Preliminary estimates of marine mammal mortality and biological sampling of cetaceans in California gillnet fisheries for 2002.

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ABSTRACT

Estimated mortality of marine mammals incidentally caught in the California halibut/angel shark set gillnet and swordfish/thresher shark drift gillnet fisheries is estimated for calendar year 2002. The set gillnet fishery was not observed in 2002, in part because of an area closure in central California inshore of 60 fathoms which reduced fishing effort to 156 days in the Monterey Bay region. Mortality estimates for the Monterey Bay region are based on kill rates observed in 2000 (the last time the fishery was observed here) and 2002 fishing effort. The remainder of the set gillnet fishery south of Monterey Bay (Morro Bay, Ventura, Channel Islands, and Southern California strata) has not been observed since 1994 and there were an estimated 2,976 days of fishing effort in 2002. Mortality estimates for these regions are based on 1991-94 kill rates and 2002 fishing effort. Estimated mortality in the set gillnet fishery for all strata (CVs in parentheses) is: 16 (0.77) harbor porpoise (*Phocoena phocoena*), 3 (0.71) unidentified common dolphins (*Delphinus* sp.), 1,104 (0.07) California sea lions (*Zalophus californianus*), 337 (0.11) harbor seals (*Phoca vitulina*), 34 (0.32) northern elephant seals (*Mirounga angustirostris*), and 24 (0.35) unidentified pinnipeds.

In the drift gillnet fishery, 20% (360 days observed/1,779 estimated days fished) of all fishing trips were observed during 2002. Estimated and observed (in parentheses) mortality in the drift gillnet fishery includes 84 (17) cetaceans and 94 (19) pinnipeds. Estimated mortality in the drift gillnet by species (CVs in parentheses) is: 49 (0.32) short-beaked common dolphins (*Delphinus delphis*), 15 (0.58) long-beaked common dolphins (*Delphinus capensis*), 15 (0.58) northern right whale dolphins (*Lissodelphis borealis*), 5 (1.00) Pacific white-sided dolphins (*Lagenorhynchus obliquidens*), 5 (1.00) northern elephant seals (*Mirounga angustirostris*), and 89 (0.24) California sea lions (*Zalophus californianus*). Biological samples were collected from all cetaceans observed incidentally killed in the fishery: 9 short-beaked common dolphins, 4 long-beaked common dolphins, 3 northern right whale dolphins, and 1 Pacific white-sided dolphin.

INTRODUCTION

The California halibut/angel shark set gillnet and swordfish/thresher shark drift gillnet fisheries are both classified as Category I fisheries under the U.S. Marine Mammal Protection Act (MMPA), meaning that 'levels of incidental serious injury and mortality of a given marine mammal stock are greater than or equal to 50% of the Potential Biological Removal (PBR) level for that stock' (NMFS List of Commercial Fisheries, 1996). PBR is defined as 'the maximum number of animals, not including natural mortalities, that may be removed from a marine mammal stock while allowing that stock to reach or maintain its optimum sustainable population' (Barlow *et al*., 1995). Category I fisheries are subject to monitoring by observer programs, which provide data on incidental marine mammal bycatch. NMFS observer programs for both the halibut/angel shark set gillnet and thresher shark/swordfish drift gillnet fisheries were initiated in 1990. Observers are placed on fishing vessels to record catch, bycatch and other gear, environmental variables and collect biological samples from incidentally caught marine mammals.

The halibut/angel shark set gillnet fishery was observed from 1990-1994 throughout its range (southern and central California), with levels of observer coverage ranging from 2-15% (mean = 9.6%)(Julian and Beeson, 1998). Historically, incidental takes of cetaceans in the set gillnet fishery have been mostly limited to harbor porpoise (*Phocoena phocoena*) in central California, although two unidentified common dolphins (*Delphinus* sp.) and one unidentified cetacean have also been reported (Julian and Beeson, 1998). In 1994, area closures restricted set gillnets to waters greater than 5.5 km (3 nmi) from the southern California mainland and greater than 1.85 km (1 nmi) from the Channel Islands. This closure resulted in a marked decrease in fishing effort in this fishery, from approximately 5,500-7,000 fishing days during 1990-93 to 2,000-4,000 days following the closure (Forney *et al.*, 2000; Cameron and Forney, 1999; 2000). In the central California portion of the fishery, depth restrictions in place since 1991 have not allowed fishing inshore of 55 m (30 fm). There was no observer coverage throughout this fishery during 1995-98. In 1999, a NMFS observer program was reinstated in the Monterey Bay portion of the set gillnet fishery, in response to renewed concerns over the incidental take of harbor porpoise. In September 2000, the California Department of Fish and Game (CDFG) issued emergency regulations that prohibited set gillnet fishing inshore of 110 m (60 fm) in central California from Point Reyes to Yankee Point in Monterey Bay and from Point Arguello to Point Sal, citing concerns over the incidental take of common murre (*Uria aalge*) and California sea otters (*Enhydra lutris*). A permanent ban on gill and trammel nets inshore of 110 m (60 fm) from Point Reyes to Point Arguello became effective in September 2002. There was limited fishing (156 days) inshore of 110 m in the area of Monterey in the first calendar quarter of 2002 after CDFG emergency regulations expired and prior to the adoption of permanent regulations. Estimates of mortality for the Monterey region presented in this report are based on those 156 estimated days of fishing effort and observed take rates from this region in 2000, the most recent year of observation.

