



NOAA Technical Memorandum NMFS-AFSC-167

Analysis of Marine Mammal Bycatch Data From the Trawl, Longline, and Pot Groundfish Fisheries of Alaska, 1998-2004, Defined by Geographic Area, Gear Type, and Catch Target Groundfish Species

by
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U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
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ABSTRACT

In 2003, Perez (2003) reported on an analysis of marine mammal incidental take data in federally managed groundfish fisheries in Alaska from 1989 to 2001. At that time, these fisheries were defined in the List of Fisheries by geographic area and gear type. In recent years, fishery definitions have changed to also specify target species. This report presents a re-analysis of the marine mammal incidental take data for the trawl, longline, and pot fishing gear from 1998 to 2001, separated by target species, and includes previously unpublished data from 2002 to 2004. Rates and variance of bycatch (incidental take mortalities and serious injuries) were calculated by stratified ratio estimates, using the sum of the marine mammals observed killed or seriously injured (including trailing gear) by fishing operations divided by the sum of the observed tonnage of fish catch in monitored hauls from the NORPAC database of the North Pacific Groundfish Observer Program, Alaska Fisheries Science Center. Estimates of total bycatch for each of 22 groundfish trawl, longline, and pot fisheries (based on intended catch target groundfish species) in Alaska were calculated using the total fishery data from the Catch Accounting System (CAS; successor to the Blend) database of the NMFS Alaska Regional Office (AKR). The target groundfish species for all NORPAC hauls in the CAS were estimated by the AKR using a sequential, hierarchical combination of a three-step process. In this study, NORPAC hauls were matched to their counterparts in the CAS by vessel, gear type, area, processing sector, and trip target date. Sixteen species of marine mammals were observed incidentally killed or injured by the groundfish fisheries in the U.S. Exclusive Economic Zone off Alaska during 1998-2004. The 22 trawl, longline and pot groundfish fisheries of Alaska were estimated to have incidentally taken 189 marine mammals during 1998-2004. Average annual rates of take for each marine mammal species and for each target fishery were calculated for the most recent 5 years (2000-2004) for use in the List of Fisheries evaluation.

Based on preliminary analyses of depredation rates of marine mammals on groundfish catch, the estimated average annual impact on the total longline fishery groundfish catch in sets

subjected to marine mammal depredation ranged from 0.1% (by weight) in the Gulf of Alaska (GOA) Pacific cod longline fishery to 22.3% in the GOA rockfish longline fishery. The average annual depredation impact (but not the quantity of fish actually consumed) by marine mammals on the combined longline fisheries was 2.2% of the total fishery groundfish catch during 1998-2004.

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INTRODUCTION

The National Marine Mammal Laboratory (NMML) and the Fisheries Monitoring and Analysis Division's North Pacific Groundfish Observer Program (NPGOP) at the Alaska Fisheries Science Center (AFSC), National Marine Fisheries Service (NMFS) routinely compile and analyze data collected by observers on the interactions of marine mammals with the groundfish fisheries in Alaska. The data on marine mammal bycatch (animals incidentally killed or seriously injured) in these fisheries during 1989-2001 were analyzed by Perez (2003); marine mammal bycatch data in the foreign and joint venture groundfish fisheries in Alaska during 1973-88 were summarized by Perez and Loughlin (1991).

Section 118 of the Marine Mammal Protection Act (MMPA) (50 CFR 229.2) requires that NMFS publish, at least annually, a List of Fisheries (LOF) that places all U.S. commercial fisheries into one of three categories based on the level of incidental serious injury and mortality of marine mammals that occurs in each fishery (16 U.S.C. 1387 (c)(1)). The categorization of a fishery in the LOF determines whether participants in that fishery may be required to comply with certain provisions of the MMPA, such as registration, observer coverage, and take reduction plan requirements. Owners of vessels or gear engaging in a Category I or II fishery are required to register with NMFS, must carry an observer if requested, and a Take Reduction Team may be convened for fisheries in Category I or II. Owners of vessels or gear engaged in a Category III fishery are not required to register with NMFS. All of the commercial groundfish fisheries discussed in this report have been classified as "Category III" fisheries in the LOFs from 1996 to 2005 (60 FR 67063, 28 December 1995; 62 FR 33, 2 January 1997; 63 FR 5748, 4 February 1998; 64 FR 9067, 24 February 1999; 65 FR 24448, 26 April 2000; 66 FR 42780, 15 August 2001; 67 FR 2410, 17 January 2002; 68 FR 41725, 15 July 2003; 69 FR 48407, 10 August 2004; 69 FR 70094, 2 December 2004) because they did not have a sufficiently high level of incidental serious injury or mortality to cause placement in Category I or II.

Until 2004 the trawl, longline/set (hook and line), and pot gear groundfish fisheries of Alaska (AK) had been considered single fisheries defined only by gear type and region. In 2004 (69 FR 48407, 10 August 2004), the LOF proposed to subdivide 5 fisheries into 22 fisheries (Table 1) based on one of eight intended catch target groundfish species groups: Atka mackerel, *Pleurogrammus monopterygius*; Greenland turbot (*Reinhardtius hippoglossoides*) (longline fisheries only), Pacific halibut, *Hippoglossus stenolepis*; flatfish (all species of the order Pleuronectiformes, except Pacific halibut, lumped into one group); Pacific cod, *Gadus macrocephalus*; walleye pollock, *Theragra chalcogramma*; rockfish (*Sebastes* spp. and related species of the family Scorpaenidae lumped into one group), and sablefish, *Anoplopoma fimbria*.

The purpose of this report is to present a re-analysis of the marine mammal incidental take data from 1998 to 2001 (Perez 2003) and add the previously unanalyzed bycatch data from 2002 to 2004, based on the new 2004 LOF classifications of groundfish fisheries in Alaska defined by the intended target groundfish species caught by trawl, longline, and pot fishing gear. An assessment of the impact on the total weight of the groundfish catch due to depredation by marine mammals feeding directly off the fishing gear in the Bering Sea (BS), Aleutian Islands region (AI), and Gulf of Alaska (GOA) is also presented in this report. This report also includes data from the AK miscellaneous other finfish mechanical jig fishery.

METHODS

Catch Target Groundfish Species

The Catch Accounting System (CAS) of the NMFS Alaska Regional Office (AKR), which is the successor to the Blend database referenced in Perez (2003), summarizes the total groundfish catch data. These totals are separated by intended target species and gear based on data from fishing industry sources (plant and logbook reports) and observers (NORPAC database from NPGOP). Unlike the Blend database, the catch data are no longer averaged ("blended")

from observer and industry sources to estimate total catch weight, but instead the data from each source are itemized separately where they are distinct. The CAS also stratifies the catch data from each processing sector and/or vessel by week and statistical fishing area in the U.S. Exclusive Economic Zone (EEZ) of the Bering Sea and Aleutian Islands region (Fig. 1) and the Gulf of Alaska (Fig. 2).

The NORPAC database does not attempt to determine intended target groundfish species. Historically, it has been difficult to separate the NORPAC data by target species because the predominant species observed in the catch may not have been the intended target for the haul (set). In addition, the species composition of the haul estimated by sampling in relation to the intended targeted catch species is sometimes affected by gear problems, marine mammal depredation, and/or sampling errors. Finally, only 73% of all hauls (92% of 109,355 pelagic trawl sets, 62% of 138,099 non-pelagic trawl sets, 68% of 134,313 longline sets, and 79% of 15,905 pot sets) on observed vessels during 1998-2004 were sampled by observers. Thus, the species composition of the total groundfish catch in at least one-fourth of the hauls recorded in NORPAC is unknown. However, the target species has been estimated for most hauls based on a sequential, hierarchical combination of three-step processes used in the CAS database:

- A) Step 1:** When an observer samples a particular haul for the composition of the groundfish catch, the target species can be estimated by the predominant (by weight of total catch) groundfish species caught in that haul. This report uses the NPGOP computer algorithms to estimate the predominant target species in a particular NORPAC haul; however, the AKR uses its own algorithms to assign targets to sampled NORPAC hauls in the CAS.
- B) Step 2:** When observers do not sample particular hauls, the CAS database assigns a target to each unsampled haul by extrapolating total groundfish catch data from matching sampled hauls recorded for that same vessel, observer cruise number, gear type, area, IFQ (individual fishing quota) flag, and date range. The date range is set at 7 days, so that the CAS computer algorithms look for a sampled haul on the same date and up to 7 days prior or 7 days after. For example, if a haul at 1400 hr on 25 January was not sampled, but a

haul conducted at 1000 hr with the same gear was sampled, the CAS assigns the target for the unsampled haul (1400 hr) to the target fishery identified for the haul at 1000 hr. If there were no previous sampled hauls on the same date then it looks for sampled hauls which occurred after the unsampled haul. If there is no match using the initial comparison criteria within a week (before or after), then the matching criteria are relaxed to ultimately a comparison merely for the same vessel and gear in the 2-week period. Following the completion of this process, there may still be a few unsampled hauls without target assignments (unknown target codes).

C) Step 3: The CAS then uses a different set of computer algorithms which calculate fishery targets at the trip level for all observed and unobserved components of the fisheries. The weight of the retained groundfish catch is combined for: 1) vessel, target date, gear type, and reporting area for catcher processors and motherships; and 2) vessel, target date, gear type, and FMP (fishery management plan) area for catcher vessels delivering to shoreside processing plants. The target date is the week ending date (Saturday) for catcher processors and motherships, and the fishing start date for catcher vessels.

Fishery targets at the haul level (**A** and **B** above) are based on the weight of the total groundfish catch, but fishery targets at the trip level (**C** above) are based only on the weight of the retained catch of groundfish or Pacific halibut (retained in the IFQ (individual fishing quota) fisheries). The targets are assigned using the following sequential procedure: 1) if more than 95% of the catch by weight consists of pollock then the pelagic pollock target is assigned; 2) if the catch is not more than 95% pollock, then the target is the dominant catch species; and 3) if the dominant catch species is not one of the recognized target species, then the "other species" code is the default target assignment. One exception for the BSAI area is determined by regulation (50 CFR 679.21): If the total amount of the flatfish catch (flathead sole, *Hippoglossoides elassodon*; rock sole, *Lepidopsetta* spp.; yellowfin sole, *Limanda aspera*; and "other flatfish") is greater than the amount of any other fishery target, and the amount of yellowfin sole is 70% or more of the total flatfish catch, the target is yellowfin sole; otherwise, if yellowfin sole comprises

less than 70% of the total amount of flatfish, the target is the greater of the remaining flatfish species (flathead sole, rock sole, or "other flatfish").

In Step 2 (**B**) above, the AKR estimates the target species for many of the unsampled hauls in the NORPAC database based on the assumption that contemporaneous hauls in the same area within 7 days would most likely be targeting the same groundfish species identified in the hauls which were sampled for species composition. In Step 3 (**C**) the AKR assigns targets in the CAS based on weekly summaries. Thus, an unsampled haul at the beginning or end of the week for each trip target date could be assigned targets in process **B** based on hauls which occurred during the previous or subsequent trip target week of process **C**. However, the trip targeting in the CAS happens after the extrapolation and haul target assignment. Therefore, the hauls inherit the species composition of the nearest haul, and as a result, the target of that haul; but it is all of the sampled and unsampled hauls in a week that make up the trip target for the catcher/processor vessels. As a result of these procedures, a marine mammal take in an observed haul (NORPAC) that consisted primarily of flatfish, for example, as the predominant weight of the total groundfish catch in that haul (Step 1, **A**) could be assigned to the Pacific cod fishery based on the trip target date in the CAS (Step 3, **C**). The AKR has recommended that the trip level target (trip target code) (Step 3, **C**) in the CAS is the best representation of the intended target of a particular haul. Thus, the estimated trip level target defines the assignment of each NORPAC haul to a particular target groundfish species fishery.

In the present analysis, the NORPAC database hauls were matched against their respective CAS database counterparts by gear type, vessel and/or processing sector, week, and statistical area to obtain their final estimated intended target groundfish species assignments (Step 3, **C**) regardless of the values estimated in Steps 1 (**A**) or 2 (**B**) (since the target groundfish species assignments from process **C** represent the official fishery targets for fishing trips). Appendix 1 lists the number of hauls (sets) on vessels with observers by fishery and a comparison of the resultant estimated target catch species from each of the aforementioned three sequential step processes: **A** for Step 1 above, **B** for Step 2, and **C** for Step 3. The percentage of

NORPAC hauls among the five generalized possible logical comparisons of these three estimation steps by the NPGOP and AKR is also listed in Appendix 1 to indicate the degree of uncertainty in the database with respect to the actual intended target groundfish species for each haul on an observed vessel (NORPAC). For purposes of these logical comparisons summarized in Appendix 1, and to avoid confusing count totals, NORPAC hauls in process **A** which were unsampled were considered equivalent to process **C** (Step 3 target species assignments) because individually they provided no target species information for Step 1 (**A**). A similar set of comparisons based on total weight of the groundfish catch is listed in Appendix 2.

Some hauls (sets) by the groundfish fisheries do not catch any of the allocated target groundfish species in a particular region by gear type, or in other situations, there is no information from the fishery regarding the intended target species of the total catch (only weight data) from some vessels or fishery plants (these latter catches are assigned unknown target species codes in the CAS database). However, these situations were infrequent because less than 1% of all NORPAC hauls during 1998-2004 caught either non-allocated or unknown target catches (most unsampled hauls on observed cruises are assigned allocated target species in the CAS). Thus, for the purposes of the analyses in this report, and to account for all groundfish catch by the combined fisheries, it was necessary to assign these non-allocated or unknown target catches to three lumped miscellaneous "other finfish target" fisheries for trawl, longline and pot gear similar to that used for the jig fishery. It must be stressed that the inclusion of non-allocated species in the "other finfish target" trawl, longline, and pot fisheries refers only to total haul catches without any officially designated intended target species and not to individual finfish species caught in a particular haul (set). Fish species caught simultaneously in the same haul (set) as the intended target species are also assigned the intended target species code in the CAS database.

Total Fishing Effort

Table 2 lists vessel observer coverage and effort (calculated as number of fishing vessels, vessel fishing days, and hauls) for observed cruises in each fishery during 1998-2004 by year and region. The term "vessel fishing day" refers to each calendar date when a vessel (with an observer) set gear to catch groundfish on that day. Each of the fisheries by gear type is not independent with respect to participating vessels. The same vessel typically participates in several fisheries of the same or multiple gear types during the same cruise. It is common for a vessel to retrieve sets throughout the same calendar date and/or in the same statistical fishing area where the total groundfish catch from each haul will belong to different fisheries. Thus, the number of vessels and fishing days listed in Table 2 are not additive across fisheries or areas.

The locations where trawl sets occurred during 1998-2004 on observed cruises (NORPAC) in the Bering Sea, Aleutian Islands region, and Gulf of Alaska are shown for all target trawl fisheries in Figures 3-12. The locations where longline sets occurred during 1998-2004 on observed cruises in the Bering Sea, Aleutian Islands region, and Gulf of Alaska are shown for all target longline fisheries in Figures 13-22. The locations where pot sets occurred during 1998-2004 on observed cruises in the Bering Sea, Aleutian Islands region, and Gulf of Alaska are shown for all target pot fisheries in Figures 23-27.

Weight (metric tons) of the groundfish caught by each vessel was the only parameter of total effort available for the entire fleet of vessels (observed and unobserved) of each fishery recorded in the CAS. AFSC (2003) discusses the methodology used by observers to sample the composition of the groundfish catch and estimate the total weight of groundfish caught on observed vessels which is recorded in NORPAC. The total number of vessels that fished, days of fishing, hauls or sets deployed, and gear devices (nets, hooks, pots, or jigs) used by unobserved vessels of each fishery in any particular area during a given week were not available. Thus, catch tonnage was used in this report as the measurement of fishing effort to estimate marine mammal bycatch rates.

Two known biases must be considered when using catch tonnage as a measure of fishing effort (Perez 2003). First, part of the groundfish catch on longline gear is lost to depredation by marine mammals (Table 3) or sharks prior to retrieval, and there is no way to account for the weight of the lost catch from the empty hooks or remaining fish fragments (heads, lips, etc.). Second, the weight of some prohibited species bycatch or miscellaneous catch may be included in NORPAC, but not completely in the CAS database. The first bias (loss to depredation) affects both NORPAC and the CAS databases equally, and thus may be considered negligible. The second bias is also mainly an issue for longline fisheries, for which prohibited fish species bycatch (e.g., Pacific salmon and herring) or miscellaneous catch items (e.g., grenadiers) can sometimes represent up to 18% of the total weight of the longline set (Perez 2003). Prohibited catch species data are included in the CAS, but the total weight of these species in the CAS is often less than the corresponding values in NORPAC for the same vessels when the catch data in the CAS for those vessels come from fishing industry sources rather than NORPAC. The total groundfish catch (metric tons (t)) by each fishery and the percent of total catch monitored for marine mammal bycatch during 1998-2004 is listed in Table 4 by region and year.

Marine Mammal Bycatch and Depredation Estimation

Marine mammal bycatch is defined in this report as serious injuries and mortalities that occur in the course of fishing operations: entangled or killed in gear during the haul, lethal takes by the crew, or lethal impacts of the marine mammal with the vessel's propeller. AFSC (2003) provides a complete and detailed discussion of all observer duties, record-keeping forms and data codes, and procedures used to record and sample marine mammal bycatch and sightings, in addition to the procedures used by observers to monitor fishing effort and the composition of the groundfish catch. The "unidentified" species groups used in this study do not imply the take of mammals from species not listed in Table 3. Rather, in most cases, the unidentified animals can be presumed to belong to one of the identified species of pinnipeds or cetaceans, but positive

identification was not possible. This generally occurred because they were neither seen nor examined closely by the observer, or they were in advanced stages of decomposition.

In the MMPA and by regulation, “serious injury” is defined as an injury that is likely to lead to mortality. A workshop held in 1997 provided additional guidance on what should constitute serious injury (Angliss and DeMaster 1998). Participants indicated that marine mammals entangled with trailing gear should be called “seriously injured” and are likely to die, particularly if the trailing gear is sufficient to impede movement or feeding. When information was plentiful on a particular incident of “trailing gear”, that information was reviewed to determine whether the entanglement was likely to be “serious”. However, if little or no information was available, a “trailing gear” incident was considered to be “serious”.

All observed (actually seen and/or examined by the observer) marine mammals which were seriously injured, killed by the gear or the vessel propeller, or lethally taken by the crew during monitored hauls (sets) were included in bycatch rate estimations. No intentional lethal takes were reported during 1998-2004. The following data were not included in the bycatch estimation procedures used in this study (but their recorded occurrences are listed in Appendix 3): 1) animals which boarded the vessel or climbed onto the gear of their own volition, or were caught by the gear and subsequently returned to the sea unharmed or with only minor injuries; 2) carcasses in varying states of decomposition which were caught by the gear but were presumed to have died at some time prior to fishing operations, including dead animals for which the time and cause of death was unknown (some of these latter animals could have been killed during fishing operations); and 3) reported occurrences of isolated marine mammal parts (e.g., walrus tusks, pieces of baleen, skulls, or bones), miscellaneous unidentifiable fragments (tissue, blubber, or skin), or solitary aborted fetuses.

The incidental take data from 1998 to 2004 were re-analyzed using methods and statistical procedures similar to those discussed by Perez (2003), except that: 1) an additional level of stratification was added to the automatic data processing procedural algorithms to represent the fisheries defined by target groundfish species; and 2) confidence intervals were

estimated with the lognormal approximation (Burnham et al. 1987) using the coefficient of variation of the extrapolated bycatch. The additional stratification level in computer programs did not require any modifications in the underlying statistical formulae because a target species definition group is an equivalent subset of the original gear (fishery) stratification level. The statistical formulae used to estimate bycatch are listed in Appendix 4. Catch rates and estimates of bycatch for each species of marine mammals were calculated for each 4-week period (minimum stratum level) by year, statistical area, gear type, vessel class and/or processing sector (catcher/processor, mothership/processor, or catcher-only vessel of shoreside plants), and targeted groundfish catch species (fishery designation). The calendar dates during 1998-2004 assigned to each 4-week period used to stratify the groundfish effort and marine mammal bycatch data are listed in Appendix 5; 4-week periods were used to approximate monthly periods because the CAS (and previous Blend database) only provides data summarized by weekly intervals. The percentage of the total groundfish catch in each of the three processing sectors, by fishery, and the percentage of each processing sector's groundfish catch monitored for marine mammals during 1998-2004 are listed in Appendix 6.

Rates and variance of incidental take for each stratum were calculated by the simple random sampling ratio estimate (\hat{R}) method, using the sum of the marine mammals observed killed or seriously injured (including those entangled in trailing gear) by fishing operations divided by the sum of the total tonnage of fish catch in monitored hauls. Total extrapolated bycatch (\hat{Y}_{R_s}) was calculated by the separate ratio estimate method in stratified random sampling (Cochran 1977, Levy and Lemeshow 1999). The fraction of hauls observed in the total fishery is unknown; instead, the percentage of total tonnage sampled was used as an estimate of the fraction of total effort observed. The resulting values are reported as multiples of 10,000 t of fish catch.

Extrapolated bycatch of marine mammals was first calculated by multiplying the observed rate (per metric ton of fish catch) of mortalities and serious injuries in each stratum by the total tonnage caught by the entire fishery in the same stratum. Second, the extrapolated takes

of all strata were summed (stratified) to obtain the total extrapolated bycatch (stratified random sampling ratio estimator, \hat{Y}_{R_s}) by year and area. Third, the calculated stratified random sampling ratio estimator was adjusted to calculate the estimated bycatch (\hat{Y}_A) by including (adding) the exact number (integers) of additional marine mammal takes (mortalities, serious injuries, and entanglement in trailing gear) actually witnessed by observers which occurred only in strata which had zero or unknown extrapolated bycatch rates (i.e., from strata where marine mammal bycatch was not observed in any monitored haul). This adjustment was necessary to prevent underestimation of annual and regional bycatch when incidental take was known to occur but was missed by the NORPAC sampling design. Observed takes in unmonitored hauls from strata which also had observed takes in monitored hauls were ignored because they comprised a fraction of the extrapolated bycatch for a stratum. Marine mammal takes which occurred on observed cruises and were seen only by the crew were not included in any estimation procedures even if they occurred during monitored hauls.

The bycatch rates and confidence intervals presented in this report were calculated using only data and extrapolated estimates based on observed marine mammals taken in randomly sampled, monitored sets. Confidence intervals were based on the lognormal approximation (Burnham et al. 1987). The natural log-transformation approximation was used to derive 95% confidence limits by calculations which use the extrapolated bycatch values and their corresponding coefficients of variation. This was done to avoid reporting negative lower confidence limits using the normal approximation as was used by Perez (2003). However, the standard errors and coefficients of variation are still calculating using the normal approximation because the bycatch data values cannot be transformed directly due to the preponderance of zero values.

The ratio estimates presented in this report were calculated by summing the exact decimal values of the extrapolated results (stratification) from the individual subgroups of the data based on target fishery and gear type, year, statistical area, vessel class, and month (4-week period). Some minor rounding errors will occur when summing the estimated bycatch totals

presented in the tables across statistical areas or years. However, the values presented in the tables were calculated by summing only decimal values and not rounded integers. Due to the stratification process for each separate fishery based on intended catch target groundfish species, the totals for fishing effort (metric tons) when summing target fisheries of the same gear type by year may be slightly higher than the gear type totals presented previously for 1998-2002 (Perez 2003) even though the same data were used in each analysis.

Observers determine whether depredation on the groundfish catch by marine mammals has occurred using three lines of evidence. Some marine mammals feed on fish from the fishing gear before it has been retrieved by the fishing vessel. Usually, marine mammals are seen swimming or diving near the fishing gear at the time of the interaction. Infrequently, observers may also see a marine mammal with a fish in its mouth which it pulled from a trawl net or more commonly from off of longline gear. On a longline vessel, having marine mammals around the vessel and seeing empty hooks is not necessarily an indication of depredation on the groundfish catch. When sampling the groundfish catch, observers look for fish heads or lips, or fish that have been bitten or raked by teeth as signs of depredation by marine mammals, both of which indicate that depredation of the groundfish catch has occurred. Observers often record instances of broken or straightened hooks and broken gangions that may indicate depredation events.

The minimum number of marine mammals feeding on the groundfish catch directly from longlines, pots or trawl nets was calculated by determining the sum of the maximum number of animals of each species, by fishery, observed feeding directly on the groundfish catch of any monitored haul on one single calendar date during the year in each of the statistical fishing areas. It was assumed that individual marine mammals in different statistical fishing areas on the same calendar date were not the same animals; however, animals observed feeding on fish caught by fishing gear on different calendar dates (or on different hauls on the same calendar date) are frequently the same animals repeatedly interacting with the fishing gear. The weight of total groundfish catch estimated to be impacted by marine mammal depredation was calculated using the total weight of hauls which were monitored by observers and in which marine mammal

feeding interactions were observed. Thus, this sampled groundfish catch weight is less than the sampled fishery weight used to estimate marine mammal bycatch because hauls with no feeding interactions were not included. It must be stressed that the estimated weight of groundfish catch impacted is not an estimate of fish consumed (which is certainly less); it is merely an indicator of the probable level of maximum predatory impact of marine mammals on the groundfish catch. Marine mammal feeding on discarded fish or effluent were not included in the estimates of impact on total groundfish catch or the minimum number of feeding animals.

RESULTS AND DISCUSSION

Bycatch and Other Incidental Take of Marine Mammals

Sixteen species of marine mammals were observed incidentally killed or seriously injured by the groundfish fisheries in the U.S. EEZ off Alaska during 1998-2004 (Tables 3 and 4). Four of these 16 marine mammal species are classified as endangered under the U.S. Endangered Species Act: the western population of the Steller sea lion (*Eumetopias jubatus*), the humpback whale (*Megaptera novaeangliae*), the fin whale (*Balaenoptera physalus*), and the sperm whale (*Physeter macrocephalus*). A total of 93 marine mammals of the 16 identified species were observed (in monitored hauls/sets) killed or seriously injured incidental to commercial fishing operations (trawl, longline, or pot gear) between 1998 and 2004 (Tables 4-7 and Appendices 3 and 7).

The locations in Alaska waters where observed bycatch, including those seen by observers in unmonitored hauls which occurred in the trawl fisheries during 1998-2004 (Table 4 and Appendices 3 and 7) are shown in Figures 28-34 as follows: 9 Steller sea lions taken by the BSAI Atka mackerel trawl fishery (Fig. 28); 2 northern fur seals (*Callorhinus ursinus*), 15 Steller sea lions, 7 walrus (*Odobenus rosmarus*), 4 bearded seals (*Erignathus barbatus*), 2 harbor seal (*Phoca vitulina*), 4 spotted seals (*Phoca largha*), 2 unidentified pinnipeds (including

1 unidentified phocid), 4 killer whales (*Orcinus orca*), and 2 harbor porpoises (*Phocoena phocoena*) taken by the BSAI flatfish trawl fishery (Fig. 29); 3 Steller sea lions and 2 harbor seals taken by the BSAI Pacific cod trawl fishery (Fig. 30); 1 northern fur seal, 15 Steller sea lions, 2 bearded seals, 3 ringed seals (*Pusa hispida*), 1 ribbon seal (*Histiophoca fasciata*), 2 humpback whales, 1 minke whale (*Balaenoptera acutorostrata*), 1 unidentified baleen whale, 3 killer whales, and 14 Dall's porpoises (*Phocoenoides dalli*) taken by the BSAI pollock trawl fishery (Figs. 31 and 32); 1 Steller sea lion taken by the GOA Pacific cod trawl fishery (Fig. 33); and 2 Steller sea lions, 1 northern elephant seal (*Mirounga angustirostris*), 1 fin whale, and 1 Dall's porpoise taken by the GOA pollock trawl fishery (Fig. 34). The locations in Alaska waters where observed bycatch, including those seen by observers in unmonitored sets which occurred in the longline fisheries during 1998-2004 (Table 4 and Appendices 3 and 7) are shown in Figures 35-37 as follows: 1 killer whale taken by the BSAI Greenland turbot longline fishery (Fig. 35); 1 Steller sea lion, 1 ribbon seal, 2 unidentified pinnipeds (including 1 unidentified otariid), 1 killer whale, and 1 Dall's porpoise taken by the BSAI Pacific cod longline fishery (Fig. 36); and 1 Steller sea lion and 1 sperm whale taken by the GOA sablefish longline fishery (Fig. 37). The locations in Alaska waters where observed bycatch, including those seen by observers in unmonitored sets which occurred in the pot fisheries during 1998-2004 (Table 4 and Appendices 3 and 7) are shown in Figures 38-40 as follows: 1 harbor seal and 1 unidentified baleen whale taken by the BSAI Pacific cod pot fishery (Fig. 38); 1 humpback whale taken by the BS sablefish pot fishery (Fig. 39); and 1 harbor seal taken by the GOA Pacific cod pot fishery (Fig. 40).

The estimated bycatch of 155 marine mammals by 6 trawl fisheries during 1998-2004 (Table 5 and Appendix 7) occurred in statistical fishing areas 509, 513, 514, 517, 519, 521, 524, 541, 542, and 543 in the Bering Sea and Aleutian Islands region (Fig. 1), and in areas 610 and 620 in the Gulf of Alaska (Fig. 2). By species, this estimated bycatch (rounded to integers) by the trawl fisheries during 1998-2004 included: 12 Steller Sea lions taken by the BSAI Atka mackerel trawl fishery; 2 northern fur seals, 21 Steller sea lions, 9 walruses, 7 bearded seals,

2 harbor seals, 5 spotted seals, 2 unidentified phocid seals, 1 unidentified pinniped, 5 killer whales, and 4 harbor porpoises taken by the BSAI flatfish trawl fishery; 5 Steller sea lions and 4 harbor seals taken by the BSAI Pacific cod trawl fishery; 3 northern fur seals, 17 Steller sea lions, 3 bearded seals, 3 ringed seals, 1 ribbon seal, 3 humpback whales, 2 minke whales, 1 unidentified baleen whale, 3 killer whales, and 22 Dall's porpoises taken by the BSAI pollock trawl fishery; 5 Steller sea lions taken by the GOA Pacific cod trawl fishery; and 4 Steller sea lions, 4 northern elephant seals, 3 fin whales, and 2 Dall's porpoises taken by the GOA pollock trawl fishery. An estimated bycatch of 29 marine mammals by 3 longline fisheries during 1998-2004 (Table 6 and Appendix 7) occurred in statistical fishing areas 509, 516, 517, 521, and 524 in the Bering Sea (Fig. 1), and in areas 640 and 650 in the Gulf of Alaska (Fig. 2). By species, this estimated bycatch (rounded to integers) by the longline fisheries during 1998-2004 included: 3 killer whales taken by the BSAI Greenland turbot longline fishery; 4 Steller sea lions, 2 unidentified otariids, 3 ribbon seals, 3 unidentified pinnipeds, 4 killer whales, and 1 Dall's porpoise taken by the BSAI Pacific cod longline fishery; and 7 Steller sea lions and 2 sperm whales taken by the GOA sablefish longline fishery. An estimated bycatch of 5 marine mammals by 3 pot fisheries during 1998-2004 (Table 7 and Appendix 7) occurred in statistical fishing areas 513, 519, and 542 in the Bering Sea and Aleutian Islands region (Fig. 1), and in area 610 in the Gulf of Alaska (Fig. 2). By species, this estimated bycatch (rounded to integers) by the pot fisheries during 1998-2004 included: 1 harbor seal and 1 unidentified baleen whale taken by the BSAI Pacific cod pot fishery; 1 humpback whale taken by the BS sablefish pot fishery; and 2 harbor seals taken by the GOA Pacific cod pot fishery.

Stock assessment reports for marine mammals (e.g., Angliss and Outlaw 2005) typically base their assessments on the most recent 5 years of information on marine mammal serious injury (including trailing gear incidents) and mortality. Table 8 lists data on the average annual rates and estimates of marine mammal bycatch in the groundfish fisheries in Alaska during 2000-2004. Since some species will not be incidentally taken every year by each fishery, the average annual estimated bycatch values have not been rounded to integers. The estimated

average annual mortality takes during 2000-2004 (Table 8) by all 22 groundfish fisheries in Alaska were: 0.48 northern fur seals, 9.65 Steller sea lions (western U.S. stock), 1.37 Steller sea lions (eastern U.S. stock), 1.68 walrus, 0.68 bearded seals, 1.25 harbor seals (Bering Sea stock), 0.88 spotted seals, 0.71 ringed seals, 0.80 ribbon seals, 0.71 northern elephant seals, 0.20 humpback whales, 0.32 minke whales, 0.59 fin whales, 0.45 sperm whales, 1.48 killer whales (Eastern North Pacific Alaska resident stock), 0.41 killer whales (Eastern North Pacific Gulf of Alaska, Aleutian Islands, and Bering Sea transient stock), 0.35 harbor porpoises (Bering Sea stock), and 1.89 Dall's porpoises. Observation of marine mammal bycatch is essentially opportunistic and there could be incidental takes (at higher or lower bycatch rates) by any of the 22 groundfish fisheries of Alaska in the future, including takes of marine mammal species and/or stocks which did not occur during 2000-2004, but which have occurred in past years (Perez 2003, Perez and Loughlin 1991, and Table 8).

The level of observer coverage (as measured by observed groundfish catch relative to total groundfish catch) directly influences the bycatch rate calculations. In strata with low observer coverage, and where marine mammal takes also occurred, an observed serious injury/mortality may be extrapolated to an estimated level of take with a large variance (Appendix 7 and Perez 2003). The stratified total estimated bycatch in this study should be considered conservative because any possible bycatch in strata (by time, area, and vessel class) without any observer coverage and/or no observed takes was not estimated.

Infrequently, the observer may feel that a take occurred due to circumstantial evidence, but the take could not be observed. For example, one observer reported that a killer whale died on 18 August 2001 in the BSAI flatfish trawl fishery in area 517 after collision with the vessel's propeller (Appendix 3), but the observer was unable to see the animal despite the fact that it was a monitored haul and the observer heard a loud noise and felt the vessel shudder at the time. This take was not included in the stratified estimation analyses of bycatch, and the extrapolated and estimated bycatch was zero (with zero variance) for the stratum which would have included this take. However, the observer's remarks of the event were similar to the remarks about vessel

shaking felt by two other observers that witnessed two events of propeller impacts on killer whales on 1 August 1998 (area 517) and 21 April 2004 (area 521) in the BSAI flatfish trawl fishery (Appendix 3). The estimated bycatch of killer whales by the BSAI flatfish trawl fishery in 2001 (Table 5) was 1.5 animals although observers reported that 2 animals were actually taken (Appendix 3). Likewise, the 5-year (2000-2004) average estimated bycatch of killer whales for the BSAI flatfish trawl fishery (Table 8) was 0.64 animals when it would have been 0.84 animals if this additional take in a monitored haul had been included in the bycatch analyses.

Two pinnipeds (1 northern fur seal and 1 unidentified otariid) were observed which had suffered minor injuries by being caught in fishing gear or were entangled in non-threatening amounts of trailing gear before being released alive to the sea (Appendix 3). Twenty-three pinnipeds (1 northern fur seal, 20 Steller sea lions, and 2 unidentified pinnipeds) were observed boarding vessels at sea of their own volition and 3 other marine mammals (1 bearded seal, 1 humpback whale, and 1 killer whale) were observed caught or entangled by the gear but subsequently freed by the crew and returned to the sea without apparent injuries; all 28 of these animals apparently were unharmed by the interaction (Appendix 3). A detailed list of all marine mammal incidental takes (including takes seen only by the crew when an observer was present, and also decomposed or miscellaneous items) reported by observers onboard groundfish vessels in the U.S. EEZ off Alaska during 1998-2004 is presented in Appendix 3.

Most fisheries operated throughout the year in all months, although weather conditions and/or sea ice may have limited some fishing during winter months; some trawl fisheries using pelagic trawl gear were also restricted from operating during some spring and/or summer months (Appendix 8). Appendix 9 lists for each fishery, by gear type, the mean, median, coefficient of variation (CV), and range of the following data: 1) the weight (t) of groundfish caught in hauls (sets); 2) the duration (hr) of sets; 3) the total number (expressed in thousands) of hooks (longline fishery) or pots (pot fishery) per set; 4) the average fishing depth (m) of nets (trawl fishery) taken from the vessel's logbook by the observer; and 5) the average bottom depth (m) of the sea where sets occurred taken from the vessel's logbook by the observer. The sample size (n)

varies among the five parameters because sets with missing data were excluded, as were sets which had gear performance problems. Although the average speed of the vessel and sea state were frequently recorded by observers in the early 1990s, the parameters listed in Appendix 9 were the only data available from NORPAC in recent years for each observed fishery describing the general characteristics of the fishing operations in all hauls (sets). The purpose of the data in Appendix 9 was to provide comparative descriptive statistics for the general characteristics of the fisheries as a whole, and no attempt was made to analyze these parameters by spatial or temporal breakdowns.

All marine mammal species which were caught in nets in the BSAI flatfish trawl fishery during 1998-2004 were taken at locations with shallower depths than the mean average bottom depth of waters where the fishery operated, and all but three marine mammal takes (1 northern fur seal, 1 walrus, and 1 bearded seal) were taken by the BSAI flatfish trawl fishery in waters when gear was used at depths equal to or shallower than the median average fishing depth (Appendices 9 and 10). However, killer whales which died by collision with the ship's propeller were taken at locations with depths more than two times the median fishing or bottom depths of the waters where the fishery operated (Appendices 9 and 10). It is unclear whether the amount of hooks or pots deployed or duration of fishing in the longline and pot fisheries (Appendices 9 and 10) have any effects on the probability of a marine mammal becoming entangled. The size of the groundfish catch (weight) does not seem to have any relationship to the occurrence of marine mammal bycatch. These preliminary observations about patterns in the bycatch data have not been fully evaluated, and further analyses regarding any possible effects of the duration of sets, amount of fishing gear deployed, and fishing depth on marine mammal bycatch are beyond the scope of this report.

Depredation on the Groundfish Catch by Marine Mammals

Toothed whales feeding directly on hooked groundfish is the most common type of interaction between marine mammals and longline vessels. Five species of marine mammals

have been observed involved in these depredation interactions (Tables 3 and 9): northern fur seals, Steller sea lions, sperm whales, killer whales, and Dall's porpoises. The locations in Alaska waters where depredation on the groundfish catch by marine mammals were observed in 10 longline fisheries during 1998-2004 are shown in Figures 41-50.

The estimated average annual impact on the total longline fishery groundfish catch in sets subjected to marine mammal depredation ranged from 0.1% (by weight) in the GOA Pacific cod longline fishery to 22.3% in the GOA rockfish longline fishery (Table 9); however, the overall average annual depredation impact by marine mammals on the combined longline fisheries was estimated to be 2.2% of the total fishery groundfish catch during 1998-2004. The quantity of fish in metric tons actually consumed from the groundfish catch by marine mammals is significantly less than these estimates of the total weight of impacted sets, and the fish species taken from the hooks may not always be the fishery's target species. For example, in the BSAI Pacific cod longline fishery, killer whales usually select bycatch fish species such as Pacific halibut or Greenland turbot caught on the hooks instead of the fishery's target species, Pacific cod (Perez, in prep.).

Using information from dockside interviews with fishermen, Dahlheim (1988) suggested that killer whale depredation on sablefish in the longline fisheries in the southeastern Bering Sea and Prince William Sound occurred on 20% of the sets during winter months. Based on observed depredation incidents, nearly 4% of the total annual groundfish catch by the BSAI sablefish longline fishery during 1998-2004 was subjected to marine mammal depredation primarily from killer whales (Table 9). Except for January and February (Appendix 8), the BSAI sablefish longline fishery operated in a slightly larger area of the Bering Sea during 1998-2004 (Fig. 17; locations of killer whale depredation are shown in Fig. 45) than in the late 1980s (Dahlheim 1988); however, the GOA sablefish longline fishery did not occur in Prince William Sound during 1998-2004 (Fig. 21; locations of killer whale depredation are shown in Fig. 49). Steller sea lions, harbor seals, and killer whales have also been infrequently observed feeding on the catch from trawl gear, and killer whales have been observed feeding on the catch from pot

gear (Table 9); however, depredation by marine mammals on the groundfish catch from trawl or pot gear is essentially insignificant relative to the total annual groundfish catch in trawl or pot fisheries (Table 9).

Interactions involving depredation of the groundfish catch by marine mammals and deterrence of the mammals from the gear by crew members are not considered incidental take. In addition to moving the vessel, longline vessel crews have sometimes attempted to deter marine mammals such as killer whales and Steller sea lions from the proximity of the vessel by the use of several methods including electronic acoustic devices and explosive devices (i.e., seal bombs) to frighten the mammals from the catch. Deterrence will not be discussed further in this paper.

Most marine mammal depredation interactions do not result in incidental takes, but there are insufficient data to determine which marine mammals that were incidentally taken during 1998-2004 (Appendix 3) may have also fed on discards or from the groundfish catch before it was landed. The juvenile killer whale which was killed by collision with the ship's propeller on 1 August 1998 in area 517 during fishing by the BSAI flatfish trawl fishery may have been part of a pod of about 30 killer whales that was seen several times by the observer between 4 July and 6 August 1998 following the net as it was retrieved and also feeding on Greenland turbot discarded by the vessel. The frequency of observed depredation interactions by marine mammals on the groundfish catch during 1997-2004 and observed deterrence interactions by the crew will be further discussed by Perez (in prep.).

Table 10 lists pairs of groundfish fisheries in Alaska during 1998-2004 in which the same vessels participated in both fisheries on the same calendar date, and the total number of the same vessel fishing calendar days in both fisheries in which observers also saw predatory interactions by marine mammals. Predatory interactions by marine mammals were defined here as any of the following three types of interactions: 1) any type of depredation interaction of the marine mammal on the groundfish catch (not discards); 2) any method of deterrence, with or without devices, actively used by the crew to prevent the animal from interacting with the gear; and

3) repeated swimming by individual marine mammals near the fishing gear. Although the total number of the same vessel fishing days is small for most pairs of groundfish fisheries because there is only a small overlap of fishing days by the vessels amongst the fisheries (Appendix 11), these data do suggest that the same pods of killer whales and sperm whales frequent two or more of the longline fisheries at the same time to feed on groundfish caught on hooks. Because of these data and the observed predatory behavior of killer whales (Tables 9 and 10), all of the observed and estimated bycatch takes of killer whales in all groundfish fisheries, except the BSAI pollock trawl fishery, discussed in this paper have been (for the purposes of this report) assumed to be part of the Eastern North Pacific Alaska resident stock even though there were insufficient results of DNA analyses to confirm this. The killer whale taken by the BSAI Pacific cod longline fishery in 2003 was confirmed by DNA analyses to be a resident (M. Dahlheim, NMML, AFSC, pers. comm.). Because Table 10 indicates that some pods of killer whales encounter fishing gear from the same vessels of both the BSAI Greenland turbot and BSAI Pacific cod longline fisheries on the same days, it seems likely that resident killer whales are the most likely killer whales to interact with the BSAI Greenland turbot longline fishery. Killer whales taken by the BSAI pollock trawl fishery were assigned to the Eastern North Pacific, Gulf of Alaska, Aleutian Islands, and Bering Sea transient stock based on DNA analyses of tissue samples collected by observers (M. Dahlheim, NMML, AFSC, pers. comm.). However, it is still possible that killer whales of either stock could be taken at any time by any fishery if individual whales should interact with the vessels.

Identification of Catch Target Groundfish Species

There are some issues related to the identification of catch target groundfish species that are important for this analysis. One issue is the occurrence of "orphan" strata that occur when there is not a direct match between NORPAC and the CAS. This occurs because, occasionally, the fishing industry will report all catches from many vessels and multiple hauls for only one area and/or trip target date that may include NORPAC hauls for which the observer recorded

entries for adjacent areas or calendar days. Less than 0.4% of the total catch by all groundfish fisheries combined during 1998-2004 occurred in these "orphan" strata. Because many observed cruises are included in the CAS via industry logbook or plant data, it is not possible to completely cross-reference all NORPAC haul data within the CAS for strata matching purposes. In addition, some NORPAC source data in the CAS are based only on hauls which were not sampled for species composition, and the predominant target species in the hauls are unknown. In all of these cases, the target fishery is often identified in the CAS and in this analysis as a non-target (not one of the fisheries listed in Table 1) or "miscellaneous" fishery.

Another way in which a catch target could be identified as "miscellaneous" is because the groundfish catch has been subjected to depredation by marine mammals. Whales and otariids may selectively eat hooked groundfish species such as Greenland turbot, Pacific halibut, sablefish, or Pacific cod directly from the longline gear before the line is retrieved by the vessel. In such instances, there would be only empty hooks as the line was retrieved over the roller onto the vessel, and there would be no visible catch of these target groundfish species. Also, non-target fish species would sometimes be the predominant catch species in these sets. Thus, the size (total metric tons caught) of the "AK miscellaneous other finfish longline fishery" may be overestimated due to marine mammal depredation on the groundfish catch as evidenced by the high percentages of estimated annual average depredation by marine mammals in some longline fisheries (Table 9): the BSAI Greenland turbot longline fishery (12.3%), the GOA rockfish longline fishery (22.3%), and the AK miscellaneous other finfish longline fishery (13.1%). Less than 4% of observed longline sets during 1998-2004 were assigned "miscellaneous" targets (Table 1).

The definition of the target fisheries in this report depends directly on the intended catch target groundfish species codes assigned to the NORPAC data by the processes used by the AKR in the CAS database. The two databases need to have their corresponding counterparts matched by a set of computer algorithms to compare all of the NORPAC data to the CAS data for the same vessel, gear type, area, processing sector, IFQ or CDQ (community development quota)

codes, catch activity date, and trip target date in order to use these data in analyses of marine mammal bycatch rates based on ratio estimation procedures. Some errors may occur in this matching process (primarily due to "orphan" NORPAC strata as described above), as well as in the target assignment processes (steps **B** and **C**) used by the CAS.

The probable error rates in target species fishery assignments, as given by the percentages in column 6 ($C \neq B$ and $B = A$) and column 7 ($C \neq B$ and $C \neq A$ and $B \neq A$) of Appendix 1, indicate that some of the sets in several fisheries could be assigned to a different fishery, but there are no further data in either the NORPAC or CAS databases for the years 1998 to 2004 to resolve this problem. The following are the fisheries for which target species may have been misidentified for over 10% of the hauls (Appendix 1): the BSAI Pacific cod trawl fishery (23%), the BSAI rockfish trawl fishery (13%), the GOA Pacific cod trawl fishery (11%), the GOA rockfish trawl fishery (12%), the BSAI Pacific halibut longline fishery (18%), the BSAI rockfish longline fishery (16%), the BSAI sablefish longline fishery (27%), the GOA Pacific halibut longline fishery (12%), and the BS sablefish pot fishery (15%). By contrast, because analyses in this report used the weight of the groundfish catch to determine fishery effort, the following fisheries could have had target species misidentifications for more than 10% of the total weight of the groundfish catch (columns 6 and 7 of Appendix 2) in the CAS and/or NORPAC databases: the BSAI Pacific cod trawl fishery (28%), the GOA Pacific cod trawl fishery (13%), the BSAI Pacific halibut longline fishery (17%), the BSAI rockfish longline fishery (12%), the BSAI sablefish longline fishery (28%), the GOA rockfish longline fishery (20%), and the BS sablefish pot fishery (13%).

Appendix 11 lists the number of individual vessel fishing calendar days when fishing vessels (with observers aboard) of one groundfish fishery also participated in other groundfish fisheries of Alaska during 1998-2004. The percentage of the total vessel fishing calendar days in each fishery when it also participated in another fishery on the same date is also listed. The following fisheries overlapped by having the same vessels participate in both fisheries (in different sets) on the same observer days at least 5% of their total fishing time: 1) BSAI flatfish

trawl fishery and BSAI Pacific cod trawl fishery (5.3 vs. 8.4%); 2) GOA flatfish trawl fishery and GOA Pacific cod trawl fishery (6.6 vs. 9.9%); 3) BSAI sablefish longline fishery and BSAI Pacific halibut longline fishery (13.8 vs. 19.1%), and 4) GOA sablefish longline fishery and GOA Pacific halibut longline fishery (9.6 vs. 40.3%) (Appendix 11). The BSAI Greenland turbot longline fishery had vessels participating on at least 5% of its fishing days in the significantly larger BSAI Pacific cod longline fishery, but less than 1% of the total number of vessel fishing days in the BSAI Pacific cod longline fishery overlapped with the BSAI Greenland turbot longline fishery. As expected, most of the miscellaneous other finfish trawl, longline and pot fisheries had high percentages of overlapping vessel fishing days with the regulated fisheries. In some cases, these data on overlapping fishery vessel calendar days are due to the target assignment issues already discussed; however, some vessels in the groundfish fisheries may intentionally target two different fish species at nearby locations when both species are found on the same day.

There were three hauls (Appendix 3) with marine mammal bycatch during 1998-2004 which had different haul level and trip level targets in the CAS: 1) one haul in the BSAI flatfish trawl fishery (non-pelagic trawl (NPT) gear) in area 513 on 8 August 1998 with a harbor porpoise (killed by gear) that may have been set by the BSAI pollock trawl fishery; 2) one haul in the BSAI Pacific cod trawl (NPT) fishery in area 517 on 16 May 2003 with a harbor seal (killed by gear) that may have been set by the BSAI flatfish trawl fishery; and 3) one haul in the BSAI flatfish trawl (NPT) fishery in area 521 on 21 April 2004 with a killer whale (killed by a collision with the vessel's propeller) that may have been set by the BSAI Pacific cod trawl fishery. In all three instances the trip level target code for the NORPAC haul in the CAS database was used to categorize marine mammal bycatch by target fishery in estimation analyses. Twenty other hauls during 1998-2004 (Appendix 3) with miscellaneous incidental takes (e.g., one killer whale which was caught in a net in 2004 but released uninjured; one fur seal that climbed onto the ship in 1998 and left unharmed; decomposed animals, skulls, bones, and baleen plates) also had different haul level and trip level fishery targets in the CAS. The two

aforementioned problems with the data (NORPAC "orphan" strata and marine mammal depredation on the groundfish catch) are partial explanations for some of the mismatched target assignments, but they do not completely explain the error rates for existing data. Both the NORPAC and CAS databases should be improved by the NPGOP and AKR, respectively, to ensure that each observed trawl, longline, and pot set is assigned the same intended catch target groundfish species as its counterpart in the fishing industry's total catch reports to avoid mismatches when estimating marine mammal bycatch (or other bycatch such as seabirds and fish species).

Stratification

The original methodology to analyze marine mammal bycatch using ratio estimates for the foreign, joint venture, and domestic groundfish fisheries of Alaska from the 1970s to the 1990s was to pool all marine mammal and fishery data for an entire year within a specified fishery and region (or statistical area) before calculating bycatch rates and extrapolated bycatch from the aggregated data which was considered to be a single set of data (or solitary stratum). This was the procedure used by Perez and Loughlin (1991) and annually in NMFS memoranda summarizing marine mammal incidental take in the domestic groundfish fisheries of Alaska. Unfortunately, the estimates calculated independently for statistical areas did not always sum to equal the estimates for entire regions (e.g., BSAI and GOA) because: 1) the Blend database by its nature of being an averaged hybrid of NORPAC and fishing industry catch data meant that there would be discrepancies spatially and temporally between the tonnage totals for the observed and total fishery data unless they were accounted for in all required combinations of the data; 2) the datasets were analyzed independently for every combination of subgroups (strata) of the data; and 3) the extrapolated bycatch and/or variance calculated independently for entire regions were sometimes arithmetically different from the sum of the extrapolated bycatch and variance for each statistical area. This pooled data approach was necessary in the early years because of limited automatic data processing resources, but eventually it became possible to

stratify the effort data to sum the results of the independent strata internally within the computer algorithms so that the extrapolated bycatch and its variance were additive for all desired combinations of the data spatially and temporally. The marine mammal bycatch data for the domestic groundfish fisheries of Alaska during 1989 to 2001 were reanalyzed by Perez (2003) using stratification, and the categorization of the strata was similar to that used in concurrent analyses of seabird bycatch for the same fisheries. The present report continues this stratified data approach.

Comparison of Analyses by Stratified and Pooled Ratio Estimates

A simple comparison was made of the marine mammal bycatch data during 1998-2004 for three overlapping 5-year periods (1998-2002, 1999-2003, and 2000-2004) analyzed by both the original pooled dataset approach and the current stratified data method (Appendix 12). There were 80 analyses (combinations of marine mammal species, fisheries and 5-year periods) listed in Appendix 12 which had nonzero bycatch rates (i.e., there were observed takes in monitored sets). The Wilcoxon paired sample (signed ranks) test (Zar 1984) was used to compare the unrounded results from both the pooled dataset and stratified data methods ($n = 80$); the one-tail test null hypothesis was that results by the stratified data method were the same as or higher than corresponding results by the pooled method.

The extrapolated bycatch values (rounded to integers) calculated by the stratified data method listed in Appendix 12 were less than the corresponding extrapolated bycatch values calculated by the pooled dataset method for 39% (31) of the 80 analyses, and they were the same by both methods for 40% (32) of the analyses (Appendix 12). Thus, bycatch estimates were lower using the stratified data method ($Z_{.05(1)} = -2.684$; $P = 0.004$). The variance values (rounded to integers) of the extrapolated bycatch calculated by the stratified data method (Appendix 12) were less than the corresponding variance of the extrapolated bycatch values calculated by the pooled dataset method for 45% (36) of the 80 analyses, and they were the same by both methods for 24% (19) of the analyses. Thus, variance of the extrapolated bycatch was lower with the

stratified data method ($Z_{.05(1)} = -2.463$; $P = 0.007$). The CV values (rounded to 1 decimal place) using the stratified data method were lower than the corresponding CV values using the pooled dataset method for 38% (30) of the analyses, and they were similar with both methods for 35% (28) of the analyses (Appendix 12). However, generally, CVs were similar using either the pooled dataset or stratified data methods ($Z_{.05(2)} = -1.494$; $P = 0.135$).

Stratification of the ratio estimates does not exaggerate extrapolated takes versus the pooled dataset method, and the stratified data method generally yields more conservative, lower extrapolated bycatch estimates than the original pooled dataset method. The stratified method was used throughout this study also because it accounts for the actual statistical areas, processing sectors, and seasons when bycatch was observed and makes no implicit assumptions about similarity of bycatch rates in the unobserved areas and seasons.

In both approaches (stratified and pooled), datasets with marine mammal takes and either small amounts of total effort (tonnage) or low monitoring levels may have higher bycatch rate levels compared to rate values based on the same number of marine mammal takes in datasets with larger amounts of groundfish catch and/or high monitoring levels. In the stratified method, the bycatch rates and extrapolated bycatch are based on the primary strata selected for the study (such as those in Appendix 7) before summation to the total fishery. It may appear from the data in Appendix 12 that some values could be exaggerated by one method versus the other method, when in fact, the results are appropriate for each method. It must be cautioned that only one method may be used to discuss all marine mammal bycatch for all species and fisheries both spatially and temporally. Thus, although the results of the two analytical methods are presented in Appendix 12, only the results of the stratified data method have been considered as indicators of marine mammal bycatch throughout this report because this is considered to be the most appropriate method.

A problem with marine mammal bycatch estimation using ratio estimate methodology for the groundfish fisheries is the increasing percentage of observed (actually seen by observers) takes in unmonitored (randomly selected) hauls relative to the number of observed takes in

monitored hauls. Often the only take in a fishery or year occurred in an unmonitored set. This is a problem for both the stratified data and pooled dataset methods. The extrapolated bycatch methodology is supposed to account for these takes in the extrapolations, but when there are no observed takes in monitored sets, then there can be no extrapolated bycatch. Thus, in order to account for such takes in total estimates so as not to ignore or underestimate bycatch, it was necessary to add (with zero variance) these observed takes which occurred in unmonitored hauls to the total for the fishery when they were the only takes in a stratum (Appendix 7 and Tables 5-7).

A similar argument can be made with respect to takes seen only by the crew on observed cruises that are reported by the observers. Presumably, unless there are reasons to question the veracity of either the observer or the crew, these takes seen by the crew but reported by observers should be considered in the final total estimation process. Perez (2003) added such takes to the estimated, but not extrapolated, bycatch because there was a large number of such takes in the early 1990s and it was desirable to account for all known takes in the estimation process. However, it was decided in this study not to include such takes in the estimation process. During 1998-2004 there was a total of three bycatch takes seen only by the crew on observed cruises (Appendix 3): 1) one Steller sea lion mortality taken by the BSAI flatfish trawl fishery in area 513 during 1998; 2) one killer whale that was killed by the vessel's propeller in the BSAI flatfish trawl fishery in area 517 during 2001 in a monitored haul; and 3) one unidentified cetacean (presumably a baleen whale) with trailing gear taken by the BSAI pollock trawl fishery in area 521 during 2001. All three takes were not included in any analytical calculations in this study, and they were actually not accounted for in the estimated bycatch by the stratified method since they were not considered in any part of the analyses. For example, the killer whale take which was seen only by the crew is theoretically supposed to be accounted for in the extrapolated bycatch, but both the pooled dataset and stratified data methods underestimated the total killer whale bycatch take for 2000-2004 because the estimated bycatch (stratified data method) was 3.3 whales, but four were actually reported by observers (Appendices 3 and 12). Therefore, lack

of consideration of all known takes (whether seen only by observers and/or crew) during the analytical process can sometimes lead to underestimation. NMML will investigate whether changes in analytical procedures can occur to allow takes witnessed only by the crew to be incorporated in some manner.

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Table 1.—Previous and current designations in the List of Fisheries (LOF) of the federally regulated and observed trawl, longline/set (hook and line), and pot gear groundfish fisheries of Alaska (AK) in the U.S. Exclusive Economic Zone in the Bering Sea (BS), Aleutian Islands region (AI), and Gulf of Alaska (GOA).

Previous LOF designations ^a	Current LOF designations ^b
Trawl Gear Fisheries	
AK BSAI groundfish trawl fishery	AK BSAI Atka mackerel trawl fishery AK BSAI flatfish trawl fishery AK BSAI Pacific cod trawl fishery AK BSAI pollock trawl fishery AK BSAI rockfish trawl fishery
AK GOA groundfish trawl fishery	AK GOA flatfish trawl fishery AK GOA Pacific cod trawl fishery AK GOA pollock trawl fishery AK GOA rockfish trawl fishery
Longline/Set (Hook and Line) Gear Fisheries	
AK BSAI groundfish longline/set line fishery (federally regulated waters, including miscellaneous finfish and sablefish)	AK BSAI Greenland turbot longline fishery AK BSAI Pacific cod longline fishery AK BSAI Pacific halibut longline fishery ^c AK BSAI rockfish longline fishery AK BSAI sablefish longline fishery
AK GOA groundfish longline/set line fishery (federally regulated waters, including miscellaneous finfish and sablefish)	AK GOA Pacific cod longline fishery AK GOA Pacific halibut longline fishery ^c AK GOA rockfish longline fishery AK GOA sablefish longline fishery
Pot Gear Fisheries	
AK BS and GOA finfish pot fishery	AK BSAI Pacific cod pot fishery AK BS sablefish pot fishery AK AI sablefish pot fishery AK GOA Pacific cod pot fishery

^a 63 FR 5748, 4 February 1998; 64 FR 9067, 24 February 1999; 65 FR 24448, 26 April 2000; 66 FR 42780, 15 August 2001; 67 FR 2410, 17 January 2002; 68 FR 41725, 15 July 2003.

^b 69 FR 48407, 10 August 2004; 69 FR 70094, 2 December 2004.

^c This fishery is essentially an IFQ (individual fishing quota) fishery.

Table 2.—Total number of vessels ^a, days ^b, and hauls (sets) monitored for marine mammal bycatch by U.S. observers aboard fishing vessels of the groundfish fisheries in the U.S. Exclusive Economic Zone off Alaska during 1998-2004 by fishery, region and year. The total numbers of vessels, days and hauls with marine mammal interactions ^c are also listed.

Fishery Region Year	Vessel coverage		Effort by fishing days		Effort by gear deployment ^d		
	Number of fishing vessels with observers	Number of fishing vessels with marine mammal interactions	Number of fishing days on vessel cruises with observers	Number of fishing days with marine mammal interactions	Total number of hauls on vessel cruises with observers	Number of hauls monitored by observers	Number of hauls with marine mammal interactions
Trawl gear fisheries							
BSAI Atka mackerel trawl fishery							
Bering Sea region only ^e							
1998	15	0	26	0	45	32	0
1999	11	2	46	2	191	136	3
2000	7	0	8	0	18	9	0
2001	1	0	1	0	1	1	0
2002	3	0	4	0	6	4	0
2003	7	1	19	1	64	29	1
2004	11	0	33	0	102	68	0
Aleutian Islands region only ^f							
1998	14	2	567	3	1,459	921	3
1999	11	4	557	5	1,422	1,052	5
2000	9	1	466	1	1,160	958	1
2001	9	2	568	3	1,351	1,070	3
2002	10	1	392	1	993	972	1
2003	10	1	468	2	1,163	1,123	2
2004	11	2	489	3	1,157	1,098	3
BSAI (areas combined)							
1998	22	2	592	3	1,504	953	3
1999	17	6	603	7	1,613	1,188	8
2000	12	1	474	1	1,178	967	1
2001	9	2	569	3	1,352	1,071	3
2002	12	1	396	1	999	976	1
2003	15	2	487	3	1,227	1,152	3
2004	20	2	522	3	1,259	1,166	3
BSAI flatfish trawl fishery							
Bering Sea region only ^e							
1998	47	16	2,819	48	11,610	6,885	52
1999	32	18	2,165	34	9,154	5,703	42
2000	42	16	2,790	53	11,553	6,945	57
2001	26	13	2,370	30	9,875	5,414	31
2002	26	14	2,346	31	10,071	5,783	34
2003	27	11	1,920	14	8,023	5,066	14
2004	29	15	2,014	47	7,997	5,061	62
Aleutian Islands region only ^f							
1998	4	0	10	0	17	11	0
1999	5	0	11	0	14	11	0
2000	0	-	-	-	-	-	-
2001	0	-	-	-	-	-	-
2002	1	0	1	0	1	1	0
2003	0	-	-	-	-	-	-
2004	0	-	-	-	-	-	-

Table 2.--Continued.

Fishery Region Year	Vessel coverage		Effort by fishing days		Effort by gear deployment ^d		
	Number of fishing vessels with observers	Number of fishing vessels with marine mammal interactions	Number of fishing days on vessel cruises with observers	Number of fishing days with marine mammal interactions	Total number of hauls on vessel cruises with observers	Number of hauls monitored by observers	Number of hauls with marine mammal interactions
Trawl gear fisheries (continued)							
BSAI flatfish trawl fishery (continued)							
BSAI (areas combined)							
1998	47	16	2,829	48	11,627	6,896	52
1999	34	18	2,176	34	9,168	5,714	42
2000	42	16	2,790	53	11,553	6,945	57
2001	26	13	2,370	30	9,875	5,414	31
2002	26	14	2,347	31	10,072	5,784	34
2003	27	11	1,920	14	8,023	5,066	14
2004	29	15	2,014	47	7,997	5,061	62
BSAI Pacific cod trawl fishery							
Bering Sea region only ^e							
1998	103	4	1,315	6	3,191	2,714	6
1999	89	2	1,164	2	2,969	2,407	2
2000	106	4	1,227	4	2,918	2,397	4
2001	73	2	897	3	2,310	1,872	5
2002	74	2	996	3	2,660	2,186	3
2003	76	4	1,226	6	3,977	2,871	6
2004	73	8	1,283	9	4,827	3,261	9
Aleutian Islands region only ^f							
1998	23	0	287	0	932	669	0
1999	16	3	210	3	706	575	3
2000	31	2	362	4	1,067	889	4
2001	22	0	281	0	802	632	0
2002	26	1	426	1	1,240	1,027	1
2003	30	1	439	1	1,324	1,133	1
2004	23	1	347	1	1,051	842	1
BSAI (areas combined)							
1998	107	4	1,599	6	4,123	3,383	6
1999	93	5	1,373	5	3,675	2,982	5
2000	109	6	1,588	8	3,985	3,286	8
2001	82	2	1,178	3	3,112	2,504	5
2002	83	3	1,422	4	3,900	3,213	4
2003	86	5	1,665	7	5,301	4,004	7
2004	85	9	1,630	10	5,878	4,103	10
BSAI pollock trawl fishery							
Bering Sea region only ^e							
1998	121	12	5,189	18	16,249	11,703	18
1999	119	12	4,237	14	12,464	10,181	14
2000	125	17	5,033	17	14,437	12,380	19
2001	119	17	5,438	27	16,286	14,482	28
2002	125	10	5,232	13	15,929	14,325	13
2003	117	9	5,182	12	15,926	14,587	13
2004	114	10	5,214	15	16,087	14,545	15

Table 2.--Continued.

Fishery Region Year	Vessel coverage		Effort by fishing days		Effort by gear deployment ^d		
	Number of fishing vessels with observers	Number of fishing vessels with marine mammal interactions	Number of fishing days on vessel cruises with observers	Number of fishing days with marine mammal interactions	Total number of hauls on vessel cruises with observers	Number of hauls monitored by observers	Number of hauls with marine mammal interactions
Trawl gear fisheries (continued)							
BSAI pollock trawl fishery (continued)							
Aleutian Islands region only ^f							
1998	20	0	97	0	214	194	0
1999	4	0	7	0	9	6	0
2000	3	0	3	0	3	3	0
2001	1	0	1	0	1	1	0
2002	0	-	-	-	-	-	-
2003	0	-	-	-	-	-	-
2004	0	-	-	-	-	-	-
BSAI (areas combined)							
1998	121	12	5,283	18	16,463	11,897	18
1999	119	12	4,244	14	12,473	10,187	14
2000	125	17	5,036	17	14,440	12,383	19
2001	119	17	5,439	27	16,287	14,483	28
2002	125	10	5,232	13	15,929	14,325	13
2003	117	9	5,182	12	15,926	14,587	13
2004	114	10	5,214	15	16,087	14,545	15
BSAI rockfish trawl fishery							
Bering Sea region only ^e							
1998	5	0	12	0	34	20	0
1999	10	0	14	0	29	15	0
2000	6	0	13	0	23	19	0
2001	6	0	10	0	22	10	0
2002	5	0	10	0	15	12	0
2003	4	0	5	0	15	9	0
2004	6	0	8	0	11	9	0
Aleutian Islands region only ^f							
1998	10	0	95	0	183	152	0
1999	9	0	121	0	235	202	0
2000	7	0	92	0	229	180	0
2001	8	0	78	0	220	135	0
2002	7	0	94	0	246	186	0
2003	8	0	114	0	280	236	0
2004	6	0	64	0	160	144	0
BSAI (areas combined)							
1998	12	0	107	0	217	172	0
1999	16	0	135	0	264	217	0
2000	11	0	103	0	252	199	0
2001	13	0	88	0	242	145	0
2002	12	0	104	0	261	198	0
2003	11	0	119	0	295	245	0
2004	11	0	72	0	171	153	0

Table 2.--Continued.

