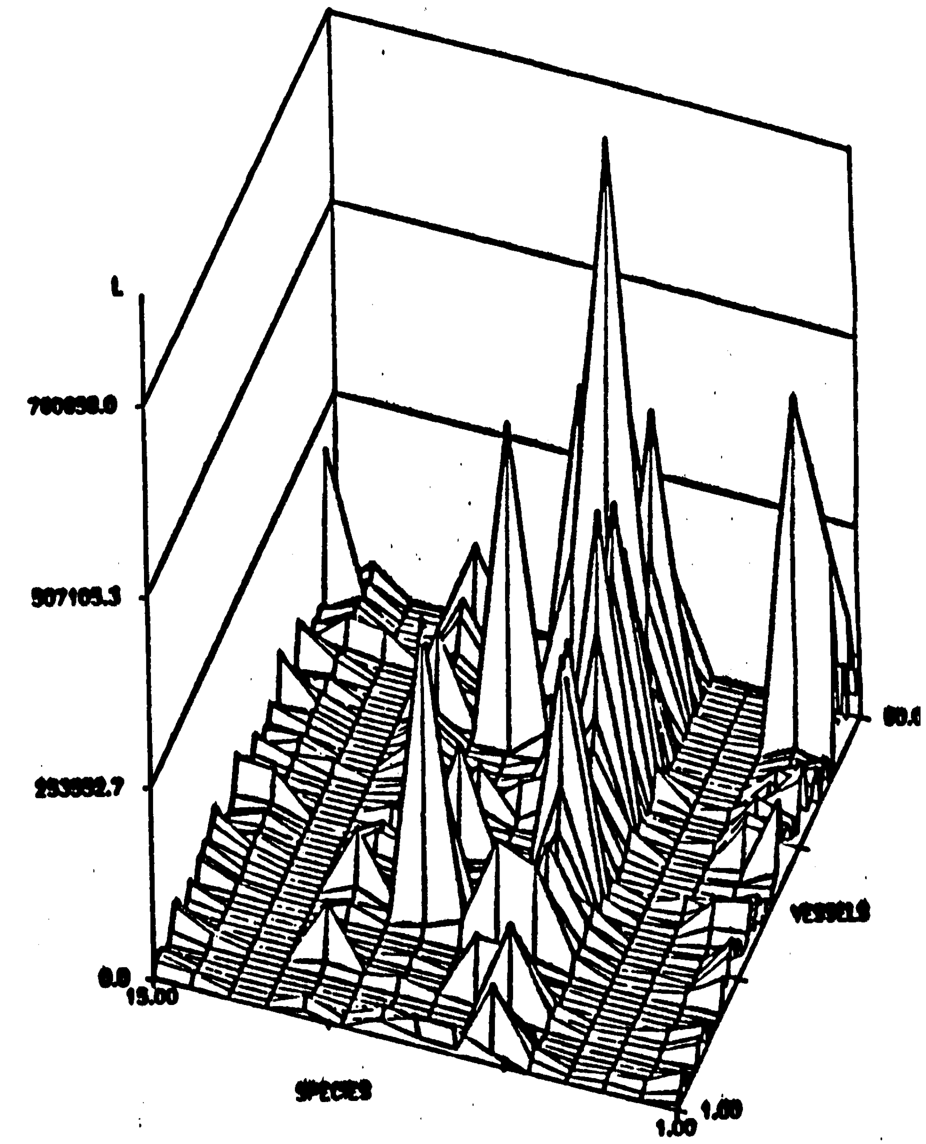
GRAPH OF OTTER TRAWL VESSEL LANDINGS 1979

PORT=PORTLAND

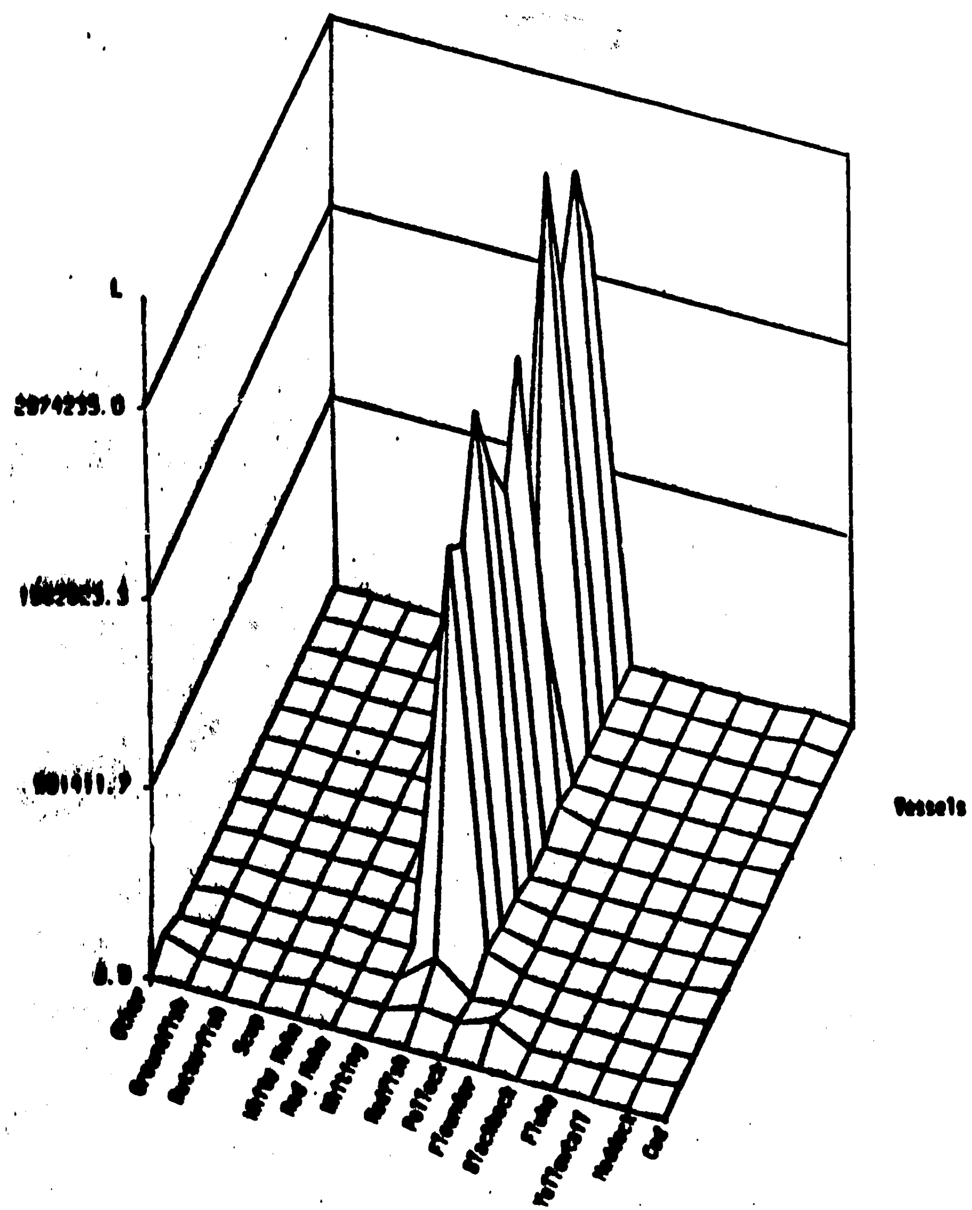


OTTER TRAWL VESSEL LANDINGS 1981

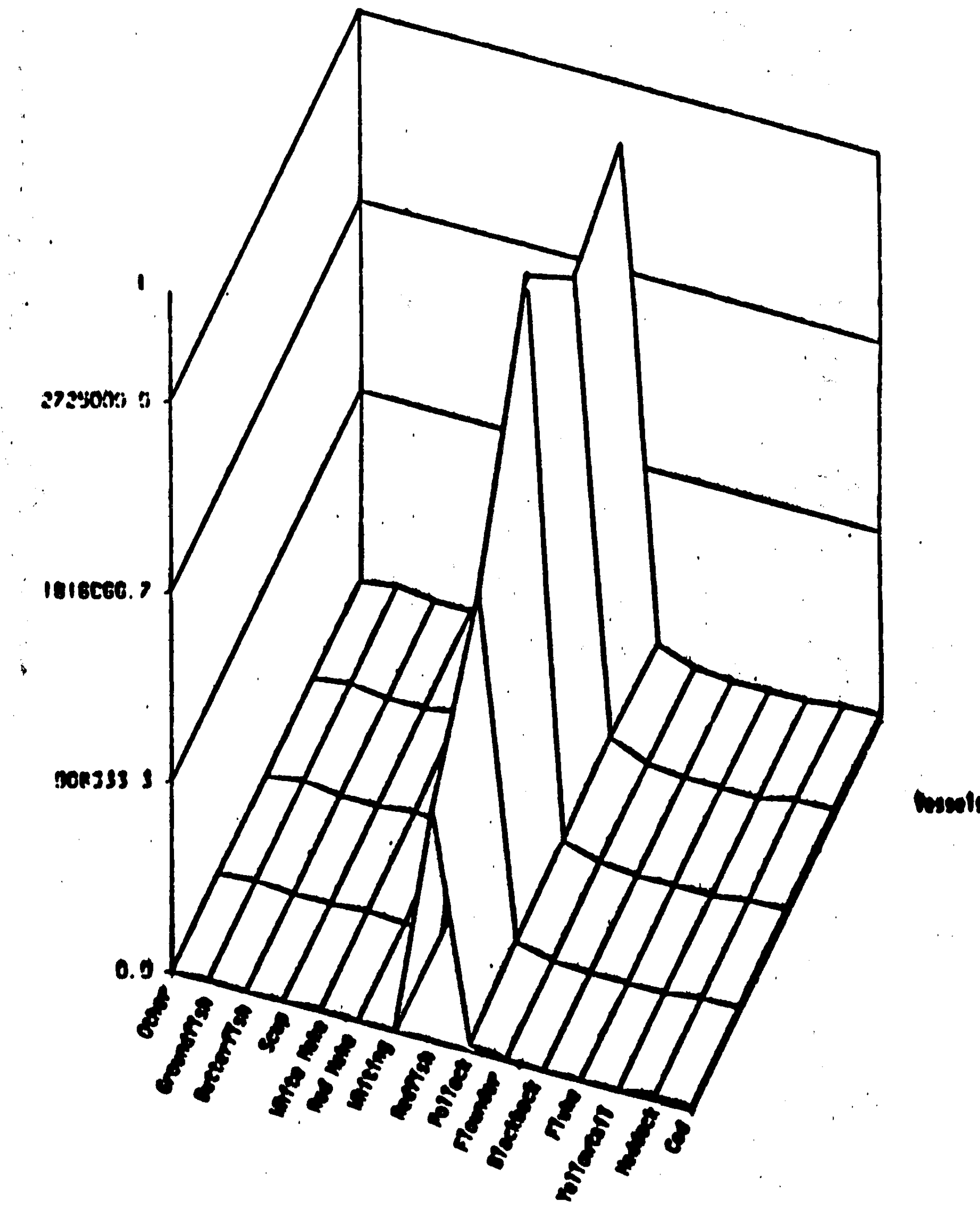
PORT=PORTLAND



GRAPH OF OTTER TRAWL VESSEL LANDINGS 1973
PORT=ROCKLAND

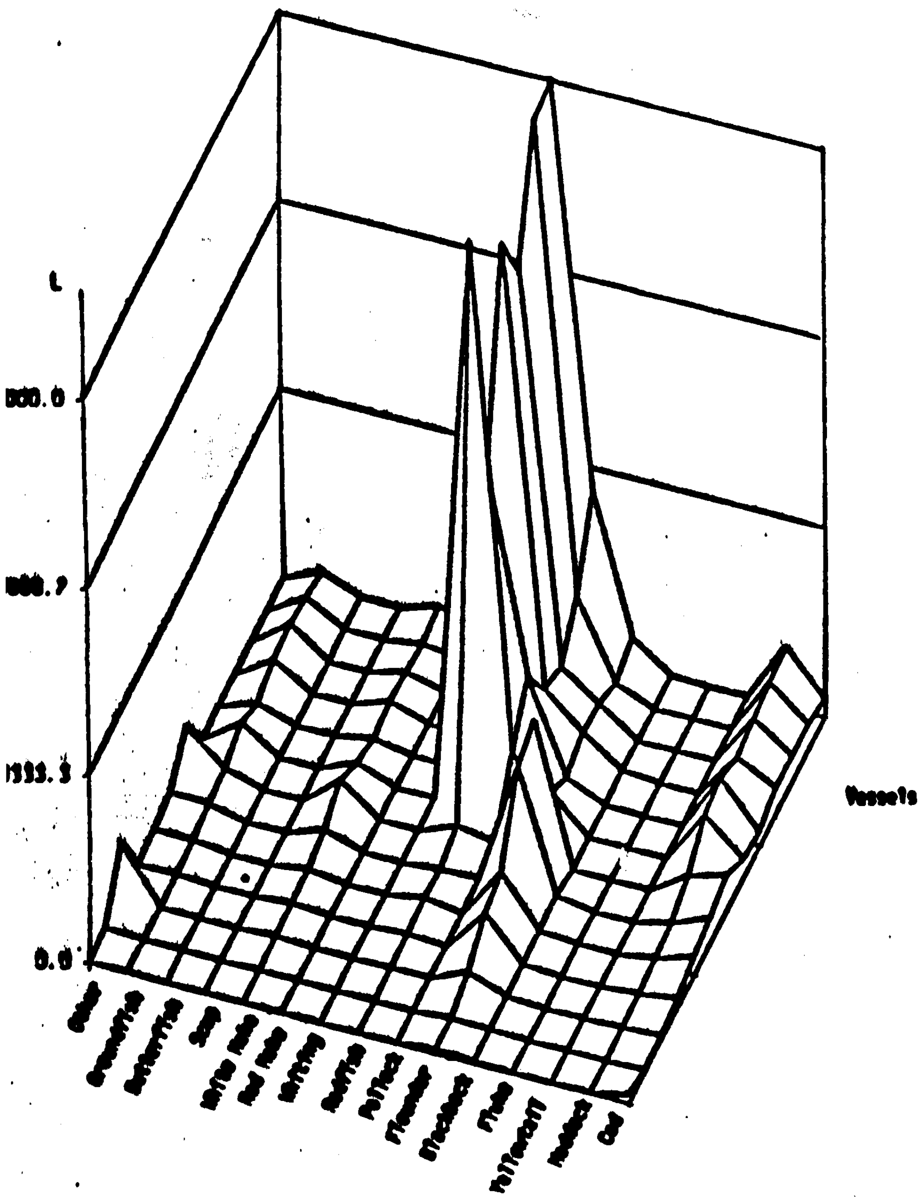


GRAPH OF OTTER TRAWL VESSEL LANDINGS 1976
PORT=ROCKLAND



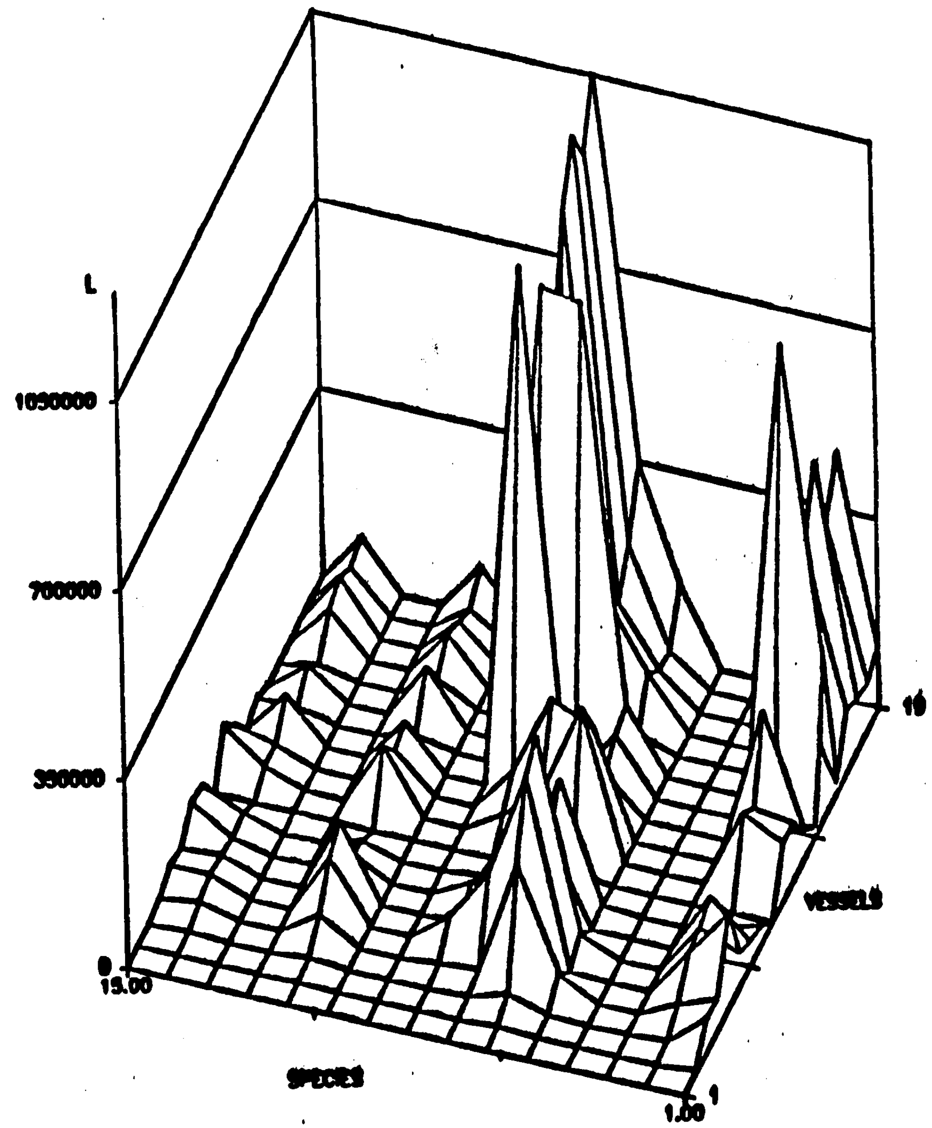
RAPH OF OTTER TRAWL VESSEL LANDINGS 1979

