NOAA Technical Memorandum NMFS-AFSC-78

Alaska Marine Mammal Stock Assessments, 1996

by
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U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
Alaska Fisheries Science Center

September 1997

NOAA Technical Memorandum NMFS

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This document should be cited as follows:

> Hill, P. S., D. P. DeMaster, and R. J. Small. 1997. Alaska Marine Mammal Stock Assessments, 1996. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-AFSC-78, 150 p.

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September 1997

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PREFACE

On April 30, 1994, Public Law 103-238 was enacted allowing significant changes to provisions within the Marine Mammal Protection Act (MMPA). Interactions between marine mammals and commercial fisheries are addressed under three new sections. This new regime replaced the interim exemption that has regulated fisheries-related incidental takes since 1988. Section 117, Stock Assessments, required the establishment of three regional scientific review groups to advise and report on the status of marine mammal stocks within Alaska waters, along the Pacific Coast (including Hawaii), and the Atlantic Coast (including the Gulf of Mexico). This report provides information on the marine mammal stocks of Alaska under the jurisdiction of the National Marine Fisheries Service.

Each stock assessment includes a description of the stock's geographic range, a minimum population estimate, current population trends, current and maximum net productivity rates, optimum sustainable population levels and allowable removal levels, and estimates of annual human-caused mortality and serious injury through interactions with commercial fisheries and subsistence hunters. Under the new regime, these data will be used to evaluate the progress of each fishery towards achieving its goal of zero mortality and serious injury of marine mammals.

This is a working document. Each stock assessment report is designed to stand alone and will be updated as new information becomes available. The MMPA requires stock assessment reports to be revised annually for stocks designated as strategic, annually for stocks where there are significant new information available, and at least once every 3 years for all other stocks. This document represents the first revision since the original development of the stock assessment reports in 1995. Minor formatting and editing changes in most reports have been initiated to allow for better consistency between the reports. In addition, for some stocks, new information (such as new abundance estimates, or new estimates of fishery related mortality) have led to substantial revisions in certain sections. Those sections of each stock assessment report containing significant changes are listed in Appendix Table 1. The authors solicit any new information or comments which would improve future stock assessment reports,

The U. S. Fish and Wildlife Service (USFWS) has management authority for polar bears, sea otters and walrus. Copies of the stock assessments for these species may be obtained through USFWS, Marine Mammals Management, 1011 E. Tudor Road, Anchorage, AK, 99501.

Ideas and comments from the Alaska Scientific Review Group (SRG) have significantly improved this document from its draft form. The authors wish to express their gratitude for the thorough reviews and helpful guidance provided by the Alaska SRG members: Lloyd Lowry (chairman), Milo Adkinson (new member), John Gauvin (new member), Carl Hild, Sue Hills, Brendan Kelly, Matt Kookesh (new member), Denby Lloyd, Beth Mathews, Craig Matkin (new member), Caleb Pungowiyi, Jan Straley, and Kate Wynne.

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Revised 8/8/97

STELLER SEA LION *(Eumetopias jubatus):* Western U. S. Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

Steller sea lions range along the North Pacific Ocean rim from northern Japan to California (Loughlin et al. 1984), with centers of abundance and distribution in the Gulf of Alaska and Aleutian Islands, respectively. The species is not known to migrate, but individuals disperse widely outside of the breeding season (late May-early July), thus potentially intermixing with animals from other areas Despite the wide ranging movements of juveniles and adult males in particular, exchange between rookeries by breeding adult females and males (other than between adjoining rookeries) appears relatively low (NMFS 1995). Loughlin (1994, 1997) considered the following information when classifying stock structure based on the phylogeographic approach of Dizon et al. (1992): 1) Distributional data: geographic distribution continuous, yet a high degree of natal site fidelity and low (<10%) exchange rate of breeding animals between rookeries; 2) Population response data: substantial differences in population dynamics (York et al. 1996); 3) Phenotypic data: unknown; and 4) Genotypic data: substantial differences in mitochondrial DNA (Bickham et al. 1996). Based on this information, two separate stocks of Steller sea lions are now recognized within U. S. waters: an Eastern U. S. stock, which includes animals east of Cape Suckling, Alaska (144°W), and a Western U. S. stock, which includes animals at and west of Cape Suckling (Loughlin 1997, Fig. 1).

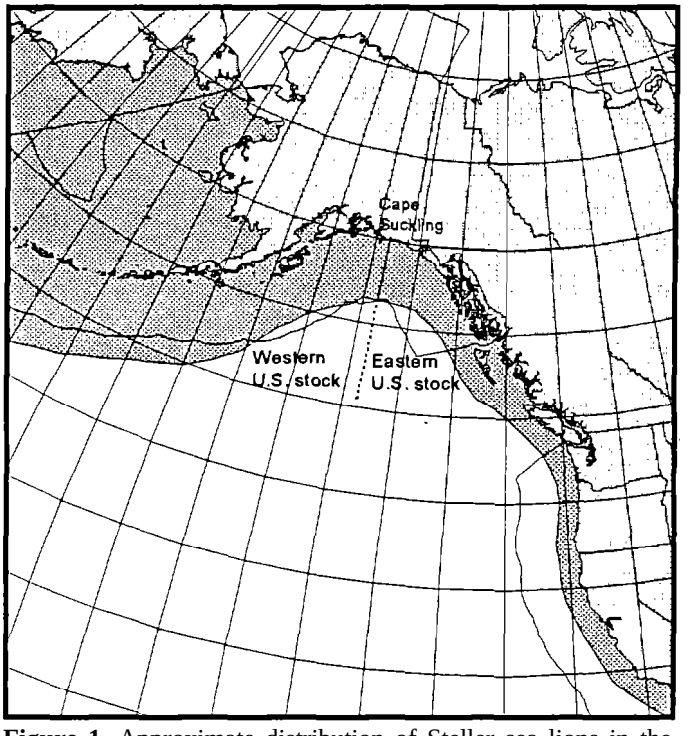

Figure 1. Approximate distribution of Steller sea lions in the eastern North Pacific (shaded area).

POPULATION SIZE

The most recent estimate of Steller sea lion abundance in Alaska is based on aerial surveys performed in June 1994 from Southeast Alaska to the western Aleutian Islands. The data from these surveys represent actual counts of nonpups at 95 'trend sites', where sea lions have been monitored since the 1970s and a few additional sites. Aerial and ship-based surveys of Steller sea lions conducted at these same trend sites during June and July 1992 resulted in coefficients of variation (CV) in counts from 0.025 to 0.12 for 7 distinct subareas of Alaska, with an overall CV of 0.0184 (Sease et al. 1993). An indication of variance for the 1994 survey is represented by the difference of 5% between the minimum count vs. the mean counts The methodology established from the 1989 range wide survey (Loughlin et al. 1992) produced a correction factor of 1.331 to be multiplied by the nonpup count to estimate total nonpup abundance, and recommended dividing the nonpup count by 2.63 to estimate the number of pups. Using these correction factors and the 1994 counts for the Gulf of Alaska, Aleutian Islands, and the Bering Sea resulted in an estimate of 33,600 nonpups and 9,600 pups, for a total abundance estimate of 43,200 Steller sea lions in the Western U. S. stock (Table 1).

Minimum Population Estimate

For the Western U. S. stock of Steller sea lions, the minimum population estimate (N_{MIN}) is calculated using Equation 1 from the PBR Guidelines (Wade and Angliss 1997): $N_{MIN} = N/\exp(0.842*[\ln(1+[CV(N)]^2)]^{½})$. Using the population estimate (N) of 43,200 and an associated CV of 0.0184, N_{MIN} for the Western U.S. stock is 42,536. Even though CVs are not currently available for the correction factors, this estimate of N_{MIN} is such that the true number of animals in the

population is very likely to be greater than N_{min} because Loughlin et al. (1992) have commented that the actual counts of pups and non-pups are likely to be underestimated by 5-10% (DeMaster 1997). This approach is consistent with the recommendations of the Alaska Scientific Review Group (DeMaster 1995, 1996, 1997).

Table 1. Estimates of the number of Steller sea lions by year and geographical area for the Western U. S. stock from the 1960s through 1994. Numbers have been are adjusted to account for missed sites and animals at-sea by the methods of Loughlin et al. (1992). The percentage each area represents of the U. S. population is also shown. Estimates from 1960 through 1989 from Loughlin et al. (1992) with Bering Sea numbers adjusted based upon new data (NMFS 1995).

Area	1960s	%	1970s	%	1985	%	1989	%	1994	%
Gulf of Alaska	88,700	36	70,700	34	48,900	33	40,600	46	22,000	33
Aleutians	127,300	51	115,700	56	78,400	53	24,400	27	19,000	28
Bering Sea	11,600	5	5,200	2	3,800	3	1,200	1	2,200	3
Total	227,600	92	191,600	92	131,100	89	66,200	75	43,200	64

Current Population Trend

The first reported trend counts (an index to examine population trends) of Steller sea lions in Alaska were made in 1956-60 which indicated that there were at least 140,000 (no correction factors applied) sea lions in the Gulf of Alaska and Aleutian Islands (Merrick et al. 1987). Subsequent surveys indicated a major population decrease, first detected in the eastern Aleutian Islands in the mid-1970s (Braham et al. 1980). Counts from 1976 to 1979 indicated about 104,000 sea lions (no correction factors applied) (NMFS 1992). The decline appears to have spread eastward to the Kodiak Island area during the late 1970s and early 1980s, and then westward to the central and western Aleutian Islands by stock for 1965-94, during the early and mid-1980s (Merrick et al. 1987, Byrd 1989). The greatest declines occurred in the eastern Aleutian Islands and western Gulf of Alaska, but declines also occurred in the central Gulf of Alaska and central Aleutian Islands. Most recently, Steller sea lions in the Western U. S. stock decreased 34.7% from 1989 to 1994. Population estimates (correction factors applied) for the Gulf of Alaska, Aleutian Islands, and the Bering Sea regions are provided in Table 1, and are compared to the Eastern U. S. stock in Figure 2.

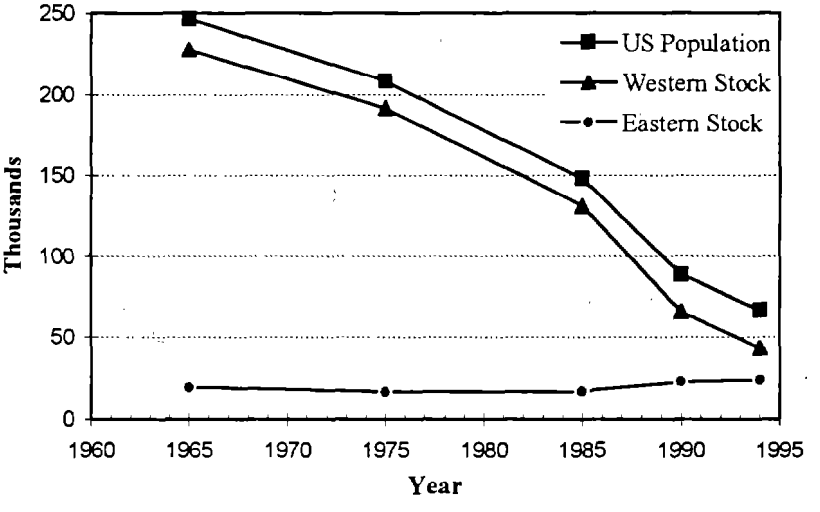

Figure 2. Estimated U. S. population of Steller sea lion adults, juveniles, and pups

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

There are no reliable estimates of maximum net productivity rate for Steller sea lions. Hence, until additional data become available, it is recommended that the theoretical maximum net productivity rate (R_{MAX} for pinnipeds of 12% be employed for this stock (Wade and Angliss 1997). However, it should also be noted that from a theoretical, single-species perspective, a population that has declined from over 200,000 individuals to less than 50,000 individuals and where the estimated annual removal rate due to human activities is on the order of l-2% of the current abundance level, should not be declining at present. For this stock, the PBR approach, given its single-species perspective, is difficult to apply.

POTENTIAL BIOLOGICAL REMOVAL

Under the 1994 re-authorized Marine Mammal Protection Act (MMPA), the potential biological removal (PBR) is defined as the product of the minimum population estimate, one-half the maximum theoretical net productivity rate, and a recovery factor: $PBR = N_{MIN} \times 0.5R_{MAX} \times F_R$ The recovery factor (F_R) for this stock has been changed from 0.3 (Small and DeMaster 1995) to 0.15. This F_R value was selected by NMFS after considering recommendations from the Alaska Scientific Review Group (DeMaster 1997), the Alaska Fisheries Science Center, the Alaska Regional Office, and public comment. Based on simulations reported in Wade (in press), the use of an F_R of 0.15 versus allowing no human-related removals at all will result in a negligible difference in the population dynamics of a stock. Thus, for the Western U.S. stock of Steller sea lions, PBR = 383 animals (42,536 x 0.06 x 0.15).

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

Fisheries Information

Six different commercial fisheries operating within the range of the Western U. S. stock of Steller sea lions were monitored for incidental take by NMFS observers during 1990-95: Bering Sea (and Aleutian Islands) groundfish trawl, longline, and pot fisheries, and Gulf of Alaska groundfish trawl, longline, and pot fisheries. No sea lion mortality was observed by NMFS observers in either pot fishery. For the fisheries with observed takes, the range of observer coverage over the 6-year period, as well as the annual observed and estimated mortalities are presented in Table 2. The mean annual (total) mortality was 12 (CV=0.29) for the Bering Sea groundfish trawl fishery, 1.2 (CV=0.61) for the Gulf of Alaska groundfish trawl fishery, 0.2 (CV=l.0) for the Bering Sea groundfish longline fishery, and 1.0 (CV=0.77) for the Gulf of Alaska groundfish longline fishery. The observed mortality in the 1993 Bering Sea longline fishery occurred during an unmonitored haul and therefore could not be used to estimate mortality for the entire fishery. Therefore, 1 mortality was used as both the observed mortality and estimated mortality in 1993 for that fishery, and should be considered a minimum estimate.

Observers also monitored the Prince William Sound salmon drift gillnet fishery in 1990 and 1991, recording 2 mortalities in 1991, extrapolated to 29 (95% CI 1-1.08) kills for the entire fishery (Wynne et al. 1992). No mortalities were observed during 1990 for this fishery (Wynne et al. 1991), resulting in a mean kill rate of 14.5 (CV=1.0) animals per year for 1990 and 1991. In 1990, observers boarded 300 (57.3%) of the 524 vessels that fished in the Prince William Sound salmon drift gillnet fishery, monitoring a total of 3,166 sets, or roughly 4% of the estimated number of sets made by the fleet, In 1991, observers boarded 531 (86.9%) of the 611 registered vessels and monitored a total of 5,875 sets, or roughly 5% of the estimated sets made by the fleet (Wynne et al. 1992). Based on the observed mortalities in 1991, the estimated mortality rate of Steller sea lions was 0.0002 deaths per set. Logbook reports from this fishery detail 12, 5, 1, and 23 Steller sea lion mortalities in 1990, 1991, 1992, and 1993, respectively. The extrapolated (estimated) observer mortality accounts for these mortalities, so they do not appear in Table 2. The Alaska Peninsula and Aleutian Island salmon drift gillnet fishery was also monitored during 1990 (roughly 4% observer coverage) and no Steller sea lion mortalities were observed. Combining the estimates from the Bering Sea and Gulf of Alaska groundfish trawl and longline fisheries presented above (12+1.2+0.2+1.0=14.4) with the estimate from the Prince William Sound salmon drift gillnet fishery (14.5) results in an estimated mean annual mortality rate in observed fisheries of 28.9 sea lions per year from this stock.

An additional source of information on the number of Steller sea lions killed or injured incidental to commercial fishing operations is the logbook reports maintained by vessel operators as required by the MMPA interim exemption program. Some incidental takes of sea lions reported in the Gulf of Alaska fisheries were listed as “unknown species”, indicating the animals could have been either Steller or California sea lions. Based on all logbook reports for both species within the Gulf of Alaska, California sea lions represented only 2.2% of all interactions. Thus, the reports of injured and killed “unknown” sea lions were considered to be Steller sea lions. During the 4-year period between 1990 and 1993, logbook reports from 5 unobserved fisheries (see Table 2) resulted in an annual mean of 5.5 mortalities from interactions with commercial fishing gear. However, because logbook records are most likely negatively biased (Credle et al. 1994), these are considered to be minimum estimates. These totals are based on all available logbook reports for Alaska fisheries, except the groundfish trawl and longline fisheries in the Bering Sea, Aleutian Islands, and Gulf of Alaska, and the Prince William Sound salmon drift gillnet fishery for which observer data were presented above. The Bristol Bay salmon drift gillnet and set gillnet fisheries accounted for the majority of the reported incidental take in unobserved fisheries, Complete logbook data after 1993 are not available.

Table 2. Summary of incidental mortality of Steller sea lions (Western U. S. stock) due to commercial fisheries from 1990 through 1995 and calculation of the mean annual mortality rate. Mean annual mortality in brackets represents a minimum estimate from logbooks or MMPA reports. Data from 1991 to 1995 are used in the mortality calculation when more than years of data are provided for a particular fishery.

Fishery name	Years	Data type	Range of observer coverage	Observed mortality (in given yrs.)	Estimated mortality (in given yrs.)	Mean annual mortality
Bering Sea/Aleutian Is. (BSA) groundfish trawl	90-95	obs data	53-74%	13, 13, 15, 4, 9, 2	13, 19, 21, 6, 11, 3	12 (CV=.29)
Gulf of Alaska (GOA) groundfish trawl	90-95	obs data	33-55%	2, 0, 0, 1, 1, 0	4, 0, 0, 3, 3, 0	1.2 (CV=.61)
BSA groundfish longline (incl. misc finfish and sablefish fisheries)	90-95	obs data	27-80%	0, 0, 0, 1, 0, 0	0, 0, 0, 1, 0, 0	0.2 (CV=1.0)
GOA groundfish longline (incl. misc finfish and sablefish fisheries)	90-95	obs data	8-21%	1, 0, 0, 0, 0, 1	2, 0, 0, 0, 1, 4	1.0 (CV=.77)
Prince William Sound salmon drift gillnet	90-91	obs data	4-5%	0, 2	0, 29	14.5 (CV=1.0)
Observer program total						28.9
				Reported mortalities		
AK Peninsula/Aleutian Island salmon set gillnet	90-93	logbook	n/a	0, 1, 1, 1	n/a	[≥0.75]
Cook Inlet salmon drift gillnet	90-93	logbook	n/a	0, 0, 0, 2	n/a	[≥0.5]
Bristol Bay salmon drift gillnet	90-93	logbook	n/a	0, 4, 2, 8	n/a	[≥3.5]
Prince William Sound set gillnet	90-93	logbook	n/a	0, 0, 2, 0	n/a	[≥0.5]
AK miscellaneous finfish set gillnet	90-93	logbook	n/a	0, 1, 0, 0	n/a	[≥0.25]
AK halibut longline (state and federal waters)	90-94	Cat III reports	n/a	0, 0, 0, 0, 1	n/a	[≥0.2]
Minimum total annual mortality						≥34.6

Under the MMPA interim exemption program, Category III fisheries were not required to submit complete logbooks, but only to report mortalities of marine mammals incidental to fishing operations. In 1994, the incidental take of one Steller sea lion was reported in the Alaska halibut longline fishery, resulting in a mean annual mortality of 0.2. One mortality was also reported in the Gulf of Alaska sablefish longline fishery, a NMFS observed fishery that observed no Steller sea lion mortalities in 1994. This reported mortality has been included in the estimated observed mortality in this fishery for 1994 because it can be considered a minimum. Under the 1994 amendments, annual logbooks are no longer a requirement. Instead, beginning in 1995, all owners or operators of commercial vessels in all fisheries must report the incidental injury or death of marine mammals to NMFS within 48 hours after the end of each fishing trip.

NMFS studies using satellite tracking devices attached to Steller sea lions suggest that they rarely go beyond the U.S. EEZ into international waters. Given that the high-seas gillnet fisheries have ended and other net fisheries in international waters are minimal, the probability that Steller sea lions are taken incidentally in commercial fisheries in international waters is very low. NMFS concludes that the number of Steller sea lions taken incidental to commercial fisheries in international waters is insignificant.

The minimum estimated mortality rate incidental to commercial fisheries is 35 sea lions per year, based on observer data (28.9) and logbook (5.5) or Category III (0.2) reporting data where observer data were not available. It should be noted

that no observers have been assigned several fisheries that are known to interact with this stock, making the estimated mortality unreliable. At present annual mortality levels less than 38 animals per year (i.e., 10% of PBR) can be considered insignificant and approaching a zero mortality and serious injury rate. However, because logbook records are most likely negatively biased, and the 1992 Recovery Plan (NMFS 1992) recommended that immediate actions be taken to reduce human-caused mortality to the "lowest level practicable" to safeguard against further population declines, the current annual level of incidental mortality cannot be considered insignificant and approaching a zero mortality and serious injury rate.

Subsistence/Native Harvest Information

The 1992-95 subsistence harvest of Steller sea lions in Alaska was estimated by the Alaska Department of Fish and Game, under contract with the NMFS (Wolfe and Mishler 1993, 1994, 1995, 1996). In each year, data were collected through systematic interviews with hunters and users of marine mammals in approximately 2,100 households in about 60 coastal communities within the geographic range of the Steller sea lion in Alaska. Approximately 43 of the interviewed communities he within the range of the Western U. S. stock. The majority (79%) of sea lions were taken by Aleut hunters in the Aleutian and Pribilof Islands. The total subsistence take of Steller sea lions in 1992 was estimated at 549 (95% CI 452-712), with 370 harvested and 179 struck and lost. The total subsistence take in 1993 was estimated at 487 (95% CI 390-629). with 348 harvested and 139 struck and lost The total subsistence take in 1994 was estimated at 416 (95% CI 330-554). with 336 harvested and 80 struck and lost The total subsistence take in 1995 was estimated at 339 (95% CI 258-465), with 307 harvested and 32 struck and lost. The great majority (approximately 99%) of the statewide subsistence take was from the Western U.S. stock. The mean annual subsistence take from this stock over the 3-year period from 1993 to 1995 was 412 sea lions. The reported average age-specific kill of the harvest across all years was 31% adults, 62% juveniles, 3% pups, and 4% unknown age. The reported average sex-specific kill of the harvest was approximately 64% males, 19% females, and 17% of unknown sex.