Fishery Region Year	Vessel coverage		Effort by fishing days		Effort by gear deployment ^d		
	Number of fishing vessels with observers	Number of fishing vessels with marine mammal interactions	Number of fishing days on vessel cruises with observers	Number of fishing days with marine mammal interactions	Total number of hauls on vessel cruises with observers	Number of hauls monitored by observers	Number of hauls with marine mammal interactions
Trawl gear fisheries (continued)							
GOA flatfish trawl fishery							
Gulf of Alaska (areas at and west of 140°W longitude) ^g							
1998	55	1	509	1	1,760	1,188	1
1999	40	0	338	0	1,403	855	0
2000	49	4	583	6	2,029	1,393	6
2001	55	1	551	1	1,632	1,143	1
2002	43	1	631	1	2,281	1,524	1
2003	41	2	668	2	2,765	1,804	2
2004	33	1	289	1	847	635	1
Gulf of Alaska (areas east of 140°W longitude) ^h and southeast Alaska							
1998	0	-	-	-	-	-	-
1999	0	-	-	-	-	-	-
2000	0	-	-	-	-	-	-
2001	0	-	-	-	-	-	-
2002	0	-	-	-	-	-	-
2003	0	-	-	-	-	-	-
2004	0	-	-	-	-	-	-
GOA Pacific cod trawl fishery							
Gulf of Alaska (areas at and west of 140°W longitude) ^g							
1998	76	0	514	0	1,303	1,089	0
1999	66	0	446	0	1,060	898	0
2000	50	0	266	0	532	478	0
2001	60	1	417	1	895	733	1
2002	53	0	292	0	533	488	0
2003	48	0	209	0	434	399	0
2004	43	1	226	1	562	458	1
Gulf of Alaska (areas east of 140°W longitude) ^h and southeast Alaska							
1998	0	-	-	-	-	-	-
1999	0	-	-	-	-	-	-
2000	0	-	-	-	-	-	-
2001	0	-	-	-	-	-	-
2002	0	-	-	-	-	-	-
2003	0	-	-	-	-	-	-
2004	0	-	-	-	-	-	-
GOA pollock trawl fishery							
Gulf of Alaska (areas at and west of 140°W longitude) ^g							
1998	98	1	901	2	1,473	1,381	2
1999	90	1	678	1	1,024	947	1
2000	59	1	503	1	753	734	1
2001	59	1	446	1	641	608	1
2002	50 ⁱ	0	417 ⁱ	0	615 ⁱ	577 ⁱ	0
2003	46	2	335	2	509	492	2
2004	47	0	367	0	538	510	0

Table 2.--Continued.

Fishery Region Year	Vessel coverage		Effort by fishing days		Effort by gear deployment ^d		
	Number of fishing vessels with observers	Number of fishing vessels with marine mammal interactions	Number of fishing days on vessel cruises with observers	Number of fishing days with marine mammal interactions	Total number of hauls on vessel cruises with observers	Number of hauls monitored by observers	Number of hauls with marine mammal interactions
Trawl gear fisheries (continued)							
GOA pollock trawl fishery (continued)							
Gulf of Alaska (areas east of 140°W longitude) ^b and southeast Alaska							
1998	0	-	-	-	-	-	-
1999	0	-	-	-	-	-	-
2000	0	-	-	-	-	-	-
2001	0	-	-	-	-	-	-
2002	0	-	-	-	-	-	-
2003	0	-	-	-	-	-	-
2004	0	-	-	-	-	-	-
GOA rockfish trawl fishery							
Gulf of Alaska (areas at and west of 140°W longitude) ^g							
1998	41	0	268	0	968	681	0
1999	43	2	300	2	1,016	680	2
2000	40	1	269	1	857	677	1
2001	45	0	277	0	853	629	0
2002	42	0	242	0	762	507	0
2003	41	0	301	0	1,055	810	0
2004	43	1	271	1	931	675	1
Gulf of Alaska (areas east of 140°W longitude) ^b and southeast Alaska							
1998	0	-	-	-	-	-	-
1999	0	-	-	-	-	-	-
2000	0	-	-	-	-	-	-
2001	0	-	-	-	-	-	-
2002	0	-	-	-	-	-	-
2003	0	-	-	-	-	-	-
2004	0	-	-	-	-	-	-
AK miscellaneous other finfish trawl fishery							
Bering Sea region only ^e							
1998	20	1	34	1	58	39	1
1999	15	0	34	0	58	35	0
2000	13	0	34	0	69	38	0
2001	9	0	24	0	55	32	0
2002	8	0	15	0	36	14	0
2003	4	0	9	0	23	16	0
2004	5	0	12	0	31	21	0
Aleutian Islands region only ^f							
1998	1	0	1	0	1	0	0
1999	1	0	1	0	1	1	0
2000	0	-	-	-	-	-	-
2001	2	0	3	0	3	3	0
2002	0	-	-	-	-	-	-
2003	0	-	-	-	-	-	-
2004	0	-	-	-	-	-	-

Table 2.--Continued.

Fishery Region Year	Vessel coverage		Effort by fishing days		Effort by gear deployment ^d		
	Number of fishing vessels with observers	Number of fishing vessels with marine mammal interactions	Number of fishing days on vessel cruises with observers	Number of fishing days with marine mammal interactions	Total number of hauls on vessel cruises with observers	Number of hauls monitored by observers	Number of hauls with marine mammal interactions
Trawl gear fisheries (continued)							
AK miscellaneous other finfish trawl fishery (continued)							
Gulf of Alaska (areas at and west of 140°W longitude) ^g							
1998	20	0	49	0	78	56	0
1999	10	0	23	0	36	28	0
2000	16	0	24	0	38	32	0
2001	20	0	29	0	43	32	0
2002	17	0	25	0	45	34	0
2003	6	0	33	0	102	94	0
2004	3	0	9	0	22	20	0
Gulf of Alaska (areas east of 140°W longitude) ^h and southeast Alaska							
1998	0	-	-	-	-	-	-
1999	0	-	-	-	-	-	-
2000	0	-	-	-	-	-	-
2001	0	-	-	-	-	-	-
2002	0	-	-	-	-	-	-
2003	0	-	-	-	-	-	-
2004	0	-	-	-	-	-	-
Alaska (all areas combined)							
1998	37	1	84	1	137	95	1
1999	23	0	58	0	95	64	0
2000	28	0	58	0	107	70	0
2001	29	0	56	0	101	67	0
2002	24	0	40	0	81	48	0
2003	10	0	42	0	125	110	0
2004	8	0	21	0	53	41	0
Longline gear fisheries							
BSAI Greenland turbot longline fishery							
Bering Sea region only ^e							
1998	34	24	569	108	1,169	904	155
1999	33	25	420	89	962	682	140
2000	33	26	432	186	868	751	276
2001	18	15	229	64	460	380	92
2002	13	7	246	36	558	431	43
2003	14	9	279	45	688	538	71
2004	12	10	221	36	505	401	51
Aleutian Islands region only ^f							
1998	9	4	104	5	246	191	7
1999	11	4	84	9	178	146	12
2000	18	8	139	18	324	252	29
2001	7	0	50	0	125	88	0
2002	7	1	25	1	56	51	1
2003	5	1	22	1	73	49	2
2004	2	0	36	0	119	71	0

Table 2.--Continued.

Fishery Region Year	Vessel coverage		Effort by fishing days		Effort by gear deployment ^d		
	Number of fishing vessels with observers	Number of fishing vessels with marine mammal interactions	Number of fishing days on vessel cruises with observers	Number of fishing days with marine mammal interactions	Total number of hauls on vessel cruises with observers	Number of hauls monitored by observers	Number of hauls with marine mammal interactions
Longline gear fisheries (continued)							
BSAI Greenland turbot longline fishery (continued)							
BSAI (areas combined)							
1998	36	28	672	113	1,415	1,095	162
1999	35	29	504	98	1,140	828	152
2000	37	34	570	204	1,192	1,003	305
2001	23	15	279	64	585	468	92
2002	16	8	271	37	614	482	44
2003	15	10	301	46	761	587	73
2004	13	10	257	36	624	472	51
BSAI Pacific cod longline fishery							
Bering Sea region only ^e							
1998	38	24	3,848	84	10,004	7,321	103
1999	43	23	3,624	99	10,072	7,436	112
2000	41	34	4,117	186	12,037	8,407	259
2001	42	30	4,601	90	13,846	9,242	113
2002	42	28	4,881	65	14,582	9,950	74
2003	39	26	5,815	69	17,723	12,723	79
2004	39	21	5,480	56	16,231	10,916	79
Aleutian Islands region only ^f							
1998	15	7	704	29	2,821	1,896	33
1999	19	5	352	15	1,324	760	17
2000	29	9	730	15	2,971	2,110	17
2001	22	1	1,004	2	4,363	2,660	2
2002	15	1	183	2	836	677	3
2003	6	3	75	3	395	228	5
2004	6	0	181	0	891	559	0
BSAI (areas combined)							
1998	38	31	4,548	113	12,825	9,217	136
1999	46	28	3,976	114	11,396	8,196	129
2000	46	43	4,847	201	15,008	10,517	276
2001	47	31	5,604	92	18,209	11,902	115
2002	44	29	5,064	67	15,418	10,627	77
2003	39	29	5,890	72	18,118	12,951	84
2004	39	21	5,661	56	17,122	11,475	79
BSAI Pacific halibut longline fishery							
Bering Sea region only ^e							
1998	15	2	46	5	76	64	6
1999	19	8	54	11	95	86	13
2000	20	8	76	14	128	110	19
2001	11	4	46	8	93	87	9
2002	7	5	32	8	61	60	12
2003	8	4	69	8	169	165	10
2004	10	4	59	16	121	108	30

Table 2.--Continued.

Fishery Region Year	Vessel coverage		Effort by fishing days		Effort by gear deployment ^d		
	Number of fishing vessels with observers	Number of fishing vessels with marine mammal interactions	Number of fishing days on vessel cruises with observers	Number of fishing days with marine mammal interactions	Total number of hauls on vessel cruises with observers	Number of hauls monitored by observers	Number of hauls with marine mammal interactions
Longline gear fisheries (continued)							
BSAI Pacific halibut longline fishery (continued)							
Aleutian Islands region only ^f							
1998	7	1	15	1	21	18	1
1999	14	3	79	5	126	120	6
2000	15	5	101	5	181	156	9
2001	11	4	68	4	112	92	5
2002	14	2	69	2	107	94	2
2003	7	3	78	4	212	182	7
2004	5	2	42	2	134	100	2
BSAI (areas combined)							
1998	18	3	61	6	97	82	7
1999	25	11	133	16	221	206	19
2000	25	13	177	19	309	266	28
2001	18	8	114	12	205	179	14
2002	19	7	101	10	168	154	14
2003	12	7	146	12	381	347	17
2004	13	6	101	18	255	208	32
BSAI rockfish longline fishery							
Bering Sea region only ^e							
1998	3	2	10	3	19	16	4
1999	3	3	4	3	4	4	3
2000	1	0	1	0	1	1	0
2001	2	2	2	2	2	2	2
2002	0	-	-	-	-	-	-
2003	2	2	2	2	3	3	3
2004	2	2	6	5	10	9	8
Aleutian Islands region only ^f							
1998	3	0	3	0	5	4	0
1999	7	1	14	1	16	16	1
2000	13	0	28	0	38	35	0
2001	8	0	13	0	27	14	0
2002	7	0	18	0	28	24	0
2003	0	-	-	-	-	-	-
2004	0	-	-	-	-	-	-
BSAI (areas combined)							
1998	5	2	13	3	24	20	4
1999	9	4	18	4	20	20	4
2000	13	0	29	0	39	36	0
2001	10	2	15	2	29	16	2
2002	7	0	18	0	28	24	0
2003	2	2	2	2	3	3	3
2004	2	2	6	5	10	9	8

Table 2.--Continued.

Fishery Region Year	Vessel coverage		Effort by fishing days		Effort by gear deployment ^d		
	Number of fishing vessels with observers	Number of fishing vessels with marine mammal interactions	Number of fishing days on vessel cruises with observers	Number of fishing days with marine mammal interactions	Total number of hauls on vessel cruises with observers	Number of hauls monitored by observers	Number of hauls with marine mammal interactions
Longline gear fisheries (continued)							
BSAI sablefish longline fishery							
Bering Sea region only ^e							
1998	8	2	24	2	45	34	2
1999	13	5	35	11	62	47	15
2000	11	4	23	5	33	28	8
2001	8	3	10	3	18	13	4
2002	7	5	14	7	21	19	9
2003	2	1	7	2	20	12	3
2004	2	2	5	3	10	9	4
Aleutian Islands region only ^f							
1998	11	6	77	11	158	125	14
1999	19	5	204	9	439	371	16
2000	18	6	192	11	414	349	13
2001	13	5	138	6	280	245	9
2002	14	2	194	3	456	419	4
2003	7	1	109	1	330	215	1
2004	5	3	118	7	314	230	10
BSAI (areas combined)							
1998	17	8	101	13	203	159	16
1999	25	10	239	20	501	418	31
2000	25	10	215	16	447	377	21
2001	15	8	148	9	298	258	13
2002	19	7	208	10	477	438	13
2003	8	2	116	3	350	227	4
2004	7	5	123	10	324	239	14
GOA Pacific cod longline fishery							
Gulf of Alaska (areas at and west of 140°W longitude) ^g							
1998	15	0	61	0	136	104	0
1999	23	1	107	1	290	214	1
2000	16	1	106	1	343	225	1
2001	12	0	129	0	413	248	0
2002	18	0	242	0	855	471	0
2003	13	0	172	0	627	396	0
2004	13	0	171	0	593	367	0
Gulf of Alaska (areas east of 140°W longitude) ^h and southeast Alaska							
1998	0	-	-	-	-	-	-
1999	0	-	-	-	-	-	-
2000	0	-	-	-	-	-	-
2001	0	-	-	-	-	-	-
2002	0	-	-	-	-	-	-
2003	0	-	-	-	-	-	-
2004	0	-	-	-	-	-	-

Table 2.--Continued.

Fishery Region Year	Vessel coverage		Effort by fishing days		Effort by gear deployment ^d		
	Number of fishing vessels with observers	Number of fishing vessels with marine mammal interactions	Number of fishing days on vessel cruises with observers	Number of fishing days with marine mammal interactions	Total number of hauls on vessel cruises with observers	Number of hauls monitored by observers	Number of hauls with marine mammal interactions
Longline gear fisheries (continued)							
GOA Pacific halibut longline fishery							
Gulf of Alaska (areas at and west of 140°W longitude) ^g							
1998	28	1	93	1	142	125	1
1999	33	2	133	2	232	202	2
2000	40	2	134	5	244	204	8
2001	36	4	130	5	263	220	7
2002	29	3	144	3	304	232	3
2003	13	0	91	0	242	206	0
2004	18	4	102	4	276	203	6
Gulf of Alaska (areas east of 140°W longitude) ^h and southeast Alaska							
1998	8	0	14	0	26	20	0
1999	8	0	9	0	14	14	0
2000	8	0	11	0	18	17	0
2001	6	0	9	0	12	11	0
2002	7	2	10	2	13	11	3
2003	0	-	-	-	-	-	-
2004	2	1	12	1	19	18	1
GOA (areas combined)							
1998	34	1	107	1	168	145	1
1999	36	2	142	2	246	216	2
2000	43	2	145	5	262	221	8
2001	40	4	139	5	275	231	7
2002	32	5	154	5	317	243	6
2003	13	0	91	0	242	206	0
2004	20	5	114	5	295	221	7
GOA rockfish longline fishery							
Gulf of Alaska (areas at and west of 140°W longitude) ^g							
1998	2	0	2	0	2	2	0
1999	2	0	2	0	2	2	0
2000	1	0	1	0	1	1	0
2001	5	3	6	3	9	8	4
2002	7	2	11	2	15	11	3
2003	0	-	-	-	-	-	-
2004	0	-	-	-	-	-	-
Gulf of Alaska (areas east of 140°W longitude) ^h and southeast Alaska							
1998	1	0	3	0	3	2	0
1999	4	0	4	0	4	4	0
2000	0	-	-	-	-	-	-
2001	4	1	5	1	5	5	1
2002	0	-	-	-	-	-	-
2003	0	-	-	-	-	-	-
2004	0	-	-	-	-	-	-

Table 2.--Continued.

Fishery Region Year	Vessel coverage		Effort by fishing days		Effort by gear deployment ^d		
	Number of fishing vessels with observers	Number of fishing vessels with marine mammal interactions	Number of fishing days on vessel cruises with observers	Number of fishing days with marine mammal interactions	Total number of hauls on vessel cruises with observers	Number of hauls monitored by observers	Number of hauls with marine mammal interactions
Longline gear fisheries (continued)							
GOA rockfish longline fishery (continued)							
GOA (areas combined)							
1998	3	0	5	0	5	4	0
1999	6	0	6	0	6	6	0
2000	1	0	1	0	1	1	0
2001	9	4	11	4	14	13	5
2002	7	2	11	2	15	11	3
2003	0	-	-	-	-	-	-
2004	0	-	-	-	-	-	-
GOA sablefish longline fishery							
Gulf of Alaska (areas at and west of 140°W longitude) ^e							
1998	53	17	424	39	1,103	905	60
1999	53	15	363	28	907	760	34
2000	53	25	466	64	1,091	909	102
2001	51	20	436	36	1,095	907	47
2002	45	17	453	35	1,126	893	49
2003	49	14	533	31	1,545	1,207	45
2004	43	20	489	38	1,382	997	67
Gulf of Alaska (areas east of 140°W longitude) ^h and southeast Alaska							
1998	30	4	84	8	180	160	13
1999	24	7	75	17	172	149	27
2000	24	10	82	17	214	167	29
2001	23	1	80	1	200	177	1
2002	22	8	80	16	185	159	29
2003	28	6	89	7	218	185	7
2004	24	3	85	3	233	188	5
GOA (areas combined)							
1998	66	21	508	47	1,283	1,065	73
1999	58	22	436	45	1,079	909	61
2000	60	35	547	80	1,305	1,076	131
2001	58	21	515	37	1,295	1,084	48
2002	51	25	533	51	1,311	1,052	78
2003	58	20	621	38	1,763	1,392	52
2004	49	23	574	41	1,615	1,185	72
AK miscellaneous other finfish longline fishery							
Bering Sea region only ^e							
1998	14	4	42	6	67	43	9
1999	18	7	69	11	140	110	17
2000	18	8	48	13	74	66	22
2001	19	5	43	12	56	51	14
2002	14	2	28	3	45	37	4
2003	4	1	5	1	9	7	2
2004	7	1	14	1	32	21	2

Table 2.--Continued.

Fishery Region Year	Vessel coverage		Effort by fishing days		Effort by gear deployment ^d		
	Number of fishing vessels with observers	Number of fishing vessels with marine mammal interactions	Number of fishing days on vessel cruises with observers	Number of fishing days with marine mammal interactions	Total number of hauls on vessel cruises with observers	Number of hauls monitored by observers	Number of hauls with marine mammal interactions
Longline gear fisheries (continued)							
AK miscellaneous other finfish longline fishery (continued)							
Aleutian Islands region only ^f							
1998	8	3	16	4	20	18	5
1999	6	1	18	1	25	23	1
2000	13	1	41	1	63	53	1
2001	13	2	28	2	53	40	2
2002	5	1	11	2	17	16	3
2003	1	0	2	0	6	4	0
2004	1	0	12	0	35	18	0
Gulf of Alaska (areas at and west of 140°W longitude) ^g							
1998	9	0	13	0	18	16	0
1999	3	0	3	0	3	3	0
2000	6	0	12	0	18	11	0
2001	8	2	11	2	11	10	2
2002	6	1	7	1	7	7	1
2003	2	0	5	0	14	12	0
2004	2	0	4	0	8	4	0
Gulf of Alaska (areas east of 140°W longitude) ^h and southeast Alaska							
1998	2	0	3	0	4	4	0
1999	2	0	6	0	6	6	0
2000	2	0	3	0	7	4	0
2001	2	0	3	0	3	3	0
2002	1	0	1	0	2	1	0
2003	0	-	-	-	-	-	-
2004	0	-	-	-	-	-	-
Alaska (all areas combined)							
1998	29	7	74	10	109	81	14
1999	26	8	96	12	174	142	18
2000	30	9	104	14	162	134	23
2001	31	9	85	16	123	104	18
2002	23	4	47	6	71	61	8
2003	7	1	12	1	29	23	2
2004	8	1	30	1	75	43	2
Pot gear fisheries							
BSAI Pacific cod pot fishery							
Bering Sea region only ^e							
1998	48	1	537	1	1,131	933	1
1999	66	0	542	0	1,206	1,022	0
2000	56	0	492	0	950	751	0
2001	57	0	556	0	1,017	887	0
2002	50	0	519	0	908	718	0
2003	56	0	500	0	988	811	0
2004	50	0	394	0	716	580	0

Table 2.--Continued.

Fishery Region Year	Vessel coverage		Effort by fishing days		Effort by gear deployment ^d		
	Number of fishing vessels with observers	Number of fishing vessels with marine mammal interactions	Number of fishing days on vessel cruises with observers	Number of fishing days with marine mammal interactions	Total number of hauls on vessel cruises with observers	Number of hauls monitored by observers	Number of hauls with marine mammal interactions
Pot gear fisheries (continued)							
BSAI Pacific cod pot fishery (continued)							
Aleutian Islands region only ^f							
1998	2	0	27	0	44	43	0
1999	27	1	305	1	1,049	758	1
2000	13	0	103	0	263	194	0
2001	2	0	72	0	341	191	0
2002	0	-	-	-	-	-	-
2003	0	-	-	-	-	-	-
2004	0	-	-	-	-	-	-
BSAI (areas combined)							
1998	50	1	564	1	1,175	976	1
1999	87	1	847	1	2,255	1,780	1
2000	63	0	595	0	1,213	945	0
2001	58	0	628	0	1,358	1,078	0
2002	50	0	519	0	908	718	0
2003	56	0	500	0	988	811	0
2004	50	0	394	0	716	580	0
BS sablefish pot fishery							
Bering Sea region only ^e							
1998	2	0	8	0	17	17	0
1999	3	0	12	0	29	28	0
2000	4	1	37	1	60	54	1
2001	3	0	32	0	66	64	0
2002	7	2	117	4	346	313	4
2003	6	0	107	0	396	374	0
2004	7	0	220	0	723	696	0
AI sablefish pot fishery							
Aleutian Islands region only ^f							
1998	1	0	1	0	1	1	0
1999	3	0	8	0	13	12	0
2000	3	0	55	0	125	117	0
2001	2	0	82	0	221	198	0
2002	2	0	81	0	248	218	0
2003	6	0	160	0	412	396	0
2004	5	0	88	0	192	187	0
GOA Pacific cod pot fishery							
Gulf of Alaska (areas at and west of 140°W longitude) ^g							
1998	29	1	213	1	515	420	1
1999	47	1	375	1	844	703	1
2000	46	0	418	0	861	706	0
2001	21	0	183	0	548	383	0
2002	24	0	172	0	530	374	0
2003	19	0	137	0	365	302	0
2004	25	0	192	0	419	351	0

Table 2.--Continued.

Fishery Region Year	Vessel coverage		Effort by fishing days		Effort by gear deployment ^d		
	Number of fishing vessels with observers	Number of fishing vessels with marine mammal interactions	Number of fishing days on vessel cruises with observers	Number of fishing days with marine mammal interactions	Total number of hauls on vessel cruises with observers	Number of hauls monitored by observers	Number of hauls with marine mammal interactions
Pot gear fisheries (continued)							
GOA Pacific cod pot fishery (continued)							
Gulf of Alaska (areas east of 140°W longitude) ^b and southeast Alaska							
1998	0	-	-	-	-	-	-
1999	0	-	-	-	-	-	-
2000	0	-	-	-	-	-	-
2001	1	0	1	0	1	1	0
2002	0	-	-	-	-	-	-
2003	0	-	-	-	-	-	-
2004	0	-	-	-	-	-	-
GOA (areas combined)							
1998	29	1	213	1	515	420	1
1999	47	1	375	1	844	703	1
2000	46	0	418	0	861	706	0
2001	21	0	184	0	549	384	0
2002	24	0	172	0	530	374	0
2003	19	0	137	0	365	302	0
2004	25	0	192	0	419	351	0
AK miscellaneous other finfish pot fishery							
Bering Sea region only ^e							
1998	6	0	8	0	8	8	0
1999	1	0	1	0	2	2	0
2000	3	0	14	0	31	31	0
2001	3	0	6	0	9	7	0
2002	5	0	21	0	35	30	0
2003	0	-	-	-	-	-	-
2004	1	0	9	0	20	17	0
Aleutian Islands region only ^f							
1998	0	-	-	-	-	-	-
1999	3	0	16	0	42	34	0
2000	2	0	4	0	5	5	0
2001	0	-	-	-	-	-	-
2002	0	-	-	-	-	-	-
2003	0	-	-	-	-	-	-
2004	0	-	-	-	-	-	-
Gulf of Alaska (areas at and west of 140°W longitude) ^g							
1998	3	0	24	0	134	2	0
1999	1	0	3	0	3	3	0
2000	2	0	4	0	4	4	0
2001	1	0	18	0	53	0	0
2002	5	0	13	0	14	14	0
2003	0	-	-	-	-	-	-
2004	0	-	-	-	-	-	-

Table 2.--Continued.

Fishery Region Year	Vessel coverage		Effort by fishing days		Effort by gear deployment ^d		
	Number of fishing vessels with observers	Number of fishing vessels with marine mammal interactions	Number of fishing days on vessel cruises with observers	Number of fishing days with marine mammal interactions	Total number of hauls on vessel cruises with observers	Number of hauls monitored by observers	Number of hauls with marine mammal interactions
Pot gear fisheries (continued)							
AK miscellaneous other finfish pot fishery (continued)							
Gulf of Alaska (areas east of 140°W longitude) ^b and southeast Alaska							
1998	0	-	-	-	-	-	-
1999	0	-	-	-	-	-	-
2000	0	-	-	-	-	-	-
2001	0	-	-	-	-	-	-
2002	0	-	-	-	-	-	-
2003	0	-	-	-	-	-	-
2004	0	-	-	-	-	-	-
Alaska (all areas combined)							
1998	9	0	32	0	142	10	0
1999	4	0	20	0	47	39	0
2000	7	0	22	0	40	40	0
2001	4	0	24	0	62	7	0
2002	8	0	34	0	49	44	0
2003	0	-	-	-	-	-	-
2004	1	0	9	0	20	17	0
Jig gear fisheries							
Alaska (all areas combined)							
1998	1	0	10	0	20	0	0
1999	0	-	-	-	-	-	-
2000	1	0	4	0	5	5	0
2001	1	0	5	0	14	0	0
2002	0	-	-	-	-	-	-
2003	0	-	-	-	-	-	-
2004	0	-	-	-	-	-	-

^a Vessels with multiple observer cruises and/or observers during the calendar year were counted only once.

^b Fishing days are the number of calendar days per vessel that set gear to catch groundfish on each day.

^c The marine mammal interactions referred to in this table include any type of interaction (e.g., marine mammals killed or injured by fishing operations; animals boarding vessels of their own volition or entangled in the gear and subsequently released unharmed; catch of decomposed carcasses or body parts; marine mammal depredation on the groundfish catch; deterrence of animals from the catch by the crew).

^d The effort by gear deployment including the tonnage caught in each haul is used to calculate bycatch rates and estimate total bycatch.

^e Excludes the Aleutian Islands region (statistical fishing areas 541, 542 and 543 in Fig. 1) of the BSAI areas.

^f Includes only statistical fishing areas 541, 542 and 543 (Fig. 1).

^g Includes only statistical fishing areas 610, 620, 630, 640 and 649 (Fig. 2) of the Gulf of Alaska.

^h Includes only statistical fishing areas 650 and 659 (Fig. 2).

ⁱ Includes three observed pair trawl sets.

Table 3.—List of marine mammal species that interacted with any type of fishing gear or vessel operations in the groundfish fisheries in the U.S. Exclusive Economic Zone off Alaska during 1998-2004. The common types of interactions reported by observers are summarized for each species (modified from Perez 2003).

Marine mammal species		Marine mammal interactions with groundfish fisheries				
		Killed by fishing operations or serious injuries ^b	Released from gear unharmed or minor injuries ^c	Decomposed carcasses or body parts in gear ^d	Depredation on groundfish catch ^e	Deterrence from groundfish catch by crew ^{f,g}
Code ^a	Common name (scientific name)					
BA	Minke whale (<i>Balaenoptera acutorostrata</i>)	Yes	No	Yes	Maybe ^h	No
BP	Fin whale (<i>Balaenoptera physalus</i>)	Yes	No	No	Maybe ^h	No
CU	Northern fur seal (<i>Callorhinus ursinus</i>)	Yes	Yes	Yes	Yes	Yes
EB	Bearded seal (<i>Erignathus barbatus</i>)	Yes	Yes	Yes	No	Yes
EJ	Steller sea lion (<i>Eumetopias jubatus</i>)	Yes	Yes	Yes	Yes	Yes
EL	Sea otter (<i>Enhydra lutris</i>)	No	No	Yes	No	No
ER	Gray whale (<i>Eschrichtius robustus</i>)	No	No	Yes	No	No
MA	Northern elephant seal (<i>Mirounga angustirostris</i>)	Yes	No	No	No	No
MN	Humpback whale (<i>Megaptera novaeangliae</i>)	Yes	Yes	Yes	Maybe ^h	No
OO	Killer whale (<i>Orcinus orca</i>)	Yes	Yes	Yes	Yes	Yes
OR	Walrus (<i>Odobenus rosmarus</i>)	Yes	No	Yes	No	No
PD	Dall's porpoise (<i>Phocoenoides dalli</i>)	Yes	No	Yes	Yes	Yes
PF	Ribbon seal (<i>Histiophoca fasciata</i>)	Yes	No	Yes	No	No
PH	Ringed seal (<i>Pusa hispida</i>)	Yes	No	No	No	No
PL	Spotted seal (<i>Phoca largha</i>)	Yes	No	Yes	No	No
PM	Sperm whale (<i>Physeter macrocephalus</i>)	Yes ⁱ	No	No	Yes	Yes
PP	Harbor porpoise (<i>Phocoena phocoena</i>)	Yes	No	Yes	No	No
PV	Harbor seal (<i>Phoca vitulina</i>)	Yes	No	Yes	Yes	No
UB	Unidentified beaked whale ^{k,l}	No	No	Yes	No	No
UC	Unidentified cetaceans ^{l,m}	Yes	No	Yes	Yes	No
UD	Unidentified dolphins/porpoises ^{l,m}	No	No	Yes	Yes	No
UO	Unidentified otariids ^m	Yes	Yes	Yes	Yes	Yes
UP	Unidentified pinnipeds ^m	Yes	Yes	Yes	Yes	Yes
US	Unidentified phocids ^m	Yes	No	Yes	No	No
UW	Unidentified whales ^{l,m}	No	No	Yes	Yes	No
UZ	Unidentified baleen whales ^{l,m}	Yes	No	Yes	No	No
ZZ	Unidentified marine mammal ^{l,m}	No	No	Yes	Yes	No

^a The code definitions used in this report are slightly different than those used in NORPAC or NMFS Platforms of Opportunity Program; code UB is used only in this paper.

^b Includes any type of incidental take that resulted in mortality including gear entanglement, propeller strikes, and serious injuries resulting from wounds or trailing gear (including broken longline hooks stuck in the mouth).

^c Includes any type of incidental take that did not impair the survivability of the animal in which the marine mammal was either caught by the gear or boarded the vessel and was subsequently released alive by the crew.

Table 3.--Continued.

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- ^d Includes any type of incidental take of carcasses or miscellaneous body parts from animals that were known to have died previous to gear deployment or were not confirmed to have been killed by the gear or fishing operations.
- ^e Includes any type of depredation interaction of the marine mammal on the groundfish catch (not discards); however, these interactions are not classified as incidental take or bycatch.
- ^f Includes any method of deterrence, with or without devices, actively used by the crew to prevent the animal from interacting with the gear; these interactions (which are not classified as incidental takes) are not discussed in this paper.
- ^g Although amendments in 1994 to the MMPA allowed for prohibition of the use by fisheries of deterrence of marine mammals, several types of deterrence methods were used during 1998-2004 in the groundfish fisheries in Alaska, especially in the longline fishery directed at killer whales, sperm whales, and Steller sea lions.
- ^h Some observers recorded that they thought an individual whale of this species may have been feeding on the groundfish catch from the fishing gear, but the observers did not record sufficient information.
- ⁱ No sperm whales were reported killed directly by the gear or during fishing operations; however, one sperm whale with trailing longline gear was considered a serious injury in 2000.
- ^k Beaked whale skulls were caught on three occasions in the trawl gear, and these skulls may have been from Bering Sea beaked whales (*Mesoplodon stejnegeri*).
- ^l Unidentifiable carcasses in very advanced stages of decomposition or miscellaneous cetacean bones without flesh found isolated in the groundfish catch may have come from any cetacean species that occurs in the area, including species not listed in this table. For example, one decomposed Risso's dolphin (*Grampus griseus*) was caught by trawl gear in the foreign and joint venture groundfish fisheries in the Bering Sea and Aleutian Islands region during 1973-1988 (Perez and Loughlin 1991).
- ^m Includes animals from any of the identified marine mammal species.

Table 4.--Total groundfish catch (metric tons) and the percent of catch monitored for marine mammals by target species fishery and region in the U.S. Exclusive Economic Zone off Alaska, 1998-2004. The total number of marine mammals (all species combined) observed incidentally killed or seriously injured is also listed.

Fishery Region Year	Groundfish			Marine mammals		Marine mammal species (statistical fishing areas) ^a
	Total groundfish catch (t)	Percent of groundfish catch monitored for marine mammals	Number of hauls/sets monitored for marine mammals (n)	Number of marine mammals (all species) observed in monitored hauls/sets	Number of marine mammals (all species) observed in unmonitored hauls/sets	

Trawl gear fisheries

BSAI Atka mackerel trawl fishery

Pelagic trawl gear

Bering Sea region only^b

1998	NF	-	-	-	-	-
1999	NF	-	-	-	-	-
2000	NF	-	-	-	-	-
2001	NF	-	-	-	-	-
2002	NF	-	-	-	-	-
2003	134.7	100.0	1	0	0	-
2004	NF	-	-	-	-	-

Aleutian Islands region only^c

1998	14.0	100.0	1	0	0	-
1999	621.6	66.4	7	0	0	-
2000	80.0	0	0	-	-	-
2001	NF	-	-	-	-	-
2002	NF	-	-	-	-	-
2003	NF	-	-	-	-	-
2004	NF	-	-	-	-	-

Non-pelagic trawl gear

Bering Sea region only^b

1998	854.6	66.1	32	0	0	-
1999	3,141.2	65.1	136	0	0	-
2000	701.2	44.9	9	0	0	-
2001	430.0	0.2	1	0	0	-
2002	149.2	35.4	4	0	0	-
2003	842.6	37.6	28	0	0	-
2004	1,889.6	47.4	68	0	0	-

Aleutian Islands region only^c

1998	65,990.8	65.0	920	3	0	EJ (542)
1999	62,671.8	78.0	1,045	3	0	EJ (542, 543)
2000	55,983.1	86.9	958	1	0	EJ (542)
2001	71,362.8	82.9	1,070	1	0	EJ (542)
2002	51,861.5	98.5	972	0	0	-
2003	62,268.6	96.1	1,123	1	0	EJ (542)
2004	63,597.9	97.0	1,098	0	0	-

BSAI flatfish trawl fishery

Pelagic trawl gear

Bering Sea region only^b

1998	240.8	20.3	5	0	0	-
1999	NF	-	-	-	-	-

Table 4.--Continued.

Fishery Region Year	Groundfish		Marine mammals			Marine mammal species (statistical fishing areas) ^a
	Total groundfish catch (t)	Percent of groundfish catch monitored for marine mammals	Number of hauls/sets monitored for marine mammals (n)	Number of marine mammals (all species) observed in monitored hauls/sets	Number of marine mammals (all species) observed in unmonitored hauls/sets	

Trawl gear fisheries (continued)**BSAI flatfish trawl fishery (continued)**

Pelagic trawl gear (continued)

Bering Sea region only^b (continued)

2000	2,638.2	60.0	76	0	0	-
2001	NF	-	-	-	-	-
2002	NF	-	-	-	-	-
2003	22.8	100.0	2	0	0	-
2004	15.0	0	0	-	-	-

Aleutian Islands region only^c

1998	NF	-	-	-	-	-
1999	NF	-	-	-	-	-
2000	NF	-	-	-	-	-
2001	NF	-	-	-	-	-
2002	NF	-	-	-	-	-
2003	NF	-	-	-	-	-
2004	NF	-	-	-	-	-

Non-pelagic trawl gear

Bering Sea region only^b

1998	222,965.9	59.4	6,880	3	2 ^d	EB (513), EJ (513), OO (517), OR (513), PP (513)
1999	177,600.5	66.3	5,703	2	1	EB (513), EJ (509), PL (514)
2000	214,610.4	64.6	6,869	5	4	CU (513), EB (513), EJ (513, 514, 524), OR (513), PV (524)
2001	175,766.1	57.6	5,414	9	0 ^e	CU (513), EB (509), EJ (509, 513), OO (519), PP (513), US (514)
2002	190,874.6	58.4	5,783	3	1	EJ (514), OR (514), UP (509)
2003	180,679.3	64.1	5,064	2	0	EJ (513, 514)
2004	190,949.8	64.3	5,061	8	2	EJ (514), OO (521), OR (514), PL (509, 514, 524), PV (509)

Aleutian Islands region only^c

1998	299.3	74.0	11	0	0	-
1999	217.0	83.4	11	0	0	-
2000	NF	-	-	-	-	-
2001	NF	-	-	-	-	-
2002	2.4	100.0	1	0	0	-
2003	29.1	0	0	-	-	-
2004	NF	-	-	-	-	-

BSAI Pacific cod trawl fishery

Pelagic trawl gear

Bering Sea region only^b

1998	220.6	77.4	17	0	0	-
1999	60.1	1.2	1	0	0	-
2000	353.3	76.3	16	0	0	-
2001	119.4	73.0	14	0	0	-
2002	826.3	8.2	15	0	0	-
2003	401.3	22.6	21	0	0	-
2004	1,579.8	98.3	105	0	0	-

Table 4.--Continued.

Fishery Region Year	Groundfish		Marine mammals			Marine mammal species (statistical fishing areas) ^a
	Total groundfish catch (t)	Percent of groundfish catch monitored for marine mammals	Number of hauls/sets monitored for marine mammals (n)	Number of marine mammals (all species) observed in monitored hauls/sets	Number of marine mammals (all species) observed in unmonitored hauls/sets	

Trawl gear fisheries (continued)**BSAI Pacific cod trawl fishery (continued)**

Pelagic trawl gear (continued)

Aleutian Islands region only^c

1998	NF	-	-	-	-	-
1999	NF	-	-	-	-	-
2000	233.5	52.2	11	0	0	-
2001	1,097.1	41.6	34	0	0	-
2002	191.0	47.5	9	0	0	-
2003	NF	-	-	-	-	-
2004	NF	-	-	-	-	-

Non-pelagic trawl gear

Bering Sea region only^b

1998	60,225.8	49.2	2,697	0	0	-
1999	71,209.0	43.6	2,406	0	0	-
2000	62,385.9	47.1	2,381	0	0	-
2001	42,678.1	53.7	1,858	0	0	-
2002	55,744.3	38.7	2,171	0	0	-
2003	64,751.6	42.4	2,850	1	0	PV (517)
2004	86,414.4	44.4	3,156	1	0	PV (517)

Aleutian Islands region only^c

1998	19,326.7	74.2	669	0	0	-
1999	16,486.9	80.9	575	1	0	EJ (541)
2000	21,346.0	64.7	878	0	0	-
2001	15,513.0	70.0	598	0	0	-
2002	29,711.7	64.9	1,018	0	0	-
2003	33,359.6	64.9	1,133	2	0	EJ (541)
2004	26,966.0	67.2	842	0	0	-

BSAI pollock trawl fishery

Pelagic trawl gear

Bering Sea region only^b

1998	1,065,452.2	66.2	10,827	7	0	CU (517), EJ (509, 517), MN (517), PD (517, 519)
1999	974,105.3	75.3	9,704	7	2	EB (509, 521), EJ (517, 521), MN (509), OO (521), PD (509, 521)
2000	1,111,199.2	75.8	11,614	7	2	BA (517), EJ (509, 517), PD (521), PH (517)
2001	1,367,582.1	79.0	14,047	7	2 ^f	EJ (509, 513, 521), PD (521), PF (517), PH (521), UZ (521)
2002	1,459,427.1	80.0	14,015	5	0	EJ (509, 513, 517), OO (521), PD (517)
2003	1,481,039.2	82.2	14,571	0	1	OO (521)
2004	1,467,145.5	81.2	14,534	2	0	EJ (513), PD (521)

Aleutian Islands region only^c

1998	23,605.8	83.9	187	0	0	-
1999	60.7	100.0	1	0	0	-
2000	NF	-	-	-	-	-
2001	NF	-	-	-	-	-
2002	NF	-	-	-	-	-

Table 4.--Continued.

Fishery Region Year	Groundfish		Marine mammals			Marine mammal species (statistical fishing areas) ^a
	Total groundfish catch (t)	Percent of groundfish catch monitored for marine mammals	Number of hauls/sets monitored for marine mammals (n)	Number of marine mammals (all species) observed in monitored hauls/sets	Number of marine mammals (all species) observed in unmonitored hauls/sets	

Trawl gear fisheries (continued)**BSAI pollock trawl fishery (continued)**

Pelagic trawl gear (continued)

Aleutian Islands region only^c (continued)

2003	NF	-	-	-	-	-
2004	NF	-	-	-	-	-

Non-pelagic trawl gear

Bering Sea region only^b

1998	44,877.1	75.5	876	0	1	PD (509)
1999	18,855.2	72.7	477	0	0	-
2000	34,440.2	87.5	766	0	0	-
2001	18,115.1	82.4	435	0	0	-
2002	9,244.2	77.3	310	0	0	-
2003	282.0	63.8	16	0	0	-
2004	693.3	43.8	11	0	0	-

Aleutian Islands region only^c

1998	156.8	96.2	7	0	0	-
1999	100.6	29.1	5	0	0	-
2000	155.4	100.0	3	0	0	-
2001	0.5	100.0	1	0	0	-
2002	NF	-	-	-	-	-
2003	NF	-	-	-	-	-
2004	NF	-	-	-	-	-

BSAI rockfish trawl fishery

Pelagic trawl gear

Bering Sea region only^b

1998	NF	-	-	-	-	-
1999	63.1	100.0	1	0	0	-
2000	NF	-	-	-	-	-
2001	NF	-	-	-	-	-
2002	NF	-	-	-	-	-
2003	NF	-	-	-	-	-
2004	NF	-	-	-	-	-

Aleutian Islands region only^c

1998	157.3	100.0	2	0	0	-
1999	NF	-	-	-	-	-
2000	NF	-	-	-	-	-
2001	42.2	100.0	1	0	0	-
2002	2.0	100.0	1	0	0	-
2003	NF	-	-	-	-	-
2004	NF	-	-	-	-	-

Non-pelagic trawl gear

Bering Sea region only^b

1998	493.2	57.4	20	0	0	-
1999	236.7	61.9	14	0	0	-

Table 4.--Continued.

Fishery Region Year	Groundfish		Marine mammals			Marine mammal species (statistical fishing areas) ^a
	Total groundfish catch (t)	Percent of groundfish catch monitored for marine mammals	Number of hauls/sets monitored for marine mammals (n)	Number of marine mammals (all species) observed in monitored hauls/sets	Number of marine mammals (all species) observed in unmonitored hauls/sets	

Trawl gear fisheries (continued)**BSAI rockfish trawl fishery (continued)**

Non-pelagic trawl gear (continued)

Bering Sea region only^b (continued)

2000	486.0	74.0	19	0	0	-
2001	325.7	54.9	10	0	0	-
2002	374.1	29.6	12	0	0	-
2003	194.7	84.0	9	0	0	-
2004	271.0	43.2	9	0	0	-

Aleutian Islands region only^c

1998	9,615.4	86.6	150	0	0	-
1999	14,566.0	86.0	202	0	0	-
2000	9,947.5	85.7	180	0	0	-
2001	9,899.8	65.5	134	0	0	-
2002	11,894.2	81.4	185	0	0	-
2003	13,826.5	81.7	236	0	0	-
2004	10,340.0	91.9	144	0	0	-

GOA flatfish trawl fishery

Pelagic trawl gear

Gulf of Alaska (areas at and west of 140°W longitude)^g

1998	673.1	1.4	1	0	0	-
1999	49.0	100.0	8	0	0	-
2000	124.1	0	0	-	-	-
2001	101.7	0	0	-	-	-
2002	1,016.9	80.3	103	0	0	-
2003	321.1	46.8	30	0	0	-
2004	0.1	0	0	-	-	-

Gulf of Alaska (areas east of 140°W longitude)^h and southeast Alaska

1998	1.3	0	0	-	-	-
1999	NF	-	-	-	-	-
2000	NF	-	-	-	-	-
2001	NF	-	-	-	-	-
2002	NF	-	-	-	-	-
2003	NF	-	-	-	-	-
2004	NF	-	-	-	-	-

Non-pelagic trawl gear

Gulf of Alaska (areas at and west of 140°W longitude)^g

1998	21,071.9	40.6	1,187	0	0	-
1999	18,776.2	35.6	847	0	0	-
2000	36,321.1	36.9	1,393	0	0	-
2001	25,456.6	40.6	1,143	0	0	-
2002	38,642.7	34.7	1,421	0	0	-
2003	46,633.4	40.5	1,774	0	0	-
2004	22,134.2	24.5	635	0	0	-

Table 4.--Continued.

Fishery Region Year	Groundfish		Marine mammals			Marine mammal species (statistical fishing areas) ^a
	Total groundfish catch (t)	Percent of groundfish catch monitored for marine mammals	Number of hauls/sets monitored for marine mammals (n)	Number of marine mammals (all species) observed in monitored hauls/sets	Number of marine mammals (all species) observed in unmonitored hauls/sets	

Trawl gear fisheries (continued)**GOA flatfish trawl fishery (continued)**

Non-pelagic trawl gear (continued)

Gulf of Alaska (areas east of 140°W longitude)^h and southeast Alaska

1998	67.4	0	0	-	-	-
1999	NF	-	-	-	-	-
2000	NF	-	-	-	-	-
2001	NF	-	-	-	-	-
2002	NF	-	-	-	-	-
2003	NF	-	-	-	-	-
2004	NF	-	-	-	-	-

GOA Pacific cod trawl fishery

Pelagic trawl gear

Gulf of Alaska (areas at and west of 140°W longitude)^g

1998	342.1	51.0	11	0	0	-
1999	602.5	19.5	15	0	0	-
2000	145.8	0	0	-	-	-
2001	151.6	84.0	16	0	0	-
2002	479.7	92.2	23	0	0	-
2003	227.3	0.4	2	0	0	-
2004	108.2	0	0	-	-	-

Gulf of Alaska (areas east of 140°W longitude)^h and southeast Alaska

1998	NF	-	-	-	-	-
1999	NF	-	-	-	-	-
2000	NF	-	-	-	-	-
2001	NF	-	-	-	-	-
2002	NF	-	-	-	-	-
2003	NF	-	-	-	-	-
2004	NF	-	-	-	-	-

Non-pelagic trawl gear

Gulf of Alaska (areas at and west of 140°W longitude)^g

1998	43,921.8	20.4	1,078	0	0	-
1999	40,983.9	16.4	883	0	0	-
2000	25,598.1	13.6	478	0	0	-
2001	30,092.3	19.9	717	1	0	EJ (610)
2002	15,822.2	21.1	465	0	0	-
2003	16,720.3	27.6	397	0	0	-
2004	18,103.9	27.2	458	0	0	-

Gulf of Alaska (areas east of 140°W longitude)^h and southeast Alaska

1998	NF	-	-	-	-	-
1999	105.1	0	0	-	-	-
2000	NF	-	-	-	-	-
2001	NF	-	-	-	-	-
2002	NF	-	-	-	-	-
2003	NF	-	-	-	-	-
2004	NF	-	-	-	-	-

Table 4.--Continued.

Fishery Region Year	Groundfish		Marine mammals			Marine mammal species (statistical fishing areas) ^a
	Total groundfish catch (t)	Percent of groundfish catch monitored for marine mammals	Number of hauls/sets monitored for marine mammals (n)	Number of marine mammals (all species) observed in monitored hauls/sets	Number of marine mammals (all species) observed in unmonitored hauls/sets	

Trawl gear fisheries (continued)**GOA pollock trawl fishery**

Pelagic trawl gear

Gulf of Alaska (areas at and west of 140°W longitude)^g

1998	121,945.2	37.9	1,265	2	0	EJ (610), PD (610)
1999	95,213.2	32.1	933	1	0	BP (620)
2000	67,092.7	27.8	642	0	0	-
2001	71,451.3	16.6	510	0	0	-
2002	51,892.4	26.2	569	0	0	-
2003	49,588.2	31.4	447	2	0	EJ (610), MA (620)
2004	55,937.9	29.8	484	0	0	-

Gulf of Alaska (areas east of 140°W longitude)^h and southeast Alaska

1998	NF	-	-	-	-	-
1999	NF	-	-	-	-	-
2000	NF	-	-	-	-	-
2001	NF	-	-	-	-	-
2002	NF	-	-	-	-	-
2003	NF	-	-	-	-	-
2004	NF	-	-	-	-	-

Non-pelagic trawl gear

Gulf of Alaska (areas at and west of 140°W longitude)^g

1998	4,802.1	25.0	116	0	0	-
1999	2,021.5	10.8	14	0	0	-
2000	7,584.3	24.4	92	0	0	-
2001	4,706.3	33.5	98	0	0	-
2002	625.3	5.7	5	0	0	-
2003	1,589.2	26.0	45	0	0	-
2004	7,869.5	10.1	26	0	0	-

Gulf of Alaska (areas east of 140°W longitude)^h and southeast Alaska

1998	NF	-	-	-	-	-
1999	NF	-	-	-	-	-
2000	NF	-	-	-	-	-
2001	NF	-	-	-	-	-
2002	NF	-	-	-	-	-
2003	NF	-	-	-	-	-
2004	NF	-	-	-	-	-

GOA rockfish trawl fishery

Pelagic trawl gear

Gulf of Alaska (areas at and west of 140°W longitude)^g

1998	2,781.3	35.3	38	0	0	-
1999	2,167.5	59.3	66	0	0	-
2000	778.3	87.0	20	0	0	-
2001	689.1	92.7	15	0	0	-
2002	837.2	80.9	15	0	0	-
2003	838.3	77.9	22	0	0	-
2004	1,052.8	77.5	16	0	0	-

Table 4.--Continued.

Fishery Region Year	Groundfish		Marine mammals			Marine mammal species (statistical fishing areas) ^a
	Total groundfish catch (t)	Percent of groundfish catch monitored for marine mammals	Number of hauls/sets monitored for marine mammals (n)	Number of marine mammals (all species) observed in monitored hauls/sets	Number of marine mammals (all species) observed in unmonitored hauls/sets	

Trawl gear fisheries (continued)**GOA rockfish trawl fishery (continued)**

Pelagic trawl gear (continued)

Gulf of Alaska (areas east of 140°W longitude)^h and southeast Alaska

1998	NF	-	-	-	-	-
1999	NF	-	-	-	-	-
2000	NF	-	-	-	-	-
2001	NF	-	-	-	-	-
2002	NF	-	-	-	-	-
2003	NF	-	-	-	-	-
2004	NF	-	-	-	-	-

Non-pelagic trawl gear

Gulf of Alaska (areas at and west of 140°W longitude)^g

1998	17,825.1	53.9	643	0	0	-
1999	25,074.2	49.0	614	0	0	-
2000	23,110.9	48.9	657	0	0	-
2001	22,006.5	49.6	614	0	0	-
2002	23,414.6	35.6	492	0	0	-
2003	26,002.8	47.6	788	0	0	-
2004	25,754.2	49.1	659	0	0	-

Gulf of Alaska (areas east of 140°W longitude)^h and southeast Alaska

1998	NF	-	-	-	-	-
1999	NF	-	-	-	-	-
2000	NF	-	-	-	-	-
2001	NF	-	-	-	-	-
2002	NF	-	-	-	-	-
2003	NF	-	-	-	-	-
2004	NF	-	-	-	-	-

AK miscellaneous other finfish trawl fishery

Pelagic trawl gear

Bering Sea region only^b

1998	337.1	<0.1	1	0	0	-
1999	910.1	<0.1	4	0	0	-
2000	484.4	0	0	-	-	-
2001	232.9	<0.1	1	0	0	-
2002	NF	-	-	-	-	-
2003	NF	-	-	-	-	-
2004	NF	-	-	-	-	-

Aleutian Islands region only^c

1998	NF	-	-	-	-	-
1999	NF	-	-	-	-	-
2000	NF	-	-	-	-	-
2001	0.1	100.0	2	0	0	-
2002	NF	-	-	-	-	-
2003	NF	-	-	-	-	-
2004	NF	-	-	-	-	-

Table 4.--Continued.

Fishery Region Year	Groundfish		Marine mammals			Marine mammal species (statistical fishing areas) ^a
	Total groundfish catch (t)	Percent of groundfish catch monitored for marine mammals	Number of hauls/sets monitored for marine mammals (n)	Number of marine mammals (all species) observed in monitored hauls/sets	Number of marine mammals (all species) observed in unmonitored hauls/sets	

Trawl gear fisheries (continued)**AK miscellaneous other finfish trawl fishery (continued)**

Pelagic trawl gear (continued)

Gulf of Alaska (areas at and west of 140°W longitude)^g

1998	0.2	0	0	-	-	-
1999	NF	-	-	-	-	-
2000	122.9	94.2	2	0	0	-
2001	115.7	100.0	2	0	0	-
2002	113.4	100.0	1	0	0	-
2003	63.2	0	0	-	-	-
2004	0.5	100.0	2	0	0	-

Gulf of Alaska (areas east of 140°W longitude)^h and southeast Alaska

1998	NF	-	-	-	-	-
1999	NF	-	-	-	-	-
2000	NF	-	-	-	-	-
2001	NF	-	-	-	-	-
2002	NF	-	-	-	-	-
2003	NF	-	-	-	-	-
2004	NF	-	-	-	-	-

Non-pelagic trawl gear

Bering Sea region only^b

1998	1,463.4	17.8	38	0	0	-
1999	701.4	22.8	31	0	0	-
2000	553.6	53.0	38	0	0	-
2001	529.1	41.1	31	0	0	-
2002	404.6	36.0	14	0	0	-
2003	409.3	61.0	16	0	0	-
2004	337.8	65.1	21	0	0	-

Aleutian Islands region only^c

1998	34.1	0	0	-	-	-
1999	4.2	94.5	1	0	0	-
2000	4.1	0	0	-	-	-
2001	1.3	77.5	1	0	0	-
2002	NF	-	-	-	-	-
2003	NF	-	-	-	-	-
2004	NF	-	-	-	-	-

Gulf of Alaska (areas at and west of 140°W longitude)^g

1998	948.7	43.6	56	0	0	-
1999	1,248.1	32.8	28	0	0	-
2000	512.4	62.0	30	0	0	-
2001	464.7	45.2	30	0	0	-
2002	460.1	76.6	33	0	0	-
2003	2,420.6	13.1	94	0	0	-
2004	752.6	10.7	18	0	0	-

Gulf of Alaska (areas east of 140°W longitude)^h and southeast Alaska

1998	NF	-	-	-	-	-
1999	NF	-	-	-	-	-
2000	NF	-	-	-	-	-

Table 4.--Continued.

Fishery Region Year	Groundfish		Marine mammals			Marine mammal species (statistical fishing areas) ^a
	Total groundfish catch (t)	Percent of groundfish catch monitored for marine mammals	Number of hauls/sets monitored for marine mammals (n)	Number of marine mammals (all species) observed in monitored hauls/sets	Number of marine mammals (all species) observed in unmonitored hauls/sets	

Trawl gear fisheries (continued)

AK miscellaneous other finfish trawl fishery (continued)

Non-pelagic trawl gear (continued)

Gulf of Alaska (areas east of 140°W longitude)^h and southeast Alaska (continued)

2001	NF	-	-	-	-	-
2002	<0.1	0	0	-	-	-
2003	NF	-	-	-	-	-
2004	NF	-	-	-	-	-

Longline gear fisheries

BSAI Greenland turbot longline fishery

Bering Sea region only^b

1998	11,143.8	30.4	904	0	0	-
1999	8,132.7	29.9	682	1	0	OO (521)
2000	7,190.4	52.3	751	0	0	-
2001	3,821.1	31.1	380	0	0	-
2002	4,044.8	37.0	431	0	0	-
2003	4,086.2	42.4	538	0	0	-
2004	3,068.2	37.6	401	0	0	-

Aleutian Islands region only^c

1998	1,137.8	43.1	191	0	0	-
1999	865.9	38.9	146	0	0	-
2000	1,643.2	54.9	252	0	0	-
2001	440.9	54.1	88	0	0	-
2002	149.0	46.1	51	0	0	-
2003	256.5	26.6	49	0	0	-
2004	344.6	19.2	71	0	0	-

BSAI Pacific cod longline fishery

Bering Sea region only^b

1998	107,200.9	33.4	7,321	0	0	-
1999	101,558.8	32.8	7,436	1	1	PD (517), UO (516)
2000	104,138.3	35.2	8,407	0	0	-
2001	112,816.6	29.8	9,242	2	0	PF (521), UP (524)
2002	126,115.6	29.3	9,950	1	0	EJ (509)
2003	142,674.1	29.9	12,723	1	0	OO (521)
2004	142,989.9	23.7	10,916	0	0	-

Aleutian Islands region only^c

1998	16,686.1	40.4	1,896	0	0	-
1999	9,032.5	20.3	760	0	0	-
2000	19,566.9	35.4	2,110	0	0	-
2001	23,018.9	28.1	2,660	0	0	-
2002	3,754.4	36.5	677	0	0	-
2003	1,326.8	29.9	228	0	0	-
2004	4,142.6	26.7	559	0	0	-

Table 4.--Continued.

Fishery Region Year	Groundfish		Marine mammals			Marine mammal species (statistical fishing areas) ^a
	Total groundfish catch (t)	Percent of groundfish catch monitored for marine mammals	Number of hauls/sets monitored for marine mammals (n)	Number of marine mammals (all species) observed in monitored hauls/sets	Number of marine mammals (all species) observed in unmonitored hauls/sets	

Longline gear fisheries (continued)**BSAI Pacific halibut longline fishery**

Bering Sea region only ^b						
1998	417.7	38.5	64	0	0	-
1999	595.7	45.0	86	0	0	-
2000	1,143.9	48.7	110	0	0	-
2001	373.4	69.8	87	0	0	-
2002	295.0	59.0	60	0	0	-
2003	1,012.4	23.9	165	0	0	-
2004	612.1	47.8	108	0	0	-
Aleutian Islands region only ^c						
1998	91.4	40.8	18	0	0	-
1999	537.6	52.2	120	0	0	-
2000	778.6	65.1	156	0	0	-
2001	421.9	64.9	92	0	0	-
2002	440.9	56.3	94	0	0	-
2003	2,977.3	19.0	182	0	0	-
2004	1,225.3	17.1	100	0	0	-

BSAI rockfish longline fishery

Bering Sea region only ^b						
1998	98.5	40.9	16	0	0	-
1999	15.6	10.5	4	0	0	-
2000	20.2	76.3	1	0	0	-
2001	12.9	40.3	2	0	0	-
2002	1.6	0	0	-	-	-
2003	14.6	74.9	3	0	0	-
2004	9.9	32.5	9	0	0	-
Aleutian Islands region only ^c						
1998	20.5	44.3	4	0	0	-
1999	141.2	22.7	16	0	0	-
2000	238.0	51.0	35	0	0	-
2001	74.9	24.6	14	0	0	-
2002	70.6	36.8	24	0	0	-
2003	NF	-	-	-	-	-
2004	0.1	0	0	-	-	-

BSAI sablefish longline fishery

Bering Sea region only ^b						
1998	511.6	10.0	34	0	0	-
1999	591.7	10.8	47	0	0	-
2000	674.3	8.4	28	0	0	-
2001	449.9	5.4	13	0	0	-
2002	792.8	2.5	19	0	0	-
2003	1,062.0	1.6	12	0	0	-
2004	475.7	5.9	9	0	0	-

Table 4.--Continued.

Fishery Region Year	Groundfish		Marine mammals			Marine mammal species (statistical fishing areas) ^a
	Total groundfish catch (t)	Percent of groundfish catch monitored for marine mammals	Number of hauls/sets monitored for marine mammals (n)	Number of marine mammals (all species) observed in monitored hauls/sets	Number of marine mammals (all species) observed in unmonitored hauls/sets	

Longline gear fisheries (continued)**BSAI sablefish longline fishery (continued)**Aleutian Islands region only^c

1998	1,112.0	23.9	125	0	0	-
1999	2,177.8	33.1	371	0	0	-
2000	2,359.2	28.9	349	0	0	-
2001	1,785.5	22.3	245	0	0	-
2002	2,669.0	38.5	419	0	0	-
2003	3,782.2	12.9	215	0	0	-
2004	1,616.1	24.3	230	0	0	-

GOA Pacific cod longline fisheryGulf of Alaska (areas at and west of 140°W longitude)^g

1998	10,690.5	3.9	104	0	0	-
1999	14,322.8	5.8	214	0	0	-
2000	14,029.8	6.2	225	0	0	-
2001	11,099.9	5.0	248	0	0	-
2002	16,074.8	11.4	471	0	0	-
2003	11,366.2	12.7	396	0	0	-
2004	13,428.6	7.4	367	0	0	-

Gulf of Alaska (areas east of 140°W longitude)^h and southeast Alaska

1998	258.0	0	0	-	-	-
1999	214.7	0	0	-	-	-
2000	189.4	0	0	-	-	-
2001	68.4	0	0	-	-	-
2002	46.5	0	0	-	-	-
2003	62.4	0	0	-	-	-
2004	159.0	0	0	-	-	-

GOA Pacific halibut longline fisheryGulf of Alaska (areas at and west of 140°W longitude)^g

1998	984.7	51.9	125	0	0	-
1999	1,513.9	47.1	202	0	0	-
2000	1,705.9	50.3	204	0	0	-
2001	1,624.3	42.0	220	0	0	-
2002	1,855.4	41.1	232	0	0	-
2003	5,519.4	9.1	206	0	0	-
2004	2,986.4	14.4	203	0	0	-

Gulf of Alaska (areas east of 140°W longitude)^h and southeast Alaska

1998	80.1	44.0	20	0	0	-
1999	27.5	50.1	14	0	0	-
2000	80.4	65.9	17	0	0	-
2001	40.6	85.0	11	0	0	-
2002	66.2	50.3	11	0	0	-
2003	987.2	0	0	-	-	-
2004	923.1	3.4	18	0	0	-

Table 4.--Continued.

Fishery Region Year	Groundfish		Marine mammals			Marine mammal species (statistical fishing areas) ^a
	Total groundfish catch (t)	Percent of groundfish catch monitored for marine mammals	Number of hauls/sets monitored for marine mammals (n)	Number of marine mammals (all species) observed in monitored hauls/sets	Number of marine mammals (all species) observed in unmonitored hauls/sets	

Longline gear fisheries (continued)**GOA rockfish longline fishery**Gulf of Alaska (areas at and west of 140°W longitude)^g

1998	175.6	1.4	2	0	0	-
1999	67.2	3.5	2	0	0	-
2000	170.7	1.0	1	0	0	-
2001	172.9	7.5	8	0	0	-
2002	118.5	18.7	11	0	0	-
2003	137.6	0	0	-	-	-
2004	349.7	0	0	-	-	-

Gulf of Alaska (areas east of 140°W longitude)^h and southeast Alaska

1998	444.0	0.9	2	0	0	-
1999	426.3	1.0	4	0	0	-
2000	619.0	0	0	-	-	-
2001	1,318.0	0.5	5	0	0	-
2002	331.1	0	0	-	-	-
2003	264.7	0	0	-	-	-
2004	2,084.0	0	0	-	-	-

GOA sablefish longline fisheryGulf of Alaska (areas at and west of 140°W longitude)^g

1998	13,239.6	23.4	905	0	0	-
1999	11,055.4	18.9	760	0	0	-
2000	12,020.2	20.6	909	1	0	PM (640)
2001	10,487.8	15.6	907	0	0	-
2002	11,420.7	16.8	893	0	0	-
2003	19,221.1	12.1	1,207	0	0	-
2004	19,222.9	9.9	997	0	0	-

Gulf of Alaska (areas east of 140°W longitude)^h and southeast Alaska

1998	7,145.7	4.9	160	0	0	-
1999	5,872.3	5.0	149	0	0	-
2000	7,120.4	6.0	167	1	0	EJ (650)
2001	5,165.1	5.9	177	0	0	-
2002	4,617.0	6.1	159	0	0	-
2003	7,101.3	4.1	185	0	0	-
2004	7,786.0	4.9	188	0	0	-

AK miscellaneous other finfish longline fisheryBering Sea region only^b

1998	597.0	28.3	43	0	0	-
1999	850.6	38.4	110	0	0	-
2000	926.8	37.1	66	0	0	-
2001	436.5	37.8	51	0	0	-
2002	270.9	44.7	37	0	0	-
2003	87.2	16.4	7	0	0	-
2004	248.4	20.4	21	0	0	-

Table 4.--Continued.

Fishery Region Year	Groundfish			Marine mammals		
	Total groundfish catch (t)	Percent of groundfish catch monitored for marine mammals	Number of hauls/sets monitored for marine mammals (n)	Number of marine mammals (all species) observed in monitored hauls/sets	Number of marine mammals (all species) observed in unmonitored hauls/sets	Marine mammal species (statistical fishing areas) ^a

Longline gear fisheries (continued)

AK miscellaneous other finfish longline fishery (continued)

Aleutian Islands region only ^c						
1998	111.9	44.4	18	0	0	-
1999	73.1	47.0	23	0	0	-
2000	230.8	49.6	53	0	0	-
2001	219.0	42.2	40	0	0	-
2002	43.7	45.4	16	0	0	-
2003	26.9	47.0	4	0	0	-
2004	98.0	16.3	18	0	0	-
Gulf of Alaska (areas at and west of 140°W longitude) ^g						
1998	123.3	36.7	16	0	0	-
1999	68.6	0.7	3	0	0	-
2000	72.5	33.5	11	0	0	-
2001	134.7	6.7	10	0	0	-
2002	30.7	31.4	7	0	0	-
2003	2,262.2	3.0	12	0	0	-
2004	323.4	0.3	4	0	0	-
Gulf of Alaska (areas east of 140°W longitude) ^h and southeast Alaska						
1998	7.8	39.5	4	0	0	-
1999	12.9	22.4	6	0	0	-
2000	54.1	15.2	4	0	0	-
2001	0.1	33.8	3	0	0	-
2002	11.5	19.2	1	0	0	-
2003	4.8	0	0	-	-	-
2004	25.5	0	0	-	-	-

Pot gear fisheries

BSAI Pacific cod pot fishery

Bering Sea region only ^b						
1998	14,070.9	14.5	933	0	1	UZ (513)
1999	13,150.2	13.8	1,022	0	0	-
2000	16,743.9	8.8	751	0	0	-
2001	17,143.0	14.2	887	0	0	-
2002	15,914.4	12.1	718	0	0	-
2003	23,236.3	12.4	811	0	0	-
2004	17,877.8	10.8	580	0	0	-
Aleutian Islands region only ^c						
1998	443.6	16.8	43	0	0	-
1999	4,338.5	23.4	758	1	0	PV (542)
2000	3,210.9	7.0	194	0	0	-
2001	582.9	27.2	191	0	0	-
2002	6.7	0	0	-	-	-
2003	NF	-	-	-	-	-
2004	NF	-	-	-	-	-

Table 4.--Continued.