PORT=ROCKLAND

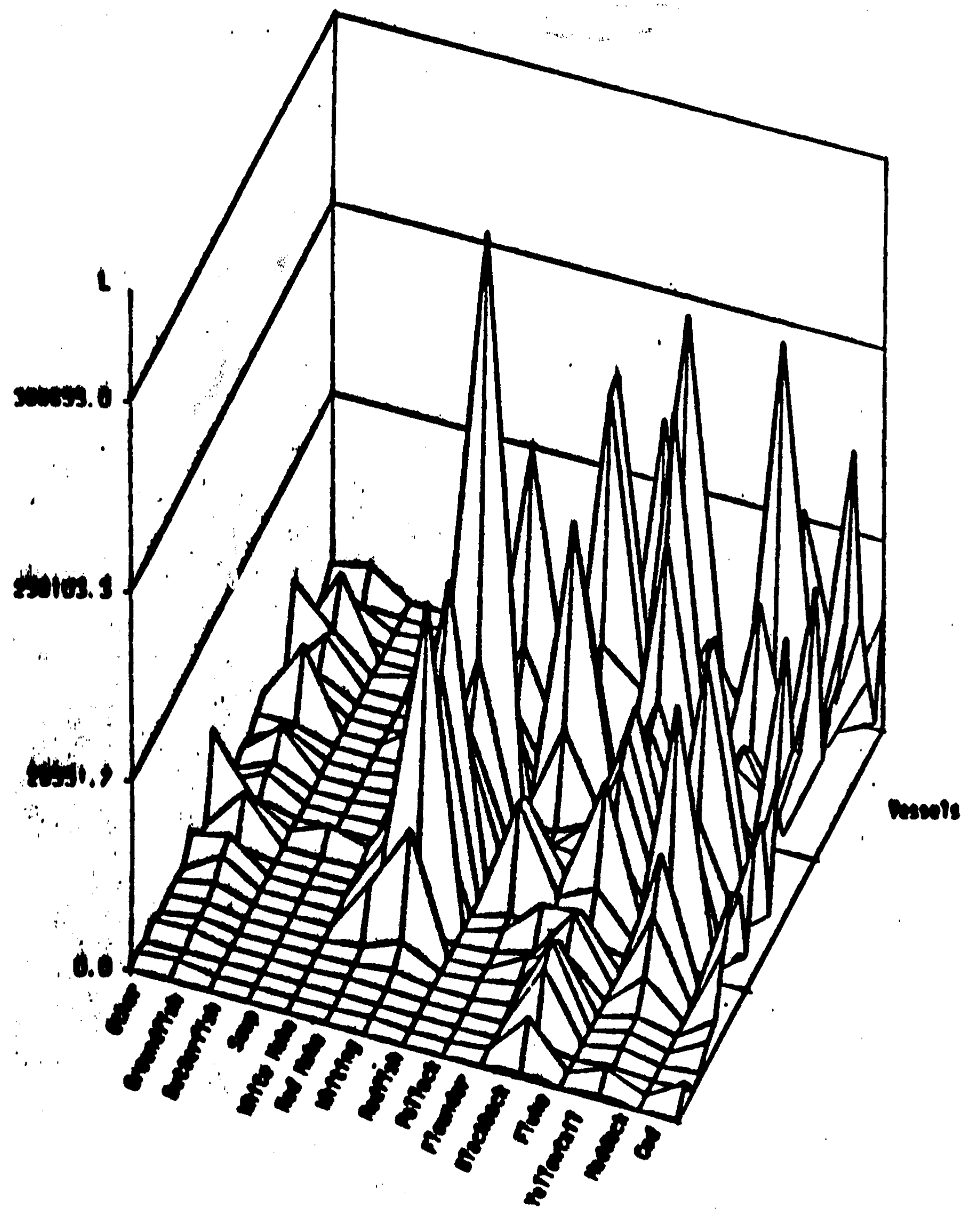


OTTER TRAWL VESSEL LANDINGS 1981

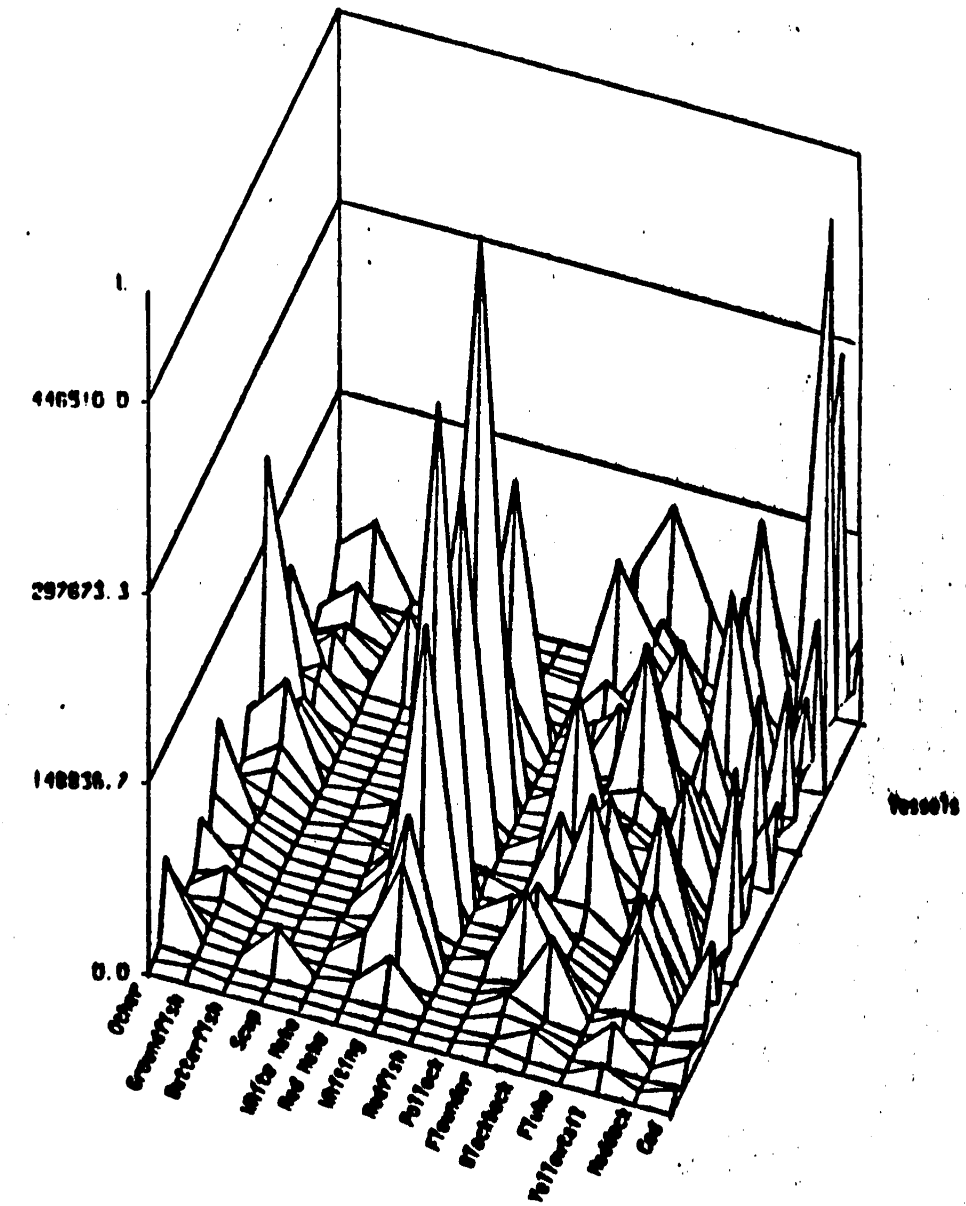
PORT=ROCKLAND



GRAPH OF OTTER TRAWL VESSEL LANDINGS 1973
PORT=PROVINCETOWN

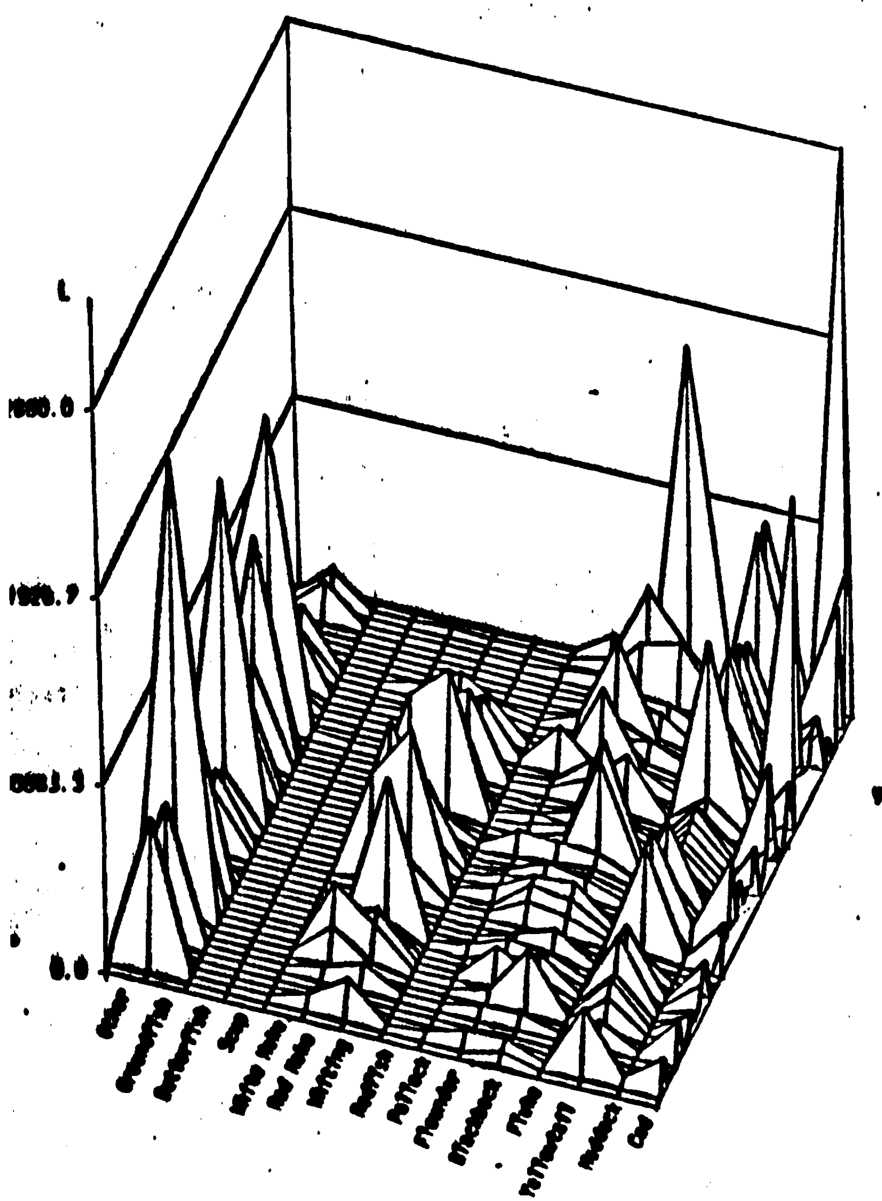


GRAPH OF OTTER TRAWL VESSEL LANDINGS 1976
PORT=PROVINCETOWN



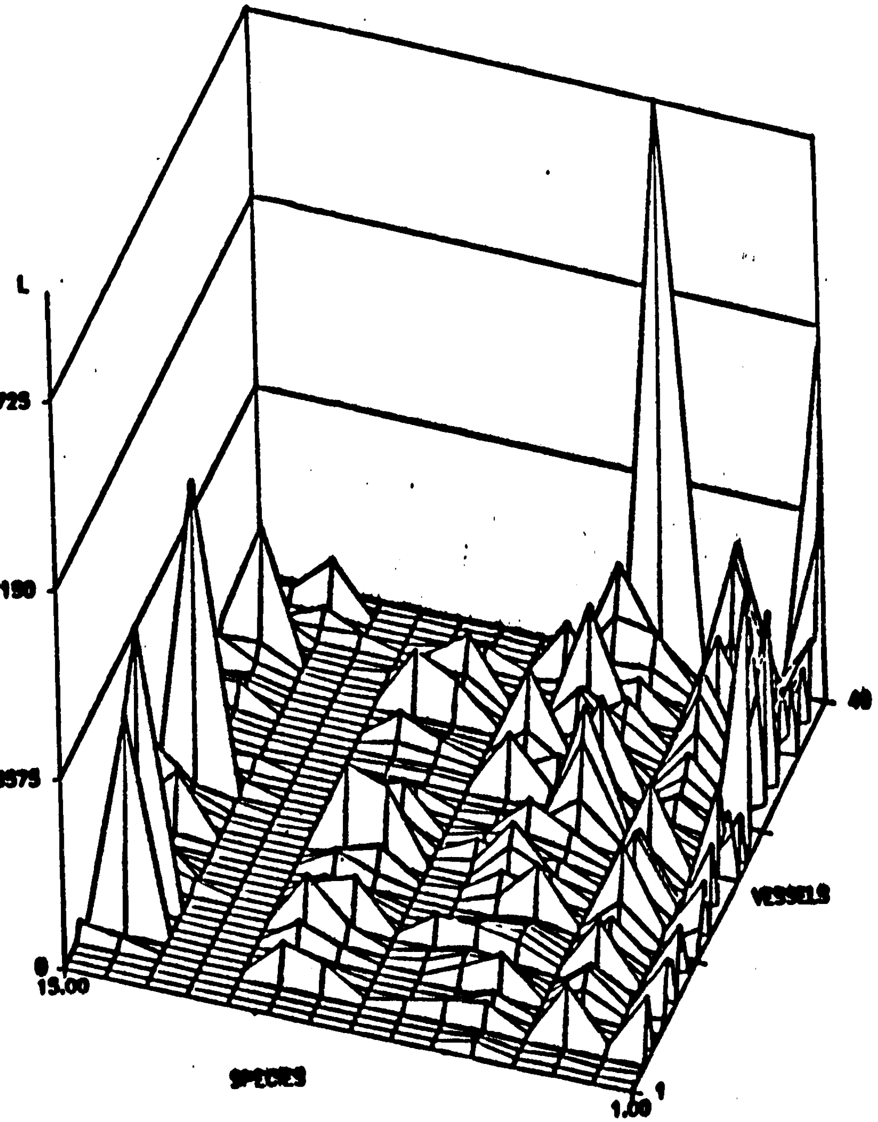
RAPH OF OTTER TRAWL VESSEL LANDINGS 1979

PORT=PROVINCETOWN



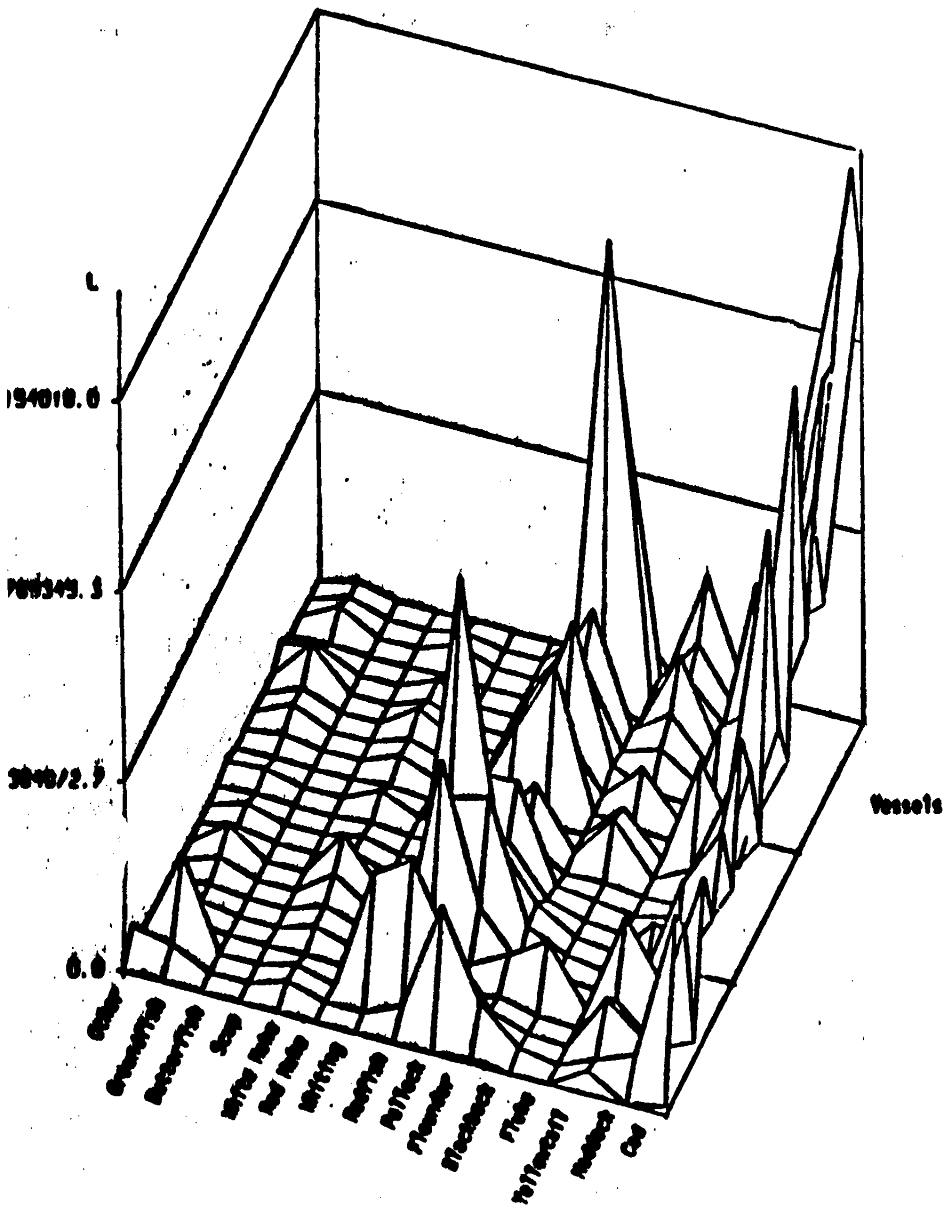
OTTER TRAWL VESSEL LANDINGS 1981

PORT=PROVINCETOWN



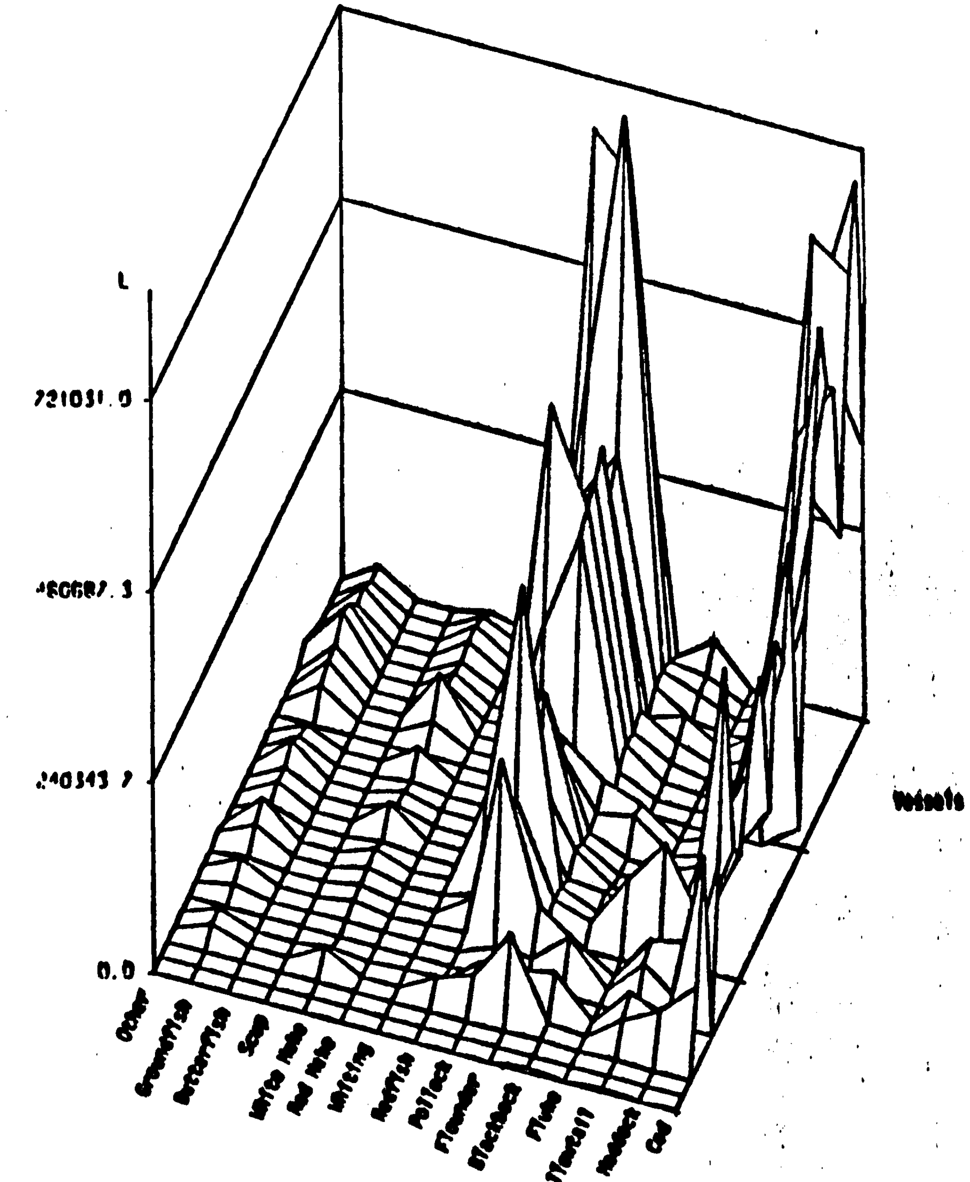
GRAPH OF OTTER TRAWL VESSEL LANDINGS 1973

PORT=BOSTON



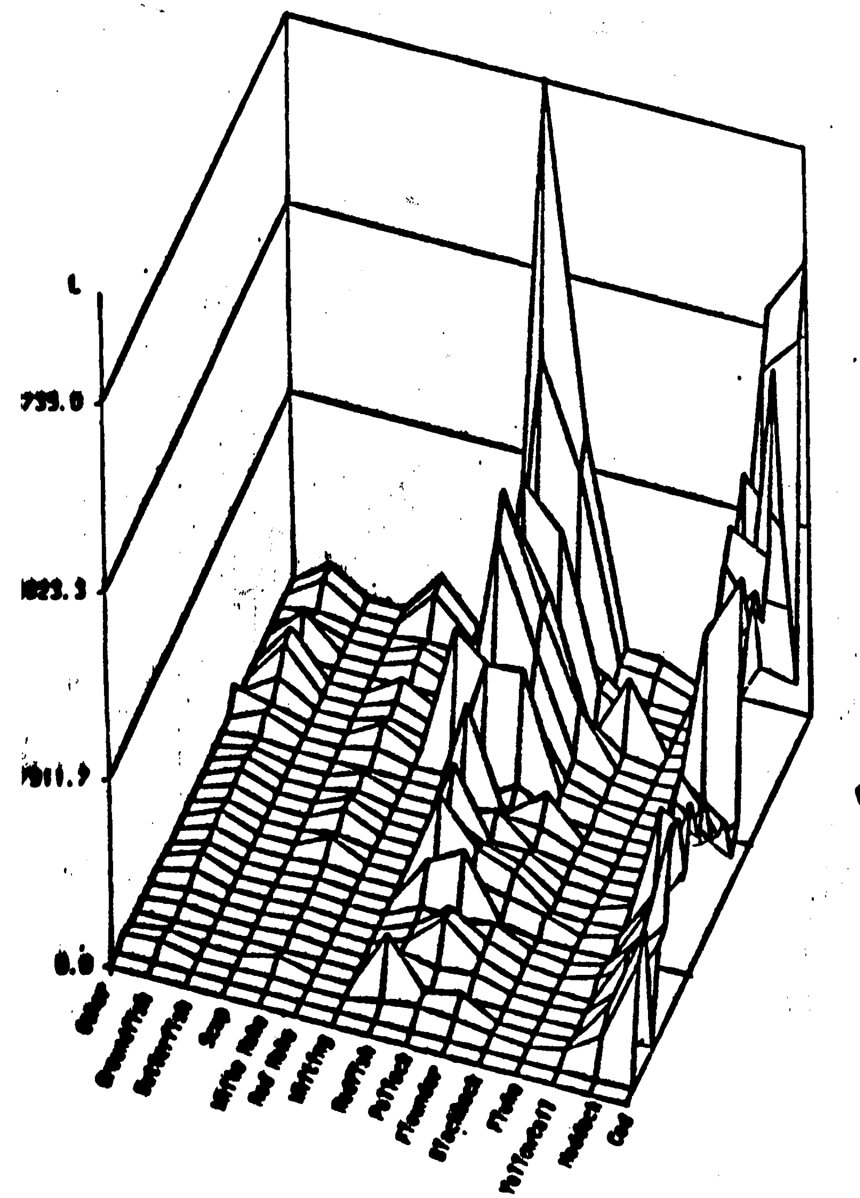
GRAPH OF OTTER TRAWL VESSEL LANDINGS 1976