Other Mortality

Shooting of sea lions by commercial fishers was thought to be a potentially significant source of mortality prior to the listing of sea lions as threatened under the ESA in 1990. Such shooting has been illegal since the species was listed as threatened. (Note: the 1994 Amendments to the MMPA made intentional lethal take of any marine mammal illegal except where imminently necessary to protect human life).

STATUS OF STOCK

Based on currently available data, the estimated annual level of total human-caused mortality and serious injury (35+412=447) is known to exceed the PBR (383) for this stock. The Western U. S. stock of Steller sea lion is currently listed as endangered under the ESA, and as a result the stock is classified as a strategic stock.

A summary ofmanagement actions recently implemented to safeguard the Western U. S. stock of Steller sea lion includes no-entry buffer zones around rookeries, prohibition of groundfish trawling within 10-20 nautical miles of certain rookeries, and spatial and temporal allocation of Gulf of Alaska pollock total allowable catch.

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Revised 8/8/97

STELLER SEA LION *(Eumetopias jubatus):* Eastern U. S. Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

Steller sea lions range along the North Pacific Ocean rim from northern Japan to California (Loughlin et al. 1984), with centers of abundance and distribution in the Gulf of Alaska and Aleutian Islands, respectively. The species is not known to migrate, but individuals disperse widely outside of the breeding season (late May-early July), thus potentially intermixing with animals from other areas. Despite the wide ranging movements of juveniles and adult males in particular, exchange between rookeries by breeding adult females and males (other than between adjoining rookeries) appears relatively low (NMFS 1995). Loughlin (1994, 1997) considered the following information when classifying stock structure based upon the phylogeographic approach of Dizon et al. (1992): I) Distributional data: geographic distribution continuous, yet a high degree of natal site fidelity and low (<10%) exchange rate of breeding animals between rookeries; 2) Population response data: substantial differences in population dynamics (York et al. 1996); 3) Phenotypic data: unknown; and 4) Genotypic data: substantial differences in mitochondrial DNA (Bickham et al. 1996). Based on this information, two separate stocks of Steller sea lions are now recognized within U. S. waters: an Eastern U. S. stock, which includes animals east of Cape Suckling, Alaska (144°W), and a Western U. S. stock, which includes animals at and west of Cape Suckling (Loughlin 1997, Fig. 3).

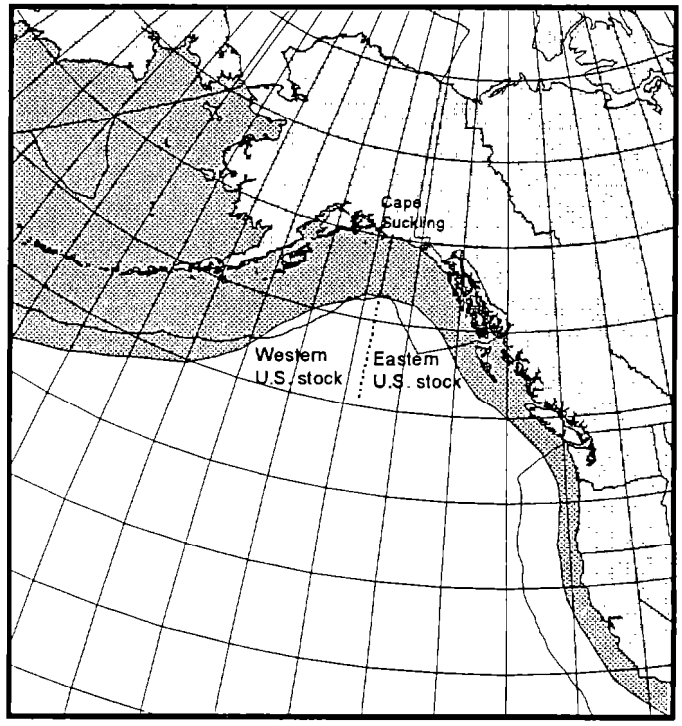

Figure 3. Approximate distribution of Steller sea lions in the eastern North Pacific (shaded area).

POPULATION SIZE

The most recent estimate of Steller sea lion abundance in Southeast Alaska is based on aerial surveys performed in June 1994 (NMFS 1995). The data from these surveys represent actual counts of nonpups at 'trend sites', where sea lions have been monitored since the 1970s, and a few additional sites. Aerial and ship-based surveys of Steller sea lions conducted at these same trend sites during June and July 1992 resulted in coefficients of variation (CV) in counts from 0.025 to 0.12 for 7 distinct subareas of Alaska, with an overall CV of 0.0184 (Sease et al. 1993). Aerial surveys and ground counts of California and Oregon rookeries were also conducted during the summer of 1994 (NMFS 1995). No comparable data are available for Washington State because no Steller sea lion rookeries exist there. The methodology established from the 1989 range wide survey (Loughlin et al. 1992) produced a correction factor of 1.331 to be multiplied by the nonpup count to estimate total nonpup abundance, and recommended dividing the nonpup count by 2.63 to estimate the number of pups. Using these correction factors and the 1994 counts for Southeast Alaska, California, and Oregon resulted in an estimate of 18,600 nonpups and 5,300 pups, for a total, abundance estimate of 23,900 Steller sea lions in the Eastern U. S. stock from rookeries located in the U. S. (Table 3).

Data from a 1995 Alaska Department of Fish and Game survey indicate that the Steller sea lion abundance in Southeast Alaska has increased to 17,000 animals (Calkins et al. 1996). This estimate from Southeast Alaska is not readily comparable to the 1994 data from other portions of this stock's range and as a result is not used to estimate the total abundance for the stock.

Table 3. Estimates of the number of Steller sea lions by year and geographical area for the Eastern U.S. stock from the 1960s through 1994. Numbers have been adjusted to account for missed sites and animals at-sea by the methods of Loughlin et al. (1992). The percentage each area represents of the U. S. population is also shown. Estimates from 1960 through 1989 from Loughlin et al. (1992) with Oregon and California numbers adjusted based upon new data (NMFS 1995). Animals from British Columbia rookeries are not included in the table.

Area	1960s	%	1970s	%	1985	%	1989	%	1994	%
Oregon and California	10,300	4	6,400	3	6,700	4	6,800	8	9,300	14
Southeast Alaska	9,000	4	10,300	5	10,300	7	15,800	18	14,600	22
Total	19,300	8	16,700	8	17,000	11	22,600	26	23,900	36

Aerial surveys in British Columbia during 1994 produced counts of 8,091 nonpups, and 1,186 pups (P. Olesiuk, pers. comm., Pacific Biological Station, Nanaimo, BC, V9R 5K6). If the same correction factors are applied to the nonpup count only, the estimated population of Steller sea lions in British Columbia is 13,846 (8,091 x 1.331 + 8,091/2.63) animals. The Eastern U. S. stock of Steller sea lions is a transboundary stock, including sea lions from British Columbia rookeries. (see Wade and Angliss 1997 for discussion of transboundary stocks). Thus, the best estimate of abundance for this stock, including Steller sea lions from British Columbia, is 37,746 animals (23,900+13,846).

Minimum Population Estimate

For the Eastern U. S. stock of Steller sea lions, the minimum population estimate (N_{MIN}) is calculated using Equation 1 from the PBR Guidelines (Wade and Angliss 1997): $N_{MIN} = N/\exp(0.842*[\ln(1+[CV(N)]^2)]^{½})$. Using the population estimate (N) of 37,746 and an associated CV of 0.0184, N_{MIN} for the Eastern stock is 37,166. Even though CVs are not currently available for the correction factors, the Alaska Scientific Review Group concluded that this estimate is such that the true number of animals in the population is very likely greater, and so would thus serve as an estimate of N_{MIN} (DeMaster 1995, 1996, 1997; see page 1 of this document).

Current Population Trend

Trend counts (an index to examine population trends) for Steller sea lions in Oregon were relatively stable in the 1980s at about 2,000-3,000 sea lions (no correction factors applied) (NMFS 1992). Counts in Oregon have shown a gradual increase since 1976, as the adult and juvenile count for that year was 1,486 compared to 3,443 for 1994 (Brown and Reimer 1992, NMFS 1995). This increase may be an artifact of unproved surveys in recent years (NMFS 1995). Steller sea lion numbers in California, especially in southern California, have declined from historic numbers. Counts in California between 1927 and 1947 have ranged between 5,000 and 7,000 nonpups with no apparent trend, but have subsequently declined by over 50%. remaining between 1,500 to 2,000 nonpups between 1980 and 1994. Limited information suggests that counts in

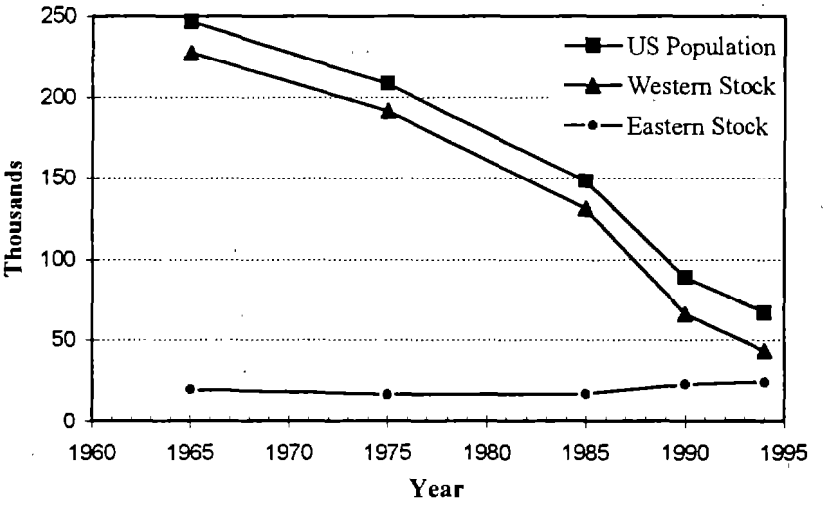

Figure 4. Estimated U. S. population of Steller sea lion adults, juveniles, and pups by stock for 1965-94.

northern California appear to be stable (NMFS 1995). At Año Nuevo, California, a steady decline in ground counts started around 1970, resulting in a 85% reduction in the breeding population by 1987 (LeBoeuf et al. 1991). In vertical aerial photographic counts conducted at Año Nuevo, pups declined at a rate of 9.9% from 1990 to 1993, while non-pups declined at a rate of 31.5% over the same time period (Westlake et al. 1997).

In Southeast Alaska, counts (no correction factors applied) of nonpups increased by 41% during 1979-94 from 6,376 to 9,005 (NMFS 199.5). Most recently, population estimates (correction factors applied) for Steller sea lions within U. S. boundaries increased slightly more than 5% from 1989 (22,600) to 1994 (23,900). Population estimates for Oregon and California and Southeast Alaska are given in Table 3, and are compared to the Western U. S. stock in Figure 4.

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

There are no reliable estimates of maximum net productivity rates for Steller sea lions. Hence, until additional data become available, it is recommended that the pinniped maximum theoretical net productivity rate (R_{MAX} of 12% be employed for this stock (Wade and Angliss 1997).

POTENTIAL BIOLOGICAL REMOVAL

Under the 1994 re-authorized Marine Mammal Protection Act (MMPA), the potential biological removal (PBR) is defined as the product of the minimum population estimate, one-half the maximum theoretical net productivity rate, and a recovery factor: $PBR = N_{MIN} \times 0.5R_{MIN} \times F_R$. The default recovery factor (F_R) for stocks listed as threatened under the Endangered Species Act (ESA) is 0.5 (Wade and Angliss 1997). However, as total population estimates for the Eastern U.S. stock have remained stable or increased over the last 20 years, the recovery factor is set at 0.75; midway between 0.5 (recovery factor for a threatened stock) and 1.0 (recovery factor for a stock within its optimal sustainable population level), This approach is consistent with the recommendations of the Alaska Scientific Review Group (DeMaster 1995: pp. 11, DeMaster 1997). Thus, for the Eastern U. S. stock of Steller sea lions, PBR = 1,672 animals (37,166 x 0.06 x 0.75).

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

Fisheries Information

NMFS observers monitored two commercial fisheries during the period from 1990 to 1995 in which Steller sea lions from this stock were taken incidentally. In 1992 and 1994, 1 Steller sea lion mortality was observed incidental to the California/Oregon thresher shark and swordfish drift gillnet fishery, resulting in an extrapolated estimated total kills of 8 and 6 animals, respectively. The mean annual mortality over the 5-year period for that fishery was 2.8 animals (CV=0.62). The only other observed mortality incidental to commercial fisheries from 1990 to 1995 was reported in the WA/OR/CA groundfish trawl fishery during the 1994 season. As that mortality occurred in an unmonitored haul, it could not be used to calculate the estimated mortality for the fishery Therefore, I mortality was used as both the observed mortality and estimated mortality in 1994 for that fishery, and should be considered a minimum estimate, resulting in a mean annual mortality over the 5-year period of 0.2 (CV=1.0) Steller sea lions. The range of observer coverage over the 5-year period, as well as the annual observed and estimated mortalities for these two observed fisheries are presented in Table 4. Averaging the incidental take data from these two observed fisheries over the 5-year period between 1991 and 1995 results in an estimated incidental mortality rate of 3.0 Steller sea lions per year from this stock. No mortalities were reported by NMFS observers monitoring drift gillnet and set gillnet fisheries in Washington and Oregon in the last 5 years; though, mortalities have been reported previously.

An additional source of information on the number of Steller sea lions killed or injured incidental to commercial fishery operations is the logbook reports maintained by vessel operators as required by the MMPA interim exemption program. During the 4-year period between 1990 and 1993, logbook reports from the Southeast Alaska salmon drift gillnet fishery (Table 4) resulted in an annual mean of 1.25 mortalities from interactions with commercial fishing gear. However, because logbook records are most likely negatively biased (Credle et al. 1994), these are considered to be minimum estimates. Not included in the table are reports from 1990 of 11 to Steller sea lion injuries incidental to the Alaska salmon troll fishery and 1 Steller sea lion injury incidental to the CA/OR/WA salmon troll fishery. Complete logbook data after 1993 are not available.

Steller sea lions are taken in British Columbia incidental to commercial salmon farming operations (Table 4). Preliminary figures from the British Columbia Aquaculture Predator Control Program resulted in a mean annual mortality of 9.8 Steller sea lions from this stock over the period from 1991 to 1995 (P. Olesiuk, pers. comm., Pacific Biological Station, Nanaimo, BC, V9R 5K6). The 1995 estimate includes one animal reported as an unidentified sea lion. Due to a

lack of observer programs, there are few data concerning the mortality of marine mammals incidental to other commercial fisheries in Canadian waters, which are analogous to U.S. fisheries that are known to take Steller sea lions. As a result, the number of Steller sea lions taken in Canadian waters is not known.

Table 4. Summary of incidental mortality of Steller sea lions (Eastern U. S. stock) due to commercial fisheries from 1990 through 1995 and calculation of the mean annual mortality rate. Mean annual mortality in brackets represents a minimum estimate from logbook reports. Data from 1991 to 1995 are used in the mortality calculation when more than 5 years of data are provided for a particular fishery.

Fishery name	Years	Data type	Range of observer coverage	Observed mortality (in given yrs.)	Estimated mortality (in given yrs.)	Mean annual mortality
CA/OR thresher shark and swordfish drift gillnet	90-95	obs data	4-18%	0, 0, 1, 0, 1, 0	0, 0, 8, 0, 6, 0	2.8 (CV=.62)
WA/OR/CA groundfish trawl (Pacific whiting component)	90-95	obs data	44-72%	0, 0, 0, 0, 1, 0	0, 0, 0, 0, 1, 0	0.2 (CV=1.0)
Observer program total						3
				Reported mortalities		
British Columbia aquaculture predator control program	91-95	permit reports	n/a	14, 8, 10, 11, 6	n/a	9.8
Southeast Alaska salmon drift gillnet	90-93	logbook	n/a	0, 1, 2, 2	n/a	[≥1.25]
Minimum total annual mortality						≥14.05

It should be noted that no observers have been assigned to Canadian fisheries and several U.S. fisheries that are known to interact with this stock, making the estimated mortality unreliable. The estimated minimum annual mortality rate incidental to commercial fisheries (15; based on observer data (3) logbook reports (rounded up to 2) or permit reports (10) where observer data were not available) is not known to exceed 10% of the PBR (167) and, therefore, can be considered to be insignificant and approaching zero mortality and serious injury rate.

Subsistence/Native Harvest Information

The 1992-95 subsistence harvest of Steller sea lions in Alaska was estimated by the Alaska Department of Fish and Game, under contract with NMFS (Wolfe and Mishler 1993, 1994, 1995, 1996). In each year, data were collected through systematic interviews with hunters and users of marine mammals in approximately 2,100 households in about 60 coastal communities within the geographic range of the Steller sea lion in Alaska. Approximately 16 of the interviewed communities lie within the range of the Eastern U. S. stock. Only a very small percentage (<1%) of the statewide subsistence take was from the Eastern U. S. stock. The total subsistence take of Steller sea lions from this stock was estimated at 6, 1, 5, and 0 animals in 1992-95, respectively. These values for total take include 1 animal per year during 1992-94 that was struck and lost. The mean annual subsistence take from this stock over the 3-year period from 1993 to 1995 was 2 sea lions.

An unknown number of Steller sea lions from this stock are harvested by subsistence hunters in Canada. The magnitude of the Canadian subsistence harvest is believed to be small. Alaska Native subsistence hunters have initiated discussions with Canadian hunters in an attempt to elucidate this information for the cooperative management process.

Other Mortality

Shooting of sea lions by commercial fishers was thought to be a potentially significant source of mortality prior to the listing of sea lions as threatened under the ESA in 1990. Such shooting has been illegal since the species was listed as threatened. (Note: the 1994 Amendments to the MMPA made intentional lethal take of any marine mammal illegal except where imminently necessary to protect human life).

STATUS OF STOCK

Based on currently available data, the estimated annual level of total human-caused mortality and serious injury (15+2=17) does not exceed the PBR (1,672) for this stock. The Steller sea lion is currently listed as threatened under the ESA and as a result, the Eastern U. S. stock of Steller sea lion is classified as a strategic stock. Although the stock size has increased in recent years, the status of this stock relative to OSP is unknown.

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Revised 8/8/97

NORTHERN FUR SEAL *(Callorhinus ursinus):* Eastern Pacific Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

Northern fur seals occur from southern California north to the Bering Sea (Fig. 5) and west to the Okhotsk Sea and Honshu Island, Japan During the breeding season, approximately 74% of the worldwide population is found on the Pribilof Islands in the southern Bering Sea, with the remaining animals spread throughout the North Pacific Ocean (Lander and Kajimura 1982). Of the seals in U.S. waters outside of the Pribilofs, approximately 1% of the population is found on Bogoslof Island in the southern Bering Sea and on San Miguel Island off southern California (NMFS 1993). Northern fur seals may temporarily haul out onto land at other sites in Alaska, British Columbia, and on islets along the coast of the continental U. S., but generally do so outside of the breeding season (Fiscus 1983).

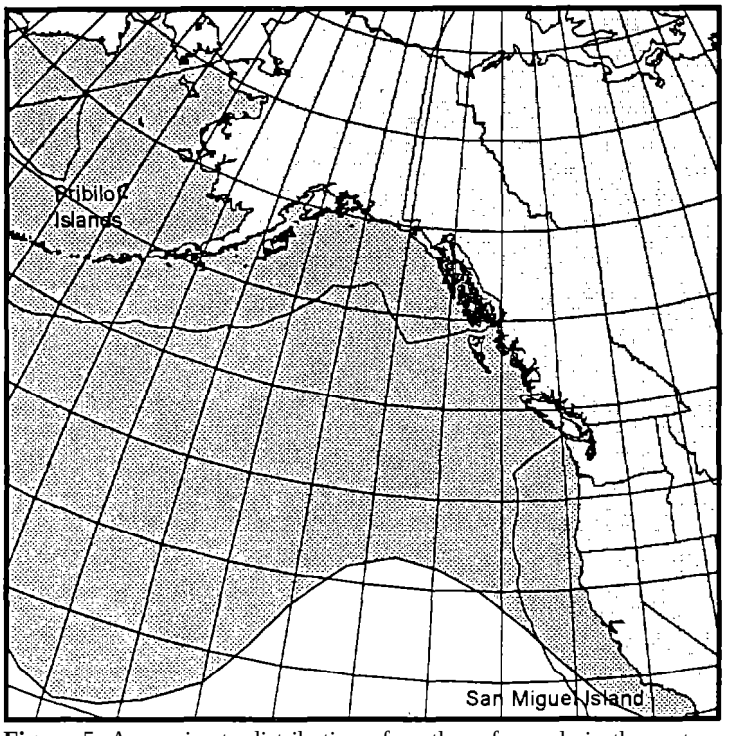

Figure 5. Approximate distribution of northern fur seals in the eastern North Pacific (shaded area).