Fishery Region Year	Groundfish		Marine mammals			
	Total groundfish catch (t)	Percent of groundfish catch monitored for marine mammals	Number of hauls/sets monitored for marine mammals (n)	Number of marine mammals (all species) observed in monitored hauls/sets	Number of marine mammals (all species) observed in unmonitored hauls/sets	Marine mammal species (statistical fishing areas) ^a

Pot gear fisheries (continued)**BS sablefish pot fishery**Bering Sea region only^b

1998	15.3	42.1	17	0	0	-
1999	34.6	44.1	28	0	0	-
2000	77.4	62.6	54	0	0	-
2001	120.6	38.7	64	0	0	-
2002	403.2	40.6	313	0	1	MN (519)
2003	601.7	21.7	374	0	0	-
2004	622.9	49.1	696	0	0	-

AI sablefish pot fisheryAleutian Islands region only^c

1998	<0.1	100.0	1	0	0	-
1999	7.7	50.3	12	0	0	-
2000	170.2	68.2	117	0	0	-
2001	175.8	60.6	198	0	0	-
2002	149.7	69.4	218	0	0	-
2003	463.1	47.5	396	0	0	-
2004	442.9	21.3	187	0	0	-

GOA Pacific cod pot fisheryGulf of Alaska (areas at and west of 140°W longitude)^g

1998	10,947.8	6.7	420	1	0	PV (610)
1999	19,436.6	5.7	703	0	0	-
2000	17,747.0	7.0	706	0	0	-
2001	7,371.1	5.8	383	0	0	-
2002	7,927.2	7.0	374	0	0	-
2003	21,271.3	4.0	302	0	0	-
2004	25,555.8	3.2	351	0	0	-

Gulf of Alaska (areas east of 140°W longitude)^h and southeast Alaska

1998	NF	-	-	-	-	-
1999	7.6	0	0	-	-	-
2000	NF	-	-	-	-	-
2001	0.3	6.4	1	0	0	-
2002	NF	-	-	-	-	-
2003	NF	-	-	-	-	-
2004	NF	-	-	-	-	-

AK miscellaneous other finfish pot fisheryBering Sea region only^b

1998	4.9	33.9	8	0	0	-
1999	64.5	0.5	2	0	0	-
2000	35.8	92.8	31	0	0	-
2001	4.8	51.6	7	0	0	-
2002	26.2	80.9	30	0	0	-

Table 4.--Continued.

Fishery Region Year	Groundfish		Marine mammals			Marine mammal species (statistical fishing areas) ^a
	Total groundfish catch (t)	Percent of groundfish catch monitored for marine mammals	Number of hauls/sets monitored for marine mammals (n)	Number of marine mammals (all species) observed in monitored hauls/sets	Number of marine mammals (all species) observed in unmonitored hauls/sets	

Pot gear fisheries (continued)**AK miscellaneous other finfish pot fishery (continued)**

Bering Sea region only ^b (continued)						
2003	1.2	0	0	-	-	-
2004	210.3	1.6	17	0	0	-
Aleutian Islands region only ^c						
1998	<0.1	0	0	-	-	-
1999	23.0	22.1	34	0	0	-
2000	1.4	100.0	5	0	0	-
2001	NF	-	-	-	-	-
2002	NF	-	-	-	-	-
2003	NF	-	-	-	-	-
2004	<0.1	0	0	-	-	-
Gulf of Alaska (areas at and west of 140°W longitude) ^g						
1998	1,164.8	<0.1	2	0	0	-
1999	46.0	1.7	3	0	0	-
2000	132.8	0.1	4	0	0	-
2001	424.5	0	0	-	-	-
2002	86.5	3.5	14	0	0	-
2003	NF	-	-	-	-	-
2004	147.9	0	0	-	-	-
Gulf of Alaska (areas east of 140°W longitude) ^h and southeast Alaska						
1998	10.6	0	0	-	-	-
1999	44.2	0	0	-	-	-
2000	39.6	0	0	-	-	-
2001	NF	-	-	-	-	-
2002	0.6	0	0	-	-	-
2003	NF	-	-	-	-	-
2004	0.4	0	0	-	-	-

Jig gear fisheries

Alaska (all areas combined)						
1998	481.4	0	0	-	-	-
1999	398.8	0	0	-	-	-
2000	348.3	<0.1	5	0	0	-
2001	439.9	0	0	-	-	-
2002	630.2	0	0	-	-	-
2003	3,635.2	0	0	-	-	-
2004	3,566.6	0	0	-	-	-

NF = No fishing.

^a The scientific names of the marine mammal species represented by the codes listed in this column are given in Table 3; the statistical fishing areas are shown in Figures 1 and 2.

Table 4.--Continued.

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- ^b Excludes the Aleutian Islands region (statistical fishing areas 541, 542 and 543 in Fig. 1) of the BSAI areas.
- ^c Includes only statistical fishing areas 541, 542 and 543 (Fig. 1).
- ^d There was also one additional Steller sea lion take in area 513 which was seen only by the crew while the observer was aboard the vessel (Appendix 3); however, this additional take was not used to estimate bycatch in this report.
- ^e There was also one additional killer whale take in area 517 which was seen only by the crew while the observer was aboard the vessel (Appendix 3); however, this additional take was not used to estimate bycatch in this report.
- ^f There was also one additional unidentified cetacean (presumably a baleen whale) take in area 521 which was seen only by the crew while the observer was aboard the vessel (Appendix 3); however, this additional take was not used to estimate bycatch in this report.
- ^g Includes only statistical fishing areas 610, 620, 630, 640 and 649 (Fig. 2) of the Gulf of Alaska.
- ^h Includes only statistical fishing areas 650 and 659 (Fig. 2).

Table 5.--Number of marine mammals, by species, incidentally taken by vessels of the groundfish trawl fisheries in the U.S. Exclusive Economic Zone in the Bering Sea, Aleutian Islands region, and Gulf of Alaska, 1998-2004, reported by U.S. fishery observers, including an estimation of the total incidental mortality by area and year. Catch rates are the ratio (\hat{R}_y) and standard error ($s(\hat{R}_y)$) of the stratified observed incidental take of marine mammals killed (or seriously injured) monitored during fishing operations to the observed groundfish catch (per 10,000 metric tons [t] basis). The coefficient of variation (CV) of the catch rate is also listed. Estimated mortality of marine mammals as bycatch is the adjusted ratio estimate (\hat{Y}_A). The 95% confidence interval ($L_{95\%}$) is an approximation based on the natural log-transformation (Burnham et al. 1987) using the CV of the nonadjusted stratified ratio estimate (extrapolated bycatch, \hat{Y}_{R_i}).

Species (stock) Fishery Area Year	Groundfish			Marine mammals						
	Total groundfish catch (t)	Percent of groundfish catch monitored	Number of trawl hauls monitored (n)	Number of marine mammals observed in monitored hauls	Bycatch rate (per 10,000 metric tons)			Estimated bycatch (number of marine mammals)		
					\hat{R}_y	$s(\hat{R}_y)$	CV	\hat{Y}_A	$L_{95\%}$	
Steller sea lion (<i>Eumetopias jubatus</i>): western U.S. stock										
BSAI Atka mackerel trawl fishery										
Area 542										
1998	23,079.6	67.7	305	3	1.9548	0.8342	0.43	4.5	2.0 to 10.1	a
1999	24,617.0	77.9	377	1	0.5854	0.3272	0.56	1.4	0.5 to 4.0	
2000	26,571.5	85.0	505	1	0.4118	0.1212	0.29	1.1	0.6 to 1.9	
2001	35,793.9	86.3	479	1	0.3438	0.1491	0.43	1.2	0.5 to 2.8	
2003	32,083.9	96.1	589	1	0.3820	0.1665	0.44	1.2	0.5 to 2.8	
Area 543										
1999	21,283.4	80.3	459	2	1.1937	0.3921	0.33	2.5	1.4 to 4.8	a
Bering Sea and Aleutian Islands region										
1998	66,859.4	65.0	953	3	0.6748	0.2880	0.43	4.5	2.0 to 10.1	a
1999	66,434.6	77.2	1,188	3	0.5993	0.1746	0.29	4.0	2.3 to 7.0	a
2000	56,764.3	86.3	967	1	0.1928	0.0567	0.29	1.1	0.6 to 1.9	
2001	71,792.8	82.4	1,071	1	0.1714	0.0743	0.43	1.2	0.5 to 2.8	
2003	63,245.9	95.3	1,152	1	0.1938	0.0844	0.44	1.2	0.5 to 2.8	
BSAI flatfish trawl fishery										
Area 509										
1999	44,762.2	67.9	1,432	1	0.3230	0.1818	0.56	1.4	0.5 to 4.0	
2001	58,960.0	52.7	1,589	2	0.5552	0.2485	0.45	3.3	1.4 to 7.6	a
Area 513										
1998	91,263.9	60.8	2,467	0	-	-	-	1.0	-	b
2000	74,340.1	69.0	2,602	2	0.2994	0.0671	0.22	2.2	1.4 to 3.4	a
2001	73,235.9	65.9	2,356	2	0.4335	0.1866	0.43	3.2	1.4 to 7.1	a
2003	64,228.0	63.2	1,810	1	0.2181	0.1166	0.53	1.4	0.5 to 3.7	
Area 514										
2000	10,263.4	78.8	376	0	-	-	-	1.0	-	b
2002	28,118.0	62.3	826	1	0.5852	0.3651	0.62	1.6	0.5 to 5.1	
2003	34,106.7	68.4	968	1	0.3930	0.1983	0.50	1.3	0.5 to 3.4	
2004	34,791.9	67.0	1,071	2	0.8821	0.3664	0.42	3.1	1.4 to 6.7	a
Area 524										
2000	4,528.7	73.4	175	1	2.7408	1.1958	0.44	1.2	0.5 to 2.8	
Bering Sea and Aleutian Islands region										
1998	223,506.0	59.4	6,896	0	-	-	-	1.0	-	b
1999	177,817.6	66.3	5,714	1	0.0813	0.0458	0.56	1.4	0.5 to 4.0	
2000	217,248.6	64.5	6,945	3	0.1596	0.0339	0.21	4.5	2.3 to 5.2	a,b
2001	175,766.1	57.6	5,414	4	0.3669	0.1140	0.31	6.4	3.6 to 11.7	
2002	190,877.0	58.4	5,784	1	0.0862	0.0538	0.62	1.6	0.5 to 5.1	
2003	180,731.2	64.1	5,066	2	0.1517	0.0559	0.37	2.7	1.4 to 5.5	a
2004	190,964.8	64.3	5,061	2	0.1607	0.0668	0.42	3.1	1.4 to 6.7	a

Table 5.--Continued.

Species (stock) Fishery Area Year	Groundfish			Marine mammals						
	Total groundfish catch (t)	Percent of groundfish catch monitored	Number of trawl hauls monitored (n)	Number of marine mammals observed in monitored hauls	Bycatch rate (per 10,000 metric tons)			Estimated bycatch (number of marine mammals)		
					\hat{R}_y	$s(\hat{R}_y)$	CV	\hat{Y}_A	$L_{95\%}$	
Steller sea lion (<i>Eumetopias jubatus</i>): western U.S. stock (continued)										
BSAI Pacific cod trawl fishery										
Area 541										
1999	15,249.9	81.3	520	1	0.7803	0.3116	0.40	1.2	0.6 to 2.5	
2003	24,288.2	59.0	844	2	1.7517	1.2812	0.73	4.3	1.2 to 15.3	a
Bering Sea and Aleutian Islands region										
1999	87,756.0	50.6	2,982	1	0.1356	0.0541	0.40	1.2	0.6 to 2.5	
2003	98,512.5	49.9	4,004	2	0.4319	0.3159	0.73	4.3	1.2 to 15.3	a
BSAI pollock trawl fishery										
Area 509										
1998	422,331.2	65.8	4,063	1	0.0318	0.0161	0.51	1.3	0.5 to 3.4	
2000	255,591.8	72.7	2,793	1	0.0451	0.0164	0.36	2.2	0.6 to 2.3	b
2001	174,193.6	69.0	1,828	1	0.0617	0.0163	0.26	1.1	0.6 to 1.8	
2002	335,949.0	79.1	3,387	1	0.0298	0	0	1.0	-	
Area 513										
2001	155,424.1	91.8	2,090	1	0.0756	0.0292	0.39	1.2	0.6 to 2.4	
2002	88,716.5	95.3	1,056	1	0.1127	0	0	1.0	-	
2004	143,645.2	91.6	1,621	1	0.0704	0.0076	0.11	1.0	0.8 to 1.2	
Area 517										
1998	413,908.5	65.6	4,364	1	0.0296	0.0128	0.43	1.2	0.5 to 2.8	
1999	467,855.6	72.4	4,552	1	0.0253	0.0099	0.39	1.2	0.6 to 2.5	
2000	457,712.0	71.4	4,685	1	0.0316	0.0175	0.55	1.4	0.5 to 4.0	
2002	620,223.8	75.1	5,464	1	0.0231	0.0127	0.55	1.4	0.5 to 3.9	
Area 521										
1999	205,110.5	86.6	2,376	2	0.1042	0.0187	0.18	2.1	1.5 to 3.0	
2001	399,461.3	88.6	4,613	0	-	-	-	1.0	-	b
Bering Sea and Aleutian Islands region										
1998	1,134,092.0	66.9	11,897	2	0.0227	0.0076	0.33	2.6	1.4 to 4.9	a
1999	993,121.8	75.2	10,187	3	0.0334	0.0061	0.18	3.3	2.3 to 4.7	a
2000	1,145,794.8	76.2	12,383	2	0.0227	0.0079	0.35	3.6	1.3 to 5.0	a,b
2001	1,385,697.7	79.0	14,483	2	0.0162	0.0039	0.24	3.3	1.4 to 3.6	a,b
2002	1,468,671.3	80.0	14,325	3	0.0234	0.0054	0.23	3.4	2.2 to 5.4	a
2004	1,467,838.8	81.2	14,545	1	0.0069	0.0007	0.11	1.0	0.8 to 1.2	
GOA Pacific cod trawl fishery										
Area 610										
2001	8,045.6	12.5	113	1	5.8136	4.8014	0.83	4.7	1.1 to 19.2	
Gulf of Alaska (areas at and west of 140°W longitude) ^c										
2001	30,243.9	20.3	733	1	1.5465	1.2773	0.83	4.7	1.1 to 19.2	
GOA pollock trawl fishery										
Area 610										
1998	29,534.0	47.8	198	1	0.5366	0.3282	0.61	1.6	0.5 to 4.8	
2003	16,583.9	19.3	49	1	1.4546	1.3998	0.96	2.4	0.5 to 11.8	a
Gulf of Alaska (areas at and west of 140°W longitude) ^c										
1998	126,747.4	37.5	1,381	1	0.1250	0.0765	0.61	1.6	0.5 to 4.8	
2003	51,177.4	31.2	492	1	0.4714	0.4536	0.96	2.4	0.5 to 11.8	a

Table 5.--Continued.

Species (stock) Fishery Area Year	Groundfish			Marine mammals						
	Total groundfish catch (t)	Percent of groundfish catch monitored	Number of trawl hauls monitored (n)	Number of marine mammals observed in monitored hauls	Bycatch rate (per 10,000 metric tons)			Estimated bycatch (number of marine mammals)		
					\hat{R}_s	$s(\hat{R}_s)$	CV	\hat{Y}_A	$L_{95\%}$	
Northern fur seal (<i>Callorhinus ursinus</i>): Eastern Pacific stock										
BSAI flatfish trawl fishery										
Area 513										
2000	74,340.1	69.0	2,602	0	-	-	-	1.0	-	b
2001	73,235.9	65.9	2,356	1	0.1894	0.1001	0.53	1.4	0.5 to 3.7	
Bering Sea and Aleutian Islands region										
2000	217,248.6	64.5	6,945	0	-	-	-	1.0	-	b
2001	175,766.1	57.6	5,414	1	0.0789	0.0417	0.53	1.4	0.5 to 3.7	
BSAI pollock trawl fishery										
Area 517										
1998	413,908.5	65.6	4,364	1	0.0844	0.0723	0.86	3.5	0.8 to 15.0	
Bering Sea and Aleutian Islands region										
1998	1,134,092.0	66.9	11,897	1	0.0308	0.0264	0.86	3.5	0.8 to 15.0	
Walrus (<i>Odobenus rosmarus</i>): Alaska stock										
BSAI flatfish trawl fishery										
Area 513										
1998	91,263.9	60.8	2,467	0	-	-	-	1.0	-	b
2000	74,340.1	69.0	2,602	0	-	-	-	2.0	-	b
Area 514										
2002	28,118.0	62.3	826	2	1.1703	0.5140	0.44	3.3	1.4 to 7.5	a
2004	34,791.9	67.0	1,071	2	0.8878	0.3732	0.42	3.1	1.4 to 6.8	a
Bering Sea and Aleutian Islands region										
1998	223,506.0	59.4	6,896	0	-	-	-	1.0	-	b
2000	217,248.6	64.5	6,945	0	-	-	-	2.0	-	b
2002	190,877.0	58.4	5,784	2	0.1724	0.0757	0.44	3.3	1.4 to 7.5	a
2004	190,964.8	64.3	5,061	2	0.1618	0.0680	0.42	3.1	1.4 to 6.8	a
Bearded seal (<i>Erignathus barbatus</i>): Alaska stock										
BSAI flatfish trawl fishery										
Area 509										
2001	58,960.0	52.7	1,589	1	0.3058	0.2039	0.67	1.8	0.5 to 5.9	
Area 513										
1998	91,263.9	60.8	2,467	1	0.1629	0.0931	0.57	1.5	0.5 to 4.2	
1999	58,305.0	71.0	2,025	1	0.2842	0.1793	0.63	1.7	0.5 to 5.2	
2000	74,340.1	69.0	2,602	1	0.2158	0.1324	0.61	1.6	0.5 to 4.9	
Bering Sea and Aleutian Islands region										
1998	223,506.0	59.4	6,896	1	0.0665	0.0380	0.57	1.5	0.5 to 4.2	
1999	177,817.6	66.3	5,714	1	0.0932	0.0588	0.63	1.7	0.5 to 5.2	
2000	217,248.6	64.5	6,945	1	0.0739	0.0453	0.61	1.6	0.5 to 4.9	
2001	175,766.1	57.6	5,414	1	0.1026	0.0684	0.67	1.8	0.5 to 5.9	

Table 5.--Continued.

Species (stock) Fishery Area Year	Groundfish			Marine mammals						
	Total groundfish catch (t)	Percent of groundfish catch monitored	Number of trawl hauls monitored (n)	Number of marine mammals observed in monitored hauls	Bycatch rate (per 10,000 metric tons)			Estimated bycatch (number of marine mammals)		
					\hat{R}_y	$s(\hat{R}_y)$	CV	\hat{Y}_A	$L_{95\%}$	
Bearded seal (<i>Erignathus barbatus</i>): Alaska stock (continued)										
BSAI pollock trawl fishery										
Area 509										
1999	203,599.2	71.0	2,090	0	-	-	-	1.0	-	b
Area 521										
1999	205,110.5	86.6	2,376	1	0.0895	0.0603	0.67	1.8	0.6 to 6.1	
Bering Sea and Aleutian Islands region										
1999	993,121.8	75.2	10,187	1	0.0185	0.0125	0.67	2.8	0.6 to 6.1	b
Harbor seal (<i>Phoca vitulina</i>): Bering Sea stock										
BSAI flatfish trawl fishery										
Area 509										
2004	42,791.5	62.6	942	0	-	-	-	1.0	-	b
Area 524										
2000	4,528.7	73.4	175	1	2.8771	1.3997	0.49	1.3	0.5 to 3.2	
Bering Sea region only ^d										
2000	217,248.6	64.5	6,945	1	0.0600	0.0292	0.49	1.3	0.5 to 3.2	
2004	190,964.8	64.3	5,061	0	-	-	-	1.0	-	b
BSAI Pacific cod trawl fishery										
Area 517										
2003	18,483.2	44.1	907	1	1.0789	0.7601	0.70	2.0	0.6 to 6.9	
2004	23,789.5	38.9	964	1	0.8227	0.5731	0.70	2.0	0.6 to 6.7	
Bering Sea region only ^d										
2003	65,152.9	42.3	2,871	1	0.3061	0.2156	0.70	2.0	0.6 to 6.9	
2004	87,994.2	45.3	3,261	1	0.2224	0.1549	0.70	2.0	0.6 to 6.7	
Spotted seal (<i>Phoca largha</i>): Alaska stock										
BSAI flatfish trawl fishery										
Area 509										
2004	42,791.5	62.6	942	1	0.3291	0.1776	0.54	1.4	0.5 to 3.8	
Area 514										
1999	25,663.2	75.1	504	0	-	-	-	1.0	-	b
2004	34,791.9	67.0	1,071	1	0.4439	0.2634	0.59	1.5	0.5 to 4.5	
Area 524										
2004	11,772.0	67.1	250	1	1.2373	0.6882	0.56	1.5	0.5 to 4.0	
Bering Sea and Aleutian Islands region										
1999	177,817.6	66.3	5,714	0	-	-	-	1.0	-	b
2004	190,964.8	64.3	5,061	3	0.2309	0.0754	0.33	4.4	2.4 to 8.2	a
Ringed seal (<i>Pusa hispida</i>): Alaska stock										
BSAI pollock trawl fishery										
Area 517										
2000	457,712.0	71.4	4,685	1	0.0316	0.0175	0.55	1.4	0.5 to 4.0	
Area 521										
2001	399,461.3	88.6	4,613	2	0.0526	0.0082	0.16	2.1	1.6 to 2.8	

Table 5.--Continued.

Species (stock) Fishery Area Year	Groundfish			Marine mammals					
	Total groundfish catch (t)	Percent of groundfish catch monitored	Number of trawl hauls monitored (n)	Number of marine mammals observed in monitored hauls	Bycatch rate (per 10,000 metric tons)			Estimated bycatch (number of marine mammals)	
					\hat{R}_y	$s(\hat{R}_y)$	CV	\hat{Y}_A	$L_{95\%}$
Ringed seal (<i>Pusa hispida</i>): Alaska stock (continued)									
BSAI pollock trawl fishery (continued)									
Bering Sea and Aleutian Islands region									
2000	1,145,794.8	76.2	12,383	1	0.0126	0.0070	0.55	1.4	0.5 to 4.0
2001	1,385,697.7	79.0	14,483	2	0.0152	0.0024	0.16	2.1	1.6 to 2.8
Ribbon seal (<i>Histiophoca fasciata</i>): Alaska stock									
BSAI pollock trawl fishery									
Area 517									
2001	427,138.4	76.3	3,945	0	-	-	-	1.0	- ^b
Bering Sea and Aleutian Islands region									
2001	1,385,697.7	79.0	14,483	0	-	-	-	1.0	- ^b
Northern elephant seal (<i>Mirounga angustirostris</i>): California breeding stock									
GOA pollock trawl fishery									
Area 620									
2003	20,308.4	38.9	292	1	1.7460	1.4957	0.86	3.5	0.8 to 15.2
Gulf of Alaska ^e									
2003	51,177.4	31.2	492	1	0.6929	0.5935	0.86	3.5	0.8 to 15.2
Unidentified phocids^f									
BSAI flatfish trawl fishery									
Area 514									
2001	7,377.6	71.6	199	1	2.4691	1.6541	0.67	1.8	0.6 to 6.0
Bering Sea and Aleutian Islands region									
2001	175,766.1	57.6	5,414	1	0.1036	0.0694	0.67	1.8	0.6 to 6.0
Unidentified pinnipeds^f									
BSAI flatfish trawl fishery									
Area 509									
2002	35,241.8	56.8	936	0	-	-	-	1.0	- ^b
Bering Sea and Aleutian Islands region									
2002	190,877.0	58.4	5,784	0	-	-	-	1.0	- ^b

Table 5.--Continued.

Species (stock) Fishery Area Year	Groundfish			Marine mammals					
	Total groundfish catch (t)	Percent of groundfish catch monitored	Number Of Trawl Hauls monitored (n)	Number of marine mammals Observed in monitored Hauls	Bycatch rate (per 10,000 metric tons)			Estimated bycatch (number of marine mammals)	
					\hat{R}_y	$s(\hat{R}_y)$	CV	\hat{Y}_A	$L_{95\%}$
Humpback whale (<i>Megaptera novaeangliae</i>): Central or Western North Pacific stocks ^g									
BSAI pollock trawl fishery									
Area 509									
1999	203,599.2	71.0	2,090	1	0.0701	0.0384	0.55	1.4	0.5 to 3.9
Area 517									
1998	413,908.5	65.6	4,364	1	0.0426	0.0280	0.66	1.8	0.5 to 5.7
Bering Sea and Aleutian Islands region									
1998	1,134,092.0	66.9	11,897	1	0.0155	0.0102	0.66	1.8	0.5 to 5.7
1999	993,121.8	75.2	10,187	1	0.0144	0.0079	0.55	1.4	0.5 to 3.9
Minke whale (<i>Balaenoptera acutorostrata</i>): Alaska stock									
BSAI pollock trawl fishery									
Area 517									
2000	457,712.0	71.4	4,685	1	0.0345	0.0209	0.61	1.6	0.5 to 4.7
Bering Sea and Aleutian Islands region									
2000	1,145,794.8	76.2	12,383	1	0.0138	0.0083	0.61	1.6	0.5 to 4.7
Fin whale (<i>Balaenoptera physalus</i>): Northeast Pacific stock									
GOA pollock trawl fishery									
Area 620									
1999	39,611.3	35.8	492	1	0.7507	0.6126	0.82	3.0	0.7 to 12.1
Gulf of Alaska ^e									
1999	97,234.7	31.7	947	1	0.3058	0.2495	0.82	3.0	0.7 to 12.1
Unidentified baleen whales ^f									
BSAI pollock trawl fishery									
Area 521									
2001	399,461.3	88.6	4,613	1	0.0265	0.0062	0.24	1.1	0.7 to 1.7
Bering Sea and Aleutian Islands region									
2001	1,385,697.7	79.0	14,483	1	0.0076	0.0018	0.24	1.1	0.7 to 1.7
Killer whale (<i>Orcinus orca</i>): Eastern North Pacific Alaska resident stock									
BSAI flatfish trawl fishery ^h									
Area 517									
1998	36,941.0	57.4	1,435	1	0.5457	0.3877	0.71	2.0	0.6 to 7.1
Area 519									
2001	626.5	51.3	34	1	23.2408	12.8809	0.55	1.5	0.5 to 4.0
Area 521									
2004	38,254.7	58.4	1,172	1	0.4576	0.3004	0.66	1.8	0.5 to 5.7
Bering Sea and Aleutian Islands region									
1998	223,506.0	59.4	6,896	1	0.0902	0.0641	0.71	2.0	0.6 to 7.1
2001	175,766.1	57.6	5,414	1	0.0828	0.0459	0.55	1.5	0.5 to 4.0
2004	190,964.8	64.3	5,061	1	0.0917	0.0602	0.66	1.8	0.5 to 5.7

Table 5.--Continued.

Species (stock) Fishery Area Year	Groundfish			Marine mammals						
	Total groundfish catch (t)	Percent of groundfish catch monitored	Number of trawl hauls monitored (n)	Number of marine mammals Observed in monitored Hauls	Bycatch rate (per 10,000 metric tons)			Estimated bycatch (number of marine mammals)		
					\hat{R}_y	$s(\hat{R}_y)$	CV	\hat{Y}_A	$L_{95\%}$	
Killer whale (<i>Orcinus orca</i>): Eastern North Pacific Gulf of Alaska, Aleutian Islands, and Bering Sea transient stock										
BSAI pollock trawl fishery¹										
Area 521										
1999	205,110.5	86.6	2,376	0	-	-	-	1.0	-	b
2002	311,630.8	91.4	3,512	1	0.0337	0.0073	0.22	1.0	0.7 to 1.6	
2003	541,245.0	92.3	6,030	0	-	-	-	1.0	-	b
Bering Sea and Aleutian Islands region										
1999	993,121.8	75.2	10,187	0	-	-	-	1.0	-	b
2002	1,468,671.3	80.0	14,325	1	0.0071	0.0015	0.22	1.0	0.7 to 1.6	
2003	1,481,321.3	82.2	14,587	0	-	-	-	1.0	-	b
Harbor porpoise (<i>Phocoena phocoena</i>): Bering Sea stock										
BSAI flatfish trawl fishery										
Area 513										
1998	91,263.9	60.8	2,467	1	0.2043	0.1388	0.68	1.9	0.6 to 6.2	
2001	73,235.9	65.9	2,356	1	0.2374	0.1548	0.65	1.7	0.5 to 5.6	
Bering Sea and Aleutian Islands region										
1998	223,506.0	59.4	6,896	1	0.0834	0.0567	0.68	1.9	0.6 to 6.2	
2001	175,766.1	57.6	5,414	1	0.0989	0.0645	0.65	1.7	0.5 to 5.6	
Dall's porpoise (<i>Phocoenoides dalli</i>): Alaska stock										
BSAI pollock trawl fishery										
Area 509										
1998	422,331.2	65.8	4,063	0	-	-	-	1.0	-	b
1999	203,599.2	71.0	2,090	1	0.1466	0.1138	0.78	3.0	0.8 to 11.5	
Area 517										
1998	413,908.5	65.6	4,364	2	0.0952	0.0516	0.54	3.9	1.5 to 10.6	a
2002	620,223.8	75.1	5,464	1	0.0231	0.0127	0.55	1.4	0.5 to 3.9	
Area 519										
1998	82,858.0	57.9	700	1	0.3447	0.2768	0.80	2.9	0.7 to 11.4	
Area 521										
1999	205,110.5	86.6	2,376	1	0.0895	0.0603	0.67	1.8	0.6 to 6.1	a,b
2000	284,440.4	86.4	3,159	3	0.1102	0.0132	0.12	4.1	2.5 to 4.0	
2001	399,461.3	88.6	4,613	2	0.0724	0.0284	0.39	2.9	1.4 to 6.1	a
2004	369,573.3	91.2	4,089	1	0.0272	0.0016	0.06	1.0	0.9 to 1.1	
Bering Sea and Aleutian Islands region										
1998	1,134,092.0	66.9	11,897	3	0.0599	0.0276	0.46	7.8	2.9 to 16.1	b
1999	993,121.8	75.2	10,187	2	0.0485	0.0265	0.54	4.8	1.8 to 13.1	
2000	1,145,794.8	76.2	12,383	3	0.0273	0.0033	0.12	4.1	2.5 to 4.0	a,b
2001	1,385,697.7	79.0	14,483	2	0.0209	0.0082	0.39	2.9	1.4 to 6.1	a
2002	1,468,671.3	80.0	14,325	1	0.0098	0.0054	0.55	1.4	0.5 to 3.9	
2004	1,467,838.8	81.2	14,545	1	0.0068	0.0004	0.06	1.0	0.9 to 1.1	

Table 5.--Continued.

Species (stock) Fishery Area Year	Groundfish			Marine mammals					
	Total groundfish catch (t)	Percent of groundfish catch monitored	Number of trawl hauls monitored (n)	Number of marine mammals observed in monitored hauls	Bycatch rate (per 10,000 metric tons)			Estimated bycatch (number of marine mammals)	
					\hat{R}_y	$s(\hat{R}_y)$	CV	\hat{Y}_A	$L_{95\%}$
Dall's porpoise (<i>Phocoenoides dalli</i>): Alaska stock (continued)									
GOA pollock trawl fishery									
Area 610									
1998	29,534.0	47.8	198	1	0.5366	0.3287	0.61	1.6	0.5 to 4.8
Gulf of Alaska ^e									
1998	126,747.4	37.5	1,381	1	0.1250	0.0766	0.61	1.6	0.5 to 4.8

- ^a The lower 95% confidence level (rounded to an integer) was less than the number of animals seen by U.S. observers in monitored hauls.
- ^b Bycatch seen by observers occurred only in the unmonitored hauls of observed cruises in some strata.
- ^c Includes only statistical fishing areas 610, 620, 630, 640 and 649 (Fig. 2).
- ^d Excludes the Aleutian Islands region (statistical fishing areas 541, 542 and 543 in Fig. 1) of the Bering Sea.
- ^e Includes all statistical fishing areas in the Gulf of Alaska and Southeast Alaska (Fig. 2).
- ^f Includes animals that may belong to one of the identified species.
- ^g The two stocks overlap in the same geographical areas (Angliss and Outlaw 2005). Due to a lack of DNA samples it was not possible to determine which stock was impacted by the different components of the groundfish fisheries.
- ^h All of the DNA samples collected from killer whales incidentally caught by the BSAI flatfish trawl fishery were from northern residents (M. Dahlheim, NMML, AFSC, pers. comm.), and the BSAI flatfish trawl fishery was considered to have been primarily involved with this stock of killer whales. However, it was not possible to determine the stock identification from all of the killer whales caught by the BSAI flatfish trawl fishery because of a lack of DNA samples for some individuals. The Eastern North Pacific northern resident and transient stocks of killer whales overlap in the same geographical areas (Angliss and Outlaw 2005). It may still be possible that some transient stock killer whales could also be caught by this fishery.
- ⁱ DNA samples collected from each of the killer whales incidentally caught by the BSAI pollock trawl fishery during 1998-2004 were from transients (M. Dahlheim, NMML, AFSC, pers. comm.), and the BSAI pollock trawl fishery was considered to have been primarily involved with this stock of killer whales. However, an incomplete carcass of a previously dead resident killer whale was caught in the lines of trawl gear during one haul in the BSAI pollock trawl fishery in 2003 (Appendix 3), and it may still be possible that some resident stock killer whales could be taken by this fishery.

Table 6.--Number of marine mammals, by species, incidentally taken by vessels of the groundfish longline fisheries in the U.S. Exclusive Economic Zone in the Bering Sea, Aleutian Islands region, and Gulf of Alaska, 1998-2004, reported by U.S. fishery observers, including an estimation of the total incidental mortality by area and year. Catch rates are the ratio (\hat{R}_s) and standard error ($s(\hat{R}_s)$) of the stratified observed incidental take of marine mammals killed (or seriously injured) monitored during fishing operations to the observed groundfish catch (per 10,000 metric tons [t] basis). The coefficient of variation (CV) of the catch rate is also listed. Estimated mortality of marine mammals as bycatch is the adjusted ratio estimate (\hat{Y}_A). The 95% confidence interval ($L_{95\%}$) is an approximation based on the natural log-transformation (Burnham et al. 1987) using the CV of the nonadjusted stratified ratio estimate (extrapolated bycatch, \hat{Y}_{R_s}).

Species (stock) Fishery Area Year	Groundfish			Marine mammals						
	Total groundfish catch (t)	Percent of groundfish catch monitored	Number of longline sets monitored (n)	Number of marine mammals observed in monitored sets	Bycatch rate (per 10,000 metric tons)			Estimated bycatch (number of marine mammals)		
					\hat{R}_s	$s(\hat{R}_s)$	CV	\hat{Y}_A	$L_{95\%}$	
Steller sea lion (<i>Eumetopias jubatus</i>): western U.S. stock										
BSAI Pacific cod longline fishery										
Area 509										
2002	23,375.5	30.4	1,940	1	1.5905	1.3631	0.86	3.7	0.9 to 15.9	
Bering Sea and Aleutian Islands region										
2002	129,870.1	29.6	10,627	1	0.2863	0.2454	0.86	3.7	0.9 to 15.9	
Steller sea lion (<i>Eumetopias jubatus</i>): eastern U.S. stock										
GOA sablefish longline fishery										
Area 650										
2000	5,049.3	8.5	167	1	13.5725	12.4949	0.92	6.9	1.5 to 31.8	
Gulf of Alaska (areas east of 140°W longitude) ^a and southeast Alaska										
2000	7,120.4	6.0	167	1	9.6248	8.8606	0.92	6.9	1.5 to 31.8	
Unidentified otariids^b										
BSAI Pacific cod longline fishery										
Area 516										
1999	2,119.9	36.5	146	1	7.2296	4.2163	0.58	1.5	0.5 to 4.4	
Bering Sea and Aleutian Islands region										
1999	110,591.3	31.8	8,196	1	0.1386	0.0808	0.58	1.5	0.5 to 4.4	
Ribbon seal (<i>Histiophoca fasciata</i>): Alaska stock										
BSAI Pacific cod longline fishery										
Area 521										
2001	48,598.5	31.7	3,627	1	0.6191	0.5066	0.82	3.0	0.7 to 12.2	
Bering Sea and Aleutian Islands region										
2001	135,835.6	29.5	11,902	1	0.2215	0.1812	0.82	3.0	0.7 to 12.2	

Table 6.--Continued.

Species (stock) Fishery Area Year	Groundfish			Marine mammals						
	Total groundfish catch (t)	Percent of groundfish catch monitored	Number of longline sets monitored (n)	Number of marine mammals observed in monitored sets	Bycatch rate (per 10,000 metric tons)			Estimated bycatch (number of marine mammals)		
					\hat{R}_y	$s(\hat{R}_y)$	CV	\hat{Y}_A	$L_{95\%}$	
Unidentified pinnipeds^b										
BSAI Pacific cod longline fishery										
Area 524										
2001	2,702.2	27.6	277	1	11.0525	8.9494	0.81	3.0	0.7 to 12.0	
Bering Sea and Aleutian Islands region										
2001	135,835.6	29.5	11,902	1	0.2199	0.1780	0.81	3.0	0.7 to 12.0	
Sperm whale (<i>Physeter macrocephalus</i>)^c										
GOA sablefish longline fishery										
Area 640										
2000	2,255.9	30.1	257	1	9.8739	7.3983	0.75	2.2	0.6 to 8.2	
Gulf of Alaska ^d										
2000	19,140.6	15.2	1,076	1	1.1637	0.8720	0.75	2.2	0.6 to 8.2	
Killer whale (<i>Orcinus orca</i>): Eastern North Pacific Alaska resident stock^e										
BSAI Greenland turbot longline fishery										
Area 521										
1999	2,839.2	29.3	236	1	10.5387	8.5685	0.81	3.0	0.7 to 12.1	
Bering Sea and Aleutian Islands region										
1999	8,998.6	30.8	828	1	3.3251	2.7035	0.81	3.0	0.7 to 12.1	
BSAI Pacific cod longline fishery										
Area 521										
2003	79,503.6	30.1	6,478	1	0.5262	0.4601	0.87	4.2	1.0 to 18.3	
Bering Sea and Aleutian Islands region										
2003	144,000.9	29.9	12,951	1	0.2905	0.2540	0.87	4.2	1.0 to 18.3	
Dall's porpoise (<i>Phocoenoides dalli</i>): Alaska stock										
BSAI Pacific cod longline fishery										
Area 517										
1999	18,218.5	34.9	1,393	0	-	-	-	1.0	-	^f
Bering Sea and Aleutian Islands region										
1999	110,591.3	31.8	8,196	0	-	-	-	1.0	-	^f

^a Includes only statistical fishing areas 650 and 659 (Fig. 2). Although animals of this stock can be found at locations east of Cape Suckling (144°W) in statistical area 640 (Fig. 2), that area was excluded because the CAS (formerly Blend) data for individual statistical fishing areas could not be subdivided.

^b Includes animals that may belong to one of the identified species.

Table 6.--Continued.

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- ^c No sperm whales have been observed killed by any type of groundfish fishery gear in Alaska. These estimates were based solely on one animal which was observed caught and released with trailing longline gear; this trailing gear take was classified as a serious injury. Another sperm whale with trailing gear was caught by the sablefish longline fishery in the same area previously in 1997.
- ^d Includes all statistical fishing areas in the Gulf of Alaska and Southeast Alaska (Fig. 2).
- ^e A DNA sample collected from the one killer whale observed incidentally taken during 1998-2004 by the BSAI Pacific cod longline fishery was from a northern resident (M. Dahlheim, NMML, AFSC, pers. comm.), and the BSAI Greenland turbot longline fishery was likewise considered to have been primarily involved with this stock of killer whales. However, it was not possible to verify the stock identification of the killer whale caught by the BSAI Greenland turbot longline fishery because of a lack of DNA samples. The Eastern North Pacific northern resident and transient stocks of killer whales overlap in the same geographical areas (Angliss and Outlaw 2005). It may still be possible that some transient stock killer whales could also be caught by either fishery.
- ^f Bycatch seen by observers occurred only in the unmonitored sets of observed cruises in some strata.

Table 7.--Number of marine mammals, by species, incidentally taken by vessels of the groundfish pot fisheries in the U.S. Exclusive Economic Zone in the Bering Sea, Aleutian Islands region, and Gulf of Alaska, 1998-2004, reported by U.S. fishery observers, including an estimation of the total incidental mortality by area and year. Catch rates are the ratio (\hat{R}_y) and standard error ($s(\hat{R}_y)$) of the stratified observed incidental take of marine mammals killed (or seriously injured) monitored during fishing operations to the observed groundfish catch (per 10,000 metric tons [t] basis). The coefficient of variation (CV) of the catch rate is also listed. Estimated mortality of marine mammals as bycatch is the adjusted ratio estimate (\hat{Y}_A). The 95% confidence interval ($L_{95\%}$) is an approximation based on the natural log-transformation (Burnham et al. 1987) using the CV of the nonadjusted stratified ratio estimate (extrapolated bycatch, \hat{Y}_{R_i}).

Species (stock) Fishery Area Year	Groundfish				Marine mammals					
	Total groundfish catch (t)	Percent of groundfish catch monitored	Number of pot sets monitored (n)	Number of marine mammals observed in monitored sets	Bycatch rate (per 10,000 metric tons)			Estimated bycatch (number of marine mammals)		
					\hat{R}_y	$s(\hat{R}_y)$	CV	\hat{Y}_A	$L_{95\%}$	
Harbor seal (<i>Phoca vitulina</i>): Gulf of Alaska stock										
BSAI Pacific cod pot fishery										
Area 542										
1999	762.1	26.3	216	1	17.2964	8.1417	0.47	1.3	0.5 to 3.2	
Aleutian Islands region only ^a										
1999	4,338.5	23.4	758	1	3.0381	1.4301	0.47	1.3	0.5 to 3.2	
GOA Pacific cod pot fishery										
Area 610										
1998	1,923.1	7.3	90	1	8.0943	5.2400	0.65	1.6	0.5 to 5.0	
Gulf of Alaska (areas at and west of 140°W longitude) ^b										
1998	10,947.8	6.7	420	1	1.4219	0.9205	0.65	1.6	0.5 to 5.0	
Humpback whale (<i>Megaptera novaeangliae</i>): Central or Western North Pacific stocks^{c,d,e}										
BS sablefish pot fishery										
Area 519										
2002	262.8	38.2	205	0	-	-	-	1.0	-	f
Bering Sea region only ^g										
2002	403.2	40.6	313	0	-	-	-	1.0	-	f
Unidentified baleen whales^{d,h}										
BSAI Pacific cod pot fishery										
Area 513										
1998	899.5	27.6	61	0	-	-	-	1.0	-	f
Bering Sea and Aleutian Islands region										
1998	14,514.5	14.6	976	0	-	-	-	1.0	-	f

Table 7.--Continued.

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- ^a Includes only statistical fishing areas 541, 542 and 543 (Fig. 1).
- ^b Includes only statistical fishing areas 610, 620, 630, 640 and 649 (Fig. 2).
- ^c The two stocks overlap in the same geographical areas (Angliss and Outlaw 2005); it was not possible to determine which stock was impacted by the different components of the groundfish fisheries.
- ^d The baleen whales which were the bases for the estimates in this table were entangled and caught by the fishing lines, and subsequently released alive from the gear by the crew with entangled trailing gear; no cetaceans were observed killed directly during fishing operations with pot gear in Alaska during 1998-2004.
- ^e A humpback whale was also observed caught in the lines during a set on another vessel in the sablefish pot fishery in the same area five months earlier in 2002, but that animal was released alive from the gear by the crew with no known injuries or trailing gear.
- ^f Bycatch seen by observers occurred only in the unmonitored sets of observed cruises in some strata.
- ^g Excludes the Aleutian Islands region (statistical fishing areas 541, 542 and 543 in Fig. 1) of the Bering Sea.
- ^h These estimates were based solely on one unidentified baleen whale which was not a humpback whale; however, it may have been a fin whale or minke whale.

Table 8.--Average annual (2000-2004) number of marine mammals, by species and stock ^a, incidentally taken by each of the groundfish fisheries in the U.S. Exclusive Economic Zone in the Bering Sea (BS), Aleutian Islands (AI), and Gulf of Alaska (GOA) ^b. Catch rates are the ratio (\hat{R}_s) and standard error ($s(\hat{R}_s)$) of the average annual stratified observed incidental take of marine mammals killed (or seriously injured) monitored during fishing operations to the average annual observed groundfish catch (per 10,000 metric tons [t] basis). The coefficient of variation (CV) of the catch rate is also listed. Estimated mortality of marine mammals as bycatch is the average annual adjusted ratio estimate (\hat{Y}_A). The 95% confidence interval ($L_{95\%}$) is an approximation based on the natural log-transformation (Burnham et al. 1987) using the CV of the nonadjusted stratified ratio estimate (extrapolated bycatch, \hat{Y}_R).

Species (stock) ^c Fishery	Percent of groundfish catch monitored	Number of marine mammals observed in monitored hauls/sets	Average annual values (2000-2004)					
			Marine mammal bycatch rate (per 10,000 metric tons)			Estimated bycatch (number of marine mammals)		
			\hat{R}_s	$s(\hat{R}_s)$	CV	\hat{Y}_A	$L_{95\%}$	
Steller sea lion (<i>Eumetopias jubatus</i>): western U.S. stock								
BSAI Atka mackerel trawl	91.2	0.6	0.1148	0.0265	0.23	0.71	0.45 to 1.11	d
BSAI flatfish trawl	61.9	2.4	0.1818	0.0301	0.17	3.67	2.52 to 4.79	e
BSAI Pacific cod trawl	51.0	0.4	0.0959	0.0701	0.73	0.85	0.24 to 3.07	d
BSAI pollock trawl	79.9	1.6	0.0134	0.0019	0.14	2.26	1.41 to 2.45	d,e
BSAI rockfish trawl	80.7	0	-	-	-	-	-	
GOA flatfish trawl ^g	36.6	0	-	-	-	-	-	
GOA Pacific cod trawl ^g	21.4	0.2	0.4353	0.3595	0.83	0.94	0.23 to 3.84	
GOA pollock trawl ^g	25.5	0.2	0.0758	0.0729	0.96	0.48	0.10 to 2.36	d
GOA rockfish trawl ^g	47.4	0	-	-	-	-	-	
BSAI Greenland turbot longline	42.6	0	-	-	-	-	-	
BSAI Pacific cod longline	29.4	0.2	0.0546	0.0468	0.86	0.74	0.17 to 3.18	
BSAI Pacific halibut longline	35.9	0	-	-	-	-	-	
BSAI rockfish longline	45.3	0	-	-	-	-	-	
BSAI sablefish longline	20.0	0	-	-	-	-	-	
GOA Pacific cod longline ^g	8.6	0	-	-	-	-	-	
GOA Pacific halibut longline ^g	23.6	0	-	-	-	-	-	
GOA rockfish longline ^g	3.9	0	-	-	-	-	-	
GOA sablefish longline ^g	14.2	0	-	-	-	-	-	
BSAI Pacific cod pot	11.7	0	-	-	-	-	-	
BS sablefish pot ^h	38.1	0	-	-	-	-	-	
AI sablefish pot ⁱ	45.7	0	-	-	-	-	-	
GOA Pacific cod pot ^g	4.9	0	-	-	-	-	-	
AK miscellaneous finfish jig ^{g,h,i}	<0.01	0	-	-	-	-	-	
Steller sea lion (<i>Eumetopias jubatus</i>): eastern U.S. stock								
GOA flatfish trawl ^j	NF	-	-	-	-	-	-	
GOA Pacific cod trawl ^j	NF	-	-	-	-	-	-	
GOA pollock trawl ^j	NF	-	-	-	-	-	-	
GOA rockfish trawl ^j	NF	-	-	-	-	-	-	
GOA Pacific cod longline ^j	0	-	-	-	-	-	-	
GOA Pacific halibut longline ^j	7.3	-	-	-	-	-	-	
GOA rockfish longline ^j	0.1	0	-	-	-	-	-	
GOA sablefish longline ^j	5.3	0.2	2.1558	1.9846	0.92	1.37	0.30 to 6.37	d
GOA Pacific cod pot ^j	6.4	-	-	-	-	-	-	
AK miscellaneous finfish jig ^j	0	-	-	-	-	-	-	
Northern fur seal (<i>Callorhinus ursinus</i>): Eastern Pacific stock								
BSAI flatfish trawl	61.9	0.2	0.0145	0.0077	0.53	0.48	0.10 to 0.73	d,e
Historical takes in the BSAI Atka mackerel trawl and BSAI pollock trawl fisheries ^f								
Walrus (<i>Odobenus rosmarus</i>): Alaska stock								
BSAI flatfish trawl	61.9	0.8	0.0668	0.0203	0.30	1.68	0.71 to 2.29	d,e

Table 8.--Continued.

Species (stock) ^c Fishery	Average annual values (2000-2004)							
	Percent of groundfish catch monitored	Number of marine mammals observed in monitored hauls/sets	Marine mammal bycatch rate (per 10,000 metric tons)			Estimated bycatch (number of marine mammals)		
			\hat{R}_s	$s(\hat{R}_s)$	CV	\hat{Y}_A	$L_{95\%}$	
Bearded seal (<i>Erignathus barbatus</i>): Alaska stock								
BSAI flatfish trawl	61.9	0.4	0.0357	0.0163	0.46	0.68	0.29 to 1.60	d
Historical takes in the BSAI Pacific cod trawl and BSAI pollock trawl fisheries								
Harbor seal (<i>Phoca vitulina</i>): Bering Sea stock								
BSAI flatfish trawl ¹	61.9	0.2	0.0136	0.0066	0.49	0.46	0.11 to 0.64	d,e
BSAI Pacific cod trawl ¹	45.0	0.4	0.1253	0.0621	0.50	0.79	0.32 to 1.98	d
Historical takes in the BSAI pollock trawl, BSAI Pacific cod longline, and BSAI Pacific cod pot fisheries								
Harbor seal (<i>Phoca vitulina</i>): Gulf of Alaska stock								
Historical takes in the GOA Pacific cod trawl, GOA sablefish longline, BSAI Pacific cod pot, and GOA Pacific cod pot fisheries								
Harbor seal (<i>Phoca vitulina</i>): Southeast Alaska stock								
Historical longline fishery take not documented by target fishery								
Spotted seal (<i>Phoca largha</i>): Alaska stock								
BSAI flatfish trawl	61.9	0.6	0.0461	0.0151	0.33	0.88	0.47 to 1.65	d
Historical take in the BSAI pollock trawl fishery								
Ringed seal (<i>Pusa hispida</i>): Alaska stock								
BSAI pollock trawl	79.9	0.6	0.0051	0.0012	0.24	0.71	0.44 to 1.14	d
Historical take in the BSAI flatfish trawl fishery								
Ribbon seal (<i>Histriophoca fasciata</i>): Alaska stock								
BSAI pollock trawl	79.9	0	-	-	-	0.20	-	e
BSAI Pacific cod longline	29.4	0.2	0.0442	0.0362	0.82	0.60	0.15 to 2.45	d
Northern elephant seal (<i>Mirounga angustirostris</i>): California breeding stock								
GOA pollock trawl	25.5	0.2	0.1114	0.0954	0.86	0.71	0.17 to 3.04	
Historical take in the GOA sablefish longline fishery								
Humpback whale (<i>Megaptera novaeangliae</i>): Central or Western North Pacific stocks^k								
BS sablefish pot	38.1	0	-	-	-	0.20	-	e
Historical take in the BSAI pollock trawl fishery								
Minke whale (<i>Balaenoptera acutorostrata</i>): Alaska stock								
BSAI pollock trawl	79.9	0.2	0.0023	0.0014	0.61	0.32	0.11 to 0.94	d
Fin whale (<i>Balaenoptera physalus</i>): Northeast Pacific stock								
Historical take in the GOA pollock trawl fishery								
Sperm whale (<i>Physeter macrocephalus</i>): North Pacific stock								
GOA sablefish longline	11.5	0.2	0.2138	0.1602	0.75	0.45	0.12 to 1.65	g
Pacific white-sided dolphin (<i>Lagenorhynchus obliquidens</i>): North Pacific stock								
Historical take in the BSAI Pacific cod longline fishery and BSAI trawl fishery (pollock or Pacific cod)								

Table 8.--Continued.

Species (stock) ^c Fishery	Average annual values (2000-2004)							
	Percent of groundfish catch monitored	Number of marine mammals observed in monitored hauls/sets	Marine mammal bycatch rate (per 10,000 metric tons)			Estimated bycatch (number of marine mammals)		
			\hat{R}_s	$s(\hat{R}_s)$	CV	\hat{Y}_A	$L_{95\%}$	
Killer whale (<i>Orcinus orca</i>): Eastern North Pacific Alaska resident stock¹								
BSAI flatfish trawl	61.9	0.4	0.0336	0.0147	0.44	0.64	0.28 to 1.46	d
BSAI Pacific cod longline	29.4	0.2	0.0615	0.0538	0.87	0.84	0.19 to 3.66	
Historical takes in the BSAI Pacific cod trawl and BSAI Greenland turbot longline fisheries								
Killer whale (<i>Orcinus orca</i>): Eastern North Pacific Gulf of Alaska, Aleutian Islands, and Bering Sea transient stock								
BSAI pollock trawl	79.9	0.2	0.0015	0.0003	0.22	0.41	0.14 to 0.32	d,e,m
Harbor porpoise (<i>Phocoena phocoena</i>): Bering Sea stock								
BSAI flatfish trawl	61.9	0.2	0.0182	0.0119	0.65	0.35	0.11 to 1.12	d
Historical take in the BSAI Pacific cod trawl fishery								
Harbor porpoise (<i>Phocoena phocoena</i>): Gulf of Alaska stock								
No documented incidental mortalities or serious injuries in the domestic groundfish fisheries								
Harbor porpoise (<i>Phocoena phocoena</i>): Southeast Alaska stock								
No documented incidental mortalities or serious injuries in the domestic groundfish fisheries								
Dall's porpoise (<i>Phocoenoides dalli</i>): Alaska stock								
BSAI pollock trawl	79.9	1.4	0.0122	0.0021	0.17	1.89	1.22 to 2.35	d,e
Historical takes in the BSAI flatfish trawl, GOA pollock trawl, BSAI Pacific cod longline, and AK miscellaneous other finfish mechanical jig fisheries								
Sea otter (<i>Enhydra lutris</i>): Southwest Alaska stock								
Historical takes in 1992 only in the BSAI Pacific cod pot fishery in the Aleutian Islands region								

NF = No fishing by the fishery in the areas where the marine mammal species stock occurs.

^a The stock definitions were taken from Angliss and Outlaw (2005).

^b The groundfish target species fisheries in Alaska were listed in 69 FR 48407 (10 August 2004). The percent of fishery catch (tons) with observer coverage for all observed groundfish fisheries in Alaska are listed for the Steller sea lion regardless of bycatch; only fisheries with reported bycatch during 2000 to 2004 (or records of historical bycatch during 1991-1999) are listed for other marine mammal species.

^c Estimated average annual bycatch of marine mammals during 2000-2004 is listed for each identified species that was incidentally killed (or seriously injured) by any gear in the groundfish fisheries in each region during 1973-2004 based on the data in Tables 5-7, Appendices 3 and 7, and in Perez and Loughlin (1991) and Perez (2003).

^d The lower 95% confidence level (rounded to one decimal place) of the average annual extrapolated bycatch was less than the average annual number (rounded to 1 decimal place) of animals seen by U.S. observers in monitored hauls/sets.

^e Bycatch seen by observers occurred only in the unmonitored hauls/sets of observed cruises in some strata.

Table 8.--Continued.

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- ^f One northern fur seal may have died in trawl gear during fishing operations in the BSAI Pacific cod fishery in 2003; however, although the observer stated that the animal was not visibly decomposed, the observer recorded the interaction as previously dead.
- ^g The data used for this fishery and species stock included only statistical fishing areas 610, 620, 630, 640 and 649 (Fig. 2).
- ^h The data used for this fishery and species stock excluded the Aleutian Islands region (statistical fishing areas 541, 542 and 543 in Fig. 1) of the Bering Sea.
- ⁱ The data used for this fishery and species stock included only statistical fishing areas 541, 542 and 543 (Fig. 1).
- ^j The data used for this fishery and species stock included only statistical areas 650 and 659 (Fig. 2). Although animals of this species stock can be found at locations east of Cape Suckling (144°W) in statistical area 640 (Fig. 2), that area was excluded because the CAS (formerly Blend) data for individual statistical fishing areas could not be subdivided.
- ^k The two stocks overlap in the same geographical areas (Angliss and Outlaw 2005); it was not possible to determine which stock was impacted by the different components of the groundfish fisheries.
- ^l All of the DNA samples collected from killer whales incidentally caught by the BSAI flatfish trawl fishery and the BSAI Pacific cod longline fishery were from northern residents (M. Dahlheim, NMML, AFSC, pers. comm.). The BSAI Pacific cod trawl fishery and the BSAI Greenland turbot longline fishery were likewise considered to have been primarily involved with this stock of killer whales. The Eastern North Pacific northern resident and transient stocks of killer whales overlap in the same geographical areas (Angliss and Outlaw 2005). It may still be possible that some transient stock killer whales could also be caught by any of these fisheries.
- ^m The upper 95% confidence level (rounded to one decimal place) of the average annual extrapolated bycatch was less than the average annual estimated bycatch (rounded to 1 decimal place).

Table 9.—Average annual weight (metric tons) of the total groundfish catch subjected to possible depredation impacts by marine mammals observed in the groundfish fisheries of Alaska, by gear and fishery, 1998-2004. The minimum number of individual marine mammals (in parentheses), by species, observed feeding directly from the gear is also listed.

Fishery	Average annual total groundfish catch (t)	Estimated groundfish catch impacted by marine mammals (t) ^a	Percent of total groundfish catch impacted	Marine mammal species (average annual minimum number of individuals feeding on the groundfish catch) ^{b,c}
Trawl gear fisheries				
BSAI Atka mackerel trawl	63,227.9	45.4	0.07	EJ (5), OO (5)
BSAI flatfish trawl	193,844.5	186.4	0.10	EJ (1), OO (28), PV (1)
BSAI Pacific cod trawl	87,314.5	49.6	0.06	EJ (1), OO (10)
BSAI pollock trawl	1,296,648.3	47.1	<0.01	OO (2)
BSAI rockfish trawl	11,819.3	0	-	-
GOA flatfish trawl	30,198.7	5.2	0.02	EJ (1)
GOA Pacific cod trawl	27,629.3	0	-	-
GOA pollock trawl	77,474.2	0	-	-
GOA rockfish trawl	24,619.0	0	-	-
AK miscellaneous other finfish trawl	1,947.2	0	-	-
Longline gear fisheries				
BSAI Greenland turbot longline	6,617.9	813.8	12.30	CU (1), EJ (3), OO (45)
BSAI Pacific cod longline	130,717.5	1,383.2	1.06	CU (4), EJ (11), OO (21), PX (1), UP (1), ZZ (1)
BSAI Pacific halibut longline	1,560.5	120.5	7.73	CU (1), EJ (1), OO (23), PM (1), UP (1)
BSAI rockfish longline	102.6	5.8	5.68	OO (12)
BSAI sablefish longline	2,865.7	108.6	3.79	EJ (1), OO (23), PM (2)
GOA Pacific cod longline	13,144.4	12.8	0.10	CU (1), EJ (1)
GOA Pacific halibut longline	2,627.9	72.8	2.77	OO (3), PM (3), UP (1)
GOA rockfish longline	954.2	212.9	22.31	OO (8), PM (1)
GOA sablefish longline	20,210.8	1,027.5	5.08	EJ (1), OO (17), PM (10)
AK miscellaneous other finfish longline	1,050.4	137.8	13.12	OO (24), PM (1)
Pot gear fisheries				
BSAI Pacific cod pot	18,102.7	0	-	-
BS sablefish pot	267.9	<0.01	<0.01	OO (2)
AI sablefish pot	201.3	0	-	-
GOA Pacific cod pot	15,752.1	0	-	-
AK miscellaneous other finfish pot	352.8	0	-	-

Table 9.--Continued.

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- ^a This amount estimates the total amount of groundfish caught in hauls (sets) impacted by marine mammal depredation; the quantity of fish in tons actually consumed by marine mammals is significantly less.
- ^b The scientific names of the marine mammal species represented by the codes listed in this column are given in Table 3.
- ^c The minimum number of marine mammals was calculated by determining the sum of the maximum number of animals of each species, by fishery, observed feeding directly on the groundfish catch of any monitored haul on one single calendar date during the year in each of the statistical fishing areas; it was assumed that individual marine mammals in different statistical fishing areas on the same calendar date were not the same animals.

Table 10.—List of pairs of groundfish fisheries in Alaska during 1998-2004 in which individual vessels participated in both fisheries on the same vessel fishing day (vday)^a when observers witnessed apparent or definite predatory behavior by marine mammal species interacting with the groundfish catch.^b The total number of vessel fishing days^c with observed predatory interactions is given in parentheses for each paired fishery, and in the right column when both fisheries had these interactions on the same vessel fishing day.

Pairs of groundfish fisheries in Alaska in which individual vessels participated in both fisheries on the same calendar date (vessel fishing day) ^a during 1998-2004 when marine mammal species were observed interacting ^b with the groundfish catch or fishing gear ^d	Number of the same vessel fishing days
Killer whale (<i>Orcinus orca</i>)	
BSAI flatfish trawl fishery (28 vdays with predatory interactions) and BSAI Pacific cod trawl fishery (9 vdays with predatory interactions)	1
BSAI Greenland turbot longline fishery (527 vdays with predatory interaction) BSAI Pacific cod longline fishery (381 vdays with predatory interactions)	6
BSAI Greenland turbot longline fishery (527 vdays with predatory interactions) and BSAI Pacific halibut longline fishery (82 vdays with predatory interactions)	5
BSAI Greenland turbot longline fishery (527 vdays) and BSAI rockfish longline fishery (15 vdays with predatory interactions)	3
BSAI Greenland turbot longline fishery (527 vdays with predatory interactions) and BSAI sablefish longline fishery (71 vdays with predatory interactions)	3
BSAI Greenland turbot longline fishery (527 vdays with predatory interactions) and AK miscellaneous other finfish longline fishery (55 vdays with predatory interactions)	11
BSAI Pacific cod longline fishery (381 vdays with predatory interactions) and BSAI Pacific halibut longline fishery (82 vdays with predatory interactions)	2
BSAI Pacific halibut longline fishery (82 vdays with predatory interactions) and BSAI rockfish longline fishery (15 vdays with predatory interactions)	2
BSAI Pacific halibut longline fishery (82 vdays with predatory interactions) and AK miscellaneous other finfish longline fishery (55 vdays with predatory interactions)	1
BSAI sablefish longline fishery (71 vdays with predatory interactions) and BSAI Pacific halibut longline fishery (82 vdays with predatory interactions)	6
BSAI sablefish longline fishery (71 vdays with predatory interactions) and AK miscellaneous other finfish longline fishery (55 vdays with predatory interactions)	1
GOA sablefish longline fishery (26 vdays with predatory interactions) and GOA rockfish longline fishery (4 vdays with predatory interactions)	2

Table 10.--Continued.

Pairs of groundfish fisheries in Alaska in which individual vessels participated in both fisheries on the same calendar date (vday) ^a during 1998-2004 when marine mammal species were observed interacting ^b with the groundfish catch or fishing gear ^d	Number of the same vessel fishing days
Killer whale (<i>Orcinus orca</i>) (continued)	
BS sablefish pot fishery (2 vdays with predatory interactions) and AK miscellaneous other finfish longline fishery (55 vdays with predatory interactions)	1
Sperm whale (<i>Physeter macrocephalus</i>)	
GOA sablefish longline fishery (286 vdays with predatory interactions) and GOA Pacific halibut longline fishery (17 vdays with predatory interactions)	6

^a The total number of vessel fishing calendar days (vdays) for each groundfish fishery in Alaska during 1998-2004 is listed in Appendix 11.

^b Predatory interactions by marine mammals were defined for the purposes of this table as any of the following three types of interactions: 1) any type of depredation interaction of the marine mammal on the groundfish catch (not discards); 2) any method of deterrence, with or without devices, actively used by the crew to prevent the animal from interacting with the gear; 3) repeated swimming by individual marine mammals near the fishing gear. These types of interactions are not discussed in this paper.

^c Only vessel fishing calendar days with interactions actually seen by observers, regardless of whether they occurred during monitored hauls or not, are included in totals.

^d Marine mammal species listed in Table 9 that are not included here were not observed with predatory interactions in two groundfish fisheries on the same vessel fishing calendar day.

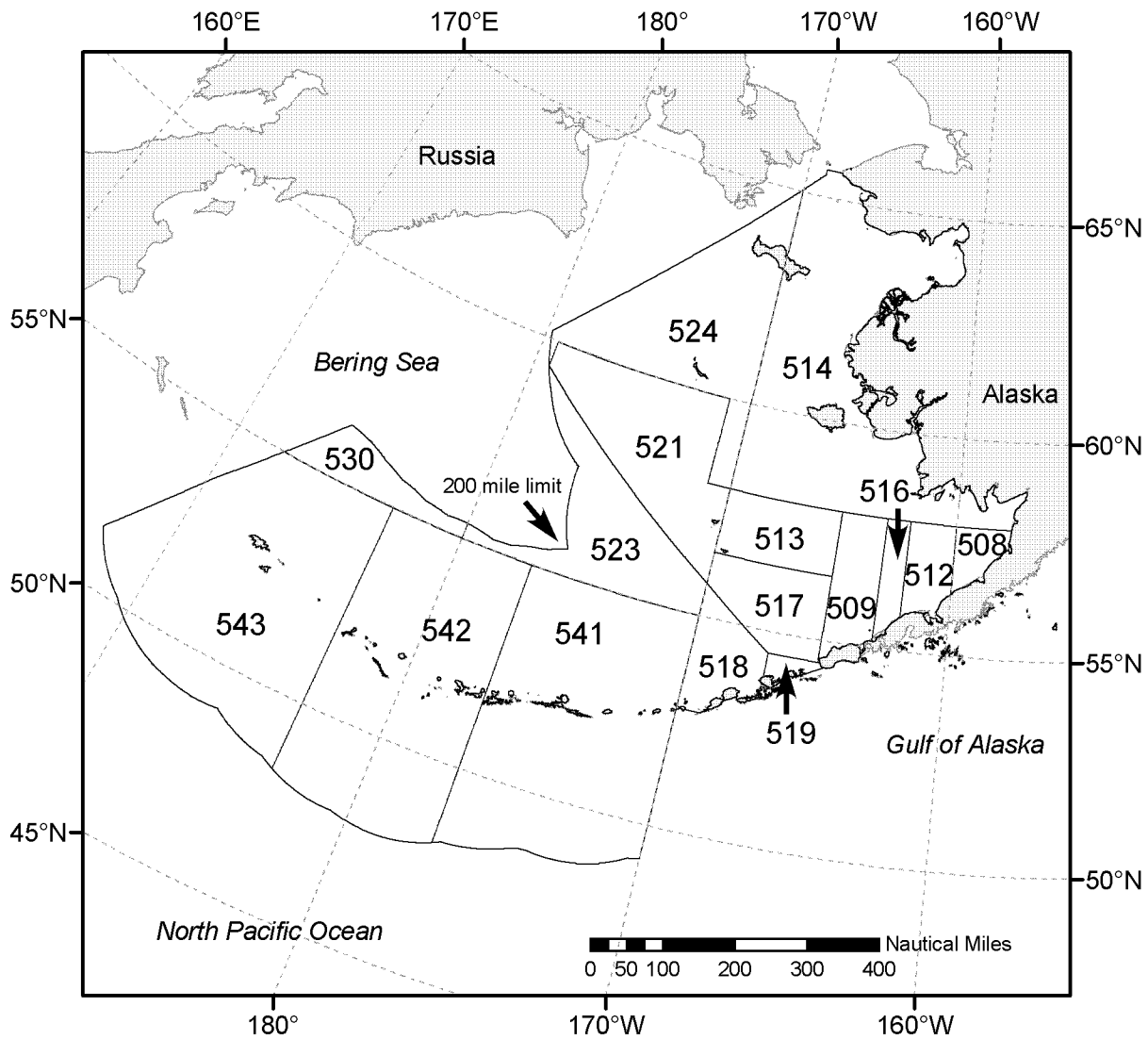


Figure 1. Statistical fishing areas in the Bering Sea and Aleutian Islands region used to summarize catch and effort data (figure taken from Perez 2003).