PORT=BOSTON



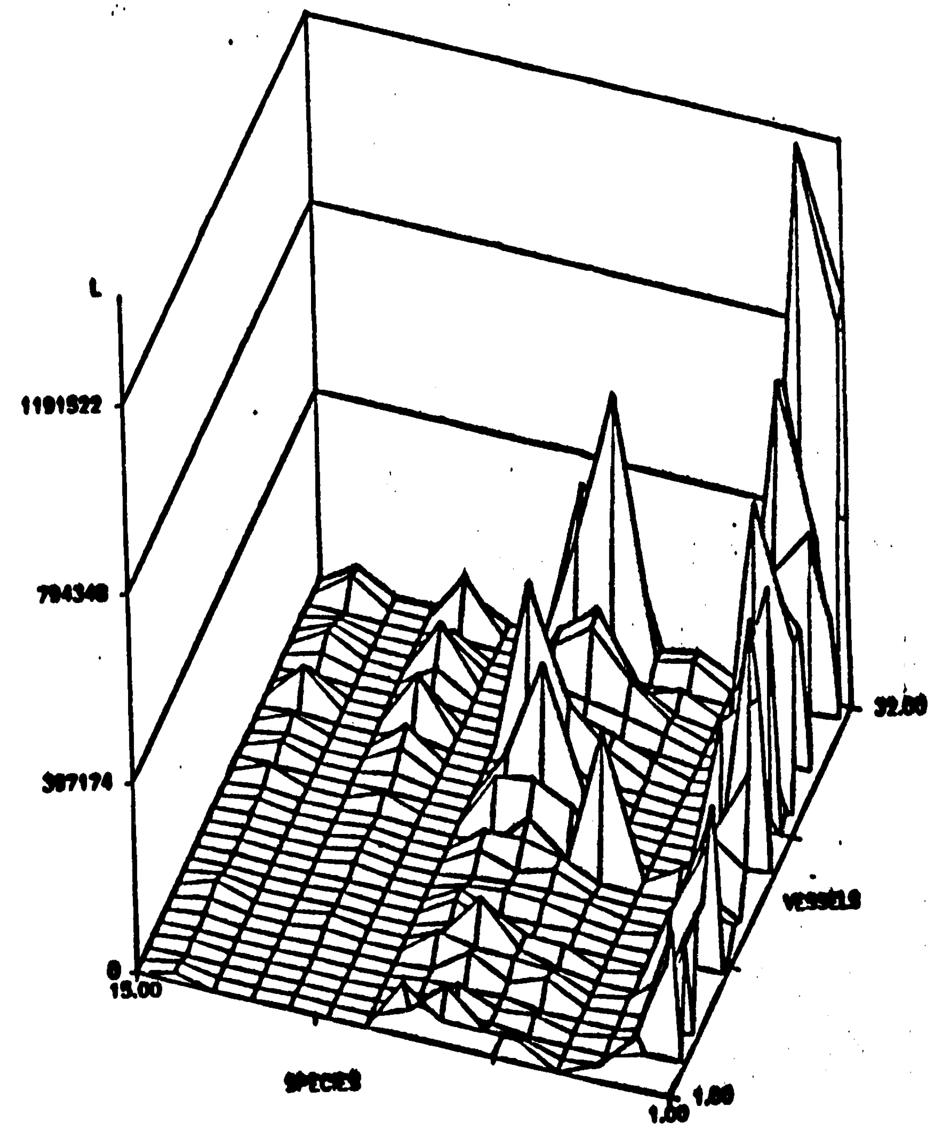
RAPH OF OTTER TRAWL VESSEL LANDINGS 1979

PORT=BOSTON



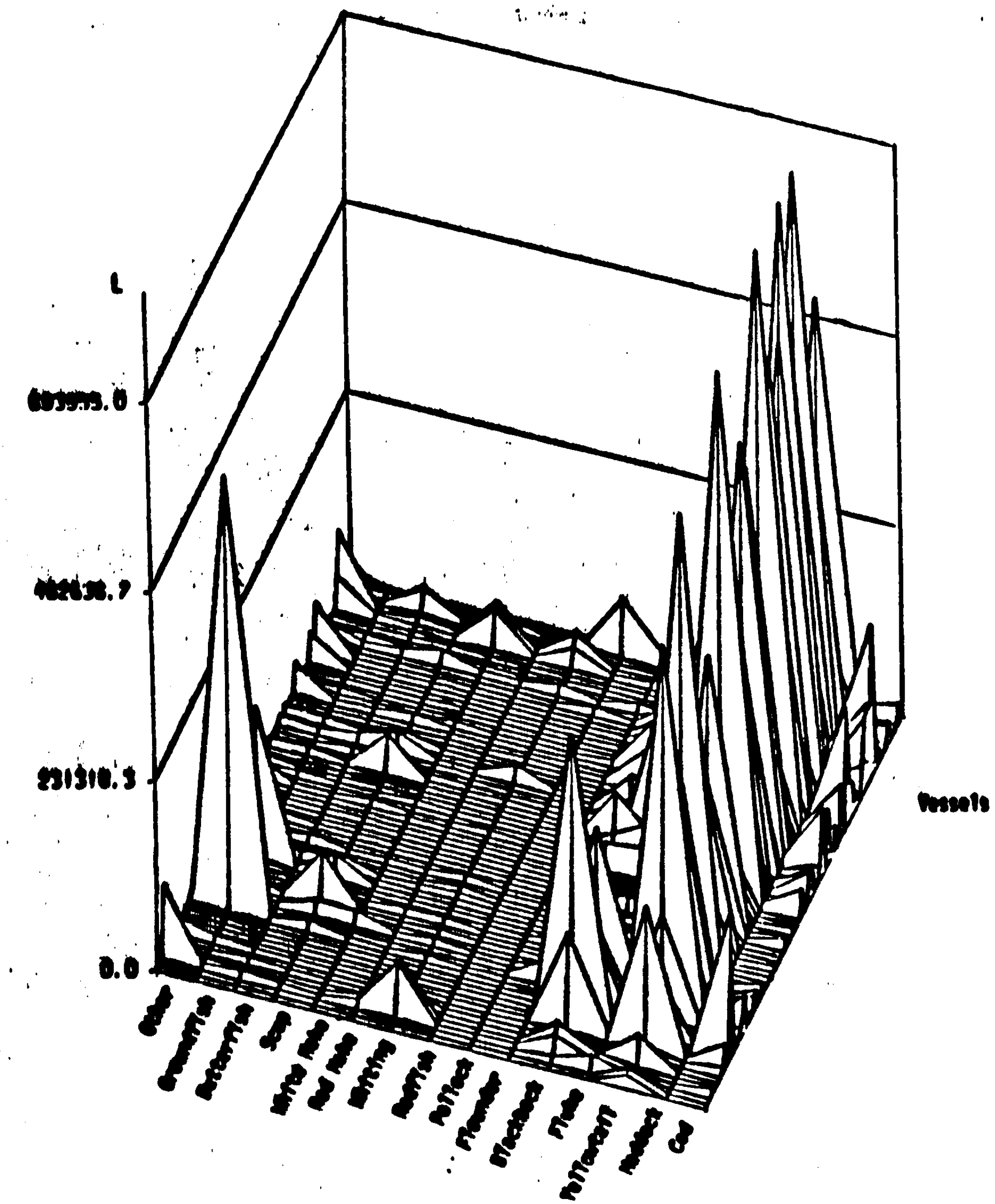
OTTER TRAWL VESSEL LANDINGS 1981

PORT=BOSTON



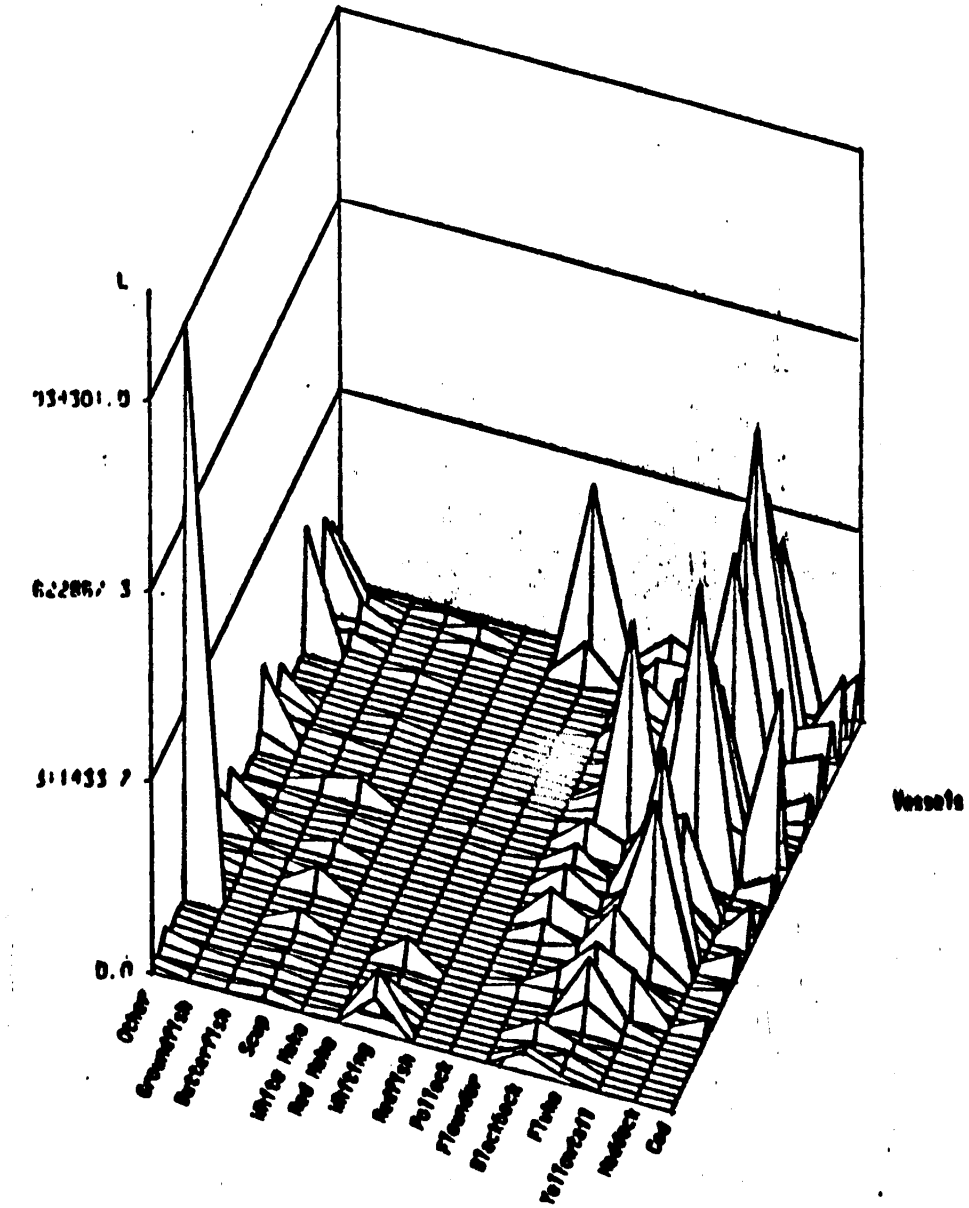
GRAPH OF OTTER TRAWL VESSEL LANDINGS 1973

PORT=NEWPORT



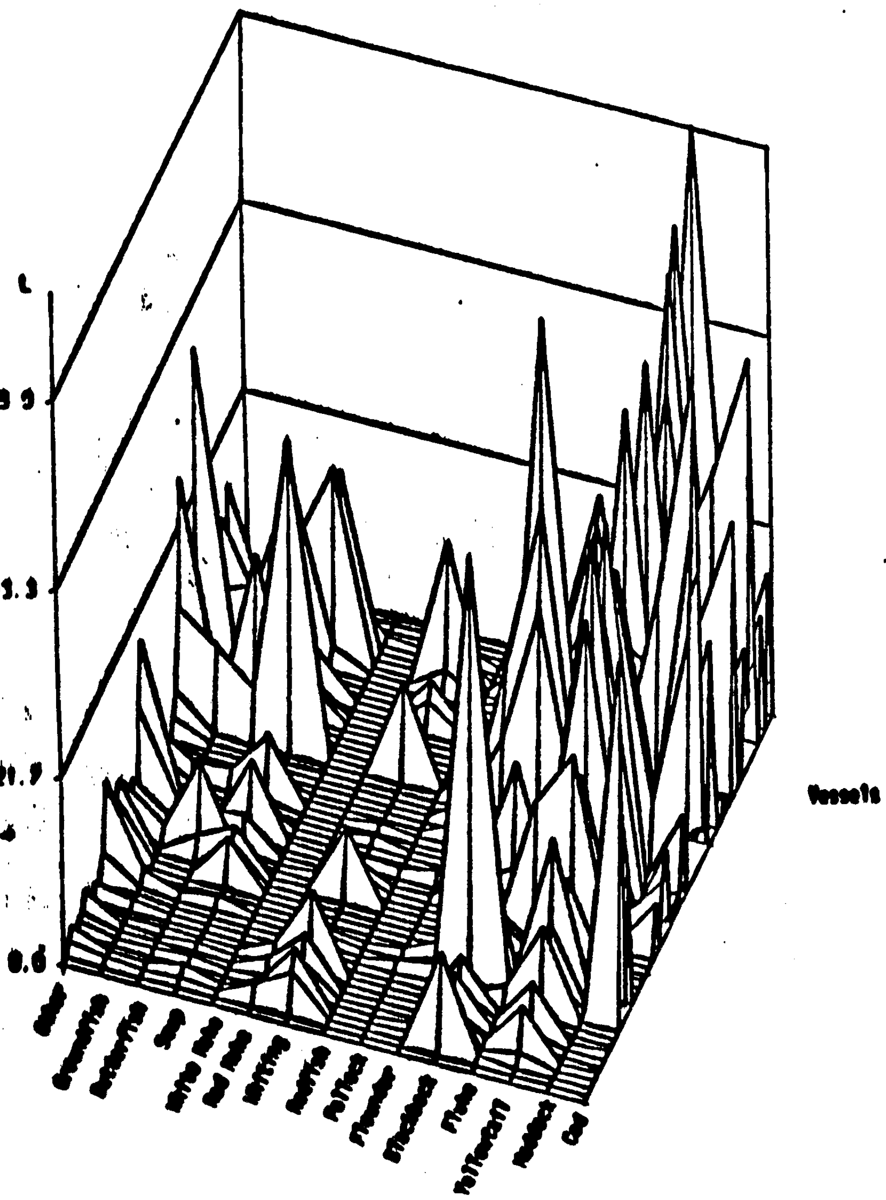
GRAPH OF OTTER TRAWL VESSEL LANDINGS 1976

PORT=NEWPORT



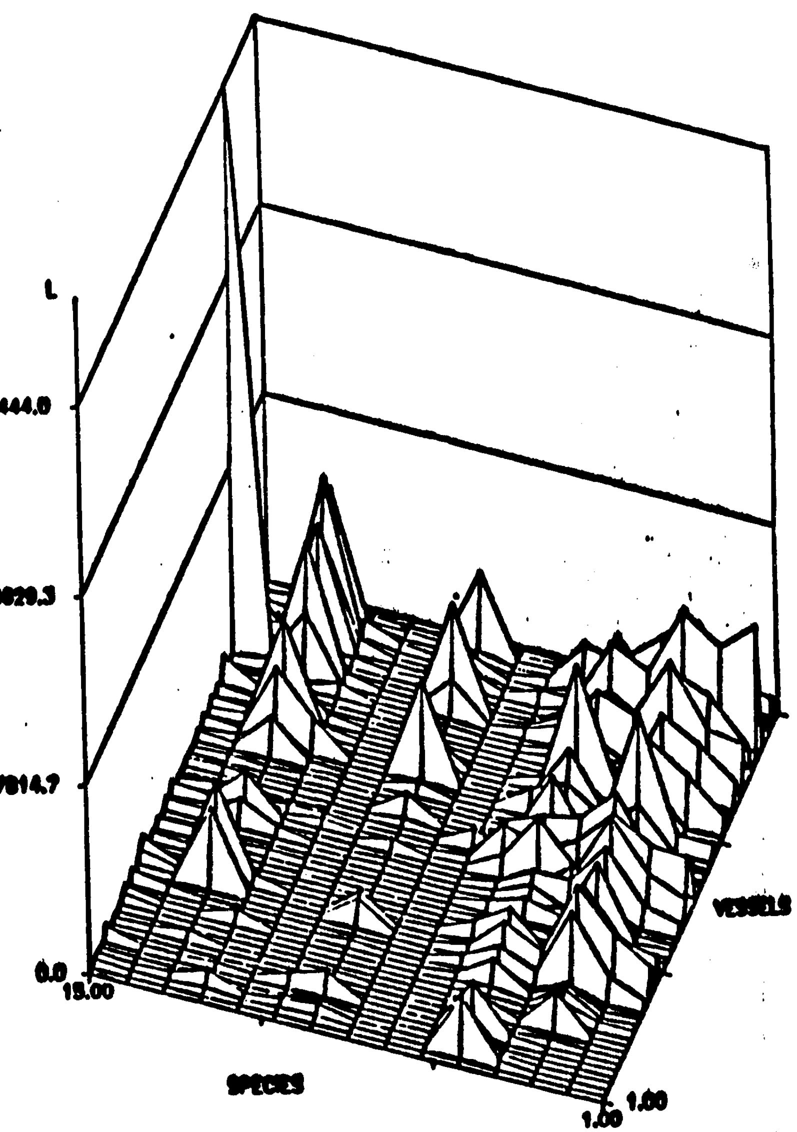
RAPH OF OTTER TRAWL VESSEL LANDINGS 1979

PORT=NEWPORT



OTTER TRAWL VESSEL LANDINGS 1981

PORT=NEWPORT



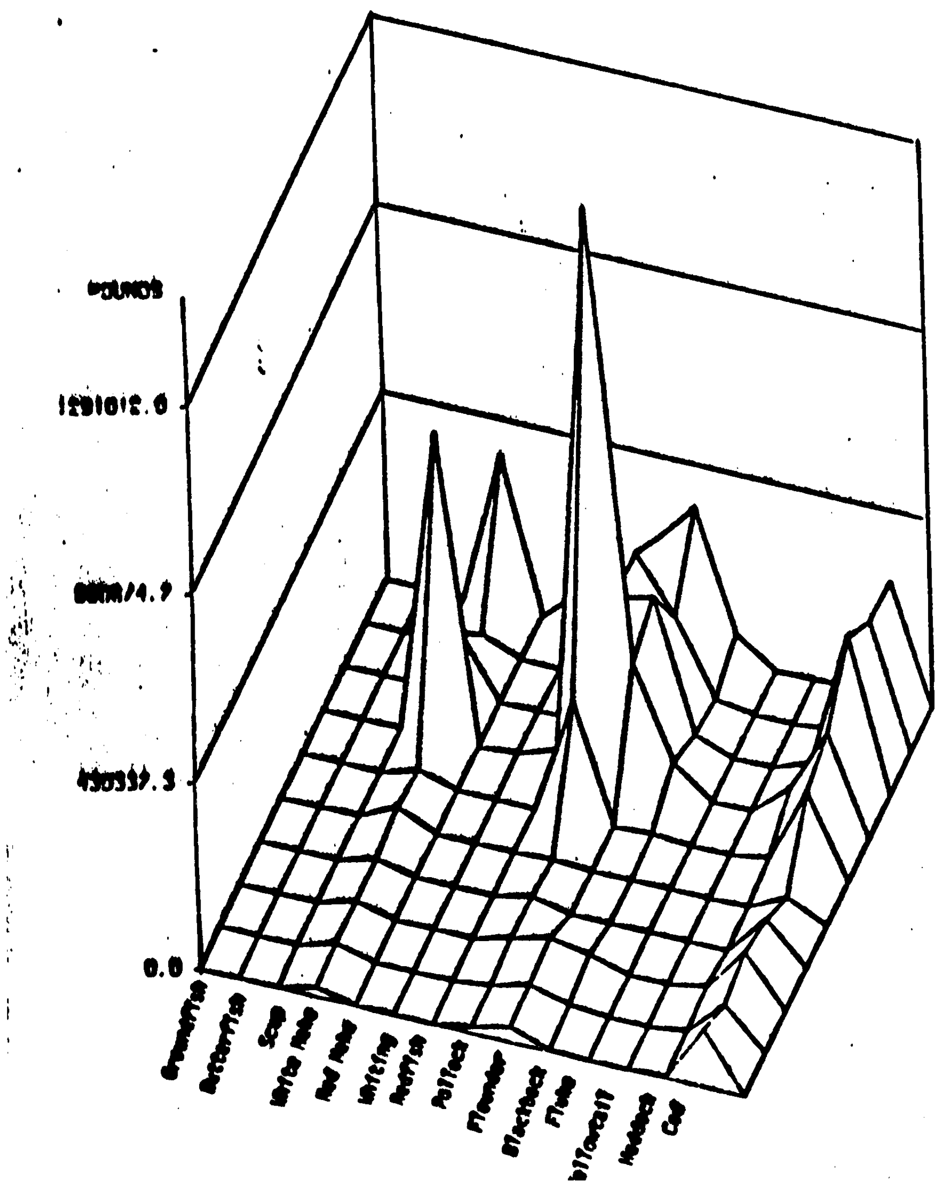
APPENDIX 3A.3

TOTAL YEARLY LANDINGS, 1973-1982

Washington County, ME
Hancock County
Rockland
Knox County
Lincoln County
Sagadahoc County
Portland
Cumberland County
York County
Gloucester
Boston
Plymouth
Scituate
Sandwich
Provincetown
Chatham
Barnstable County
Dukes County
New Bedford
Newport
Point Judith
New York
New Jersey
Virginia