Due to differing requirements during the annual reproductive season, adult males and females 'typically occur ashore at different, though overlapping times. Adult males usually occur on shore during the 4-month period from May-August, though some may be present until November (well after giving up their territories). Adult females are found ashore for as long as 6 months (June-November). Following their respective times ashore, seals of both genders then migrate south and spend the next 7-8 months at sea (Rappel 1984). Adult females and pups from the Pribilof Islands migrate through the Aleutian Islands into the North Pacific Ocean, often to the Oregon and California offshore waters. Many pups may remain at sea for 22 months before returning to their rookery of birth. Adult males generally migrate only as far south as the Gulf of Alaska (Kajimura 1984). There is considerable interchange of individuals between rookeries. The following information was considered in classifying stock structure based on the Dizon et al. (1992) phylogeographic approach: I) Distributional data: geographic distribution is continuous during feeding, geographic separation during the breeding season, high natal site fidelity (DeLong 1982); 2) Population response data: substantial differences in population dynamics between Pribilofs and San Miguel Island (DeLong 1982, DeLong and Antonelis 1991, NMFS 1993); 3) Phenotypic data: unknown; and 4) Genotypic data: unknown. Based on this information, two separate stocks of northern fur seals are recognized within U.S. waters an Eastern Pacific stock and a San Miguel Island stock. The San Miguel Island stock is reported separately in the Stock Assessment Reports for the Pacific Region.

POPULATION SIZE

The population estimate for the Eastern Pacific stock of northern fur seals is calculated as the estimated number of pups at rookeries multiplied by a series of different expansion factors determined from a life table analysis to estimate the number of yearlings, 2 year olds, 3 year olds, and animals at least 4 years old (Lander 1981). The resulting population estimate is equal to the pup count multiplied by approximately 4.475. The expansion factors are based on a sex and age distribution estimated after the harvest of juvenile males was terminated. Currently, CVs are unavailable for the expansion factor, As the great majority of pups are born on the Pribilof Islands, pup estimates are concentrated on these islands, though

additional counts are made on Bogoslof Island. Since 1990, pup counts have occurred biennially. Results of the 1996 survey will be available in 1997. Based on the average mean pup count of 226,613 (CV=0.0593) from 1990 (234,919), 1992 (219,151), and 1994 (225,770) on the Pribilofs and a total population estimate of 5,173 for Bogoslof Island in 1994 (NMFS unpubl. data, National Marine Mammal Laboratory, 7600 Sand Point Way, NE, Seattle, WA 98115), the most recent estimate for the number of fur seals in the Eastern Pacific stock is approximately 1,019,192 (1,014,019+5,173).

Minimum Population Estimate

The minimum population estimate (N_{MIN}) for this stock is calculated using Equation 1 from the PBR Guidelines (Wade and Angliss 1997): $N_{MIN} = N/\exp(0.842*[\ln(1+[CV(N)]^2)]^{1/2})$. Using the population estimate (N) of 1,019,192 and the CV (0.0593) associated with the pup counts, N_{MIN} for the Eastern Pacific stock of northern fur seals is 969,595. Even though CVs are not currently available for the correction factor, the Alaska Scientific Review Group concluded that this estimate is such that the true number of animals in the population is very likely greater because 1) the data used to derived the estimate of the fraction of the population composed of pups were collected at a time when the population was declining, 2) the estimate of pup production is the average of pup count data from 1990, 1992, and 1994, and 3) the estimate of N_{MIN} was based on the CV (pup counts) (DeMaster 1996).

Current Population Trend

The Alaska population of northern fur seals recovered to approximately 1.25 million in 1974 after the killing of females in the pelagic fur seal harvest was terminated in 1968. The population then began to decrease with pup production declining at a rate of 6.5-7.8% per year into the 1980s (York 1987). By 1983 the total stock estimate was 877,000 (Briggs and Fowler 1984). Annual pup production on St. Paul Island has remained relatively stable since 1981 (Fig. 6), indicating that stock size has not changed much in recent years (York and Fowler 1992). The most recent stock estimates prior to 1994 were 984,000 in 1992, and 1.01 million in 1990 (NMFS 1993). The northern fur seal was designated as depleted under the MMPA in 1988 because population levels had declined to less than 50% of levels observed in the late 1950s and there was no compelling evidence that carrying capacity (K) had changed substantially since the late 1950s (NMFS 1993). Under the Marine Mammal Protection Act (MMPA), this stock will remain listed as depleted until population levels reach at least the lower limit of its optimum sustainable population (estimated at 60% of K).

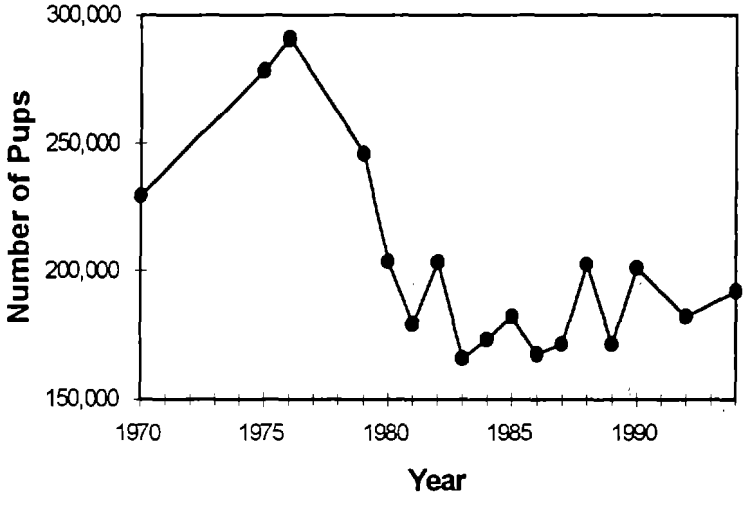

Figure 6. Annual production of northern fur seal pups on St. Paul Island, Alaska, 1970-94.

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

The northern fur seal population increased steadily during 19 12-24 after the commercial harvest no longer included pregnant females. During this period, the rate of population growth was approximately 8.6% (SE=l.47) per year (A. York unpubl. data National Marine Mammal Laboratory, 7600 Sand Point Way NE, Seattle, WA 98115), the maximum recorded for this species. This growth rate is similar and slightly higher than the 8.12% rate of increase (approximate SE=l.29) estimated by Gerrodette et al. (I 985). Though not as high as growth rates estimated for other fur seal species, the 8.6% rate of increase is considered a reliable estimate of R_{MAX} given the extremely low density of the population in the early 1900s.

POTENTIAL BIOLOGICAL REMOVAL

Under the 1994 re-authorized MMPA, the potential biological removal (PBR) is defined as the product of the minimum population estimate, one-half the maximum theoretical net productivity rate, and a recovery factor: PBR = N_{MIN}

$x 0.5 R_{MAX} x F_R$. The recovery factor (F_R) for this stock is 0.5, the value for depleted stocks under the MMPA (Wade and Angliss 1997). Thus, for the Eastern Pacific stock of northern fur seals, PBR = 20,846 animals (969,595 x 0.043 x 0.5).

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

Fisheries Information

The NMFS estimate of the total number of northern fur seals killed incidental to both the foreign and joint U.S.-foreign commercial groundfish trawl fisheries in the North Pacific from 1978 to 1988 was 246 (95% Confidence Interval: 68-567), resulting in an estimated mean annual rate of 22 northern fur seals (Perez and Loughlin 1991). The foreign high seas driftnet fisheries also incidentally killed large numbers of northern fur seals, with an estimated 5,200 (95% Confidence Interval: 4,500-6,000) animals taken during 1991 (Larntz and Garrott 1993). These estimates were not included in the mortality rate calculation because the fisheries are no longer operative. Commercial net fisheries in international waters of the North Pacific Ocean have decreased significantly in recent years. The assumed level of incidental catch of northern fur seals in those fisheries, though unknown, is thought to be minimal.

Six different commercial fisheries in Alaska that could have interacted with northern fur seals were monitored for incidental take by NMFS observers during 1990-95: Bering Sea (and Aleutian Islands) groundfish trawl, longline. and pot fisheries, and Gulf of Alaska groundfish trawl, longline, and pot fisheries. The only observed fishery in which incidental mortality occurred was the Bering Sea and Aleutian Islands groundfish trawl (Table 5), with a mean annual (total) mortality of 3 (CV=0.38). In 1990 and 1991, observers also monitored the Prince William Sound salmon drift gillnet fishery and recorded no mortalities of northern fur seals. In 1990, observers boarded 300 (57.3%) of the 524 vessels that fished in the Prince William Sound salmon drift gillnet fishery, monitoring a total of 3,166 sets, or roughly 4% of the estimated number of sets made by the fleet (Wynne et al. 1991). In 1991, observers boarded 531 (86.9%) of the 611 registered vessels and monitored a total of 5,875 sets, or roughly 5% of the estimated sets made by the fleet (Wynne et al. 1992). During 1990, observers also boarded 59 (38.3%) of the 154 vessels participating in the Alaska Peninsula/Aleutian Island salmon drift gillnet fishery, monitoring a total of 373 sets, or roughly 4% of the estimated number of sets made by the fleet (Wynne et al. 1991). The low level of observer coverage for these fisheries apparently did not observe interactions with northern fur seals which had occurred, as logbook mortalities were reported in both fisheries during the observed years (see Table 5).

Table 5. Summary of incidental mortality of northern fur seals (Eastern Pacific stock) due to commercial fisheries from 1990 through 1995 and calculation of the mean annual mortality rate. Mean annual mortality in brackets represents a minimum estimate from logbook reports. Data from 1991 to 1995 are used in the mortality calculation when more than 5 years of data

Fishery name	Years	Data type	Range of observer coverage	Observed mortality (in given yrs.)	Estimated mortality (in given yrs.)	Mean annual mortality
Bering Sea/Aleutian Is. (BSA) groundfish trawl	90-95	obs data	53-74%	0, 3, 4, 1, 2, 0	0, 6, 5, 1, 3, 0	3 (CV=.38)
Observer program total						3
				Reported mortalities		
Prince William Sound salmon drift gillnet	90-93	logbook	n/a	1, 1, 0, 0	n/a	[≥0.5]
AK Peninsula/Aleutian Island salmon drift gillnet	90-93	logbook	n/a	2, 0, 0, 0	n/a	[≥0.5]
Bristol Bay salmon drift gillnet	90-93	logbook	n/a	5, 0, 49, 0	n/a	[≥13.5]
Minimum total annual mortality						≥17.5

An additional source of information on the number of northern fur seals killed or injured incidental to commercial fishery operations is the logbook reports maintained by vessel operators as required by the MMPA interim exemption program, During the 4-year period between 1990 and 1993, logbook reports from 3 unobserved fisheries (see Table 5)

resulted in an annual mean of 14.5 mortalities from interactions with commercial fishing gear. While logbook records are most likely negatively biased (Credle et al. 1994), the bias in these estimates are hard to quantify because at least in one area (Prince William Sound), it is unlikely that fur seals occur and reports of fur seal-fishery interactions are likely the result of species misidentification. The great majority of the logbook incidental take occurred in the Bristol Bay salmon drift net fishery In 1990, logbook records from the Bristol Bay set and drift gillnet fisheries were combined. As a result, some of the northern fur seal mortalities reported in 1990 may have occurred in the set net fishery. Complete logbook data after 1993 are not available.

It should be noted that no observers have been assigned several of the gillnet fisheries that are known to interact with this stock, making the estimated mortality unreliable. However, the large stock size makes it unlikely that unreported mortalities from those fisheries would be a significant source of mortality for the stock. The estimated minimum annual mortality rate incidental to commercial fisheries (18; based on observer data (3) and logbook reports (rounded to 15) where observer data were not available) is less than 10% of the PBR (2,085) and, therefore, can be considered to be insignificant and approaching zero mortality and serious injury rate.

Subsistence/Native Harvest Information

Alaska Natives residing on the Pribilof Islands are allowed an annual subsistence harvest of northern fur seals, with a take range determined from annual household surveys. From 1986 to 1995, the annual subsistence harvest level averaged 1,394 and 189 for St. Paul and St. George Islands, respectively, for a total of 1,583. The subsistence harvest in 1993 was 1,518 and 319 on St. Paul and St. George, respectively, for a total of 1,837. The subsistence harvest in 1994 was 1,616 and 161 on St. Paul and St. George, respectively, for a total of 1,777. The subsistence harvest in 1995 was 1,265 and 260 on St. Paul and St. George, respectively, for a total of 1,525. Thus, the mean annual subsistence take of northern fur seals from this stock during the 3-year period from 1993 to 1995 was 1,713 animals. Only juvenile males are taken in the subsistence harvest, which likely results in a much smaller impact on population growth than a harvest of equal proportions of males and females. Subsistence take in areas other than the Pribilof Islands is known to occur, though believed to be minimal (NMFS unpubl. data, National Marine Mammal Laboratory, 7600 Sand Point Way NE, Seattle, WA 98115).

Other Mortality

Intentional killing of northern fur seals by commercial fishers, sport fishers, and others may occur, but the magnitude of this mortality is unknown Such shooting has been illegal since the species was listed as depleted in 1988. (Note: the 1994 Amendments to the MMPA made intentional lethal take of any marine mammal illegal except where imminently necessary to protect human life).

STATUS OF STOCK

Based on currently available data, the estimated annual level of total human-caused mortality and serious injury (18+1,713 = 1,731) is not known to exceed the PBR (20,846) for this stock. The Eastern Pacific stock of northern fur seal is classified as a strategic stock because it is designated as depleted under the MMPA. The Alaska SRG has noted that the multiplier used to convert pup counts to total population size is likely negatively biased and that the estimate of the current population size using the existing multiplier is only marginally less than 60% of the best available estimate of K (DeMaster 1996). Therefore, the Alaska SRG has recommended that the NMFS undertake research to evaluate the degree to which the currently used multiplier may be biased, and if necessary, consider re-evaluating the status of this stock relative to carrying capacity

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Revised 8/8/97

HARBOR SEAL *(Phoca vitulina richardsi):* Southeast Alaska Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

Harbor seals inhabit coastal and estuarine waters off Baja California, north along the western coasts of the U.S., British Columbia, and Southeast Alaska, west through the Gulf of Alaska and Aleutian Islands, and in the Bering Sea north to Cape Newenham and the Pribilof Islands. They haul out on rocks, reefs, beaches, and drifting glacial ice, and feed in marine, estuarine, and occasionally fresh waters. Harbor seals generally are non-migratory, with -local movements associated with such factors as tides, weather, season, food availability, and reproduction (Scheffer and Slipp 1944; Fisher 1952; Bigg 1969, 1981). The results of recent satellite tagging studies in Southeast Alaska, Prince William Sound, and Kodiak are also consistent with the conclusion that harbor seals are non-migratory (Frost et al. 1996, Swain et al. 1996). However, some long-distance movements of tagged animals in Alaska have been recorded (Pitcher and McAllister 1981, Frost et al. 1996).

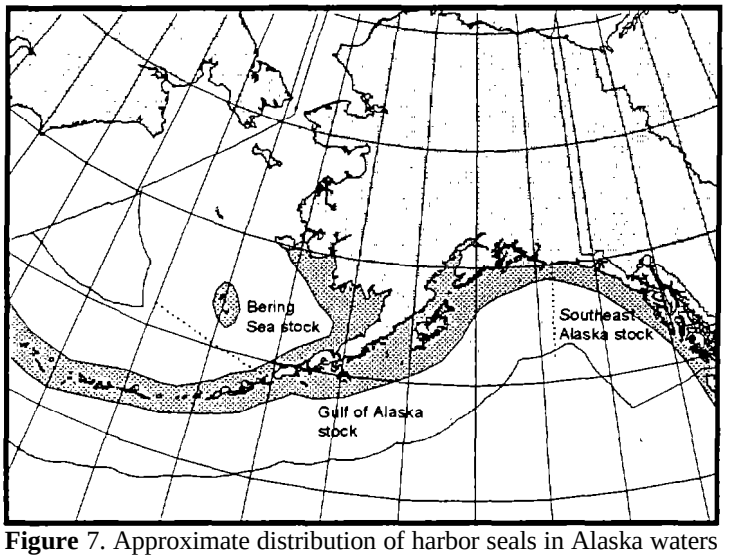

Figure 7. Approximate distribution of harbor seals in Alaska waters (shaded area).

Strong fidelity of individuals for haul out sites in June and August also has been reported, although these studies considered only limited hauling area during a relatively short period of time (Pitcher and Calkins 1979, Pitcher and McAllister 1981).

The following information was considered in classifying stock structure based on the Dizon et al. (1992) phylogeographic approach: 1) Distributional data: geographic distribution continuous, natal- dispersal characteristics unknown breeding dispersal is presumed to be very limited, year-round site fidelity observed, seasonal movements greater than 300 km rare (Harvey 1987) except in western Alaska (Hoover-Miller 1994); 2) Population response data: substantial differences in population dynamics between Southeast Alaska and the rest of Alaska, and presumed differences between Gulf of Alaska and Bering Sea (Hoover 1988, Hoover-Miller 1994, Withrow and Loughlin 1996); 3) Phenotypic data: clinal variation in body size and color phase (Shaughnessy and Fay 1977, Kelly 1981); 4) Genotypic data: undetermined for Alaska, mitochondrial DNA analyses currently underway. Preliminary genetic data indicate substantial variation in mtDNA suggesting two genetically distinct stocks may occur in Alaska, and possibly more (S. Chivers, pers. comm., Southwest Fisheries Science Center, P.O. Box 271, La Jolla, CA, 92038; Westlake et al. 1996). However, until additional samples are analyzed the Alaska Scientific Review Group (SRG) recommended using the same stock boundaries as in the draft Stock Assessment Reports for 1996 (Hill et al. 1996) and DeMaster (1995).

The Alaska SRG concluded that the scientific data available to support three distinct biological stocks (i.e., genetically isolated populations) were equivocal. However, the Alaska SRG recommended that the available data were sufficient to justify the establishment of three management units for harbor seals in Alaska (DeMaster 1996). Further, the SRG recommended that, unlike the stock structure reported in Small and DeMaster (1995) animals in the Aleutian Islands should be included in the same management unit as animals in the Gulf of Alaska. As noted above, this recommendation has been adopted by NMFS with the caveat that management units and stocks are equivalent (Wade and Angliss 1996). Therefore, based primarily on the significant population decline of seals in the Gulf of Alaska, the possible decline in the Bering Sea, and the stable population in Southeast Alaska, three separate stocks are recognized in Alaska waters: 1) the Southeast Alaska stock - occurring from the Alaska/British Columbia border to Cape Suckling, Alaska (144°W), 2) the Gulf of Alaska stock - occurring from Cape Suckling to Unimak Pass, including animals throughout the Aleutian Islands, and 3) the Bering Sea stock - including all waters north of Unimak Pass (Fig. 7). Information concerning the three harbor seal

stocks recognized along the west coast of the continental U.S. can be found in the Stock Assessment Reports for the Pacific Region.

POPULATION SIZE

The most recent comprehensive aerial survey of harbor seals in Southeast Alaska was conducted during the autumn molt in 1993. Eleven separate areas, with a mean of 39 (21-59) sites each, were surveyed 5-9 times each; the minimum number of surveys for each of the 427 sites was usually 4 or 5. Ten of 11 areas were surveyed during the third week of September, one area was surveyed from 31 August to 6 September. All known harbor seal haulout sites in each area were surveyed, and reconnaissance surveys were flown prior to photographic surveys to establish the location of additional sites. Aerial surveys were flown within 2 hours on either side of low tide, based on the assumption that at locations affected by tides, harbor seals haul out in greatest numbers at and around the time of low tide (Pitcher and Calkins 1979, Calambokidis et al. 1987). Some of the survey effort was conducted after the molt peak. If it is assumed that harbor seals decrease their amount of time hauled out after the molt, the counts from the 1993 surveys may have underestimated the number of seals. Mathews and Kelly (1996), for instance, suggested more than half of the estimated 6,000 seals found in Glacier Bay in August were not detected in the bay, or within a 60-km radius of the bay, during the September 1993 survey.

The sum of all mean counts was 21,523 with a combined CV=0.026 (Loughlin 1994). This method of estimating abundance and its CV assumes that during the survey period no migration occurred between sites and that there was no trend in the number of animals ashore. The number of seals moving between areas was assumed to be small considering each area's large geographic size, though a small number of seals may have been counted twice, or not at all. Data collected from 36 tagged harbor seals in Southeast Alaska from 1 to 11 September 1994 resulted in a correction factor of 1.74 (CV=0.068) to account for animals in the water which are thus missed during the aerial surveys (Withrow and Loughlin 1995). Although this correction factor (CF) was not derived during the actual survey in 1993, it was considered conservative because the data used to develop the CF were collected during an earlier time period (early September) than when the surveys were flown (late September) in 1993. Utilizing this correction factor results in a population estimate of 37,450 (21,523 x 1.74; CV=0.073) for the Southeast Alaska stock of harbor seals.

It should be noted that the CF developed for tidally influenced rocky substrate may not apply to seals hauled on ice from tidewater glaciers (Alaska SRG, see DeMaster 1996). Given the relatively small number of harbor seals counted on glacial haul outs (ca. 1,300), the magnitude of any bias resulting from using an inappropriate CF is likely small. That is, if no CF were applied to the counts of seals hauled on glacial haul outs during the 1993 surveys, the resulting abundance estimate for Southeast Alaska would be reduced by approximately 3% or 1,000 animals. NMFS will attempt to capture and radio-tag seals that utilize glacial haul outs prior to the next survey in Southeast Alaska. If such efforts are unsuccessful, pending recommendations from the Alaska SRG, NMFS will reconsider the methods used to correct for the number of seals hauled on glacial haul outs.

Minimum Population Estimate

The minimum population estimate (N_{MIN}) for this stock is calculated using Equation 1 from the PBR Guidelines (Wade and Angliss 1997): $N_{MIN} = N/\exp(0.842*[\ln(1+[CV(N)]^2)]^{½})$. Using the population estimate (N) of 37,450 and its associated CV of 0.073, N_{MIN} for this stock of harbor seals is 35,226.