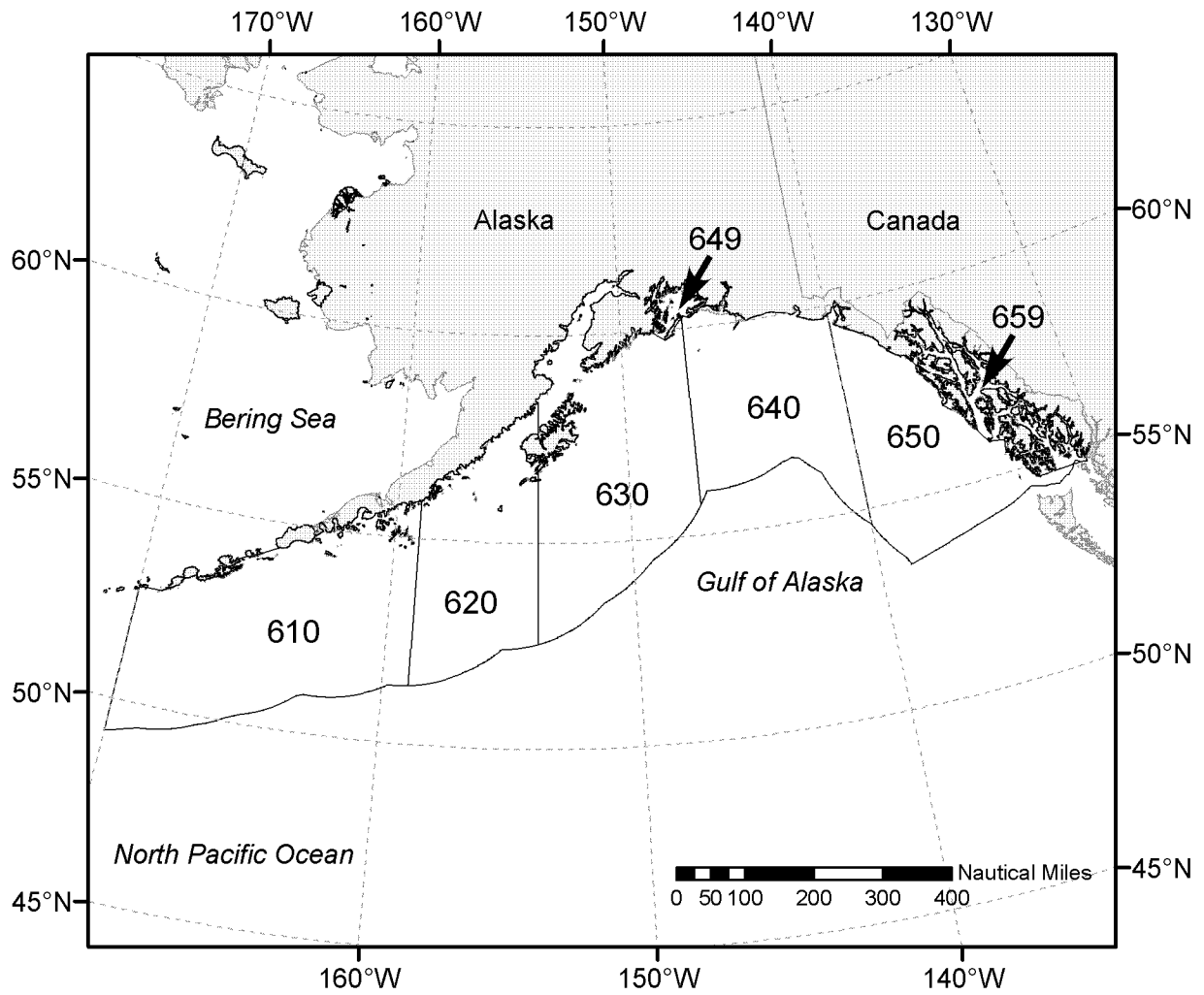


Figure 2. Statistical fishing areas in the Gulf of Alaska used to summarize catch and effort data (figure taken from Perez 2003).

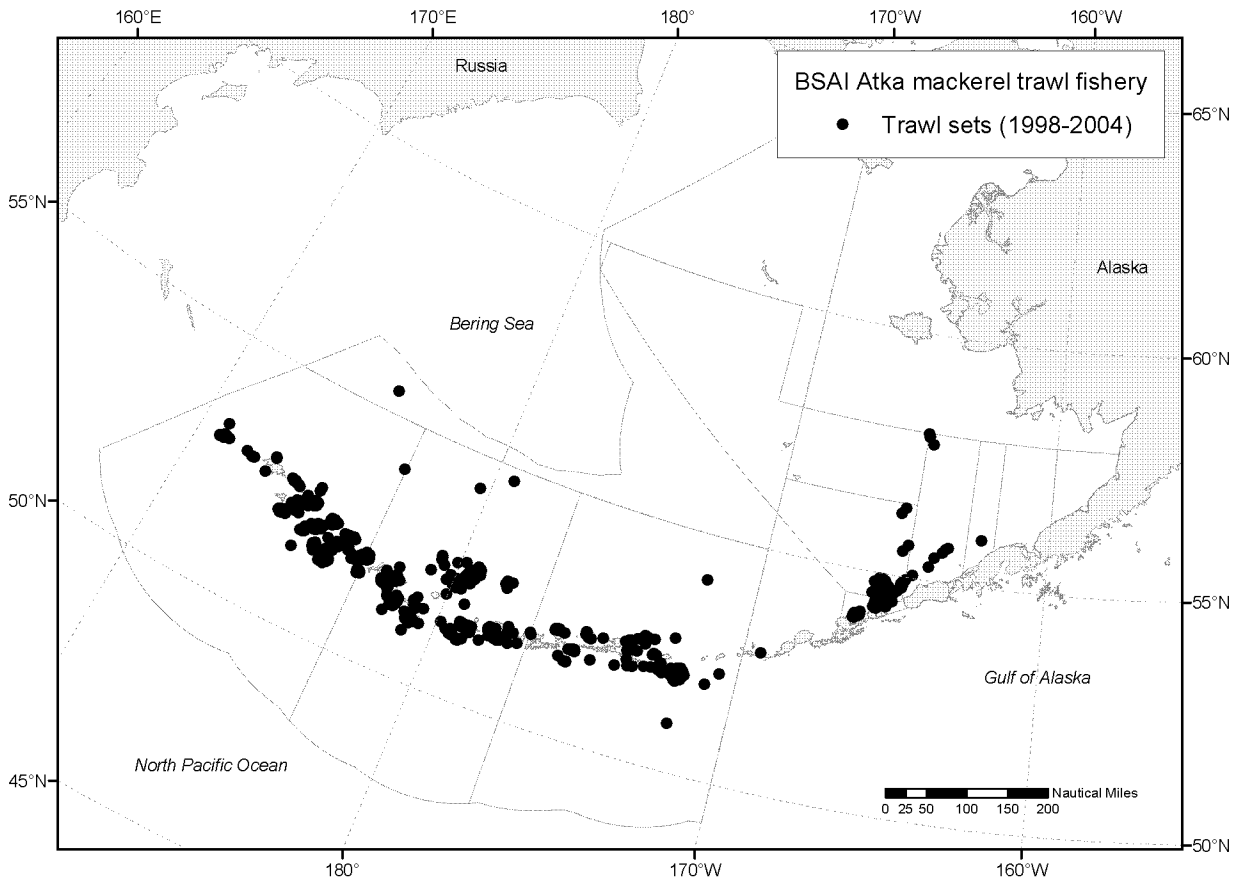


Figure 3. Locations in the Bering Sea and Aleutian Islands region where trawl gear was used during fishing operations in the BSAI Atka mackerel trawl fishery, 1998-2004. Only trawl sets on vessels with observers were included.

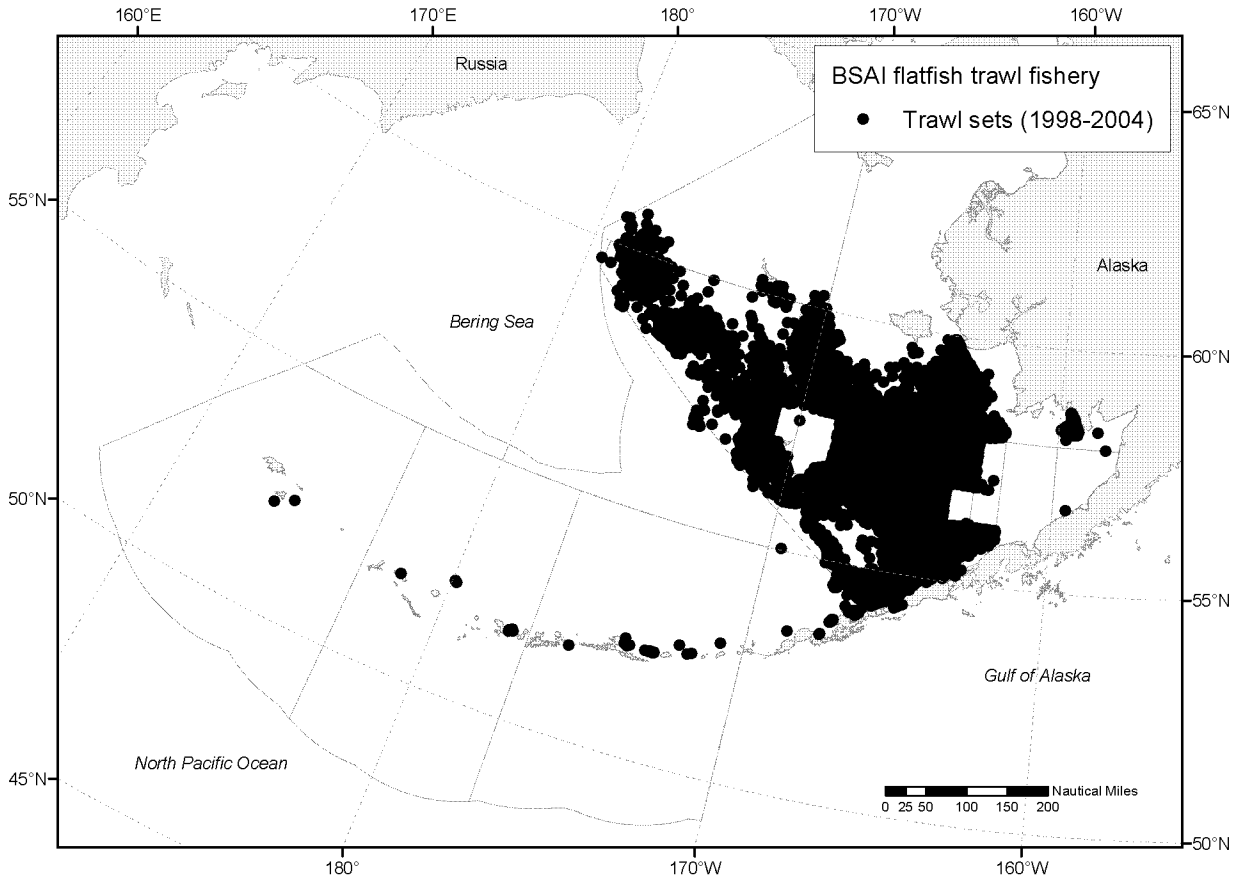


Figure 4. Locations in the Bering Sea and Aleutian Islands region where trawl gear was used during fishing operations in the BSAI flatfish trawl fishery, 1998-2004. Only trawl sets on vessels with observers were included.

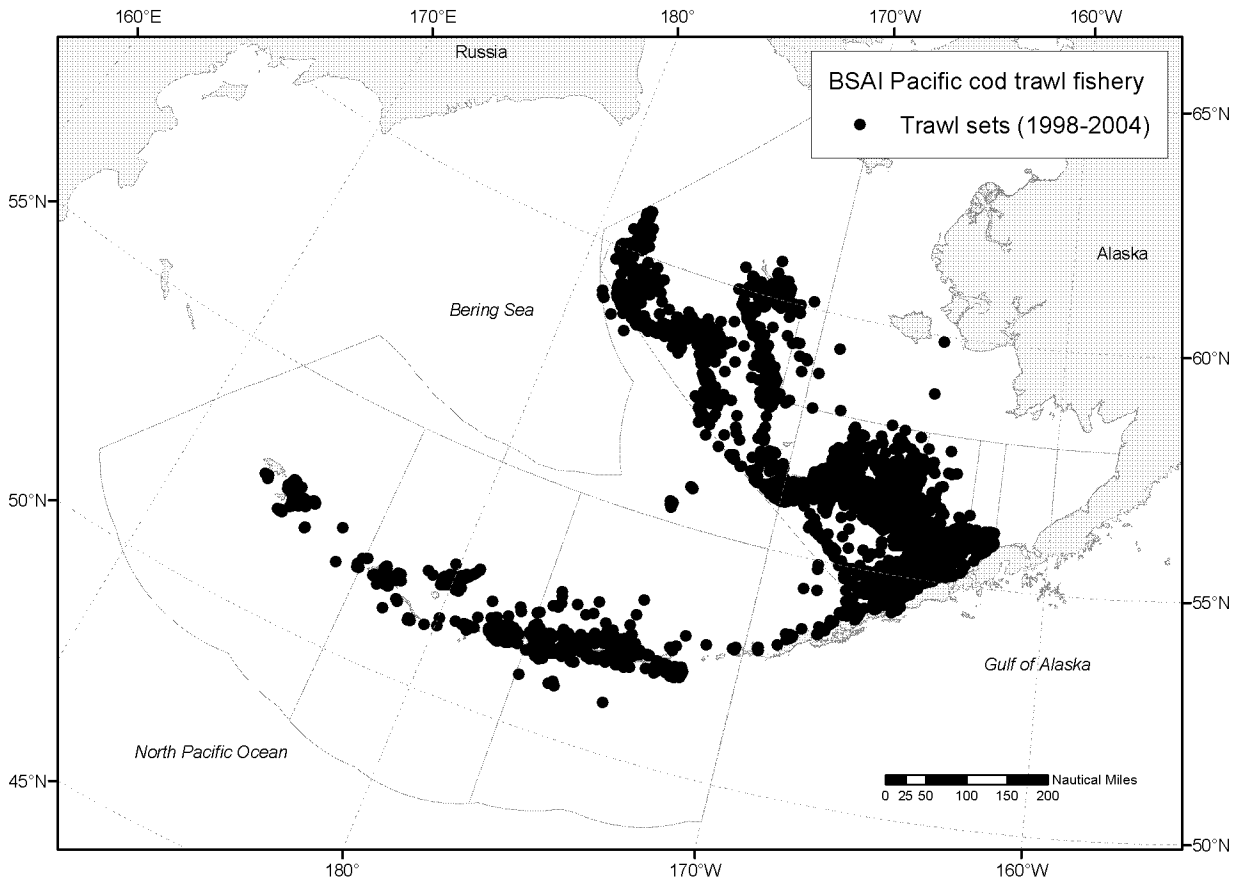


Figure 5. Locations in the Bering Sea and Aleutian Islands region where trawl gear was used during fishing operations in the BSAI Pacific cod trawl fishery, 1998-2004. Only trawl sets on vessels with observers were included.

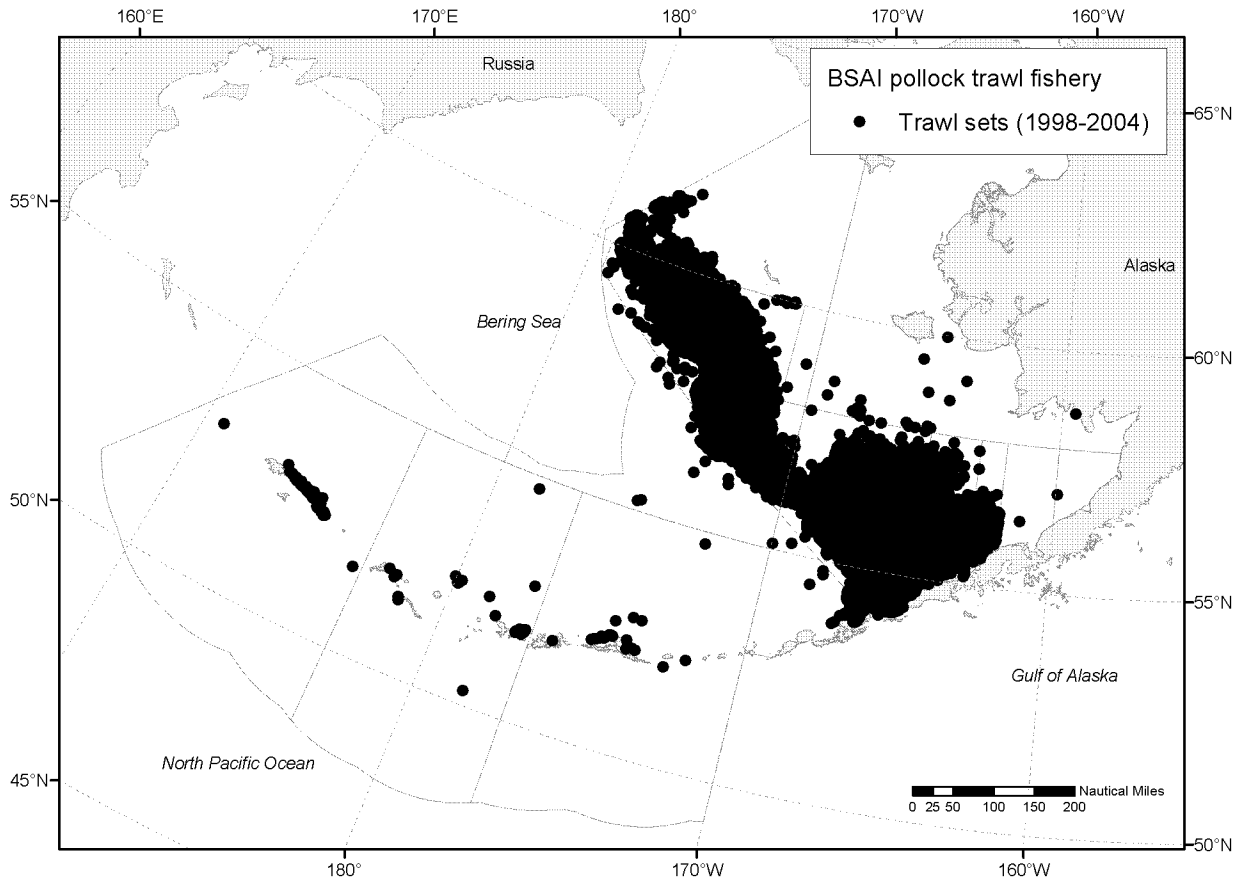


Figure 6. Locations in the Bering Sea and Aleutian Islands region where trawl gear was used during fishing operations in the BSAI pollock trawl fishery, 1998-2004. Only trawl sets on vessels with observers were included.

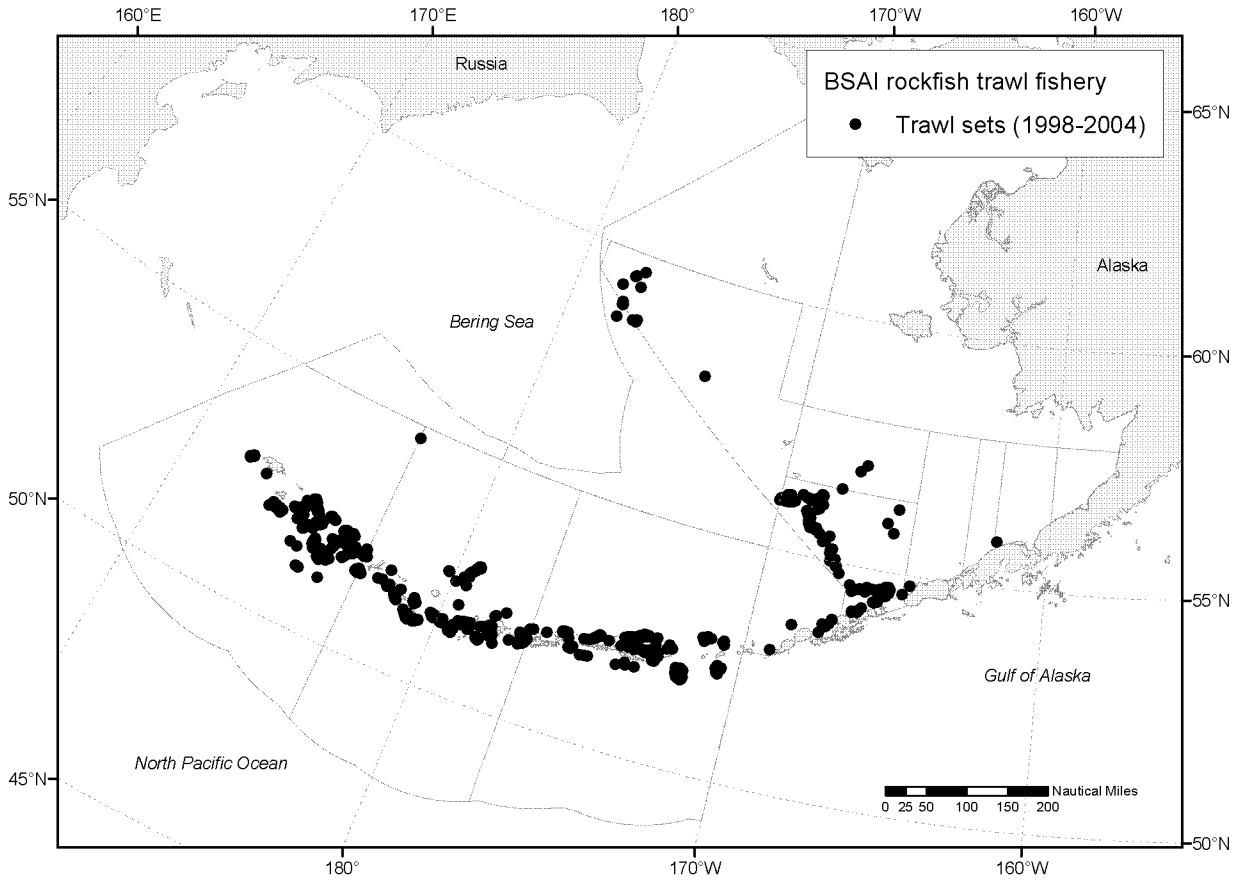


Figure 7. Locations in the Bering Sea and Aleutian Islands region where trawl gear was used during fishing operations in the BSAI rockfish trawl fishery, 1998-2004. Only trawl sets on vessels with observers were included.

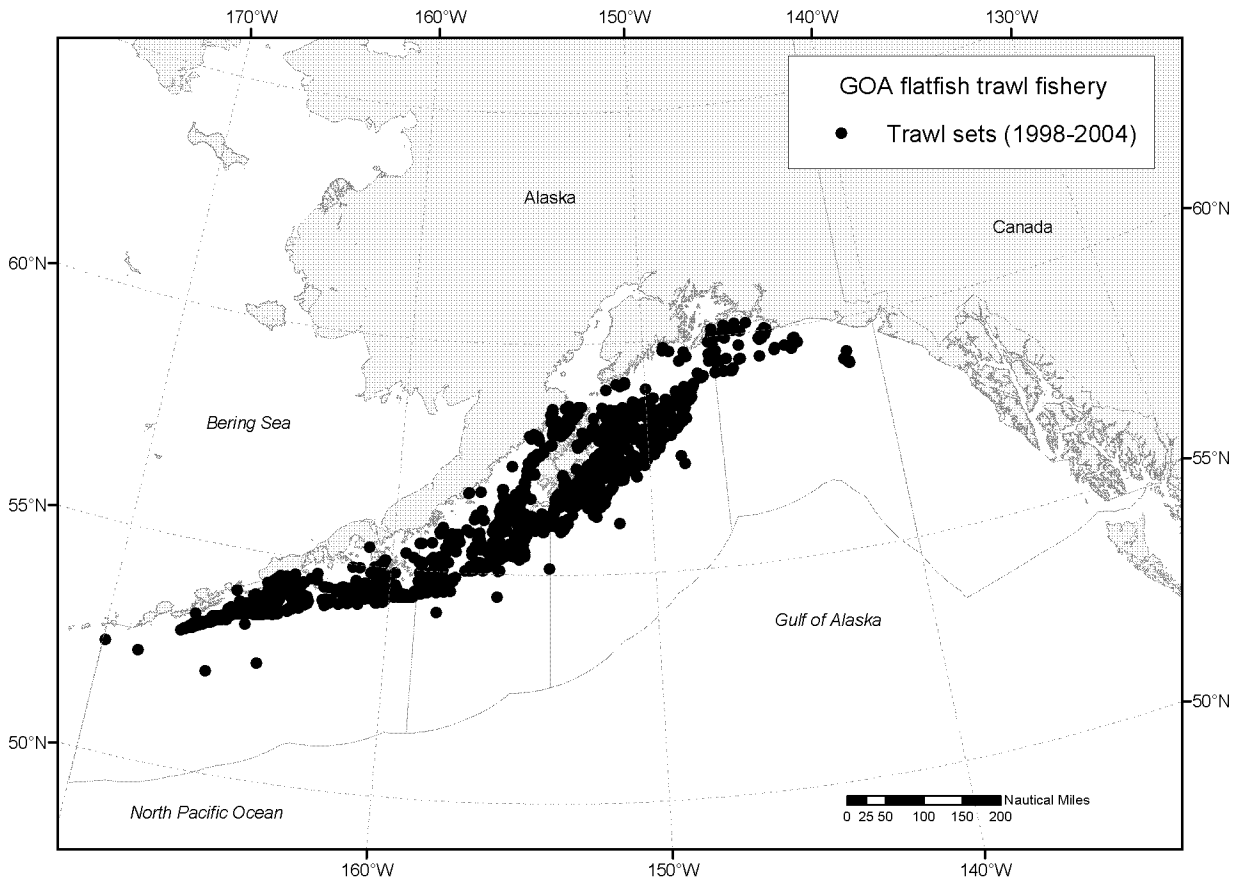


Figure 8. Locations in the Gulf of Alaska where trawl gear was used during fishing operations in the GOA flatfish trawl fishery, 1998-2004. Only trawl sets on vessels with observers were included.

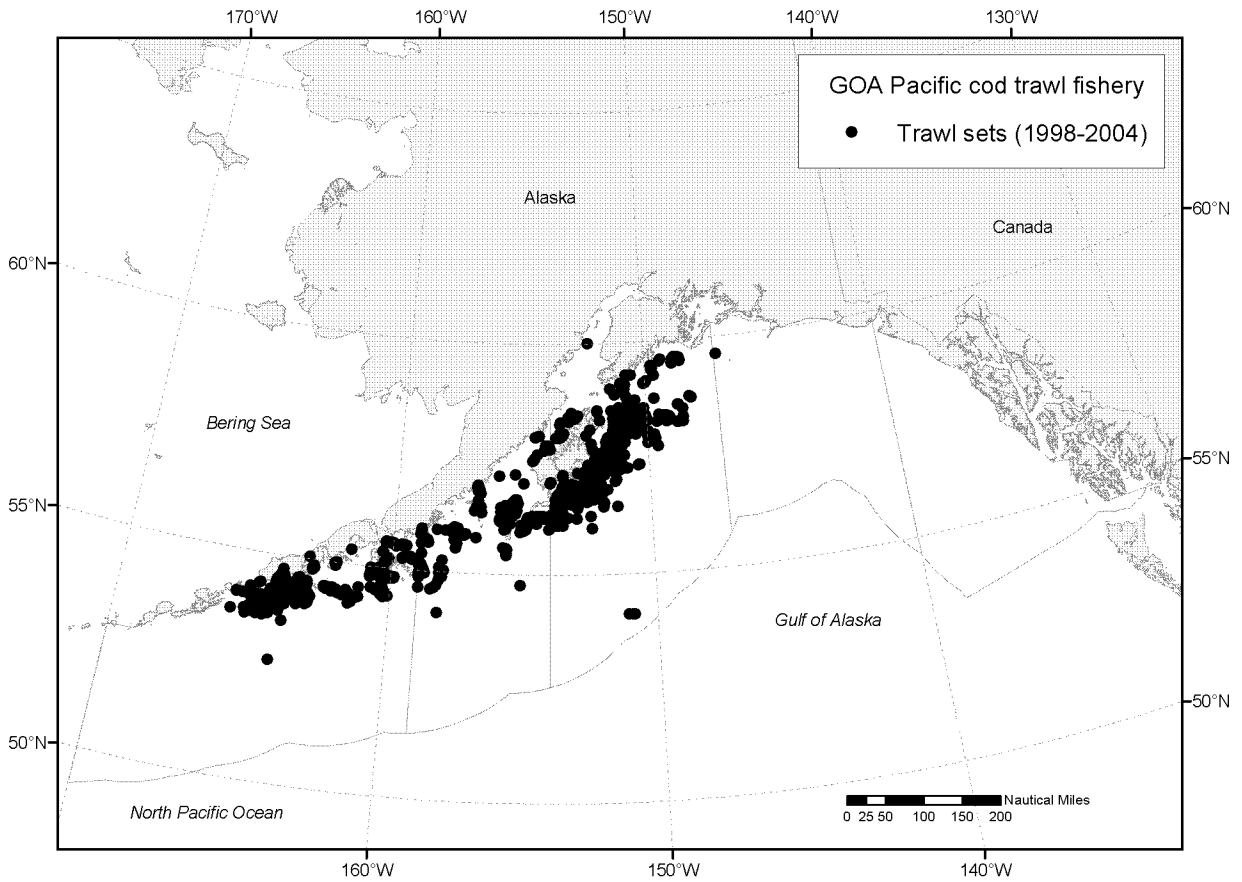


Figure 9. Locations in the Gulf of Alaska where trawl gear was used during fishing operations in the GOA Pacific cod trawl fishery, 1998-2004. Only trawl sets on vessels with observers were included.

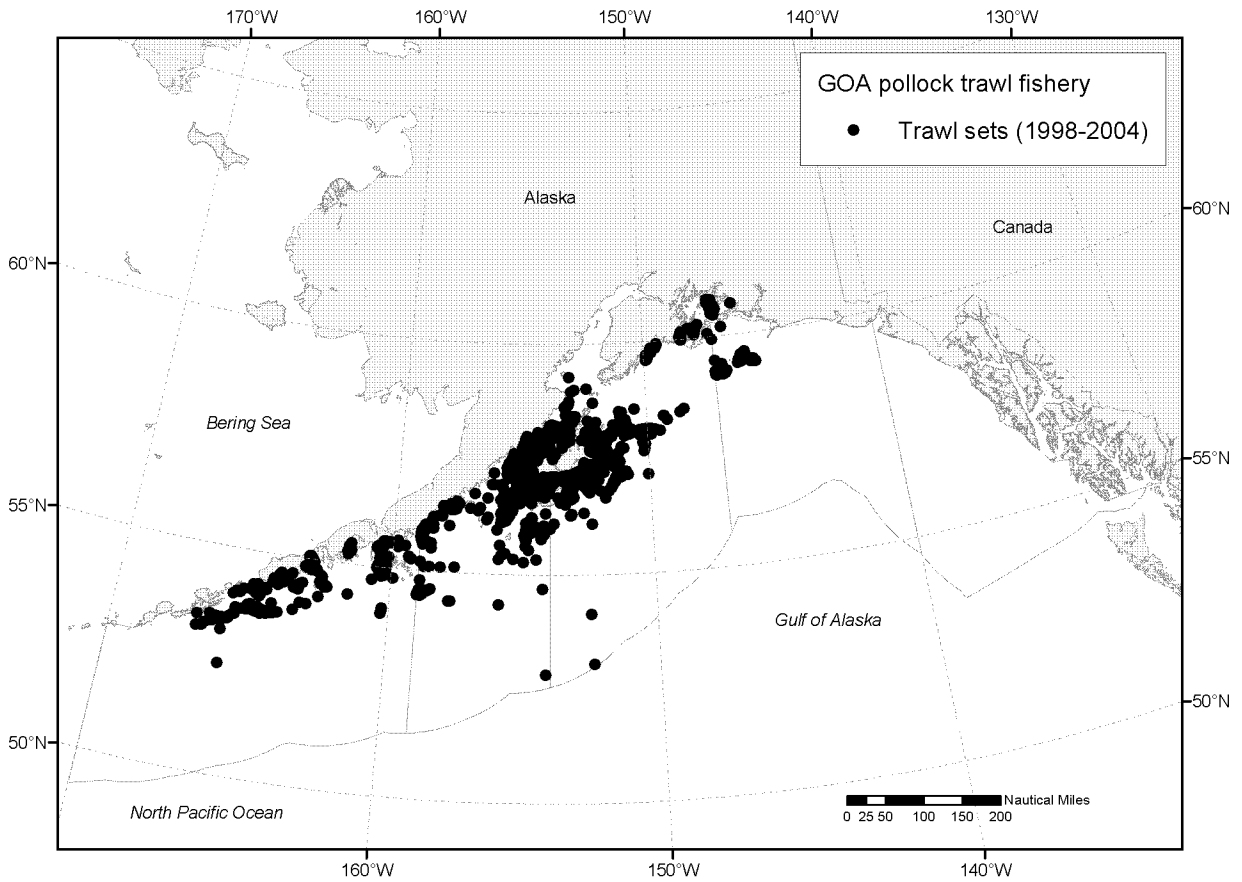


Figure 10. Locations in the Gulf of Alaska where trawl gear was used during fishing operations in the GOA pollock trawl fishery, 1998-2004. Only trawl sets on vessels with observers were included.

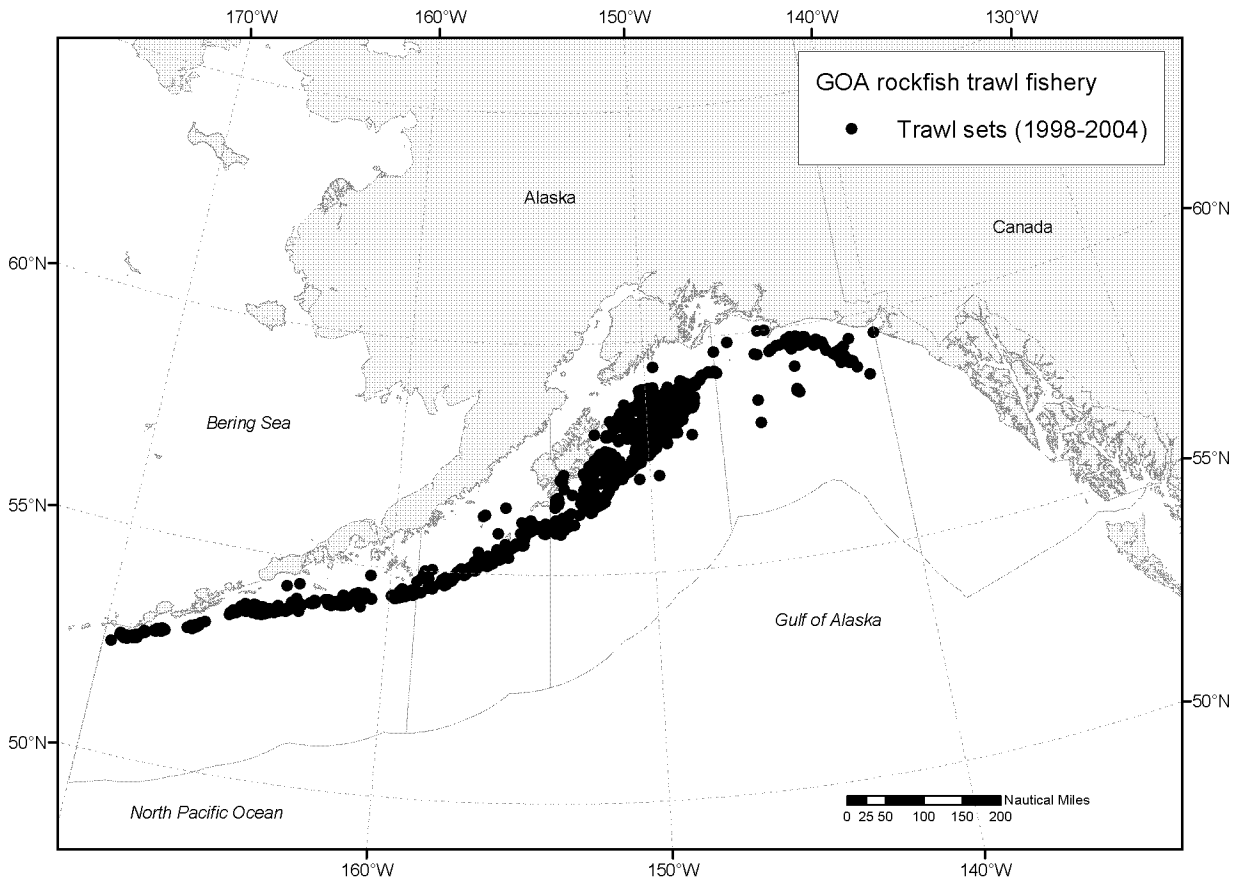


Figure 11. Locations in the Gulf of Alaska where trawl gear was used during fishing operations in the GOA rockfish trawl fishery, 1998-2004. Only trawl sets on vessels with observers were included.

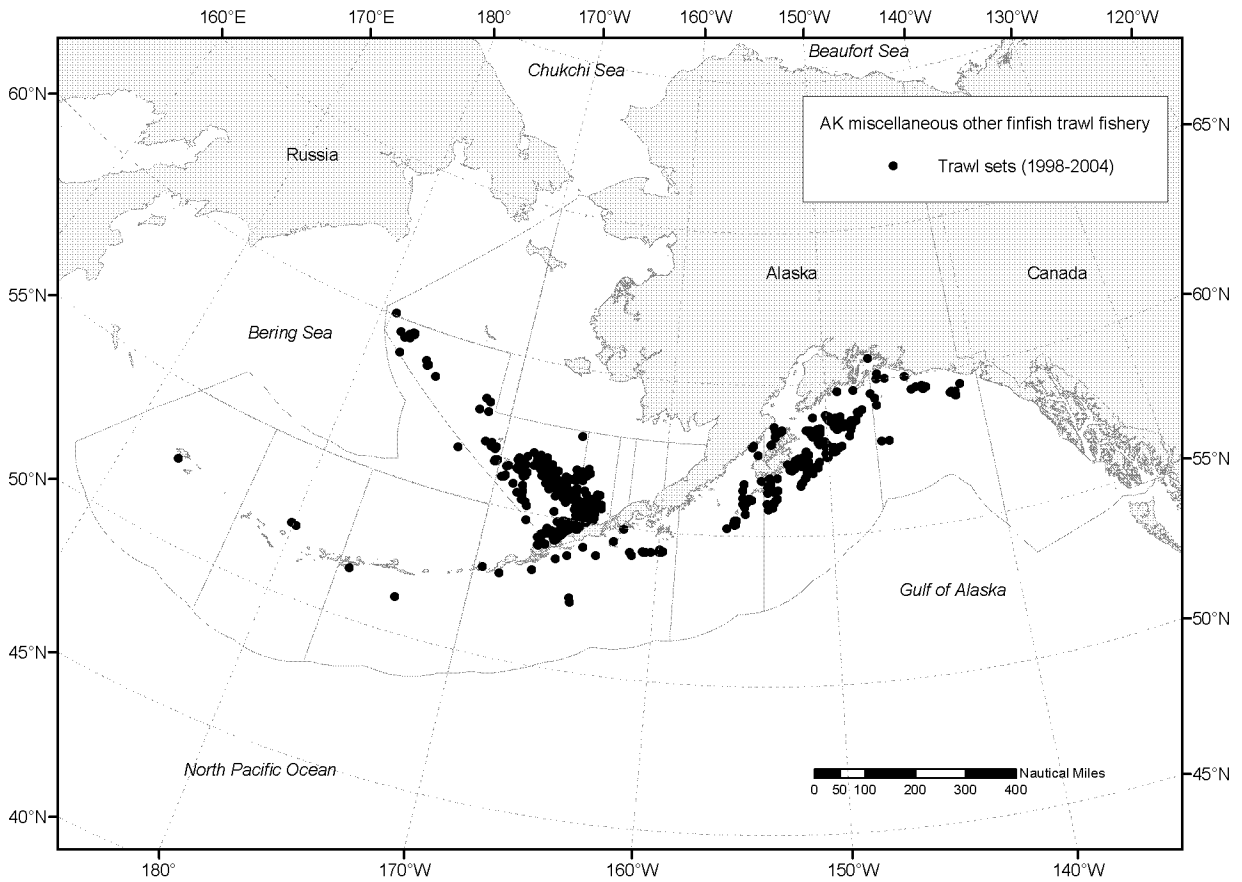


Figure 12. Locations in the Bering Sea, Aleutian Islands region, and Gulf of Alaska where trawl gear was used during fishing operations in the AK miscellaneous other finfish trawl fishery, 1998-2004. Only trawl sets on vessels with observers were included.

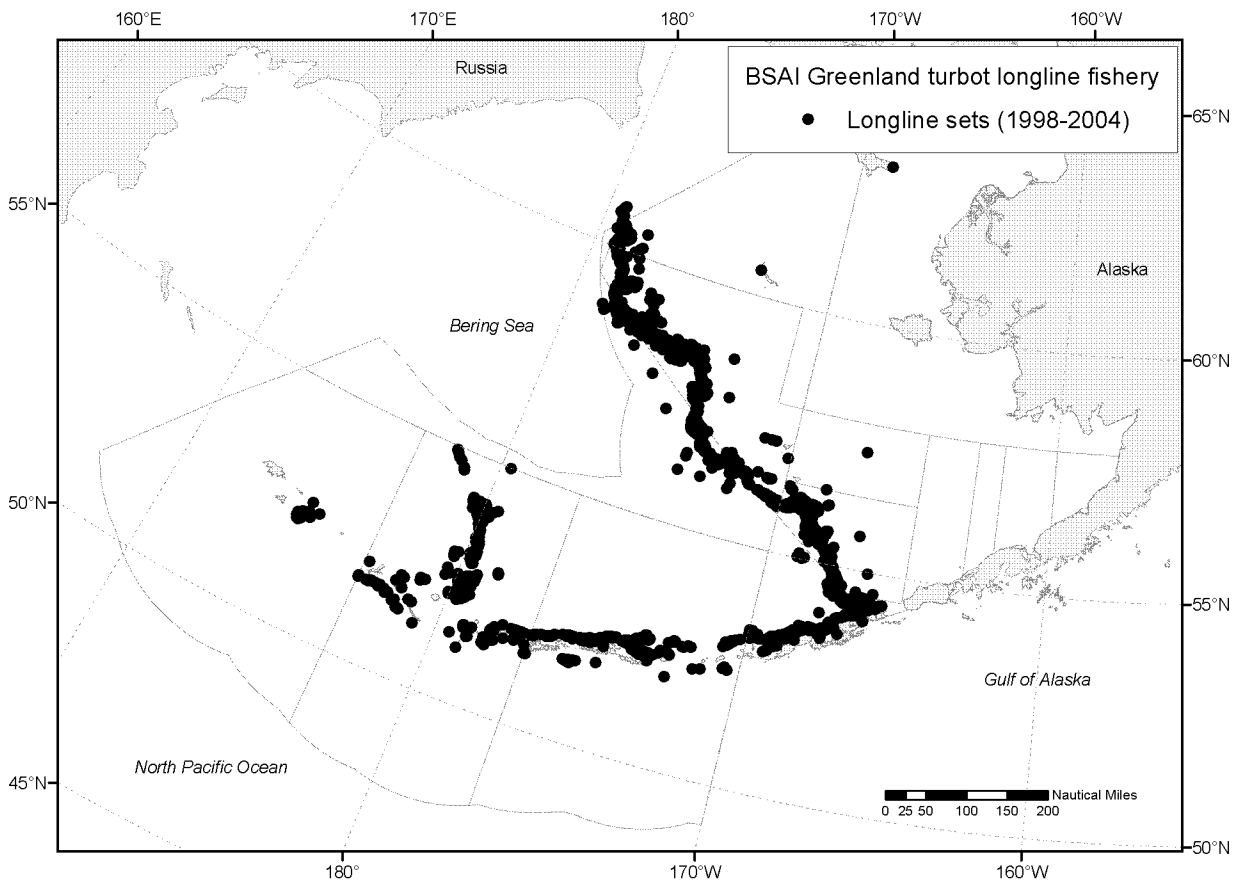


Figure 13. Locations in the Bering Sea and Aleutian Islands region where longline gear was used during fishing operations in the BSAI Greenland turbot longline fishery, 1998-2004. Only longline sets on vessels with observers were included.

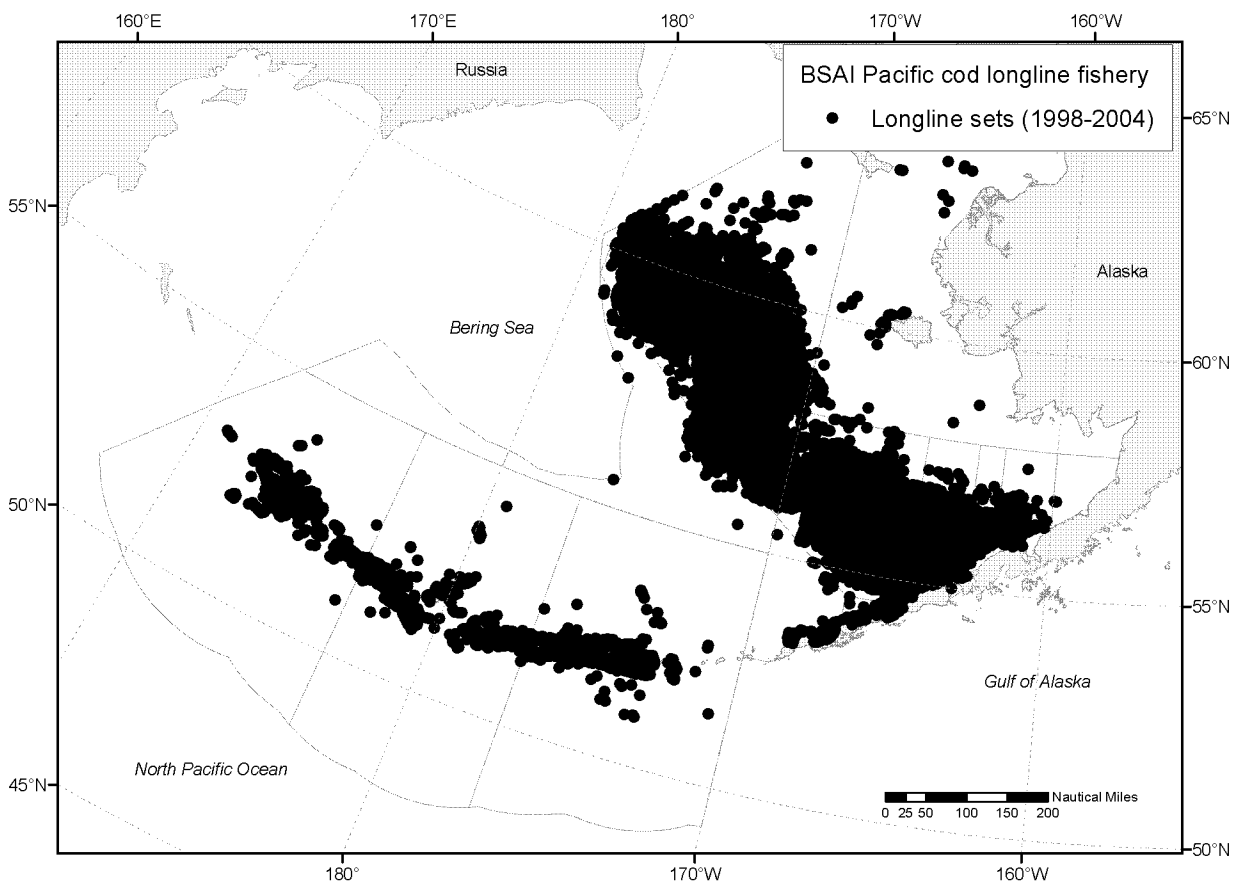


Figure 14. Locations in the Bering Sea and Aleutian Islands region where longline gear was used during fishing operations in the BSAI Pacific cod longline fishery, 1998-2004. Only longline sets on vessels with observers were included.

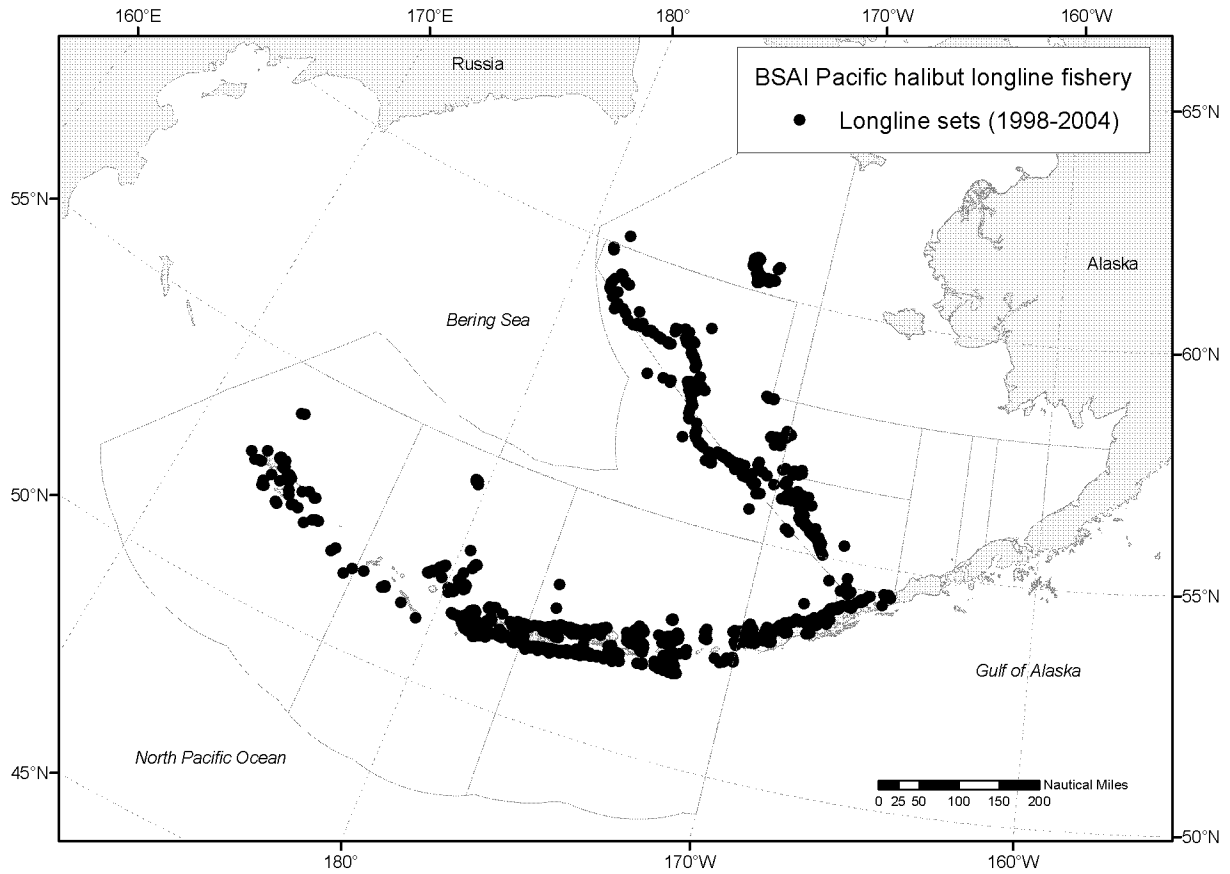


Figure 15. Locations in the Bering Sea and Aleutian Islands region where longline gear was used during fishing operations in the BSAI Pacific halibut longline fishery, 1998-2004. Only longline sets on vessels with observers were included.

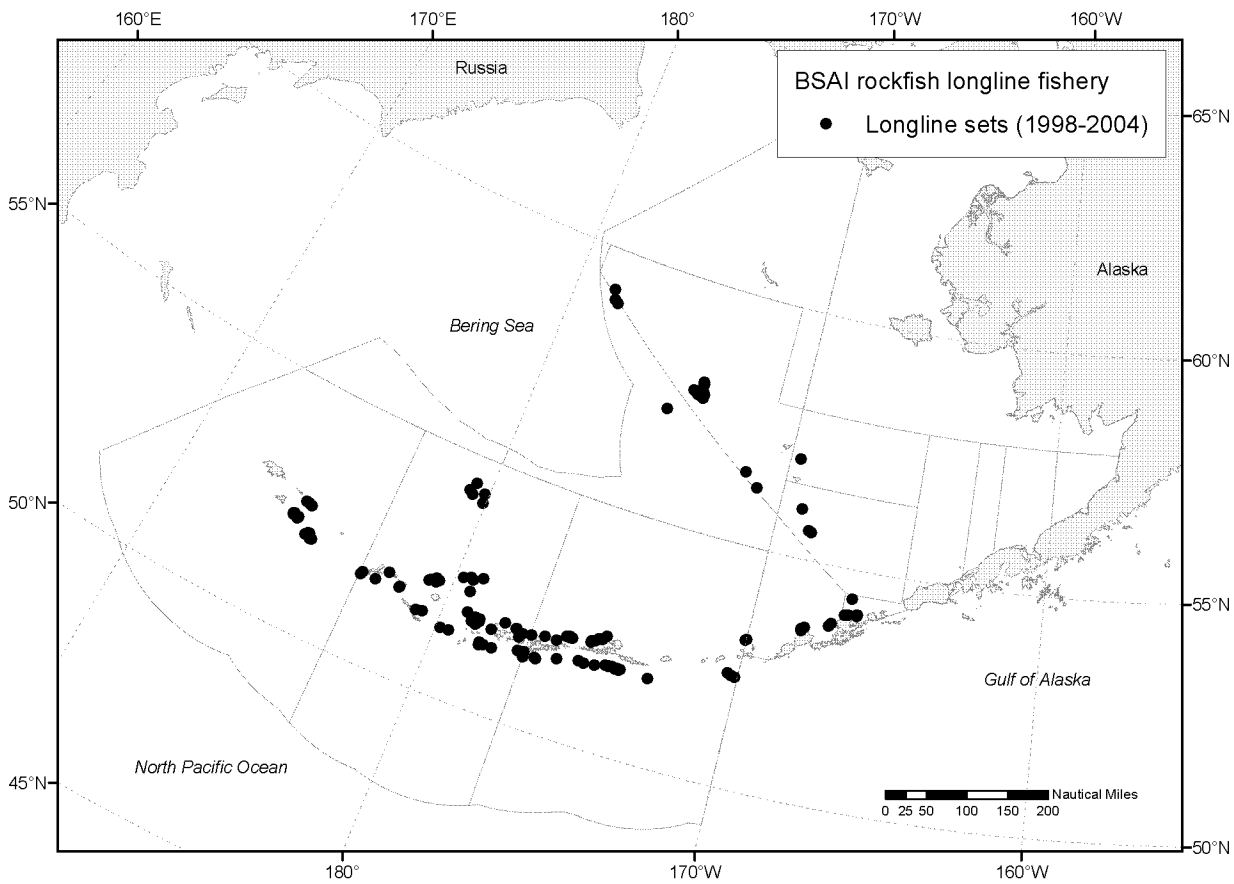


Figure 16. Locations in the Bering Sea and Aleutian Islands region where longline gear was used during fishing operations in the BSAI rockfish longline fishery, 1998-2004. Only longline sets on vessels with observers were included.

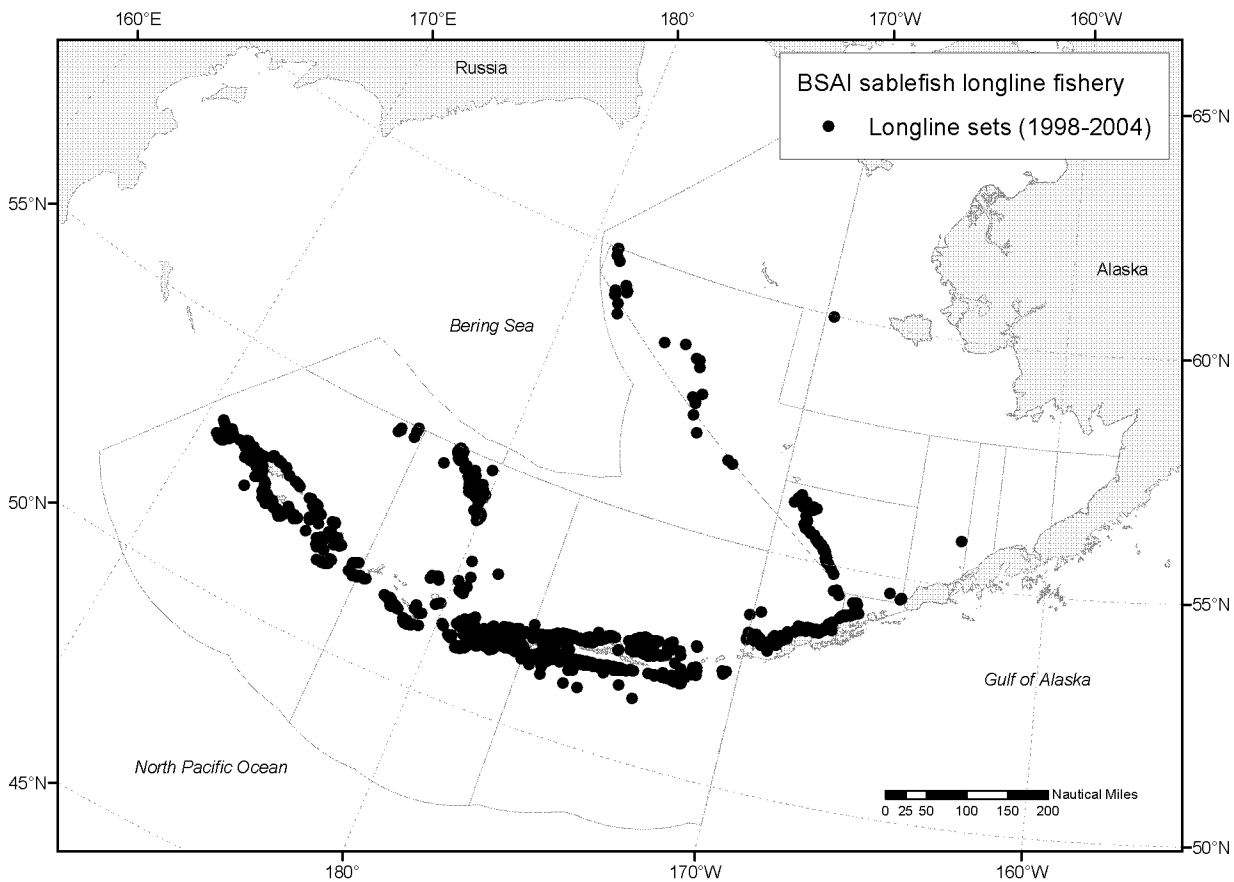


Figure 17. Locations in the Bering Sea and Aleutian Islands region where longline gear was used during fishing operations in the BSAI sablefish longline fishery, 1998-2004. Only longline sets on vessels with observers were included.

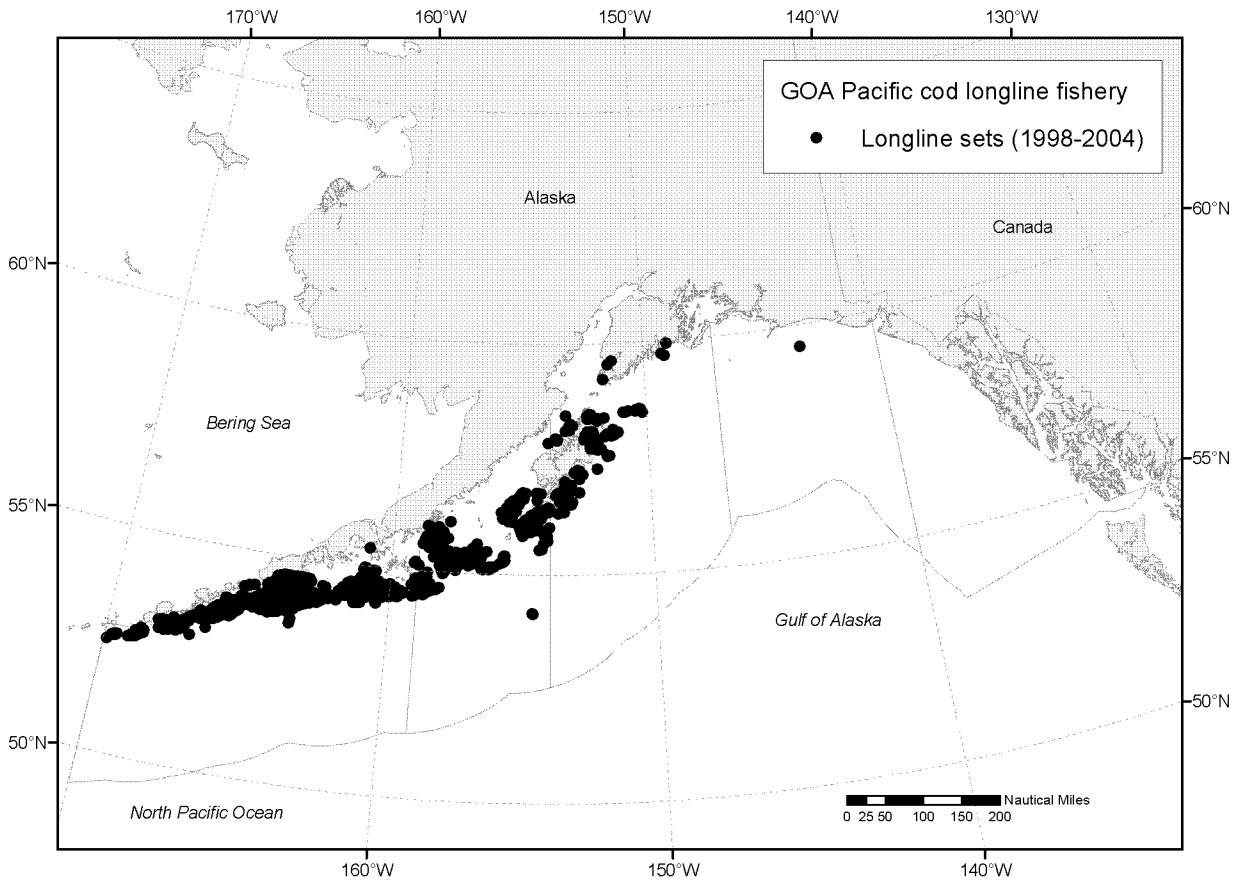


Figure 18. Locations in the Gulf of Alaska where longline gear was used during fishing operations in the GOA Pacific cod longline fishery, 1998-2004. Only longline sets on vessels with observers were included.

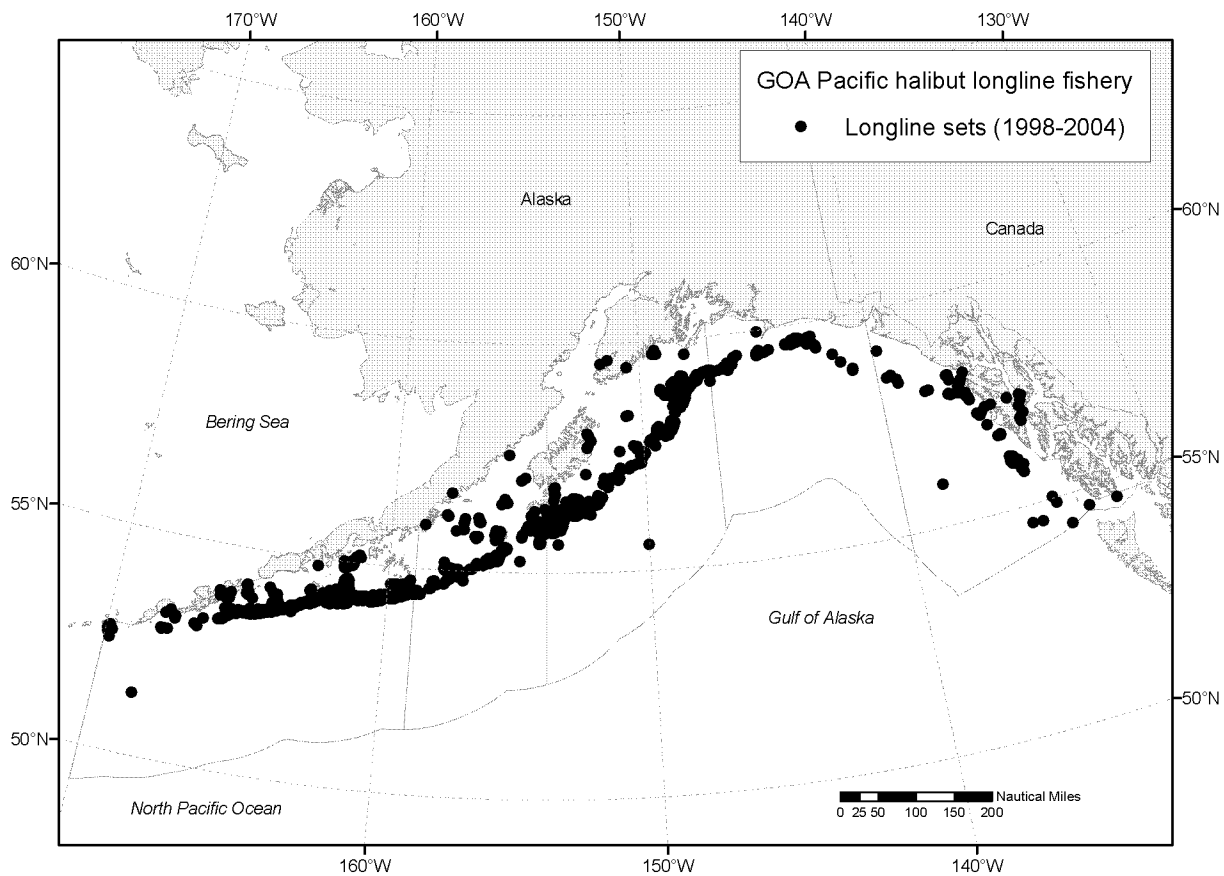


Figure 19. Locations in the Gulf of Alaska where longline gear was used during fishing operations in the GOA Pacific halibut longline fishery, 1998-2004. Only longline sets on vessels with observers were included.