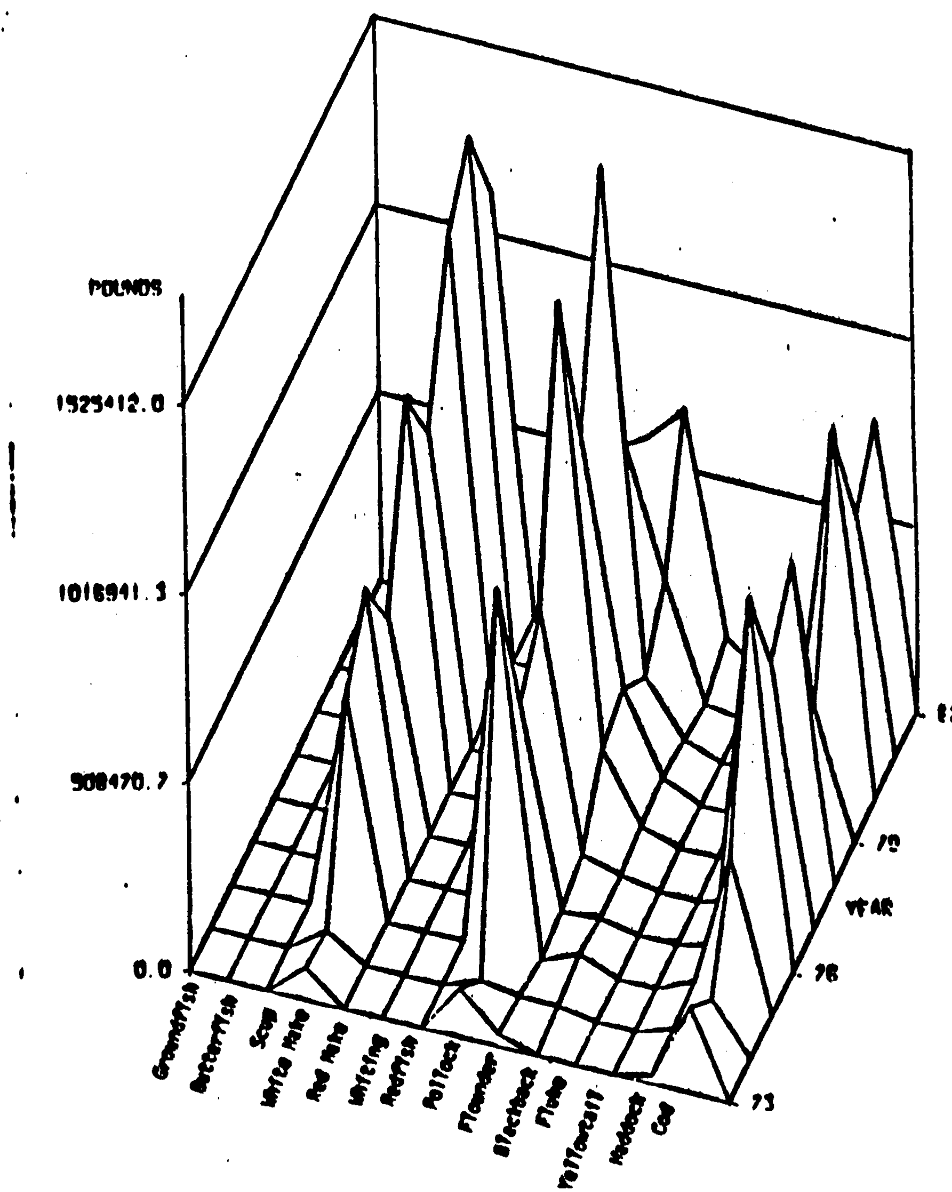
GRAPH OF YEARLY PORT LANDINGS 1972--82

PORTCODE=WASHINGTON ME



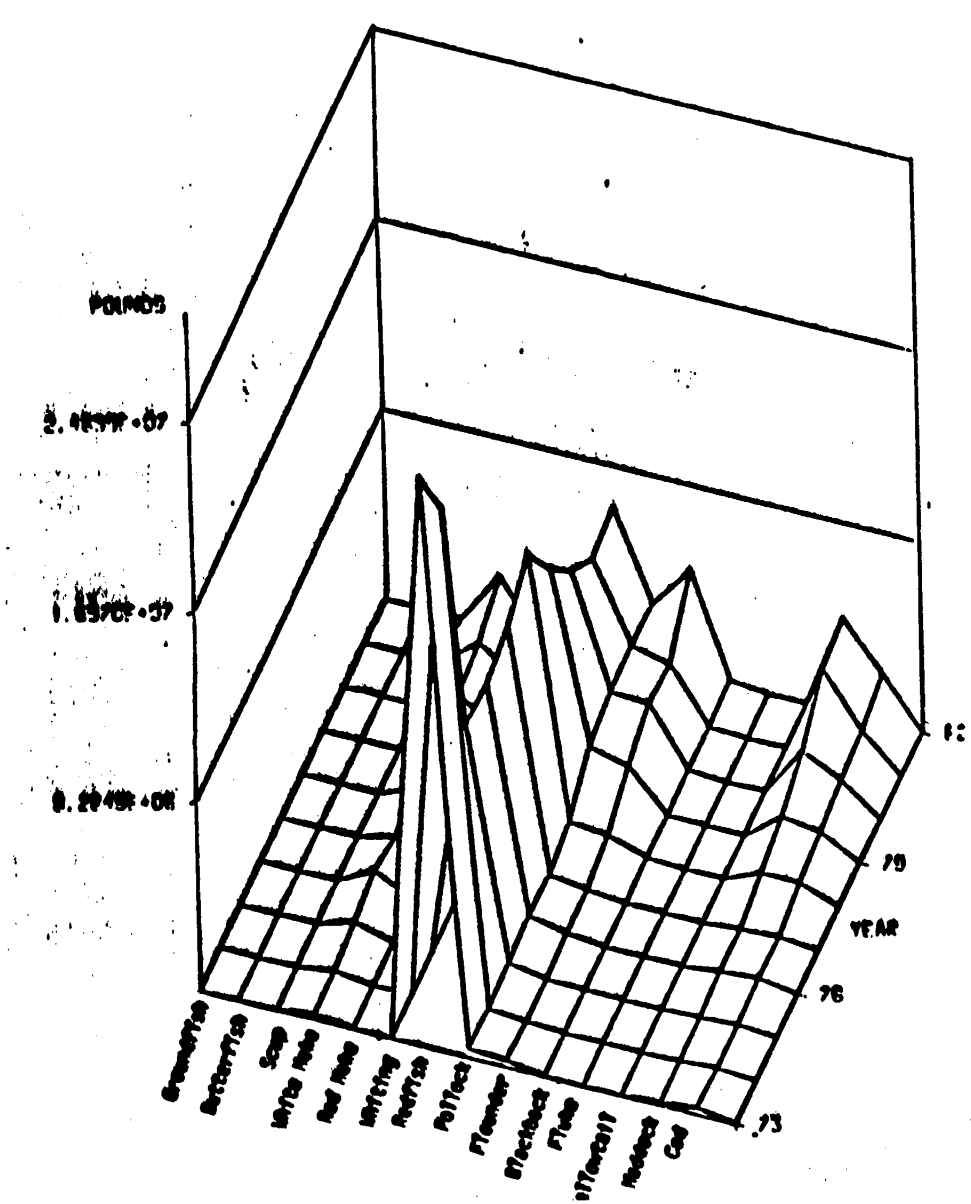
GRAPH OF YEARLY PORT LANDINGS 1972-82

PORTCODE=HANCOCK



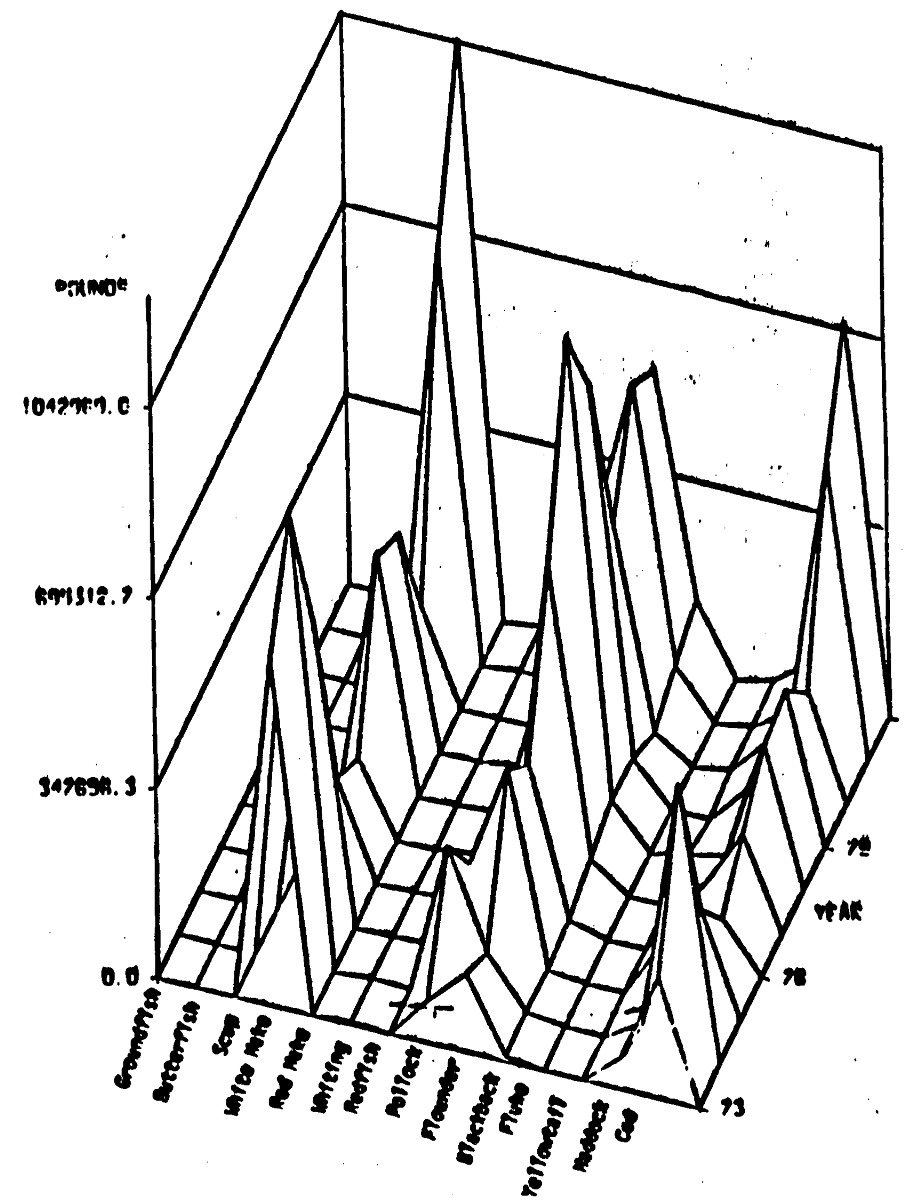
GRAPH OF YEARLY PORT LANDINGS 1972--82

PORTCODE=ROCKLAND

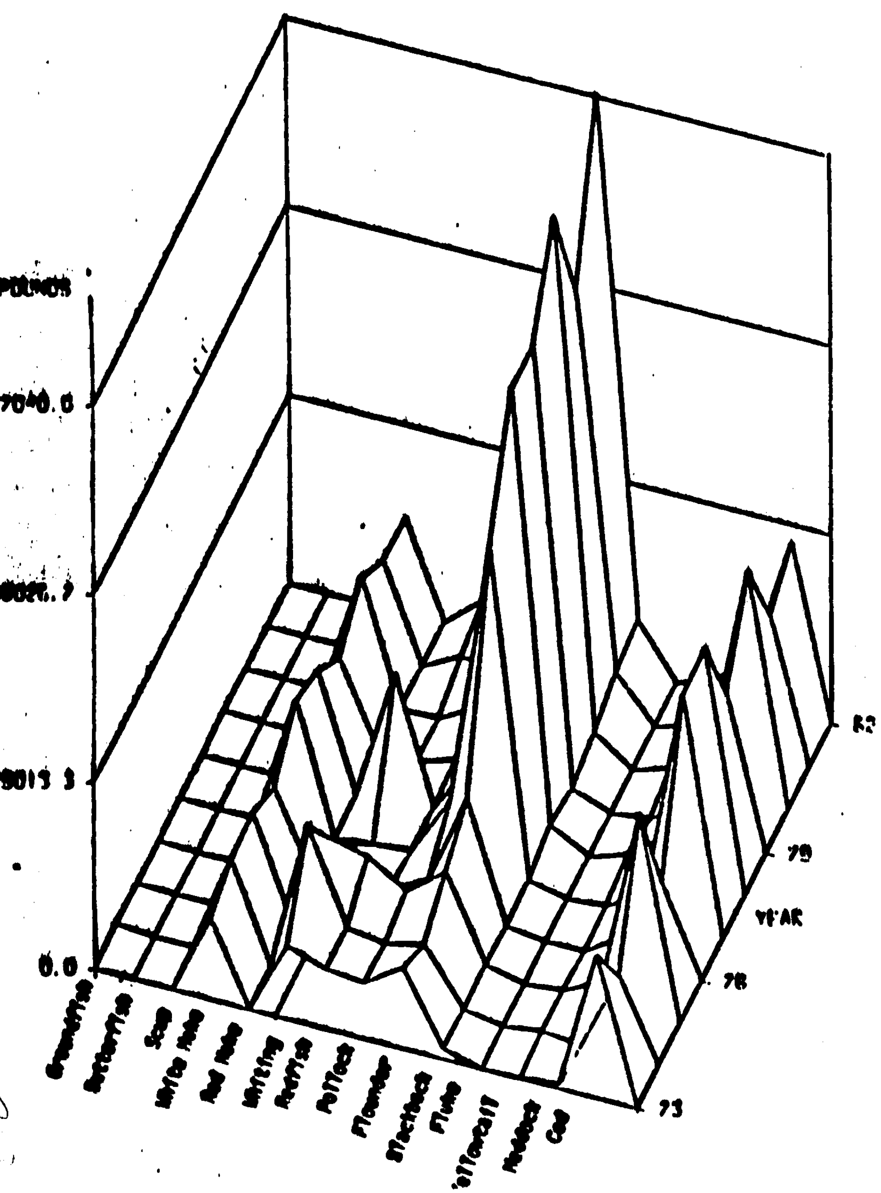


GRAPH OF YEARLY PORT LANDINGS 1972–82

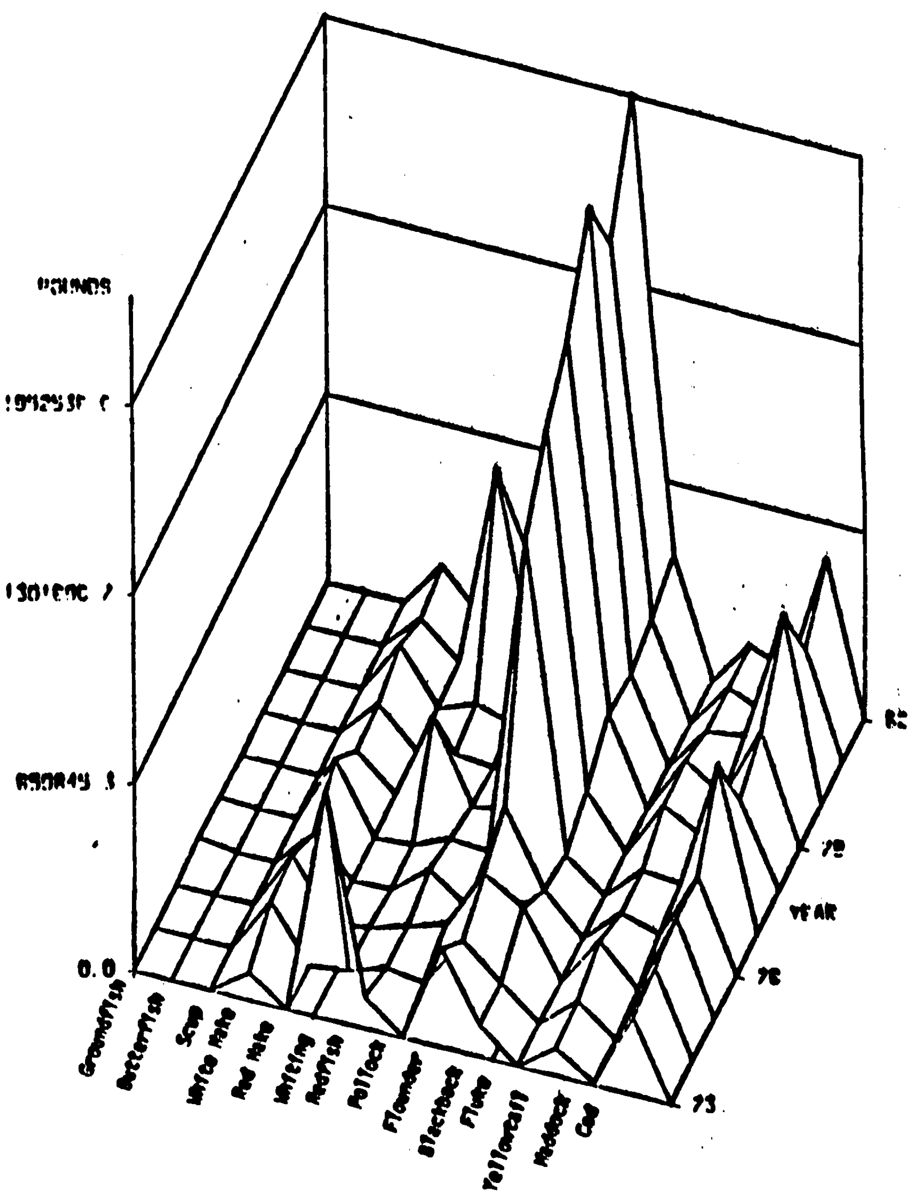
PORTCODE=KNOX



GRAPH OF YEARLY PORT LANDINGS 1972–82
PORTCODE=LINCOLN

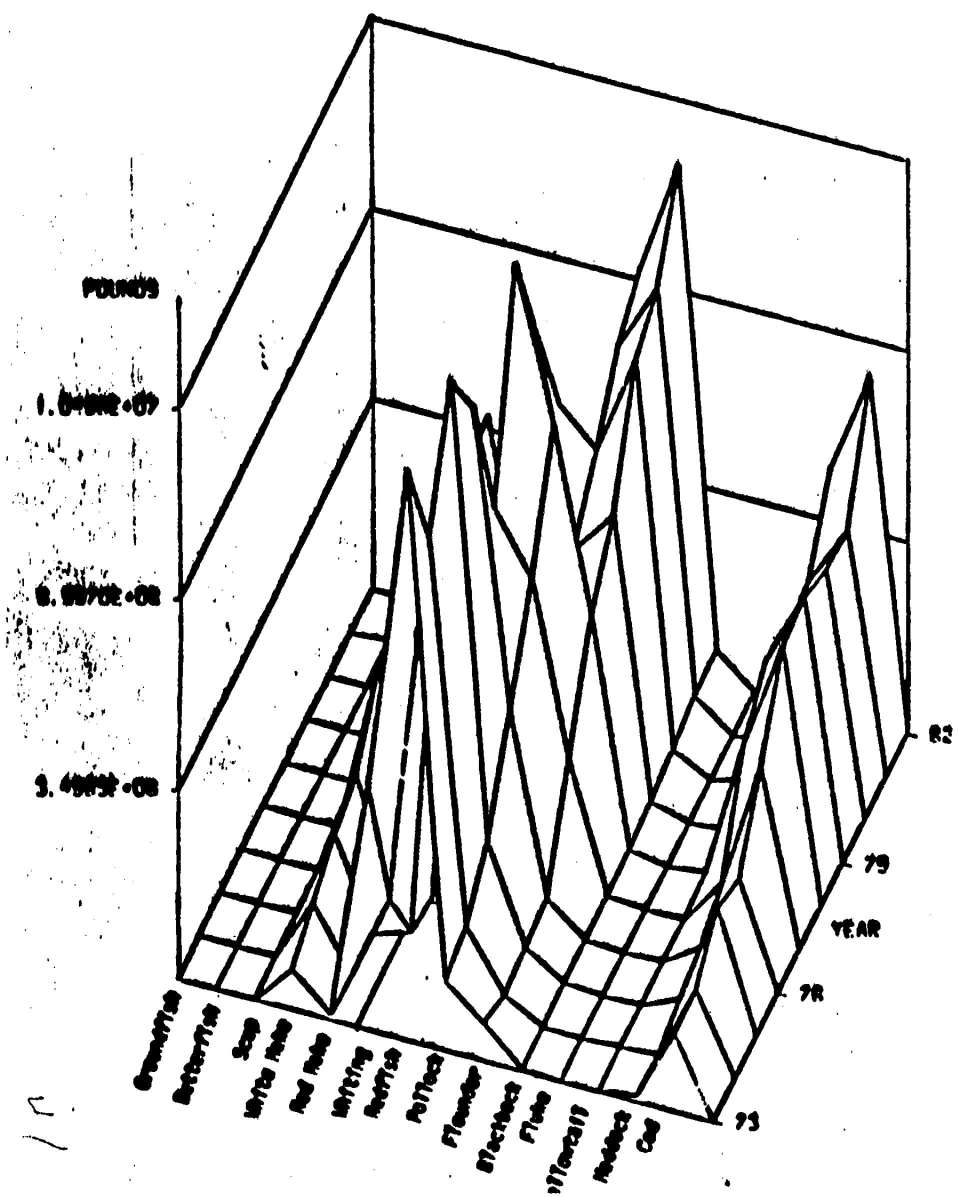


GRAPH OF YEARLY PORT LANDINGS 1972–82
PORTCODE=SAGADAHOC



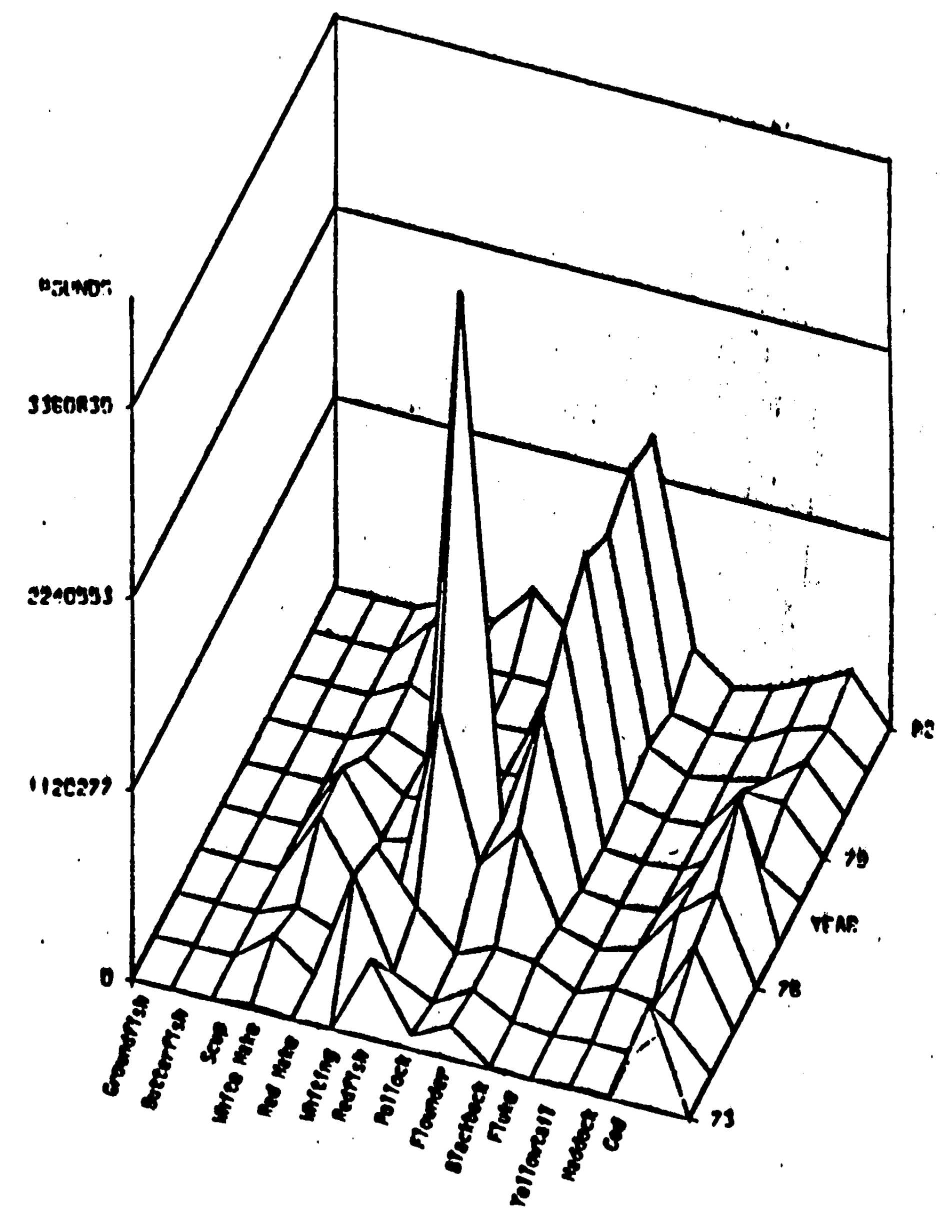
GRAPH OF YEARLY PORT LANDINGS, 1972-82

PORTCODE=PORTLAND

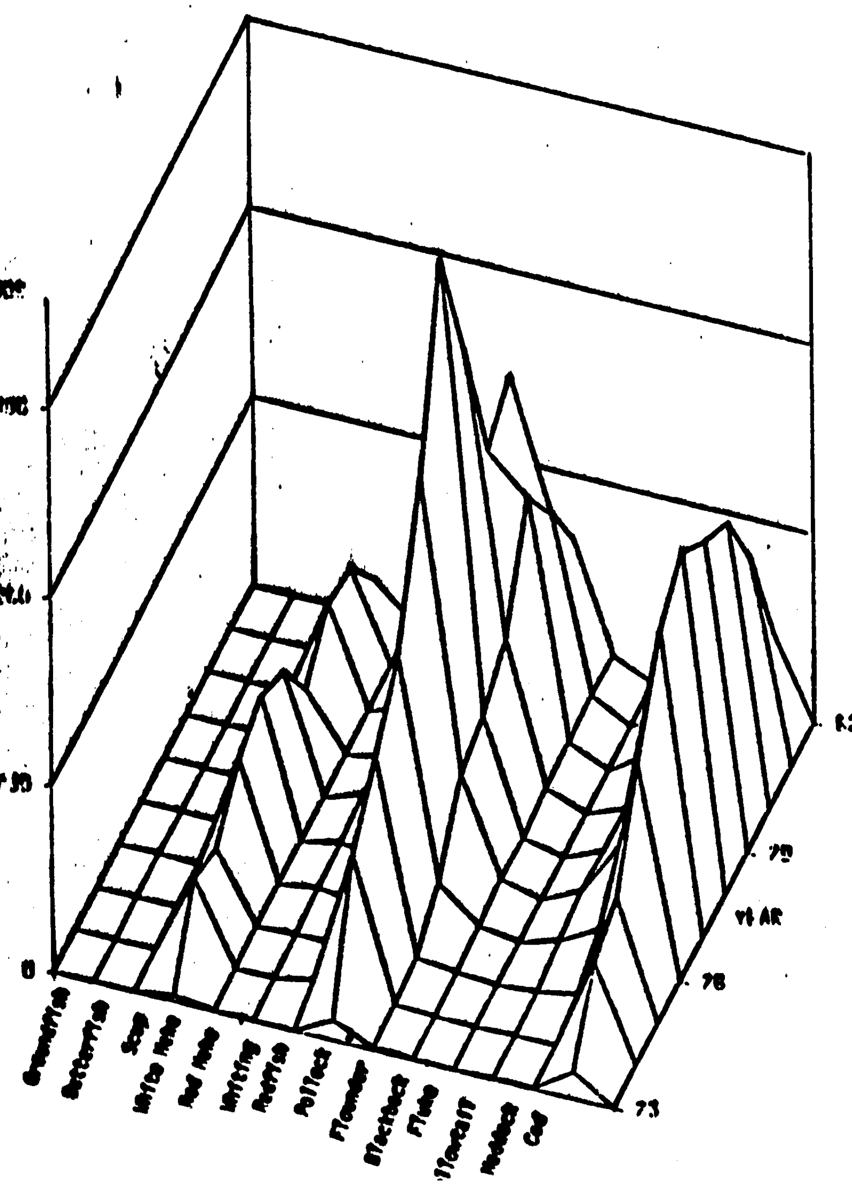


GRAPH OF YEARLY PORT LANDINGS, 1972-82

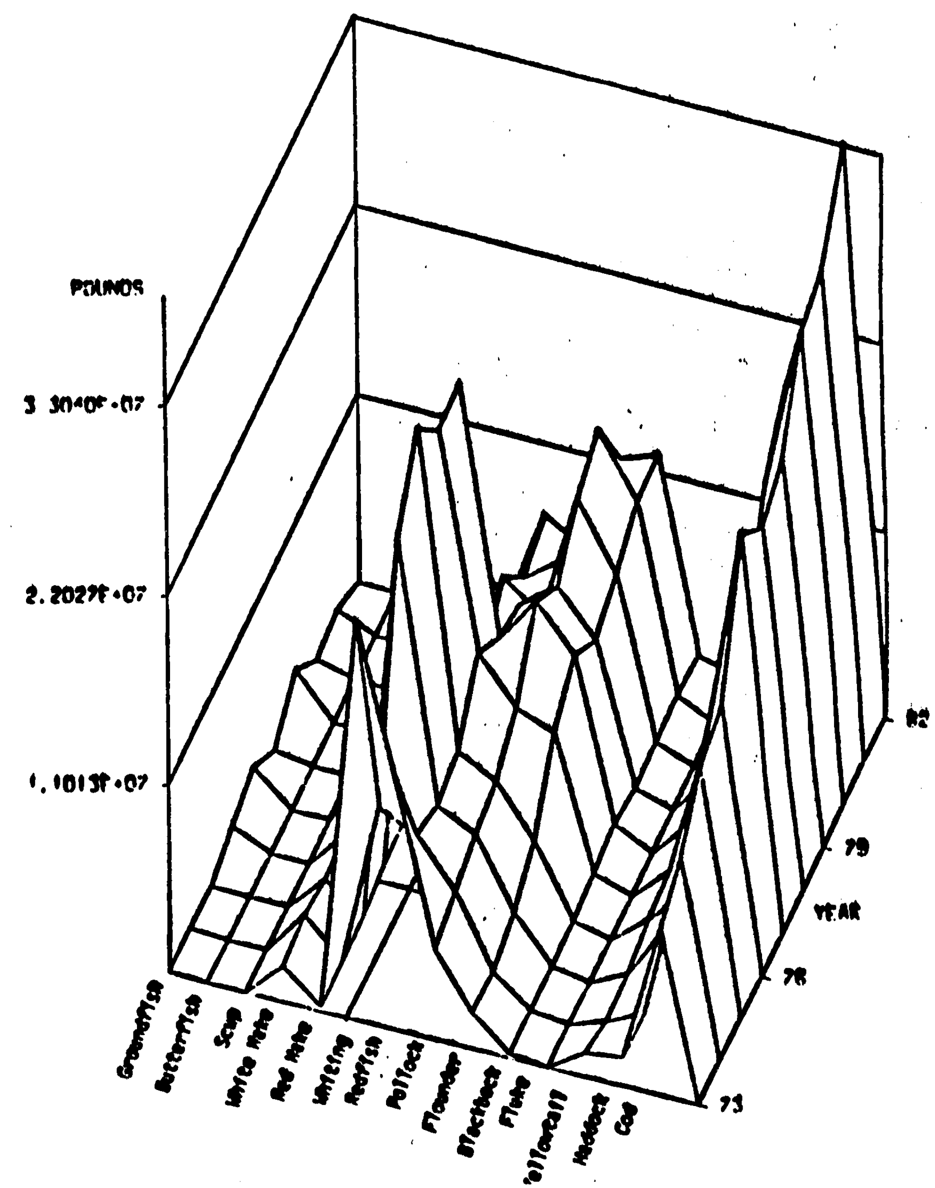
PORTCODE=CUMBERLAND



GRAPH OF YEARLY PORT LANDINGS. 1972–82
PORTCODE=YORK

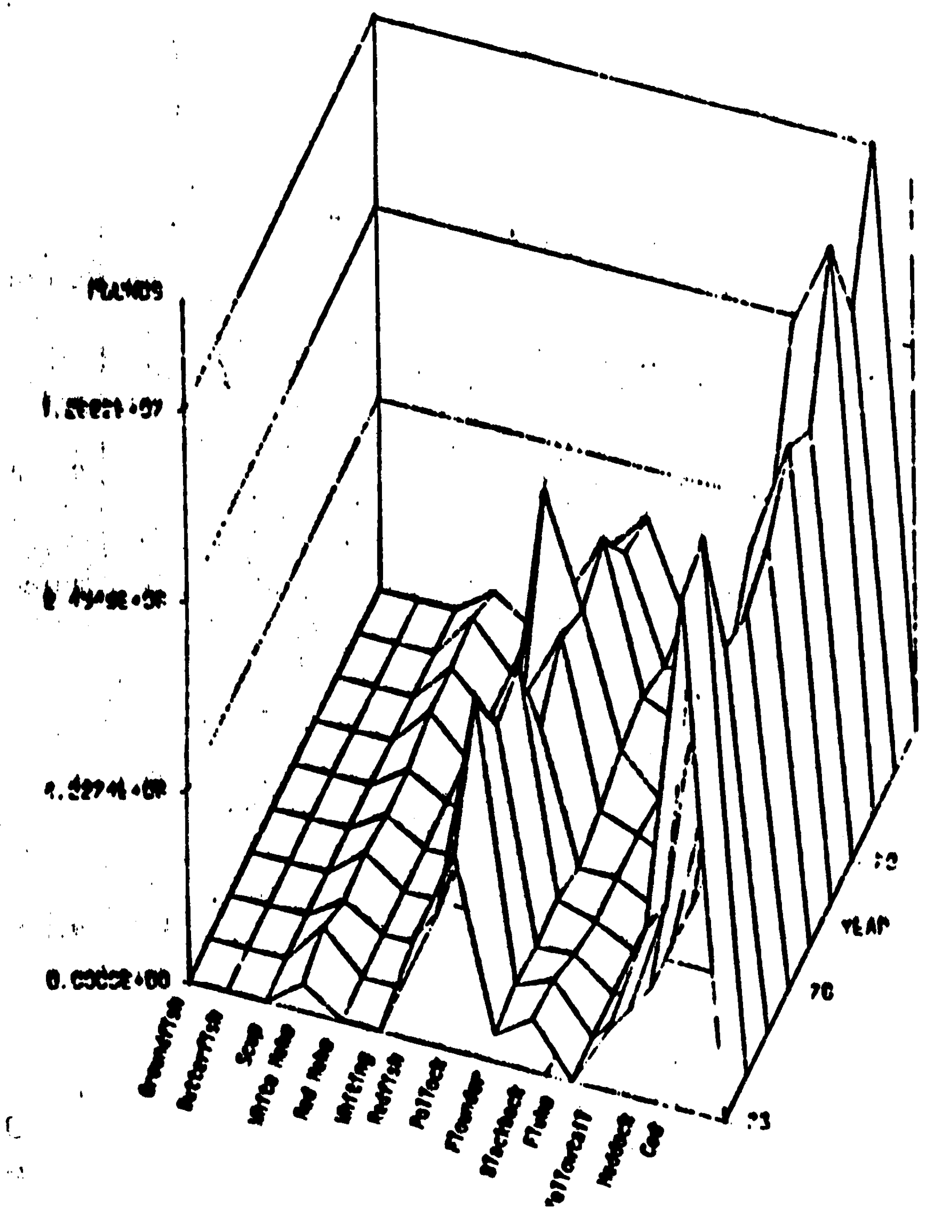


GRAPH OF YEARLY PORT LANDINGS, 1972–82
PORTCODE=GLOUCESTER



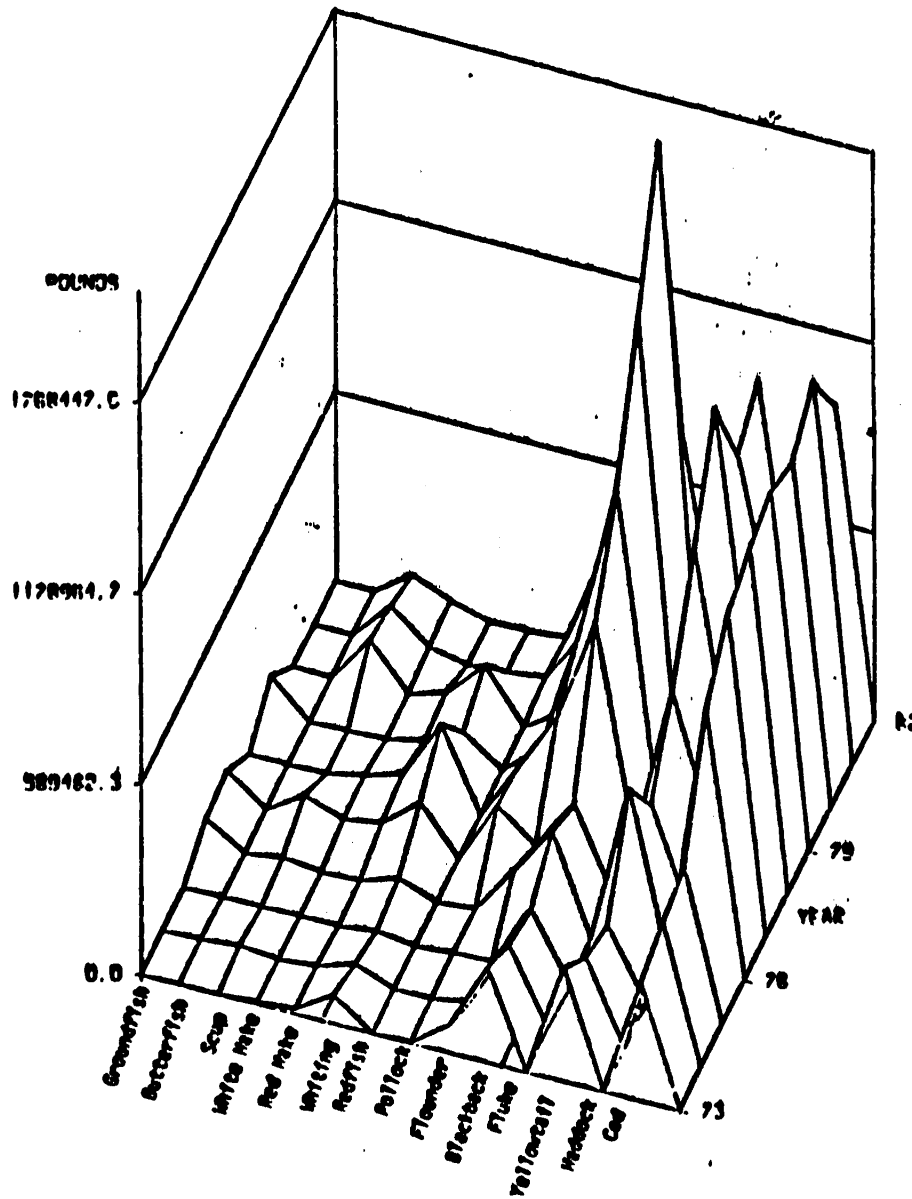
GRAPH OF YEARLY PORT LANDINGS 1972-82

PORTCODE=BOSTON



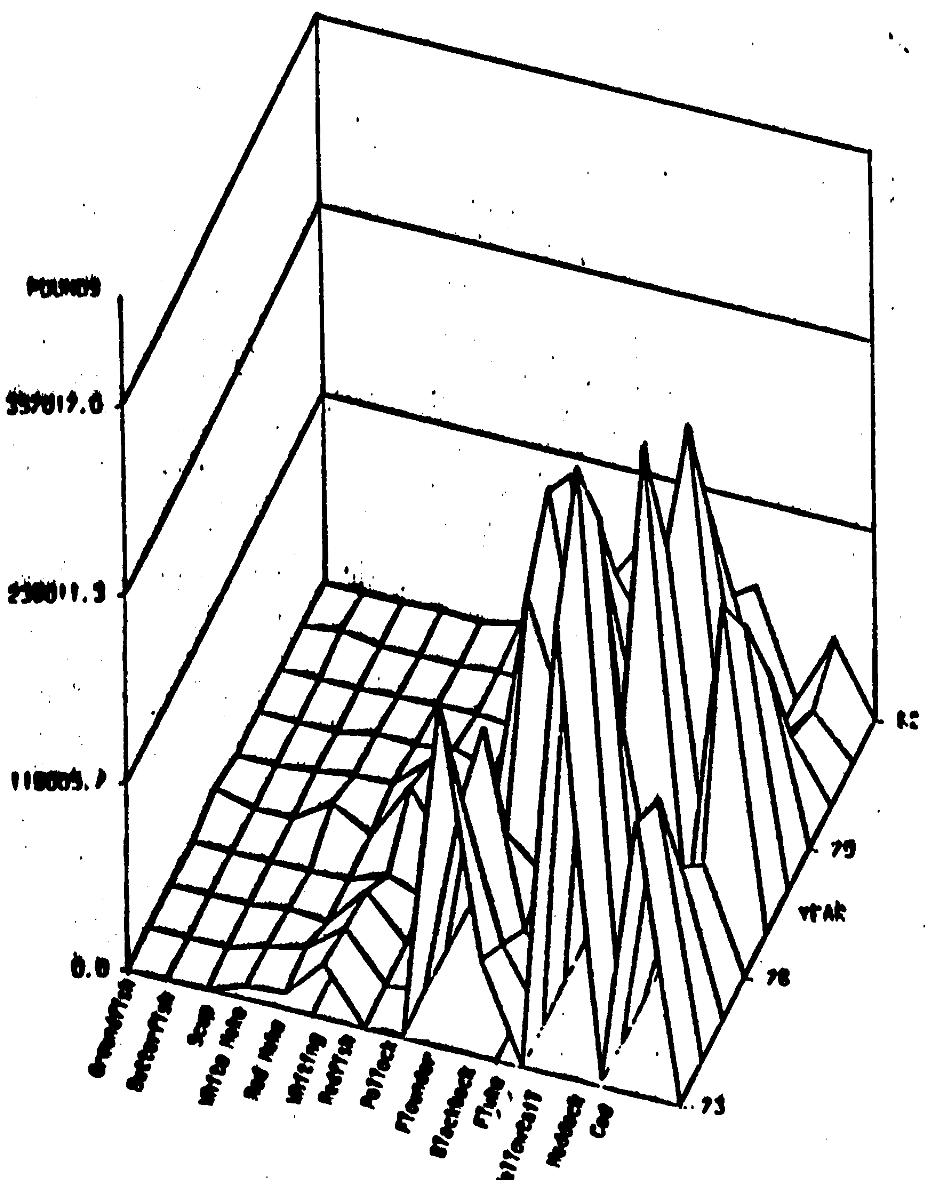
GRAPH OF YEARLY PORT LANDINGS. 1972-82

PORTCODE=PLYMOUTH