The swordfish/thresher shark drift gillnet fishery has been observed by NMFS every year since 1990. Levels of fishing effort in this fishery have decreased from approximately 5,500 days in 1993 to 1,779 days in 2002 (Forney *et al*., 2000; Read, 2002a; 2002b; 2002c; 2003). Observer coverage levels in this fishery ranged from 4-18% (mean = 13%) during 1990-96 and

between 20-25% from 1997-2002. Bycatch in the drift gillnet fishery has included a wide variety of cetacean, pinniped, sea turtle, and seabird species (Julian and Beeson, 1998; Cameron and Forney, 1999; 2000). Initiation of a Take Reduction Plan (TRP) in 1996 followed concerns over incidental take levels that exceeded PBR for some cetacean stocks. The TRP included the use of acoustic pingers all on nets (typically 20 each on the floatline and leadline), net extenders to increase minimum fishing depth to 11 m (6 fm), and mandatory skipper education workshops regarding marine mammals and TRP goals. Barlow and Cameron (2003) report on the overall decline in marine mammal bycatch resulting from the use of acoustic pingers in this fishery. In 2001, a seasonal (15 August – 15 November) area closure was implemented in the drift gillnet fishery north of Point Conception to protect leatherback turtles that feed in the area and have been observed entangled in previous fishing seasons. Additional seasonal/area closures in the drift gillnet fishery are being considered to protect loggerhead turtles during El NiZo years.

It should be noted that there is also a set/drift gillnet fishery in California waters for white seabass and yellowtail which is not observed. Estimated fishing effort in this fishery during 2002 was 676 days. Historically, this fishery has been known to entangle harbor porpoise (Norris and Prescott, 1961). Some limited fishing for tuna using small-mesh drift gillnets also occurs in California waters, but the estimated effort during 2002 using this method was only 5 days.

METHODS

Estimation of Total Fishing Effort

Estimates of overall fishing effort are provided quarterly by the California Department of Fish and Game (CDFG). Effort estimates are generated from fisher logbooks and landing receipts. The preliminary CDFG estimate of fishing effort in the halibut/angel shark set gillnet fishery for 2002 is 3,132 days, of which 156 days are estimated to have been in the Monterey Bay stratum. The remaining 2,976 days of effort are distributed as follows: Channel Islands (187 days), Southern California (1,583), Ventura (1,185) and Morro Bay (21). Geographic strata for the set gillnet fishery are shown in Figure 1. Estimated 2002 fishing effort by CDFG block in the set gillnet fishery for southern and central California is shown in Figures 2-3, respectively. The estimated number of days fished in the swordfish/shark drift gillnet fishery in 2002 is 1,779 days. Effort estimates for both fisheries are preliminary and may be revised upwards as additional fishing records are received. For this same reason, mortality estimates are also considered preliminary.

Mortality Estimation in the set gillnet fishery

Mortality in the halibut/angelshark set gillnet fishery is estimated with mean-per-unit (MPU) estimators, using effort days (= trips) as the sampling unit (Julian and Beeson, 1998; Cameron and Forney, 1999; 2000). As in previous analyses, kill rates are stratified by geographic area, and by calendar quarter for Southern California and Ventura. There were insufficient data to stratify by calendar quarter for other geographic strata. In 2002, the set gillnet fishery was not observed and mortality estimates are based on the most recent kill rates for each stratum. In this

case, Monterey Bay mortality estimates are based on kill rates observed in 2000 and estimates of fishing effort in 2002. For all other strata (Southern California, Ventura, Channel Islands, and Morro Bay), the fishery has not been observed since 1994, therefore, current kill rates and mortalities are based on 1991-94 observer program data (the last period for which year-round observations are available) and estimated fishing effort for 2002.