Current Population Trend

Population trend data dating back to 1983 are available from two locations for the Southeast Alaska stock: Sitka and Ketchikan. When counts from 1993 were compared with those made in the early 1980s, mean counts of harbor seals at both locations were lower. However, mean counts in 1995 from both sites were higher than in the early 1980s. When including the 1995 data and correcting the data from all years for environmental factors, the number of harbor seals at the Sitka trend sites appears stable, and- the number of harbor seals at the Ketchikan trend sites appears to have increased at approximately 8% per year over the period from 1983 to 1995 (Lewis et al. 1996). It should be clear that these data are from selected 'trend' sites and not complete census surveys. Further, both of these trend sites are terrestrial haul outs, which may not be representative of animals that use glacial haul outs.

Counts from National Park Service surveys indicate increasing numbers of harbor seals in Johns Hopkins Inlet (a tidewater glacial fjord in Glacier Bay) between the mid- 1970s and 1984, followed by relatively stable numbers (Mathews 1995).

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

Reliable rates of maximum net productivity have not been estimated for the Southeast Alaska harbor seal stock. Population growth rates of 6% and 8% were observed between 1991 and 1992 in Oregon and Washington, respectively. Harbor seals have been protected in British Columbia since 1970, and the population has responded with an annual rate of increase of approximately 12.5% since 1973 (Olesiuk et al. 1990). However, until additional data become available, it is recommended that the pinniped maximum theoretical net productivity rate (R_{MAX}) of 12% be employed for this stock (Wade and Angliss 1997).

POTENTIAL BIOLOGICAL REMOVAL

Under the 1994 re-authorized Marine Mammal Protection Act (MMPA), the potential biological removal (PBR) is defined as the product of the minimum population estimate, one-half the maximum theoretical net productivity rate, and a recovery factor: PBR = N_{MIN} x $0.5R_{MAX}$ x F_R The recovery factor (F_R) for this stock is 1.0 (Wade and Angliss 1997), as population levels have increased or remained stable with a known human take (Pitcher 1990, Lewis et al. 1996). Thus, for this stock of harbor seals, PBR = 2,114 animals (35,745 x 0.06 x 1.0).

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

Fisheries Information

Some fishing effort by vessels participating in the Gulf of Alaska (GOA) groundfish longline fishery occurs in the offshore waters of Southeast Alaska. Effort levels are insignificant for the portion of the GOA groundfish trawl and pot fisheries operating in these waters. During the period from 1990 to 1995, 21-31% of the GOA longline catch occurred within the range of the Southeast Alaska harbor seal stock. This fishery has been monitored for incidental take by NMFS observers from 1990 to 1995 (8-21% observer coverage), although observer coverage has been very low in the offshore waters of Southeast Alaska (Table 6). The only observed harbor seal mortality in this fishery occurred in 1995, resulting in a mean annual (total) mortality of 4 (CV= 1.0).

Table 6. Summary of incidental mortality of harbor seals (Southeast Alaska stock) due to commercial fisheries from 1990 through 1995 and calculation of the mean annual mortality rate. Mean annual mortality in brackets represents a minimum estimate from logbook reports, Data from 1991 to 1995 are used in the mortality calculation when more than 5 years of data are provided for a particular fishery.

Fishery name	Years	Data type	Range of observer coverage	Reported mortality (in given yrs.)	Estimated mortality (in given yrs.)	Mean annual mortality
Gulf of Alaska groundfish longline (incl. misc finfish and sablefish fisheries)	90-95	obs data	<1-4%	0, 0, 0, 0, 0, 1	0, 0, 0, 0, 0, 20	4 (CV=1.0)
Observer program total	90-95					4
				Reported mortalities		
Southeast Alaska salmon drift gillnet	90-93	logbook	n/a	8, 1, 4, 2	n/a	[≥3.75]
Yakutat salmon set gillnet	90-93	logbook	n/a	0, 18, 31, 61	n/a	[≥27.5]
Minimum total annual mortality						≥35.25

An additional source of information on the number of harbor seals killed or injured incidental to commercial fishery operations is the logbook reports maintained by vessel operators as required by the Marine Mammal Protection Act (MMPA) interim exemption program. During the 4-year period between 1990 and 1993, logbook reports from 2 unobserved fisheries (see Table 6) resulted in an annual mean of 31.25 mortalities from interactions with commercial fishing gear. However, because logbook records are most likely negatively biased (Credle et al. 1994) these are considered to be minimum estimates. As recommended by the Alaska Scientific Review Group, given that harbor seals are the only common phocid

in Southeast Alaska, logbook reports of unidentified phocid mortalities have been included as incidental takes of harbor seals in Table 6 (DeMaster 1996: pp. 8). The majority of the logbook incidental takes were reported in the Yakutat salmon set gillnet fishery. Complete logbook data after 1993 are not available.

The estimated minimum annual mortality rate incidental to commercial fisheries (based on observer data (4) and logbook reports (rounded to 32) is 36 harbor seals, However, a reliable estimate of the mortality rate incidental to commercial fisheries is currently unavailable because of the absence of observer placements in the gillnet fisheries mentioned above. Therefore, it is unknown whether the kill rate is insignificant. At present, annual mortality levels less than 211 animals per year (i.e., 10% of PBR) can be considered insignificant and approaching zero mortality and serious injury rate.

Subsistence/Native Harvest Information

The 1992-95 subsistence harvest of harbor seals in Alaska was estimated by the Alaska Department of Fish and Game, under contract with NMFS (Wolfe and Mishler 1993, 1994, 1995.1996). In each year, data were collected through systematic interviews with hunters arid users of marine mammals in approximately 2,100 households in about 60 coastal communities within the geographic range of the harbor seal in Alaska. Interviews were conducted in 18 communities in Southeast Alaska. The statewide total subsistence take of harbor seals in 1992 was estimated at 2,888 (95% CI 2,320-3,741), with 2,535 harvested and 353 struck and lost. The total subsistence take in 1993 was estimated at 2,736 (95% CI 2,334-3,471), with 2,365 harvested and 371 struck and lost The total subsistence take in 1994 was estimated at 2,621 (95% CI 2,110-3,457), with 2,313 harvested and 308 struck and lost. The total subsistence take in 1995 was estimated at 2,742 (95% CI 2,184-3,679); with 2,499 harvested and 243 struck and lost. The majority of the seals were taken in Southeast Alaska: with 1,671 (58.3% of statewide total) taken in 1992, 1,615 (59.2%) taken in 1993, 1,500 (57.2%) taken in 1994, and 1,890 (68.9%) taken in 1995. The mean annual subsistence take from this stock of harbor seals, including struck and lost, over the 3-year period from 1993 to 1995 was 1,668 animals. The reported average age-specific kill of the harvest from the Southeast Alaska stock across the three years was 86% adults, 7% juveniles, 1% pups, and 6% of unknown age. The reported average sex-specific kill of the harvest was 49% males, 24% females, and 27% of unknown sex.

Other **Mortality**

Illegal intentional killing of harbor seals by commercial fishers, sport fishers, and others may occur, but the magnitude of this mortality is unknown (Note: the 1994 Amendments to the MMPA made intentional lethal take of any marine mammal illegal except where imminently necessary to protect human life).

STATUS OF STOCK

Harbor seals are not listed as “depleted” under the MMPA or listed as “threatened” or “endangered” under the Endangered Species Act. Based on currently available data, the estimated annual level of total human-caused mortality is 1,704 (36+1,668) harbor seals. A reliable estimate of the annual rate of mortality incidental to commercial fisheries is unavailable. Therefore, although unlikely, it is unknown if the estimated annual level of total human-caused mortality and serious injury exceeds the PBR (2,114) for this stock. Until additional information on mortality incidental to commercial fisheries becomes available, the Southeast Alaska stock of harbor seals is not classified as strategic. This classification is consistent with the recommendations of the Alaska Scientific Review Group (DeMaster 1995: pp. 14). The status of this stock relative to OSP is unknown

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Revised 8/8/97

HARBOR SEAL *(Phoca vitulina richardsi):* Gulf of Alaska Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

Harbor seals inhabit coastal and estuarine waters off Baja California, north along the western coasts of the U.S. British Columbia, and Southeast Alaska, west through the Gulf of Alaska and Aleutian Islands, and in the Bering Sea northward to Cape Newenham and the Pribilof Islands. They haul out on rocks, reefs, beaches, and drifting glacial ice, and feed in marine, estuarine, and occasionally fresh waters. Harbor seals generally are non-migratory, with local movements associated with such factors as tides, weather, season, food availability, and reproduction (Scheffer and Slipp 1944; Fisher 1952; Bigg 1969, 1981). The results of recent satellite tagging studies in Southeast Alaska, Prince William Sound, and Kodiak are also consistent with the conclusion that harbor seals are non-migratory (Frost et al. 1996, Swain et al. 1996). However, some long-distance movements of tagged animals in Alaska have been recorded (Pitcher and McAllister 1981, Frost et al. I 996).

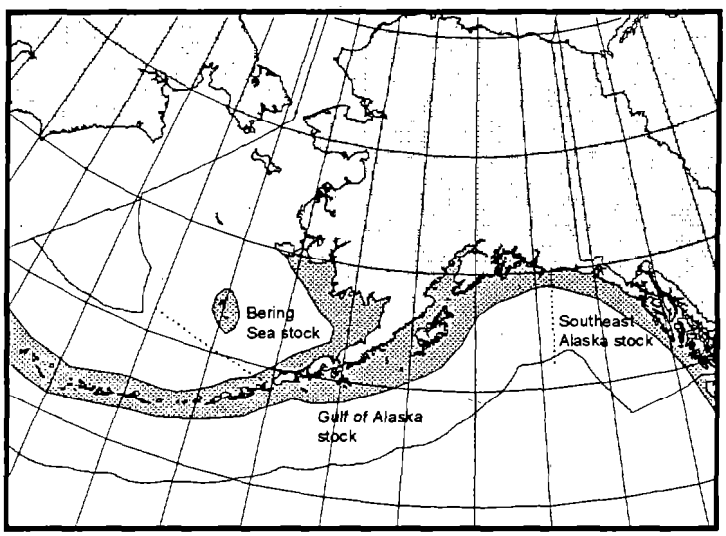

Figure 8. Approximate distribution of harbor seals in Alaska waters (shaded area).

Strong fidelity of individuals for haul out sites in June and August also has been reported, although these studies considered only limited hauling area during a relatively short period of time (Pitcher and Calkins 1979, Pitcher and McAllister 1981).

The following information was considered in classifying stock structure based on the Dizon et al. (1992) phylogeographic approach: 1) Distributional data: geographic distribution continuous, natal dispersal characteristics unknown, breeding dispersal is presumed to be very limited, year-round site fidelity observed, seasonal movements greater than 300 km rare (Harvey 1987) except in western Alaska (Hoover-Miller 1994); 2) Population response data: substantial differences in population dynamics between Southeast Alaska and the rest of Alaska, and presumed differences between Gulf of Alaska and Bering Sea (Hoover 1988, Hoover-Miller 1994, Withrow and Loughlin 1996); 3) Phenotypic data: clinical variation in body size and color phase (Shaughnessy and Fay 1977, Kelly 1981); 4) Genotypic data: undetermined for Alaska, mitochondrial DNA analyses currently underway. Preliminary genetic data indicate substantial variation in mtDNA suggesting two genetically distinct stocks may occur in Alaska, and possibly more (S. Chivers, pers. comm., Southwest Fisheries Science Center, P.O. Box 271, La Jolla, CA, 92038; Westlake et al. 1996). However, until additional samples are analyzed the Alaska Scientific Review Group (SRG) recommended using the same stock boundaries as in the draft Stock Assessment Reports for 1996 (Hill et al. 1996) and DeMaster (1995).

The Alaska SRG concluded that the scientific data available to support three distinct biological stocks (i.e., genetically isolated populations) were equivocal. However, the Alaska SRG recommended that the available data were sufficient to justify the establishment of three management units for harbor seals in Alaska (DeMaster 1996). Further, the SRG recommended that unlike the stock structure reported in Small and DeMaster (1995), animals in the Aleutian Islands should be included in the same management unit as animals in the Gulf of Alaska. As noted above, this recommendation has been adopted by NMFS with the caveat that management units and stocks are equivalent (Wade and Angliss 1996). Therefore, based primarily on the significant population decline of seals in the Gulf of Alaska, the possible decline in the Bering Sea, and the stable population in Southeast Alaska, three separate stocks are recognized in Alaska waters: 1) the Southeast Alaska stock - occurring from the Alaska/British Columbia border to Cape Suckling, Alaska (144°W), 2) the Gulf of Alaska stock - occurring from Cape Suckling to Unimak Pass, including animals throughout the Aleutian Islands, and 3) the Bering Sea stock - including all waters north of Unimak Pass (Fig. 8). Information concerning the three harbor seal

stocks recognized along the west coast of the continental U.S. can be found in the Stock Assessment Reports for the Pacific Region.

POPULATION SIZE

Extensive photographic aerial surveys of harbor seals in the Gulf of Alaska were conducted during the autumn molt in 1991 (23 August - 29 August): Prince William Sound and the Copper River Delta; in 1992 (25 August - 9 September): south side of the Alaska Peninsula, Cook Inlet, Kenai Peninsula, the Kodiak Archipelago, and Prince William Sound; and in 1994 (29 August - 8 September): Aleutian Islands (Withrow and Loughlin 1995a). All known harbor seal haulout sites in each area were surveyed, and reconnaissance surveys were flown prior to photographic surveys to establish the location of additional sites. Aerial surveys were flown within 2 hours on either side of low tide, based on the assumption that at locations affected by tides, harbor seals haul out in greatest numbers at and around the time of low tide (Pitcher and Calkins 1979, Calambokidis et al. 1987). At least four repetitive photographic counts were obtained for each major rookery and haulout site within each study area. Coefficients of variation (CV) were determined for multiple surveys and found to be <0.19 in all cases. This method of estimating abundance and its CV assumes that during the survey period no migration occurred between sites and that there was no trend in the number of animals ashore. The number of seals moving between areas was assumed to be small considering each area's large geographic size, though a small number of seals may have been counted twice or not at all.

Due to the extreme difficulty in censusing harbor seals during the 1994 Aleutian Islands survey, it is recommended that the maximum count of 3,437 be used for an abundance estimate for that region (Withrow and Loughlin 1995a). The coefficient of variation for the mean count (CV=0.059) should be used for the 1994 survey data because no CV is available for the maximum count. The total count for the 1991 and 1992 surveys was 12,232 (CV=0.030) harbor seals, with the following mean counts for the major survey areas: Copper River Delta 3,491; Prince William Sound 2,394; Kenai Peninsula 695; Cook Inlet 1,105; Kodiak Archipelago 2,422; and the south side of the Alaska Peninsula 2,125 (Loughlin 1992, Loughlin 1993). Therefore, for the Gulf of Alaska stock of harbor seals, the total combined count from the 1991, 1992 and 1994 aerial surveys was 15,669 (CV=0.028) animals.

Data collected from 36 tagged harbor seals in Southeast Alaska during 1994 resulted in a correction factor of 1.14 (CV=0.068) to account for animals in the water which are thus missed during the aerial surveys (Withrow and Loughlin 1995b). In 1995, 25 harbor seals were tagged at a sand bar haulout near Cordova, AK (note: within the Gulf of Alaska). The haulout behavior of these seals was monitored from August 12 to 23, and a correction factor of 1.50 (CV=0.047) was developed for the 1995 aerial survey in this area (Withrow and Loughlin 1996). Although much of the haulout substrate in the Gulf of Alaska area is rocky, the 1.50 CF (correction factor) from 1995 is considered to be the best available and most conservative CF for the 1991 and 1992 survey data because (Alaska SRG, see DeMaster 1996) the data used to estimate the CF were 1) collected in the survey area, 2) collected during a comparable low-tide survey window, and 3) collected more closely to the peak haul out time period (i.e., CF data collected from 12 August to 23 August versus the survey data from 23 August to 9 September). The Southeast Alaska correction factor of 1.74 was not employed for this stock because the data used to calculate the CF were 1) not collected from the Gulf of Alaska area and 2) collected to some extent after the survey period was completed (i.e., CF data from SE Alaska were collected from 1 September to 11 September). Therefore, using the Gulf of Alaska correction factor results in an abundance estimate of 23,504 (15,669 x 1.50, CV=0.056) for the Gulf of Alaska stock of harbor seals.

Minimum Population Estimate

The minimum population estimate (N_{MIN}) for this stock is calculated using Equation 1 from the PBR Guidelines (Wade and Angliss 1997): $N_{MIN} = N/\exp(0.842*[\ln(1+[CV(N)]^2)]^{1/2})$. Using the population estimate (N) of 23,504 and its associated CV of 0.056, N_{MIN} for this stock of harbor seals is 22,427.

Current Population Trend

The population trend in the Aleutian Islands is unclear because the 1994 survey was the most complete census to date for that region. Previous harbor seal counts in that area are not comparable to the 1994 data because they were conducted incidental to surveys designed to assess other species (i.e., sea otters or Steller sea lions). However, a subset of the 1994 survey in the eastern Aleutian Islands indicated a count of 1,600 in an area that had counts of approximately 1,000-2,500 seals during 1975-77 (Small 1996).

In Prince William Sound, harbor seal numbers declined by 57% from 1984 to 1992 (Pitcher 1989, Frost and Lowry 1993). The decline began before the 1989 Exxon Valdez oil spill, was greatest in the year of the spill, and may have lessened

thereafter. Between 1989 and 1995 aerial survey counts of 25 trend sites in Prince William Sound showed significant declines in the number of seals during the molt (19%) and during pupping (31%) (Frost et al. 1996).

A steady decrease in numbers of harbor seals has been reported throughout the Kodiak Archipelago since 1976. On southwestern Tugidak Island, formally one of the largest concentrations of harbor seals in the world, counts declined 85% from 1976 (6,919) to 1988 (1,014) (Pitcher 1990). More recently, the Tugidak Island count has increased from 769 in 1992 to 1,810 in 1994 (Small 1996). though still only represents a fraction of its historical size. The population around Kodiak Island, based on an aerial photographic route established in 1992, appears to be stable or slightly increasing during the 1993-1995 period (Lewis et al. 1996). Despite some positive signs of growth in certain areas, the overall Gulf of Alaska stock size remains small compared to its size in the 1970s and 1980s.

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

Reliable rates of maximum net productivity have not been estimated for the Gulf of Alaska or Bering Sea harbor seal stock. Population growth rates were estimated at 6% and 8% between 1991 and 1992 in Oregon and Washington, respectively (Huber et al. 1994). Harbor seals have been protected in British Columbia since 1970, and the population has responded with an annual rate of increase of approximately 12.5% since 1973 (Olesiuk et al. 1990). However, until additional data become available from which more reliable estimates of population growth can be determined, it is recommended that the pinniped maximum theoretical net productivity rate (R_{MAX} of 12% be employed for this stock (Wade and Angliss 1997).

POTENTIAL BIOLOGICAL REMOVAL

Under the 1994 re-authorized Marine Mammal Protection Act (MMPA), the potential biological removal (PBR) is defined as the product of the minimum population estimate, one-half the maximum theoretical net productivity rate, and a recovery factor: PBR $= N_{MIN} \times 0.5R_{MAX} \times F_R$. The recovery factor ($F_R$) for this stock is 0.5, the value for pinniped stocks with unknown status (Wade and Angliss 1997) Thus, for the Gulf of Alaska stock of harbor seals, PBR = 673 animals (22,427 x 0.06 x 0.5).

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

Fisheries Information

Three different commercial fisheries operating within the range of the Gulf of Alaska stock of harbor seals were monitored for incidental take by NMFS observers during 1990-95: Gulf of Alaska groundfish trawl, longline, and pot fisheries. For the fisheries with observed takes, the range of observer coverage over the 6-year period, as well as the annual observed and estimated mortalities are presented in Table 7. The mean annual (total) mortality rate was 1 (CV=0.63) for the Gulf of Alaska groundfish trawl fishery and was 0.2 (CV=1.0) Gulf of Alaska pot fishery. The harbor seal taken in the pot fishery in 1995 occurred during an unmonitored haul and therefore could not be used to estimate mortality for the entire fishery. Therefore, 1 mortality was used as both the observed mortality and estimated mortality in 1995 for that fishery, and should beconsidered a minimum estimate.

In the Prince William Sound salmon drift gillnet fishery, observers recorded 2 incidental mortalities of harbor seals in 1990 (Wynne et al. 1991), and 1 in 1991 (Wynne et al. 1992). The extrapolated kill estimates were 36 (95% CI 2-74) in 1990 and 12 (95% CI 1-44) in 1991, resulting in a mean kill rate of 24 (CV=0.5) animals per year for this fishery. In 1990, observers boarded 300 (57.3%) of the 524 vessels that fished in the Prince William Sound salmon drift gillnet fishery, monitoring a total of 3,166 sets, or roughly 4% of the estimated number of sets made by the fleet. In 1991, observers boarded 531 (869%) of the 611 registered vessels and monitored a total of 5,875 sets, or roughly 5% of the estimated sets made by the fleet. The estimated mortality rate of harbor seals based on the 1990 and 1991 observed mortalities for this fishery is 0.0002 kills per set Logbook reports of harbor seal mortalities due to this fishery detail 19,4,7, and 24 mortalities in 1990, 1991, 1992, and 1993, respectively. The extrapolated (estimated) mortality from the 1990-91 observer program (24 seals per year) accounts for these mortalities, so they do not appear in Table 7. Combining the estimates from the groundfish trawl and pot fisheries presented above (1+0.2=1.2) with the estimate from the Prince William Sound salmon drift gillnet fishery (24) results in an estimated annual incidental kill rate in observed fisheries of 25.2 harbor seals per year from this stock. It should be noted that in 1990, observers also boarded 59 (38.3%) of the 154 vessels participating in the Alaska Peninsula/Aleutian Island salmon drift gillnet fishery, monitoring a total of 373 sets, or roughly 4% of the estimated number of sets made by the fleet (Wynne et al. 1991). The low level of observer coverage for this fishery apparently missed

interaction with harbor seals which had occurred, as logbook mortalities were reported in 1990 (see Table 7) which were not recorded by the observer program.