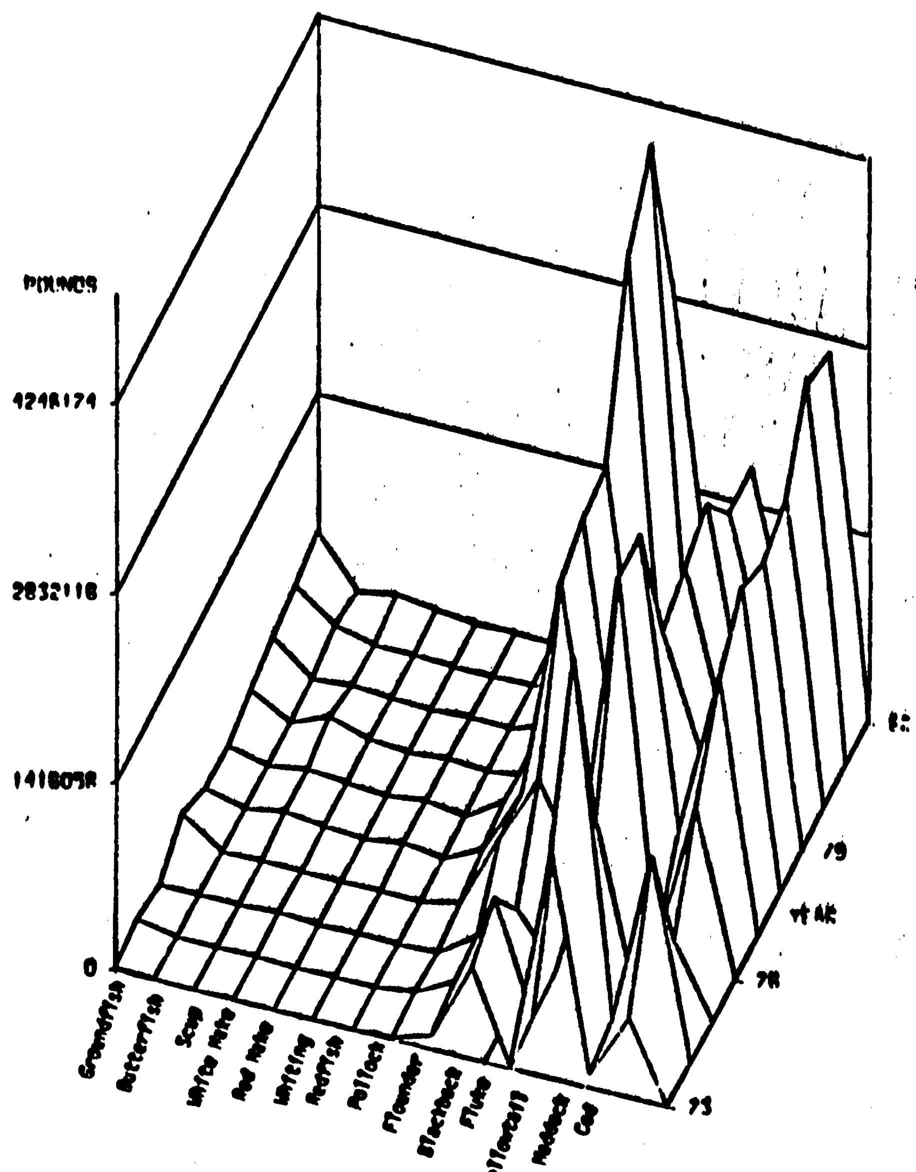
GRAPH OF YEARLY PORT LANDINGS. 1972-82

PORTCODE=SCITUATE

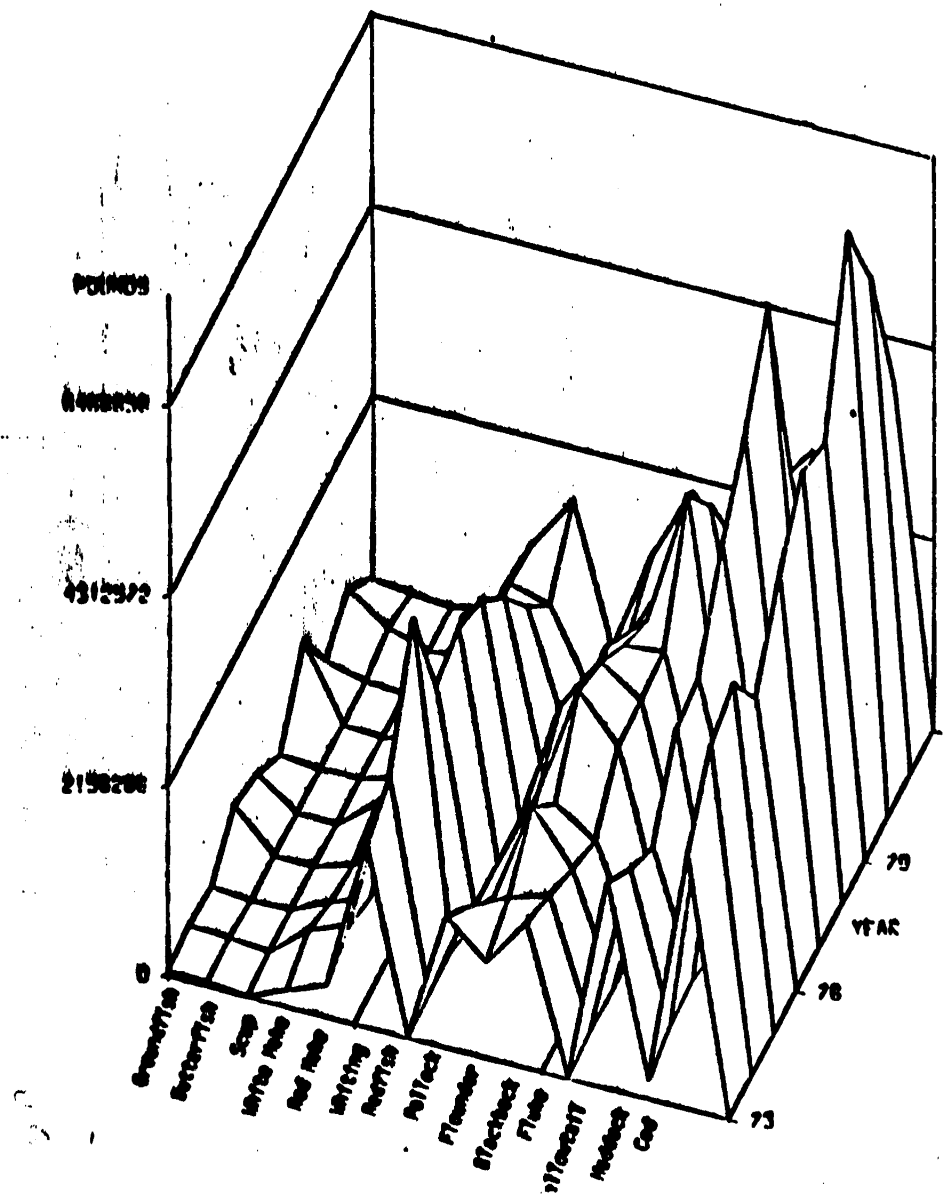


GRAPH OF YEARLY PORT LANDINGS. 1972-82

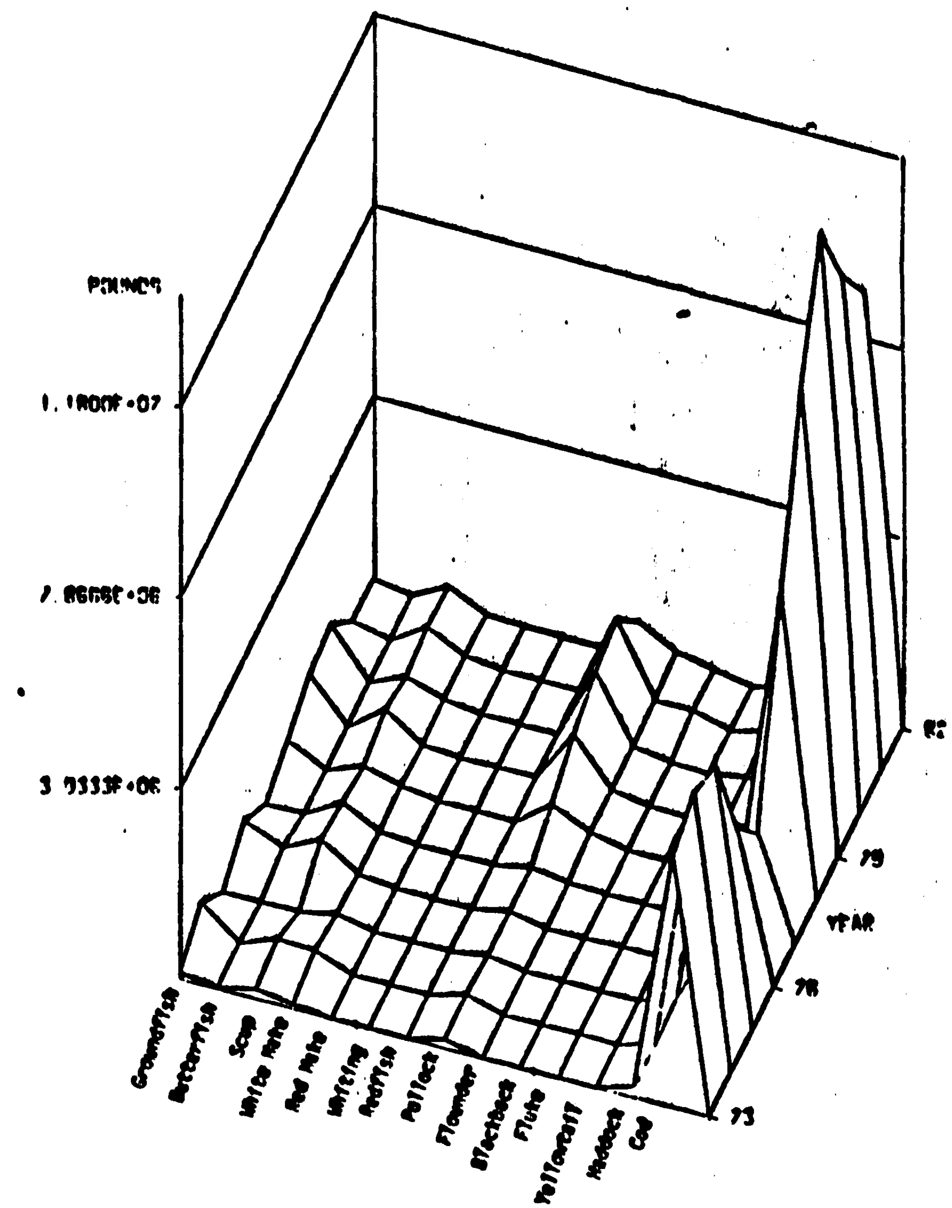
PORTCODE=SANDWICH



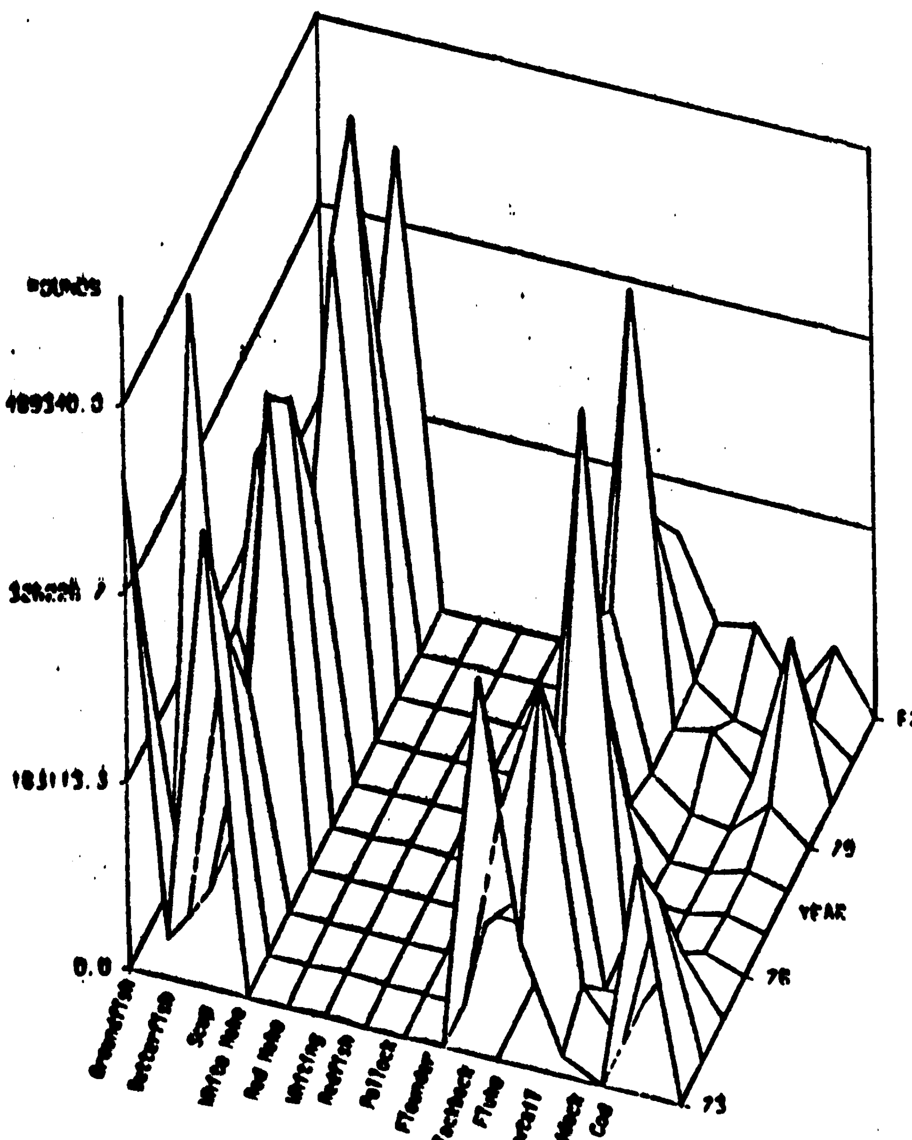
GRAPH OF YEARLY PORT LANDINGS, 1972--82
PORTCODE=PROVINCETOWN



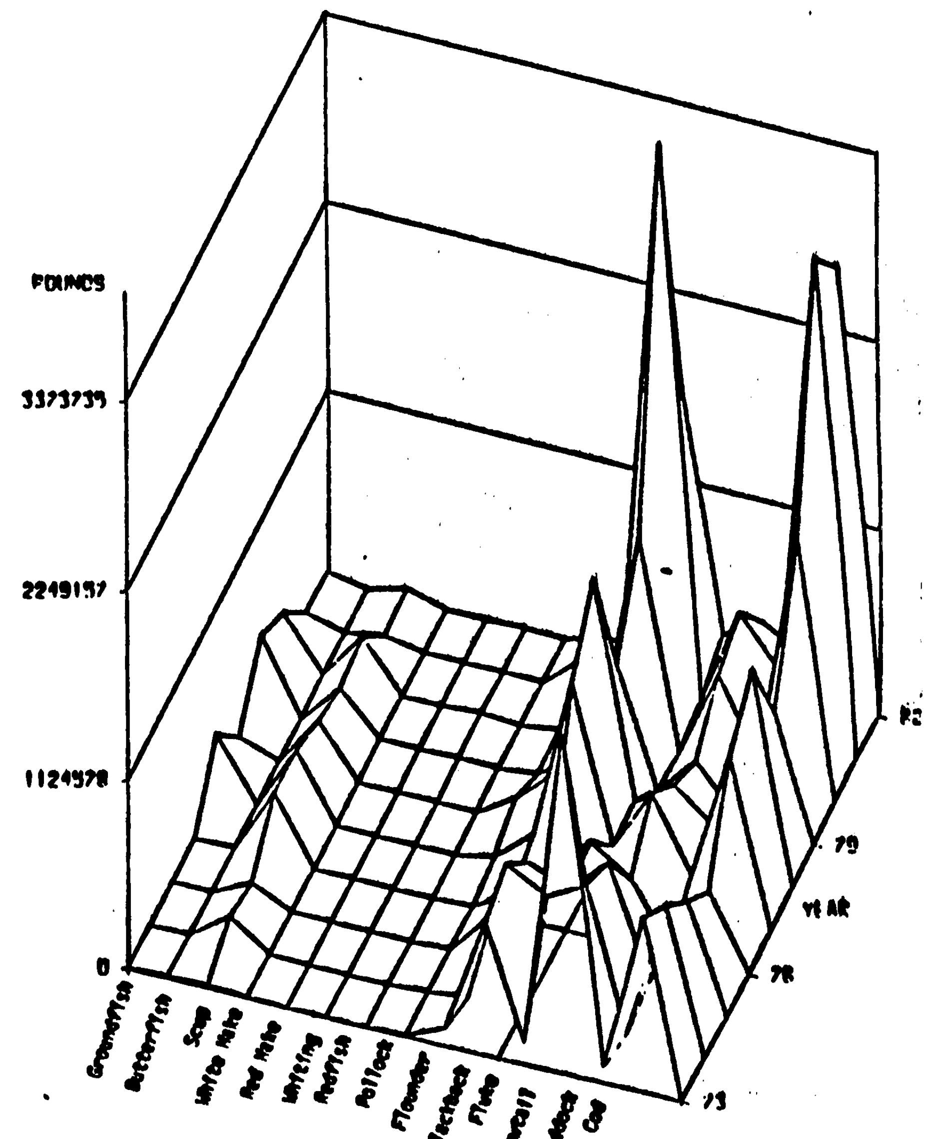
GRAPH OF YEARLY PORT LANDINGS, 1972–82
PORTCODE=CHATHAM



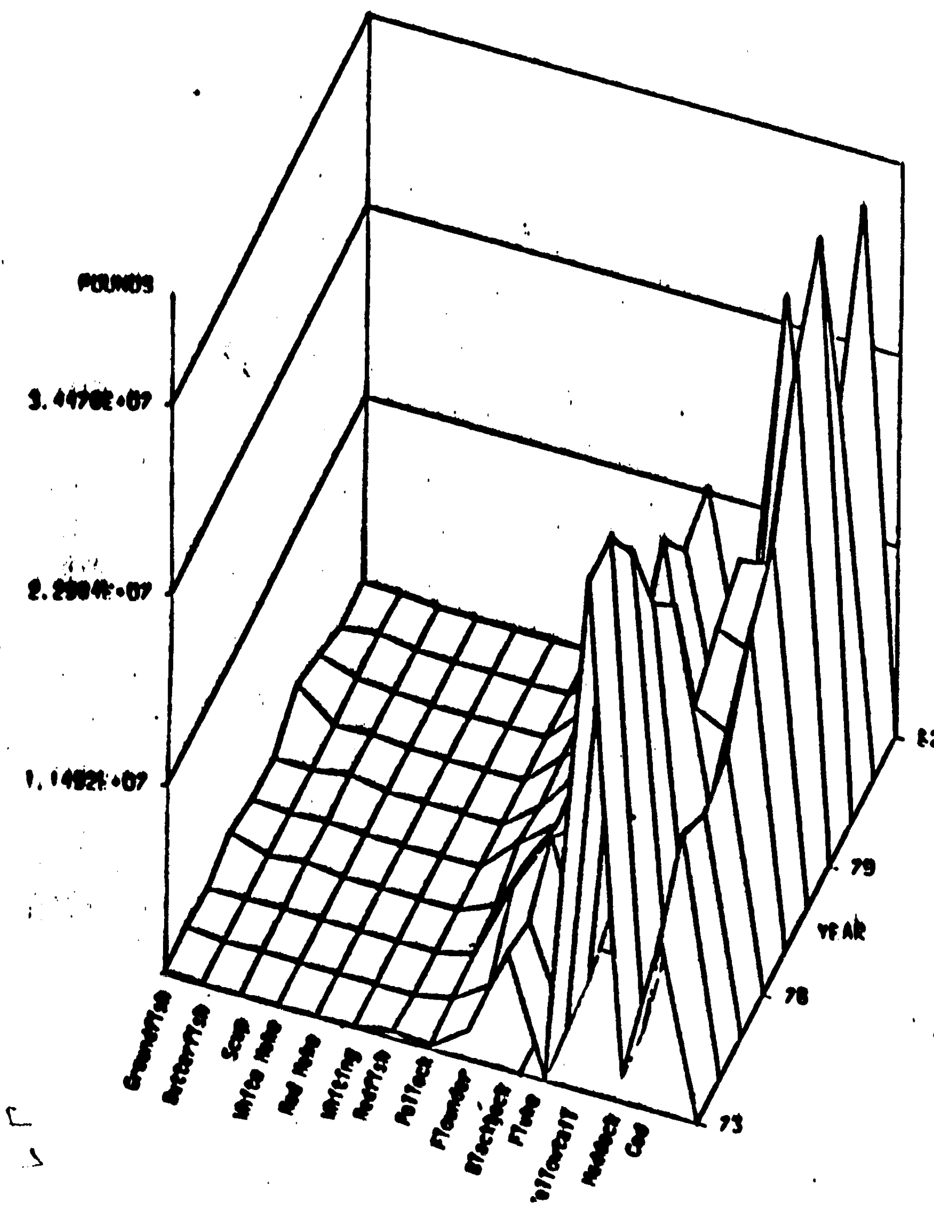
GRAPH OF YEARLY PORT LANDINGS. 1972–82
PORTCODE=BARNSTABLE



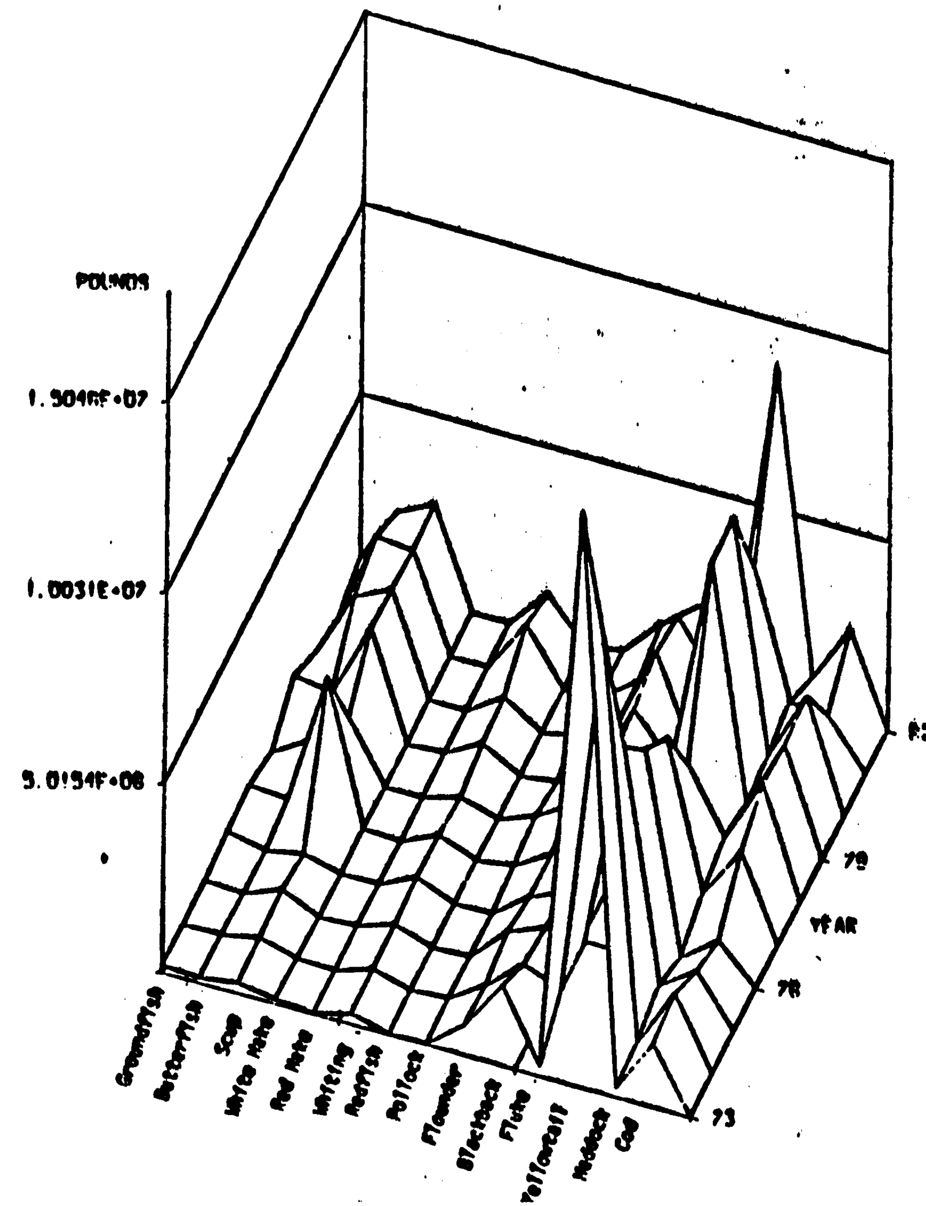
GRAPH OF YEARLY PORT LANDINGS. 1972–82
PORTCODE=DUKES



GRAPH OF YEARLY PORT LANDINGS. 1972–82
PORTCODE=NEW BEDFORD

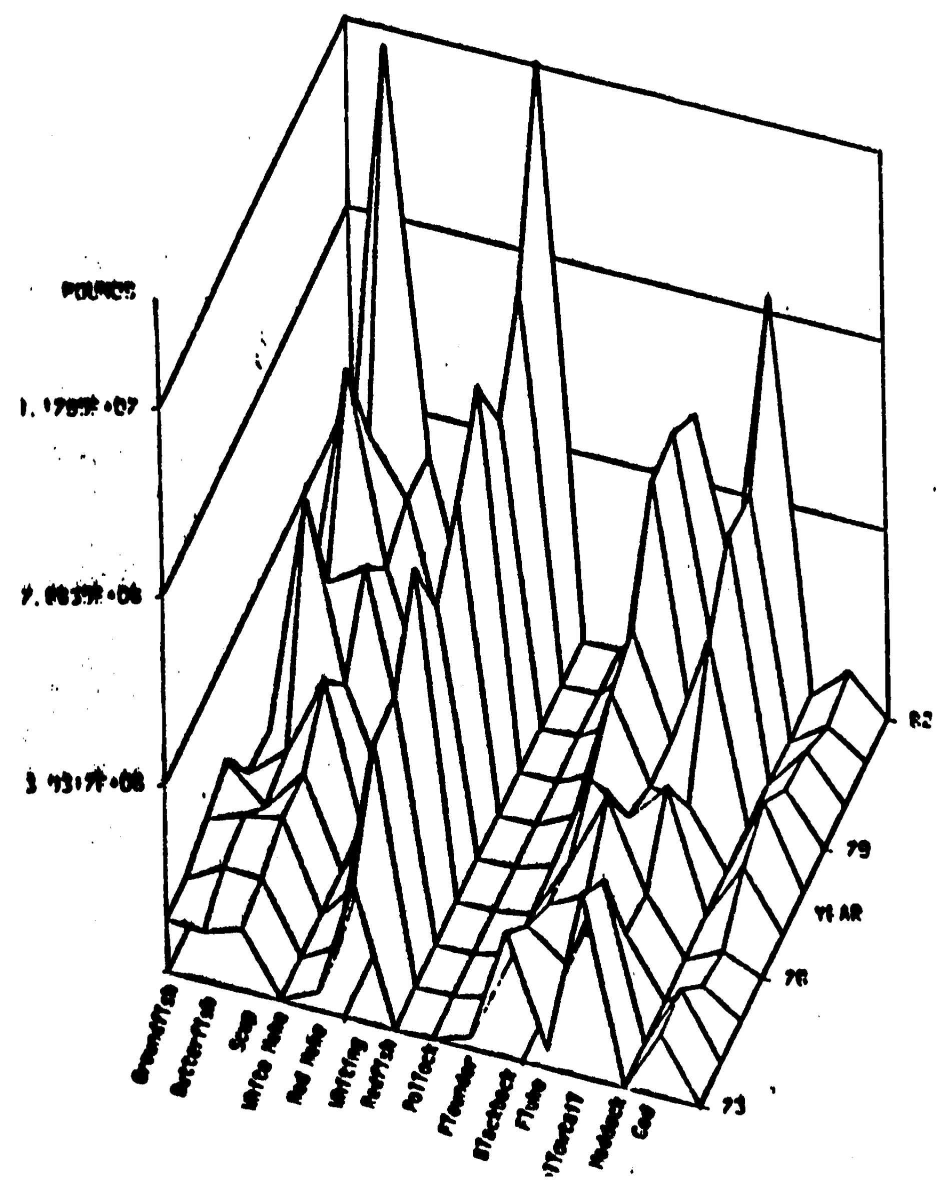


GRAPH OF YEARLY PORT LANDINGS. 1972–82
PORTCODE=NEWPORT



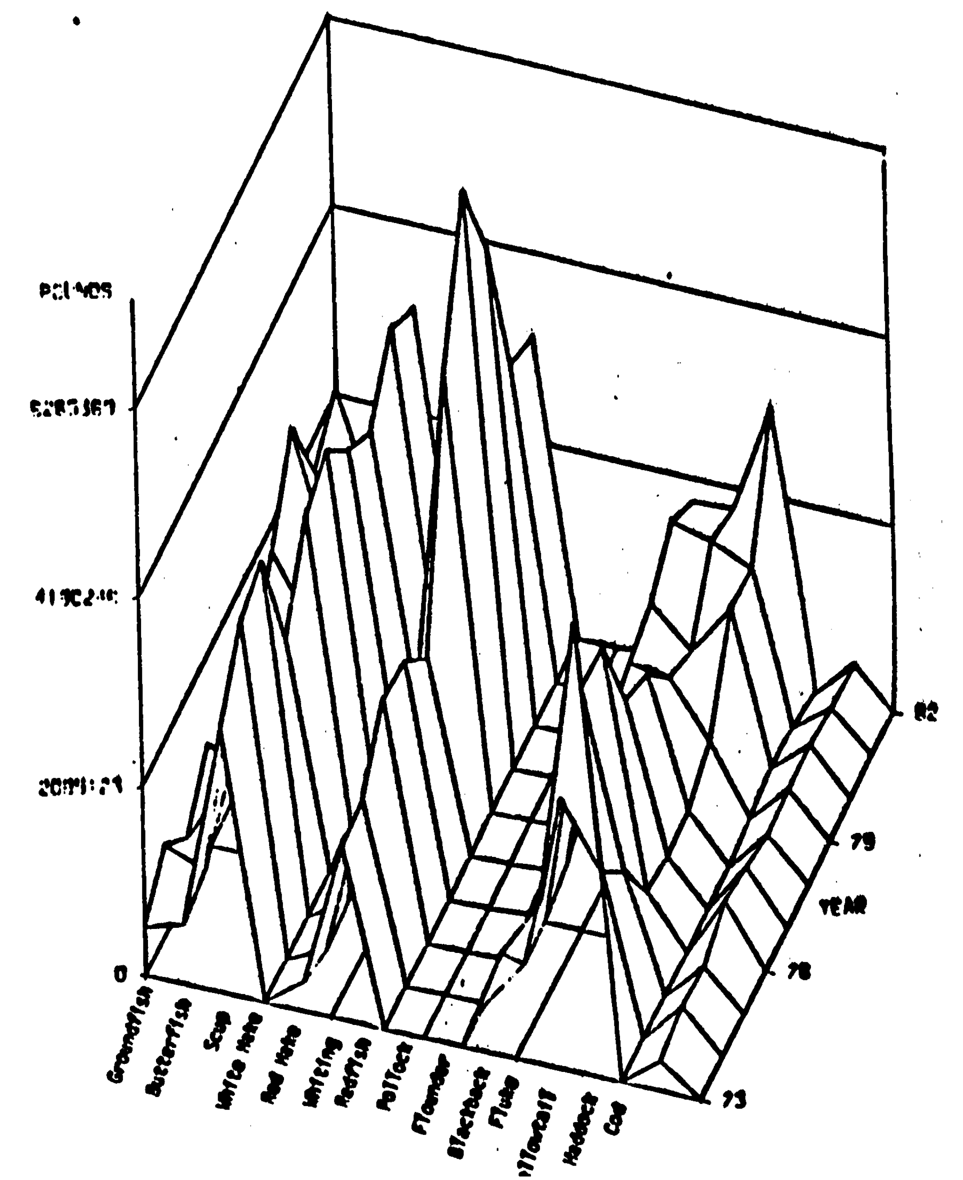
GRAPH OF YEARLY PORT LANDINGS 1972–82

PORTCODE=POINT JUDITH

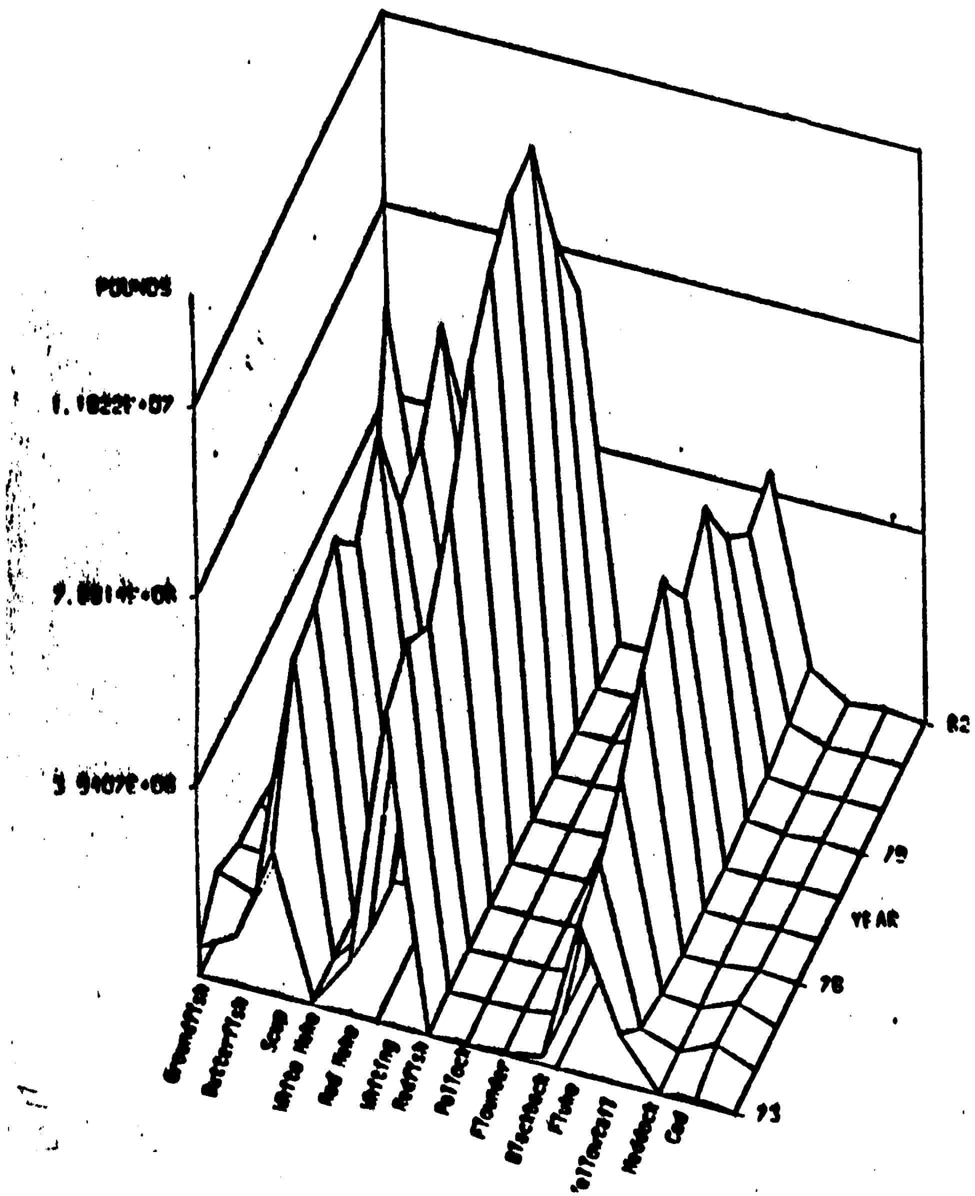


GRAPH OF YEARLY PORT LANDINGS, 1972–82

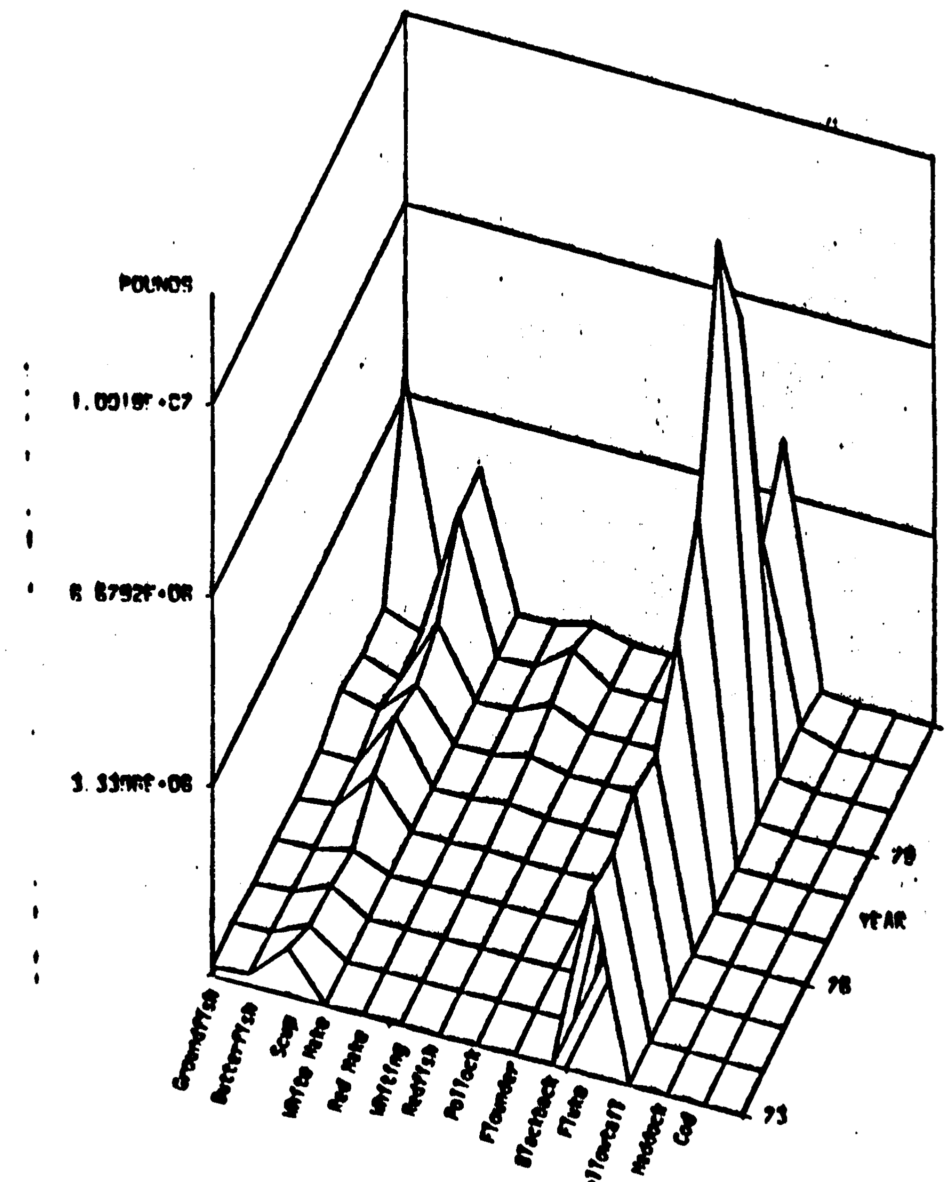
PORTCODE=NEW YORK



GRAPH OF YEARLY PORT LANDINGS, 1972-82
PORTCODE=NEW JERSEY



GRAPH OF YEARLY PORT LANDINGS, 1972-82
PORTCODE=VIRGINIA



APPENDIX TO SECTION 7A