The kill rate for each stratum ($\hat{r}_s$) is calculated as

$$\hat{r}_s = \frac{\sum_i k_{i,s}}{d_s} \qquad (1)$$

where $k_{i,s}$ is the observed kill for the i^{th} observed day in stratum s and d_s are the number of days observed in stratum s. In lieu of analytical formulae previously used to estimate kill rate variances (Julian and Beeson, 1998; Cameron and Forney, 1999; 2000), we estimate kill rate variances using a bootstrap procedure, where one trip (= day) represented the sampling unit. Within a stratum, days are resampled with replacement until each bootstrap sample contains the same number of days as the actual observed level of effort. A kill rate is then calculated from each bootstrap sample. This procedure is repeated 1,000 times, from which the bootstrap sample variance (kill rate variance) is calculated. Estimated mortality, $\hat{m}$ and its associated variance are calculated for each stratum as

$$\hat{m}_s = D_s r_s \qquad (2)$$

$$\hat{s}^2_{m,s} = D_s^2 \hat{s}^2_{r,s} \qquad (3)$$

where

$\hat{m}_s$ is the estimated mortality within stratum s,

D_s is the estimated number of days fished in stratum s,

$\hat{r}_s$ is the kill rate in stratum s,

$\hat{s}^2_{m,s}$ is the variance of the estimated mortality in stratum s, and

$\hat{s}^2_{r,s}$ is the bootstrap sample variance of the kill rate in stratum s.

Quarterly estimates of mortality within a stratum are added to yield annual mortality estimates for that stratum. Annual kill rates and standard errors within a stratum represent effort-weighted averages of the quarterly kill rates and standard errors (weighted by the number of days observed). Fishery-wide estimates of mortality and associated variances are obtained by adding mortality estimates and variances across all strata. Annual estimates of mortality are considered preliminary because fishing effort estimates will likely be revised upwards as more fishing records are received.

Mortality Estimation in the drift gillnet fishery

Mortality in the swordfish/shark drift gillnet fishery is estimated with mean-per-unit estimators, using days as the sampling unit, since trip-specific information was unavailable at the time of analysis. (*When trip-specific information becomes available, final mortality estimates will be made using ratio estimators, with trips as the sampling unit and the number of days per trip as an auxillary variable.*) No geographic or seasonal strata are used in estimating drift gillnet fishery kill rates. Differences in previous mortality estimates for this fishery using both seasonal stratification and pooling of all annual data have been negligible (Carretta, 2001; 2002). The kill rate for each species was calculated as

$$\hat{r}_s = \frac{\sum k_s}{\sum d} \qquad (4)$$

where k_s is the observed number of species s killed and d is the number of days (=sets) observed in the fishery.

Precision of the mortality estimates is calculated using a sample-sized Poisson assumption, where the coefficient of variation (CV) of a mortality estimate is

$$CV = \sqrt{n_i} / n_i \qquad (5)$$

where n is the number of animals of species and i is the observed kill. Carretta (2001; 2002) compared the precision of mortality estimates using both the Poisson assumption and bootstrap-based resampling methods and found similar results for both methods. In general, the bootstrap method yields higher variances (or lower precision).

RESULTS

Set gillnet fishery

Estimates of fishing effort and mortality for the Monterey Bay stratum of the set gillnet fishery are presented in Table 1. Fishing effort in the Monterey Bay stratum was estimated to be 156 days, in part because CDFG regulations prohibited fishing in waters shallower than 110 m (60 fm), which effectively eliminated set gillnet fishing in Monterey Bay for most of calendar year 2002. There was no observer program in Monterey Bay during 2002; therefore, no mortalities were observed, and estimates are based on kill rates observed during 2000 (the last year for which observer data are available). For geographic strata other than Monterey Bay, the only cetacean species for which current estimates of mortality are available are unidentified common dolphin (*Delphinus sp.*) (Table 2). However, this estimate is based on 1991-94 kill rates (2 killed/2,289 days = 0.0009 killed/day) when the fishery outside of Monterey was still observed, and it is unknown whether these prior-year kill rates are still representative of current rates. Similarly, kill rates of pinnipeds for non-Monterey geographic strata in the set gillnet fishery are

based on 1991-94 kill rates and thus are subject to a great degree of uncertainty. Mortality estimates and kill rates for geographic strata other than Monterey Bay appear in Table 2. Annual mortality estimates in the set gillnet fishery for all geographic strata combined are summarized in Table 3.

Drift gillnet fishery

Drift gillnet fishing effort, observer coverage, observed mortalities, and mortality estimates are summarized in Table 4. Observer coverage in this fishery was 20%, with 360 days (sets) observed out of an estimated 1,779 days (sets) fished during calendar year 2002. Biological samples collected from cetaceans observed killed in the drift gillnet fishery is presented in the Appendix. As in previous years, the short-beaked common dolphin (*Delphinus delphis*) was the most frequently entangled species in the drift gillnet fishery, with 9 observed mortalities resulting in a mortality estimate of 49 animals (CV = 0.32).