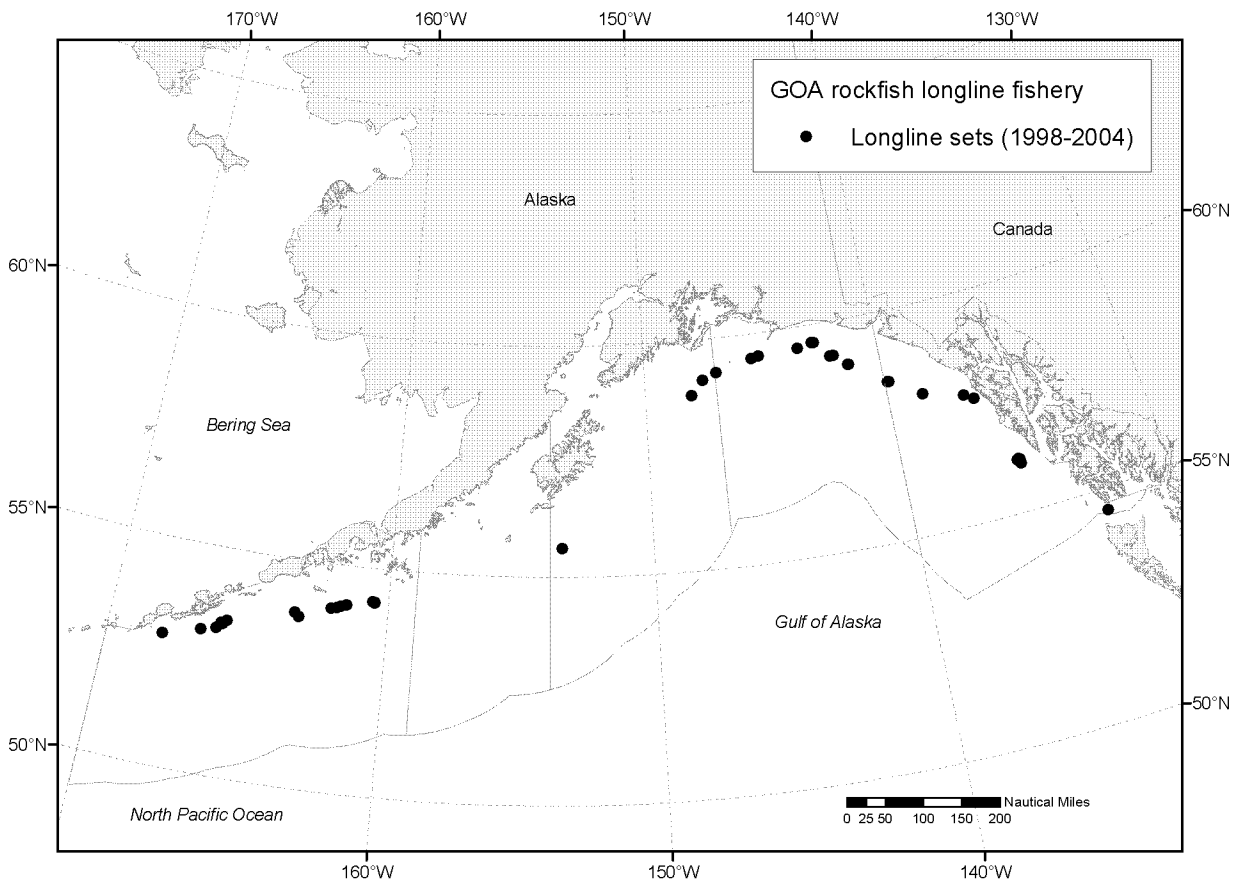


Figure 20. Locations in the Gulf of Alaska where longline gear was used during fishing operations in the GOA rockfish longline fishery, 1998-2004. Only longline sets on vessels with observers were included.

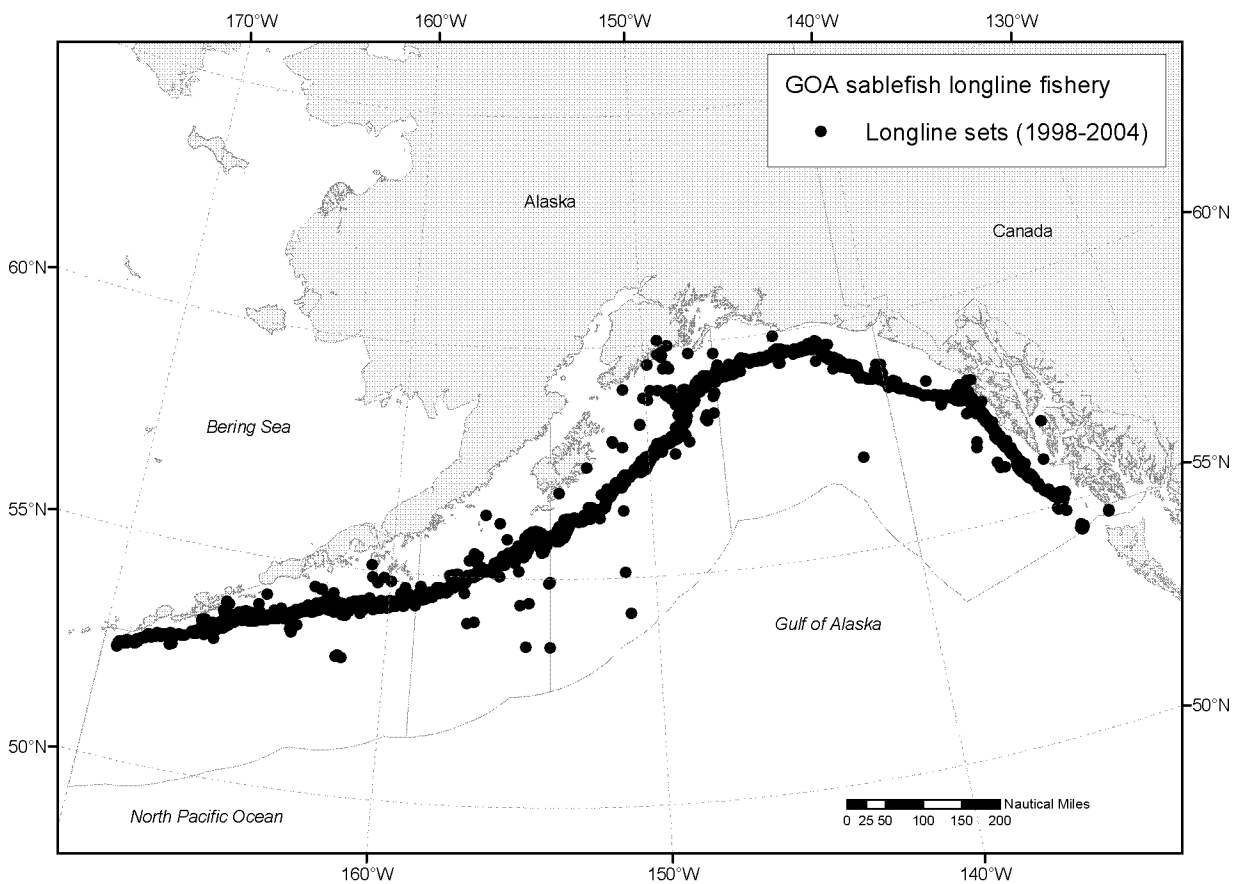


Figure 21. Locations in the Gulf of Alaska where longline gear was used during fishing operations in the GOA sablefish longline fishery, 1998-2004. Only longline sets on vessels with observers were included.

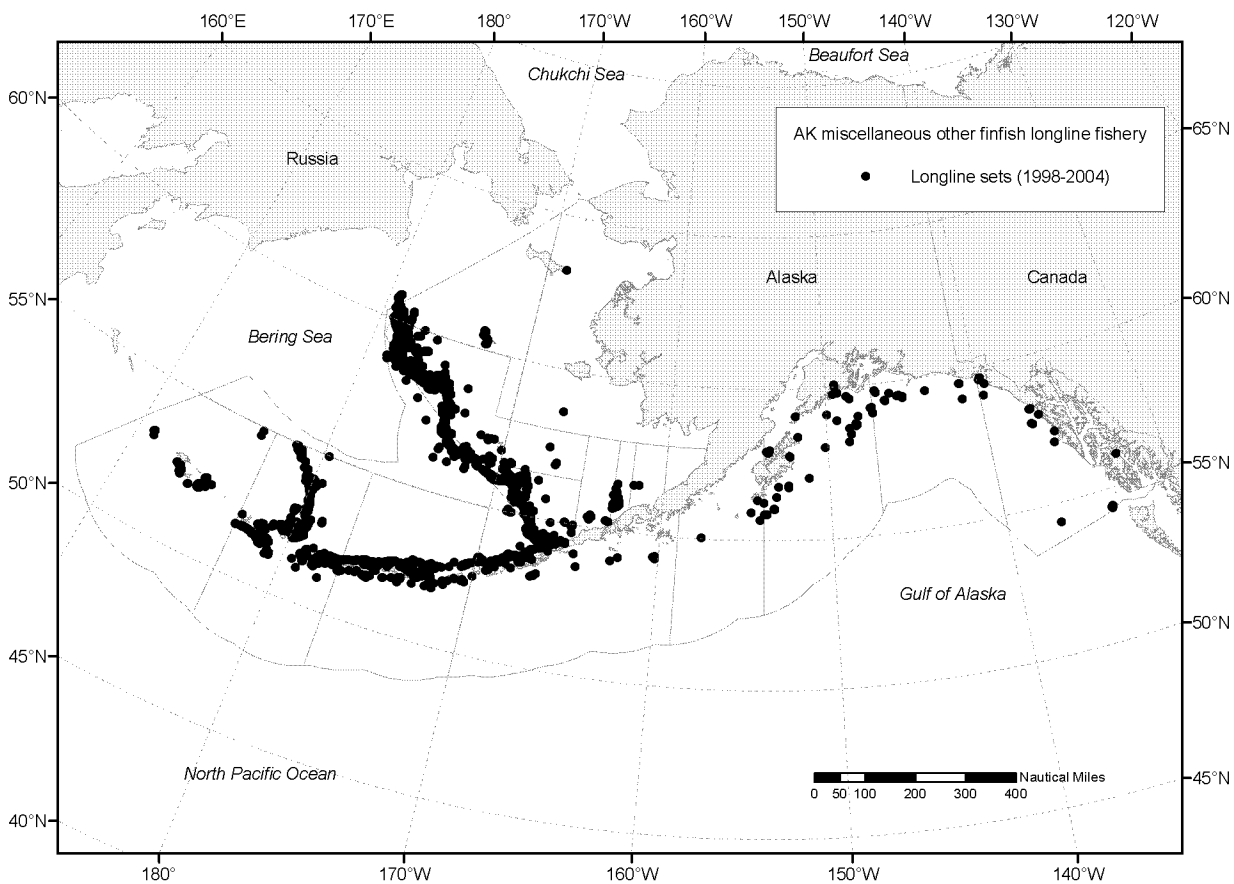


Figure 22. Locations in the Bering Sea, Aleutian Islands region, and Gulf of Alaska where longline gear was used during fishing operations in the AK miscellaneous other finfish longline fishery, 1998-2004. Only longline sets on vessels with observers were included.

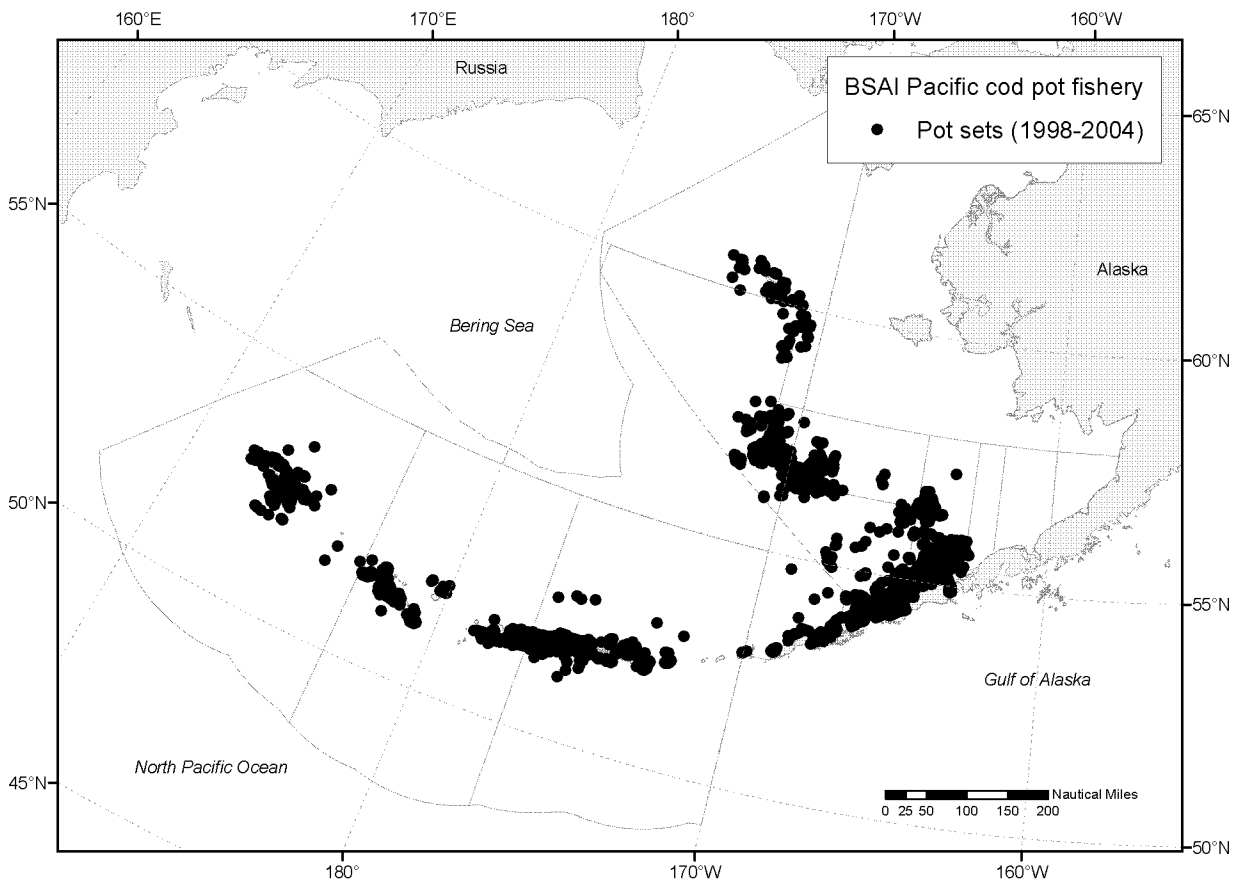


Figure 23. Locations in the Bering Sea and Aleutian Islands region where pot gear was used during fishing operations in the BSAI Pacific cod pot fishery, 1998-2004. Only pot sets on vessels with observers were included.

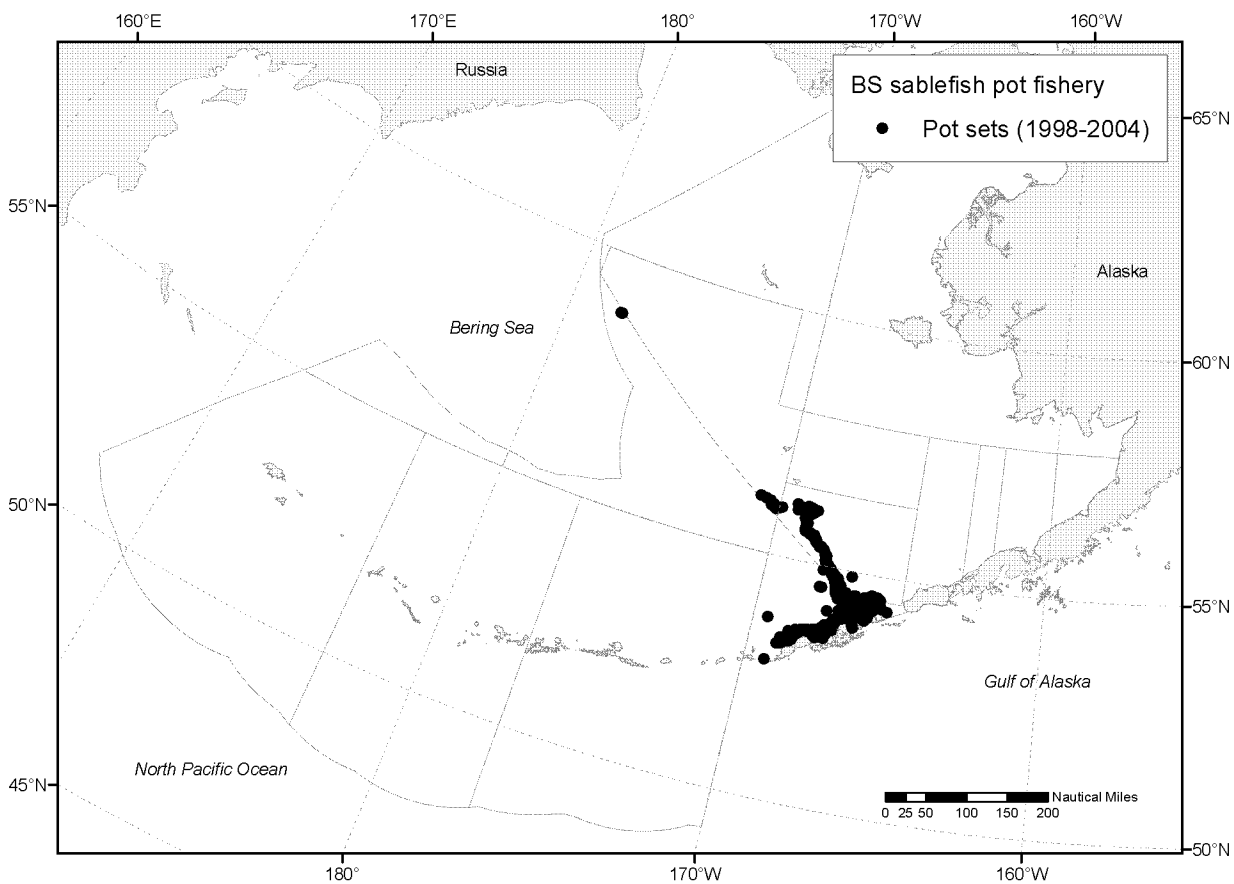


Figure 24. Locations in the Bering Sea where pot gear was used during fishing operations in the BS sablefish pot fishery, 1998-2004. Only pot sets on vessels with observers were included.

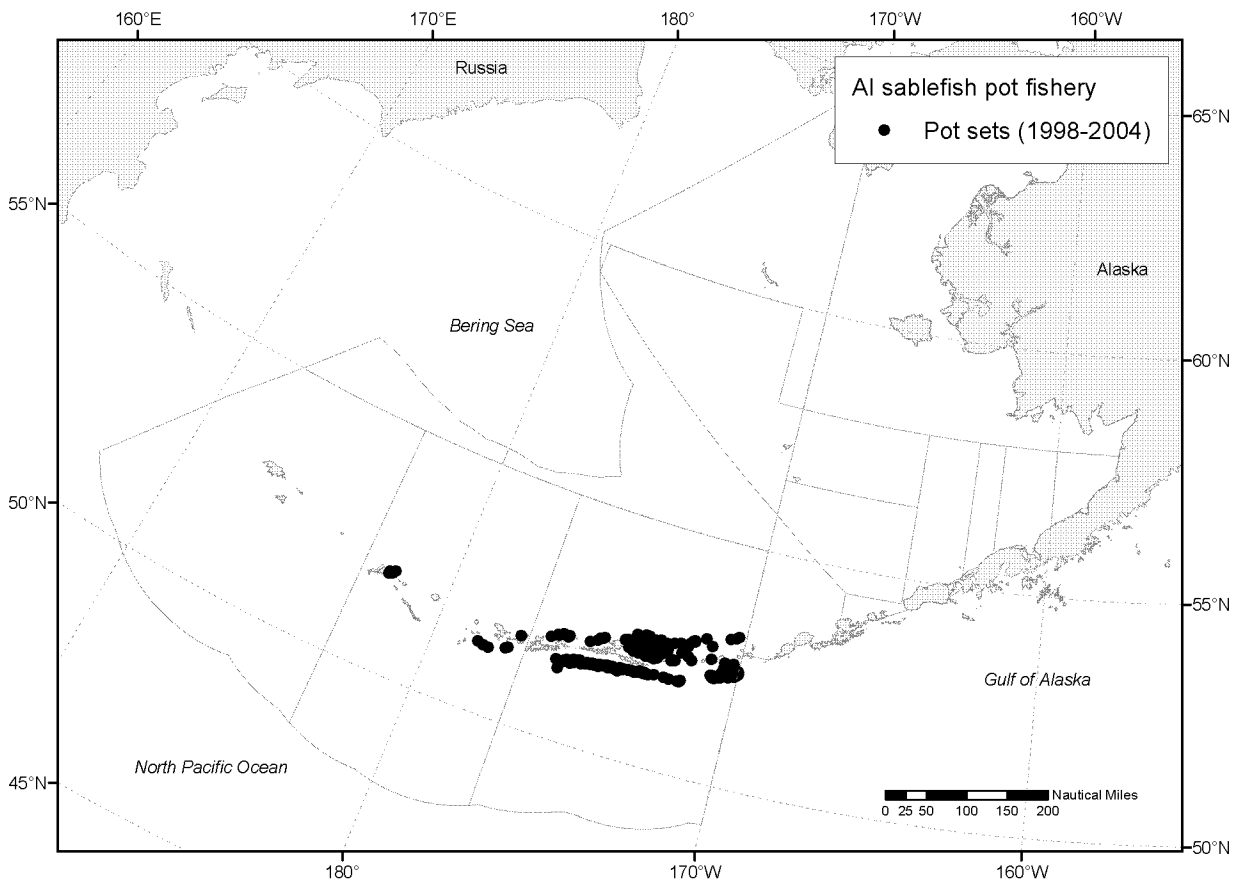


Figure 25. Locations in the Aleutian Islands region where pot gear was used during fishing operations in the AI sablefish pot fishery, 1998-2004. Only pot sets on vessels with observers were included.

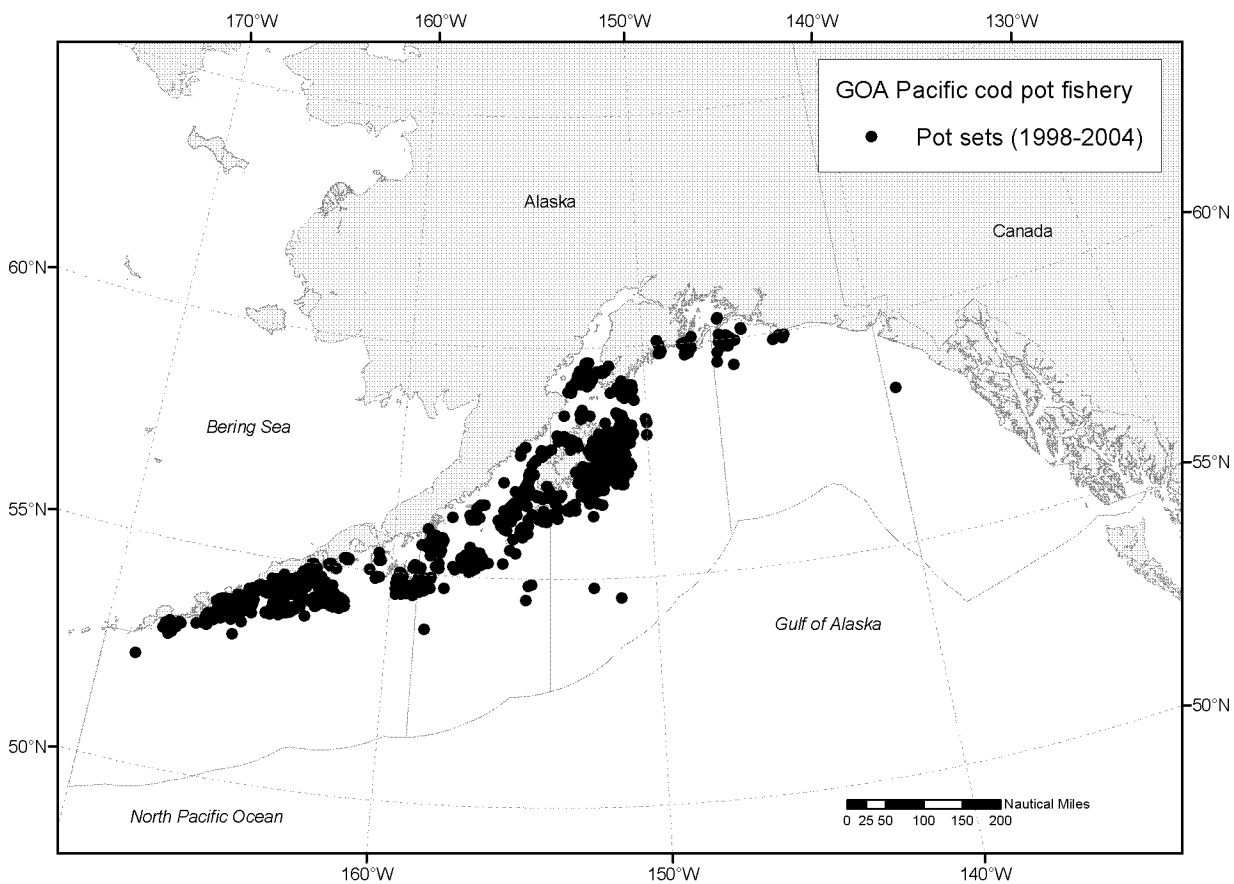


Figure 26. Locations in the Gulf of Alaska where pot gear was used during fishing operations in the GOA Pacific cod pot fishery, 1998-2004. Only pot sets on vessels with observers were included.

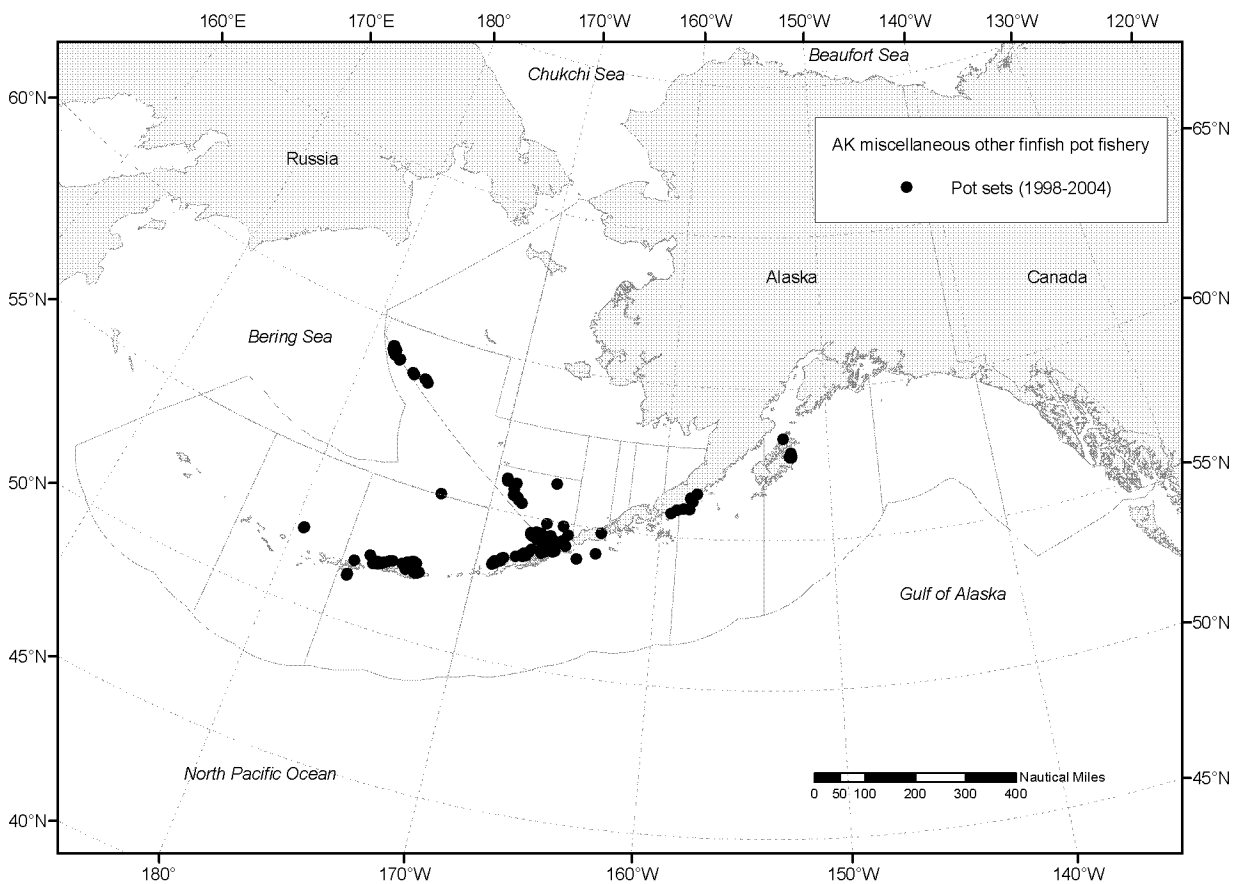


Figure 27. Locations in the Bering Sea, Aleutian Islands region, and Gulf of Alaska where pot gear was used during fishing operations in the AK miscellaneous other finfish pot fishery, 1998-2004. Only pot sets on vessels with observers were included.

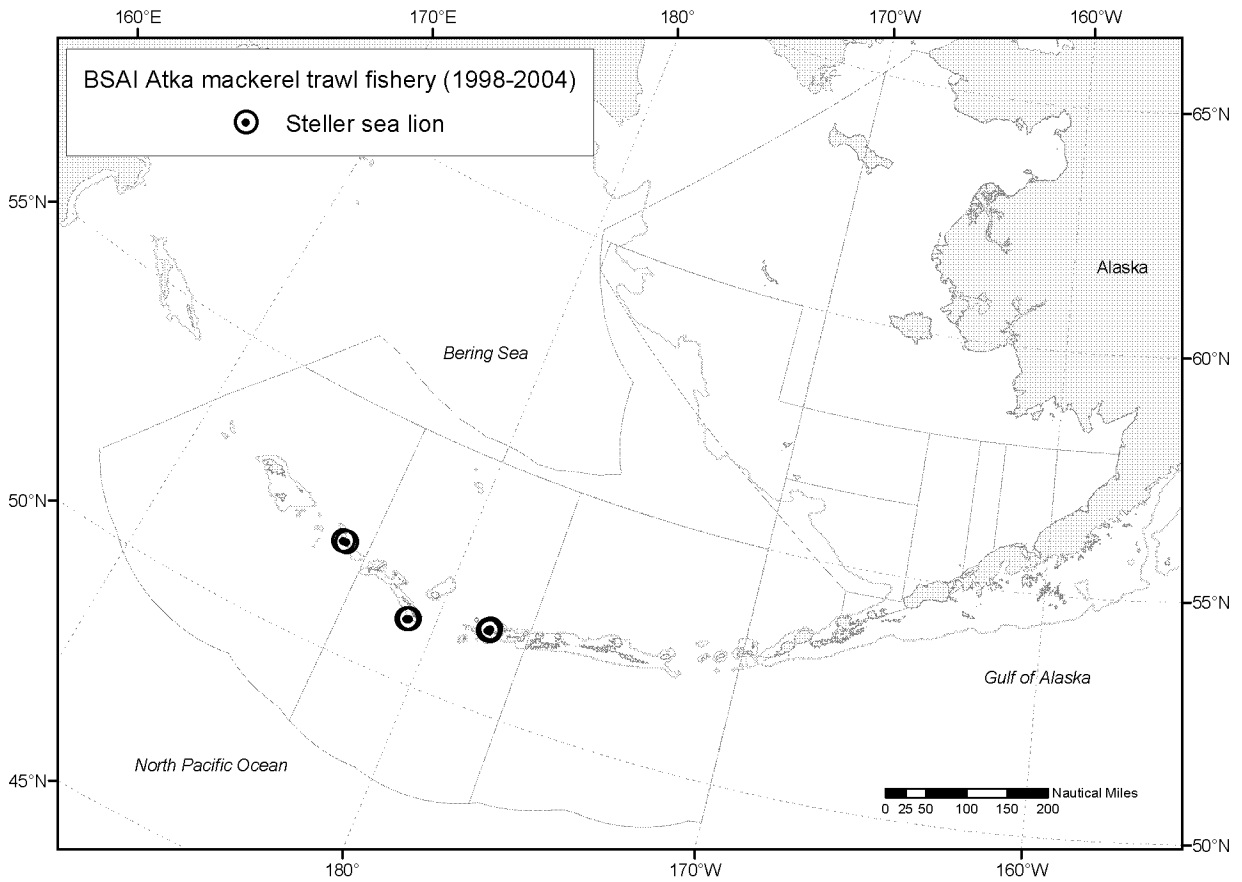


Figure 28. Locations in the Bering Sea and Aleutian Islands region where Steller sea lions were observed incidentally taken by the BSAI Atka mackerel trawl fishery, 1998-2004. Only animals which were either killed or seriously injured during fishing operations were included. The 200 m depth contour is also indicated.

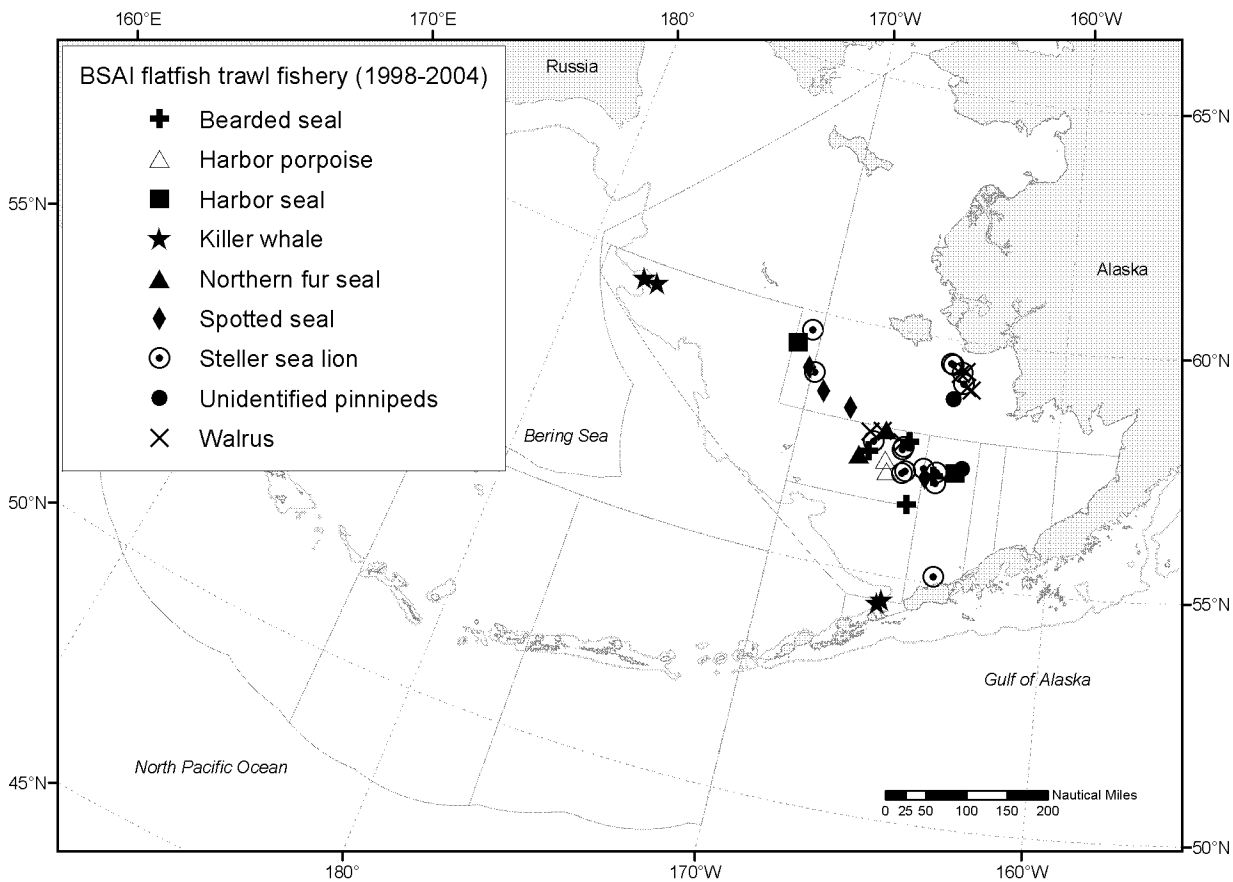


Figure 29. Locations in the Bering Sea and Aleutian Islands region where bearded seals, harbor porpoises, harbor seals, killer whales, northern fur seals, spotted seals, Steller sea lions, unidentified pinnipeds, and walrus were observed incidentally taken by the BSAI flatfish trawl fishery, 1998-2004. Only animals which were either killed or seriously injured during fishing operations were included. The 200 m depth contour is also indicated.

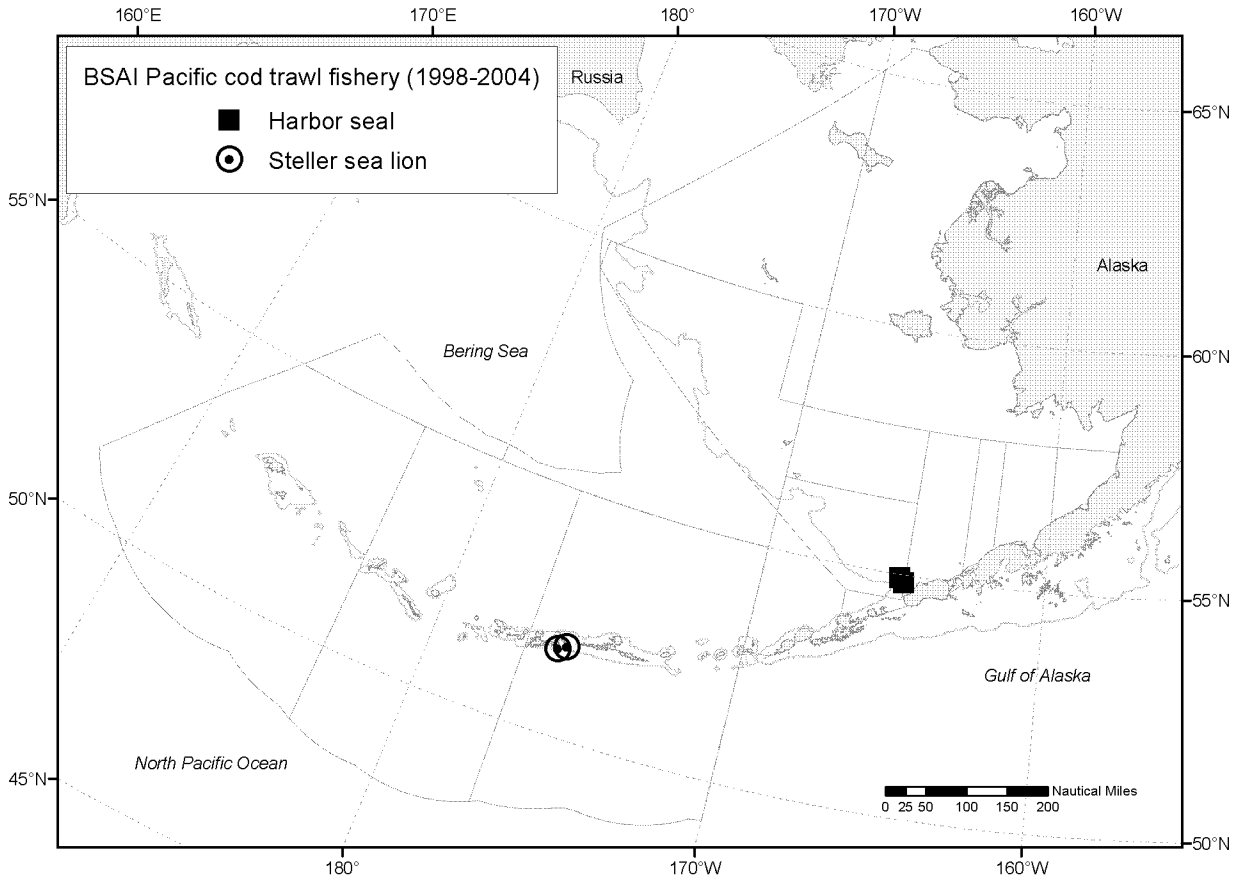


Figure 30. Locations in the Bering Sea and Aleutian Islands region where harbor seals and Steller sea lions were observed incidentally taken by the BSAI Pacific cod trawl fishery, 1998-2004. Only animals which were either killed or seriously injured during fishing operations were included. The 200 m depth contour is also indicated.

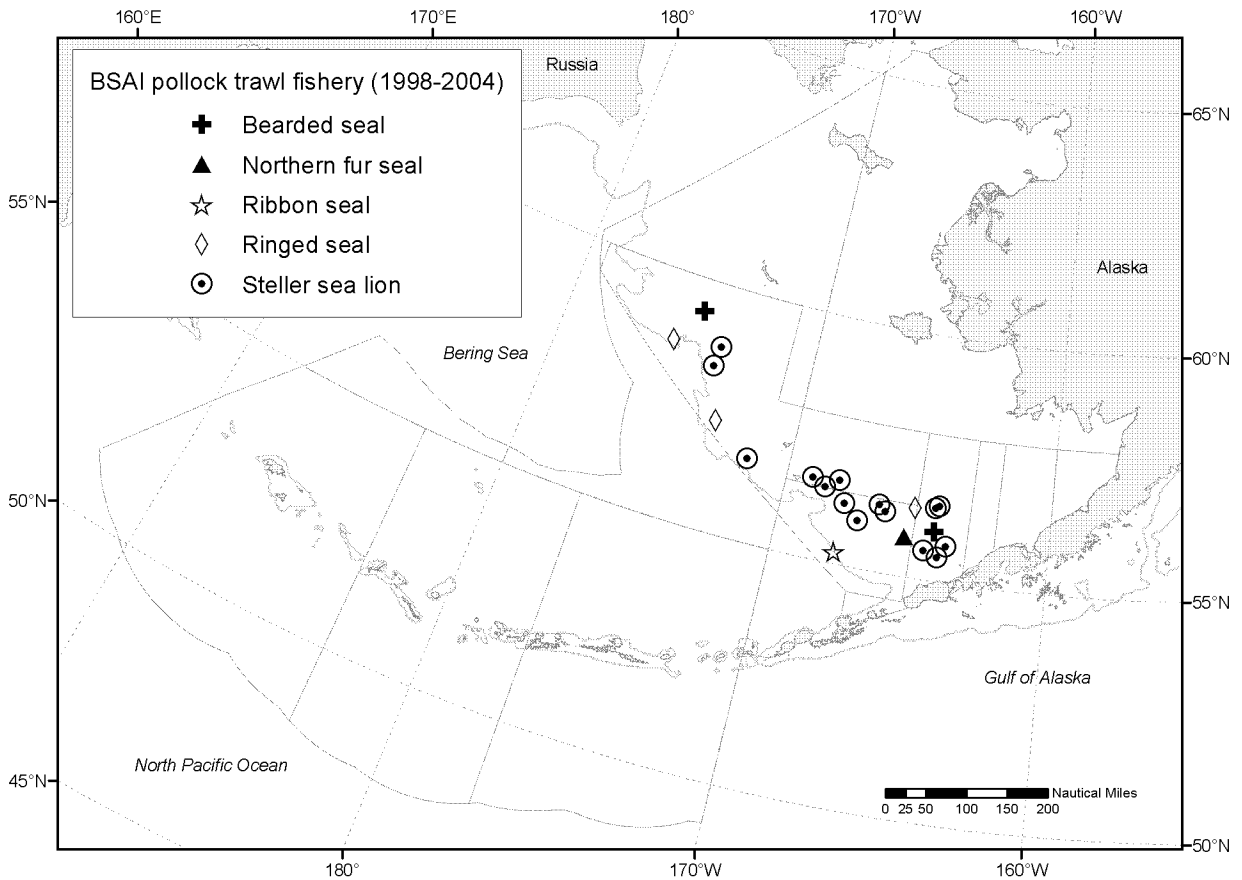


Figure 31. Locations in the Bering Sea and Aleutian Islands region where pinnipeds including bearded seals, northern fur seals, ribbon seals, ringed seals, and Steller sea lions were observed incidentally taken by the BSAI pollock trawl fishery, 1998-2004. Only animals which were either killed or seriously injured during fishing operations were included. The 200 m depth contour is also indicated.

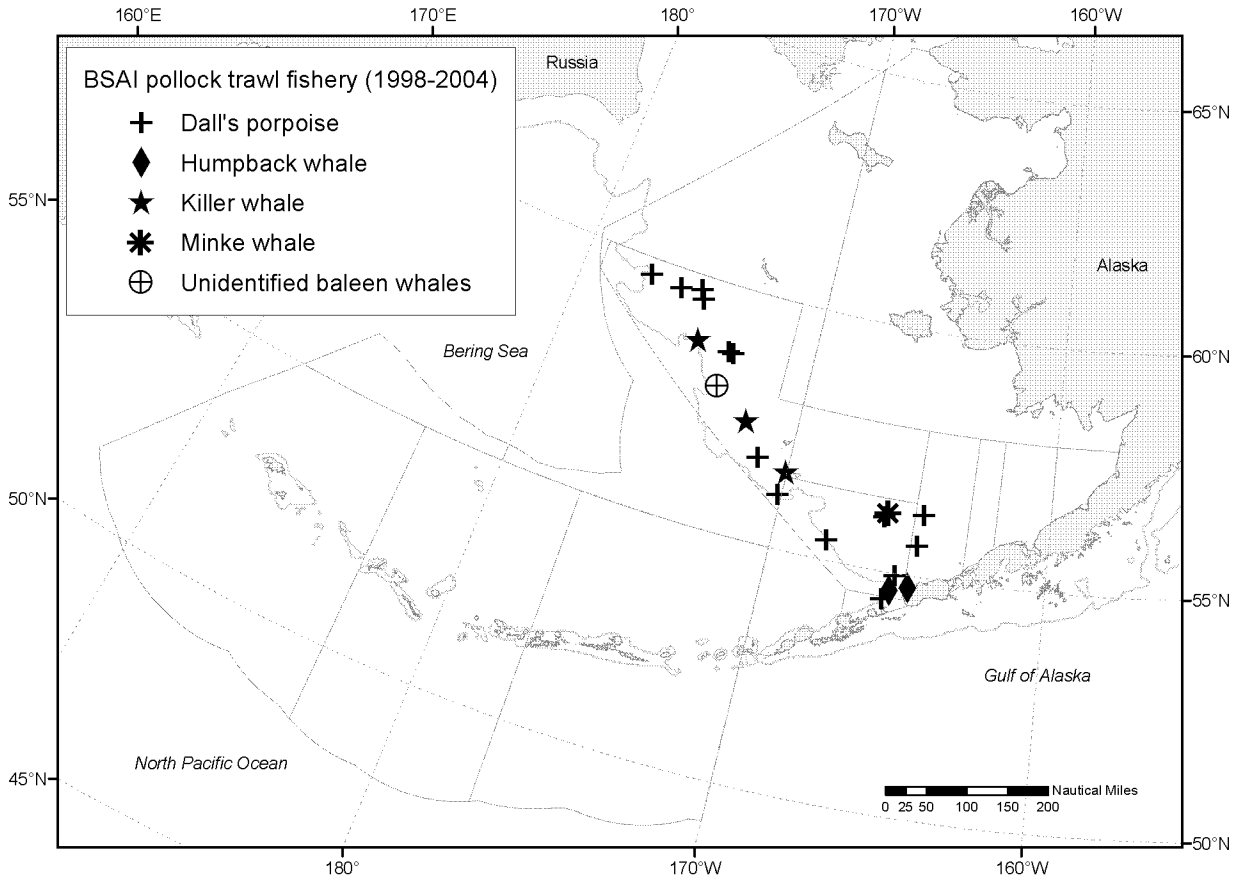


Figure 32. Locations in the Bering Sea and Aleutian Islands region where cetaceans including Dall's porpoises, humpback whales, killer whales, minke whales, and unidentified baleen whales were observed incidentally taken by the BSAI pollock trawl fishery, 1998-2004. Only animals which were either killed or seriously injured during fishing operations were included. The 200 m depth contour is also indicated.

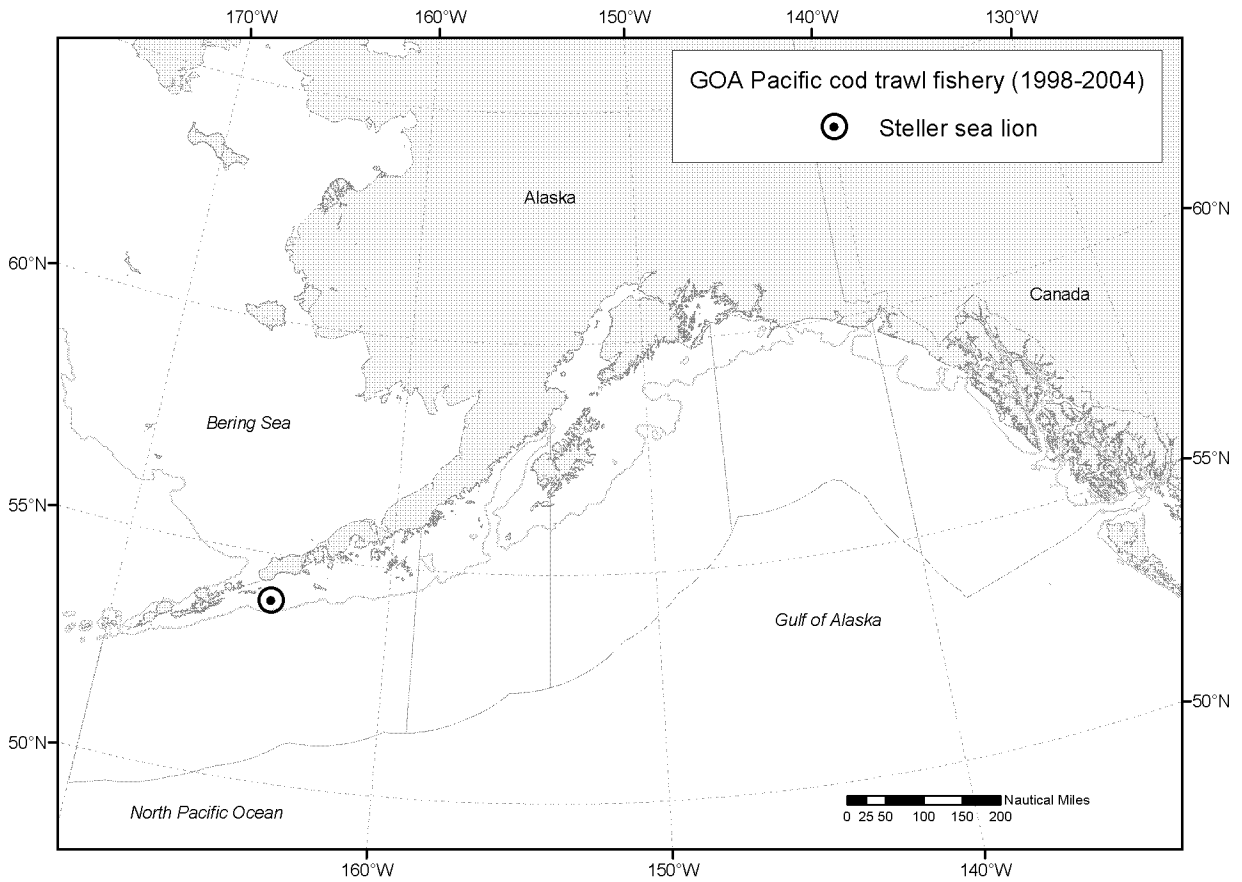


Figure 33. Locations in the Gulf of Alaska where Steller sea lions were observed incidentally taken by the GOA Pacific cod trawl fishery, 1998-2004. Only animals which were either killed or seriously injured during fishing operations were included. The 200 m depth contour is also indicated.

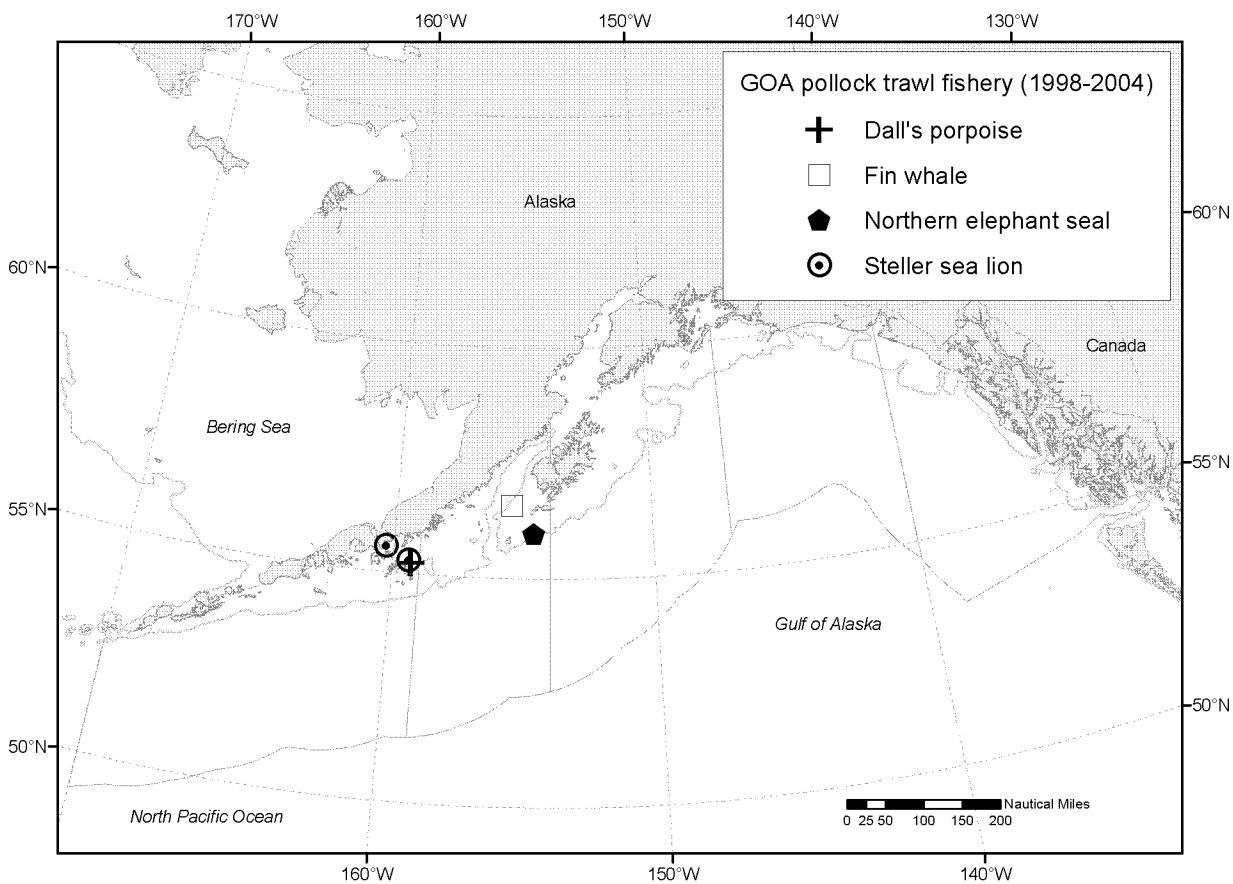


Figure 34. Locations in the Gulf of Alaska where Dall's porpoises, fin whales, northern elephant seals, and Steller sea lions were observed incidentally taken by the GOA pollock trawl fishery, 1998-2004. Only animals which were either killed or seriously injured during fishing operations were included. The 200 m depth contour is also indicated.

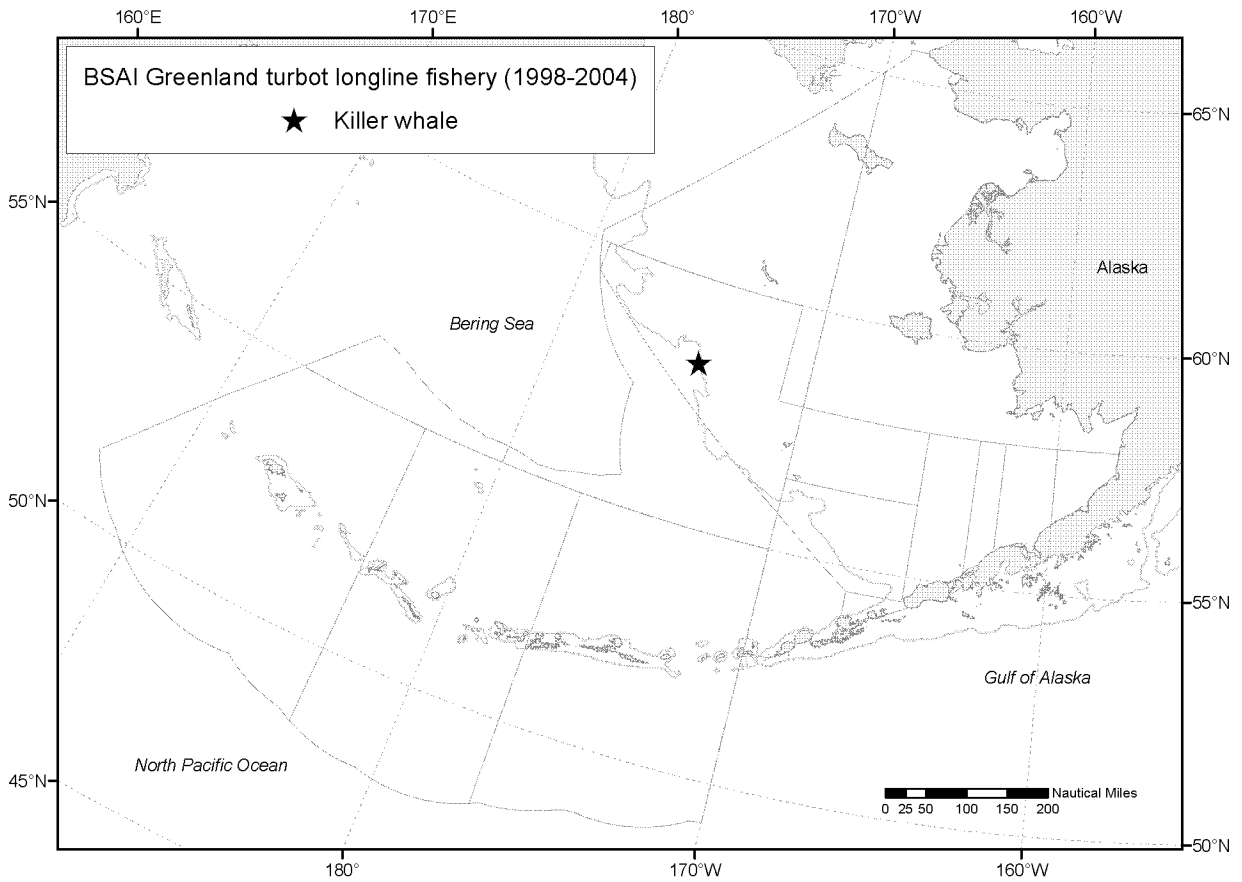


Figure 35. Locations in the Bering Sea and Aleutian Islands region where killer whales were observed incidentally taken by the BSAI Greenland turbot longline fishery, 1998-2004. Only animals which were either killed or seriously injured during fishing operations were included. The 200 m depth contour is also indicated.

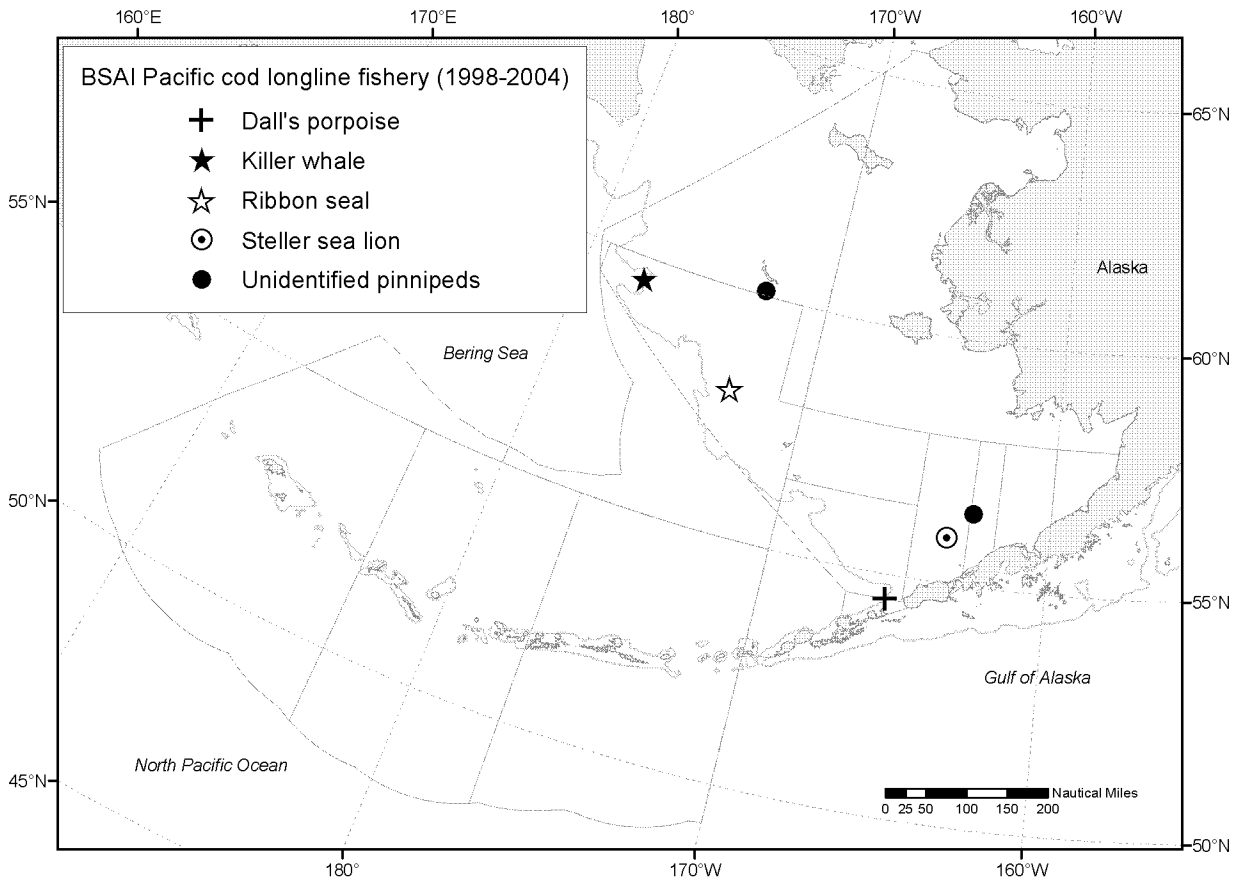


Figure 36. Locations in the Bering Sea and Aleutian Islands region where Dall's porpoises, killer whales, ribbon seals, Steller sea lions, and unidentified pinnipeds were observed incidentally taken by the BSAI Pacific cod longline fishery, 1998-2004. Only animals which were either killed or seriously injured during fishing operations were included. The 200 m depth contour is also indicated.

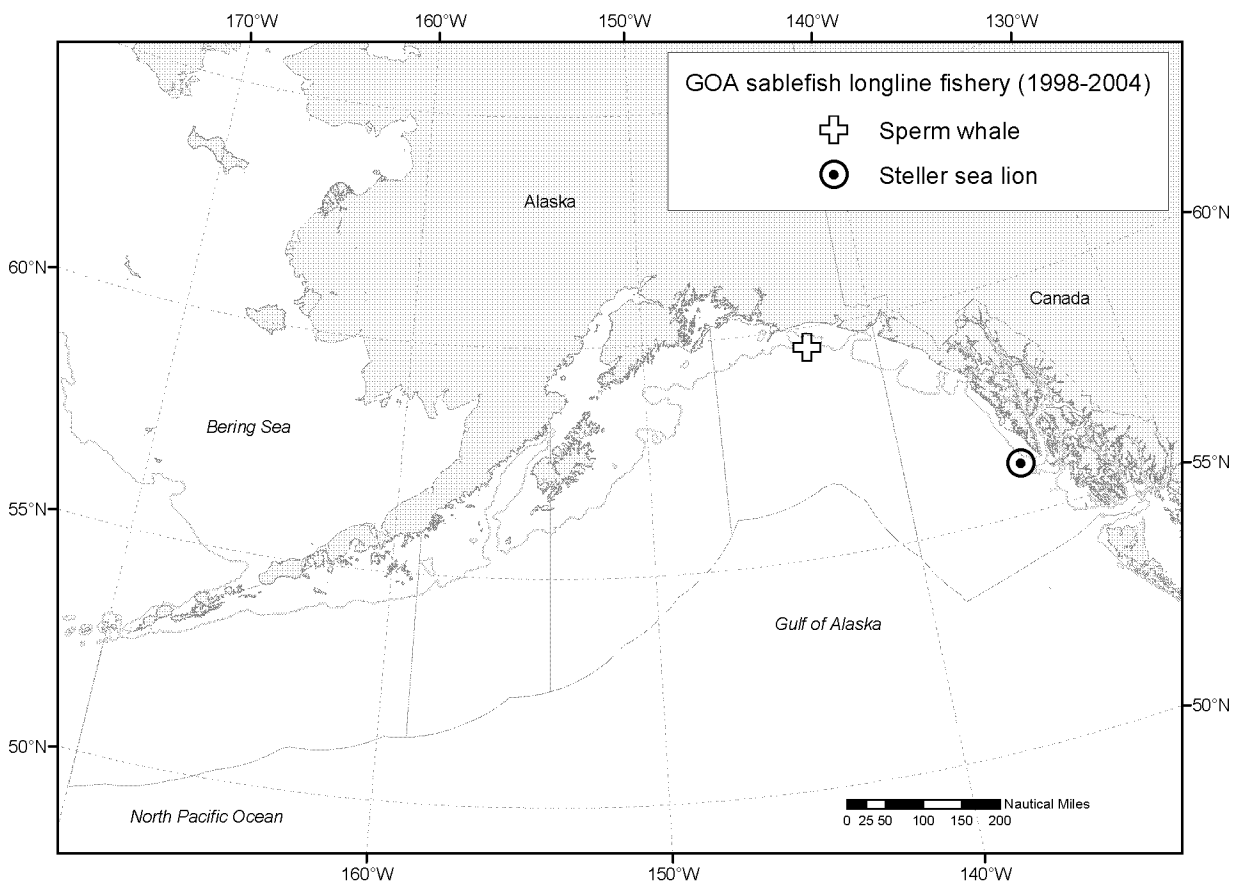


Figure 37. Locations in the Gulf of Alaska where sperm whales and Steller sea lions were observed incidentally taken by the GOA sablefish longline fishery, 1998-2004. Only animals which were either killed or seriously injured during fishing operations were included. The 200 m depth contour is also indicated.

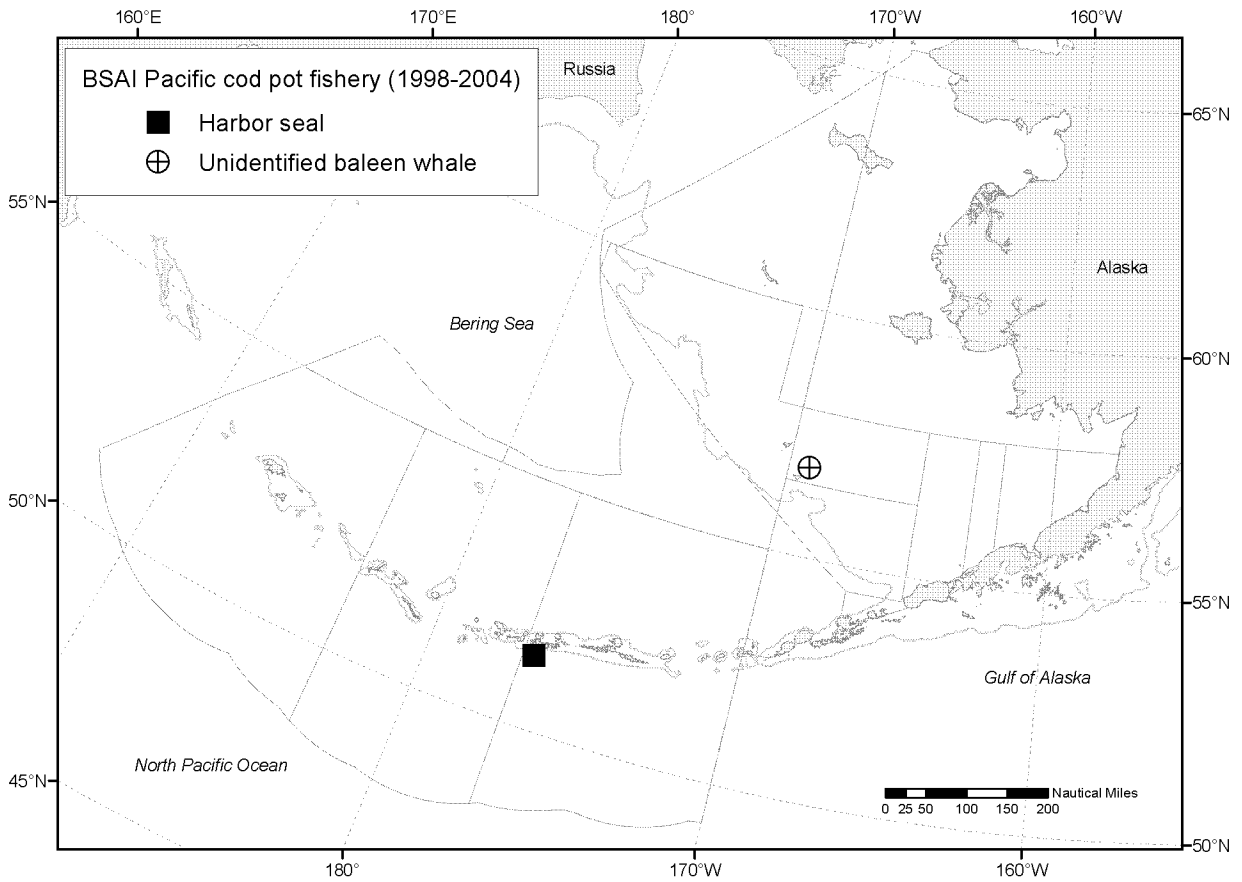


Figure 38. Locations in the Bering Sea and Aleutian Islands region where harbor seals and unidentified baleen whales were observed incidentally taken by the BSAI Pacific cod pot fishery, 1998-2004. Only animals which were either killed or seriously injured during fishing operations were included. The 200 m depth contour is also indicated.