Landings & Prices Tables for 7 Options

Annual Change for ADF Mesh Size Option 2

SPECIES LANDINGS (millions)

year	Cod Base	Change	%	Haddock Base	Change	%	Yellowtail Base	Change	%
85	79.30	-22.48	-28.4	20.05	-5.88	-29.3	48.04	-13.19	-27.5
86	76.07	-15.45	-20.3	17.17	-1.52	-8.8	49.93	-7.83	-15.7
87	76.38	-9.62	-12.6	15.49	0.13	0.8	51.02	-2.03	-4.0
88	76.25	-5.77	-7.6	14.53	0.80	5.5	51.32	1.60	3.1
89	76.68	-3.41	-4.4	14.22	1.11	7.8	51.53	3.43	6.7
90	77.09	-1.98	-2.6	14.08	1.26	8.9	51.71	4.31	8.3
91	77.31	-1.16	-1.5	14.06	1.34	9.5	51.73	4.70	9.1
92	77.38	-0.73	-0.9	14.01	1.36	9.7	51.73	4.81	9.3
93	77.46	-0.48	-0.6	14.01	1.36	9.7	51.73	4.81	9.3
94	77.46	-0.48	-0.6	14.01	1.36	9.7	51.73	4.81	9.3

year	Pollock Base	Change	%	Flounder Base	Change	%	Redfish Base	Change	%
85	36.22	-6.67	-18.4	57.75	-4.76	-8.2	9.87	-5.08	-51.4
86	38.25	-5.44	-14.2	58.67	-3.96	-6.7	9.27	-4.69	-50.6
87	40.83	-4.21	-10.3	60.55	-2.85	-4.7	9.02	-4.40	-48.7
88	42.75	-3.26	-7.6	62.28	-1.83	-2.9	9.09	-4.50	-49.5
89	44.73	-2.56	-5.7	63.65	-1.04	-1.6	9.20	-4.49	-48.8
90	45.89	-2.02	-4.4	64.65	-0.46	-0.7	9.55	-4.69	-49.1
91	46.33	-1.63	-3.5	65.34	-0.05	-0.1	9.87	-4.85	-49.1
92	47.05	-1.33	-2.8	65.80	0.22	0.3	10.26	-4.96	-48.3