DISCUSSION

Fishing effort in the set gillnet fishery continues to decline in California. Effort in the set gillnet fishery in Monterey Bay has declined considerably since September 2000 due to depth restrictions imposed by the CDFG. A permanent year-round ban on set gillnets inshore of 110 m (60 fms) from Pt. Reyes to Point Arguello, California was implemented in September of 2002. Prior to this permanent closure, some set-gillnet fishing effort occurred in the Monterey Bay area (156 days), which resulted in an estimated 16 harbor porpoise mortalities. With a permanent ban on gillnet fishing inshore of 110 m (60 fms) in this region, it is expected that incidental mortality of harbor porpoise will approach zero. Considerable uncertainty remains in estimating mortality for the southern California portion of the set gillnet fishery because it has not been observed since 1994 and because 2002 mortality is estimated using 1991-94 kill rates. Only three cetaceans other than harbor porpoise (2 *Delphinus* sp. and 1 unidentified cetacean) have been observed taken in the set gillnet fishery (Julian and Beeson, 1998), however kill rates reported by Julian and Beeson (1998) probably do not reflect current conditions in the fishery, owing to geographical changes in set gillnet effort since the 5.5 km (3 nmi) inshore ban was implemented in 1994. For this same reason, considerable uncertainty also exists in estimating mortality levels for pinnipeds in the southern California portion of the set gillnet fishery.

Effort in the drift gillnet fishery has been around 1,700 days for the past three years. An area/seasonal closure to protect leatherback turtles has been in effect since 2001 and further area closures are being considered in southern California to protect loggerhead turtles. The short-beaked common dolphin continues to be the most frequently entangled cetacean in the drift gillnet fishery, which probably reflects it being the most abundant cetacean in California waters (Barlow, 1995; Forney *et al*., 1995).

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Table 1. Summary of 2002 mortality estimates for the halibut/angel shark set gillnet fishery in Monterey Bay. Estimates are based on kill rates observed in calendar year 2000 and 156 days of fishing effort in 2001. There was no observer program in this fishery in 2002.

	Kill/Day	SE Kill/Day	Mort (M)	var M	CV Mort
California sea lion	0.41791	0.1881	65	861	0.45
Harbor seal	0.358209	0.1742	56	738	0.49
Elephant seal	0.059701	0.0597	9	87	1.00
Harbor Porpoise	0.104478	0.0807	16	158	0.77
Common Murre	10.61	1.87	1,655	84,864	0.18
Brandt's Cormorant	0.0298	0.0286	5	20	0.96

Table 2. Mortality estimates for the set gillnet fishery (non-Monterey strata: Southern California, Ventura, Channel Is., and Morro Bay). Kill rates are based on 1991-94 observer data and estimated 2002 fishing effort. There was no observer program in this fishery in 2002.

Species	Kill/Day	Var Kill Rate	Mort	Var Mort	SE Mort	CV Mort
unidentified common dolphin	0.00087374	3.89E-07	3	3	2	0.714
California sea lion	0.34919783	0.000624	1039	5527	74	0.072
Harbor seal	0.09441408	0.000075	281	664	26	0.092
Northern elephant seal	0.00813362	0.000003	24	27	5	0.213
Unidentified pinniped	0.00800563	0.000008	24	71	8	0.353
Common Murre	0.00043687	1.75E-07	1	2	1	0.957
Brandt's Cormorant	0.03058104	4.77E-05	91	423	21	0.226

Table 3. Total 2002 mortality estimates for the halibut/angel shark set gillnet fishery (all strata combined). 2001 and 2002 (in bold) estimates are shown for comparison.

Species	2001 Mort	**2002 Mort**	**Var Mort**	**SE Mort**	**2002 CV Mort**
Harbor porpoise	3	**16**	**158**	**13**	**0.77**
Unid. Common dolphin	3	**3**	**3**	**2**	**0.71**
California sea lion	1,194	**1,104**	**6,388**	**80**	**0.07**
Harbor seal	329	**337**	**1,403**	**37**	**0.11**
N. elephant seal	29	**34**	**113**	**11**	**0.32**
Unid. pinniped	27	**24**	**71**	**8**	**0.35**
Common murre	277	**1,656**	**84,865**	**291**	**0.18**
Brandt's cormorant	104	**96**	**443**	**21**	**0.22**

Table 4. Summary of 2002 fishing effort, observer coverage, observed 2002 kill, and estimated 2002 mortality in the swordfish/shark drift gillnet fishery.

Estimated Fishing Effort (Days)	1,779
NMFS Days Observed	360
Fraction Observer Coverage	0.20

	Observed Kill	Kill per day	2002 Mortality (CV)
Short-beaked common dolphin	10	0.02778	49 (0.32)
Long-beaked common dolphin	3	0.00833	15 (0.58)
Northern right whale dolphin	3	0.00833	15 (0.58)
Pacific white-sided dolphin	1	0.002778	5 (1.00)
California sea lion	18	0.05	89 (0.24)
Northern elephant seal	1	0.00278	5 (1.00)

Figure 1. Geographic strata used in the analysis of the halibut/angel shark set gillnet fishery.