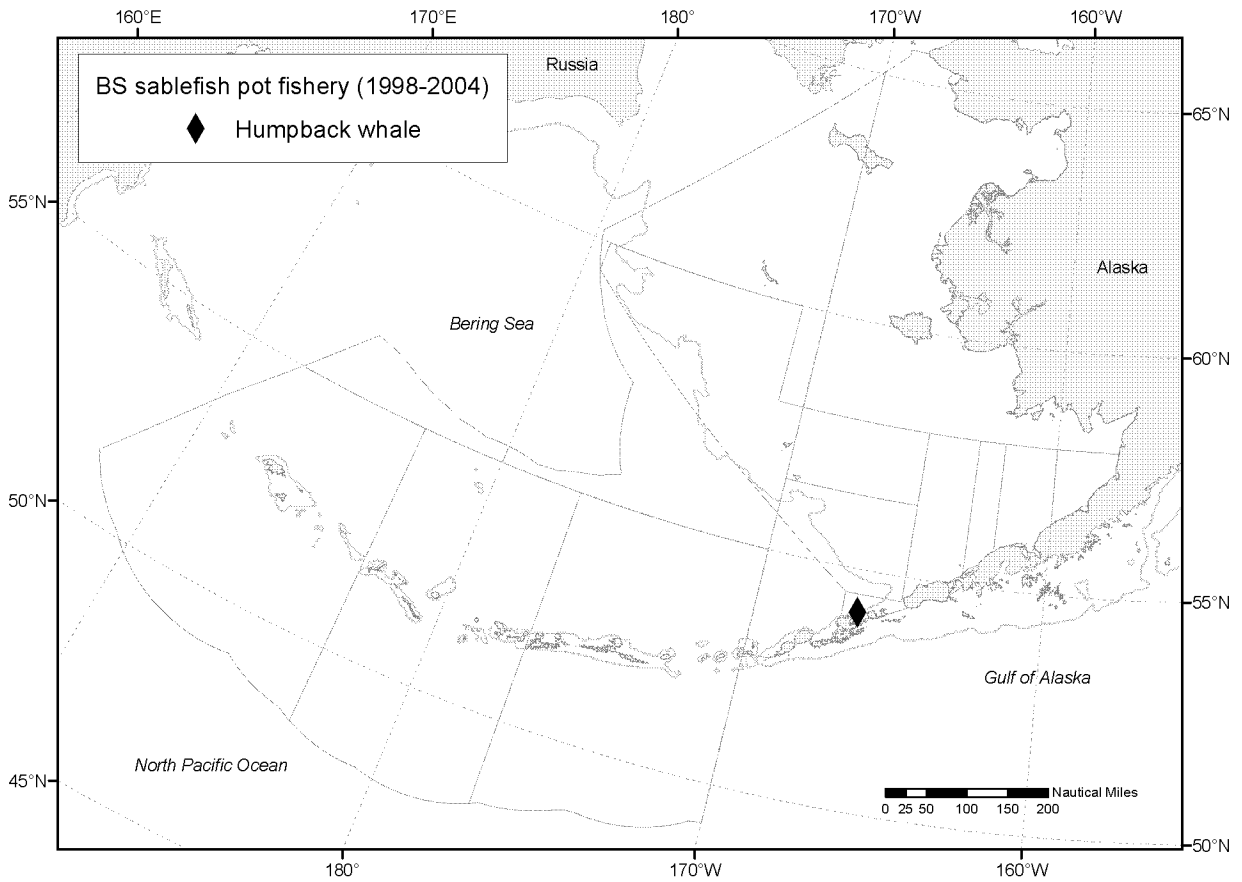


Figure 39. Locations in the Bering Sea where humpback whales were observed incidentally taken by the BS sablefish pot fishery, 1998-2004. Only animals which were either killed or seriously injured during fishing operations were included. The 200 m depth contour is also indicated.

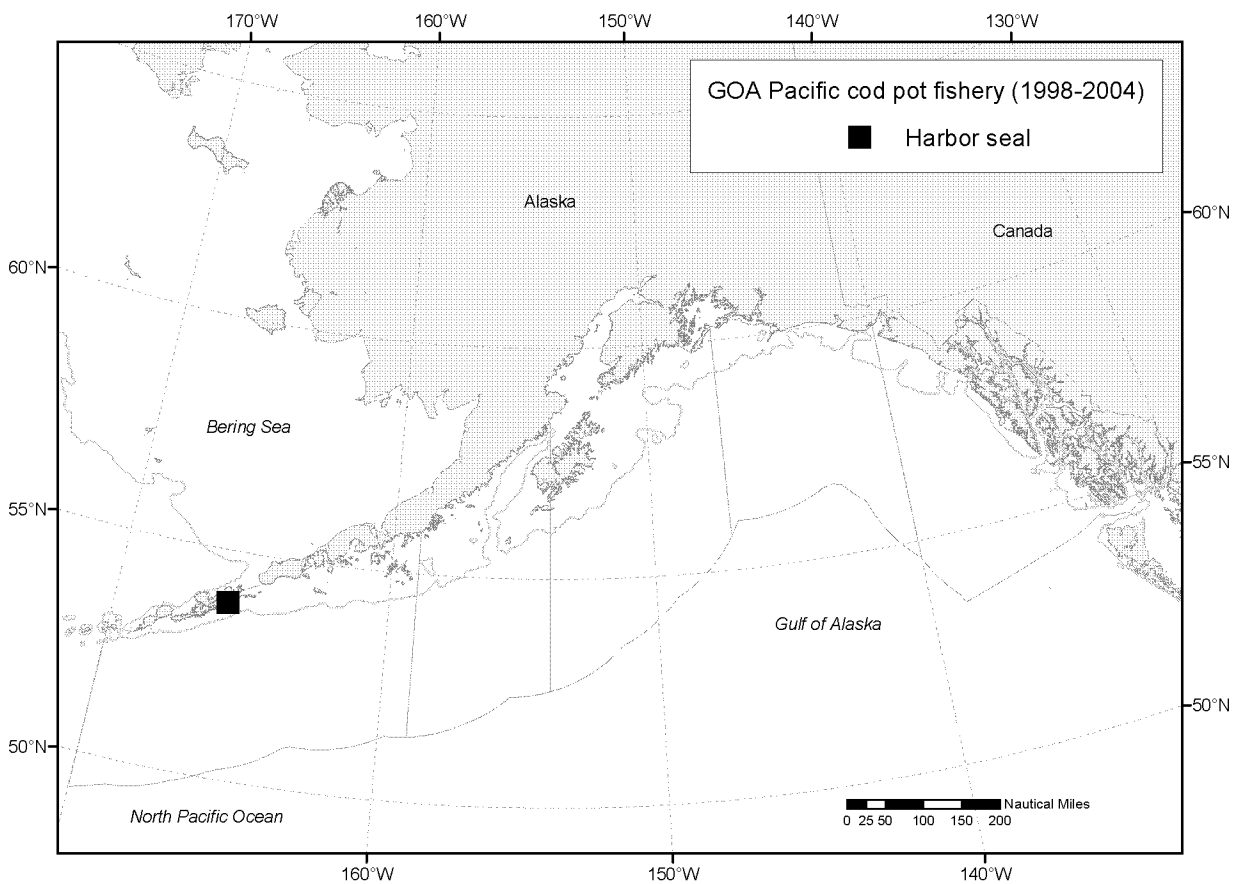


Figure 40. Locations in the Gulf of Alaska where harbor seals were observed incidentally taken by the GOA Pacific cod pot fishery, 1998-2004. Only animals which were either killed or seriously injured during fishing operations were included. The 200 m depth contour is also indicated.

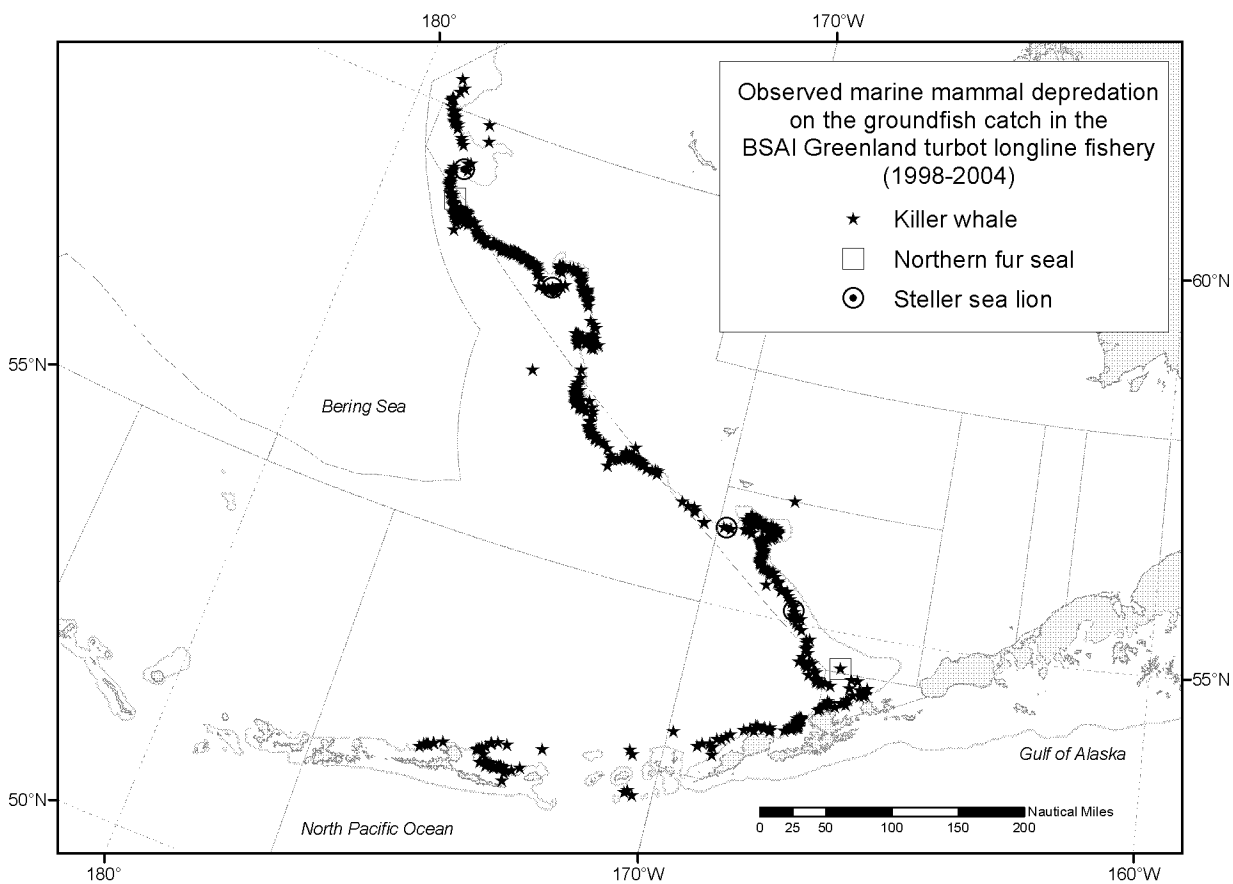


Figure 41. Locations in the Bering Sea and Aleutian Islands region where depredation on the groundfish catch by killer whales, northern fur seals, and Steller sea lions was observed in the BSAI Greenland turbot longline fishery, 1998-2004. The 200 m depth contour is also indicated.

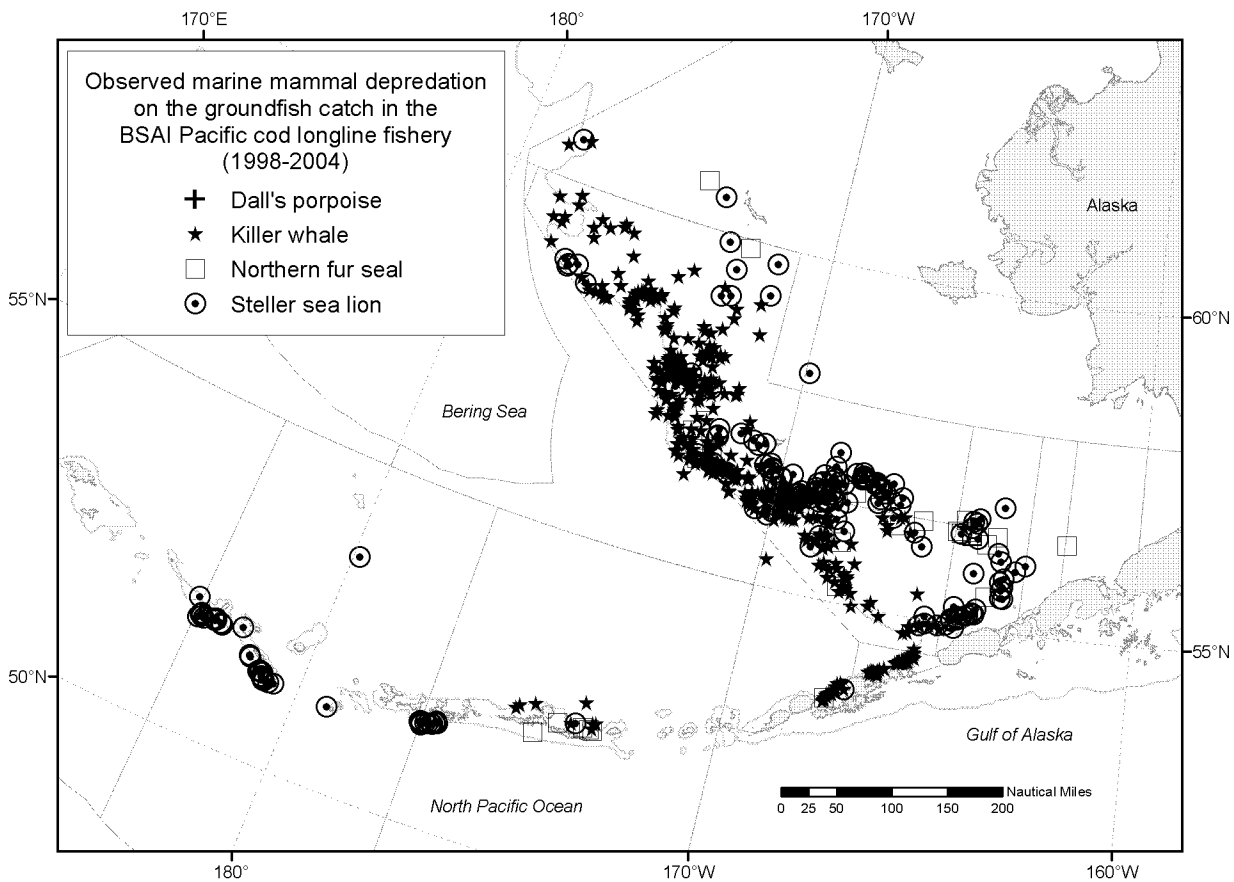


Figure 42. Locations in the Bering Sea and Aleutian Islands region where depredation on the groundfish catch by Dall's porpoises, killer whales, northern fur seals, and Steller sea lions was observed in the BSAI Pacific cod longline fishery, 1998-2004. The 200 m depth contour is also indicated.

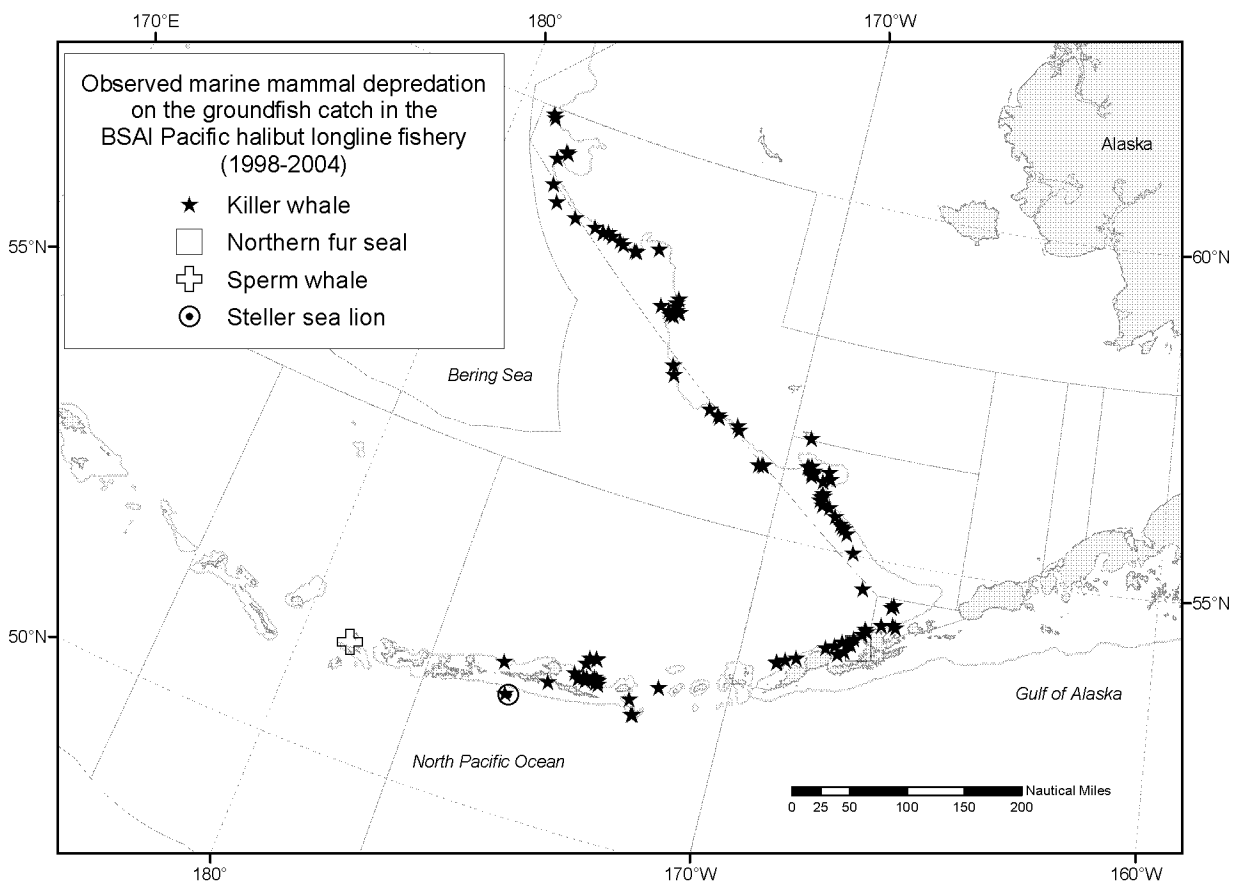


Figure 43. Locations in the Bering Sea and Aleutian Islands region where depredation on the groundfish catch by killer whales, northern fur seals, sperm whales, and Steller sea lions was observed in the BSAI Pacific halibut longline fishery, 1998-2004. The 200 m depth contour is also indicated.

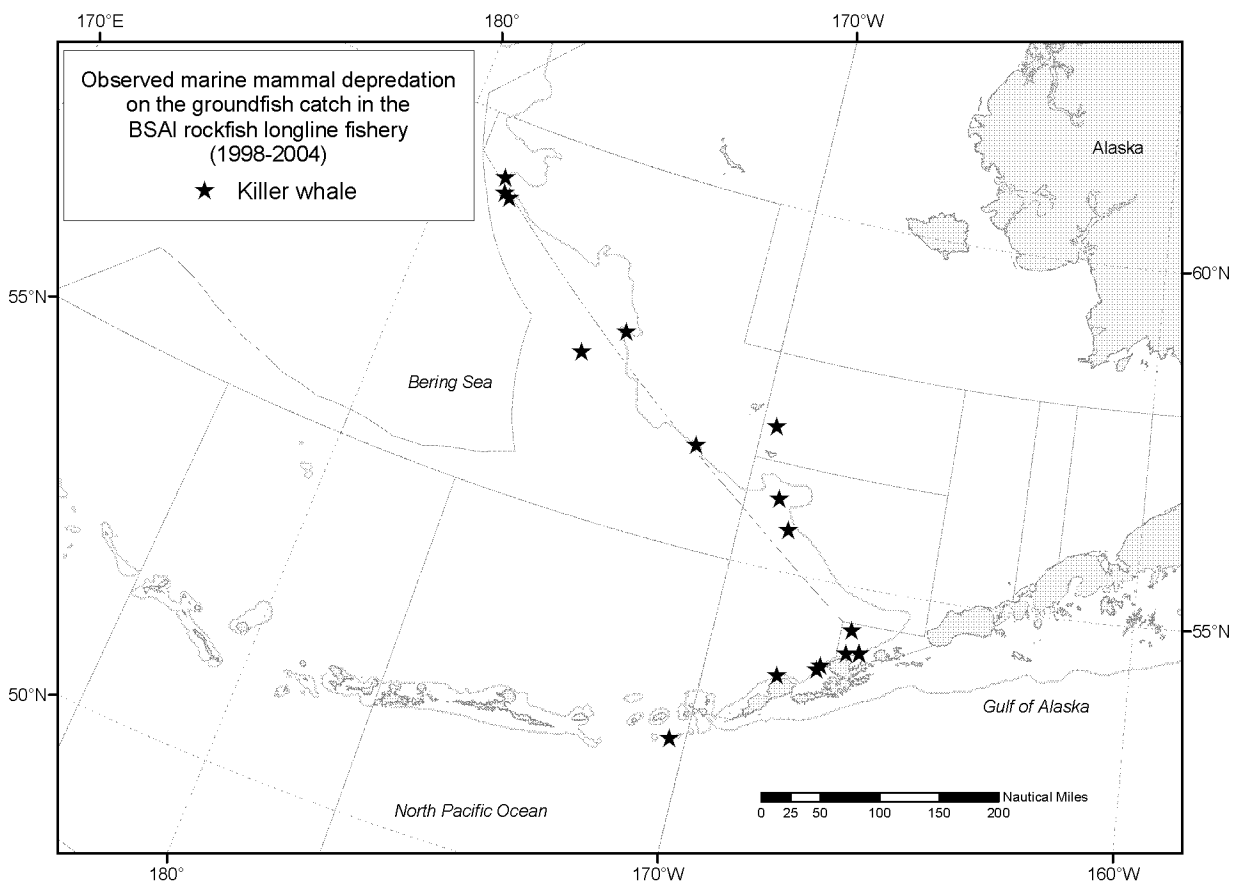


Figure 44. Locations in the Bering Sea and Aleutian Islands region where depredation on the groundfish catch by killer whales was observed in the BSAI rockfish longline fishery, 1998-2004. The 200 m depth contour is also indicated.

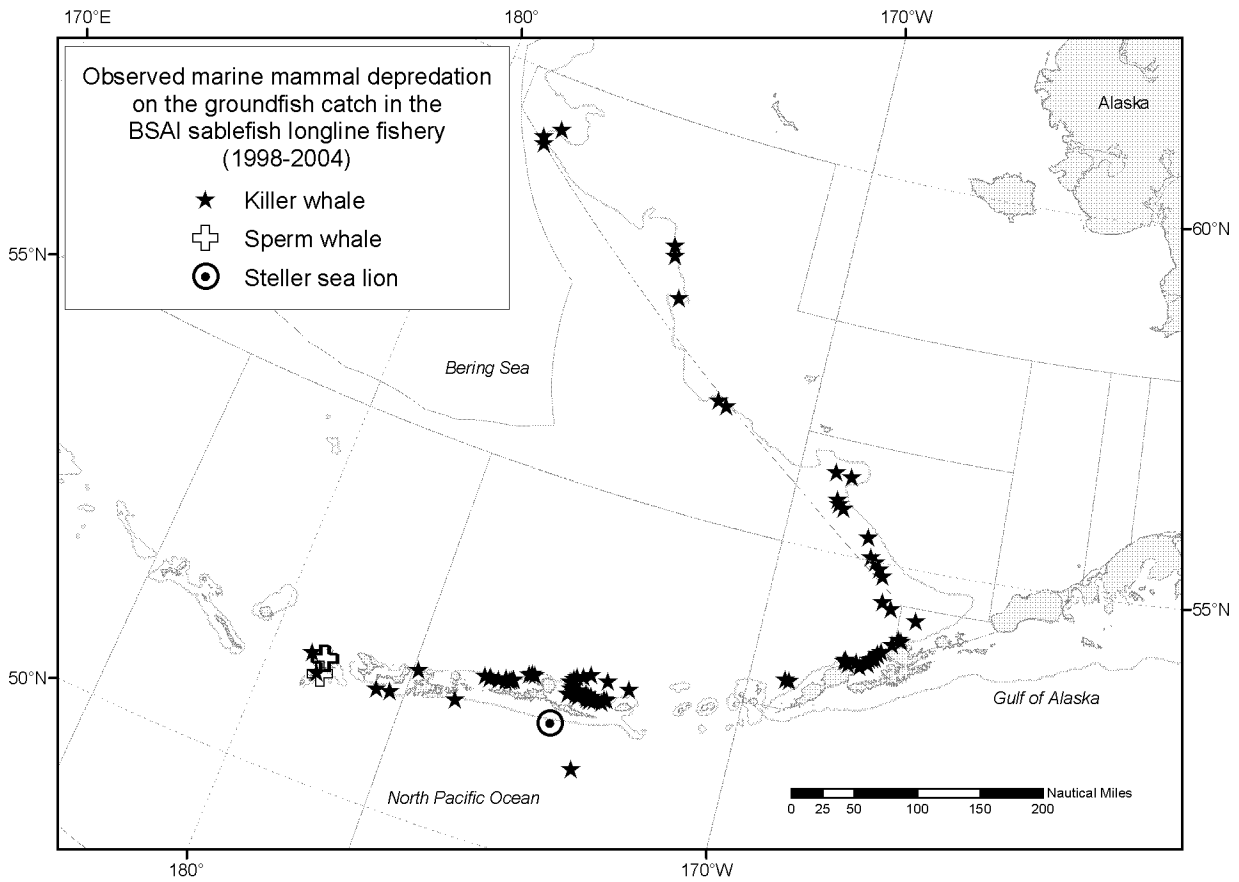


Figure 45. Locations in the Bering Sea and Aleutian Islands region where depredation on the groundfish catch by killer whales, sperm whales, and Steller sea lions was observed in the BSAI sablefish longline fishery, 1998-2004. The 200 m depth contour is also indicated.

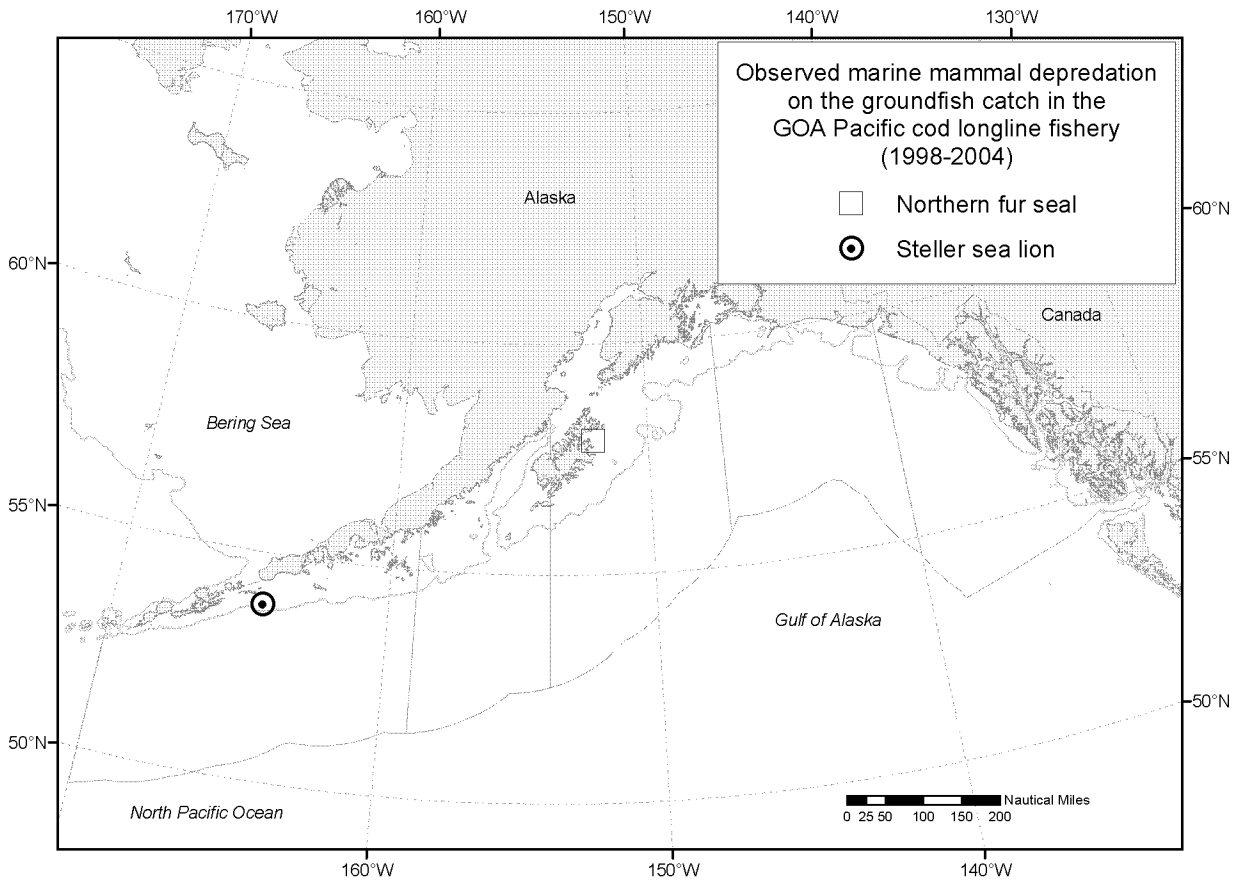


Figure 46. Locations in the Gulf of Alaska where depredation on the groundfish catch by northern fur seals and Steller sea lions was observed in the GOA Pacific cod longline fishery, 1998-2004. The 200 m depth contour is also indicated.

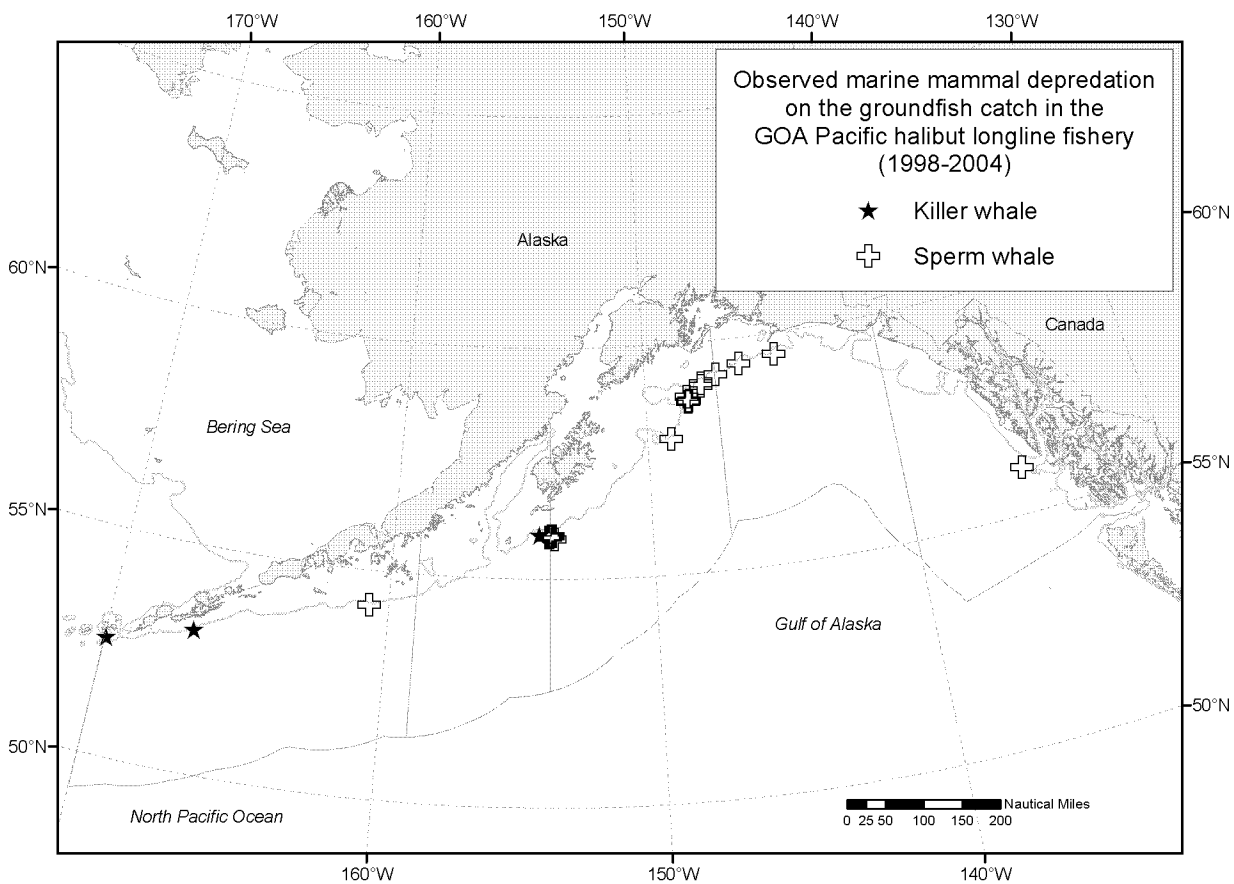


Figure 47. Locations in the Gulf of Alaska where depredation on the groundfish catch by killer whales and sperm whales was observed in the GOA Pacific halibut longline fishery, 1998-2004. The 200 m depth contour is also indicated.

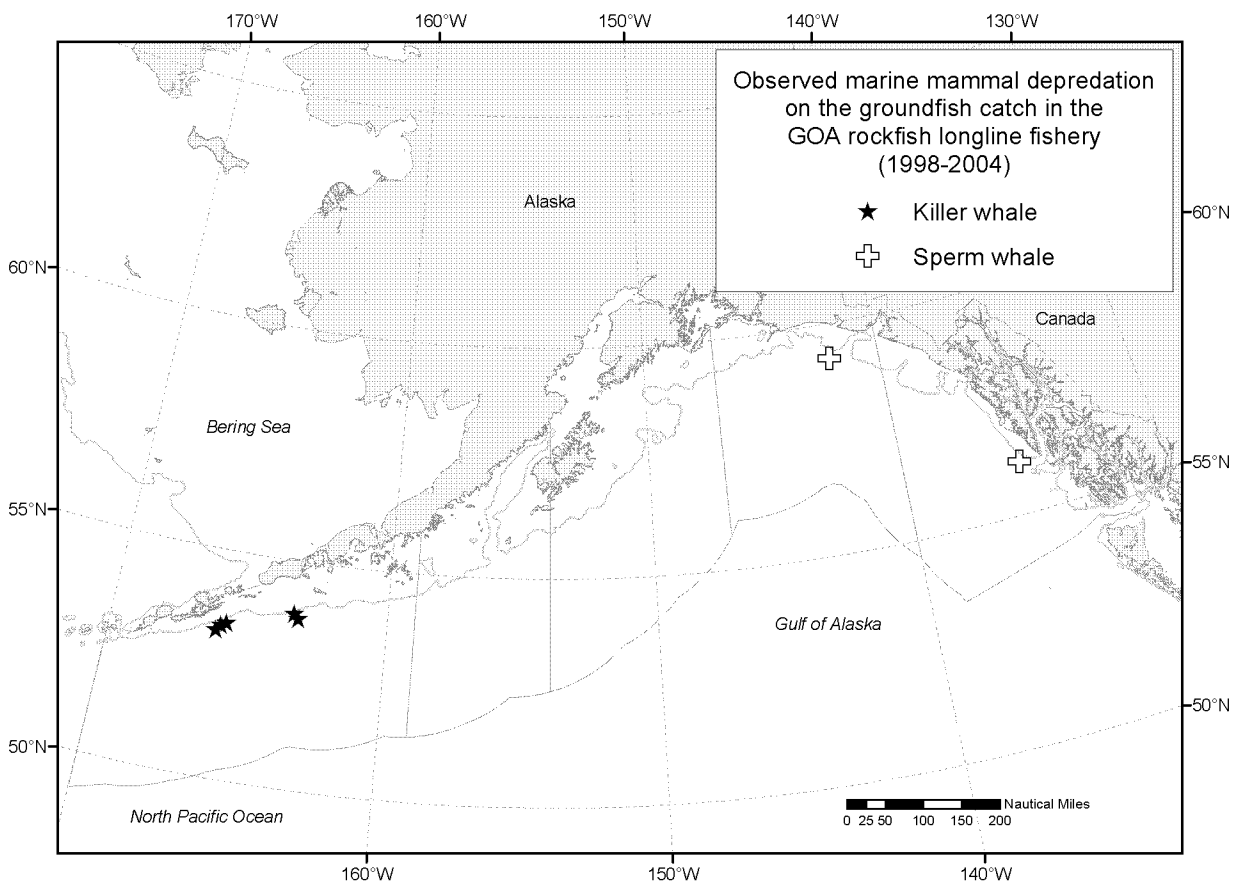


Figure 48. Locations in the Gulf of Alaska where depredation on the groundfish catch by killer whales and sperm whales was observed in the GOA rockfish longline fishery, 1998-2004. The 200 m depth contour is also indicated.

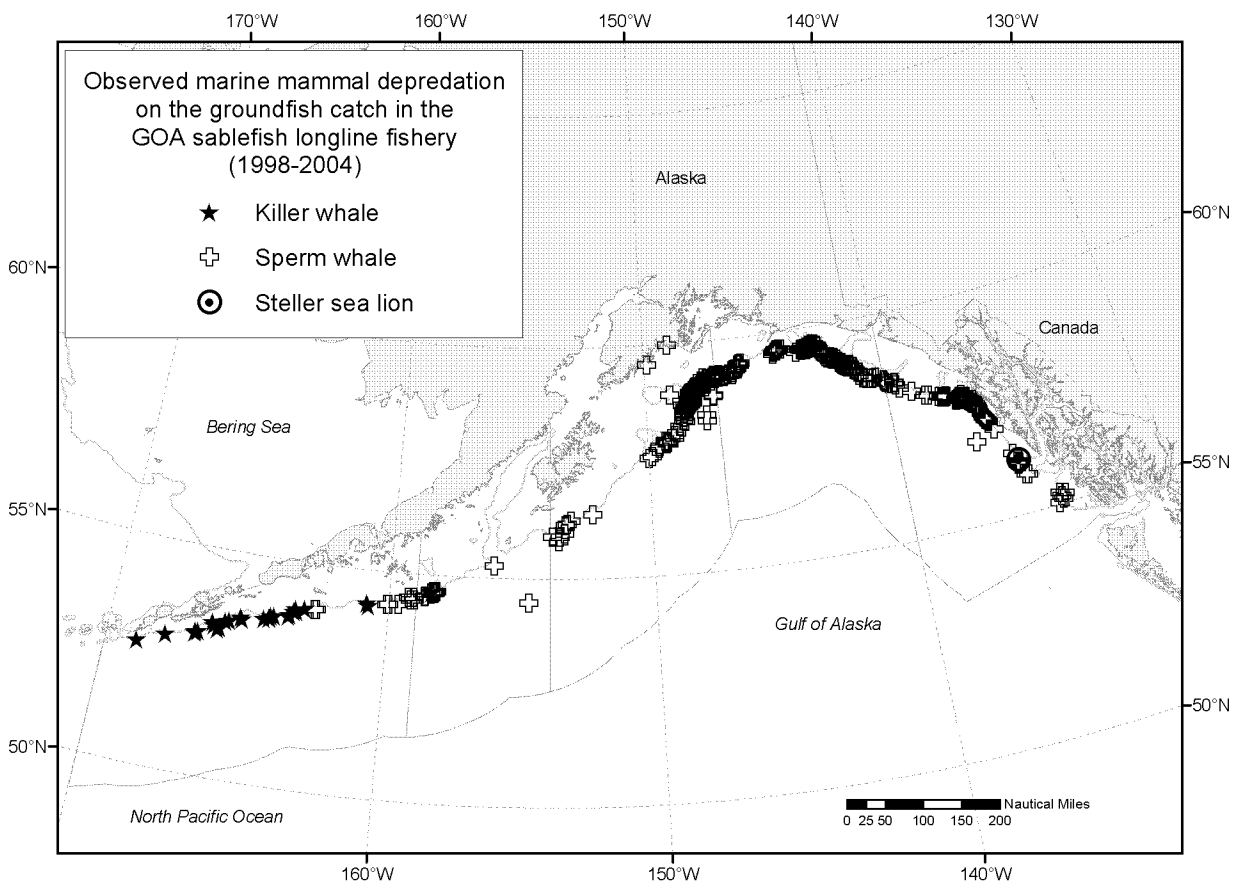


Figure 49. Locations in the Gulf of Alaska where depredation on the groundfish catch by killer whales, sperm whales, and Steller sea lions was observed in the GOA sablefish longline fishery, 1998-2004. The 200 m depth contour is also indicated.

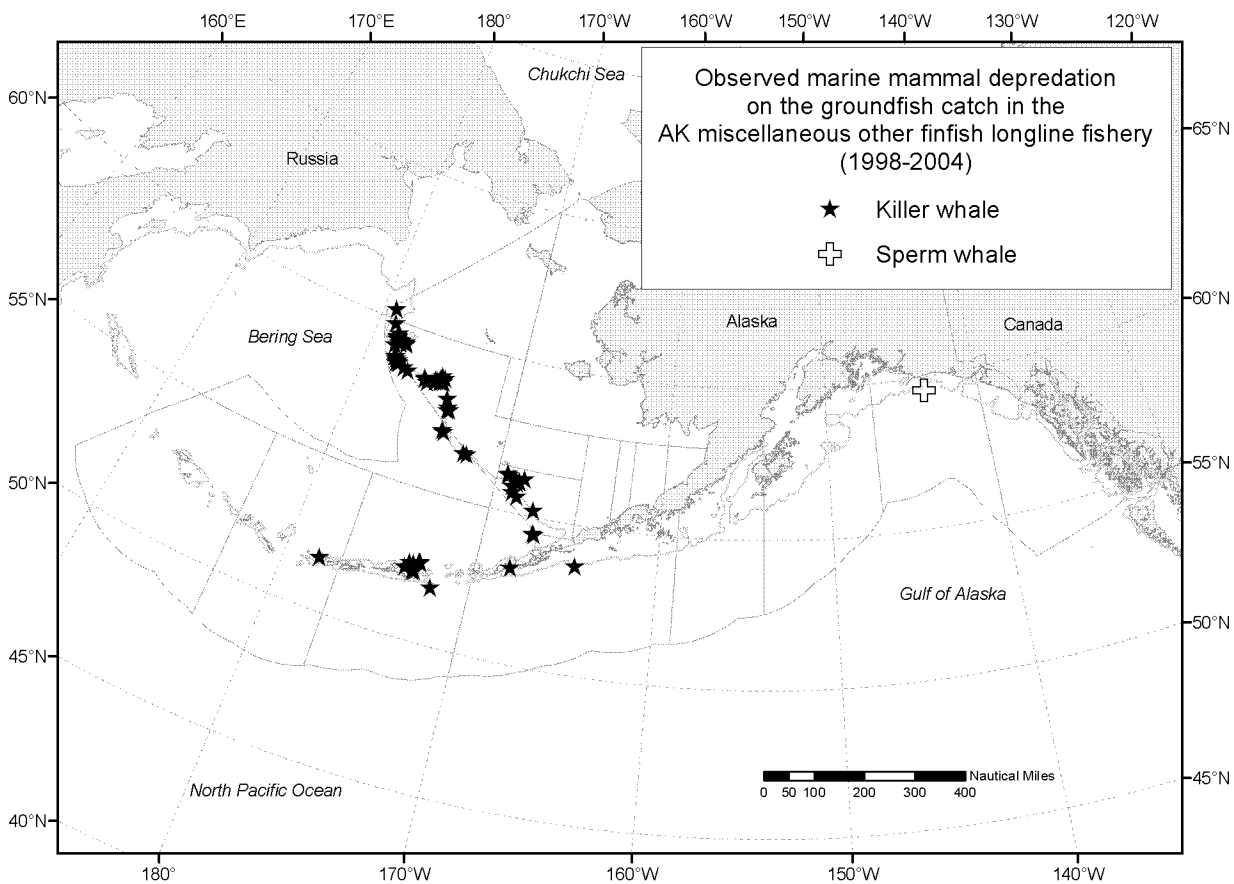


Figure 50. Locations in the Gulf of Alaska where depredation on the groundfish catch by killer whales and sperm whales was observed in the AK miscellaneous other finfish longline fishery, 1998-2004. The 200 m depth contour is also indicated.

Appendix 1.--Number and percent of hauls (sets) on vessels with observers in the Alaska groundfish fisheries during 1998-2004 (years combined) by fishery and comparison of the three steps in the processes used by the CAS to estimate the catch target groundfish species of NORPAC data. The three catch target estimation methods compared in the table are: (A) Step 1: the predominant catch groundfish species caught in each sampled NORPAC haul (set); (B) Step 2: the assignment of target species for unsampled NORPAC hauls by the AKR using NORPAC data from the same vessel within 7 days of the unsampled hauls; and (C) Step 3: the final CAS (Blend) intended catch target species by trip target date (target definition used in this report).

Number (percent) of NORPAC hauls (1998-2004) by comparison of three estimations of catch target groundfish species ¹							
Fishery		(C=B) and (C=A) ²	(C=B) and (C≠A)	(C≠B) and (C=A) ³	(C≠B) and (B=A)	(C≠B) and (C≠A) and (B≠A) ⁴	Total
Trawl gear fisheries							
BSAI Atka mackerel trawl	Number	8,321	2	0	622	187	9,132
	Percent	91.12	0.02	0	6.81	2.05	100
BSAI flatfish trawl	Number	63,955	33	130	2,323	1,874	68,315
	Percent	93.62	0.05	0.19	3.40	2.74	100
BSAI Pacific cod trawl	Number	23,058	44	2	4,220	2,650	29,974
	Percent	76.93	0.15	0.01	14.08	8.84	100
BSAI pollock trawl	Number	107,361	23	0	175	46	107,605
	Percent	99.77	0.02	0	0.16	0.04	100
BSAI rockfish trawl	Number	1,485	4	0	144	69	1,702
	Percent	87.25	0.24	0	8.46	4.05	100
GOA flatfish trawl	Number	11,541	78	34	701	363	12,717
	Percent	90.75	0.61	0.27	5.51	2.85	100
GOA Pacific cod trawl	Number	4,653	55	0	385	226	5,319
	Percent	87.48	1.03	0	7.24	4.25	100
GOA pollock trawl	Number	5,428	5	0	104	16	5,553
	Percent	97.75	0.09	0	1.87	0.29	100
GOA rockfish trawl	Number	5,644	26	0	595	177	6,442
	Percent	87.61	0.40	0	9.24	2.53	100
AK miscellaneous other finfish trawl	Number	616	8	29	45	1	699
	Percent	88.13	1.14	4.15	6.44	0.14	100

Appendix 1.--Continued.

Number (percent) of NORPAC hauls (1998-2004) by comparison of three estimations of catch target groundfish species ¹							
Fishery		(C=B) and	(C=B) and	(C≠B) and	(C≠B) and	(C≠B) and	Total
		(C=A) ²	(C≠A)	(C=A) ³	(B=A)	(B≠A) ⁴	
Longline gear fisheries							
BSAI Greenland turbot longline	Number	5,808	90	47	270	116	6,331
	Percent	91.74	1.42	0.74	4.26	1.83	100
BSAI Pacific cod longline	Number	106,248	638	3	976	231	108,096
	Percent	98.29	0.59	<0.01	0.90	0.21	100
BSAI Pacific halibut longline	Number	1,230	39	78	234	55	1,636
	Percent	75.18	2.38	4.77	14.30	3.36	100
BSAI rockfish longline	Number	101	27	0	23	2	153
	Percent	66.01	17.65	0	15.03	1.31	100
BSAI sablefish longline	Number	1,762	126	2	515	195	2,600
	Percent	67.77	4.85	0.08	19.81	7.50	100
GOA Pacific cod longline	Number	3,083	92	0	65	17	3,257
	Percent	94.66	2.82	0	2.00	0.52	100
GOA Pacific halibut longline	Number	1,583	1	3	162	56	1,805
	Percent	87.70	0.06	0.17	8.98	3.10	100
GOA rockfish longline	Number	34	3	0	1	3	41
	Percent	82.93	7.32	0	2.44	7.32	100
GOA sablefish longline	Number	9,055	22	0	393	181	9,651
	Percent	93.82	0.23	0	4.07	1.88	100
AK miscellaneous other finfish longline	Number	532	148	49	11	3	743
	Percent	71.60	19.92	6.59	1.48	0.40	100
Pot gear fisheries							
BSAI Pacific cod pot	Number	8,456	2	4	146	5	8,613
	Percent	98.18	0.02	0.05	1.70	0.06	100

Appendix 1.--Continued.

Number (percent) of NORPAC hauls (1998-2004) by comparison of three estimations of catch target groundfish species ¹							
Fishery		(C=B) and	(C=B) and	(C≠B) and	(C≠B) and	(C≠B) and	Total
		(C=A) ²	(C≠A)	(C=A) ³	(B=A)	(B≠A) ⁴	
Pot gear fisheries							
BS sablefish pot	Number	1,330	57	0	245	5	1,637
	Percent	81.25	3.48	0	14.97	0.31	100
AI sablefish pot	Number	1,113	27	0	69	3	1,212
	Percent	91.83	2.23	0	5.69	0.25	100
GOA Pacific cod pot	Number	3,073	960	0	50	0	4,083
	Percent	75.26	23.51	0	1.22	0	100
AK miscellaneous other finfish pot	Number	326	0	9	25	0	360
	Percent	90.56	0	2.50	6.94	0	100

¹ For purposes of these logical comparisons, unsampled NORPAC hauls in Step 1 (A) were considered equivalent to CAS target assignments in Step 3 (C) because individually the unsampled hauls provided no target species information. All miscellaneous other finfish target species were considered one target group.

² Also includes unsampled NORPAC hauls where Step 2 (B) in the CAS process to estimate the target catch species for the unsampled haul either could not yield a known fishery target definition, or estimated the same target as the final CAS (Blend) weekly production target (Step 3, C).

³ Also includes unsampled NORPAC hauls where Step 2 (B) in the CAS process to estimate the target catch species for the unsampled haul did yield a fishery target definition, including miscellaneous other finfish, but the final CAS (Blend) weekly production target code (Step 3, C) was the unknown target data code.

⁴ Also includes unsampled NORPAC hauls where Step 2 (B) in the CAS process to estimate the target catch species for the unsampled haul did yield a known fishery target definition which was not the same as the final CAS (Blend) weekly production target (Step 3, C).

Appendix 2.—Total weight (t) and percent of the groundfish catch by vessels with observers in the Alaska groundfish fisheries during 1998-2004 (years combined) by fishery and comparison of the three steps in the processes used by the CAS to estimate the catch target groundfish species of NORPAC data. The three catch target estimation methods compared in the table are: (A) Step 1: the predominant catch groundfish species caught in each sampled NORPAC haul (set); (B) Step 2: the assignment of target species for unsampled NORPAC hauls by the AKR using NORPAC data from the same vessel within 7 days of the unsampled hauls; and (C) Step 3: the final CAS (Blend) intended catch target species by trip target date (target definition used in this report).

Weight of groundfish catch (t), and percent of total, of NORPAC hauls (1998-2004) by comparison of three estimations of catch target groundfish species¹

Fishery		(C=B) and	(C=B) and	(C≠B) and	(C≠B) and	(C≠B) and	Total
		(C=A) ²	(C≠A)	(C=A) ³	(B=A)	(B≠A) ⁴	
Trawl gear fisheries							
BSAI Atka mackerel trawl	Weight	419,397	23	0	14,586	3,564	437,570
	Percent	95.89	0.01	0	3.33	0.81	100
BSAI flatfish trawl	Weight	1,186,049	266	2,671	50,160	27,766	1,266,912
	Percent	93.62	0.02	0.21	3.96	2.19	100
BSAI Pacific cod trawl	Weight	277,182	321	8	78,656	27,747	383,914
	Percent	72.20	0.08	<0.01	20.49	7.23	100
BSAI pollock trawl	Weight	7,998,100	291	0	4,455	619	8,003,464
	Percent	99.93	<0.01	0	0.06	0.01	100
BSAI rockfish trawl	Weight	73,579	46	0	4,900	1,644	80,170
	Percent	91.78	0.06	0	6.11	2.05	100
GOA flatfish trawl	Weight	105,778	396	182	5,509	2,533	114,398
	Percent	92.46	0.35	0.16	4.82	2.21	100
GOA Pacific cod trawl	Weight	39,451	325	0	3,792	1,990	45,557
	Percent	86.60	0.71	0	8.32	4.37	100
GOA pollock trawl	Weight	166,915	43	0	889	235	168,083
	Percent	99.31	0.03	0	0.53	0.14	100
GOA rockfish trawl	Weight	107,783	218	0	6,351	1,302	115,654
	Percent	93.19	0.19	0	5.49	1.13	100
AK miscellaneous other finfish trawl	Weight	5,083	100	249	582	15	6,028
	Percent	84.32	1.66	4.13	9.66	0.24	100

Appendix 2.--Continued.

Weight of groundfish catch (t), and percent of total, of NORPAC hauls (1998-2004)
by comparison of three estimations of catch target groundfish species¹

Fishery		(C ≠ B) and (C ≠ A) and (C = B) and (C = A) ²					Total
		(C = B) and (C = A) ²	(C = B) and (C ≠ A)	(C ≠ B) and (C = A) ³	(C ≠ B) and (B = A)	(C ≠ B) and (B ≠ A) ⁴	
Longline gear fisheries							
BSAI Greenland turbot longline	Weight	40,265	494	207	1,667	427	43,061
	Percent	93.51	1.15	0.48	3.87	0.99	100
BSAI Pacific cod longline	Weight	858,411	3,334	11	5,668	1,009	868,433
	Percent	98.85	0.38	<0.01	0.65	0.12	100
BSAI Pacific halibut longline	Weight	6,178	255	238	1,236	162	8,068
	Percent	76.57	3.16	2.95	15.32	2.00	100
BSAI rockfish longline	Weight	386	121	0	62	6	575
	Percent	67.12	21.10	0	10.69	1.10	100
BSAI sablefish longline	Weight	5,715	483	23	1,733	673	8,627
	Percent	66.24	5.60	0.27	20.08	7.81	100
GOA Pacific cod longline	Weight	24,299	970	0	302	79	25,649
	Percent	94.74	3.78	0	1.18	0.31	100
GOA Pacific halibut longline	Weight	9,843	4	<0.1	527	253	10,628
	Percent	92.62	0.04	<0.01	4.96	2.38	100
GOA rockfish longline	Weight	106	5	0	3	25	139
	Percent	76.43	3.31	0	2.39	17.87	100
GOA sablefish longline	Weight	38,560	115	0	1,732	858	41,265
	Percent	93.45	0.28	0	4.20	2.08	100
AK miscellaneous other finfish longline	Weight	3,237	575	136	31	8	3,987
	Percent	81.18	14.42	3.41	0.78	0.21	100
Pot gear fisheries							
BSAI Pacific cod pot	Weight	37,550	<1	28	75	2	37,654
	Percent	99.72	<0.01	0.07	0.20	0.01	100

Appendix 2.--Continued.

Weight of groundfish catch (t), and percent of total, of NORPAC hauls (1998-2004)
by comparison of three estimations of catch target groundfish species¹

Fishery		(C=B) and	(C=B) and	(C≠B) and	(C≠B) and	(C≠B) and	Total
		(C=A) ²	(C≠A)	(C=A) ³	(B=A)	(B≠A) ⁴	
Pot gear fisheries							
BS sablefish pot	Weight	876	24	0	126	3	1,030
	Percent	85.14	2.34	0	12.27	0.25	100
AI sablefish pot	Weight	820	28	0	48	5	901
	Percent	91.02	3.10	0	5.31	0.57	100
GOA Pacific cod pot	Weight	9,600	2,070	0	8	0	11,679
	Percent	82.20	17.72	0	0.07	0	100
AK miscellaneous other finfish pot	Weight	1,541	0	5	8	0	1,554
	Percent	99.16	0	0.35	0.49	0	100

¹ For purposes of these logical comparisons, unsampled NORPAC hauls in Step 1 (A) were considered equivalent to CAS target assignments in Step 3 (C) because individually the unsampled hauls provided no target species information. All miscellaneous other finfish target species were considered one target group.

² Also includes unsampled NORPAC hauls where Step 2 (B) in the CAS process to estimate the target catch species for the unsampled haul either could not yield a known fishery target definition, or estimated the same target as the final CAS (Blend) weekly production target (Step 3, C).

³ Also includes unsampled NORPAC hauls where Step 2 (B) in the CAS process to estimate the target catch species for the unsampled haul did yield a fishery target definition, including miscellaneous other finfish, but the final CAS (Blend) weekly production target code (Step 3, C) was the unknown target data code.

⁴ Also includes unsampled NORPAC hauls where Step 2 (B) in the CAS process to estimate the target catch species for the unsampled haul did yield a known fishery target definition which was not the same as the final CAS (Blend) weekly production target (Step 3, C).

Appendix 3.--List of marine mammals that were incidentally caught by fishing gear used by U.S. vessels of the groundfish fisheries in the U.S. EEZ of the Bering Sea, Aleutian Islands region, and Gulf of Alaska during 1998-2004.

Fishery Area	Date	Marine mammal species	Number	Status ^a	Haul/set monitored by observer	Marine mammal seen by observer	Location
Trawl gear fisheries							
BSAI Atka mackerel trawl fishery							
Non-pelagic trawl gear vessels							
	5 March 1998	<i>Eumetopias jubatus</i> ^b	1	Killed by gear	Yes	Yes	Area 542
	25 March 1998	<i>Eumetopias jubatus</i> ^b	2	Killed by gear	Yes	Yes	Area 542
	11 February 1999	<i>Eumetopias jubatus</i>	1	Killed by gear	Yes	Yes	Area 542
	7 October 1999	<i>Eumetopias jubatus</i> ^b	1	Killed by gear	Yes	Yes	Area 543
	8 October 1999	<i>Eumetopias jubatus</i>	1	Killed by gear	Yes	Yes	Area 543
	24 February 2000	<i>Eumetopias jubatus</i> ^b	1	Killed by gear	Yes	Yes	Area 542
	2 February 2001	<i>Eumetopias jubatus</i> ^b	1	Killed by gear	Yes	Yes	Area 542
	18 April 2003	<i>Eumetopias jubatus</i> ^b	1	Killed by gear	Yes	Yes	Area 542
^c	29 May 2001	Unidentified pinniped	1	Skull only	Yes	Yes	Area 542
	29 September 1999	Unidentified large whale	1	Skull only	No	Yes	Area 543
^c	4 September 2001	Unidentified marine mammal	1	Bones only	No	No	Area 542
BSAI flatfish trawl fishery							
Pelagic trawl gear vessels							
	2 November 2000	Unidentified marine mammal	1	Decomposed	No	Yes	Area 509
Non-pelagic trawl gear vessels							
	23 April 1998	<i>Eumetopias jubatus</i>	1	Decomposed	Yes	Yes	Area 514
	24 April 1998	<i>Eumetopias jubatus</i>	1	Decomposed	Yes	Yes	Area 513
	4 May 1998	<i>Eumetopias jubatus</i>	1	Killed by gear ^d	No	No	Area 513
	26 November 1998	<i>Eumetopias jubatus</i> ^b	1	Killed by gear	No	Yes	Area 513
	30 January 1999	<i>Eumetopias jubatus</i> ^b	1	Killed by gear	Yes	Yes	Area 509
	13 May 1999	<i>Eumetopias jubatus</i> ^b	1	Decomposed	Yes	Yes	Area 514
	24 April 2000	<i>Eumetopias jubatus</i> ^b	1	Killed by gear	Yes	Yes	Area 513
	29 April 2000	<i>Eumetopias jubatus</i> ^b	1	Killed by gear	Yes	Yes	Area 513
	19 May 2000	<i>Eumetopias jubatus</i> ^b	1	Killed by gear	Yes	Yes	Area 524
	4 June 2000	<i>Eumetopias jubatus</i>	1	Decomposed	Yes	Yes	Area 513
	10 June 2000	<i>Eumetopias jubatus</i>	1	Decomposed	Yes	Yes	Area 513
	18 June 2000	<i>Eumetopias jubatus</i> ^b	1	Killed by gear	No	Yes	Area 514
	8 June 2001	<i>Eumetopias jubatus</i> ^b	1	Killed by gear	Yes	Yes	Area 513
	30 July 2001	<i>Eumetopias jubatus</i> ^b	1	Killed by gear	Yes	Yes	Area 509
	2 October 2001	<i>Eumetopias jubatus</i> ^b	1	Killed by gear	Yes	Yes	Area 509
	3 October 2001	<i>Eumetopias jubatus</i> ^b	1	Killed by gear	Yes	Yes	Area 513
	7 May 2002	<i>Eumetopias jubatus</i>	1	Decomposed	Yes	No	Area 514
	25 May 2002	<i>Eumetopias jubatus</i> ^b	1	Killed by gear	Yes	Yes	Area 514
	30 March 2003	<i>Eumetopias jubatus</i> ^b	1	Killed by gear	Yes	Yes	Area 513
	29 May 2003	<i>Eumetopias jubatus</i> ^b	1	Killed by gear	Yes	Yes	Area 514
	2 June 2003	<i>Eumetopias jubatus</i> ^b	1	Carcass ^{d,e}	Yes	Yes	Area 514
	5 June 2003	<i>Eumetopias jubatus</i>	1	Decomposed ^f	Yes	Yes	Area 514
	6 May 2004	<i>Eumetopias jubatus</i>	1	Decomposed	Yes	Yes	Area 514
	18 May 2004	<i>Eumetopias jubatus</i> ^b	1	Killed by gear	Yes	Yes	Area 514
	23 May 2004	<i>Eumetopias jubatus</i> ^b	1	Killed by gear	Yes	Yes	Area 514
^c	24 July 1998	<i>Callorhinus ursinus</i>	1	Boarded ship	Yes	Yes	Area 521
	7 June 1999	<i>Callorhinus ursinus</i>	1	Decomposed	Yes	Yes	Area 514
	28 July 1999	<i>Callorhinus ursinus</i> ^b	1	Decomposed	Yes	Yes	Area 513
	20 September 1999	<i>Callorhinus ursinus</i> ^b	1	Aborted fetus	Yes	Yes	Area 517
	9 August 2000	<i>Callorhinus ursinus</i> ^b	1	Killed by gear	No	Yes	Area 513
	14 October 2000	<i>Callorhinus ursinus</i> ^b	1	Decomposed	Yes	Yes	Area 517

Appendix 3--Continued.

Fishery Area	Date	Marine mammal species	Number	Status ^a	Haul/set monitored by observer	Marine mammal seen by observer	Location
Trawl gear fisheries (continued)							
BSAI flatfish trawl fishery (continued)							
Non-pelagic trawl gear vessels (continued)							
	7 August 2001	<i>Callorhinus ursinus</i> ^b	1	Killed by gear ^g	Yes	Yes	Area 513
	29 August 2001	<i>Callorhinus ursinus</i> ^b	1	Decomposed	Yes	Yes	Area 509
	12 August 2004	<i>Callorhinus ursinus</i> ^b	1	Decomposed	Yes	Yes	Area 513
	30 October 2001	Unidentified otariid	1	Carcass ^d	No	Yes	Area 513
	1 May 2004	Unidentified otariid	1	Decomposed	Yes	Yes	Area 514
	2 May 2004	Unidentified otariid	1	Decomposed	No	No	Area 514
	29 May 1998	<i>Odobenus rosmarus</i>	1	Tusks only	Yes	Yes	Area 513
	13 June 1998	<i>Odobenus rosmarus</i>	1	Skull only	No	Yes	Area 513
	15 June 1998	<i>Odobenus rosmarus</i>	1	Killed by gear	No	Yes	Area 513
	18 June 1998	<i>Odobenus rosmarus</i>	1	Skull only	Yes	Yes	Area 513
	28 July 1998	<i>Odobenus rosmarus</i>	1	Decomposed	No	Yes	Area 513
	28 September 1998	<i>Odobenus rosmarus</i>	1	Skull only	Yes	Yes	Area 513
	29 October 1998	<i>Odobenus rosmarus</i>	1	Skull only	Yes	Yes	Area 509
	12 February 1999	<i>Odobenus rosmarus</i>	1	Decomposed	No	Yes	Area 516
	2 April 1999	<i>Odobenus rosmarus</i>	1	Skull only	Yes	Yes	Area 513
	3 May 1999	<i>Odobenus rosmarus</i>	1	Decomposed	No	Yes	Area 514
	19 June 1999	<i>Odobenus rosmarus</i>	1	Decomposed	Yes	Yes	Area 514
	19 August 1999	<i>Odobenus rosmarus</i>	1	Skull only	Yes	Yes	Area 509
	20 August 1999	<i>Odobenus rosmarus</i>	1	Decomposed	Yes	Yes	Area 509
	22 August 1999	<i>Odobenus rosmarus</i>	1	Decomposed	Yes	Yes	Area 513
	3 September 1999	<i>Odobenus rosmarus</i>	1	Decomposed	Yes	Yes	Area 513
	22 March 2000	<i>Odobenus rosmarus</i>	1	Killed by gear	No	Yes	Area 513
	4 April 2000	<i>Odobenus rosmarus</i>	1	Decomposed	Yes	Yes	Area 513
	17 April 2000	<i>Odobenus rosmarus</i>	1	Decomposed	Yes	Yes	Area 509
	22 April 2000	<i>Odobenus rosmarus</i> ^b	1	Decomposed	Yes	Yes	Area 509
	5 May 2000	<i>Odobenus rosmarus</i>	1	Decomposed	Yes	Yes	Area 513
	24 May 2000	<i>Odobenus rosmarus</i>	1	Decomposed	Yes	Yes	Area 524
	25 May 2000	<i>Odobenus rosmarus</i> ^b	1	Decomposed	Yes	Yes	Area 514
	27 May 2000	<i>Odobenus rosmarus</i>	1	Decomposed	Yes	Yes	Area 514
	31 May 2000	<i>Odobenus rosmarus</i> ^b	1	Decomposed	Yes	Yes	Area 514
	1 June 2000	<i>Odobenus rosmarus</i>	1	Decomposed	Yes	Yes	Area 514
	4 June 2000	<i>Odobenus rosmarus</i>	1	Killed by gear	No	Yes	Area 513
	4 June 2000	<i>Odobenus rosmarus</i>	1	Decomposed	Yes	Yes	Area 513
	13 July 2000	<i>Odobenus rosmarus</i>	1	Skull only	Yes	Yes	Area 513
^c	31 July 2000	<i>Odobenus rosmarus</i>	1	Decomposed	Yes	Yes	Area 513
	1 August 2000	<i>Odobenus rosmarus</i>	1	Decomposed	Yes	Yes	Area 513
	16 August 2000	<i>Odobenus rosmarus</i>	1	Tusks only	Yes	No	Area 513
	20 August 2000	<i>Odobenus rosmarus</i>	1	Decomposed	Yes	Yes	Area 509
	16 October 2000	<i>Odobenus rosmarus</i>	1	Decomposed	No	Yes	Area 513
	7 November 2000	<i>Odobenus rosmarus</i>	1	Skull only	No	Yes	Area 513
	30 November 2000	<i>Odobenus rosmarus</i>	1	Skull only	Yes	Yes	Area 509
	7 April 2001	<i>Odobenus rosmarus</i>	1	Decomposed	No	Yes	Area 513
	11 October 2001	<i>Odobenus rosmarus</i>	1	Carcass ^d	Yes	Yes	Area 513
	17 March 2002	<i>Odobenus rosmarus</i>	1	Decomposed	Yes	Yes	Area 513
	14 May 2002	<i>Odobenus rosmarus</i>	1	Decomposed	Yes	Yes	Area 514
	20 May 2002	<i>Odobenus rosmarus</i>	1	Killed by gear	Yes	Yes	Area 514
	26 May 2002	<i>Odobenus rosmarus</i>	1	Killed by gear	Yes	Yes	Area 514
	31 May 2002	<i>Odobenus rosmarus</i>	1	Decomposed	Yes	Yes	Area 514
	12 June 2002	<i>Odobenus rosmarus</i>	1	Skull/bones	Yes	Yes	Area 514
	1 August 2002	<i>Odobenus rosmarus</i> ^b	1	Decomposed	Yes	Yes	Area 514
	18 August 2002	<i>Odobenus rosmarus</i>	1	Skull only	Yes	Yes	Area 513
	27 August 2002	<i>Odobenus rosmarus</i>	1	Decomposed	Yes	Yes	Area 514

Appendix 3--Continued.