93	47.30	-1.17	-2.5	66.12	0.41	0.6	10.67	-5.01	-47.0
94	47.27	-1.14	-2.4	66.32	0.54	0.8	11.05	-4.95	-44.8

SPECIES PRICES (dollars)

year	Cod Base	Change	%	Haddock Base	Change	%	Yellowtail Base	Change	%
85	0.50	0.05	9.2	0.83	0.05	6.3	0.89	0.11	12.0
86	0.55	0.03	5.2	0.91	0.02	2.0	0.99	0.07	6.9
87	0.59	0.01	2.5	0.99	0.00	0.4	1.10	0.03	2.4
88	0.64	0.01	0.8	1.07	-0.00	-0.3	1.22	-0.00	-0.1
89	0.69	-0.00	-0.1	1.15	-0.01	-0.5	1.35	-0.02	-1.2
90	0.74	-0.00	-0.5	1.23	-0.01	-0.7	1.49	-0.02	-1.6
91	0.80	-0.01	-0.7	1.32	-0.01	-0.7	1.65	-0.03	-1.7
92	0.86	-0.01	-0.8	1.42	-0.01	-0.7	1.82	-0.03	-1.7
93	0.92	-0.01	-0.8	1.52	-0.01	-0.6	2.00	-0.03	-1.5
94	0.99	-0.01	-0.7	1.63	-0.01	-0.6	2.20	-0.03	-1.4

year	Pollock Base	Change	%	Flounder Base	Change	%	Redfish Base	Change	%
85	0.23	0.02	8.7	0.86	0.07	8.6	0.34	0.02	5.8
86	0.24	0.01	6.0	0.98	0.05	5.2	0.38	0.02	5.8
87	0.25	0.01	3.3	1.09	0.03	2.3	0.40	0.02	4.1
88	0.26	0.00	1.4	1.22	0.01	0.6	0.43	0.01	2.9
89	0.26	0.00	0.3	1.36	-0.00	-0.2	0.45	0.01	2.3
90	0.27	-0.00	-0.4	1.51	-0.01	-0.6	0.47	0.01	1.9
91	0.28	-0.00	-0.8	1.67	-0.01	-0.7	0.49	0.01	1.6
92	0.29	-0.00	-1.0	1.86	-0.01	-0.8	0.52	0.01	1.5
93	0.30	-0.00	-1.1	2.05	-0.02	-0.7	0.54	0.01	1.4
94	0.31	-0.00	-1.1	2.26	-0.02	-0.7	0.57	0.01	1.3