An additional source of information on the number of harbor seals killed or injured incidental to commercial fishing operations is the logbook reports maintained by vessel operators as required by the MMPA interim exemption program. During the 4-year period between 1990 and 1993, logbook reports from 5 unobserved fisheries (see Table 7) resulted in an annual mean of 10.25 mortalities from interactions with commercial fishing gear. However, because logbook records are most likely negatively biased (Credle et al. 1994), these are considered to be minimum estimates. These totals are based on all available logbook reports for Gulf of Alaska fisheries, except the Prince William Sound salmon drift gillnet fishery and the Gulf of Alaska groundfish trawl and pot fisheries for which observer data were presented above. In 1990, logbook records from the Cook Inlet set and drift gillnet fisheries were combined. As a result, some of the harbor seal mortalities reported in 1990 may have occurred in the drift net fishery. Complete logbook data after 1993 are not available.

The estimated minimum annual mortality rate incidental to commercial fisheries is 36, based on observer data (25) and logbook reports (rounded up to 11) where observer data were not available. However, a reliable estimate of the mortality rate incidental to commercial fisheries is currently unavailable because of the absence of observer placements in several fisheries mentioned above. Therefore, it is unknown whether the kill rate due to commercial fishing is insignificant. At present, annual mortality levels less than 67 animals per year (i.e., 10% of PBR) can be considered insignificant and approaching zero mortality and serious injury rate.

Table 7. Summary of incidental mortality of harbor seals (Gulf of Alaska stock) due to commercial fisheries from 1990 through 1995 and calculation of the mean annual mortality rate. Mean annual mortality in brackets represents a minimum estimate from logbook reports. Data from 1991 to 1995 are used in the mortality calculation when more than 5 years of data are provided for a particular fishery.

Fishery name	Years	Data type	Range of observer coverage	Observed mortality (in given yrs.)	Estimated mortality (in given yrs.)	Mean annual mortality
Gulf of Alaska (GOA) groundfish trawl	90-95	obs data	33-55%	0, 1, 1, 0, 0, 0	0, 3, 2, 0, 0, 0	1.0 (CV=.63)
GOA finfish pot	90-95	obs data	7-13%	0, 0, 0, 0, 0, 1	0, 0, 0, 0, 0, 1	0.2 (CV=1.0)
Prince William Sound salmon drift gillnet	90-91	obs data	4-5%	2, 1	36, 12	24 (CV=.50)
Observer program total						25.2
				Reported mortalities		
Cook Inlet salmon set gillnet	90-93	logbook	n/a	6, 0, 1, 0	n/a	[≥1.75]
Prince William Sound set gillnet	90-93	logbook	n/a	0, 0, 0, 1	n/a	[≥0.25]
Kodiak salmon set gillnet	90-93	logbook	n/a	3, 0, 0, 0	n/a	[≥0.75]
AK salmon purse seine (except for Southeast)	90-93	logbook	n/a	0, 0, 0, 2	n/a	[≥0.5]
AK Peninsula/Aleutian Island salmon drift gillnet	90-93	logbook	n/a	9, 2, 12, 5	n/a	[≥7.0]
Minimum total annual mortality						≥35.45

Subsistence/Native Harvest Information

The 1992-95 subsistence harvest of harbor seals in Alaska was estimated by the Alaska Department of Fish and Game, under contract with the NMFS (Wolfe and Mishler 1993, 1994, 1995, 1996). In each year, data were collected through systematic interviews with hunters and users of marine mammals in approximately 2,100 households in about 60 coastal communities within the geographic range of the harbor seal in Alaska. Interviews were conducted in approximately

29 communities that lie within the range of the Gulf of Alaska harbor seal stock. The statewide total subsistence take of harbor seals in 1992 was estimated at 2,888 (95% CI 2,320-3,741), with 2,535 harvested and 353 struck and lost. The total subsistence take in 1993 was estimated at 2,736 (95% CI 2,334-3,471), with 2,365 harvested and 371 struck and lost. The total subsistence take in 1994 was estimated at 2,621 (95% CI 2,110-3,457), with 2,313 harvested and 308 struck and lost. The total subsistence take in 1995 was estimated at 2,742 (95% CI 2,184-3,679), with 2,499 harvested and 243 struck and lost From 1992 through 1995, the number of seals taken from the Gulf of Alaska stock was 967 (33.7% of statewide total), 914 (33.5%), 913 (34.9%), and 724 (26.4%) respectively. The mean annual subsistence take from this stock of harbor seals, including struck and lost, over the 3-year period from 1993 to 1995 was 850 animals. The reported average age-specific kill of the harvest from the Gulf of Alaska stock during the three years was 57% adults, 27% juveniles, 2% pups, and 14% of unknown age. The reported average sex-specific kill of the harvest was 45% males, 18% females, and 37% of unknown sex.

Other Mortality

Illegal intentional killing of harbor seals by commercial fishers. sport fishers, and others may occur, but the magnitude of this mortality is unknown (Note: the 1994 Amendments to the MMPA made intentional lethal take of any marine mammal illegal except where imminently necessary to protect human life).

STATUS OF STOCK

Sustainable harvest levels for this stock will be determined from the analysis of information gathered through the cooperative management process, and will reflect the degree of uncertainty associated with the information obtained for this stock. Efforts were initiated in 1995 and 1996 to develop a cooperative approach for management of this stock; however, a final agreement has not been approved to date.

Harbor seals are not listed as "depleted" under the MMPA or listed as "threatened" or "endangered" under the Endangered Species Act A reliable estimate of the annual rate of mortality incidental to commercial fisheries is unavailable. Based on currently available data, the estimated annual level of total human-caused mortality is 886 (36+850) harbor seals which exceeds the PBR (673) for this stock. However, because of 1) uncertainty regarding stock boundaries, 2) the likelihood that the cooperative management process will address the concern that this stock may be being overharvested, and 3) the likelihood that the current level of take is sustainable because the total removal of female harbor seals is less than one-half of the PBR, this stock is not classified as strategic at this time. This classification is consistent with the recommendations of the Alaska SRG (DeMaster 1997). The status of this stock relative to OSP is unknown.

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HARBOR SEAL *(Phoca vitulina richardsi):* Bering Sea Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

Harbor seals inhabit' coastal and estuarine waters off Baja California, north along the western coasts of the U. S., British Columbia, and Southeast Alaska, west through the Gulf of Alaska and Aleutian Islands, and in the Bering Sea north to Cape Newenham and the Pribilof Islands. They haul out on rocks, reefs, beaches, and drifting glacial ice, and feed in marine, estuarine, and occasionally fresh waters. Harbor seals generally are non-migratory, with local movements associated with such factors as tides, weather, season, food availability, and reproduction (Scheffer and Slipp 1944; Fisher 1952; Bigg 1969, 1981). The results of recent satellite tagging studies in Southeast Alaska, Prince William Sound, and Kodiak are also consistent with the conclusion that harbor seals are non-migratory (Frost et al. 1996, Swain et al. 1996). However, some long-distance movements of tagged animals in Alaska have been recorded (Pitcher and McAllister 1981, Frost et al. 1996). Strong fidelity of individuals for haul out sites in June and August also has been reported, although these studies considered only limited hauling area during a relatively short period of time (Pitcher and Calkins 1979, Pitcher and McAllister 1981).

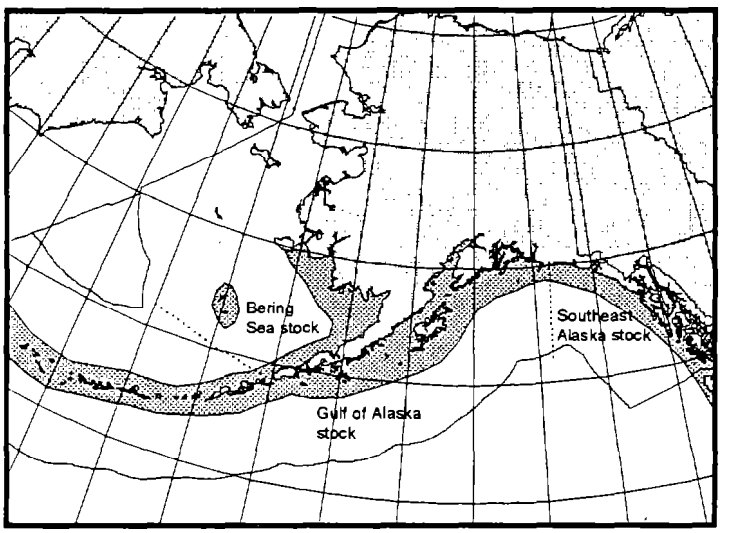

Figure 9. Approximate distribution of harbor seals in Alaska waters (shaded area).

The following information was considered in classifying stock structure based on the Dizon et al. (1992) phylogeographic approach: 1) Distributional data: geographic distribution continuous, natal dispersal characteristics unknown breeding dispersal is presumed to be very limited, year-round site fidelity observed, seasonal movements greater than 300 km rare (Harvey 1987) except in western Alaska (Hoover-Miller 1994); 2) Population response data: substantial differences in population dynamics between Southeast Alaska and the rest of Alaska, and presumed differences between Gulf of Alaska and Bering Sea (Hoover 1988, Hoover-Miller 1994, Withrow and Loughlin 1996); 3) Phenotypic data: clinical variation in body size and color phase (Shaughnessy and Fay 1977, Kelly 1981); 4) Genotypic data: undetermined for Alaska, mitochondrial DNA analyses currently underway. Preliminary genetic data indicate substantial variation in mtDNA suggesting two genetically distinct stocks may occur in Alaska, and possibly more (S. Chivers, pers. comm., Southwest Fisheries Science Center, P.O. Box 271, La Jolla, CA, 92038; Westlake et al. 1996). However, until additional samples are analyzed the Alaska Scientific Review Group (SRG) recommended using the same stock boundaries as in the draft Stock Assessment Reports for 1996 (Hill et al. 1996) and DeMaster (1995).

The Alaska SRG concluded that the scientific data available to support three distinct biological stocks (i.e., genetically isolated populations) were equivocal. However, the Alaska SRG recommended that the available data were sufficient to justify the establishment of three management units for harbor seals in Alaska (DeMaster 1996). Further, the SRG recommended that, unlike the stock structure reported in Small and DeMaster (1995), animals in the Aleutian Islands should be included in the same management unit as animals in the Gulf of Alaska. As noted above, this recommendation has been adopted by NMFS with the caveat that management units and stocks are equivalent (Wade and Angliss 1996). Therefore, based primarily on the significant population decline of seals in the Gulf of Alaska, the possible decline in the Bering Sea, and the stable population in Southeast Alaska, three separate stocks are recognized in Alaska waters: 1) the Southeast Alaska stock - occurring from the Alaska/British Columbia border to Cape Suckling, Alaska (144°W), 2) the Gulf of Alaska stock - occurring from Cape Suckling to Unimak Pass, including animals throughout the Aleutian Islands, and 3) the Bering Sea stock - including all waters north of Unimak Pass (Fig. 9). Information concerning the three harbor seal

stocks recognized along the west coast of the continental U. S. can be found in the Stock Assessment Reports for the Pacific Region.

POPULATION SIZE

Extensive photographic aerial surveys of harbor seals in the Bering Sea were conducted during the autumn molt in 1995 (28 August - 10 September), throughout northern Bristol Bay and along the north side of the Alaska Peninsula (Withrow and Loughlin 1996a). All known harbor seal haul out sites in each area were surveyed, and reconnaissance surveys were flown prior to photographic surveys to establish the location of additional sites. Aerial surveys were flown within 2 hours on either side of low tide, based on the assumption that at locations affected by tides, harbor seals haul out in greatest numbers at and around the time of low tide (Pitcher and Calkins 1979, Calambokidis et al. 1987). At least four repetitive photographic counts were obtained for each major rookery and haul out site within each study area. Coefficients of variation were determined for multiple surveys and found to be <0.19 in all cases. This method of estimating abundance and its CV assumes that during the survey period no migration occurred between sites and that there was no trend in the number of animals ashore. The number of seals moving between areas was assumed to be small considering each area's large geographic size, though a small number of seals may have been counted twice or not at all.

The total mean count for the 1995 surveys was 8,740 (CV=0.040) harbor seals, with mean counts of 955 (CV=.071) for northern Bristol Bay and 7,785 (CV=.044) for the north side of the Alaska Peninsula (Withrow and Loughlin 1996a). A correction factor based on data from animals from this stock is currently unavailable. A tagging experiment conducted from 17 to 23 August 1995 collected data from 25 harbor seals using a sand bar haul out near Cordova, Alaska (within the Gulf of Alaska), resulted in a correction factor of 1.50 (CV=0.047) to account for animals in the water which are thus missed during the aerial surveys (Withrow and Loughlin 1996b). This correction factor was used for the Bering Sea stock due to the similarity in haul out habitat type (sand bar) to a majority of harbor seal haul out sites found in the Bering Sea. Further, this CF was considered conservative by the Alaska SRG (DeMaster 1996) because the timing of the aerial survey was later than the timing of the CF study and it is likely that the fraction of seals hauled out during the surveys was smaller. Multiplying these aerial survey counts by the correction factor results in and estimated abundance of 13,110 (8,740 x 1.50; CV=0.062) harbor seals.

In 1995, daily land counts of harbor seals were conducted on Otter Island (one of the Pribilof Islands) from July 2 through August 8. The maximum count during this study was 202 seals (Withrow and Loughlin 1996a). Adding this count to the corrected estimated abundance from the aerial surveys results in an estimated abundance of 13,312 (13,110+202) harbor seals for the Bering Sea stock.

Minimum Population Estimate

The minimum population estimate (N_{MIN}) for this stock is calculated using Equation 1 from the PBR Guidelines (Wade and Angliss 1997): $N_{MIN} = N/\exp(0.842*[\ln(1+[CV(N)]^2)]^{½})$. Using the population estimate (N) of 13,110 from the aerial surveys and the associated CV of 0.062, results in an estimate of 12,446 harbor seals. Adding the maximum count of 202 seals from the Otter Island survey results in an N_{MIN} of 12,648 for the Bering Sea harbor seal stock.

Current Population Trend

The number of harbor seals in the Bering Sea stock is thought to be declining (Alaska SRG, see DeMaster 1996); however, published data to support this conclusion are unavailable. Specifically, in 1974 there were 1,175 seals reported on Otter Island. The maximum count in 1995 (202 seals) represents an 83% decline (Withrow and Loughlin 1996a). However, as noted by the Alaska SRG (DeMaster 1996). the reason(s) for this decline is(are) confounded by the recolonization of Otter Island by northern fur seals since 1974, which has caused a loss of available habitat for harbor seals. Further, counts of harbor seals on the north side of the Alaska Peninsula in 1995 were less than 42% of the 1975 counts, representing a decline of 3.5% per year. The number of harbor seals in northern Bristol Bay are also lower, but have remained stable since 1990 (Withrow and Loughlin 1996a).

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

Reliable rates of maximum net productivity have not been estimated for the Gulf of Alaska or Bering Sea stock of harbor seal. Population growth rates were estimated at 6% and 8% between 1991 and 1992 in Oregon and Washington, respectively (Huber et al. 1994). Harbor seals have been protected in British Columbia since 1970, and the population has responded with an annual rate of increase of approximately 12.5% since 1973 (Olesiuk et al. 1990). However, until additional data become available from which more reliable estimates of population growth can be determined, it is

recommended that the pinniped maximum theoretical net productivity rate (R_{MAX}) of 12% be employed for this stock (Wade and Angliss 1997).

POTENTIAL BIOLOGICAL REMOVAL

Under the 1994 re-authorized Marine Mammal Protection Act (MMPA), the potential biological removal (PBR) is defined as the product of the minimum population estimate, one-half the maximum theoretical net productivity rate, and a recovery factor: PBR = N_{MIN} x $0.5R_{MAX}$ x F_R. The recovery factor (F_R) for this stock is 0.5, the value for pinniped stocks with unknown population status (Wade and Angliss 1997). Thus, for the Bering Sea harbor seal stock, PBR = 379 animals (12,648 x 0.06 x 0.5).

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

Fisheries Information

Three different commercial fisheries operating within the range of the Bering Sea stock of harbor seals were monitored for incidental take by NMFS observers during 1990-95: Bering Sea (and Aleutian Islands) groundfish trawl, longline, and pot fisheries. Harbor seal mortality was observed in all three fisheries at low levels. The range of observer coverage over the 6-year period, as well as the annual observed and estimated mortalities are presented in Table 8. The mean annual (total) mortality rate was 1.2 (CV=0.54) for the Bering Sea groundfish trawl fishery, 0.6 (CV=l.0) for the Bering Sea longline fishery, and 1.2 (CV=.81) for the Bering Sea pot fishery. The harbor seal taken in the pot fishery in 1992 occurred during an unmonitored haul and therefore could not be used to estimate mortality for the entire fishery. Therefore, 1 mortality was used as both the observed mortality and estimated mortality in 1992 for that fishery, and should be considered a minimurn estimate. Combining the estimates from the Bering Sea groundfish trawl, longline, and pot fisheries presented above (1.2+0.6+1.2=3.6) results in an estimated annual incidental kill rate in observed fisheries of 3.6 harbor seals per year from the Bering Sea stock.

Table 8. Summary of incidental mortality of harbor seals (Bering Sea stock) due to commercial fisheries from 1990 through 1995 and calculation of the mean annual mortality rate. Mean annual mortality in brackets represents a minimum estimate from logbook reports. Data from 1991 to 1995 are used in the mortality calculation when more than 5 years of data are provided for a particular fishery.

Fishery name	Years	Data type	Range of observer coverage	Observed mortality (in given yrs.)	Estimated mortality (in given yrs.)	Mean annual mortality
Bering Sea/Aleutian Is. (BSA) groundfish trawl	90-95	obs data	53-74%	1, 1, 2, 0, 3, 0	1, 1, 3, 0, 5, 0	1.8 (CV=.54)
BSA groundfish longline (incl. misc finfish and sablefish fisheries)	90-95	obs data	27-80%	0, 0, 0, 1, 0, 0	0, 0, 0, 3, 0, 0	0.6 (CV=1.0)
BSA finfish pot	90-95	obs data	20-43%	0, 0, 1, 0, 0, 1	0, 0, 1, 0, 0, 5	1.2 (CV=.81)
Observer program total						3.6
				Reported mortalities		
Bristol Bay salmon drift gillnet	90-93	logbook	n/a	38, 23, 2, 42	n/a	[≥26.25]
Bristol Bay salmon set gillnet	90-93	logbook	n/a	0, 0, 1, 1	n/a	[≥0.5]
Minimum total annual mortality						≥30.35

An additional source of information on the number of harbor seals killed or injured incidental to commercial fishing operations is the logbook reports maintained by vessel operators as required by the MMPA interim exemption program, During the 4-year period between 1990 and 1993; logbook reports from the Bristol Bay salmon drift and set gillnet fisheries

(see Table 8) resulted in an annual mean of 26.75 mortalities from interactions with commercial fishing gear. However, because logbook records are most likely negatively biased (Credle et al. 1994), these are considered to be minimum estimates. These totals are based on all available logbook reports for Bering Sea fisheries, except the groundfish trawl, longline and pot fisheries for which observer data were presented above. In 1990, logbook records from the Bristol Bay set and drift gillnet fisheries were combined. As a result, some of the harbor seal mortalities reported in 1990 may have occurred in the set net fishery. Complete logbook data after 1993 are not available.

The estimated minimum annual mortality rate incidental to commercial fisheries is 31, based on observer data (4) and logbook reports (27) where observer data were not available: However, a reliable estimate of the mortality rate incidental to commercial fisheries is currently unavailable because of the absence of observer placements in the gillnet fisheries mentioned above. Therefore, it is unknown whether the kill rate due to commercial fishing is insignificant. At present, annual mortality levels less than 38 animals per year (i.e.. 10% of PBR) can be considered insignificant and approaching zero mortality and serious injury rate.

Subsistence/Native Harvest Information

The 1992-95 subsistence harvest of harbor seals in Alaska was estimated by the Alaska Department of Fish and Game, under contract with the NMFS (Wolfe and Mishler 1993, 1994, 1995, 1996). In each year, data were collected through systematic interviews with hunters and users of marine mammals in approximately 2,100 households in about 60 coastal communities within the geographic range of the harbor seal in Alaska. Interviews were conducted in approximately 14 communities that he within the range of the Bering Sea harbor seal stock. The statewide total subsistence take of harbor seals in 1992 was estimated at 2,888 (95% CI 2,320-3,741) with 2,535 harvested and 353 struck and lost. The total subsistence take in 1993 was estimated at 2,736 (95% CI 2,334-3,471), with 2,365 harvested and 371 struck and lost. The total subsistence take in 1994 was estimated at 2,621 (95% CI 2,110-3,457), with 2,313 harvested and 308 struck and lost. The total subsistence take in 1995 was estimated at 2,742 (95% CI 2,184-3,679) with 2,499 harvested and 243 struck and lost. From 1992 through 1995, the number of seals taken from the Bering Sea stock was 229 (8.0% of statewide total), 199 (7.3%), 208 (7.9%). and 127 (4.6%) respectively. The mean annual subsistence take from this stock of harbor seals, including struck and lost, over the 3-year period from 1993 to 1995 was 178, animals.. The reported average age-specific kill of the harvest from the Bering Sea stock during the three years was 72% adults, 15% juveniles, 3% pups, and 10% of unknown age. The reported average sex-specific kill of the harvest was 26% males, 7% females, and 67% of unknown sex.