Fishery Area	Date	Marine mammal species	Number	Status ^a	Haul/set monitored by observer	Marine mammal seen by observer	Location
Trawl gear fisheries (continued)							
BSAI flatfish trawl fishery (continued)							
Non-pelagic trawl gear vessels (continued)							
	5 June 2003	<i>Odobenus rosmarus</i>	1	Decomposed	Yes	Yes	Area 514
	29 July 2003	<i>Odobenus rosmarus</i>	1	Decomposed	Yes	Yes	Area 514
	9 August 2003	<i>Odobenus rosmarus</i>	1	Decomposed	No	Yes	Area 513
	20 April 2004	<i>Odobenus rosmarus</i>	1	Decomposed	No	Yes	Area 514
	3 May 2004	<i>Odobenus rosmarus</i>	1	Killed by gear	Yes	Yes	Area 514
	6 May 2004	<i>Odobenus rosmarus</i>	1	Killed by gear	Yes	Yes	Area 514
	24 May 2004	<i>Odobenus rosmarus</i>	1	Decomposed	Yes	Yes	Area 514
	31 May 2004	<i>Odobenus rosmarus</i>	1	Decomposed	No	Yes	Area 514
	3 June 2004	<i>Odobenus rosmarus</i>	1	Decomposed	Yes	Yes	Area 514
	5 August 2004	<i>Odobenus rosmarus</i>	1	Decomposed	Yes	Yes	Area 514
	2 May 1998	<i>Erignathus barbatus</i> ^b	1	Killed by gear	Yes	Yes	Area 513
	31 August 1999	<i>Erignathus barbatus</i> ^b	1	Killed by gear	Yes	Yes	Area 513
	6 May 2000	<i>Erignathus barbatus</i>	1	Bones only	No	Yes	Area 514
	20 August 2000	<i>Erignathus barbatus</i>	1	Killed by gear	Yes	Yes	Area 513
	5 October 2001	<i>Erignathus barbatus</i> ^b	1	Killed by gear	Yes	Yes	Area 509
c	1 April 2002	<i>Erignathus barbatus</i> ^{b,h}	2	Decomposed	Yes	Yes	Area 513
	5 June 2003	<i>Erignathus barbatus</i> ^{b,h}	1	Decomposed	Yes	Yes	Area 514
	26 August 2003	<i>Erignathus barbatus</i>	1	Unharm ^{di}	Yes	Yes	Area 513
	10 May 2004	<i>Erignathus barbatus</i> ^{b,h}	1	Decomposed	No	Yes	Area 514
	25 May 2004	<i>Erignathus barbatus</i> ^{b,h}	1	Decomposed	Yes	Yes	Area 514
	31 May 1999	<i>Phoca vitulina</i>	1	Decomposed	Yes	Yes	Area 509
	19 May 2000	<i>Phoca vitulina</i> ^b	1	Decomposed	Yes	Yes	Area 524
	27 May 2000	<i>Phoca vitulina</i>	1	Killed by gear	Yes	Yes	Area 524
c	4 March 2002	<i>Phoca vitulina</i>	1	Decomposed	Yes	Yes	Area 513
	13 April 2004	<i>Phoca vitulina</i> ^{b,h}	1	Killed by gear	No	Yes	Area 509
	6 April 1999	<i>Phoca largha</i>	1	Decomposed	Yes	Yes	Area 513
	9 May 1999	<i>Phoca largha</i> ^{h,j}	1	Killed by gear	No	Yes	Area 514
	9 April 2004	<i>Phoca largha</i>	1	Killed by gear	Yes	Yes	Area 509
	7 May 2004	<i>Phoca largha</i> ^{b,h}	1	Killed by gear	Yes	Yes	Area 514
	17 May 2004	<i>Phoca largha</i> ^{b,h}	1	Decomposed	Yes	Yes	Area 514
	18 May 2004	<i>Phoca largha</i>	1	Decomposed	No	Yes	Area 524
	22 May 2004	<i>Phoca largha</i> ^{b,h}	1	Killed by gear	Yes	Yes	Area 524
	31 May 2004	<i>Phoca largha</i>	1	Decomposed	Yes	Yes	Area 514
	21 May 1999	Unidentified phocid	1	Decomposed	No	Yes	Area 514
	29 May 2000	Unidentified phocid	1	Decomposed	Yes	Yes	Area 514
	26 May 2001	Unidentified phocid	1	Killed by gear	Yes	Yes	Area 514
	27 May 2000	Unidentified pinniped	1	Decomposed	Yes	Yes	Area 514
	4 August 2001	Unidentified pinniped	1	Decomposed	Yes	Yes	Area 517
c	21 August 2001	Unidentified pinniped	1	Decomposed	Yes	Yes	Area 513
	23 April 2002	Unidentified pinniped	1	Killed by gear	No	Yes	Area 509
	15 August 2002	Unidentified pinniped	1	Decomposed	Yes	Yes	Area 514
	20 August 2002	Unidentified pinniped	1	Decomposed	Yes	Yes	Area 513
	28 August 2002	Unidentified pinniped	1	Decomposed	Yes	Yes	Area 513
	27 May 2003	Unidentified pinniped	1	Decomposed	Yes	No	Area 514
	9 June 2003	Unidentified pinniped	1	Decomposed	Yes	Yes	Area 514
	11 June 2003	Unidentified pinniped	1	Decomposed	Yes	Yes	Area 514
	1 August 2003	Unidentified pinniped	1	Decomposed	No	Yes	Area 514
	17 May 2004	Unidentified pinniped	1	Decomposed	Yes	Yes	Area 514
	24 May 2004	Unidentified pinniped	1	Decomposed	Yes	Yes	Area 514
	9 July 2002	<i>Balaenoptera acutorostrata</i>	1	Skull only	Yes	Yes	Area 521
	17 March 2000	<i>Eschrichtius robustus</i> ^h	1	Decomposed	Yes	Yes	Area 513

Appendix 3--Continued.

Fishery Area Date	Marine mammal species	Number	Status ^a	Haul/set monitored by observer	Marine mammal seen by observer	Location
Trawl gear fisheries (continued)						
BSAI flatfish trawl fishery (continued)						
Non-pelagic trawl gear vessels (continued)						
11 July 1998	Unidentified baleen whale	1	Decomposed	Yes	Yes	Area 517
^c 15 August 2001	Unidentified baleen whale	1	Baleen only	Yes	Yes	Area 524
25 August 2000	Unidentified beaked whale	1	Skull only	Yes	Yes	Area 517
1 August 1998	<i>Orcinus orca</i>	1	Hit propeller	Yes	Yes	Area 517
14 August 1998	<i>Orcinus orca</i>	1	Decomposed	Yes	Yes	Area 517
11 August 2001	<i>Orcinus orca</i> (resident) ^h	1	Hit propeller	Yes	Yes	Area 519
18 August 2001	<i>Orcinus orca</i>	1	Hit propeller ^{d,k}	Yes	No	Area 517
25 July 2002	<i>Orcinus orca</i>	1	Decomposed	Yes	Yes	Area 517
7 April 2004	<i>Orcinus orca</i> (resident) ^h	1	Decomposed	No	Yes	Area 519
^c 21 April 2004	<i>Orcinus orca</i> (resident) ^h	1	Hit propeller	Yes	Yes	Area 521
22 April 2004	<i>Orcinus orca</i> (resident) ^h	1	Hit propeller	No	Yes	Area 521
^c 29 July 2004	<i>Orcinus orca</i>	1	Unharm ^d	Yes	Yes	Area 517
^c 8 August 1998	<i>Phocoena phocoena</i>	1	Killed by gear	Yes	Yes	Area 513
17 August 1999	<i>Phocoena phocoena</i> ^h	1	Decomposed	Yes	Yes	Area 514
18 August 1999	<i>Phocoena phocoena</i> ^h	1	Decomposed	Yes	Yes	Area 514
30 April 2000	<i>Phocoena phocoena</i> ^h	1	Decomposed	Yes	Yes	Area 513
28 September 2000	<i>Phocoena phocoena</i> ^h	1	Decomposed	Yes	Yes	Area 513
16 August 2001	<i>Phocoena phocoena</i> ^h	1	Killed by gear	Yes	Yes	Area 513
25 April 2004	<i>Phocoena phocoena</i>	1	Decomposed	No	Yes	Area 513
26 April 2004	<i>Phocoena phocoena</i>	1	Decomposed	Yes	Yes	Area 513
30 April 2004	<i>Phocoena phocoena</i> ^h	1	Decomposed	Yes	Yes	Area 514
28 July 2004	<i>Phocoena phocoena</i> ^h	1	Decomposed	Yes	Yes	Area 513
2 September 1999	<i>Phocoenoides dalli</i> ^h	1	Decomposed	Yes	Yes	Area 513
19 February 2000	<i>Phocoenoides dalli</i>	1	Skull only	Yes	Yes	Area 509
20 July 2004	<i>Phocoenoides dalli</i>	1	Decomposed	Yes	Yes	Area 513
30 March 2001	Unidentified dolphin/porpoise	1	Skull/bones	Yes	Yes	Area 513
30 May 1998	Unidentified whale	1	Bones only	Yes	Yes	Area 513
17 July 1998	Unidentified whale	1	Skull only	Yes	Yes	Area 521
22 September 1998	Unidentified whale	1	Bones only	Yes	Yes	Area 513
8 November 1998	Unidentified whale	1	Bones only	Yes	Yes	Area 513
11 November 1998	Unidentified whale	1	Bones only	Yes	Yes	Area 517
17 May 1999	Unidentified whale	1	Bones only	Yes	Yes	Area 514
25 August 1999	Unidentified whale	1	Bones only	Yes	Yes	Area 513
27 August 2000	Unidentified whale	1	Skull only	Yes	Yes	Area 513
30 July 2001	Unidentified whale	1	Bones only	Yes	Yes	Area 513
^c 31 July 2001	Unidentified whale	1	Bones only	Yes	Yes	Area 521
9 August 2001	Unidentified whale	1	Bones only	Yes	Yes	Area 519
7 October 2001	Unidentified whale	1	Bones only	Yes	Yes	Area 513
18 October 2001	Unidentified whale	1	Skull only	Yes	Yes	Area 509
13 November 2001	Unidentified whale	1	Bones only	Yes	Yes	Area 513
28 September 2000	Unidentified small whale	1	Bones only	Yes	Yes	Area 513
17 April 1998	Unidentified large whale	1	Decomposed	Yes	Yes	Area 517
14 July 2001	Unidentified large whale	1	Bones only	Yes	Yes	Area 521
22 October 2001	Unidentified large whale	1	Bones only	Yes	No	Area 509
1 March 2003	Unidentified large whale	1	Bones only	Yes	Yes	Area 509
28 August 2003	Unidentified large whale	1	Bones only	Yes	Yes	Area 513
10 July 2004	Unidentified large whale	1	Skull only	Yes	Yes	Area 521
4 May 1998	Unidentified cetacean	1	Bones only	Yes	Yes	Area 509
9 November 1998	Unidentified cetacean	1	Skull only	Yes	Yes	Area 517
11 November 1998	Unidentified cetacean	1	Bones only	Yes	Yes	Area 519
14 March 1999	Unidentified cetacean	1	Bones only	Yes	Yes	Area 509

Appendix 3--Continued.

Fishery Area	Marine mammal species	Number	Status ^a	Haul/set monitored by observer	Marine mammal seen by observer	Location	
Trawl gear fisheries (continued)							
BSAI flatfish trawl fishery (continued)							
Non-pelagic trawl gear vessels (continued)							
	26 July 2000	Unidentified cetacean	1	Decomposed	Yes	Yes	Area 521
	9 August 2000	Unidentified cetacean	1	Decomposed	Yes	Yes	Area 521
	6 October 2000	Unidentified cetacean	1	Bones only	Yes	Yes	Area 513
c	23 August 2002	Unidentified cetacean	1	Bones only	No	Yes	Area 514
c	13 March 2004	Unidentified cetacean	1	Skull only	Yes	Yes	Area 513
c	17 April 2004	Unidentified cetacean	1	Bones only	Yes	Yes	Area 521
	19 April 2000	<i>Enhydra lutris</i>	1	Decomposed	Yes	Yes	Area 514
	27 May 2004	<i>Enhydra lutris</i>	1	Decomposed	Yes	Yes	Area 514
	27 April 1998	Unidentified marine mammal	1	Decomposed	Yes	Yes	Area 513
	8 September 1998	Unidentified marine mammal	1	Bones only	Yes	Yes	Area 513
	9 October 1998	Unidentified marine mammal	1	Bones only	Yes	Yes	Area 513
	30 October 1998	Unidentified marine mammal	1	Bones only	Yes	Yes	Area 513
	31 March 1999	Unidentified marine mammal	1	Bones only	Yes	Yes	Area 509
	8 May 1999	Unidentified marine mammal	1	Carcass ^d	Yes	No	Area 513
	19 May 1999	Unidentified marine mammal	1	Bones only	Yes	Yes	Area 514
	27 August 1999	Unidentified marine mammal	1	Decomposed	Yes	Yes	Area 517
	17 April 2000	Unidentified marine mammal	1	Bones only	Yes	No	Area 509
	9 May 2000	Unidentified marine mammal	1	Bones only	Yes	Yes	Area 514
	16 June 2000	Unidentified marine mammal	1	Bones only	No	Yes	Area 513
	17 June 2000	Unidentified marine mammal	1	Bones only	Yes	Yes	Area 513
	6 October 2000	Unidentified marine mammal	1	Decomposed	Yes	Yes	Area 513
	27 November 2000	Unidentified marine mammal	1	Decomposed	Yes	Yes	Area 509
	11 October 2001	Unidentified marine mammal	1	Decomposed	No	Yes	Area 509
	18 February 2004	Unidentified marine mammal	1	Bones only	Yes	Yes	Area 516
	4 May 2004	Unidentified marine mammal	1	Carcass ^d	Yes	No	Area 514
BSAI Pacific cod trawl fishery							
Non-pelagic trawl gear vessels							
	20 March 1999	<i>Eumetopias jubatus</i> ^b	1	Killed by gear	Yes	Yes	Area 541
	9 October 1999	<i>Eumetopias jubatus</i>	3	Boarded ship	Yes	Yes	Area 517
	21 February 2002	<i>Eumetopias jubatus</i>	4	Boarded ship	Yes	Yes	Area 517
	8 March 2003	<i>Eumetopias jubatus</i> ^b	2	Killed by gear	Yes	Yes	Area 541
	16 August 2003	<i>Callorhinus ursinus</i>	1	Carcass ^{d,e}	Yes	Yes	Area 513
c	16 May 2003	<i>Phoca vitulina</i> ^{b,h}	1	Killed by gear	Yes	Yes	Area 517
	21 March 2004	<i>Phoca vitulina</i> ^{b,h}	1	Killed by gear	Yes	Yes	Area 517
c	11 April 2004	<i>Phoca vitulina</i> ^h	1	Mandible	Yes	Yes	Area 521
	24 September 2003	Unidentified baleen whale	1	Decomposed	Yes	Yes	Area 517
	1 April 2004	Unidentified dolphin/porpoise	1	Decomposed	Yes	Yes	Area 509
	2 April 2004	Unidentified dolphin/porpoise	1	Decomposed	Yes	Yes	Area 509
	11 March 1998	<i>Orcinus orca</i>	1	Decomposed	Yes	Yes	Area 509
c	28 July 2004	<i>Orcinus orca</i>	1	Decomposed ^l	Yes	Yes	Area 519
	9 March 1999	<i>Phocoena phocoena</i> ^h	1	Decomposed	Yes	Yes	Area 509
	11 March 1999	<i>Phocoenoides dalli</i> ^h	1	Decomposed	Yes	Yes	Area 541
	14 March 1998	Unidentified whale	1	Decomposed	Yes	Yes	Area 517
c	2 March 2000	Unidentified whale	1	Bones only	Yes	No	Area 517
	13 April 2000	Unidentified whale	1	Bones only	Yes	Yes	Area 517
	27 February 2004	Unidentified whale	1	Bones only	Yes	Yes	Area 541
	18 February 2001	Unidentified small whale	1	Skull only	Yes	Yes	Area 517
	11 February 2002	Unidentified large whale	1	Bones only	Yes	Yes	Area 541
	15 August 2003	Unidentified large whale	1	Decomposed	No	Yes	Area 513
c	21 June 2004	Unidentified large whale	1	Decomposed	Yes	Yes	Area 517

Appendix 3.--Continued.

Fishery Area	Date	Marine mammal species	Number	Status ^a	Haul/set monitored by observer	Marine mammal seen by observer	Location
Trawl gear fisheries (continued)							
BSAI Pacific cod trawl fishery (continued)							
Non-pelagic trawl gear vessels (continued)							
	18 March 1999	Unidentified cetacean	1	Bones only	Yes	Yes	Area 541
	25 March 2000	Unidentified cetacean	1	Bones only	Yes	Yes	Area 521
	14 April 2000	Unidentified cetacean	1	Carcass ^d	Yes	No	Area 517
	22 April 1998	Unidentified marine mammal	1	Decomposed	Yes	Yes	Area 509
BSAI pollock trawl fishery							
Pelagic trawl gear vessels							
	25 September 1998	<i>Eumetopias jubatus</i>	1	Killed by gear	Yes	Yes	Area 509
	11 October 1998	<i>Eumetopias jubatus</i> ^b	1	Killed by gear	Yes	Yes	Area 517
	19 August 1999	<i>Eumetopias jubatus</i> ^b	1	Killed by gear	Yes	Yes	Area 521
	25 August 1999	<i>Eumetopias jubatus</i> ^b	1	Killed by gear	Yes	Yes	Area 521
	29 September 1999	<i>Eumetopias jubatus</i> ^b	1	Killed by gear	Yes	Yes	Area 517
	8 September 2000	<i>Eumetopias jubatus</i> ^b	1	Killed by gear	Yes	Yes	Area 509
	16 September 2000	<i>Eumetopias jubatus</i> ^b	1	Killed by gear	Plant	Yes	Area 509 ^m
	11 October 2000	<i>Eumetopias jubatus</i> ^b	1	Killed by gear	Yes	Yes	Area 517
	19 February 2001	<i>Eumetopias jubatus</i> ^b	1	Killed by gear	Yes	Yes	Area 513
	12 March 2001	<i>Eumetopias jubatus</i> ^b	1	Killed by gear	Yes	Yes	Area 509
	20 July 2001	<i>Eumetopias jubatus</i> ^b	1	Killed by gear	No	Yes	Area 521
	26 July 2001	<i>Eumetopias jubatus</i>	1	Boarded ship	Yes	Yes	Area 521
	26 July 2001	<i>Eumetopias jubatus</i>	1	Boarded ship	Yes	Yes	Area 521
	28 July 2001	<i>Eumetopias jubatus</i>	1	Boarded ship	Yes	Yes	Area 521
	5 February 2002	<i>Eumetopias jubatus</i>	1	Boarded ship	In port	Yes	Area 519
	24 February 2002	<i>Eumetopias jubatus</i>	1	Boarded ship	In port	Yes	Area 519
	29 August 2002	<i>Eumetopias jubatus</i> ^b	1	Killed by gear	Yes	Yes	Area 509
	2 September 2002	<i>Eumetopias jubatus</i> ^b	1	Killed by gear	Yes	Yes	Area 513
	5 October 2002	<i>Eumetopias jubatus</i> ^b	1	Killed by gear	Yes	Yes	Area 517
	30 June 2003	<i>Eumetopias jubatus</i>	1	Boarded ship	Yes	Yes	Area 521
	5 July 2003	<i>Eumetopias jubatus</i>	1	Boarded ship	No	Yes	Area 521
	5 July 2003	<i>Eumetopias jubatus</i>	1	Boarded ship	No	Yes	Area 521
	13 July 2003	<i>Eumetopias jubatus</i>	1	Boarded ship	Yes	Yes	Area 521
	17 July 2003	<i>Eumetopias jubatus</i>	1	Boarded ship	Yes	Yes	Area 521
	17 July 2003	<i>Eumetopias jubatus</i>	1	Boarded ship	Yes	No	Area 521
	17 July 2003	<i>Eumetopias jubatus</i>	1	Boarded ship	Yes	Yes	Area 521
	13 February 2004	<i>Eumetopias jubatus</i>	3	Boarded ship	Yes	Yes	Area 509
	15 July 2004	<i>Eumetopias jubatus</i> ^b	1	Killed by gear	Yes	Yes	Area 513
	9 September 1998	<i>Callorhinus ursinus</i> ^b	1	Killed by gear	Yes	Yes	Area 517
	1 August 2001	Unidentified otariid	1	Boarded ship	Yes	No	Area 521
	10 October 2001	<i>Odobenus rosmarus</i>	1	Skull only	Yes	Yes	Area 513
	14 July 2002	<i>Odobenus rosmarus</i>	1	Skull only	Yes	Yes	Area 521
	17 February 2004	<i>Odobenus rosmarus</i>	1	Skull only	Yes	Yes	Area 513
	4 September 1999	<i>Erignathus barbatus</i> ⁿ	1	Killed by gear	Yes	Yes	Area 521
	14 September 1999	<i>Erignathus barbatus</i> ^b	1	Killed by gear	No	Yes	Area 509
	12 October 2000	<i>Pusa hispida</i> ^b	1	Killed by gear	Yes	Yes	Area 517
	28 July 2001	<i>Pusa hispida</i> ^b	1	Killed by gear	Yes	Yes	Area 521
	5 September 2001	<i>Pusa hispida</i> ^b	1	Killed by gear	Yes	Yes	Area 521
	24 August 2001	<i>Histiophoca fasciata</i> ^{hh}	1	Killed by gear	No	Yes	Area 517
	22 July 2001	Unidentified pinniped	2	Boarded ship	Yes	No	Area 523
	27 August 2001	Unidentified pinniped	1	Misc. flesh ^o	Yes	No	Area 521
	8 July 2003	Unidentified pinniped	1	Misc. flesh	Yes	Yes	Area 521

Appendix 3.--Continued.

Fishery Area	Date	Marine mammal species	Number	Status ^a	Haul/set monitored by observer	Marine mammal seen by observer	Location
Trawl gear fisheries (continued)							
BSAI pollock trawl fishery (continued)							
Pelagic trawl gear vessels (continued)							
	25 October 1998	<i>Megaptera novaeangliae</i>	1	Killed by gear	Yes	Yes	Area 517
	2 February 1999	<i>Megaptera novaeangliae</i> ^h	1	Killed by gear	Yes	Yes	Area 509
	14 September 2000	<i>Balaenoptera acutorostrata</i> ^h	1	Killed by gear	Yes	Yes	Area 517
	5 September 2001	<i>Balaenoptera acutorostrata</i> ^h	1	Misc. flesh ^p	Yes	No	Area 521
	21 August 2002	<i>Balaenoptera acutorostrata</i> ^h	1	Decomposed	Yes	Yes	Area 521
	4 September 1999	<i>Eschrichtius robustus</i> ^h	1	Skull only	No	Yes	Area 521
	8 September 2000	Unidentified baleen whale	1	Decomposed	Yes	Yes	Area 521
	11 July 2001	Unidentified baleen whale	1	Decomposed ^q	Yes	Yes	Area 521
	26 July 2001	Unidentified baleen whale	1	Killed by gear	Yes	Yes	Area 521
	4 August 2001	Unidentified baleen whale	1	Decomposed	Yes	Yes	Area 517
	17 March 2003	Unidentified beaked whale	1	Decomposed	Yes	Yes	Area 521
	13 September 2003	Unidentified baleen whale	1	Decomposed	Yes	Yes	Area 521
	28 July 2000	Unidentified beaked whale	1	Skull only	Yes	Yes	Area 517
	20 August 1999	<i>Orcinus orca</i> (transient) ^h	1	Killed by gear	No	Yes	Area 521
	1 September 1999	<i>Orcinus orca</i>	1	Decomposed	No	Yes	Area 517
	12 March 2002	<i>Orcinus orca</i> (transient) ^h	1	Killed by gear	Yes	Yes	Area 521
	20 March 2003	<i>Orcinus orca</i> (transient) ^h	1	Killed by gear	No	Yes	Area 521
	22 July 2003	<i>Orcinus orca</i> (resident) ^h	1	Decomposed	Yes	Yes	Area 517
	19 February 1998	<i>Phocoenoides dalli</i>	1	Killed by gear	Yes	Yes	Area 517
	30 August 1998	<i>Phocoenoides dalli</i>	1	Killed by gear	Yes	Yes	Area 517
	5 October 1998	<i>Phocoenoides dalli</i>	1	Killed by gear	Yes	Yes	Area 519
	15 August 1999	<i>Phocoenoides dalli</i> ^h	1	Killed by gear	Yes	Yes	Area 509
	9 September 1999	<i>Phocoenoides dalli</i>	1	Killed by gear	Yes	Yes	Area 521
	20 July 2000	<i>Phocoenoides dalli</i> ^h	1	Killed by gear	Yes	Yes	Area 521
	15 August 2000	<i>Phocoenoides dalli</i> ^h	1	Killed by gear	No	Yes	Area 521
	8 September 2000	<i>Phocoenoides dalli</i> ^h	1	Killed by gear	Yes	Yes	Area 521
	10 September 2000	<i>Phocoenoides dalli</i> ^h	1	Killed by gear	Yes	Yes	Area 521
	18 August 2001	<i>Phocoenoides dalli</i> ^h	1	Killed by gear	Yes	Yes	Area 521
	22 September 2001	<i>Phocoenoides dalli</i> ^h	1	Killed by gear	Yes	Yes	Area 521
	24 September 2002	<i>Phocoenoides dalli</i> ^h	1	Killed by gear	Yes	Yes	Area 517
	20 July 2004	<i>Phocoenoides dalli</i>	1	Killed by gear	Yes	Yes	Area 521
	8 September 1998	Unidentified whale	1	Decomposed	Yes	Yes	Area 517
	26 September 1998	Unidentified whale	1	Bones only	Yes	Yes	Area 509
	6 October 1998	Unidentified whale	1	Bones only	Yes	Yes	Area 509
	15 October 1998	Unidentified whale	1	Bones only	No	Yes	Area 517
	5 September 2000	Unidentified whale	1	Decomposed	Yes	Yes	Area 513
	14 October 2000	Unidentified whale	1	Bones only	Yes	Yes	Area 521
	25 February 2002	Unidentified whale	1	Bones only	Yes	Yes	Area 509
	9 July 2004	Unidentified whale	1	Decomposed	Yes	Yes	Area 517
	19 August 2004	Unidentified whale	1	Decomposed	Yes	Yes	Area 521
	4 September 1998	Unidentified small whale	1	Decomposed	Yes	Yes	Area 521
	14 April 2001	Unidentified large whale	1	Bones only	Yes	Yes	Area 521
	16 September 2001	Unidentified large whale	1	Bones only	Yes	Yes	Area 521
	6 July 2004	Unidentified large whale	1	Bones only	Yes	Yes	Area 517
	23 August 2004	Unidentified large whale	1	Bones only	Yes	Yes	Area 517
	28 June 2001	Unidentified cetacean	1	Misc. flesh ^f	Yes	No	Area 509
	25 July 2001	Unidentified cetacean ^s	1	Trailing gear ^d	No	No	Area 521
	16 February 2002	Unidentified cetacean	1	Bones only	No	Yes	Area 517
	21 August 2002	Unidentified cetacean	1	Bones only	Yes	Yes	Area 521
	24 September 2002	Unidentified cetacean	1	Skull only	Yes	Yes	Area 513

Appendix 3.--Continued.

Fishery Area	Marine mammal species	Number	Status ^a	Haul/set monitored by observer	Marine mammal seen by observer	Location
Trawl gear fisheries (continued)						
BSAI pollock trawl fishery (continued)						
Pelagic trawl gear vessels (continued)						
28 June 2004	Unidentified cetacean	1	Skull/bones	Yes	Yes	Area 517
1 September 2004	Unidentified cetacean	1	Skull/bones	Yes	Yes	Area 521
16 September 2004	Unidentified cetacean	1	Bones only	Yes	Yes	Area 521
2 October 2004	Unidentified cetacean	1	Bones only	Yes	Yes	Area 521
20 October 1998	Unidentified marine mammal	1	Decomposed	Yes	Yes	Area 517
20 October 1998	Unidentified marine mammal	1	Bones only	No	No	Area 517
13 September 2000	Unidentified marine mammal	1	Bones only	Yes	Yes	Area 521
30 August 2001	Unidentified marine mammal	1	Bones only	Yes	Yes	Area 521
28 August 2002	Unidentified marine mammal	1	Decomposed	Yes	Yes	Area 517
25 January 2004	Unidentified marine mammal	1	Bones only	Yes	Yes	Area 509
23 February 2004	Unidentified marine mammal	1	Bones only	Yes	Yes	Area 513
17 August 2004	Unidentified marine mammal	1	Bones only	Yes	Yes	Area 521
Non-pelagic trawl gear vessels						
12 February 2001	Unidentified baleen whale	1	Decomposed	Yes	Yes	Area 509
19 September 1998	<i>Phocoenoides dalli</i>	1	Killed by gear	No	Yes	Area 509
19 September 1998	Unidentified large whale	1	Skull only	Yes	Yes	Area 521
GOA flatfish trawl fishery						
Non-pelagic trawl gear vessels						
6 April 2000	<i>Eschrichtius robustus</i> ^h	1	Decomposed	Yes	Yes	Area 630
23 July 2000	<i>Megaptera novaeangliae</i>	1	Decomposed	Plant	No	Area 630 ^m
13 July 2004	Unidentified dolphin/porpoise	1	Decomposed	Yes	Yes	Area 610
10 May 2000	Unidentified whale	1	Bones only	Yes	Yes	Area 610
^c 11 May 2000	Unidentified whale	1	Bones only	Yes	Yes	Area 610
11 August 2003	Unidentified whale	1	Bones only	Yes	Yes	Area 620
6 May 2000	Unidentified small whale	1	Skull only	No	Yes	Area 610
18 April 1998	Unidentified large whale	1	Skull only	Yes	Yes	Area 630
12 April 2002	Unidentified large whale	1	Skull/bones	Yes	Yes	Area 630
25 July 2001	Unidentified cetacean	1	Bones only	Yes	Yes	Area 630
GOA Pacific cod trawl fishery						
Non-pelagic trawl gear vessels						
18 October 2001	<i>Eumetopias jubatus</i>	1	Killed by gear	Yes	Yes	Area 610
4 September 2004	Unidentified large whale	1	Bones only	Yes	Yes	Area 630
GOA pollock trawl fishery						
Pelagic trawl gear vessels						
2 June 1998	<i>Eumetopias jubatus</i> ^b	1	Killed by gear	Yes	Yes	Area 610
25 January 2001	<i>Eumetopias jubatus</i>	1	Boarded ship	Yes	Yes	Area 630
11 March 2003	<i>Eumetopias jubatus</i> ^b	1	Killed by gear	Yes	Yes	Area 610
23 March 2003 ^t	<i>Mirounga angustirostris</i>	1	Killed by gear	Yes	Yes	Area 620
7 October 1999	<i>Balaenoptera physalus</i>	1	Killed by gear	Yes	Yes	Area 620
1 June 1998	<i>Phocoenoides dalli</i>	1	Killed by gear	Yes	Yes	Area 610

Appendix 3.--Continued.

Fishery Area Date	Marine mammal species	Number	Status ^a	Haul/set monitored by observer	Marine mammal seen by observer	Location
Trawl gear fisheries (continued)						
GOA rockfish trawl fishery						
Non-pelagic trawl gear vessels						
18 July 1999	<i>Phoca vitulina</i>	1	Decomposed	Yes	Yes	Area 630
7 July 2000	Unidentified whale	1	Skull only	Yes	Yes	Area 640
9 July 1999	Unidentified large whale	1	Bones only	Yes	Yes	Area 630
18 July 2004	Unidentified marine mammal	1	Decomposed	Yes	Yes	Area 610
AK miscellaneous other finfish trawl fishery						
Non-pelagic trawl gear vessels						
4 November 1998	<i>Phocoenoides dalli</i>	1	Decomposed	Yes	Yes	Area 509
Longline gear fisheries						
BSAI Greenland turbot longline fishery						
11 May 1999	<i>Orcinus orca</i>	1	Killed by gear	Yes	Yes	Area 521
BSAI Pacific cod longline fishery						
7 September 2002	<i>Eumetopias jubatus</i>	1	Killed by gear	Yes	Yes	Area 509
4 August 2004	<i>Eumetopias jubatus</i>	1	Unknown ^{d,u}	No	No	Area 513
28 February 2000	<i>Callorhinus ursinus</i>	1	Minor injury ^d	Yes	Yes	Area 541
14 October 1999	Unidentified otariid	1	Killed by gear	Yes	Yes	Area 516
27 May 2001	Unidentified otariid	1	Minor injury ^d	Yes	Yes	Area 524
6 November 1998	<i>Odobenus rosmarus</i>	1	Skull only	Yes	Yes	Area 521
30 September 1999	<i>Odobenus rosmarus</i>	1	Skull only	Yes	Yes	Area 521
19 July 2003	<i>Odobenus rosmarus</i>	1	Tusks only	Yes	No	Area 524
29 March 1999	<i>Phoca largha</i>	1	Carcass ^d	Yes	Yes	Area 517
11 March 1998	<i>Histriophoca fasciata</i>	1	Unknown ^{d,v}	Yes	No	Area 521
15 March 2001	<i>Histriophoca fasciata</i>	1	Killed by gear	Yes	Yes	Area 521
30 May 2001	Unidentified pinniped	1	Killed by gear	Yes	Yes	Area 524
11 February 2003	Unidentified pinniped	1	Decomposed	Yes	Yes	Area 521
27 October 2000	<i>Orcinus orca</i>	1	Bones only	Yes	Yes	Area 523
9 September 2003	<i>Orcinus orca</i> (resident) ^h	1	Killed by gear	Yes	Yes	Area 521
6 March 1999	<i>Phocoenoides dalli</i>	1	Killed by gear	No	Yes	Area 517
24 February 2000	Unidentified whale	1	Bones only	Yes	Yes	Area 521
23 August 2000	Unidentified whale	1	Bones only	Yes	Yes	Area 521
1 November 2000	Unidentified whale	1	Bones only	Yes	Yes	Area 521
4 October 2001	Unidentified whale	1	Bones only	Yes	Yes	Area 517
2 December 2001	Unidentified whale	1	Bones only	Yes	Yes	Area 517
4 March 2002	Unidentified whale	1	Bones only	Yes	Yes	Area 509
7 October 2003	Unidentified large whale	1	Bones only	Yes	Yes	Area 521
12 December 1998	Unidentified cetacean	1	Bones only	Yes	Yes	Area 517
27 January 2000	Unidentified cetacean	1	Bones only	Yes	Yes	Area 509
18 February 1998	Unidentified marine mammal	1	Bones only	Yes	Yes	Area 521
12 May 1998	Unidentified marine mammal	1	Bones only	Yes	Yes	Area 521
2 December 2000	Unidentified marine mammal	1	Bones only	No	No	Area 517
21 August 2001	Unidentified marine mammal	1	Bones only	Yes	No	Area 517
4 January 2002	Unidentified marine mammal	1	Bones only	Yes	Yes	Area 521
4 January 2003	Unidentified marine mammal	1	Bones only	Yes	Yes	Area 523

Appendix 3.--Continued.

Fishery Area Date	Marine mammal species	Number	Status ^a	Haul/set monitored by observer	Marine mammal seen by observer	Location
Longline gear fisheries (continued)						
BSAI sablefish longline fishery						
^c 16 August 1999	Unidentified marine mammal	1	Bones only	Yes	Yes	Area 541
GOA sablefish longline fishery						
12 April 2000	<i>Eumetopias jubatus</i>	1	Killed by gear	Yes	Yes	Area 650
25 April 2000	<i>Physeter macrocephalus</i>	1	Trailing gear	Yes	Yes	Area 640
26 May 2000	Unidentified marine mammal	1	Bones only	Yes	Yes	Area 610
Pot gear fisheries						
BSAI Pacific cod pot fishery						
21 September 1999	<i>Phoca vitulina</i> ^{bh}	1	Killed by gear	Yes	Yes	Area 542
14 July 1998	Unidentified baleen whale ^w	1	Trailing gear	No	Yes	Area 513
BS sablefish pot fishery						
30 July 2002	<i>Megaptera novaeangliae</i>	1	Unharmd ^{dx}	Yes	Yes	Area 519
3 November 2002	<i>Megaptera novaeangliae</i>	1	Trailing gear ^y	No	Yes	Area 519
15 May 2002	Unidentified marine mammal	1	Bones only ^z	Yes	Yes	Area 517
GOA Pacific cod pot fishery						
7 October 1998	<i>Phoca vitulina</i>	1	Killed by gear	Yes	Yes	Area 610

Appendix 3.--Continued.

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- ^a The following codes were used to indicate the various types of incidental take: 1) "Killed by gear" refers to a marine mammal which died as a direct result of being caught or entangled in the gear during fishing operations or retrieval; 2) "Hit propeller" indicates a marine mammal that was killed during fishing operations by collision with the ship's propeller and/or hull; 3) "Carcass" refers to a dead marine mammal caught or entangled in the gear, but the time or mode of death could not be determined; 4) "Decomposed" indicates a marine mammal which had died previously and was in the process of decomposition prior to being caught or entangled in the gear; 5) "Trailing gear" indicates that a marine mammal, which was caught or entangled in the gear, was subsequently returned to the sea with attached pieces of fishing gear (e.g., hook and line, net fragments, or buoy that will seriously restrict the animal's survivability) after the gear was broken either accidentally or intentionally by the crew; 6) "Minor injury" refers to a marine mammal that was wounded on the body or appendages by the gear, but will subsequently heal and survive at sea without serious impact from the incident; 7) "Unharmful" refers to a marine mammal which was caught or entangled in the gear and subsequently returned to the sea, without injury or trauma, either on its own volition or after being freed from the gear by the crew; 8) "Boarded ship" indicates a marine mammal that climbed onto the vessel (e.g., via the stern ramp or trawl alley) and subsequently returned to the sea, without injury or trauma, either on its own volition or after being deterred from the ship by the crew; 9) "Aborted fetus" indicates that only an isolated fetus (which was aborted at sea by its mother sometime prior to the interaction) was caught or entangled in the gear; 10) "Misc. flesh" indicates that miscellaneous mammalian remnants (e.g., isolated fragments of blubber, skin or tissue) were either found in the catch or caught/entangled in the gear; 11) "Baleen only" indicates that only an isolated piece of baleen was caught or entangled in the gear; 12) "Bones only" indicates a miscellaneous isolated bone specimen(s) (not from a skull, and usually vertebrae) without flesh from a marine mammal which had died and decomposed long before the part was caught or entangled in gear; 13) "Skull only" indicates a miscellaneous complete skull (which may have attached bones or tusks) without flesh from a marine mammal which had died and decomposed long before the part was caught or entangled in the gear; 14) "Skull/bones" indicates a combination of a miscellaneous skull without flesh and unattached skeletal bones from a marine mammal which had died and decomposed long before the part was caught or entangled in the gear; 15) "Mandible" indicates that only an isolated jaw bone was caught or entangled in the gear; 16) "Tusks only" indicates isolated walrus tusks were found caught or entangled in the gear; and 17) "Unknown" indicates that the status of the animal could not be determined as to whether it was dead or alive (or injured).
- ^b Species identification was confirmed by examination of teeth specimens collected by observers.
- ^c The estimated predominant catch target or fishery target groundfish species of the haul (set) in NORPAC was not the same as the assigned target species for the haul's trip level target date in the CAS for this marine mammal incidental take. In all cases the trip level target code for the NORPAC haul in the CAS was used to categorize marine mammal bycatch by target fishery in this report.
- ^d Data from this take was not used in analyses to estimate bycatch.
- ^e This animal may have been killed by the gear, but the observer recorded the interaction as decomposed.
- ^f Recaptured sea lion from 3 days earlier.
- ^g This female northern fur seal was pregnant.
- ^h Species and stock (killer whales) identification was verified by analysis of DNA from tissue specimens collected by observers.
- ⁱ There were no known injuries, but the observer couldn't verify this; however, the seal did appear to be in a weak state.
- ^j The species identification of this animal was changed from an unidentified phocid (Perez 2003) to a spotted seal in 2006 based on analysis of DNA from vibrissae; however, the observer originally thought the animal was a spotted seal, but the teeth were difficult to identify as to whether it was a spotted seal or harbor seal.
- ^k The observer felt and heard the collision of a killer whale with the propeller, but did not see any part of the animal.
- ^l A decaying head from a killer whale was caught in the trawl net.
- ^m This take occurred in the unmonitored portion of the fishery which has no observers at sea; the take was reported by an observer at the shoreside processing plant where the catcher vessel delivered its groundfish catch.

Appendix 3.--Continued.

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- ⁿ The species identification of this animal was changed from a harbor seal (Perez 2003) to a bearded seal in 2004 based on recently discovered teeth specimens misplaced by the NPGOP.
- ^o Many chunks of flesh were found in the catch along with many mud sharks; the observer assumed that these pinniped remnants were from the stomach contents of one or more of the mud sharks.
- ^p Only an intestine of a minke whale was found in the catch.
- ^q This same whale was caught again in the next haul on the same date by the same vessel.
- ^r Only a 3-inch round plug of mammalian skin and blubber was found in the catch.
- ^s This animal was presumably a baleen whale.
- ^t The fishing start date was used instead of the haul retrieval date to determine the 4-week period of this take by a catcher-only vessel.
- ^u The observer was informed by the crew several days later that a live sea lion dropped off the line, but the observer could not verify the status of this take.
- ^v The observer did not know if the ribbon seal was dead or alive before the interaction because only a piece of fur (with a 5 cm wide band) was found hooked on the line; this take could have been a serious injury or mortality since the piece of fur was apparently ripped off the animal.
- ^w This unidentified baleen whale was not a humpback whale, but it may have been a fin whale or minke whale.
- ^x This humpback whale was caught in the lines of the pot gear during a set, and the animal was freed from the gear by the crew with no known injuries or trailing gear.
- ^y The observer stated that the whale had apparently wrapped its tail in the line and could not get free. The crew attempted to bring the animal close to the boat in order to free the line, but it thrashed about violently. The line connecting the pots and the buoys (attached at the end of each set of gear) had become wrapped around the caudal peduncle area of the animal. The observer speculated that there was probably little that the crew could have done to free the line and buoys from the whale, but the whale eventually broke the line after quite a bit of thrashing and splashing about. Once the line was broken, the whale immediately swam off and at the last point the observer saw it, the gear was still attached. Approximately two or three buoy bags were still attached to the base of the whale's tail; the observer doubted that much line remained since it seemed to have broken very near to the end of the gear.
- ^z The marine mammal bone was entangled in the lines or webbing of the pot gear.

Appendix 4.--Statistical formulae used to calculate bycatch rates and estimates.

Estimates of catch rates of incidental mortality of marine mammals were obtained by ratio estimates of pooled data within each stratum. For each fishery (defined by groundfish catch target species), the data were stratified into subgroups (subgroup = stratum, indexed by the letter h) by gear type, year, statistical area, 4-week period, and processing sector (i.e., vessel class). Sampling units (indexed by the letter i) were defined as individual hauls (sets). Catch rates and variance were based only on bycatch data from observed marine mammals in monitored hauls. Since the catch rates (incidental take ratios) calculated with the equations below were all less than one, they were multiplied by 10,000 to facilitate readability. The phrase "marine mammals" below refers only to the marine mammal species for which catch rates were calculated in each analysis, unless specifically stated otherwise in the text or tables. Equations for ratio estimates were based on Cochran (1977) and Levy and Lemeshow (1999). The stratified random sampling ratio estimator for total incidental take was adjusted by the addition of the number of observed mortality takes (actually seen by observers) from strata which had zero or unknown bycatch rates (i.e., from strata where no marine mammals were observed in monitored hauls). Confidence intervals based on the natural log-transformation (Burnham et al. 1987) were calculated using only the non-adjusted ratio estimates and their corresponding coefficients of variation.

Given:

- J = number of strata analyzed (total for fishery by gear type, year, statistical area, 4-week period, or processing sector);
- n_h = number of **monitored** (randomly selected) sampling units in stratum h ;
- N_h = total number of sampling units in the fishery in stratum h (including those not monitored for marine mammal bycatch, but which may still be sampled for fish composition by observers);
- x_i = metric tons of groundfish monitored in sampling unit i ;
- \bar{x}_h = mean number of metric tons of groundfish monitored in stratum h ;
- X_h = total metric tons of groundfish caught in the fishery in stratum h ;
- y_i = number of marine mammals observed in sampling unit i ;
- \bar{y}_h = mean number of marine mammals observed in stratum h ;

Appendix 4 -- Continued.

- f_h = the sampling fraction (n_h / N_h) (since N_h is unknown, f was approximated by the proportion of total groundfish catch observed in stratum h);
- \hat{R} = observed incidental take ratio (catch rate) for stratum h ;
- $s(\hat{R})$ = standard error of observed incidental take ratio (catch rate) for stratum h ;
- \hat{Y}_R = ratio estimate of total incidental take for stratum h ;
- \hat{R}_s = total observed incidental take ratio (catch rate) for the sum of J strata;
- \hat{Y}_{R_s} = stratified random sampling ratio estimator for total incidental take obtained by summing the separate ratio estimates from J strata;
- $V(\hat{Y}_R)$ = variance of ratio estimate for stratum h ;
- $V(\hat{Y}_{R_s})$ = variance of stratified random sampling ratio estimator from J strata;
- A_s = number of marine mammals actually seen by observers which occurred in unmonitored hauls from J strata which had zero or unknown bycatch rates; and
- \hat{Y}_A = adjusted stratified random sampling ratio estimator for total incidental take.

Catch rates and ratio estimates were obtained from:

$$f_h = \frac{\sum_{i=1}^{n_h} x_i}{X_h} \quad (1)$$

$$\hat{R} = \hat{R}_h = \frac{\sum_{i=1}^{n_h} y_i}{\sum_{i=1}^{n_h} x_i} = \frac{\bar{y}_h}{\bar{x}_h} \quad (2)$$

Appendix 4 -- Continued.

$$s(\hat{R}) = s(\hat{R}_h) = \frac{\sqrt{1-f_h}}{\bar{x}_h \sqrt{n_h}} \bullet \sqrt{\frac{\sum y_i^2 - 2\hat{R}_h \sum y_i x_i + \hat{R}_h^2 \sum x_i^2}{n_h - 1}} \quad (3)$$

$$\hat{Y}_R = \hat{Y}_{R_h} = X_h \hat{R}_h \quad (4)$$

$$V(\hat{Y}_R) = V(\hat{Y}_{R_h}) = X_h^2 [s(\hat{R}_h)]^2 \quad (5)$$

$$\hat{Y}_{R_s} = \sum_I^J \hat{Y}_{R_h} \quad (6)$$

$$V(\hat{Y}_{R_s}) \approx \frac{I}{(\sum x_h)^2} \sum_I^J V(\hat{Y}_{R_h}) \quad (7)$$

$$\hat{Y}_A = \hat{Y}_{R_s} + A_s \quad (8)$$

Lower (L_1) and upper (L_2) 95% confidence interval (CI) limits were estimated with the lognormal approximation (Burnham et al. 1987) using the following formulas:

$$L_1(\hat{Y}_{R_s}) = \hat{Y}_{R_s} / C \quad (9)$$

$$L_2(\hat{Y}_{R_s}) = \hat{Y}_{R_s} C \quad (10)$$

where

$$C = \exp \left[z_{\alpha/2} \sqrt{\ln(1 + [\text{cv}(\hat{Y}_{R_s})]^2)} \right] \quad (11)$$

using the coefficient of variation, $\text{cv}(\hat{Y}_{R_s})$, and $\alpha = 0.05$. Both 95% confidence interval limits expressed as a range are indicated by $L_{95\%}$. The value of $z_{\alpha/2}$ was 1.959964.

Appendix 5.—Calendar dates during 1998-2004 assigned to each 4-week period used to stratify the bycatch data in analyses.^a

Yearly calendar date ranges within each 4-week period							
Period	1998	1999	2000	2001	2002	2003	2004
1	1 January to 31 January	1 January to 30 January	1 January to 29 January	1 January to 27 January	1 January to 26 January	1 January to 25 January	1 January to 31 January
2	1 February to 28 February	31 January to 27 February	30 January to 26 February	28 January to 24 February	27 January to 23 February	26 January to 22 February	1 February to 28 February
3	1 March to 28 March	28 February to 27 March	27 February to 25 March	25 February to 24 March	24 February to 23 March	23 February to 22 March	29 February to 27 March
4	29 March to 25 April	28 March to 24 April	26 March to 22 April	25 March to 21 April	24 March to 20 April	23 March to 19 April	28 March to 24 April
5	26 April to 23 May	25 April to 22 May	23 April to 20 May	22 April to 19 May	21 April to 18 May	20 April to 17 May	25 April to 22 May
6	24 May to 20 June	23 May to 19 June	21 May to 17 June	20 May to 16 June	19 May to 15 June	18 May to 14 June	23 May to 19 June
7	21 June to 18 July	20 June to 17 July	18 June to 15 July	17 June to 14 July	16 June to 13 July	15 June to 12 July	20 June to 17 July
8	19 July to 15 August	18 July to 14 August	16 July to 12 August	15 July to 11 August	14 July to 10 August	13 July to 9 August	18 July to 14 August
9	16 August to 12 September	15 August to 11 September	13 August to 9 September	12 August to 8 September	11 August to 7 September	10 August to 6 September	15 August to 11 September
10	13 September to 10 October	12 September to 9 October	10 September to 7 October	9 September to 6 October	8 September to 5 October	7 September to 4 October	12 September to 9 October
11	11 October to 7 November	10 October to 6 November	8 October to 4 November	7 October to 3 November	6 October to 2 November	5 October to 1 November	10 October to 6 November
12	8 November to 5 December	7 November to 4 December	5 November to 2 December	4 November to 1 December	3 November to 30 November	2 November to 29 November	7 November to 4 December
13	6 December to 31 December	5 December to 31 December	3 December to 31 December	2 December to 31 December	1 December to 31 December	30 November to 31 December	5 December to 31 December

^a Fishing weeks end on Saturdays in the CAS and Blend databases. The extra days from incomplete weeks at the start and end of each year were included in the first and thirteenth 4-week periods, respectively.

Appendix 6.--Percentage of the total groundfish catch in each of the three processing sectors, by fishery, and the percentage of each processing sector's groundfish catch monitored for marine mammals during 1998-2004.

Fishery	Fishery processing sector						
	Total fishery groundfish catch (t)	Catcher/Processors		Motherships		Catcher-only vessels	
		Percent of total fishery groundfish catch	Percent of processing sector groundfish catch monitored for marine mammals	Percent of total fishery groundfish catch	Percent of processing sector groundfish catch monitored for marine mammals	Percent of total fishery groundfish catch	Percent of processing sector groundfish catch monitored for marine mammals
Trawl fisheries							
BSAI Atka mackerel trawl	442,595.1	99.99	85.17	<0.01	3.38	0.01	100.00
BSAI flatfish trawl	1,356,911.3	99.64	62.05	0.07	37.70	0.29	67.66
BSAI Pacific cod trawl	611,201.3	45.44	48.70	7.06	59.52	47.50	52.94
BSAI pollock trawl	9,076,537.8	45.51	91.98	10.95	61.25	43.53	67.07
BSAI rockfish trawl	82,735.3	99.76	82.28	0	-	0.24	22.14
GOA flatfish trawl	211,390.9	59.71	44.51	<0.01	0	40.28	25.31
GOA Pacific cod trawl	193,404.9	11.29	33.62	0.38	49.09	88.33	18.26
GOA pollock trawl	542,319.4	0.09	75.39	0.05	34.86	99.86	29.33
GOA rockfish trawl	172,332.8	54.16	65.45	0	-	45.84	28.01
AK miscellaneous other finfish trawl	13,630.4	65.91	30.48	0.18	0	33.91	27.24
Longline fisheries							
BSAI Greenland turbot longline	46,325.1	95.73	38.39	0	-	4.27	14.90
BSAI Pacific cod longline	915,022.6	99.43	30.41	0.08	0	0.50	24.44
BSAI Pacific halibut longline	10,923.2	53.75	44.58	0	-	46.25	28.88
BSAI rockfish longline	718.5	86.08	39.94	0	-	13.92	36.50
BSAI sablefish longline	20,059.7	48.37	37.52	0.09	0	51.54	5.77
GOA Pacific cod longline	92,011.1	46.31	14.77	0.02	0	53.67	1.30
GOA Pacific halibut longline	18,395.1	37.74	32.31	0	-	62.26	21.10
GOA rockfish longline	6,679.6	2.38	14.46	0.06	0	97.55	0.52
GOA sablefish longline	141,475.6	23.61	28.54	<0.01	0	76.39	7.63
AK miscellaneous other finfish longline	7,353.1	50.22	37.25	0	-	49.78	9.00
Pot fisheries							
BSAI Pacific cod pot	126,719.1	16.20	21.96	6.27	0	77.53	11.69
BS sablefish pot	1,875.6	0.95	51.83	0	-	99.05	38.08
AI sablefish pot	1,409.3	1.83	85.58	0	-	98.17	45.01
GOA Pacific cod pot	110,264.7	7.52	14.58	0.84	0	91.64	4.49
AK miscellaneous other finfish pot	2,469.9	3.64	10.29	59.98	0	37.39	6.87
Jig fisheries							
AK miscellaneous finfish jig	9,500.4	<0.01	6.33	0.29	0	99.70	0

Appendix 7.--Results from the primary analytical strata with observed mortalities or serious injuries of marine mammals during 1998-2004 in the analyses for the data in Tables 5-8. The extrapolated mortality (\hat{Y}_R), variance ($V(\hat{Y}_R)$), and 95% confidence interval^a ($L_{95\%}$) of marine mammals as bycatch are listed. The coefficient of variation (CV) of the bycatch rate is also listed. The number of marine mammals (A_s) actually seen by observers in unmonitored sets is stated in the table, and these takes (with zero variance) were assigned as the estimated bycatch for strata without observed takes (strata with zero bycatch rates and variance).

Species (stock) ^b	Fishery Area	4-week period of year ^c	Fishery processing sector ^d	Percent of catch monitored for marine mammals	Number of marine mammals seen by observers in monitored catch	Extrapolated bycatch				Number of marine mammals seen by observers in unmonitored catch (A_s) ^e	Estimated bycatch ^f \hat{Y}_A	
						\hat{Y}_R	$V(\hat{Y}_R)$	CV	$L_{95\%}$			
Steller sea lion (<i>Eumetopias jubatus</i>): western U.S. stock												
BSAI Atka mackerel trawl fishery (non-pelagic trawl gear)												
Area 542												
	1998	3	P	66.5	3	4.5	3.707	0.43	2.0 to 10.1	0	4.5	g
	1999	2	P	69.4	1	1.4	0.649	0.56	0.5 to 4.0	0	1.4	
	2000	2	P	91.4	1	1.1	0.104	0.29	0.6 to 1.9	0	1.1	
	2001	2	P	81.3	1	1.2	0.285	0.43	0.5 to 2.8	0	1.2	
	2003	4	P	81.6	1	1.2	0.285	0.44	0.5 to 2.8	0	1.2	
Area 543												
	1999	10	P	78.7	2	2.5	0.697	0.33	1.4 to 4.8	0	2.5	g
BSAI flatfish trawl fishery (non-pelagic trawl gear)												
Area 509												
	1999	1	P	69.2	1	1.4	0.662	0.56	0.5 to 4.0	0	1.4	
	2001	8	P	68.0	1	1.5	0.693	0.57	0.5 to 4.1	0	1.5	
	2001	10	P	55.5	1	1.8	1.454	0.67	0.5 to 5.9	0	1.8	
Area 513												
	1998	12	P	52.1	0	0	0	-	-	1	1.0	h
	2000	5	P	89.9	2	2.2	0.249	0.22	1.4 to 3.4	0	2.2	g
	2001	6	P	63.6	1	1.6	0.907	0.61	0.5 to 4.7	0	1.6	
	2001	10	P	62.4	1	1.6	0.960	0.61	0.5 to 4.8	0	1.6	
	2003	4	P	71.4	1	1.4	0.561	0.53	0.5 to 3.7	0	1.4	
Area 514												
	2000	7	P	76.6	0	0	0	-	-	1	1.0	h
	2002	6	P	60.8	1	1.6	1.054	0.62	0.5 to 5.1	0	1.6	
	2003	6	P	74.6	1	1.3	0.458	0.50	0.5 to 3.4	0	1.3	
	2004	5	P	64.7	1	1.5	0.841	0.59	0.5 to 4.5	0	1.5	
	2004	6	P	65.6	1	1.5	0.784	0.58	0.5 to 4.4	0	1.5	
Area 524												
	2000	5	P	80.6	1	1.2	0.293	0.44	0.5 to 2.8	0	1.2	
BSAI Pacific cod trawl fishery (non-pelagic trawl gear)												
Area 541												
	1999	3	P	84.0	1	1.2	0.226	0.40	0.6 to 2.5	0	1.2	g
	2003	3	C	47.0	2	4.3	9.683	0.73	1.2 to 15.3	0	4.3	g
BSAI pollock trawl fishery (pelagic trawl gear)												
Area 509												
	1998	10	P	74.5	1	1.3	0.460	0.51	0.5 to 3.4	0	1.3	
	2000	9	P	86.8	1	1.2	0.175	0.36	0.6 to 2.3	0	1.2	
	2000	10	C	57.6	0	0	0	-	-	1	1.0	h
	2001	3	P	93.0	1	1.1	0.081	0.26	0.6 to 1.8	0	1.1	
	2002	9	P	100.0	1	1.0	0	0	-	0	1.0	

Appendix 7.--Continued.

Species (stock) ^b	Fishery Area	4-week period of year ^c	Fishery processing sector ^d	Percent of catch monitored for marine mammals	Number of marine mammals seen by observers in monitored catch	Extrapolated bycatch				Number of marine mammals seen by observers in unmonitored catch (A _i) ^e	Estimated bycatch ^f \hat{Y}_A
						\hat{Y}_R	$V(\hat{Y}_R)$	CV	$L_{95\%}$		
Steller sea lion (<i>Eumetopias jubatus</i>): western U.S. stock (continued)											
BSAI pollock trawl fishery (pelagic trawl gear) (continued)											
Area 513											
	2001	2	C	85.1	1	1.2	0.206	0.39	0.6 to 2.4	0	1.2
	2002	9	P	100.0	1	1.0	0	0	-	0	1.0
	2004	7	P	98.8	1	1.0	0.012	0.11	0.8 to 1.2	0	1.0
Area 517											
	1998	11	P	81.5	1	1.2	0.279	0.43	0.5 to 2.8	0	1.2
	1999	10	C	84.6	1	1.2	0.216	0.39	0.6 to 2.5	0	1.2
	2000	11	C	69.1	1	1.4	0.645	0.55	0.5 to 4.0	0	1.4
	2002	10	M	69.8	1	1.4	0.620	0.55	0.5 to 3.9	0	1.4
Area 521											
	1999	9	P	93.6	2	2.1	0.147	0.18	1.5 to 3.0	0	2.1
	2001	8	P	94.5	0	0	0	-	-	1	1.0 ^h
GOA Pacific cod trawl fishery (non-pelagic trawl gear)											
Area 610											
	2001	11	P	21.4	1	4.7	14.923	0.83	1.1 to 19.2	0	4.7
GOA pollock trawl fishery (pelagic trawl gear)											
Area 610											
	1998	6	C	63.1	1	1.6	0.940	0.61	0.5 to 4.8	0	1.6
	2003	3	C	41.5	1	2.4	5.389	0.96	0.5 to 11.8	0	2.4 ^g
BSAI Pacific cod longline fishery											
Area 509											
	2002	9	P	26.9	1	3.7	10.153	0.86	0.9 to 15.9	0	3.7
Steller sea lion (<i>Eumetopias jubatus</i>): eastern U.S. stock											
GOA sablefish longline fishery											
Area 650											
	2000	4	C	14.6	1	6.9	39.805	0.92	1.5 to 31.8	0	6.9
Northern fur seal (<i>Callorhinus ursinus</i>): Eastern Pacific stock											
BSAI flatfish trawl fishery (non-pelagic trawl gear)											
Area 513											
	2000	8	P	67.7	0	0	0	-	-	1	1.0 ^h
	2001	8	P	72.1	1	1.4	0.537	0.53	0.5 to 3.7	0	1.4
BSAI pollock trawl fishery (pelagic trawl gear)											
Area 517											
	1998	9	M	28.6	1	3.5	8.965	0.86	0.8 to 15.0	0	3.5

Appendix 7.--Continued.

Species (stock) ^b	Fishery Area	4-week period of year ^c	Fishery processing sector ^d	Percent of catch monitored for marine mammals	Number of marine mammals seen by observers in monitored catch	Extrapolated bycatch				Number of marine mammals seen by observers in unmonitored catch (A _i) ^e	Estimated bycatch ^f \hat{Y}_A
						\hat{Y}_R	$V(\hat{Y}_R)$	CV	$L_{95\%}$		
Unidentified otariidsⁱ											
BSAI Pacific cod longline fishery											
Area 516											
	1999	11	P	65.2	1	1.5	0.799	0.58	0.5 to 4.4	0	1.5
Walrus (<i>Odobenus rosmarus</i>): Alaska stock											
BSAI flatfish trawl fishery (non-pelagic trawl gear)											
Area 513											
	1998	6	P	62.7	0	0	0	-	-	1	1.0 ^h
	2000	3	P	58.5	0	0	0	-	-	1	1.0 ^h
	2000	6	P	85.7	0	0	0	-	-	1	1.0 ^h
Area 514											
	2002	6	P	60.8	2	3.3	2.089	0.44	1.4 to 7.5	0	3.3 ^g
	2004	5	P	64.7	2	3.1	1.686	0.42	1.4 to 6.8	0	3.1 ^g
Bearded seal (<i>Erignathus barbatus</i>): Alaska stock											
BSAI flatfish trawl fishery (non-pelagic trawl gear)											
Area 509											
	2001	10	P	55.5	1	1.8	1.445	0.67	0.5 to 5.9	0	1.8
Area 513											
	1998	5	P	67.2	1	1.5	0.721	0.57	0.5 to 4.2	0	1.5
	1999	9	P	60.4	1	1.7	1.093	0.63	0.5 to 5.2	0	1.7
	2000	9	P	62.3	1	1.6	0.969	0.61	0.5 to 4.9	0	1.6
BSAI pollock trawl fishery (pelagic trawl gear)											
Area 509											
	1999	10	P	78.6	0	0	0	-	-	1	1.0 ^h
Area 521											
	1999	9	M	54.5	1	1.8	1.531	0.67	0.6 to 6.1	0	1.8
Harbor seal (<i>Phoca vitulina</i>): Bering Sea stock											
BSAI flatfish trawl fishery (non-pelagic trawl gear)											
Area 509											
	2004	4	P	71.0	0	0	0	-	-	1	1.0 ^h
Area 524											
	2000	6	P	76.7	1	1.3	0.402	0.49	0.5 to 3.2	0	1.3
BSAI Pacific cod trawl fishery (non-pelagic trawl gear)											
Area 517											
	2003	5	P	50.1	1	2.0	1.974	0.70	0.6 to 6.9	0	2.0
	2004	3	C	51.1	1	2.0	1.859	0.70	0.6 to 6.7	0	2.0

Appendix 7.--Continued.

Species (stock) ^b	Fishery Area	4-week period of year ^c	Fishery processing sector ^d	Percent of catch monitored for marine mammals	Number of marine mammals seen by observers in monitored catch	Extrapolated bycatch				Number of marine mammals seen by observers in unmonitored catch (A_s) ^e	Estimated bycatch ^f \hat{Y}_A
						\hat{Y}_R	$V(\hat{Y}_R)$	CV	$L_{95\%}$		
Harbor seal (<i>Phoca vitulina</i>): Gulf of Alaska stock											
BSAI Pacific cod pot fishery											
Area 542											
	1999	10	C	75.9	1	1.3	0.385	0.47	0.5 to 3.2	0	1.3
GOA Pacific cod pot fishery											
Area 610											
	1998	10	C	64.2	1	1.6	1.015	0.65	0.5 to 5.0	0	1.6 ^g
Spotted seal (<i>Phoca largha</i>): Alaska stock											
BSAI flatfish trawl fishery (non-pelagic trawl gear)											
Area 509											
	2004	4	P	71.0	1	1.4	0.578	0.54	0.5 to 3.8	0	1.4
Area 514											
	1999	5	P	73.8	0	0	0	-	-	1	1.0 ^h
	2004	5	P	64.7	1	1.5	0.840	0.59	0.5 to 4.5	0	1.5
Area 524											
	2004	5	P	68.7	1	1.5	0.656	0.56	0.5 to 4.0	0	1.5
Ringed seal (<i>Pusa hispida</i>): Alaska stock											
BSAI pollock trawl fishery (pelagic trawl gear)											
Area 517											
	2000	11	C	69.1	1	1.4	0.645	0.55	0.5 to 4.0	0	1.4
Area 521											
	2001	8	P	94.5	1	1.1	0.062	0.24	0.7 to 1.7	0	1.1
	2001	9	P	95.9	1	1.0	0.044	0.20	0.7 to 1.5	0	1.0
Ribbon seal (<i>Histiophoca fasciata</i>): Alaska stock											
BSAI pollock trawl fishery (pelagic trawl gear)											
Area 517											
	2001	9	P	82.3	0	0	0	-	-	1	1.0 ^h
BSAI Pacific cod longline fishery											
Area 521											
	2001	3	P	33.2	1	3.0	6.061	0.82	0.7 to 12.2	0	3.0
Northern elephant seal (<i>Mirounga angustirostris</i>): California breeding stock											
GOA pollock trawl fishery (pelagic trawl gear)											
Area 620											
	2003	3 ^f	C	28.2	1	3.5	9.226	0.86	0.8 to 15.2	0	3.5

Appendix 7.--Continued.