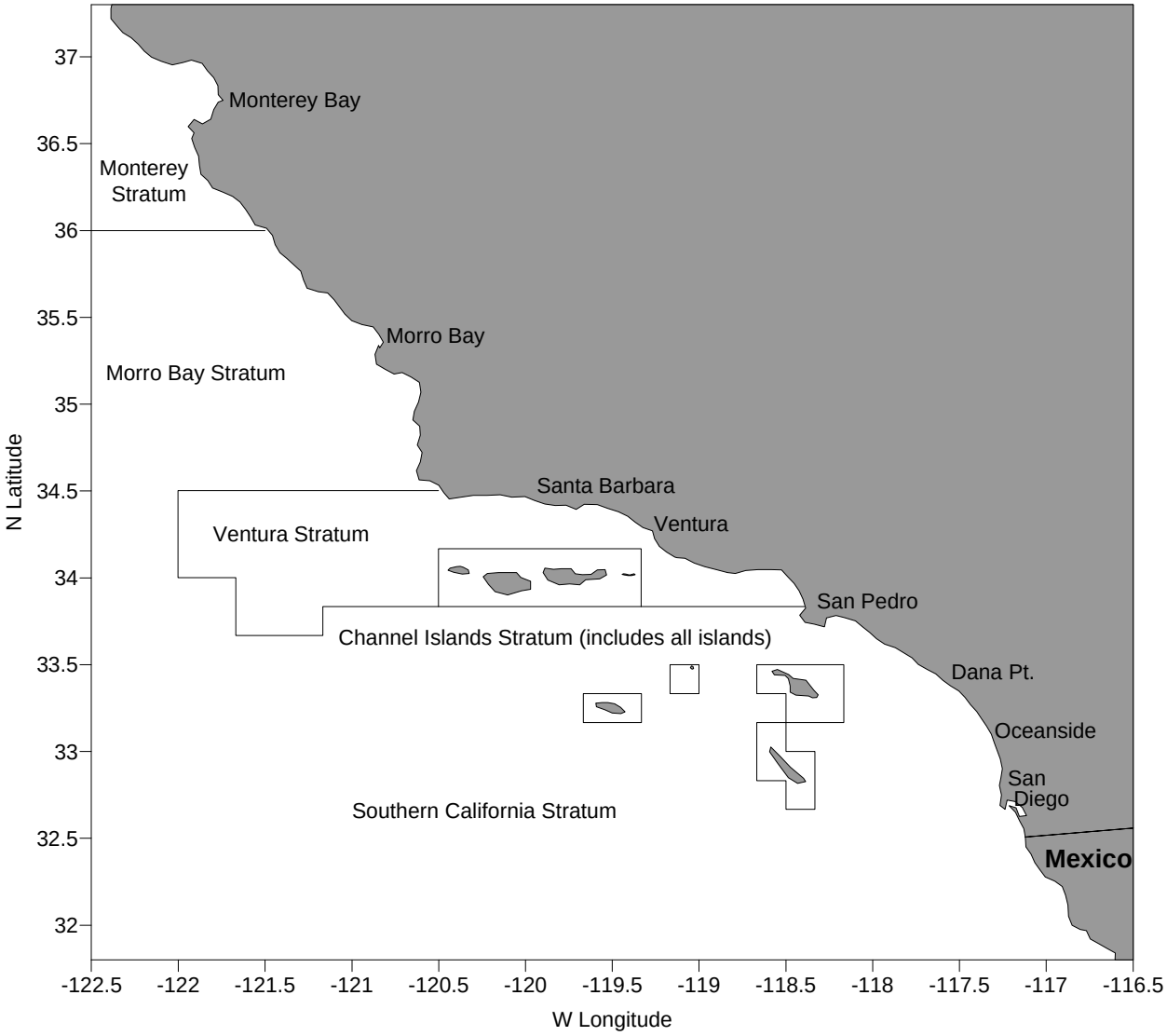


Figure 2. Estimated number of days of set gillnet fishing effort by CDFG block in southern California for calendar year 2002.