Other Mortality

Illegal intentional killing of harbor seals by commercial fishers, sport fishers, and others may occur, but the magnitude of this mortality is unknown (Note: the 1994 Amendments to the MMPA made intentional lethal take of any marine mammal illegal except where imminently necessary to protect human life).

STATUS OF STOCK

Harbor seals are not listed as “depleted” under the MMPA or listed as “threatened” or “endangered” under the Endangered Species Act. Based on the best scientific information available, the estimated level of human-caused mortality and serious injury (31 + 178=209) is not known to exceed the PBR (379). Therefore, the Bering Sea stock of harbor seals is not classified as a strategic stock. The status of this stock relative to OSP is unknown.

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Revised 8/8/97

SPOTTED SEAL *(Phoca largha):* Alaska Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

Spotted seals are distributed along the continental shelf of the Beaufort, Chukchi, Bering, and Okhotsk Seas south to the northern Yellow Sea and western Sea of Japan (Shaughnessy and Fay 1977, Fig. 10). Little is known of their winter distribution and migration routes, although satellite tagging studies on a small number of animals in Alaska have been completed. These studies indicate that spotted seals migrate south from the Chukchi Sea utilizing haul outs in both Russia and Alaska and overwinter in the Bering Sea along the ice edge (Lowry et al. 1994). During spring they inhabit mainly the southern margin of the ice, with movement to coastal habitats after the retreat of the sea ice (Fay 1974, Shaughnessy and Fay 1977). In summer, spotted seals may be found as far north as 69-72°N in the Chukchi and Beaufort Seas (Porsild 1945, Shaughnessy and Fay 1977). To the south, along the west coast of Alaska, spotted seals are known to occur around the Pribilof Islands, Bristol Bay, and the eastern Aleutian Islands. Of 8 known breeding areas, 3 occur in the Bering Sea, with the remaining 5 in the Okhotsk Sea and Sea of Japan. There is little morphological difference between seals from these areas. Spotted seals are closely related to and often mistaken for North Pacific harbor seals ***(Phoca vitulina).*** The two species are often seen together and are partially sympatric, as their ranges overlap in the southern part of the Bering Sea (Quakenbush 1988). Yet, spotted seals breed earlier and are less social during the breeding season, and only spotted seals are regularly associated with pack ice (Shaughnessy and Fay 1977). These and other ecological, behavioral, and morphological differences support their recognition as two separate species (Quakenbush 1988).

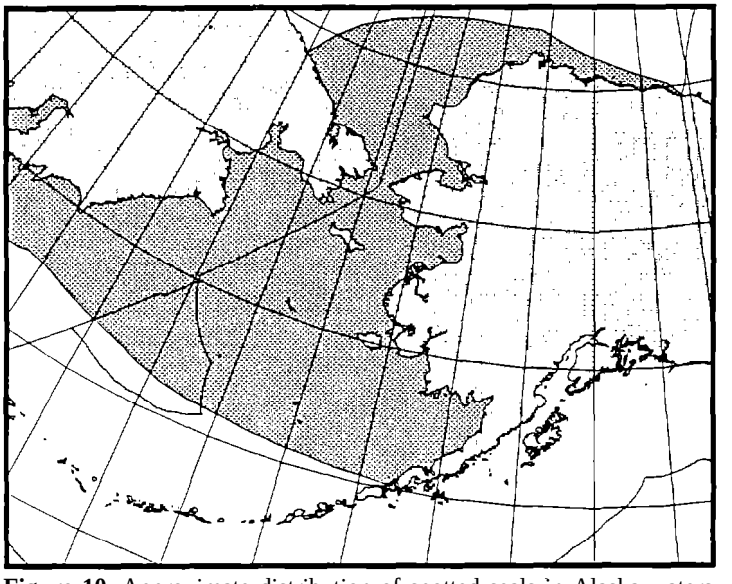

Figure 10. Approximate distribution of spotted seals in Alaska waters (shaded area).

The following information was considered in classifying stock structure based on the Dizon et al. (1992) phylogeographic approach: 1) Distributional data: geographic distribution continuous; 2) Population response data: unknown; 3) Phenotypic data: unknown; 4) Genotypic data: unknown. Based on this limited information, and the absence of any significant fishery interactions, there is currently no strong evidence to suggest splitting the distribution of spotted seals into more than one stock. Therefore, only the Alaska stock is recognized in U.S. waters.

POPULATION SIZE

A reliable estimate of spotted seal population abundance is currently not available (Rugh et al. 1995). However, early estimates of the world population were in the range of 335,000-450,000 animals (Bums 1973). The population of the Bering Sea, including Russian waters, was estimated to be 200,000-250,000 based on the distribution of family groups on ice during the mating season (Burns 1973). Fedoseev (1971) estimated 168,000 seals in the Okhotsk Sea. Aerial surveys were flown in 1992 and 1993 to examine the distribution and abundance of spotted seals in Alaska. In 1992, survey methods were tested and distributional studies were conducted over the Bering Sea pack ice in spring and along the western Alaska coast during summer (Rugh et al. 1993). In 1993, the survey effort concentrated on known haul out sites in summer (Rugh et al. 1994). The sum of maximum counts of hauled out animals were 4,145 and 2,951 in 1992 and 1993, respectively. Using mean counts from days with the highest estimates for all sites visited in either 1992 or 1993, there were 3,570 seals seen, of which 3,356 (CV=0.06) were hauled out (Rugh et al. 1995).

Studies to determine a correction factor for the number of spotted seals at sea missed during surveys have been initiated but only preliminary results are currently available. The Alaska Department of Fish and Game placed satellite radio transmitters on 4 spotted seals in Kasegaluk Lagoon to estimate the ratio of time hauled out vs. time at sea. Preliminary results indicate that the proportion hauled out averages about 6.8% (CV=0.85) (Lowry et al. 1994b). Using this correction factor with the maximum count of 4,145 from 1992 results in an estimate of 59,214. However, the estimate must be considered equivocal because it resulted from a survey which covered only the eastern portion of the spotted seal's geographic range and may have included harbor seals. In addition, the correction factor data have not been stratified by season, tide, and time of day.

Minimum Population Estimate

A reliable minimum population estimate (N_{MIN} for this stock can not presently be determined because current reliable estimates of abundance are not available.

Current Population Trend

Frost et al. (1993) report that counts of spotted seals have been relatively stable at Kasegaluk Lagoon since the late 1970s. As this represents only a fraction of the stock's range, reliable data on trends in population abundance for the Alaska stock of spotted seals are considered unavailable.

An element of concern is the potential for Arctic climate change, which will probably affect high northern latitudes more than elsewhere. There is evidence that over the last 10-15 years, there has been a shift in regional weather patterns in the Arctic region (Tynan and DeMaster 1996). Ice-associated seals, such as the spotted seal, are particularly sensitive to changes in weather and sea-surface temperature in that these strongly affect their ice habitats. There are insufficient data to make reliable predictions of the effects of Arctic climate change on the Alaska spotted seal stock.

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

A reliable estimate of the maximum net productivity rate is currently unavailable for the Alaska stock of spotted seals. Hence, until additional data become available, it is recommended that the pinniped maximum theoretical net productivity rate (R_{MAX} of 12% be employed for this stock (Wade and Angliss 1997).

POTENTIAL BIOLOGICAL REMOVAL

Under the 1994 re-authorized Marine Mammal Protection Act (MMPA), the potential biological removal (PBR) is defined as the product of the minimum population estimate, one-half the maximum theoretical net productivity rate, and a recovery factor: PBR = $N_{MIN} \times 0.5R_{MAX} \times F_R$. The recovery factor ($F_R$) for this stock is 0.5, the value for pinniped stocks with unknown population status (Wade and Angliss 1997). However, because a reliable estimate of N_{MIN} is-currently not available, the PBR for this stock is unknown,

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS **INJURY**

Fisheries Information

Three different commercial fisheries operating within the range of the Alaska stock of spotted seals were monitored for incidental take by NMFS observers during 1990-95: Bering Sea (and Aleutian Islands) groundfish trawl, longline, and pot fisheries. Observers did not report any mortality or serious injury of spotted seals incidental to these groundfish fisheries.

An additional source of information on the number of spotted seals killed or injured incidental to commercial fishing operations is the logbook reports maintained by vessel operators as required by the MMPA interim exemption program. During the 4-year period between 1990 and 1993, logbook reports from the Bristol Bay salmon drift gillnet and set gillnet fisheries (see Table 9) resulted in an annual mean of 1.5 mortalities from interactions with commercial fishing gear. However, because logbook records are most likely negatively biased (Credle et al. 1994), these are considered to be minimum estimates. These totals are based on all available logbook reports for Alaska fisheries through 1993. In 1990, logbook records from the Bristol Bay set and drift gillnet fisheries were combined. As a result, some of the spotted seal mortalities repotted in 1990 may have occurred in the set net fishery. Complete logbook data after 1993 are not available.

The estimated minimum mortality rate incidental to commercial fisheries is 2 animals per year (rounded from 1.5), based solely upon logbook data. Yet, it should be noted that most interactions with these fisheries are likely to be harbor seals rather than spotted seals, and that due to the difficulty of distinguishing between spotted and harbor seals, the reliability of such logbook data is questionable. Further, no observers have been assigned the Bristol Bay fisheries that are known to

interact with this stock making the estimated mortality unreliable. Because the PBR for this stock is unknown, it is currently not possible to determine what annual mortality level is considered to be insignificant and approaching zero mortality and serious injury rate However, if there were 50,000 spotted seals the PBR would equal 1,500 (50,000 x 0.06 x 0.5 = 1,500), and annual mortality levels less than 150 animals (i.e., 10% of PBR) would be considered insignificant. Currently, there is no reason to believe there are less than 50,000 spotted seals in U.S. waters.

Table 9. Summary of incidental mortality of spotted seals (Alaska stock) due to commercial fisheries from 1990 through 1995 and calculation of the mean annual mortality rate. Mean annual mortality in brackets represents a minimum estimate from logbook reports.

Fishery name	Years	Data type	Range of observer coverage	Reported mortality (in given yrs.)	Estimated mortality (in given yrs.)	Mean annual mortality
Observer program total	90-95					0
Bristol Bay salmon drift gillnet	90-93	logbook	n/a	5, 1, 0, 0	n/a	[≥1.5]
Minimum total annual mortality						≥1.5

Subsistence/Native Harvest Information

Spotted seals are an important species for Alaskan subsistence hunters, primarily in the Bering Strait and Yukon-Kuskokwim regions, with estimated annual harvests ranging from 850 to 3,600 seals (averaging about 2,400 annually) taken during 1966-76 (Lowry 1984). From September 1985 to June 1986 the combined harvest from five Alaska villages was 986 (Quakenbush 1988). In a study designed to assess the subsistence harvest of harbor seals and Steller sea lions in Alaska, Wolfe and Mishler (1993, 1994, 1995, 1996) estimated subsistence takes of spotted seals in the northern part of Bristol Bay. The spotted seal take (including struck and lost) was estimated to be 437 in 1992, 265 in 1993, 270 in 1994, and 197 in 1995. Variance estimates for these values are not available. The mean annual subsistence take of spotted seals in this region during the 3-year period from 1993 to 1995 was 244 animals. Reliable information on subsistence harvests from the remainder of Alaska during the 1993-95 period are not available. Therefore, 244 is considered an underestimate for the statewide total of the annual subsistence take.

STATUS OF STOCK

Spotted seals are not listed as "depleted' under the MMPA or listed as "threatened" or "endangered" under the Endangered Species Act. Reliable estimates of the minimum population, PBR, and human-caused mortality and serious injury are currently not available. However, due to a lack of information suggesting subsistence hunting is adversely affecting this stock and because of the minimal interactions between spotted seals and any U.S. fishery, the Alaska stock of spotted seals is not classified as a strategic stock. This classification is consistent with the recommendations of the Alaska Scientific Review Group (DeMaster 1995: pp. 26).

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BEARDED SEAL *(Erignathus barbatus):* Alaska Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

Bearded seals are circumpolar in their distribution, extending from the Arctic Ocean (85°N) south to Hokkaido (45°N) in the western Pacific. They generally inhabit areas of shallow water (less than 200 m) that are at least seasonally ice covered. During winter they are most common in broken pack ice (Burns 1967) and in some areas also inhabit shorefast ice (Smith and Hammill 1981). In Alaska waters, bearded seals are distributed over the continental shelves of the Bering, Chukchi, and Beaufort Seas (Ognev 1935, Johnson et al. 1966, Burns 1981, Fig. 11). Bearded seals are evidently most concentrated from January to April over the northern part of the Bering Sea shelf (Burns 1981, Braham et al. 1984). Many of the seals that winter in the Bering Sea migrate north through the Bering Strait from late April through June, and spend the summer along the ice edge in the Chukchi Sea (Burns 1967, Burns 1981). The overall summer distribution is quite broad, with seals rarely hauled out on land, and some seals do not migrate but remain in open-water areas of the Bering and Chukchi Seas (Bums 1981, Nelson 1981, Smith and Hammill 1981), An unknown proportion of the population migrates southward from the Chukchi Sea in late fall and winter, and Burns (1967) noted a movement of bearded seals away from shore during that season as well.

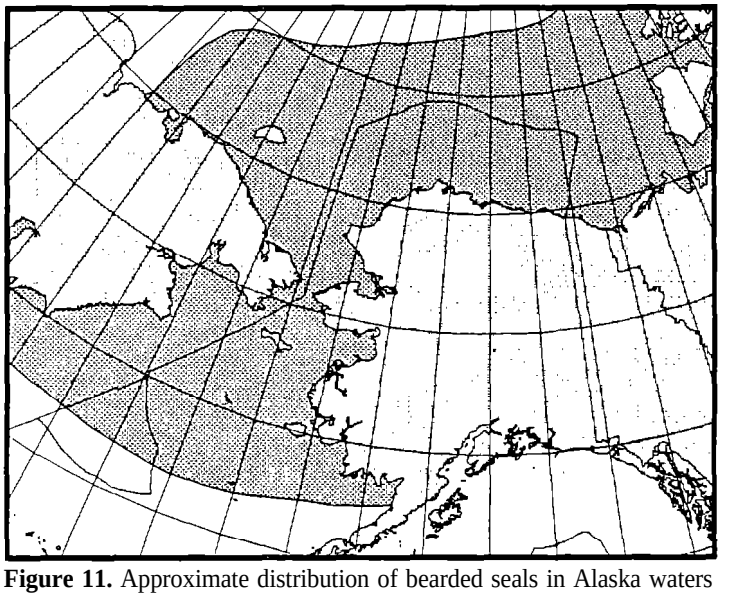

Figure 11. Approximate distribution of bearded seals in Alaska waters (shaded area). The combined summer and winter distributions are depicted.

The following information was considered in classifying stock structure based on the Dizon et al. (1992) phylogeographic approach: 1) Distributional data: geographic distribution continuous, 2) Population response data: unknown; 3) Phenotypic data: unknown; 4) Genotypic data: unknown. Based on this limited information, and the absence of any significant fishery interactions, there is currently no strong evidence to suggest splitting the distribution of bearded seals into more than one stock. Therefore, only the Alaska stock is recognized in U.S. waters.

POPULATION SIZE

Early estimates of the Bering-Chukchi Sea population range from 250,000 to 300,000 (Popov 1976, Burns 1981). Until additional surveys are conducted reliable estimates of abundance for the Alaska stock of bearded seals are considered unavailable.

Minimum Population Estimate

A reliable minimum population estimate (N_{MIN}) for this stock can not presently be determined because current reliable estimates of abundance are not available.

Current Population Trend

At present, reliable data on trends in population abundance for the Alaska stock of bearded seals are unavailable, though there is no evidence that population levels are declining.

An element of concern is the potential for Arctic climate change, which will probably affect high northern latitudes more than elsewhere. There is evidence that over the last 10-15 years, there has been a shift in regional weather patterns in the Arctic region (Tynan and DeMaster 1996). Ice-associated seals, such as the bearded seal, are particularly sensitive

to changes in weather and sea-surface temperatures in that these strongly affect their ice habitats. There are insufficient data to make reliable predictions of the effects of Arctic climate change on the Alaska bearded seal stock.

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

A reliable estimate of the maximum net productivity rate is currently unavailable for the Alaska stock of bearded seals. Hence, until additional data become available, it is recommended that the pinniped maximum theoretical net productivity rate (R_{MAX}) of 12% be employed for this stock (Wade and Angliss 1997).

POTENTIAL BIOLOGICAL REMOVAL

Under the 1994 re-authorized Marine Mammal Protection Act (MMPA), the potential biological removal (PBR) is defined as the product of the minimum population estimate, one-half the maximum theoretical net productivity rate, and a recovery factor: $PBR = N_{MIN} \times 0.5R_{MAX} \times F_R$. The recovery factor ($F_R$) for this stock is 0.5, the value for pinniped stocks with unknown population status (Wade and Angliss 1997). However, because a reliable estimate of minimum abundance N_{MIN} is currently not available, the PBR for this stock is unknown.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

Fisheries Information

Three different commercial fisheries operating within the range of the Alaska stock of bearded seals were monitored for incidental take by NMFS observers during 1990-95: Bering Sea (and Aleutian Islands) groundfish trawl, longline, and pot fisheries, The only fishery for which incidental kill was observed was the Bering Sea groundfish trawl fishery, with 3 mortalities reported in 1991 and 4 mortalities reported in 1994. These mortalities resulted in a mean annual (total) mortality rate of 2 (CV=0.63) bearded seals per year. The range of observer coverage over the 5-year period, as well as the annual observed and estimated mortalities are presented in Table IO. It should be noted that one of the 1991 observed kills was later identified as a juvenile elephant seal (K. Wynne, pers. comm, Univ. AK, 900 Trident Way, Kodiak, AK 99615). Further, only 1 mortality was reported during monitored hauls in 1994, which extrapolated to 2 mortalities for the entire fishery. Because NMFS observers recorded 3 additional bearded seal mortalities in unmonitored hauls, the estimated mortality in 1994 (2 seals) was known to be an underestimate. Accordingly, 4 was used as both the observed and estimated mortality for 1994 (Table 10).

An additional source of information on the number of bearded seals killed or injured incidental to commercial fishing operations is the logbook reports maintained by vessel operators as required by the MMPA interim exemption program. During the 4-year period between 1990 and 1993, the only logbook reports for bearded seals detailed 14 mortalities and 31 injuries in the Bristol Bay salmon drift gillnet fishery in 1991. These reports are suspect because it is highly unlikely that bearded seals would have been in the Bristol Bay vicinity during the summer salmon fishing months. These logbook mortalities have not been included in Table 10. However, because logbook records are most likely negatively biased (Credle et al. 1994), the absence of mortality reports does not assure bearded seal mortality did not occur. These logbook totals (0 animals) are based on all available logbook reports for Alaska fisheries through 1993. Complete logbook data after 1993 are not available.

Table 10. Summary of incidental mortality of bearded seals (Alaska stock) due to commercial fisheries from 1990 through 1995 and calculation of the mean annual mortality rate. Data from 1991 to 1995 are used in the mortality calculation when lore than 5 years of data are provided for a particular fishery.

Fishery name	Years	Data type	Range of observer coverage	Observed mortality (in given yrs.)	Estimated mortality (in given yrs.)	Mean annual mortality
Bering Sea/Aleutian Is. (BSA) groundfish trawl	90-95	obs data	53-74%	0, 3, 0, 0, 4, 0	0, 6, 0, 0, 4, 0	2 (CV=.63)
Observer program total						2
Total estimated annual mortality						2

The estimated minimum mortality rate incidental to commercial fisheries is 2 bearded seals per year, based exclusively on observer data. Because the PBR for this stock is unknown, it is currently not possible to determine what annual mortality level is insignificant and approaching zero mortality and serious injury rate. However, if there were 50,000 bearded seals the PBR would equal 1,500 (50,000 x 0.06 x 0.5 = 1,500) and annual mortality levels less than 150 animals (i.e., 10% of PBR) would be considered insignificant. Currently, there is no reason to believe there are less than 50,000 bearded seals in U. S. waters.

Subsistence/Native Harvest Information

Bearded seals are an important species for Alaska subsistence hunters, with estimated annual harvests of 1,784 (SD=941) from 1966 to 1977 (Burns 1981). Between August 1985 and June 1986, 791 bearded seals were harvested in five villages in the Bering Strait region based on reports from the Alaska Eskimo Walrus Commission (Kelly 1988). A reliable estimate of the annual number of bearded seals currently taken by Alaska Natives for subsistence is unavailable.

STATUS OF STOCK

Bearded seals are not listed as "depleted" under the MMPA or listed as "threatened" or "endangered" under the Endangered Species Act. Reliable estimates of the minimum population, PBR, and human-caused mortality and serious injury are currently not available. Due to a lack of information suggesting subsistence hunting is adversely affecting this stock and because of the minimal interactions between bearded seals and any U S. fishery, the Alaska stock of bearded seals is not classified as a strategic stock. This classification is consistent with the recommendations of the Alaska Scientific Review Group (DeMaster 1995: pp. 26).