Species (stock) ^b	Fishery Area	4-week period of year ^c	Fishery processing sector ^d	Percent of catch monitored for marine mammals	Number of marine mammals seen by observers in monitored catch	Extrapolated bycatch				Number of marine mammals seen by observers in unmonitored catch (A _i) ^e	Estimated bycatch ^f \hat{Y}_A
						\hat{Y}_R	$V(\hat{Y}_R)$	CV	$L_{95\%}$		
Unidentified phocidsⁱ											
BSAI flatfish trawl fishery (non-pelagic trawl gear)											
Area 514											
	2001	6	P	54.9	1	1.8	1.489	0.67	0.6 to 6.0	0	1.8
Unidentified pinnipedsⁱ											
BSAI flatfish trawl fishery (non-pelagic trawl gear)											
Area 509											
	2002	5	P	67.2	0	0	0	-	-	1	1.0 ^h
BSAI Pacific cod longline fishery											
Area 524											
	2001	6	P	33.5	1	3.0	5.848	0.81	0.7 to 12.0	0	3.0
Humpback whale (<i>Megaptera novaeangliae</i>): Central or Western North Pacific stocks^j											
BSAI pollock trawl fishery (pelagic trawl gear)											
Area 509											
	1999	2	C	70.0	1	1.4	0.610	0.55	0.5 to 3.9	0	1.4
Area 517											
	1998	11	C	56.7	1	1.8	1.347	0.66	0.5 to 5.7	0	1.8
BS sablefish pot fishery											
Area 519											
	2002	12	C	16.9	0	0	0	-	-	1	1.0 ^h
Minke whale (<i>Balaenoptera acutorostrata</i>): Alaska stock											
BSAI pollock trawl fishery (pelagic trawl gear)											
Area 517											
	2000	10	C	63.4	1	1.6	0.915	0.61	0.5 to 4.7	0	1.6
Fin whale (<i>Balaenoptera physalus</i>): Northeast Pacific stock											
GOA pollock trawl fishery (pelagic trawl gear)											
Area 620											
	1999	10	C	33.6	1	3.0	5.887	0.82	0.7 to 12.1	0	3.0
Unidentified baleen whalesⁱ											
BSAI pollock trawl fishery (pelagic trawl gear)											
Area 521											
	2001	8	P	94.5	1	1.1	0.062	0.24	0.7 to 1.7	0	1.1

Appendix 7.--Continued.

Species (stock) ^b	Fishery Area	4-week period of year ^c	Fishery processing sector ^d	Percent of catch monitored for marine mammals	Number of marine mammals seen by observers in monitored catch	Extrapolated bycatch				Number of marine mammals seen by observers in unmonitored catch (A_i) ^e	Estimated bycatch ^f \hat{Y}_A
						\hat{Y}_R	$V(\hat{Y}_R)$	CV	$L_{95\%}$		
Unidentified baleen whalesⁱ (continued)											
BSAI Pacific cod pot fishery											
Area 513											
	1998	7	P	21.2	0	0	0	-	-	1	1.0 ^h
Sperm whale (<i>Physeter macrocephalus</i>)^k											
GOA sablefish longline fishery											
Area 640											
	2000	5	C	44.9	1	2.2	2.786	0.75	0.6 to 8.2	0	2.2
Killer whale (<i>Orcinus orca</i>): Eastern North Pacific Alaska resident stock^{l,m}											
BSAI flatfish trawl fishery (non-pelagic trawl gear)											
Area 517											
	1998	8	P	49.6	1	2.0	2.051	0.71	0.6 to 7.1	0	2.0
Area 519											
	2001	8	P	68.7	1	1.5	0.651	0.55	0.5 to 4.0	0	1.5
Area 521											
	2004	4	P	57.1	1	1.8	1.321	0.66	0.5 to 5.7	1	1.8 ⁿ
BSAI Greenland turbot longline fishery											
Area 521											
	1999	5	P	33.4	1	3.0	5.918	0.81	0.7 to 12.1	0	3.0
BSAI Pacific cod longline fishery											
Area 521											
	2003	10	P	23.9	1	4.2	13.382	0.87	1.0 to 18.3	0	4.2
Killer whale (<i>Orcinus orca</i>): Eastern North Pacific Gulf of Alaska, Aleutian Islands, and Bering Sea transient stock¹											
BSAI pollock trawl fishery (pelagic trawl gear)											
Area 521											
	1999	9	P	93.6	0	0	0	-	-	1	1.0 ^h
	2002	3	P	95.3	1	1.0	0.052	0.22	0.7 to 1.6	0	1.0
	2003	3	M	67.1	0	0	0	-	-	1	1.0 ^h
Harbor porpoise (<i>Phocoena phocoena</i>): Bering Sea stock											
BSAI flatfish trawl fishery (non-pelagic trawl gear)											
Area 513											
	1998	8	P	53.6	1	1.9	1.606	0.68	0.6 to 6.2	0	1.9
	2001	9	P	57.5	1	1.7	1.286	0.65	0.5 to 5.6	0	1.7

Appendix 7.--Continued.

Species (stock) ^b	Fishery Area	4-week period of year ^c	Fishery processing sector ^d	Percent of catch monitored for marine mammals	Number of marine mammals seen by observers in monitored catch	Extrapolated bycatch				Number of marine mammals seen by observers in unmonitored catch (A_s) ^e	Estimated bycatch ^f \hat{Y}_A
						\hat{Y}_R	$V(\hat{Y}_R)$	CV	$L_{95\%}$		
Dall's porpoise (<i>Phocoenoides dalli</i>): Alaska stock											
BSAI pollock trawl fishery (pelagic trawl gear)											
Area 509											
	1999	9	C	33.5	1	3.0	5.369	0.78	0.8 to 11.5	0	3.0
Area 517											
	1998	2	M	38.9	1	2.6	4.040	0.78	0.7 to 10.0	0	2.6
	1998	9	P	72.9	1	1.4	0.513	0.52	0.5 to 3.6	0	1.4
	2002	10	M	69.8	1	1.4	0.620	0.55	0.5 to 3.9	0	1.4
Area 519											
	1998	10	C	35.0	1	2.9	5.261	0.80	0.7 to 11.4	0	2.9
Area 521											
	1999	9	M	54.5	1	1.8	1.532	0.67	0.6 to 6.1	0	1.8
	2000	8	P	93.9	1	1.1	0.069	0.25	0.7 to 1.7	0	1.1
	2000	9	P	95.9	1	1.0	0.044	0.20	0.7 to 1.5	0	1.0
	2000	9	M	59.2	0	0	0	-	-	1	1.0 ^h
	2000	10	P	97.5	1	1.0	0.026	0.16	0.8 to 1.4	0	1.0
	2001	9	M	71.9	1	1.4	0.542	0.53	0.5 to 3.7	0	1.4
	2001	10	M	66.6	1	1.5	0.748	0.58	0.5 to 4.3	0	1.5
	2004	8	P	99.7	1	1.0	0.003	0.06	0.9 to 1.1	0	1.0
BSAI pollock trawl fishery (non-pelagic trawl gear)											
Area 509											
	1998	10	P	81.7	0	0	0	-	-	1	1.0 ^h
GOA pollock trawl fishery (pelagic trawl gear)											
Area 610											
	1998	6	C	63.1	1	1.6	0.942	0.61	0.5 to 4.8	0	1.6
BSAI Pacific cod longline fishery											
Area 517											
	1999	3	P	24.9	0	0	0	-	-	1	1.0 ^h

^a The 95% confidence interval ($L_{95\%}$) is an approximation based on the natural log-transformation (Burnham et al. 1987) using the CV of the nonadjusted ratio estimate (\hat{Y}_R).

^b The stock definitions were taken from Angliss and Outlaw (2005).

^c The calendar date ranges of the 4-week periods during 1998-2004 are listed in Appendix 5. The fishing start date and not the haul retrieval date was used to determine the 4-week period for takes by catcher-only vessels.

^d P = catcher/processor vessels; M = mothership vessels, C = catcher-only vessels.

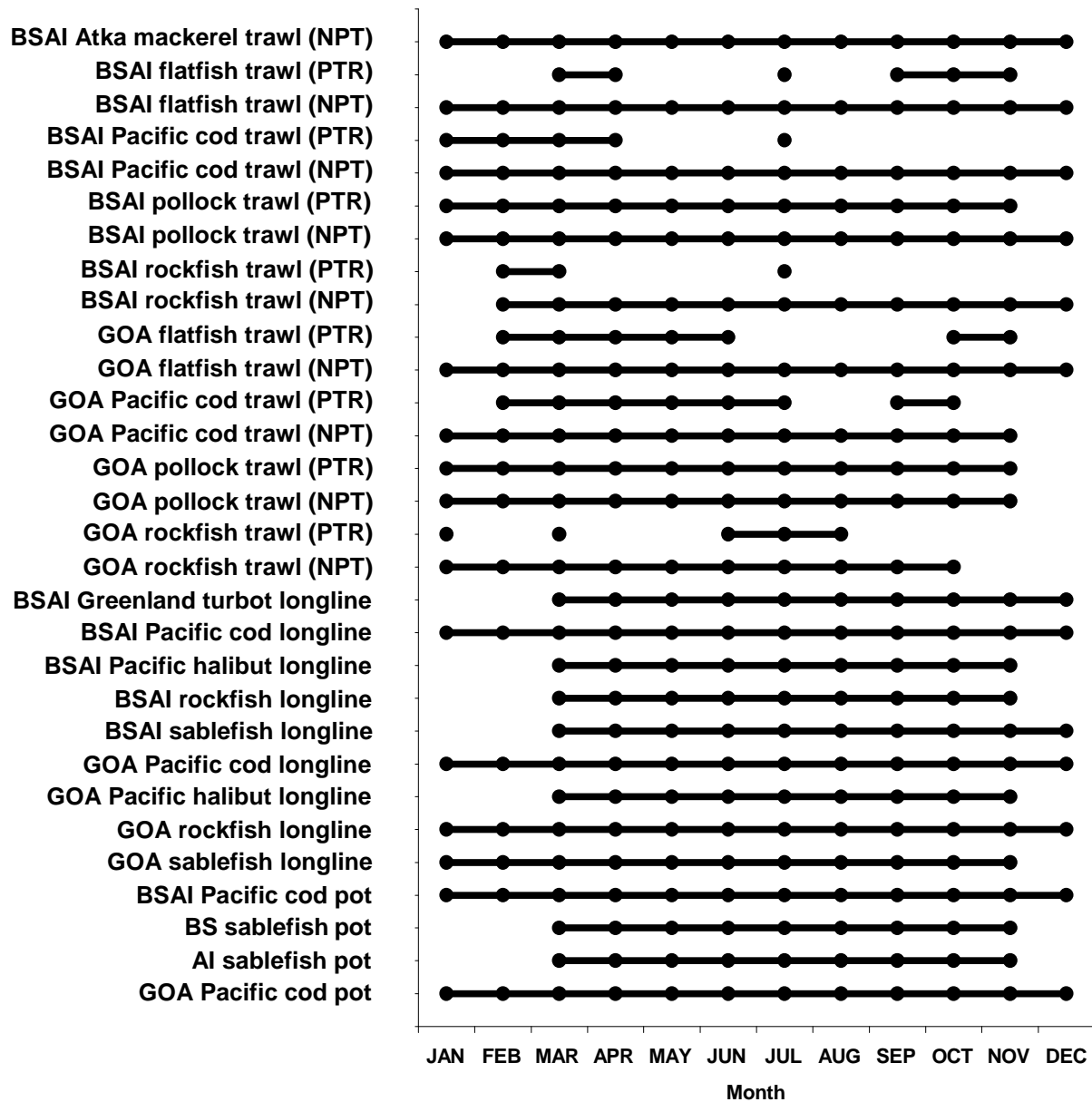
^e The unmonitored catch referred to in this table was the catch in monitored sets during the same cruises with observers aboard as the monitored sets. However, the animals taken in these unmonitored sets were actually seen by observers when alerted by the crew.

^f Unlike the approach used by Perez (2003), the number of animals (A_s) in the unmonitored catch analyzed in the present report includes only animals actually seen by observers (no animals seen only by the crew were used in bycatch analyses). These observed, but unmonitored, marine mammals were included in the estimated bycatch (\hat{Y}_A) when they were the only animals observed taken in a stratum.

Appendix 7.--Continued.

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- ^g The lower 95% confidence level (rounded to an integer) was less than the number of animals seen by observers in monitored hauls.
- ^h Bycatch seen by observers occurred only in the unmonitored hauls of observed cruises in this stratum.
- ⁱ Includes animals that may belong to one of the identified species.
- ^j The two stocks overlap in the same geographical areas (Angliss and Outlaw 2005). Due to a lack of DNA samples it was not possible to determine which stock was impacted by the different components of the groundfish fisheries.
- ^k No sperm whales have been observed killed by any type of groundfish fishery gear in Alaska. These estimates were based solely on one animal which was observed caught and released with trailing longline gear; this trailing gear take was classified as a serious injury.
- ^l The stock identification of killer whales incidentally taken by the groundfish fisheries in Alaska was based on DNA analyses of tissue samples collected by observers from dead animals (M. Dahlheim, NMML, AFSC, pers. comm.).
- ^m All of the DNA samples collected from killer whales incidentally caught by the BSAI flatfish trawl fishery were from northern residents, and the BSAI flatfish trawl fishery was considered to have been primarily involved with this stock of killer whales. However, it was not possible to determine the stock identification from all of the killer whales caught by the BSAI flatfish trawl fishery because of a lack of DNA samples for some individuals. A DNA sample collected from the one killer whale observed incidentally taken in 2003 by the BSAI Pacific cod longline fishery was also from a northern resident, and the BSAI Greenland turbot longline fishery was likewise considered to have been primarily involved with this stock of killer whales. However, it was not possible to verify the stock identification of the killer whale caught by the BSAI Greenland turbot longline fishery in 1999 because of a lack of DNA samples.
- ⁿ The marine mammal bycatch which was seen by observers in unmonitored sets in this stratum was not included in the estimated bycatch.

Fishing Months in the Groundfish Fisheries of Alaska (1998-2004)



Appendix 8.--The months of the year during which fishing occurred in each groundfish fishery of Alaska, 1998-2004 (years combined), are indicated by fishery.

NPT = non-pelagic trawl gear. PTR = pelagic trawl gear.

Appendix 9.--The weight (t) of groundfish caught per set (haul), the duration (hr) of sets, the total number (in thousands) of hooks (longline fishery) or pots (pot fishery) per set, the fishing depth (m) of trawl nets, and the bottom depth (m) where vessels with observers fished in each groundfish fishery in the U.S. Exclusive Economic Zone of Alaska, 1998-2004. The mean (\bar{x}), median, CV, range, and sample size (n) values are listed for each parameter^a.

Fishery	Groundfish catch per set (t)			Duration of set (hr)			Total number of hooks or pots used per set (10^3)			Average trawl net fishing depth ^b (m)			Average bottom depth ^b (m)		
	\bar{x}	median	CV	\bar{x}	median	CV	\bar{x}	median	CV	\bar{x}	median	CV	\bar{x}	median	CV
	[range] (n)			[range] (n)			[range] (n)			[range] (n)			[range] (n)		
Trawl gear fisheries															
BSAI Atka mackerel trawl (Non-pelagic trawl gear)	48.3	41.1	0.70	2.87	2.58	0.59	N/A	129.4	122.5	0.32	130.6	124.4	0.36		
	[0 to 200.9] (7,292)			[0.07 to 20.92] (7,292)				[29.3 to 1,645.9] (7,291)			[29.3 to 2,000.7] (7,291)				
BSAI flatfish trawl (Pelagic trawl gear)	19.8	18.4	0.57	5.89	5.46	0.42	N/A	67.6	69.5	0.16	68.0	69.5	0.16		
	[1.4 to 54.0] (122)			[0.37 to 11.83] (122)				[51.2 to 137.2] (122)			[51.2 to 137.2] (122)				
BSAI flatfish trawl (Non-pelagic trawl gear)	18.4	14.9	0.83	3.44	3.17	0.46	N/A	88.8	71.3	0.96	89.4	71.3	0.99		
	[0 to 150.1] (59,742)			[0.03 to 17.67] (59,730)				[3.7 to 10,299.8] (59,741)			[7.3 to 10,299.8] (59,741)				
BSAI Pacific cod trawl (Pelagic trawl gear)	12.6	9.3	0.93	4.47	4.33	0.53	N/A	93.5	91.4	0.31	94.3	91.4	0.32		
	[0 to 87.2] (223)			[0.12 to 11.08] (221)				[32.9 to 184.7] (223)			[32.9 to 184.7] (223)				
BSAI Pacific cod trawl (Non-pelagic trawl gear)	13.1	8.8	1.16	3.71	3.50	0.54	N/A	101.2	95.1	0.49	102.4	96.9	0.51		
	[0 to 271.6] (25,907)			[0.03 to 24.00] (25,889)				[7.3 to 3,749.0] (25,890)			[23.8 to 4,306.8] (25,891)				
BSAI pollock trawl (Pelagic trawl gear)	76.5	71.5	0.55	4.12	3.42	0.75	N/A	111.3	89.6	0.77	137.2	109.7	0.81		
	[0 to 522.8] (94,690)			[0.02 to 31.50] (94,641)				[5.5 to 10,892.3] (94,663)			[9.1 to 14,345.1] (94,659)				
BSAI pollock trawl (Non-pelagic trawl gear)	28.6	18.2	1.10	3.45	3.00	0.63	N/A	100.1	86.0	0.54	107.5	89.6	1.64		
	[0 to 330.2] (3,588)			[0.08 to 24.33] (3,582)				[9.1 to 585.2] (3,584)			[20.1 to 10,071.2] (3,584)				
BSAI rockfish trawl (Non-pelagic trawl gear)	46.7	40.0	0.71	3.05	2.68	0.59	N/A	239.6	239.6	0.30	242.0	243.2	0.31		
	[0 to 173.9] (1,451)			[0.17 to 11.57] (1,450)				[71.3 to 680.3] (1,451)			[73.2 to 680.3] (1,451)				
GOA flatfish trawl (Pelagic trawl gear)	7.4	6.6	0.75	2.69	2.50	0.69	N/A	115.6	95.1	0.67	115.9	95.1	0.67		
	[0 to 25.3] (139)			[0.08 to 12.85] (139)				[38.4 to 524.9] (139)			[38.4 to 524.9] (139)				
GOA flatfish trawl (Non-pelagic trawl gear)	9.3	6.9	0.93	2.67	2.50	0.53	N/A	161.2	148.1	0.55	161.7	148.1	0.56		
	[0 to 92.8] (11,251)			[0.02 to 18.40] (11,246)				[3.7 to 749.8] (11,249)			[5.5 to 2,170.8] (11,251)				
GOA Pacific cod trawl (Pelagic trawl gear)	14.0	7.2	1.64	2.78	2.40	0.74	N/A	73.0	69.5	0.25	75.3	69.5	0.29		
	[0.1 to 124.2] (59)			[0.17 to 11.00] (59)				[38.4 to 118.9] (59)			[38.4 to 146.3] (59)				

Appendix 9.--Continued.

Fishery	Groundfish catch per set (t)			Duration of set (hr)			Total number of hooks or pots used per set (10^3)			Average trawl net fishing depth ^b (m)			Average bottom depth ^b (m)		
	\bar{x}	median	CV	\bar{x}	median	CV	\bar{x}	median	CV	\bar{x}	median	CV	\bar{x}	median	CV
	[range]	[range]	(n)	[range]	[range]	(n)	[range]	[range]	(n)	[range]	[range]	(n)	[range]	[range]	(n)
Trawl gear fisheries (continued)															
GOA Pacific cod trawl (Non-pelagic trawl gear)	8.7	5.8	1.07	2.63	2.25	0.65	N/A	91.4	84.1	0.41	91.9	86.0	0.41		
	[0 to 135.3]	[0 to 135.3]	(4,465)	[0.03 to 17.42]	[0.03 to 17.42]	(4,464)		[29.3 to 548.6]	[29.3 to 548.6]	(4,465)	[29.3 to 548.6]	[29.3 to 548.6]	(4,464)		
GOA pollock trawl (Pelagic trawl gear)	32.8	24.4	0.95	5.40	4.58	0.73	N/A	159.9	146.3	0.53	200.4	179.2	0.67		
	[0 to 420.0]	[0 to 420.0]	(4,406)	[0.08 to 22.25]	[0.08 to 22.25]	(4,405)		[1.8 to 493.8]	[1.8 to 493.8]	(4,361)	[27.4 to 1,828.8]	[27.4 to 1,828.8]	(4,379)		
GOA pollock trawl (Non-pelagic trawl gear)	16.1	10.6	1.17	3.01	2.00	0.96	N/A	130.4	118.9	0.46	140.6	126.2	0.47		
	[0 to 112.8]	[0 to 112.8]	(387)	[0.07 to 18.50]	[0.07 to 18.50]	(386)		[18.3 to 530.4]	[18.3 to 530.4]	(387)	[47.5 to 530.4]	[47.5 to 530.4]	(387)		
GOA rockfish trawl (Pelagic trawl gear)	31.2	33.8	0.66	2.65	2.25	0.60	N/A	200.4	201.2	0.32	237.1	237.7	0.37		
	[0 to 80.4]	[0 to 80.4]	(199)	[0.25 to 8.08]	[0.25 to 8.08]	(199)		[64.0 to 512.1]	[64.0 to 512.1]	(199)	[64.0 to 731.5]	[64.0 to 731.5]	(199)		
GOA rockfish trawl (Non-pelagic trawl gear)	18.2	12.0	1.09	2.34	2.00	0.72	N/A	179.6	164.6	0.47	180.7	164.6	0.47		
	[0 to 153.9]	[0 to 153.9]	(5,471)	[0.02 to 15.50]	[0.02 to 15.50]	(5,465)		[36.6 to 658.4]	[36.6 to 658.4]	(5,465)	[36.6 to 658.4]	[36.6 to 658.4]	(5,456)		
Longline gear fisheries															
BSAI Greenland turbot longline	6.9	5.7	0.73	20.47	18.00	0.64	7.772	7.489	0.45	N/A	590.6	610.8	0.23		
	[0 to 54.6]	[0 to 54.6]	(5,080)	[1.00 to 245.40]	[1.00 to 245.40]	(5,079)	[0.115 to 29.250]	[0.115 to 29.250]	(5,080)		[20.1 to 1,499.6]	[20.1 to 1,499.6]	(5,080)		
BSAI Pacific cod longline	8.0	6.6	0.75	14.14	13.68	0.60	12.447	11.390	0.52	N/A	114.0	109.7	0.36		
	[0 to 78.8]	[0 to 78.8]	(103,897)	[0.02 to 1,449.00]	[0.02 to 1,449.00]	(103,707)	[0.001 to 153.600]	[0.001 to 153.600]	(103,896)		[3.7 to 4,023.4]	[3.7 to 4,023.4]	(103,886)		
BSAI Pacific halibut longline	4.8	3.2	1.07	12.71	11.05	0.60	3.794	3.692	0.69	N/A	339.7	327.4	1.22		
	[0 to 49.0]	[0 to 49.0]	(1,347)	[0.93 to 74.00]	[0.93 to 74.00]	(1,347)	[0.021 to 18.300]	[0.021 to 18.300]	(1,347)		[14.6 to 13,238.7]	[14.6 to 13,238.7]	(1,347)		
BSAI rockfish longline	3.9	3.1	0.81	13.09	10.94	0.58	4.637	4.550	0.41	N/A	463.3	494.7	0.41		
	[0 to 18.1]	[0 to 18.1]	(114)	[0.83 to 41.92]	[0.83 to 41.92]	(114)	[0.500 to 11.200]	[0.500 to 11.200]	(114)		[43.9 to 737.0]	[43.9 to 737.0]	(114)		
BSAI sablefish longline	3.4	2.5	0.87	15.29	13.72	0.52	4.497	4.320	0.39	N/A	573.8	585.2	0.22		
	[0 to 22.2]	[0 to 22.2]	(2,148)	[0.83 to 98.75]	[0.83 to 98.75]	(2,146)	[0.081 to 13.068]	[0.081 to 13.068]	(2,148)		[40.2 to 1,303.9]	[40.2 to 1,303.9]	(2,148)		
GOA Pacific cod longline	8.0	7.1	0.69	12.09	11.42	0.46	8.588	8.056	0.64	N/A	100.6	89.6	0.68		
	[0 to 54.2]	[0 to 54.2]	(3,082)	[0.50 to 85.67]	[0.50 to 85.67]	(3,066)	[0.001 to 176.880]	[0.001 to 176.880]	(3,082)		[36.6 to 1,026.0]	[36.6 to 1,026.0]	(3,082)		

Appendix 9.--Continued.

Fishery	Groundfish catch per set (t)			Duration of set (hr)			Total number of hooks or pots used per set (10^3)			Average trawl net fishing depth ^b (m)			Average bottom depth ^b (m)		
	\bar{x}	median	CV	\bar{x}	median	CV	\bar{x}	median	CV	\bar{x}	median	CV	\bar{x}	median	CV
	[range]	[range]	(n)	[range]	[range]	(n)	[range]	[range]	(n)	[range]	[range]	(n)	[range]	[range]	(n)
Longline gear fisheries (continued)															
GOA Pacific halibut longline	5.7	4.8	0.75	12.34	10.58	0.57	4.094	3.884	0.55	N/A	353.0	342.0	0.56		
	[0 to 35.4]	[0 to 35.4]	(1,694)	[0.50 to 81.00]	[0.50 to 81.00]	(1,690)	[0.087 to 15.250]	[0.087 to 15.250]	(1,694)		[11.0 to 821.1]	[11.0 to 821.1]	(1,694)		
GOA rockfish longline	3.6	3.3	0.80	11.77	11.48	0.43	3.739	3.240	0.44	N/A	432.9	422.5	0.26		
	[0 to 13.1]	[0 to 13.1]	(37)	[3.50 to 28.50]	[3.50 to 28.50]	(37)	[0.278 to 7.350]	[0.278 to 7.350]	(37)		[192.0 to 636.4]	[192.0 to 636.4]	(37)		
GOA sablefish longline	4.3	3.6	0.68	14.25	12.95	0.51	4.539	4.420	0.36	N/A	565.2	581.6	0.27		
	[0 to 39.0]	[0 to 39.0]	(8,980)	[0.08 to 154.25]	[0.08 to 154.25]	(8,977)	[0.005 to 14.500]	[0.005 to 14.500]	(8,980)		[7.3 to 4,866.4]	[7.3 to 4,866.4]	(8,970)		
Pot gear fisheries															
BSAI Pacific cod pot	4.1	1.9	1.34	27.55	20.08	1.05	0.064	0.034	1.06	N/A	87.6	82.3	0.51		
	[0 to 51.0]	[0 to 51.0]	(7,999)	[0.02 to 733.00]	[0.02 to 733.00]	(7,951)	[0.001 to 0.434]	[0.001 to 0.434]	(7,999)		[1.8 to 1,280.2]	[1.8 to 1,280.2]	(7,976)		
BS sablefish pot	0.6	0.5	0.77	95.92	71.38	1.02	0.053	0.048	0.46	N/A	596.9	574.2	0.25		
	[0 to 6.2]	[0 to 6.2]	(1,420)	[1.40 to 1,158.58]	[1.40 to 1,158.58]	(1,420)	[0.001 to 0.288]	[0.001 to 0.288]	(1,420)		[21.9 to 1,139.3]	[21.9 to 1,139.3]	(1,420)		
AI sablefish pot	0.7	0.6	0.78	61.28	41.00	1.02	0.057	0.046	0.49	N/A	554.2	548.6	0.20		
	[0 to 4.6]	[0 to 4.6]	(1,098)	[1.25 to 738.92]	[1.25 to 738.92]	(1,098)	[0.019 to 0.216]	[0.019 to 0.216]	(1,098)		[160.9 to 1,069.8]	[160.9 to 1,069.8]	(1,098)		
GOA Pacific cod pot	2.7	1.7	1.23	29.95	20.53	1.19	0.045	0.029	1.07	N/A	83.6	80.5	0.36		
	[0 to 37.4]	[0 to 37.4]	(3,911)	[0.08 to 830.50]	[0.08 to 830.50]	(3,879)	[0.001 to 0.310]	[0.001 to 0.310]	(3,911)		[3.7 to 859.5]	[3.7 to 859.5]	(3,878)		

N/A = not applicable

^a Only data from sets without gear performance problems were used to calculate statistics; missing (null) values were also excluded.

^b The average depth values were taken by the observer from the vessel's logbook.

Appendix 10.--The weight (t) of groundfish caught, the duration (hr), the total number (10^3) of hooks (longline fishery) or pots (pot fishery), the average fishing depth (m) of trawl nets, and the average bottom depth (m) at the fishing location of sets (hauls) in which observers reported that marine mammals were incidentally killed or entangled, by species and groundfish fishery of Alaska, 1998-2004. ^a The location of each set and the status of the marine mammal bycatch in the haul and its monitoring by observers are listed in Appendix 3; unless denoted, each haul is represented by one animal which was killed by the gear.

Species (stock) Fishery	Area	Date	Groundfish catch (t)	Duration of set (hr)	Total number of hooks or pots used (10^3)	Average trawl net fishing depth ^b (m)	Average bottom depth ^b (m)
Steller sea lion (<i>Eumetopias jubatus</i>): western U.S. stock							
BSAI Atka mackerel trawl (NPT)	542	5 March 1998	94.6	3.9	N/A	101	101
BSAI Atka mackerel trawl (NPT)	542	25 March 1998 ^c	88.7	5.3	N/A	176	176
BSAI Atka mackerel trawl (NPT)	542	11 February 1999	6.6	1.7	N/A	296	313
BSAI Atka mackerel trawl (NPT)	542	24 February 2000	42.3	3.0	N/A	104	104
BSAI Atka mackerel trawl (NPT)	542	2 February 2001	71.0	3.2	N/A	93	93
BSAI Atka mackerel trawl (NPT)	542	18 April 2003	25.0	3.6	N/A	110	110
BSAI Atka mackerel trawl (NPT)	543	7 October 1999	30.0 ^d	3.3	N/A	93	93
BSAI Atka mackerel trawl (NPT)	543	8 October 1999	2.0	2.5	N/A	110	115
BSAI flatfish trawl (NPT)	509	30 January 1999	10.8 ^e	2.6	N/A	64	68
BSAI flatfish trawl (NPT)	509	30 July 2001	19.9	3.5	N/A	37	37
BSAI flatfish trawl (NPT)	509	2 October 2001	11.0	4.5	N/A	66	66
BSAI flatfish trawl (NPT)	513	4 May 1998 ^f	18.0	UNK ^g	N/A	59	59
BSAI flatfish trawl (NPT)	513	26 November 1998	59.6	7.8	N/A	66	66
BSAI flatfish trawl (NPT)	513	24 April 2000	26.3	1.3	N/A	57	60
BSAI flatfish trawl (NPT)	513	29 April 2000	68.4	7.1	N/A	66	66
BSAI flatfish trawl (NPT)	513	8 June 2001	17.0	4.5	N/A	68	68
BSAI flatfish trawl (NPT)	513	3 October 2001	31.8	4.0	N/A	66	66
BSAI flatfish trawl (NPT)	513	30 March 2003	47.8	1.5	N/A	66	66
BSAI flatfish trawl (NPT)	514	18 June 2000	5.0	1.6	N/A	18	22
BSAI flatfish trawl (NPT)	514	25 May 2002	37.7	4.1	N/A	15	15
BSAI flatfish trawl (NPT)	514	29 May 2003	17.4	3.0	N/A	20	20
BSAI flatfish trawl (NPT)	514	2 June 2003 ^{f,h}	70.0	5.5	N/A	24	24
BSAI flatfish trawl (NPT)	514	18 May 2004	22.9	3.9	N/A	14	14
BSAI flatfish trawl (NPT)	514	23 May 2004	112.7	7.5	N/A	62	62
BSAI flatfish trawl (NPT)	524	19 May 2000	41.3	6.0	N/A	66	66
BSAI Pacific cod trawl (NPT)	541	20 March 1999	33.2	UNK ^g	N/A	108	108
BSAI Pacific cod trawl (NPT)	541	8 March 2003 ^c	4.1	6.0	N/A	119	119
BSAI pollock trawl (PTR)	509	25 September 1998	56.4	4.0	N/A	49	73
BSAI pollock trawl (PTR)	509	8 September 2000	96.5	5.5	N/A	59	77
BSAI pollock trawl (PTR)	509	12 March 2001	91.0	3.0	N/A	73	97
BSAI pollock trawl (PTR)	509	29 August 2002	102.1	4.3	N/A	69	88
BSAI pollock trawl (PTR)	513	19 February 2001	90.7	9.0	N/A	91	110
BSAI pollock trawl (PTR)	513	2 September 2002	118.0	3.8	N/A	150	179
BSAI pollock trawl (PTR)	513	15 July 2004	41.3	6.7	N/A	77	95

Appendix 10.--Continued.

Species (stock) Fishery	Area	Date	Groundfish catch (t)	Duration of set (hr)	Total number of hooks or pots used (10 ³)	Average trawl net fishing depth ^b (m)	Average bottom depth ^b (m)
Steller sea lion (<i>Eumetopias jubatus</i>): western U.S. stock (continued)							
BSAI pollock trawl (PTR)	517	11 October 1998	45.9 ^e	3.0	N/A	99	99
BSAI pollock trawl (PTR)	517	29 September 1999	73.8	15.5	N/A	108	132
BSAI pollock trawl (PTR)	517	11 October 2000	127.6	8.5	N/A	101	101
BSAI pollock trawl (PTR)	517	5 October 2002	55.6	9.4	N/A	88	126
BSAI pollock trawl (PTR)	521	19 August 1999	88.7	5.8	N/A	95	121
BSAI pollock trawl (PTR)	521	25 August 1999	74.7	UNK ^g	N/A	119	119
BSAI pollock trawl (PTR)	521	20 July 2001	37.9 ^e	5.8	N/A	104	121
GOA Pacific cod trawl (NPT)	610	18 October 2001	15.3 ^d	3.8	N/A	71	71
GOA pollock trawl (PTR)	610	2 June 1998	40.1	7.8	N/A	55	110
GOA pollock trawl (PTR)	610	11 March 2003	28.0	5.6	N/A	148	196
BSAI Pacific cod longline	509	7 September 2002	14.9	20.8	20.496	N/A	91
BSAI Pacific cod longline	513	4 August 2004 ^{f,i}	7.0	13.1	14.385	N/A	108
Steller sea lion (<i>Eumetopias jubatus</i>): eastern U.S. stock							
GOA sablefish longline	650	12 April 2000	3.9	13.6	2.518	N/A	582
Northern fur seal (<i>Callorhinus ursinus</i>): Eastern Pacific stock							
BSAI flatfish trawl (NPT)	513	9 August 2000	23.0	5.3	N/A	73	73
BSAI flatfish trawl (NPT)	513	7 August 2001	17.4	5.3	N/A	59	59
BSAI Pacific cod trawl (NPT)	513	16 August 2003 ^{f,h}	18.8	3.3	N/A	95	95
BSAI pollock trawl (PTR)	517	9 September 1998	7.7	5.1	N/A	75	99
BSAI Pacific cod longline	541	28 February 2000 ^{f,j}	11.3	13.0	11.690	N/A	121
Unidentified otariids^k							
BSAI flatfish trawl (NPT)	513	30 October 2001 ^{f,h}	23.7	5.3	N/A	64	64
BSAI Pacific cod longline	516	14 October 1999	15.0 ^d	12.8	18.900	N/A	75
BSAI Pacific cod longline	524	27 May 2001 ^{f,j}	16.8	13.7	20.900	N/A	62
Walrus (<i>Odobenus rosmarus</i>): Alaska stock							
BSAI flatfish trawl (NPT)	513	15 June 1998	13.0	5.4	N/A	59	59
BSAI flatfish trawl (NPT)	513	22 March 2000	8.0	7.4	N/A	68	68
BSAI flatfish trawl (NPT)	513	4 June 2000	21.0	5.6	N/A	60	60
BSAI flatfish trawl (NPT)	513	11 October 2001 ^{f,h}	18.0 ^d	2.5	N/A	73	73

Appendix 10.--Continued.

Species (stock) Fishery	Area	Date	Groundfish catch (t)	Duration of set (hr)	Total number of hooks or pots used (10 ³)	Average trawl net fishing ^b depth ^b (m)	Average bottom ^b depth ^b (m)
Walrus (<i>Odobenus rosmarus</i>): Alaska stock (continued)							
BSAI flatfish trawl (NPT)	514	20 May 2002	54.5	6.8	N/A	16	16
BSAI flatfish trawl (NPT)	514	26 May 2002	17.0	4.8	N/A	20	20
BSAI flatfish trawl (NPT)	514	3 May 2004	3.6	2.8	N/A	20	20
BSAI flatfish trawl (NPT)	514	6 May 2004	23.4	3.6	N/A	17	17
Bearded seal (<i>Erignathus barbatus</i>): Alaska stock							
BSAI flatfish trawl (NPT)	509	5 October 2001	21.3	3.8	N/A	64	64
BSAI flatfish trawl (NPT)	513	2 May 1998	30.8	6.0	N/A	59	59
BSAI flatfish trawl (NPT)	513	31 August 1999	3.6	3.9	N/A	75	75
BSAI flatfish trawl (NPT)	513	20 August 2000	23.4	4.6	N/A	71	71
BSAI flatfish trawl (NPT)	513	26 August 2003 ^{fl}	5.0	3.4	N/A	66	66
BSAI pollock trawl (PTR)	509	14 September 1999	61.5	8.0	N/A	64	91
BSAI pollock trawl (PTR)	521	4 September 1999	67.2	5.8	N/A	99	123
Harbor seal (<i>Phoca vitulina</i>): Bering Sea stock							
BSAI flatfish trawl (NPT)	509	13 April 2004	51.7 ^e	6.0	N/A	65	65
BSAI flatfish trawl (NPT)	524	27 May 2000	8.8	3.5	N/A	71	71
BSAI Pacific cod trawl (NPT)	517	16 May 2003	15.2	4.3	N/A	124	124
BSAI Pacific cod trawl (NPT)	517	21 March 2004	16.4	7.1	N/A	115	119
BSAI Pacific cod pot	542	21 September 1999	1.4	55.0	0.030	N/A	64
GOA Pacific cod pot	610	7 October 1998	3.1	11.8	0.067	N/A	119
Spotted seal (<i>Phoca largha</i>): Alaska stock							
BSAI flatfish trawl (NPT)	514	9 May 1999	61.0	5.3	N/A	69	69
BSAI flatfish trawl (NPT)	509	9 April 2004	43.7	6.4	N/A	65	65
BSAI flatfish trawl (NPT)	514	7 May 2004	34.6	4.3	N/A	65	65
BSAI flatfish trawl (NPT)	524	22 May 2004	75.7	8.2	N/A	65	65
BSAI Pacific cod longline	517	29 March 1999 ^{fh}	23.8	17.3	31.590	N/A	104
Ringed seal (<i>Pusa hispida</i>): Alaska stock							
BSAI pollock trawl (PTR)	517	12 October 2000	129.5	9.5	N/A	93	93
BSAI pollock trawl (PTR)	521	28 July 2001	91.1	2.7	N/A	93	115
BSAI pollock trawl (PTR)	521	5 September 2001	74.2	6.4	N/A	108	132

Appendix 10.--Continued.

Species (stock) Fishery	Area	Date	Groundfish catch (t)	Duration of set (hr)	Total number of hooks or pots used (10 ³)	Average trawl net fishing depth ^b (m)	Average bottom depth ^b (m)
Ribbon seal (<i>Histiophoca fasciata</i>): Alaska stock							
BSAI pollock trawl (PTR)	517	24 August 2001	39.1	4.1	N/A	146	210
BSAI Pacific cod longline	521	11 March 1998 ^{f,m}	56.9	19.5	32.256	N/A	143
BSAI Pacific cod longline	521	15 March 2001	14.7	18.0	22.176	N/A	106
Northern elephant seal (<i>Mirounga angustirostris</i>): California breeding stock							
GOA pollock trawl (PTR)	620	23 March 2003	14.9	9.8	N/A	402	439
Unidentified phocids^k							
BSAI flatfish trawl (NPT)	514	26 May 2001	29.3	4.8	N/A	27	27
Unidentified pinnipeds^k							
BSAI flatfish trawl (NPT)	509	23 April 2002	13.0	2.0	N/A	55	55
BSAI Pacific cod longline	524	30 May 2001	16.1	20.3	18.810	N/A	60
Humpback whale (<i>Megaptera novaeangliae</i>): Central or Western North Pacific stocksⁿ							
BSAI pollock trawl (PTR)	509	2 February 1999	118.4	4.0	N/A	46	69
BSAI pollock trawl (PTR)	517	25 October 1998	54.0	9.1	N/A	192	219
BS sablefish pot	519	30 July 2002 ^{f,j}	1.1	53.8	0.046	N/A	613
BS sablefish pot	519	3 November 2002 ^o	0.6 ^l	176.0	0.026	N/A	591
Minke whale (<i>Balaenoptera acutorostrata</i>): Alaska stock							
BSAI pollock trawl (PTR)	517	14 September 2000	41.9	10.8	N/A	90	90
Fin whale (<i>Balaenoptera physalus</i>): Northeast Pacific stock							
GOA pollock trawl (PTR)	620	7 October 1999	31.3 ^d	12.8	N/A	102	143

Appendix 10.--Continued.

Species (stock) Fishery	Area	Date	Groundfish catch (t)	Duration of set (hr)	Total number of hooks or pots used (10 ³)	Average trawl net fishing depth ^b (m)	Average bottom depth ^b (m)
Unidentified baleen whales^k							
BSAI pollock trawl (PTR)	521	26 July 2001	124.8	4.1	N/A	90	121
BSAI Pacific cod pot	513	14 July 1998 ^o	10.9	22.4	0.275	N/A	79
Sperm whale (<i>Physeter macrocephalus</i>)							
GOA sablefish longline	640	25 April 2000 ^o	2.9 ^p	12.8	3.542	N/A	662
Killer whale (<i>Orcinus orca</i>): Eastern North Pacific Alaska resident stock							
BSAI flatfish trawl (NPT)	517	1 August 1998 ^{r,s}	15.0	2.5	N/A	338	338
BSAI flatfish trawl (NPT)	517	18 August 2001 ^{r,s}	5.7	3.8	N/A	311	311
BSAI flatfish trawl (NPT)	517	29 July 2004 ^{f,l,q}	29.6 ^d	3.1	N/A	311	311
BSAI flatfish trawl (NPT)	519	11 August 2001 ^{q,r}	13.7	2.5	N/A	430	430
BSAI flatfish trawl (NPT)	521	21 April 2004 ^{q,r}	5.9	8.6	N/A	188	188
BSAI flatfish trawl (NPT)	521	22 April 2004 ^{q,r,t}	8.0	8.5	N/A	160	160
BSAI Greenland turbot longline	521	11 May 1999 ^s	21.7	60.8	12.960	N/A	686
BSAI Pacific cod longline	521	9 September 2003 ^q	4.1 ^d	14.3	18.544	N/A	170
Killer whale (<i>Orcinus orca</i>): Eastern North Pacific Gulf of Alaska, Aleutian Islands, and Bering Sea transient stock							
BSAI pollock trawl (PTR)	521	20 August 1999 ^q	108.6	0.3	N/A	146	174
BSAI pollock trawl (PTR)	521	12 March 2002 ^q	75.1	5.5	N/A	82	101
BSAI pollock trawl (PTR)	521	20 March 2003 ^q	56.5	4.0	N/A	79	97
Harbor porpoise (<i>Phocoena phocoena</i>): Bering Sea stock							
BSAI flatfish trawl (NPT)	513	8 August 1998	35.8	5.3	N/A	69	69
BSAI flatfish trawl (NPT)	513	16 August 2001	15.4	3.6	N/A	69	69
Dall's porpoise (<i>Phocoenoides dalli</i>): Alaska stock							
BSAI pollock trawl (PTR)	509	15 August 1999	120.5	6.8	N/A	77	99
BSAI pollock trawl (PTR)	517	19 February 1998	52.5	7.8	N/A	99	117
BSAI pollock trawl (PTR)	517	30 August 1998	36.6	1.4	N/A	208	208
BSAI pollock trawl (PTR)	517	24 September, 2002	56.4	1.0	N/A	79	106

Appendix 10.--Continued.

Species (stock) Fishery	Area	Date	Groundfish catch (t)	Duration of set (hr)	Total number of hooks or pots used (10 ³)	Average trawl net fishing depth ^b (m)	Average bottom depth ^b (m)
Dall's porpoise (<i>Phocoenoides dalli</i>): Alaska stock							
BSAI pollock trawl (PTR)	519	5 October 1998	90.7	5.5	N/A	159	159
BSAI pollock trawl (PTR)	521	9 September 1999	64.3	3.2	N/A	124	132
BSAI pollock trawl (PTR)	521	20 July 2000	134.1	6.0	N/A	91	112
BSAI pollock trawl (PTR)	521	15 August 2000	62.3	3.0	N/A	99	115
BSAI pollock trawl (PTR)	521	8 September 2000	106.1	0.8	N/A	108	130
BSAI pollock trawl (PTR)	521	10 September 2000	12.0	1.4	N/A	159	183
BSAI pollock trawl (PTR)	521	18 August 2001	64.3	2.8	N/A	75	106
BSAI pollock trawl (PTR)	521	22 September 2001	77.0	5.0	N/A	95	112
BSAI pollock trawl (PTR)	521	20 July 2004	79.2	1.2	N/A	88	117
BSAI pollock trawl (NPT)	509	19 September 1998	45.0	3.5	N/A	71	82
GOA pollock trawl (PTR)	610	1 June 1998	29.8	5.4	N/A	46	88
BSAI Pacific cod longline	517	6 March 1999	4.5	6.4	5.832	N/A	113
Unidentified cetaceans^k							
BSAI Pacific cod trawl (NPT)	517	14 April 2000 ^{f,h}	6.2	5.5	N/A	91	91
BSAI pollock trawl (PTR)	521	25 July 2001 ^{f,o}	51.4	4.9	N/A	102	126
Unidentified marine mammals^k							
BSAI flatfish trawl (NPT)	513	8 May 1999 ^{f,h}	2.0	1.3	N/A	66	66
BSAI flatfish trawl (NPT)	514	4 May 2004 ^{f,h}	11.2	3.3	N/A	15	15

N/A = not applicable

NPT = non-pelagic trawl gear

PTR = pelagic trawl gear

UNK = no data available

^a Only hauls with marine mammal bycatch classified (Appendix 3) as "Killed by gear", "Hit propeller", "Carcass", "Trailing gear", "Minor injury", or "Unharmed" were included in this table only. Hauls which had other types of incidental take or marine mammal interactions are only listed in Appendix 3.

^b The average depth values were taken by the observer from the vessel's logbook.

^c Two Steller sea lions were incidentally taken and died during this haul.

^d There was an unspecified problem during this haul (set) which affected the performance of the fishing gear.

^e A crab pot was caught in the trawl net during this haul.

Appendix 10.--Continued.

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- ^f Data from this take was not used in analyses to estimate bycatch.
- ^g There was a problem with the trawl net and/or tow that affected the duration of this haul.
- ^h The time or mode of death of the marine mammal which was incidentally taken during this haul (set) could not be determined.
- ⁱ The observer was informed by the crew several days later that a live sea lion dropped off the line, but the observer could not verify the status of this take.
- ^j The marine mammal which was caught or entangled during this set suffered a minor injury.
- ^k Includes animals that may belong to one of the identified species.
- ^l The marine mammal which was caught or entangled during this haul was essentially unharmed with no known injuries, but the observer couldn't verify this
- ^m The observer did not know if the ribbon seal was dead or alive before the interaction because only a piece of fur (with a 5 cm wide band) was found hooked on the line; this take could have been a serious injury or mortality since the piece of fur was apparently ripped off the animal.
- ⁿ The two stocks overlap in the same geographical areas (Angliss and Outlaw 2005); it was not possible to determine which stock was impacted by the different components of the groundfish fisheries.
- ^o The marine mammal which was caught or entangled during this set was released with trailing gear.
- ^p Some of the fishing gear was lost during this set, and the total weight of the groundfish catch was affected.
- ^q The stock identification of killer whales incidentally taken by the groundfish fisheries in Alaska was based on DNA analyses of tissue samples collected by observers from dead animals (M. Dahlheim, NMML, AFSC, pers. comm.).
- ^r The killer whale which was incidentally taken during this haul died as a result of a collision with the ship's propeller.
- ^s The stock identification could not be verified because of a lack of DNA samples.
- ^t The killer whale fragments caught on 22 April 2004 may have been from the same animal which was hit by the same vessel's propeller the previous day, but it was not possible to verify from the DNA samples whether both incidents involved the same individual killer whale.

Appendix 11.—The number of individual vessel fishing calendar days (vdays) when fishing vessels (with observers aboard) of one groundfish fishery also participated in the other groundfish fisheries of Alaska during 1998-2004. The percent (row based) of the total vessel days in the fishery shared by each other fishery is also listed in parentheses.

Fishery	Number of vessel fishing days ^a (vdays)	BSAI Atka mackerel trawl fishery (3,643 vdays)	BSAI flatfish trawl fishery (16,446 vdays)	BSAI Pacific cod trawl fishery (10,455 vdays)	BSAI pollock trawl fishery (35,630 vdays)	BSAI rockfish trawl fishery (730 vdays)
BSAI Atka mackerel trawl	3,643	SAME	46 (1.26)	88 (2.42)	23 (0.63)	36 (0.99)
BSAI flatfish trawl	16,446	46 (0.28)	SAME	874 (5.31)	946 (5.75)	45 (0.27)
BSAI Pacific cod trawl	10,455	88 (0.84)	874 (8.36)	SAME	348 (3.33)	18 (0.17)
BSAI pollock trawl	35,630	23 (0.07)	946 (2.66)	348 (0.98)	SAME	7 (0.02)
BSAI rockfish trawl	730	36 (4.93)	45 (6.16)	18 (2.47)	7 (0.96)	SAME
GOA flatfish trawl	3,569	0	0	0	0	0
GOA Pacific cod trawl	2,370	0	0	0	0	0
GOA pollock trawl	3,647	0	0	0	0	0
GOA rockfish trawl	1,928	0	0	0	0	0
AK miscellaneous other finfish trawl	359	1 (0.28)	87 (24.23)	52 (14.49)	23 (6.41)	3 (0.84)
BSAI Greenland turbot longline	2,854	0	0	0	0	0
BSAI Pacific cod longline	35,590	0	0	0	0	0
BSAI Pacific halibut longline	833	0	0	0	0	0
BSAI rockfish longline	101	0	0	0	0	0
BSAI sablefish longline	1,150	0	0	0	0	0
GOA Pacific cod longline	988	0	0	0	0	0
GOA Pacific halibut longline	892	0	0	0	0	0
GOA rockfish longline	34	0	0	0	0	0
GOA sablefish longline	3,734	0	0	0	0	0
AK miscellaneous other finfish longline	448	0	0	0	0	0
BSAI Pacific cod pot	4,047	0	0	1 (0.25)	0	0
BS sablefish pot	533	0	0	0	0	0
AI sablefish pot	475	0	0	0	0	0
GOA Pacific cod pot	1,691	0	0	0	0	0
AK miscellaneous other finfish pot	141	0	0	0	0	0

Appendix 11.--Continued.

Fishery	Number of vessel fishing days (vdays)	GOA flatfish trawl fishery (3,569 vdays)	GOA Pacific cod trawl fishery (2,370 vdays)	GOA pollock trawl fishery (3,647 vdays)	GOA rockfish trawl fishery (1,928 vdays)	AK miscellaneous other finfish trawl fishery (359 vdays)
BSAI Atka mackerel trawl	3,643	0	0	0	0	1 (0.03)
BSAI flatfish trawl	16,446	0	0	0	0	87 (0.53)
BSAI Pacific cod trawl	10,455	0	0	0	0	52 (0.50)
BSAI pollock trawl	35,630	0	0	0	0	23 (0.07)
BSAI rockfish trawl	730	0	0	0	0	3 (0.41)
GOA flatfish trawl	3,569	SAME	234 (6.56)	49 (1.37)	87 (2.44)	46 (1.29)
GOA Pacific cod trawl	2,370	234 (9.87)	SAME	28 (1.81)	21 (0.89)	20 (0.84)
GOA pollock trawl	3,647	49 (1.34)	28 (0.77)	SAME	6 (0.17)	4 (0.11)
GOA rockfish trawl	1,928	87 (4.51)	21 (1.09)	6 (0.31)	SAME	62 (3.22)
AK miscellaneous other finfish trawl	359	46 (12.81)	20 (5.57)	4 (1.11)	62 (17.27)	SAME
BSAI Greenland turbot longline	2,854	0	0	0	0	0
BSAI Pacific cod longline	35,590	0	0	0	0	0
BSAI Pacific halibut longline	833	0	0	0	0	0
BSAI rockfish longline	101	0	0	0	0	0
BSAI sablefish longline	1,150	0	0	0	0	0
GOA Pacific cod longline	988	0	0	0	0	0
GOA Pacific halibut longline	892	0	0	0	0	0
GOA rockfish longline	34	0	0	0	0	0
GOA sablefish longline	3,734	0	0	0	0	0
AK miscellaneous other finfish longline	448	0	0	0	0	0
BSAI Pacific cod pot	4,047	0	0	0	0	0
BS sablefish pot	533	0	0	0	0	0
AI sablefish pot	475	0	0	0	0	0
GOA Pacific cod pot	1,691	0	2 (0.12)	2 (0.12)	0	0
AK miscellaneous other finfish pot	141	0	0	0	0	0

Appendix 11.--Continued.

Fishery	Number of vessel fishing days ^a (vdays)	BSAI Greenland turbot longline fishery (2,854 vdays)	BSAI Pacific cod longline fishery (35,590 vdays)	BSAI Pacific halibut longline fishery (833 vdays)	BSAI rockfish longline fishery (101 vdays)	BSAI sablefish longline fishery (1,150 vdays)
BSAI Atka mackerel trawl	3,643	0	0	0	0	0
BSAI flatfish trawl	16,446	0	0	0	0	0
BSAI Pacific cod trawl	10,455	0	0	0	0	0
BSAI pollock trawl	35,630	0	0	0	0	0
BSAI rockfish trawl	730	0	0	0	0	0
GOA flatfish trawl	3,569	0	0	0	0	0
GOA Pacific cod trawl	2,370	0	0	0	0	0
GOA pollock trawl	3,647	0	0	0	0	0
GOA rockfish trawl	1,928	0	0	0	0	0
AK miscellaneous other finfish trawl	359	0	0	0	0	0
BSAI Greenland turbot longline	2,854	SAME	143 (5.01)	91 (3.19)	17 (0.60)	101 (3.54)
BSAI Pacific cod longline	35,590	143 (0.40)	SAME	49 (0.14)	14 (0.04)	12 (0.03)
BSAI Pacific halibut longline	833	91 (10.92)	49 (5.89)	SAME	22 (2.64)	159 (19.09)
BSAI rockfish longline	101	17 (16.83)	14 (13.86)	22 (21.78)	SAME	29 (28.71)
BSAI sablefish longline	1,150	101 (8.78)	12 (1.04)	159 (13.83)	29 (2.52)	SAME
GOA Pacific cod longline	988	0	0	0	0	0
GOA Pacific halibut longline	892	0	0	0	0	0
GOA rockfish longline	34	0	0	0	0	0
GOA sablefish longline	3,734	0	0	0	0	0
AK miscellaneous other finfish longline	448	87 (19.42)	112 (25.00)	25 (5.58)	10 (2.23)	16 (3.57)
BSAI Pacific cod pot	4,047	8 (0.20)	0	4 (0.10)	0	0
BS sablefish pot	533	6 (1.13)	0	4 (0.75)	0	1 (0.19)
AI sablefish pot	475	1 (0.21)	1 (0.21)	1 (0.21)	1 (0.21)	2 (0.42)
GOA Pacific cod pot	1,691	0	0	0	0	0
AK miscellaneous other finfish pot	141	6 (4.26)	1 (0.71)	1 (0.71)	0	5 (3.55)

Appendix 11.--Continued.

Fishery	Number of vessel fishing days ^a (vdays)	GOA Pacific cod longline fishery (988 vdays)	GOA Pacific halibut longline fishery (892 vdays)	GOA rockfish longline fishery (34 vdays)	GOA sablefish longline fishery (3,734 vdays)	AK miscellaneous other finfish longline fishery (448 vdays)
BSAI Atka mackerel trawl	3,643	0	0	0	0	0
BSAI flatfish trawl	16,446	0	0	0	0	0
BSAI Pacific cod trawl	10,455	0	0	0	0	0
BSAI pollock trawl	35,630	0	0	0	0	0
BSAI rockfish trawl	730	0	0	0	0	0
GOA flatfish trawl	3,569	0	0	0	0	0
GOA Pacific cod trawl	2,370	0	0	0	0	0
GOA pollock trawl	3,647	0	0	0	0	0
GOA rockfish trawl	1,928	0	0	0	0	0
AK miscellaneous other finfish trawl	359	0	0	0	0	0
BSAI Greenland turbot longline	2,854	0	0	0	0	87 (3.05)
BSAI Pacific cod longline	35,590	0	0	0	0	112 (0.32)
BSAI Pacific halibut longline	833	0	0	0	0	25 (3.00)
BSAI rockfish longline	101	0	0	0	0	10 (9.90)
BSAI sablefish longline	1,150	0	0	0	0	16 (1.39)
GOA Pacific cod longline	988	SAME	12 (1.22)	0	2 (0.20)	5 (0.51)
GOA Pacific halibut longline	892	12 (1.35)	SAME	7 (0.79)	359 (40.25)	11 (1.23)
GOA rockfish longline	34	0	7 (20.59)	SAME	21 (61.77)	0
GOA sablefish longline	3,734	2 (0.05)	359 (9.61)	21 (0.56)	SAME	13 (0.35)
AK miscellaneous other finfish longline	448	5 (1.12)	11 (2.46)	0	13 (2.90)	SAME
BSAI Pacific cod pot	4,047	0	0	0	0	0
BS sablefish pot	533	0	0	0	0	1 (0.19)
AI sablefish pot	475	0	0	0	0	0
GOA Pacific cod pot	1,691	0	0	0	0	0
AK miscellaneous other finfish pot	141	0	0	0	0	0

Appendix 11.--Continued.

Fishery	Number of vessel fishing days ^a (vdays)	BSAI Pacific cod pot fishery (4,047 vdays)	BS sablefish pot fishery (533 vdays)	AI sablefish pot fishery (475 vdays)	GOA Pacific cod pot fishery (1,691 vdays)	AK miscellaneous other finfish pot fishery (141 vdays)
BSAI Atka mackerel trawl	3,643	0	0	0	0	0
BSAI flatfish trawl	16,446	0	0	0	0	0
BSAI Pacific cod trawl	10,455	1 (0.01)	0	0	0	0
BSAI pollock trawl	35,630	0	0	0	0	0
BSAI rockfish trawl	730	0	0	0	0	0
GOA flatfish trawl	3,569	0	0	0	0	0
GOA Pacific cod trawl	2,370	0	0	0	2 (0.08)	0
GOA pollock trawl	3,647	0	0	0	2 (0.06)	0
GOA rockfish trawl	1,928	0	0	0	0	0
AK miscellaneous other finfish trawl	359	0	0	0	0	0
BSAI Greenland turbot longline	2,854	8 (0.28)	6 (0.21)	1 (0.04)	0	6 (0.21)
BSAI Pacific cod longline	35,590	0	0	1 (<0.01)	0	1 (<0.01)
BSAI Pacific halibut longline	833	4 (0.48)	4 (0.48)	1 (0.12)	0	1 (0.12)
BSAI rockfish longline	101	0	0	1 (0.99)	0	0
BSAI sablefish longline	1,150	0	1 (0.09)	2 (0.17)	0	5 (0.44)
GOA Pacific cod longline	988	0	0	0	0	0
GOA Pacific halibut longline	892	0	0	0	0	0
GOA rockfish longline	34	0	0	0	0	0
GOA sablefish longline	3,734	0	0	0	0	0
AK miscellaneous other finfish longline	448	0	1 (0.22)	0	0	0
BSAI Pacific cod pot	4,047	SAME	6 (0.15)	0	0	3 (0.07)
BS sablefish pot	533	6 (1.13)	SAME	0	0	18 (3.38)
AI sablefish pot	475	0	0	SAME	0	7 (1.47)
GOA Pacific cod pot	1,691	0	0	0	SAME	2 (0.12)
AK miscellaneous other finfish pot	141	3 (2.13)	18 (12.77)	7 (4.97)	2 (1.42)	SAME

Appendix 11.--Continued.

^a The number of vessel days (vdays) are the number of calendar days per vessel (with an observer) that set gear to catch groundfish on these days.

Appendix 12.--Continued.

Fishery Years	Percent of groundfish catch monitored for marine mammals	Number of marine mammals seen by observers ⁱ		Pooled fishery data analysis				Stratified fishery data analysis				Estimated bycatch \hat{Y}_A
		Monitored hauls only	All hauls	Extrapolated bycatch				Extrapolated bycatch				
				\hat{R}	CV	\hat{Y}_R	$L_{95\%}$	\hat{R}_s	CV	\hat{Y}_{R_s}	$L_{95\%}$	
Northern fur seal (<i>Callorhinus ursinus</i>): Eastern Pacific stock (continued)												
BSAI pollock trawl fishery												
1998-2002	75.9	1	1	0.0022	0.49	1.32	0.53 to 3.28	0.0057	0.86	3.49	0.82 to 14.96	3.49
		(1 yr)	(1 yr)									
1999-2003	78.9	0	0	0	-	0	-	0	-	0	-	0
2000-2004	79.9	0	0	0	-	0	-	0	-	0	-	0
Walrus (<i>Odobenus rosmarus</i>): Alaska stock												
BSAI flatfish trawl fishery												
1998-2002	61.3	2	5	0.0331	0.44	3.27	1.43 to 7.45	0.0334	0.44	3.29	1.44 to 7.50	6.29 ^{c.e.g}
		(1 yr)	(3 yr)									
1999-2003	62.2	2	4	0.0341	0.43	3.21	1.42 to 7.26	0.0349	0.44	3.29	1.44 to 7.50	5.29 ^{c.e.g}
		(1 yr)	(2 yr)									
2000-2004	61.9	4	6	0.0676	0.31	6.46	3.58 to 11.67	0.0668	0.30	6.38	3.56 to 11.44	8.38 ^{c.e.g}
		(2 yr)	(3 yr)									
Bearded seal (<i>Erignathus barbatus</i>): Alaska stock												
BSAI flatfish trawl fishery												
1998-2002	61.3	4	4	0.0663	0.31	6.53	3.60 to 11.85	0.0665	0.31	6.55	3.59 to 11.95	6.55 ^{c.e.g}
		(4 yr)	(4 yr)									
1999-2003	62.2	3	3	0.0511	0.35	4.82	2.45 to 9.47	0.0537	0.37	5.06	2.51 to 10.22	5.06 ^{c.e}
		(3 yr)	(3 yr)									
2000-2004	61.9	2	2	0.0338	0.44	3.23	1.43 to 7.33	0.0357	0.46	3.41	1.45 to 7.99	3.41 ^{e.g}
		(2 yr)	(2 yr)									
BSAI pollock trawl fishery												
1998-2002	75.9	1	2	0.0022	0.49	1.32	0.53 to 3.28	0.0030	0.67	1.84	0.55 to 6.09	2.84
		(1 yr)	(1 yr)									
1999-2003	78.9	1	2	0.0020	0.46	1.27	0.54 to 2.99	0.0028	0.67	1.84	0.55 to 6.09	2.84
		(1 yr)	(1 yr)									
2000-2004	79.9	0	0	0	-	0	-	0	-	0	-	0

Appendix 12.--Continued.

Fishery Years	Percent of groundfish catch monitored for marine mammals	Number of marine mammals seen by observers ⁱ		Pooled fishery data analysis				Stratified fishery data analysis				Estimated bycatch \hat{Y}_A
		Monitored hauls only	All hauls	Extrapolated bycatch				Extrapolated bycatch				
				\hat{R}	CV	\hat{Y}_R	$L_{95\%}$	\hat{R}_s	CV	\hat{Y}_{R_s}	$L_{95\%}$	
Dall's porpoise (<i>Phocoenoides dalli</i>): Alaska stock (continued)												
GOA pollock trawl fishery												
1998-2002	29.4	1	1	0.0795	0.84	3.40	0.81 to 14.22	0.0371	0.61	1.58	0.52 to 4.79	1.58 ^{b,d,f}
		(1 yr)	(1 yr)									
1999-2003	26.8	0	0	0	-	0	-	0	-	0	-	0
2000-2004	25.5	0	0	0	-	0	-	0	-	0	-	0
BSAI Pacific cod longline fishery												
1998-2002	32.0	0	1	0	-	0	-	0	-	0	-	1.00
		(1 yr)										
1999-2003	31.1	0	1	0	-	0	-	0	-	0	-	1.00
		(1 yr)										
2000-2004	29.4	0	0	0	-	0	-	0	-	0	-	0

^a The average annual marine mammal bycatch results for 2000-2004 by the stratified groundfish fishery data analyses are listed in Table 8.

^b The value (rounded to one decimal place) of the coefficient of variation (CV) by the stratified data method was lower than the corresponding CV value (rounded to one decimal place) by the pooled dataset method.

^c The CV value (rounded to one decimal place) by the stratified data method was lower than the corresponding CV value (rounded to one decimal place) by the pooled dataset method.

^d The value (rounded to an integer) of the extrapolated bycatch (\hat{Y}_{R_s}) by the stratified data method was lower than the corresponding value (rounded to an integer) of the extrapolated bycatch (\hat{Y}_R) by the pooled dataset method.

^e The value (rounded to an integer) of the extrapolated bycatch (\hat{Y}_{R_s}) by the stratified data method was the same as the corresponding value (rounded to an integer) of the extrapolated bycatch (\hat{Y}_R) by the pooled dataset method.

^f The value (rounded to an integer) of the variance ($V(\hat{Y}_{R_s})$) of the extrapolated bycatch by the stratified data method was lower than the corresponding value (rounded to an integer) of the variance ($V(\hat{Y}_R)$) of the extrapolated bycatch by the pooled dataset method.

^g The value (rounded to an integer) of the variance ($V(\hat{Y}_{R_s})$) of the extrapolated bycatch by the stratified data method was the same as the corresponding value (rounded to an integer) of the variance ($V(\hat{Y}_R)$) of the extrapolated bycatch by the pooled dataset method.

^h The extrapolated bycatch and estimated bycatch by both the pooled dataset and stratified data analytical methods underestimated the actual number of killer whales which observers reported were taken by the vessels (in both monitored and unmonitored sets whether seen by observers or not) while the observers were aboard the vessels.

ⁱ The numbers in parentheses under all hauls refer to the total number of marine mammals observers reported were taken by the vessel while the observer was aboard including animals seen only by the crew. The number of years during the 5-year periods in which the reported takes occurred are listed in parentheses below the numbers of marine mammals taken.

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