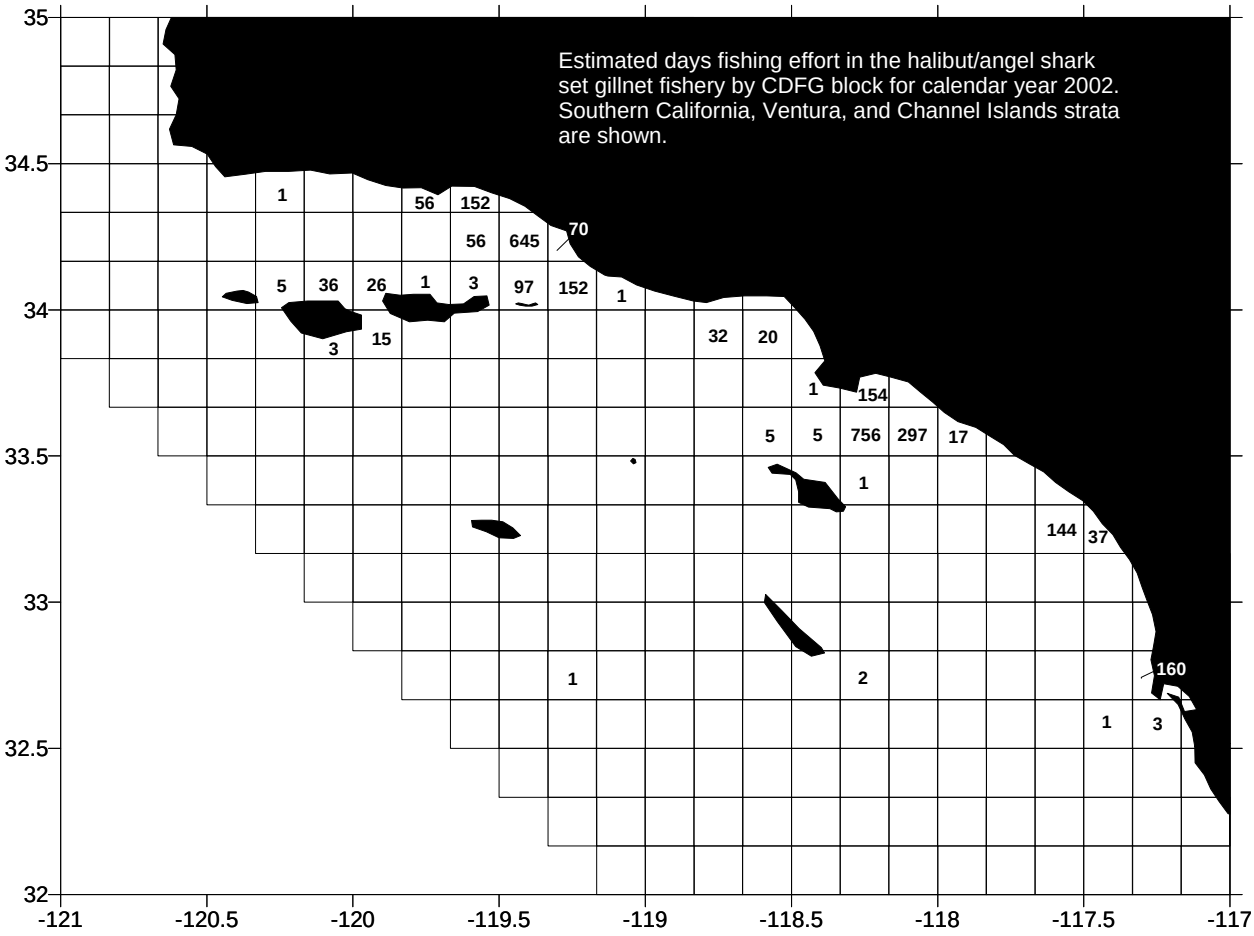
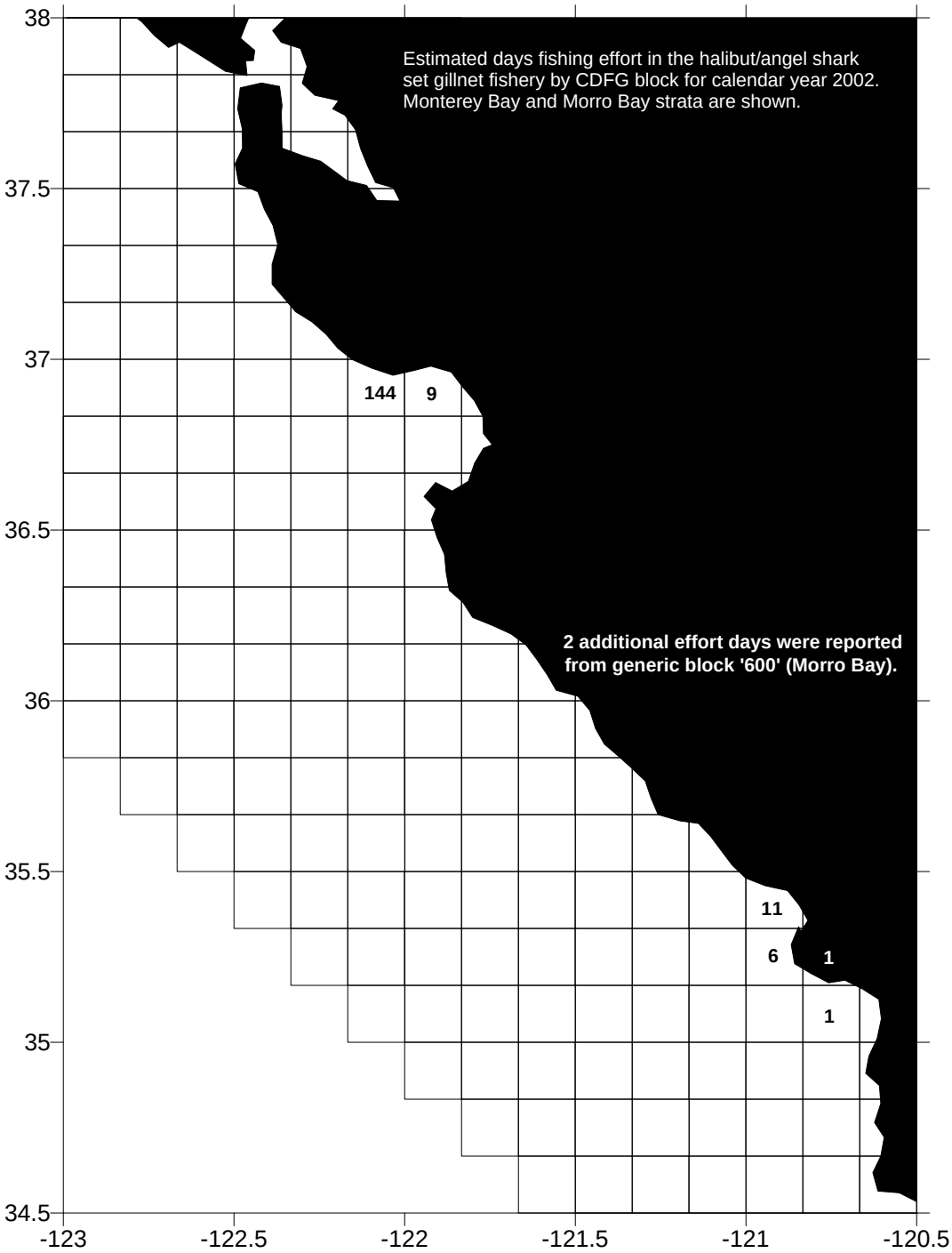