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RINGED SEAL *(Phoca hispida):* Alaska Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

Ringed seals have a circumpolar distribution from approximately 35°N to the North Pole, occurring in all seas of the Arctic Ocean (King 1983). In the eastern North Pacific, they are found in the southern Bering Sea and range as far south as the Seas of Okhotsk and Japan. Throughout their range, ringed seals have an affinity for ice-covered waters and are well adapted to occupying seasonal and permanent ice. They remain in contact with ice most of the year and pup on the ice in late winter-early spring. Ringed seals are found throughout the Beaufort, Chukchi, and Bering Seas, as far south as Bristol Bay in years of extensive ice coverage (Fig. 12). During late April through June, ringed seals are distributed throughout their range from the southern ice edge northward (Burns and Harbo 1972, Burns et al. 1981, Braham et al. 1984). The overall winter distribution is probably similar, and it is believed there is a net movement of seals northward with the ice edge in late spring and summer (Burns 1970). Thus, ringed seals occupying the Bering and southern Chukchi Seas in winter apparently are migratory, but details of their movements are unknown, The seasonal migrations of seals wintering in the northern Chukchi and Beaufort Seas presumably are less extensive.

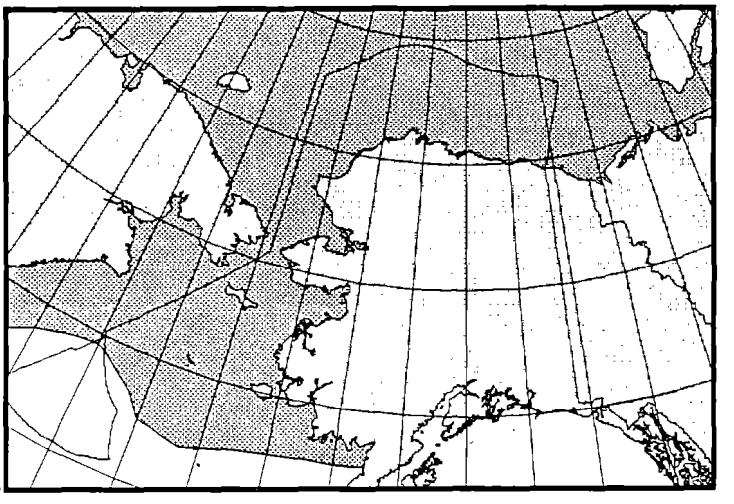

Figure 12. Approximate distribution of ringed seals in Alaska waters (shaded area). The combined summer and winter distribution is depicted.

The following information was considered in classifying stock structure based on the Dizon et al. (1992) phylogeographic approach: 1) Distributional data: geographic distribution continuous, 2) Population response data: unknown; 3) Phenotypic data: unknown; 4) Genotypic data: unknown Based on this limited information, and the absence of any significant fishery interactions, there is currently no strong evidence to suggest splitting the distribution of ringed seals into more than one stock. Therefore, only the Alaska ringed seal stock is recognized in U. S. waters.

POPULATION SIZE

A reliable abundance estimate for the Alaska stock of ringed seals is currently not available. Crude estimates of the world population have ranged from 2.3 to 7 million, with 1 to 1.5 million in Alaska waters (Kelly 1988). The most recent abundance estimates of ringed seals are based on aerial surveys conducted in 1985, 1986, and 1987 by Frost et al. (1988). Survey effort was directed towards shorefast ice, though some areas of adjacent pack ice were also surveyed, in the Chukchi and Beaufort Seas from southern Kotzbue Sound north and east to the U. S. - Canada border. The abundance estimate from 1987 was 44,360±9,130 (95% CI). However, this estimate represents only a portion of the geographic range of the stock; as many ringed seals occur in the pack ice and along the coast of Russia.

Minimum Population Estimate

A reliable minimum population estimate N_{MIN} for this stock can not presently be determined because current reliable estimates of abundance are not available.

Current Population Trend

At present, reliable data on trends in population abundance for the Alaska stock of ringed seals are unavailable, though there is no evidence population levels are declining.

An element of concern is the potential for Arctic climate change, which will probably affect high northern latitudes more than elsewhere. There is evidence that over the last 10-15 years, there has been a shift in regional weather patterns in the Arctic region Tynan and DeMaster 1996). Ice-associated seals, such as the ringed seal, are particularly sensitive to changes in weather and sea-surface temperatures in that these strongly affect their ice habitats. There are insufficient data to make reliable predictions of the effects of Arctic climate change on the Alaska ringed seal stock.

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

A reliable estimate of the maximum net productivity rate is currently unavailable for the Alaska stock of ringed seals. Hence, until additional data become available, it is recommended that the pinniped maximum theoretical net productivity rate (R_{MAX}) of 12% be employed for this stock (Wade and Angliss 1997).

POTENTIAL BIOLOGICAL REMOVAL

Under the 1994 re-authorized Marine Mammal Protection Act (MMPA), the potential biological removal (PBR) is defined as the product of the minimum population estimate, one-half the maximum theoretical net productivity rate, and a recovery factor: $PBR = N_{MIN} \times 0.5R_{MAX}, \times F_R$. The recovery factor ($F_R$) for this stock is 0.5, the value for pinniped stocks with unknown population status (Wade and Angliss 1997). However, because a reliable estimate of minimum abundance N_{MIN} is currently not available, the PBR for this stock is unknown.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

Fisheries Information

Three different commercial fisheries operating within the range of the Alaska stock of ringed seals were monitored for incidental take by NMFS observers during 1990-95: Bering Sea (and Aleutian Islands) groundfish trawl, longline, and pot fisheries. The only fishery for which incidental kill was observed was the Bering Sea groundfish trawl fishery, with 2 mortalities reported in 1992. These mortalities resulted in a mean annual (total) mortality rate of .6(CV=1.0) ringed seals per year. The range of observer coverage over the 6-year period, as well as the annual observed and estimated mortalities are presented in Table 11.

An additional source of information on the number of ringed seals killed or injured incidental to commercial fishing operations is the logbook reports maintained by vessel operators as required by the MMPA interim exemption program. During the 4-year period between 1990 and 1993, logbook reports from all Alaska fisheries indicated no mortalities of ringed seals. Complete logbook data after 1993 are not available.

Table 11. Summary of incidental mortality of ringed seals (Alaska stock) due to commercial fisheries from 1990 through 1995 and calculation of the mean annual mortality rate. Data from 1991 to 1995 are used in the mortality calculation when more than 5 years of data are provided for a particular fishery.

Fishery name	Years	Data type	Range of observer coverage	Observed mortality (in given yrs.)	Estimated morality (in given yrs.)	Mean annual mortality
Bering Sea/Aleutian Is. (BSA) groundfish trawl	90-95	obs data	53-74%	0, 0, 2, 0, 0, 0	0, 0, 3, 0, 0, 0	0.6 (CV=1.0)
Total estimated annual mortality						0.6

The estimated minimum average mortality rate incidental to commercial fisheries is 1 ringed seal per year (rounded up from 0.6), based exclusively on observer data. Because the PBR for this stock is unknown, it is currently not possible to determine what annual mortality level considered to be insignificant and approaching zero mortality and serious injury rate. However, if there were 50,000 ringed seals the PBR would equal 1,500 (50,000 x 0.06 x 0.5 = 1,500) and annual mortality levels less than 150 animals (i.e., 10% of PBR) would be considered insignificant. Currently, there is no reason to believe there are less than 50,000 ringed seals in U. S. waters.

Subsistence/Native Harvest Information

Ringed seals are an important species for Alaska Native subsistence hunters. The annual subsistence harvest in Alaska dropped from 7,000 to 15,000 in the period from 1962 to 1972 to an estimated 2,000-3,000 in 1979 (Frost unpubl.

report). Based on data from two villages on St. Lawrence Island, the annual take in Alaska during the mid-1980s likely exceeded 3,000 seals (Kelly 1988). A reliable estimate of the annual number of ringed seals currently taken by Alaska Natives for subsistence is unavailable.

STATUS OF STOCK

Ringed seals are not listed as "depleted" under the MMPA or listed as "threatened" or "endangered" under the Endangered Species Act. Reliable estimates of the minimum population, PBR, and human-caused mortality and serious injury are currently not available. Due to a lack of information suggesting subsistence hunting is adversely affecting this stock and because of the minimal interactions between ringed seals and any U. S. fishery, the Alaska stock of ringed seals is not classified as a strategic stock. This classification is consistent with the recommendations of the Alaska Scientific Review Group (DeMaster 1995: pp. 26).

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Revised 8/8/97

RIBBON SEAL *(Phoca fasciata):* Alaska Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

Ribbon seals inhabit the North Pacific Ocean and adjacent fringes of the Arctic Ocean, In Alaska waters, ribbon seals are found in the open sea, on the pack ice, and only rarely on shorefast ice (Kelly 1988). They range northward from Bristol Bay in the Bering Sea into the Chukchi and western Beaufort Seas (Fig. 13). From late March to early May, ribbon seals inhabit the Bering Sea ice front (Burns 1970, Burns 1981, Braham et al. 1984). They are most abundant in the northern part of the ice front in the central and western parts of the Bering Sea (Bums 1970, Burns et al. 1981). As the ice recedes in May to mid-July the seals move farther to the north in the Bering Sea, where they haul out on the. receding ice edge and remnant ice (Burns 1970, Burns 1981, Burns et al. 1981). There has been little agreement on the range of ribbon seals during the rest of the year Recent sightings and a review of the literature suggest that many ribbon seals migrate into the Chukchi Sea for the summer (Kelly 1988).

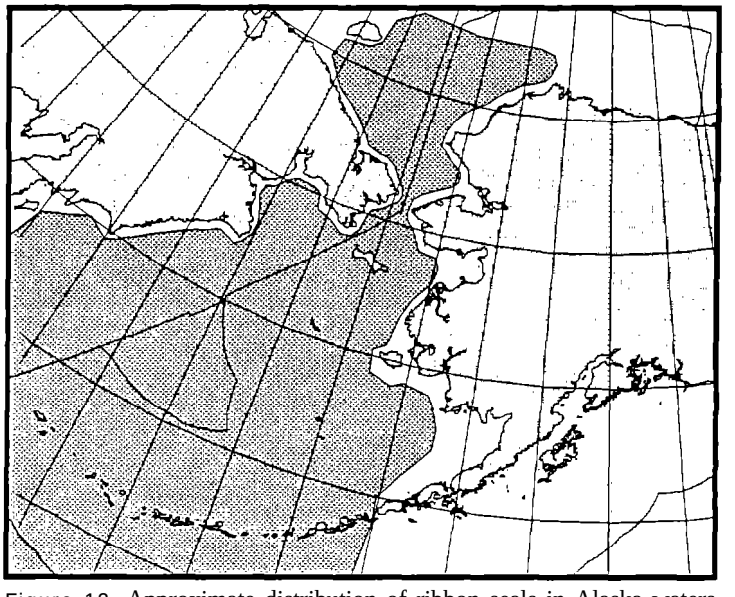

Figure 13. Approximate distribution of ribbon seals in Alaska waters (shaded area). The combined summer and winter distribution is

The following information was depicted. considered in classifying stock structure based on the Dizon et al. (1992) phylogeographic approach: 1) Distributional data: geographic distribution continuous, 2) Population response data: unknown 3) Phenotypic data: unknown; 4) Genotypic data: unknown. Based on this limited information, and the absence of any significant fishery interactions, there is currently no strong evidence to suggest splitting the distribution of ribbon seals into more than one stock. Therefore, only the Alaska stock of ribbon seal is recognized in U.S. waters.

POPULATION SIZE

A reliable abundance estimate for the Alaska stock of ribbon seals is currently not available. Burns (1981) estimated the worldwide population of ribbon seals at 240,000 in the mid- 1970s with an estimate for the Bering Sea at 90,000- 100,000.

Minimum Population Estimate

A reliable minimum population estimate (N_{MIN}) for this stock can not presently be determined because current reliable estimates of abundance are not available.

Current Population Trend

At present, reliable data on trends in population abundance for the Alaska stock of ribbon seals are unavailable, though there is no evidence population levels are declining,

An element of concern is the potential for Arctic climate change, which will probably affect high northern latitudes more than elsewhere. There is evidence that over the last 10-15 years, there has been a shift in regional weather patterns in the Arctic region (Tynan and DeMaster 1996). Ice-associated seals, such as the ribbon seal, are particularly sensitive to changes in weather and sea-surface temperatures in that these strongly affect their ice habitats. There are insufficient data to make reliable predictions of the effects of Arctic climate change on the Alaska ribbon seal stock.

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

A reliable estimate of the maximum net productivity rate is currently unavailable for the Alaska stock of ribbon seals. Hence, until additional data become available, it is recommended that the pinniped maximum theoretical net productivity rate (R_{MAX}) of 12% be employed for this stock (Wade and Angliss 1997).

POTENTIAL BIOLOGICAL REMOVAL

Under the 1994 re-authorized Marine Mammal Protection Act (MMPA), the potential biological removal (PBR) is defined as the product of the minimum population estimate, one-half the maximum theoretical net productivity rate, and a recovery factor: PBR = N_{MIN} x $0.5R_{MAX}$, x F_R. The recovery factor (F_R) for this stock is 0.5, the value for pinniped stocks with unknown population status (Wade and Angliss 1997). However, because a reliable estimate of minimum abundance N_{MIN} is currently not available, the PBR for this stock is unknown.

ANNUALHUMAN-CAUSED MORTALITY AND SERIOUS INJURY

Fisheries Information

Three different commercial fisheries operating within the range of the Alaska stock of ribbon seals were monitored for incidental take by NMFS observers during 1990-95: Bering Sea (and Aleutian Islands) groundfish trawl, longline, and pot fisheries. The only fishery for which incidental kill was observed was the Bering Sea groundfish trawl fishery, with 1 mortality reported both in 1990 and 1991. Averaging the estimated mortalities over the 1991-95 period results in a mean annual (total) mortality rate of 0.2 (CV=1.0) ribbon seals per year. The range of observer coverage over the 6-year period, as well as the annual observed and estimated mortalities are presented in Table 12.

An additional source of information on the number of ribbon seals killed or injured incidental to commercial fishing operations is the logbook reports maintained by vessel operators as required by the MMPA interim exemption program. During the 4-year period between 1990 and 1993, logbook reports from all Alaska fisheries indicated no mortalities of ribbon seals. Complete logbook data after 1993 are not available.

Table 12. Summary of incidental mortality of ribbon seals (Alaska stock) due to commercial fisheries from 1990 through 1995 and calculation of the mean annual mortality rate. Data from 1991 to 1995 are used in the mortality calculation when more than 5 years of data are provided for a particular fishery.

Fishery name	Years	Data type	Range of observer coverage	Observed mortality (in given yrs.)	Estimated mortality (in given yrs.)	Mean annual mortality
Bering Sea/Aleutian Is. (BSA) groundfish trawl	90-95	obs data	53-74%	1, 1, 0, 0, 0, 0	1, 1, 0, 0, 0, 0	0.2 (CV=1.0)
Total estimated annual mortality						0.2

The estimated minimum mortality rate incidental to commercial fisheries is I ribbon seal per year (rounded up from 0.2), based exclusively on observer data Because the PBR for this stock is unknown, it is currently not possible to determine what annual mortality level is considered to be insignificant and approaching zero mortality and serious injury rate, However, if there were 50,000 ribbon seals the PBR would equal 1,500 (50,000 x 0.06 x 0.5 = 1,500), and annual mortality levels less than 150 animals (i.e., 10% of PBR) would be considered insignificant. Currently, there is no reason to believe there are less than 50,000 ribbon seals in U.S. waters.

Subsistence/Native Harvest Information

Ribbon seals are an important species for Alaska Native subsistence hunters, primarily from villages in the vicinity of the Bering Strait and to a lesser extent at villages along the Chukchi Sea coast (Kelly 1988). The annual subsistence harvest was estimated to be less than 100 seals annually from 1968 to 1980 (Burns 1981). In the mid-1980s the Alaska Eskimo Walrus Commission estimated the subsistence take to still be less than 100 seals annually (Kelly 1988). A reliable estimate of the annual number of ribbon seals currently taken by Alaska Natives for subsistence is unavailable.

STATUS OF STOCK

Ribbon seals are not listed as "depleted' under the MMPA or listed as "threatened' or "endangered" under the Endangered Species Act. Reliable estimates of the minimum population, PBR, and human-caused mortality and serious injury are currently not available. Due to a lack of information suggesting subsistence hunting is adversely affecting this stock and because of the minimal interactions between ribbon seals and any U. S. fishery, the Alaska stock of ribbon seals is not classified as a strategic stock. This classification is consistent with the recommendations of the Alaska Scientific Review Group (DeMaster 1995: pp. 26).

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BELUGA WHALE *(Delphinapterus leucas):* Beaufort Sea Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

Beluga whales are distributed throughout seasonally ice-covered arctic and subarctic waters of the Northern Hemisphere (Gurevich 1980), and are closely associated with open leads and polynyas in ice-covered regions (Hazard 1988). Depending on season and region, beluga whales may occur in both offshore and coastal waters, with concentrations in Cook Inlet, Bristol Bay, Norton Sound, Kasegaluk Lagoon, and the Mackenzie Delta (Hazard 1988). It is assumed that most beluga whales from these summering areas overwinter in the Bering Sea, excluding those found in the northern Gulf of Alaska (Shelden 1994). Seasonal distribution is affected by ice cover, tidal conditions, access to prey, temperature, and human interaction (Lowry 1985). During the winter, beluga whales occur in offshore waters associated with pack ice, In the spring, they migrate to warmer coastal estuaries, bays, and rivers for molting (Finley 1982) and calving (Sergeant and Brodie 1969). Annual migrations may cover thousands of kilometers (Reeves 1990).

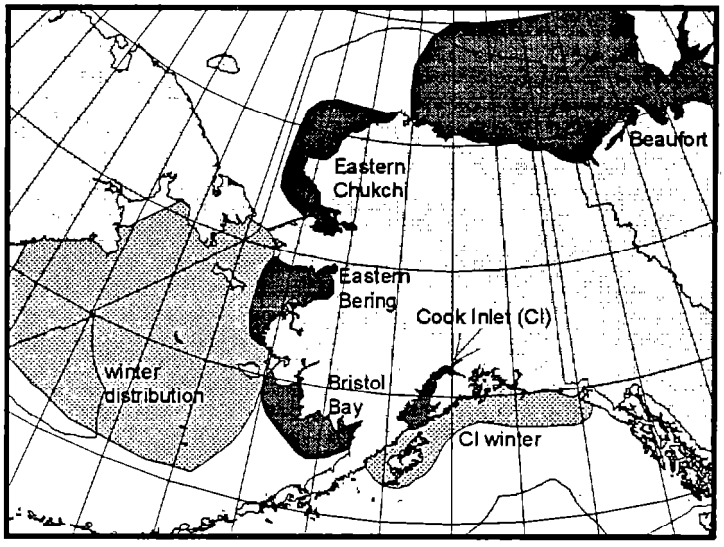

Figure 14. Approximate distribution of beluga whales in Alaska waters. The dark shading displays the summer distributions of the five stocks. Winter distributions are depicted with lighter shading.

The following information was considered in classifying beluga whale stock structure based on the Dizon et al. (1992) phylogeographic approach: 1) Distributional data: geographic distribution discontinuous in summer (Frost and Lowry 1990), distribution unknown outside of summer; 2) Population response data: possible extirpation of local populations; distinct population trends between regions occupied in summer, 3) Phenotypic data: unknown; and 4) Genotypic data: preliminary mitochondrial DNA analyses indicate distinct differences among summering areas (G. O'Corry-Crowe, unpubl. data, Southwest Fisheries Science Center, P.O. Box 271, La Jolla, CA 92038). Based on this information, 5 stocks of beluga whales are recognized within U. S. waters: 1) Cook Inlet, 2) Bristol Bay, 3) Eastern Bering Sea, 4) Eastern Chukchi Sea, and 5) Beaufort Sea (Fig. 14).

POPULATION SIZE,--

The sources of information to estimate abundance for belugas in the waters of northern Alaska and western Canada have included both opportunistic and systematic observations. Duval (1993) reported an estimate of 21,000 for the Beaufort Sea stock, similar to that reported by Seaman et al. (1985). The most recent aerial survey was conducted in July of 1992, when stock size was estimated to include 19,629 (CV=0.229) beluga whales (Harwood et al. 1996). To account for availability bias a correction factor of 2, which was not data-based, has been recommended for the Beaufort Sea beluga whale stock (Duval 1993). resulting in a population estimate of 39,258 (19,629 x 2) animals. A CV for the correction factor is not available; however, this correction factor was considered negatively biased by the Alaska SRG considering that CFs for this species typically range between 2.5 and 3.27 (Frost and Lowry 1995).

Minimum Population Estimate

For the Beaufort Sea stock of beluga whales, the minimum population estimate (N_{MIN}) is calculated according to Equation 1 from the PBR Guidelines (Wade and Angliss 1997). Thus, $N_{MIN} = N/\exp(0.842*[\ln(1+[CV(N)]^2)]^{½})$. Using the population estimate (N) of 39,258 and an associated CV of 0.229, N_{MIN} for this stock is 32,453.

Current Population Trend

The Beaufort Sea stock of beluga whales is considered to be stable or increasing (DeMaster 1995: pp. 16).

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

A reliable estimate of the maximum net productivity rate is currently unavailable for the Beaufort Sea stock of beluga whales. Hence, until additional data become available, it is recommended that the cetacean maximum theoretical net productivity rate (R_{MAX} of 4% be employed for this stock (Wade and Angliss 1997).

POTENTIAL BIOLOGICAL REMOVAL

Under the 1994 t-e-authorized Marine Mammal Protection Act (MMPA), the potential biological removal (PBR) is defined as the product of the minimum population estimate, one-half the maximum theoretical net productivity rate, and a recovery factor: $PBR = N_{MIN} \times 0.5R_{MAX} \times F_R$ As this stock is stable or increasing (DeMaster 1995: pp. 16), the recovery factor (F_R) for this stock is 1.0 (Wade and Angliss 1997). Thus, for the Beaufort Sea stock of beluga whales, PBR = 649 animals (32,453 x 0.02 x 1.0).