Annual Change for ADF Mesh Size Option 3

SPECIES LANDINGS (millions)

year	Cod Base	Change	%	Haddock Base	Change	%	Yellowtail Base	Change	%
85	79.30	-17.35	-21.9	20.05	-4.02	-20.0	48.04	-13.72	-28.6
86	76.07	-12.43	-16.3	17.17	-0.87	-5.1	49.93	-7.52	-15.1
87	76.38	-5.85	-7.7	15.49	0.53	3.4	51.02	-0.25	-0.5
88	76.25	-1.61	-2.1	14.53	1.23	8.5	51.32	4.30	8.4
89	76.68	0.56	0.7	14.22	1.56	11.0	51.53	6.51	12.6
90	77.09	1.87	2.4	14.08	1.70	12.1	51.71	7.55	14.6
91	77.31	2.45	3.2	14.06	1.76	12.5	51.73	8.01	15.5
92	77.38	2.72	3.5	14.01	1.78	12.7	51.73	8.14	15.7
93	77.46	2.82	3.6	14.01	1.78	12.7	51.73	8.14	15.7
94	77.46	2.82	3.6	14.01	1.78	12.7	51.73	8.14	15.7

year	Pollock Base	Change	%	Flounder Base	Change	%	Redfish Base	Change	%
85	36.22	-4.67	-12.9	57.75	-3.81	-6.6	9.87	-5.08	-51.4
86	38.25	-3.43	-9.0	58.67	-3.26	-5.6	9.27	-4.69	-50.6
87	40.83	-2.00	-4.9	60.55	-2.04	-3.4	9.02	-4.40	-48.7
88	42.75	-0.99	-2.3	62.28	-0.77	-1.2	9.09	-4.50	-49.5
89	44.73	-0.31	-0.7	63.65	0.20	0.3	9.20	-4.49	-48.8
90	45.89	0.18	0.4	64.65	0.89	1.4	9.55	-4.69	-49.1
91	46.33	0.53	1.1	65.34	1.36	2.1	9.87	-4.85	-49.1
92	47.05	0.77	1.6	65.80	1.66	2.5	10.26	-4.96	-48.3
93	47.30	0.93	2.0	66.12	1.86	2.8	10.67	-5.01	-47.0
94	47.27	0.94	2.0	66.32	1.98	3.0	11.05	-4.95	-44.8

SPECIES PRICES (dollars)

year	Cod Base	Change	%	Haddock Base	Change	%	Yellowtail Base	Change	%
85	0.50	0.03	6.8	0.83	0.04	4.4	0.89	0.10	11.5
86	0.55	0.02	3.9	0.91	0.01	1.3	0.99	0.06	6.2
87	0.59	0.01	0.9	0.99	-0.00	-0.1	1.10	0.01	0.9
88	0.64	-0.01	-0.8	1.07	-0.01	-0.8	1.22	-0.02	-2.0
89	0.69	-0.01	-1.5	1.15	-0.01	-1.0	1.35	-0.04	-3.1
90	0.74	-0.01	-1.8	1.23	-0.01	-1.1	1.49	-0.05	-3.4
91	0.80	-0.02	-1.9	1.32	-0.01	-1.1	1.65	-0.06	-3.3
92	0.86	-0.02	-1.9	1.42	-0.01	-1.0	1.82	-0.06	-3.1
93	0.92	-0.02	-1.7	1.52	-0.01	-1.0	2.00	-0.06	-2.9
94	0.99	-0.02	-1.6	1.63	-0.01	-0.9	2.20	-0.06	-2.6

year	Pollock Base	Change	%	Flounder Base	Change	%	Redfish Base	Change	%
85	0.23	0.02	7.1	0.86	0.07	7.7	0.34	0.02	4.9
86	0.24	0.01	4.5	0.98	0.04	4.4	0.38	0.02	4.9
87	0.25	0.00	1.3	1.09	0.01	1.2	0.40	0.01	3.2
88	0.26	-0.00	-0.9	1.22	-0.01	-0.7	0.43	0.01	2.0
89	0.26	-0.01	-2.0	1.36	-0.02	-1.5	0.45	0.01	1.4
90	0.27	-0.01	-2.7	1.51	-0.03	-1.8	0.47	0.00	1.0
91	0.28	-0.01	-3.0	1.67	-0.03	-1.8	0.49	0.00	0.9
92	0.29	-0.01	-3.1	1.86	-0.03	-1.8	0.52	0.00	0.8
93	0.30	-0.01	-3.1	2.05	-0.03	-1.6	0.54	0.00	0.7
94	0.31	-0.01	-3.0	2.26	-0.03	-1.5	0.57	0.00	0.7

Annual Change for ADF Mesh Option 4

SPECIES LANDINGS (millions)

year	Cod Base	Change	%	Haddock Base	Change	%	Yellowtail Base	Change	%
85	79.30	-15.07	-19.0	20.05	-3.65	-18.2	48.04	-11.70	-24.3
86	76.07	-11.99	-15.8	17.17	-0.76	-4.4	49.93	-6.02	-12.1
87	76.38	-8.58	-11.2	15.49	0.30	1.9	51.02	-2.12	-4.2
88	76.25	-3.26	-4.3	14.53	1.12	7.7	51.32	3.37	6.6
89	76.68	-0.20	-0.3	14.22	1.51	10.6	51.53	6.12	11.9
90	77.09	1.41	1.8	14.08	1.68	11.9	51.71	7.39	14.3
91	77.31	2.25	2.9	14.06	1.75	12.5	51.73	7.96	15.4
92	77.38	2.62	3.4	14.01	1.78	12.7	51.73	8.13	15.7
93	77.46	2.78	3.6	14.01	1.78	12.7	51.73	8.14	15.7
94	77.46	2.82	3.6	14.01	1.78	12.7	51.73	8.14	15.7

year	Pollock Base	Change	%	Flounder Base	Change	%	Redfish Base	Change	%
85	36.22	-3.68	-10.2	57.75	-2.66	-4.6	9.87	-5.08	-51.4
86	38.25	-2.79	-7.3	58.67	-1.99	-3.4	9.27	-4.69	-50.6
87	40.83	-2.42	-5.9	60.55	-2.48	-4.1	9.02	-4.40	-48.7
88	42.75	-1.28	-3.0	62.28	-1.14	-1.8	9.09	-4.50	-49.5
89	44.73	-0.51	-1.1	63.65	-0.06	-0.1	9.20	-4.49	-48.8
90	45.89	0.04	0.1	64.65	0.71	1.1	9.55	-4.69	-49.1
91	46.33	0.43	0.9	65.34	1.23	1.9	9.87	-4.85	-49.1
92	47.05	0.70	1.5	65.80	1.58	2.4	10.26	-4.96	-48.3
93	47.30	0.88	1.9	66.12	1.81	2.7	10.67	-5.01	-47.0
94	47.27	0.94	2.0	66.32	1.95	2.9	11.05	-4.95	-44.8

SPECIES PRICES (dollars)

year	Cod Base	Change	%	Haddock Base	Change	%	Yellowtail Base	Change	%
85	0.50	0.03	5.6	0.83	0.03	3.9	0.89	0.09	9.6
86	0.55	0.02	3.6	0.91	0.01	1.2	0.99	0.05	4.9
87	0.59	0.01	2.0	0.99	0.00	0.2	1.10	0.02	2.1
88	0.64	-0.00	-0.2	1.07	-0.01	-0.6	1.22	-0.02	-1.3
89	0.69	-0.01	-1.3	1.15	-0.01	-1.0	1.35	-0.04	-2.8
90	0.74	-0.01	-1.7	1.23	-0.01	-1.1	1.49	-0.05	-3.3
91	0.80	-0.01	-1.8	1.32	-0.01	-1.1	1.65	-0.05	-3.3
92	0.86	-0.02	-1.8	1.42	-0.01	-1.0	1.82	-0.06	-3.1
93	0.92	-0.02	-1.7	1.52	-0.01	-1.0	2.00	-0.06	-2.9
94	0.99	-0.02	-1.6	1.63	-0.01	-0.9	2.20	-0.06	-2.6

year	Pollock Base	Change	%	Flounder Base	Change	%	Redfish Base	Change	%
85	0.23	0.01	5.7	0.86	0.05	6.3	0.34	0.02	4.4
86	0.24	0.01	3.4	0.98	0.03	3.5	0.38	0.02	4.5
87	0.25	0.01	2.1	1.09	0.02	2.0	0.40	0.01	3.5
88	0.26	-0.00	-0.3	1.22	-0.00	-0.2	0.43	0.01	2.4
89	0.26	-0.00	-1.7	1.36	-0.02	-1.3	0.45	0.01	1.5
90	0.27	-0.01	-2.5	1.51	-0.03	-1.7	0.47	0.01	1.1
91	0.28	-0.01	-2.9	1.67	-0.03	-1.8	0.49	0.00	0.9
92	0.29	-0.01	-3.0	1.86	-0.03	-1.7	0.52	0.00	0.8
93	0.30	-0.01	-3.1	2.05	-0.03	-1.6	0.54	0.00	0.7
94	0.31	-0.01	-3.0	2.26	-0.03	-1.5	0.57	0.00	0.7

Annual Change for ADF Mesh Option 5

SPECIES LANDINGS (millions)

	Cod			Haddock			Yellowtail		
year	Base	Change	%	Base	Change	%	Base	Change	%
85	79.30	-22.48	-28.4	20.05	-5.88	-29.3	48.04	-13.19	-27.5
86	76.07	-15.45	-20.3	17.17	-1.52	-8.8	49.93	-7.83	-15.7
87	76.38	-9.62	-12.6	15.49	0.13	0.8	51.02	-2.03	-4.0
88	76.25	-5.77	-7.6	14.53	0.80	5.5	51.32	1.60	3.1
89	76.68	-3.41	-4.4	14.22	1.11	7.8	51.53	3.43	6.7
90	77.09	-1.98	-2.6	14.08	1.26	8.9	51.71	4.31	8.3
91	77.31	-1.16	-1.5	14.06	1.34	9.5	51.73	4.70	9.1
92	77.38	-0.73	-0.9	14.01	1.36	9.7	51.73	4.81	9.3
93	77.46	-0.48	-0.6	14.01	1.36	9.7	51.73	4.81	9.3
94	77.46	-0.48	-0.6	14.01	1.36	9.7	51.73	4.81	9.3

	Pollock			Flounder			Redfish		
year	Base	Change	%	Base	Change	%	Base	Change	%
85	36.22	-6.67	-18.4	57.75	-4.92	-8.5	9.87	-7.42	-75.2
86	38.25	-5.44	-14.2	58.67	-4.09	-7.0	9.27	-6.84	-73.8
87	40.83	-4.21	-10.3	60.55	-2.91	-4.8	9.02	-6.43	-71.2
88	42.75	-3.26	-7.6	62.28	-1.82	-2.9	9.09	-6.55	-72.1
89	44.73	-2.56	-5.7	63.65	-0.99	-1.6	9.20	-6.55	-71.1
90	45.89	-2.02	-4.4	64.65	-0.39	-0.6	9.55	-6.82	-71.4
91	46.33	-1.63	-3.5	65.34	0.04	0.1	9.87	-7.05	-71.4
92	47.05	-1.33	-2.8	65.80	0.33	0.5	10.26	-7.21	-70.2
93	47.30	-1.17	-2.5	66.12	0.53	0.8	10.67	-7.28	-68.2
94	47.27	-1.14	-2.4	66.32	0.66	1.0	11.05	-7.20	-65.2

SPECIES PRICES (dollars)

	Cod			Haddock			Yellowtail		
year	Base	Change	%	Base	Change	%	Base	Change	%
85	0.50	0.05	9.2	0.83	0.05	6.3	0.89	0.11	12.0
86	0.55	0.03	5.3	0.91	0.02	2.0	0.99	0.07	6.9
87	0.59	0.01	2.5	0.99	0.00	0.4	1.10	0.03	2.4
88	0.64	0.01	0.8	1.07	-0.00	-0.3	1.22	-0.00	-0.1
89	0.69	-0.00	-0.1	1.15	-0.01	-0.5	1.35	-0.02	-1.2
90	0.74	-0.00	-0.5	1.23	-0.01	-0.7	1.49	-0.02	-1.6
91	0.80	-0.01	-0.7	1.32	-0.01	-0.7	1.65	-0.03	-1.7
92	0.86	-0.01	-0.8	1.42	-0.01	-0.7	1.82	-0.03	-1.7
93	0.92	-0.01	-0.8	1.52	-0.01	-0.6	2.00	-0.03	-1.6
94	0.99	-0.01	-0.8	1.63	-0.01	-0.6	2.20	-0.03	-1.4

	Pollock			Flounder			Redfish		
year	Base	Change	%	Base	Change	%	Base	Change	%
85	0.23	0.02	8.7	0.86	0.07	8.7	0.34	0.02	6.5
86	0.24	0.01	6.1	0.98	0.05	5.3	0.38	0.03	6.6
87	0.25	0.01	3.3	1.09	0.03	2.3	0.40	0.02	4.8
88	0.26	0.00	1.4	1.22	0.01	0.6	0.43	0.02	3.7
89	0.26	0.00	0.3	1.36	-0.00	-0.2	0.45	0.01	2.9
90	0.27	-0.00	-0.4	1.51	-0.01	-0.6	0.47	0.01	2.5
91	0.28	-0.00	-0.8	1.67	-0.01	-0.8	0.49	0.01	2.3
92	0.29	-0.00	-1.0	1.86	-0.01	-0.8	0.52	0.01	2.1
93	0.30	-0.00	-1.1	2.05	-0.02	-0.8	0.54	0.01	2.0
94	0.31	-0.00	-1.1	2.26	-0.02	-0.7	0.57	0.01	1.8

Annual Change for ADF Mesh Option 6

SPECIES LANDINGS (millions)

year	Cod Base	Change	%	Haddock Base	Change	%	Yellowtail Base	Change	%
85	79.30	-17.35	-21.9	20.05	-4.02	-20.0	48.04	-13.72	-28.6
86	76.07	-12.43	-16.3	17.17	-0.87	-5.1	49.93	-7.52	-15.1
87	76.38	-5.85	-7.7	15.49	0.53	3.4	51.02	-0.25	-0.5
88	76.25	-1.61	-2.1	14.53	1.23	8.5	51.32	4.30	8.4
89	76.68	0.56	0.7	14.22	1.56	11.0	51.53	6.51	12.6
90	77.09	1.87	2.4	14.08	1.70	12.1	51.71	7.55	14.6
91	77.31	2.45	3.2	14.06	1.76	12.5	51.73	8.01	15.5
92	77.38	2.72	3.5	14.01	1.78	12.7	51.73	8.14	15.7
93	77.46	2.82	3.6	14.01	1.78	12.7	51.73	8.14	15.7
94	77.46	2.82	3.6	14.01	1.78	12.7	51.73	8.14	15.7

year	Pollock Base	Change	%	Flounder Base	Change	%	Redfish Base	Change	%
85	36.22	-4.67	-12.9	57.75	-4.15	-7.2	9.87	-7.22	-73.2
86	38.25	-3.43	-9.0	58.67	-3.53	-6.0	9.27	-6.67	-72.0
87	40.83	-2.00	-4.9	60.55	-2.15	-3.6	9.02	-6.26	-69.3
88	42.75	-0.99	-2.3	62.28	-0.75	-1.2	9.09	-6.39	-70.4
89	44.73	-0.31	-0.7	63.65	0.32	0.5	9.20	-6.39	-69.4
90	45.89	0.18	0.4	64.65	1.07	1.7	9.55	-6.67	-69.8
91	46.33	0.53	1.1	65.34	1.58	2.4	9.87	-6.90	-69.8
92	47.05	0.77	1.6	65.80	1.91	2.9	10.26	-7.05	-68.7
93	47.30	0.93	2.0	66.12	2.13	3.2	10.67	-7.13	-66.8
94	47.27	0.94	2.0	66.32	2.27	3.4	11.05	-7.05	-63.8

SPECIES PRICES (dollars)

year	Cod Base	Change	%	Haddock Base	Change	%	Yellowtail Base	Change	%
85	0.50	0.03	6.8	0.83	0.04	4.4	0.89	0.10	11.5
86	0.55	0.02	3.9	0.91	0.01	1.3	0.99	0.06	6.2
87	0.59	0.01	0.9	0.99	-0.00	-0.1	1.10	0.01	0.9
88	0.64	-0.01	-0.8	1.07	-0.01	-0.8	1.22	-0.02	-2.0
89	0.69	-0.01	-1.5	1.15	-0.01	-1.0	1.35	-0.04	-3.1
90	0.74	-0.01	-1.9	1.23	-0.01	-1.1	1.49	-0.05	-3.4
91	0.80	-0.02	-1.9	1.32	-0.01	-1.1	1.65	-0.06	-3.4
92	0.86	-0.02	-1.9	1.42	-0.01	-1.0	1.82	-0.06	-3.2
93	0.92	-0.02	-1.8	1.52	-0.01	-1.0	2.00	-0.06	-2.9
94	0.99	-0.02	-1.6	1.63	-0.01	-0.9	2.20	-0.06	-2.7

year	Pollock Base	Change	%	Flounder Base	Change	%	Redfish Base	Change	%
85	0.23	0.02	7.2	0.86	0.07	7.8	0.34	0.02	5.5
86	0.24	0.01	4.5	0.98	0.04	4.5	0.38	0.02	5.6
87	0.25	0.00	1.3	1.09	0.01	1.2	0.40	0.02	3.9
88	0.26	-0.00	-0.9	1.22	-0.01	-0.7	0.43	0.01	2.7
89	0.26	-0.01	-2.1	1.36	-0.02	-1.5	0.45	0.01	2.0
90	0.27	-0.01	-2.7	1.51	-0.03	-1.8	0.47	0.01	1.6
91	0.28	-0.01	-3.0	1.67	-0.03	-1.9	0.49	0.01	1.5
92	0.29	-0.01	-3.1	1.86	-0.03	-1.8	0.52	0.01	1.3
93	0.30	-0.01	-3.2	2.05	-0.03	-1.7	0.54	0.01	1.3
94	0.31	-0.01	-3.1	2.26	-0.03	-1.5	0.57	0.01	1.2

Annual Change for ADF Mesh Option 7

SPECIES LANDINGS (millions)

year	Cod Base	Change	%	Haddock Base	Change	%	Yellowtail Base	Change	%
85	79.30	-15.07	-19.0	20.05	-3.65	-18.2	48.04	-11.70	-24.3
86	76.07	-11.99	-15.8	17.17	-0.76	-4.4	49.93	-6.02	-12.1
87	76.38	-8.58	-11.2	15.49	0.30	1.9	51.02	-2.12	-4.2
88	76.25	-3.26	-4.3	14.53	1.12	7.7	51.32	3.37	6.6
89	76.68	-0.20	-0.3	14.22	1.51	10.6	51.53	6.12	11.9
90	77.09	1.41	1.8	14.08	1.68	11.9	51.71	7.39	14.3
91	77.31	2.25	2.9	14.06	1.75	12.5	51.73	7.96	15.4
92	77.38	2.62	3.4	14.01	1.78	12.7	51.73	8.13	15.7
93	77.46	2.78	3.6	14.01	1.78	12.7	51.73	8.14	15.7
94	77.46	2.82	3.6	14.01	1.78	12.7	51.73	8.14	15.7

year	Pollock Base	Change	%	Flounder Base	Change	%	Redfish Base	Change	%
85	36.22	-3.68	-10.2	57.75	-2.82	-4.9	9.87	-7.22	-73.2
86	38.25	-2.79	-7.3	58.67	-2.12	-3.6	9.27	-6.67	-72.0
87	40.83	-2.42	-5.9	60.55	-2.67	-4.4	9.02	-6.26	-69.3
88	42.75	-1.28	-3.0	62.28	-1.18	-1.9	9.09	-6.39	-70.4
89	44.73	-0.51	-1.1	63.65	0.01	0.0	9.20	-6.39	-69.4
90	45.89	0.04	0.1	64.65	0.86	1.3	9.55	-6.67	-69.8
91	46.33	0.43	0.9	65.34	1.44	2.2	9.87	-6.90	-69.8
92	47.05	0.70	1.5	65.80	1.82	2.8	10.26	-7.05	-68.7
93	47.30	0.88	1.9	66.12	2.07	3.1	10.67	-7.13	-66.8
94	47.27	0.94	2.0	66.32	2.23	3.4	11.05	-7.05	-63.8

SPECIES PRICES (dollars)

year	Cod Base	Change	%	Haddock Base	Change	%	Yellowtail Base	Change	%
85	0.50	0.03	5.6	0.83	0.03	4.0	0.89	0.09	9.6
86	0.55	0.02	3.6	0.91	0.01	1.2	0.99	0.05	4.9
87	0.59	0.01	2.0	0.99	0.00	0.2	1.10	0.02	2.2
88	0.64	-0.00	-0.2	1.07	-0.01	-0.6	1.22	-0.02	-1.3
89	0.69	-0.01	-1.3	1.15	-0.01	-1.0	1.35	-0.04	-2.8
90	0.74	-0.01	-1.7	1.23	-0.01	-1.1	1.49	-0.05	-3.3
91	0.80	-0.01	-1.8	1.32	-0.01	-1.1	1.65	-0.05	-3.3
92	0.86	-0.02	-1.8	1.42	-0.01	-1.0	1.82	-0.06	-3.1
93	0.92	-0.02	-1.7	1.52	-0.01	-1.0	2.00	-0.06	-2.9
94	0.99	-0.02	-1.6	1.63	-0.01	-0.9	2.20	-0.06	-2.7

year	Pollock Base	Change	%	Flounder Base	Change	%	Redfish Base	Change	%
85	0.23	0.01	5.7	0.86	0.05	6.4	0.34	0.02	5.1
86	0.24	0.01	3.5	0.98	0.03	3.5	0.38	0.02	5.3
87	0.25	0.01	2.1	1.09	0.02	2.0	0.40	0.02	4.2
88	0.26	-0.00	-0.3	1.22	-0.00	-0.2	0.43	0.01	3.0
89	0.26	-0.00	-1.8	1.36	-0.02	-1.3	0.45	0.01	2.2
90	0.27	-0.01	-2.5	1.51	-0.03	-1.7	0.47	0.01	1.7
91	0.28	-0.01	-2.9	1.67	-0.03	-1.8	0.49	0.01	1.5
92	0.29	-0.01	-3.1	1.86	-0.03	-1.8	0.52	0.01	1.4
93	0.30	-0.01	-3.1	2.05	-0.03	-1.7	0.54	0.01	1.3
94	0.31	-0.01	-3.1	2.26	-0.03	-1.5	0.57	0.01	1.2