Figure 3. Estimated number of days of set gillnet fishing effort by CDFG block in central California for calendar year 2002. Monterey and Morro Bay strata are shown.



APPENDIX

Biological samples or life history data were collected from all of the cetaceans observed incidentally killed between 1 January and 31 December 2002. The observed kill included 9 *Delphinus delphis*, 4 *D. capensis*, 3 *Lissodelphis borealis*, and 1 *Lagenorhynchus obliquidens*. The information presented here is a preliminary description because data and sample processing were not completed in time for this report.

Biological sampling

Observers placed aboard California gillnet fishing vessels record the location and other pertinent data for each net set (*i.e.*, unit of fishing activity) including any incidental kill (Lennert *et al.*, 1994). For each incidental kill of a cetacean, observers record at least the species and gender of the animal. Additional biological data and samples (e.g. total body length, gonads, teeth, skin sample) are collected whenever possible. Procedures for the collection of biological data are described in Perrin *et al*. (1976) and Jefferson *et al*. (1994). The data form used by fishery observers in this program is 'Appendix 4' in Jefferson *et al*. (1994). Post-cruise processing of biological samples in the laboratory includes assessing the accuracy of species identifications made by observers in the field, examining the gonads to determine state of sexual maturity (Akin *et al*., 1993) and preparing collected teeth to estimate age (Perrin and Myrick, 1980; Myrick *et al*., 1983).

During 2002, 17 cetaceans were recorded incidentally killed in the driftnet fishery: 9 *D. delphis*, 4 *D. capensis*, 3 *Lissodelphis borealis*, and 1 *Lagenorhynchus obliquidens*. Life history data, including at least the collection of a skin sample for molecular genetic analyses, were collected from all of these animals. Complete life history data, which includes total body length, gender, teeth, gonads, and a skin sample, were collected for 15 of the animals sampled (Table 1). We will summarize the data collected by species, gender, and state of sexual maturity for all animals with data available (Table 2). Neither total body length nor age estimates were available for this report.

Whole carcasses were collected for 1 female *D. delphis*, 1 female and 1 male *L. borealis*, and 1 female *L. obliquidens* specimens. Heads were collected from 13 of the animals sampled. All materials are archived at the Southwest Fisheries Science Center (SWFSC). However, the osteological specimens will be archived at the Natural History Museum of Los Angeles County, Los Angeles, California when processing at the SWFSC is completed.

Species Identification

Species identifications are confirmed using molecular genetic techniques for species that are difficult to identify in the field and when osteological specimens (e.g. a skull) are not available (Baker and Palumbi, 1994; Henshaw *et al*., 1997b). In fact, several species have proven difficult for observers to identify in the field. These species include the two species of common dolphin

(*Delphinus delphis* and *D. capensis*), the beaked whale species (family Ziphiidae), short-finned pilot whale (*Globicephala macrorhynchus*) and Risso's dolphin *(Grampus griseus)* (Heyning and Perrin, 1994; Henshaw *et al.*, 1997b; Chivers *et al*., 1997).

Of these difficult to identify species, only common dolphin were observed killed during 2002. The identification of *Delphinus* spp. specimens to species is based on a 410 base pair sequence of the 5' end of the mitochondrial gene, cytochrome-*B*, which is prepared using standard protocols (Palumbi *et al*., 1991; Saiki *et al*., 1988; Rosel *et al*., 1994). Species identifications are made by comparing sequences from the suspect, or unknown, specimen to all available cytochrome-*B* sequences from *Delphinus* spp. specimens with identifications confirmed by morphology (Rosel *et al.*, 1994; Southwest Fisheries Science Center, unpublished data).

Species identifications were confirmed or determined using molecular genetic techniques for 9 *Delphinus* spp. sampled and external morphology for 4 *Delphinus* spp. sampled.

Gender determination

When gender was not determined in the field and the carcass was not collected for the determination to be made in the laboratory, gender is molecularly determined by amplifying the SRY gene. The gene is amplified with PCR using primers SRY-Y53-3C and SRY-Y53-3D (Rosenberg and Mesnick, 2001[1]). We used the zinc finger gene (*i.e.*, ZFX/ZFY) as an internal control to confirm PCR conditions (Bérubé and Palsbøll, 1996a; 1996b).

Molecular gender determinations will be made for two of the animals with only skin samples collected.

SUMMARY

The collection of biological data from observed incidental kill in the driftnet fishery has regularly exceeded 95% (Chivers *et al*., 1997; Chivers and Robertson, 2000; 2001), and in 2002 as in 2001 (Chivers *et al*., 2002), observers sampled 100% of the observed kill. There were 17 cetaceans observed killed and all had at least total body length measured or a skin sample collected. Additionally, 15 animals had a complete suite of life history data collected (i.e., species, gender, length, teeth, gonads, and skin). The species, gender and size composition of the observed kill in 2002 was comparable to that of prior years.

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Table 1. The observed incidental kill and number of specimens collected by fishery observers during 2002 are listed by species. All of these species were observed killed in the driftnet fishery. Specimens with minimum data collected are those for which species identity, and total body length and/or a skin sample were collected. Specimens with full life history data collected are those for which the species identification, gender, total body length, teeth, gonads, and skin samples were collected. The two 'unknown genders' will be molecularly determined and were not available at the time this report was compiled.

Species	Observed Incidental Kill	Specimens with minimum data collected	Specimens with full life history data collected
Delphinus delphis	**9**	**9**	**8**
Delphinus capensis	**4**	**4**	**3**
Lagenorhynchus obliquidens	**1**	**1**	**1**
Lissodelphis borealis	**3**	**3**	**3**
TOTAL	**17**	**17**	**15**

Table 2. For each species, we present the gender and state of sexual maturity of animals sampled by California drift gillnet fishery observers in 2002. Females are considered sexually mature when 1 corpus or more are present in either ovary. Sexual maturity in males can only be definitively determined by examination of histological preparations of testes tissue. We do not presently have these data available, and therefore used testes weight, which increases markedly when a cetacean attains sexual maturity, as a proxy for estimating state of sexual maturity. We used the following published information to estimate the state of sexual maturity for males in our sample. All testes weight criteria are for the weight of one testis, and a testis weight greater than the minimum listed is considered sexually mature. (1) For *Delphinus*, males with weight of one testis > 200 g are considered sexually mature (Ferrero and Walker, 1994), (2) for *Lissodelphis borealis*, > 300 g (Ferrero and Walker, 1993) and (3) for *Lagenorhynchus obliquidens*, > 50 g (SWFSC unpublished data; Ferrero et al., 1991). If gonads for a specimen were not available, sexual maturity was "undetermined."

SPECIES	GENDER	SEXUAL MATURITY
Delphinus delphis	**Males**	**Immature (n=2)** **Mature (n=2)**
	Females	**Immature (n=1)** **Mature (n=2)** **Undetermined (n=1)**
	Unknown (n=1)	
Delphinus capensis	**Males**	**Immature (n=1)** **Mature (n=1)**
	Females	**Immature (n=1)** **Mature (n=0)**
	Unknown (n=1)	
Lagenorhynchus obliquidens	**Females**	**Undetermined (n=1)**
Lissodelphis borealis	**Males**	**Undetermined (n=1)**
	Females	**Immature (n=0)** **Mature (n=1;pregnant)** **Undetermined (n=1)**