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

Fisheries Information

The total fishery mortality and serious injury for this stock is estimated to be zero as there are no reports of mortality incidental to commercial fisheries in recent years, The estimated annual mortality rate incidental to commercial fisheries (0) is not known to exceed 10% of the PBR (65) and, therefore, is considered to be insignificant and approaching zero mortality and serious injury rate.

Subsistence/Native Harvest Information

The subsistence take of beluga whales within U. S. waters of the Beaufort Sea is reported by the Alaska Beluga Whale Committee (ABWC), who reported that the number of whales harvested annually for subsistence has averaged approximately 50 during the 5-year period from 1990 to 1994 (Frost and Suydam 1995). The 1995 harvest report for this stock is not available. Estimates from the Canadian harvest for this stock over the same 5-year period from 1990 to 1994 have averaged 110 whales per year (DeMaster 1995, pp. 15). Thus, the mean estimated subsistence take for the Beaufort Sea beluga stock is 160 (50+110). This estimate is based on household surveys and on-site harvest monitoring, but is negatively biased because it has not been corrected for hunters that did not respond, and does not account for animals which are struck and lost. There is not a reliable estimate for the percent struck and lost from this stock.

In the draft stock assessment reports (Hill et al. 1996) subsistence mortality was averaged over the most recent 3-year period for which data were available. This was an attempt to incorporate interannual variability, while still recognizing that mortality rates have declined in recent years. However, based on a request from the ABWC, human-related removals have been averaged over the last 5 years for which data are available for all beluga whale stocks, except the Cook Inlet stock. This request was due to the large amount of interannual variability in harvest levels in most areas (letter from ABWC to Alaska SRG, 20 December 1996).

STATUS OF STOCK

Beluga whales are not listed as "depleted" under the MMPA or listed as "threatened" or "endangered" under the Endangered Species Act. Based on currently available data, the level of human-caused mortality and serious injury (160) is not known to exceed the PBR (649). Therefore, the Beaufort Sea stock of beluga whales is not classified as a strategic stock. The population size is considered stable or increasing, however, at this time it is not possible to assess the status of this stock relative to OSP.

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BELUGA WHALE *(Delphinapterus leucas):* Eastern Chukchi Sea Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

Beluga whales are distributed throughout seasonally ice-covered arctic and subarctic waters of the Northern Hemisphere (Gurevich 1980), and are closely associated with open leads and polynyas in ice-covered regions (Hazard 1988). Depending on season and region, beluga whales may occur in both offshore and coastal waters, with concentrations in Cook Inlet, Bristol Bay, Norton Sound, Kasegaluk Lagoon, and the Mackenzie Delta (Hazard 1988). It is assumed that most beluga whales from these summering areas overwinter in the Bering Sea, excluding those found in the northern Gulf of Alaska (Shelden 1994). Seasonal distribution is affected by ice cover, tidal conditions, access to prey, temperature, and human interaction (Lowry 1985). During the winter, beluga whales occur in offshore waters associated with pack ice. In the spring, they migrate to warmer coastal estuaries, bays, and rivers for molting (Finley 1982) and calving (Sergeant and Brodie 1969). Annual migrations may cover thousands of kilometers (Reeves 1990).

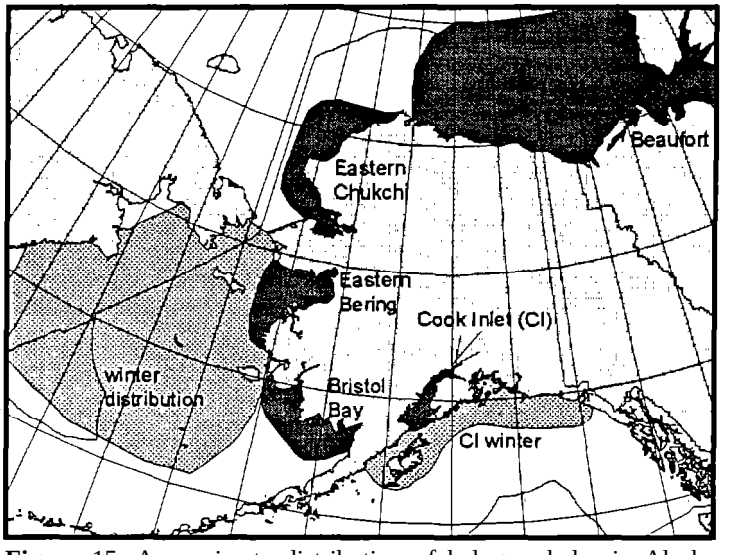

Figure 15. Approximate distribution of beluga whales in Alaska waters. The dark shading displays the summer distributions of the five stocks. Winter distributions are depicted with lighter shading.

The following information was considered in classifying beluga whale stock structure based on the Dizon et al. (1992) phylogeographic approach: 1) Distributional data: geographic distribution discontinuous in summer (Frost and Lowry 1990), distribution unknown outside of summer; 2) Population response data: possible extirpation of local populations; distinct population trends between regions occupied in summer, 3) Phenotypic data: unknown; and 4) Genotypic data: preliminary mitochondrial DNA analyses indicate distinct differences among summering areas (G. O'Corry-Crowe, unpubl. data Southwest Fisheries Science Center, P.O. Box 271, La Jolla, CA 92038). Based on this information, 5 stocks of beluga whales are recognized within U.S. waters: 1) Cook Inlet, 2) Bristol Bay, 3) Eastern Bering Sea, 4) Eastern Chukchi Sea, and 5) Beaufort Sea (Fig. 15).

POPULATION SIZE

Frost et al. (1993) estimated the minimum size of the eastern Chukchi stock of belugas at 1,200, based on counts of animals from aerial surveys conducted during 1989-91. Survey effort was concentrated on the 170 km long Kasegaluk Lagoon, an area known to be regularly used by belugas during the open-water season. Other areas that belugas from this stock are known to frequent (e.g., Kotzebue Sound) were not surveyed. Therefore, the survey effort resulted in a minimum count. If this count is corrected for the proportion of animals that were diving using radio telemetry data and thus not visible at the surface (2.62, Frost and Lowry 1995) and for the proportion of newborns and yearlings not observed due to small size and dark coloration (1.18; Brodie 1971), the total corrected abundance estimate for the eastern Chukchi stock is 3,710 (1,200 x 2.62 x 1.18).

Minimum Population Estimate

The survey technique utilized for estimating the abundance of beluga whales is a direct count which incorporates correction factors. Although CVs of the correction factors are not available, the Alaska Scientific Review Group concluded that the population estimate of 3.710 can serve as an estimate of minimum population size because the survey did not include areas where beluga are known to occur (Small and DeMaster 1995). That is, if the distribution of beluga whales in the

eastern Chukchi Sea is similar to the distribution of beluga whales in the Beaufort Sea, which is likely, then a substantial fraction of the population remains in offshore waters during the survey period (DeMaster 1997).

Current Population Trend

The most recent raw counts (1,200 animals) of beluga whales in this area are similar to counts of 1,104 and 1,601 conducted in the same area during the summer of 1979 (Frost et al. 1993). Based on these data, there is no evidence that the Eastern Chukchi Sea stock of beluga whales is declining in spite of a history of subsistence takes.

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

A reliable estimate of the maximum net productivity rate is currently unavailable for this stock of beluga whales. Hence, until additional data become available, it is recommended that the cetacean maximum theoretical net productivity rate (R_{MAX}) of 4% be employed for this stock (Wade and Angliss 1997).

POTENTIAL BIOLOGICAL REMOVAL

Under the 1994 re-authorized Marine Mammal Protection Act (MMPA), the potential biological removal (PBR) is defined as the product of the minimum population estimate, one-half the maximum theoretical net productivity rate, and a recovery factor: $PBR = N_{MIN} \times 0.5R_{MAX} \times F_R$. This stock is considered relatively stable and not declining in the presence of known take, thus the recovery factor (F_R) for this stock is 1.0 (DeMaster 1995: pp. 17, Wade and Angliss 1997). For the Eastern Chukchi Sea stock of beluga whales, PBR = 74 animals (3,710 x 0.02 x 1.0).

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

Fisheries Information

Three different commercial fisheries that could have interacted with beluga whales from this stock were monitored for incidental take by NMFS observers during 1990-95: Bering Sea (and Aleutian Islands) groundfish trawl, longline, and pot fisheries. Observers did not report any mortality or serious injury of beluga whales incidental to these groundfish fisheries. An additional source of information on the number of beluga whales killed or injured incidental to commercial fishery operations is the logbook reports maintained by vessel operators required by the MMPA interim exemption program During the 4-year period between 1990 and 1993, logbook reports, where observer data were not available, did not include any mortality to beluga whales from this stock. Complete logbook data after 1993 are not available.

In the near shore waters of the Eastern Chukchi Sea, substantial effort occurs in gillnet (mostly set nets), and personal-use fisheries. Although a potential source of mortality, there have been no reported takes of beluga whales as a result of these fisheries.

The estimated minimum annual mortality rate incidental to commercial fisheries (0) is not known to exceed 10% of the PBR (7) and, therefore, is considered to be insignificant and approaching zero mortality and serious injury rate.

Subsistence/Native Harvest Information

The subsistence take of beluga whales from the eastern Chukchi Sea stock is provided by the ABWC, who reported that the number of whales harvested for subsistence has averaged approximately 54 whales annually during the 5-year period from 1991 to 1995 (Frost and Suydam 1995, ABWC unpubl. data, ABWC, P.O. Box 69, Barrow, AK, 99723). This estimate is based on household surveys and on-site harvest monitoring, but is negatively biased because there is not a reliable estimate for the percent struck and lost. The 1995 subsistence take of 43 animals includes 6 whales which were reported as struck and lost (ABWC unpubl. data, ABWC, P.O. Box 69, Barrow, AK, 99723).

In the draft stock assessment reports (Hill et al. 1996) subsistence mortality was averaged over the most recent 3-year period for which data were available. This was an attempt to incorporate interannual variability, while still recognizing that mortality rates have declined in recent years. However, based on a request from the ABWC, human-related removals have been averaged over the last 5 years for which data are available for all beluga whale stocks, except the Cook Inlet stock. This request was due to the large amount of interannual variability in harvest levels in most areas (letter from ABWC to Alaska SRG, 20 December 1996).

STATUS OF STOCK

Beluga whales are not listed as “depleted” under the MMPA or listed as “threatened” or “endangered” under the Endangered Species Act. Based on currently available data the estimated annual rate of human-caused mortality and serious

injury (54) is not known to exceed the PBR (74). Therefore, the Eastern Chukchi Sea stock of beluga whales is not classifed as a strategic stock. The population size is considered stable, however, at this time it is not possible to assess the status of this stock relative to OSP.

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BELUGA WHALE *(Delphinapterus leucas):* Eastern Bering Sea Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

Beluga whales are distributed throughout seasonally ice-covered arctic and subarctic waters of the Northern Hemisphere (Gurevich 1980), and are closely associated with open leads and polynyas in ice-covered regions (Hazard 1988). Depending on season and region, beluga whales may occur in both offshore and coastal waters, with concentrations in Cook Inlet, Bristol Bay, Norton Sound, Kasegaluk Lagoon. and the Mackenzie Delta (Hazard 1988). It is assumed that most beluga whales from these summering areas overwinter in the Bering Sea, excluding those found in the northern Gulf of Alaska (Shelden 1994). Seasonal distribution is affected by ice cover, tidal conditions, access to prey, temperature, and human interaction (Lowry 1985). During the winter, beluga whales occur in offshore waters associated with pack ice. In the spring, they migrate to warmer coastal estuaries, bays, and rivers for molting (Finley 1982) and calving (Sergeant and Brodie 1969). Annual migrations may cover thousands of kilometers (Reeves 1990).

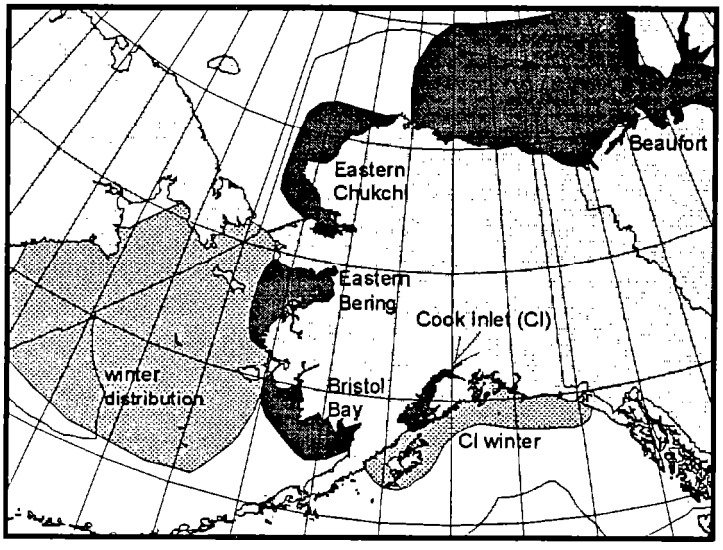

Figure 16. Approximate distribution of beluga whales in Alaska waters. The dark shading displays the summer distributions of the live stocks, Winter distributions are depicted with lighter shading.

The following information was considered in classifying beluga whale stock structure based on the Dizon et al. (1992) phylogeographic approach: 1) Distributional data: geographic distribution discontinuous in summer (Frost and Lowry 1990), distribution unknown outside of summer; 2) Population response data: possible extirpation of local populations; distinct population trends between regions occupied in summer, 3) Phenotypic data: unknown; and 4) Genotypic data: preliminary mitochondrial DNA analyses indicate distinct differences among summering areas (G. O'Corry-Crowe, unpubl. data, Southwest Fisheries Science Center, P.O. Box 271, La Jolla, CA 92038). Based on this information, 5 stocks of beluga whales are recognized within U.S. waters: 1) Cook Inlet, 2) Bristol Bay, 3) Eastern Bering Sea, 4) Eastern Chukchi Sea, and 5) Beaufort Sea (Fig. 16).

POPULATION SIZE

DeMaster et al (1994) estimated the minimum abundance (e.g., uncorrected for probability of sighting) of belugas from aerial surveys over Norton Sound in 1992, 1993, and 1994 at 2,095,620, and 695, respectively (see also Lowry et al. 1995). The variation between years was due, in part, to variability in the timing of the migration and movement of animals into the Sound. As a result the 1993 and 1994 estimates were considered to be negatively biased. Due to the disparity of estimates, the Norton Sound aerial surveys were repeated in June of 1995 leading to the highest abundance estimate of any year, but not significantly different than in 1992. An aerial survey conducted June 22 of 1995 resulted in an uncorrected estimate of 2,583 beluga whales (Lowry and DeMaster 1996). It should be noted that a slightly higher estimate (2,666) occurred during the 1995 survey over three day period from June 6-8. The single day estimate of (2,583), instead of the 3-day estimate was used to minimize the potential for double counting of whales. Correction factors recommended from studies of belugas range from 2.5 to 3.27 (Frost and Lowry 1995). For Norton Sound, the correction factor of 2.62 (CV[CF] not available) is recommended for the proportion of animals that were diving and thus not visible at the surface (based on methods of Frost and Lowry 1995), given the particular altitude and speed of the survey aircraft. If this correction factor is applied to the June 22 estimate of 2,583 (CV=0.26) along with the additional correction factor for the proportion of

newborns and yearlings not observed due to their small size and dark coloration (1.18; Brodie 1971), the total corrected abundance estimate for the Eastern Bering Sea stock is 7,986 (2,583 x 2.62 x 1.18) beluga whales.

Minimum Population Estimate

For the Eastern Bering Sea stock of beluga whales, the minimum population estimate (N_{MIN}) is calculated according to Equation 1 from the PBR Guidelines (Wade and Angliss I 997). Thus, $N_{MIN} = N/\exp(0.842*[\ln(1+[CV(N)]^2)]^{½})$. Using the population estimate (N) of 7,986 and an associated CV of 0.26, N_{MIN} for this stock is 6,439 beluga whales. A CV(N) that incorporates variance due to all of the correction factors is currently not available. However, the Alaska Scientific Review Group (SRG) considers the CV derived from the abundance estimate (CV=0.26) as adequate in calculating a minimum population estimate (DeMaster 1996, 1997; see discussion of N_{MIN} for the Eastern Chukchi stock of beluga whales). Due to foggy conditions encountered during the 1995 surveys, it was not possible to survey the entire Norton Sound area occupied by belugas during a continuous time period. As a result, the 1995 abundance estimate is-considered to be conservative (Lowry and DeMaster 1996).

Current Population Trend

Surveys to estimate population abundance in Norton Sound were not conducted prior to 1992. However, between 1992 and 1995, survey data indicate that the population is less likely to be declining than it is to be stable or increasing.

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

A reliable estimate of the maximum net productivity rate is currently unavailable for the Eastern Bering Sea stock of beluga whales Hence, until additional data become available, it is recommended that the cetacean maximum theoretical net productivity rate (R_{MAX} of 4% be employed for this stock (Wade and Angliss 1997).

POTENTIAL BIOLOGICAL REMOVAL

Under the 1994 re-authorized Marine Mammal Protection Act (MMPA), the potential biological removal (PBR) is defined as the product of the minimum population estimate, one-half the maximum theoretical net productivity rate, and a recovery factor: $PBR = N_{MIN} \times 0.5R_{MAX} \times F_R$. The recovery factor ($F_R$ for this stock is 1.0, the value for cetacean stocks that are thought to be stable in the presence of a subsistence harvest (Wade and Angliss 1997). The Alaska SRG recommended using a F_R of 1.0 for this stock as the Alaska Beluga Whale Committee (ABWC) intends to continue regular surveys (i.e., 3-5 years) to estimate abundance for this stock and to annually monitor levels of subsistence harvest (DeMaster 1997). For the Eastern Bering Sea stock of beluga whales, PBR = 129 animals (6,439 x 0.02 x 1.0).

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

Fisheries Information

Three different commercial fisheries that could have interacted with beluga whales in the Eastern Bering Sea were monitored for incidental take by NMFS observers during 1990-95: Bering Sea (and Aleutian Islands) groundfish trawl, longline, and pot fisheries, Observers did not report any mortality or serious injury of beluga whales incidental to these groundfish fisheries. An additional source of information on the number of beluga whales killed or injured incidental to commercial fishery operations is the logbook reports maintained by vessel operators as required by the MMPA interim exemption program. During the 4-year period from 1990 to 1993, logbook reports, where observer data were not available, did not include any mortality or injury to beluga whales from this stock. Complete logbook data after 1993 are not available.

In the near shore waters of the Eastern Bering Sea, substantial effort occurs in gillnet (mostly set nets), herring, and personal-use fisheries. Although a potential source of mortality, there have been no reported takes of beluga whales as a result of these fisheries.

The estimated minimum annual mortality rate incidental to commercial fisheries (0) is not known to exceed 10% of the PBR (16) and, therefore, is considered to be insignificant and approaching zero mortality and serious injury rate.

Subsistence/Native Harvest Information

The subsistence take of beluga whales from the Eastern Bering Sea stock is provided by the ABWC, who reported that the number of whales harvested for subsistence during the period from 1991 through 1994 was 209, 94, 136 and 122 whales, respectively (Frost and Suydam 1995). These estimates are based on household surveys and on-site harvest monitoring but are negatively biased because they have not been corrected for hunters that did not respond, and there is not

a reliable estimate for the percent struck and lost. In 1995, the ABWC reported 56 whales taken from the stock, including 6 animals which were struck and lost. The harvest report from one Yukon Delta village in 1995 is unknown, but based on historical information is expected to be approximately 8 (Frost 1996), making the estimated harvest from the stock 64 (56+8) whales. However, the 1995 data did not include harvest information from the Kuskokwim region, an area averaging approximately 10 whales annually from 1990 to 1994 (Frost and Suydam 1995). Assuming the Kuskohwim subsistence take was similar to previous years, the best estimate for the 1995 take from the Eastern Bering Sea stock is 74 (64+10) whales. Thus, during the 5-year period from 1991 to 1995 the average subsistence take is approximately 127 whales. As mentioned above, this estimate is negatively biased, furthermore, an unknown proportion of the animals harvested each year by Native hunters in this region may belong to other beluga stocks migrating through Norton Sound in both the fall and spring (DeMaster 1995: pp. 4).

In the draft stock assessment reports (Hill et al. 1996). subsistence mortality was averaged over the most recent 3-year period for which data were available. This was an attempt to incorporate interannual variability, while still recognizing that mortality rates have declined in recent years. However, based on a request from the ABWC, human-related removals have been averaged over the last 5 years for which data are available for all beluga whale stocks, except the Cook Inlet stock. This request was due to the large amount of interannual variability in harvest levels in most areas (letter from ABWC to Alaska SRG, 20 December 1996).

STATUS OF STOCK

Beluga whales are not listed as "depleted" under the MMPA or listed as "threatened" or "endangered" under the Endangered Species Act. Based on currently available data, the estimated annual rate, over the 5-year period from 1991 to 1995, of human-caused mortality and serious injury (I 27) is not known to exceed the PBR (129) for this stock. Further, the 1995 estimate (74) was well below the PBR, and may reflect a lower directed level of take rather than annual variation in harvest data Therefore, the Eastern Bering Sea beluga whale stock is not classified as strategic. No decreasing trend has been detected for this stock in the presence of a known harvest, although at this time it is not possible to assess the status of this stock relative to OSP.

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BELUGA WHALE *(Delphinapterus leucas):* Bristol Bay Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

Beluga whales are distributed throughout seasonally ice-covered arctic and subarctic waters of the Northern Hemisphere (Gurevich 1980). and are closely associated with open leads and polynyas in ice-covered regions (Hazard 1988). Depending on season and region, beluga whales may occur in both offshore and coastal waters, with concentrations in Cook Inlet, Bristol Bay, Norton Sound, Kasegaluk Lagoon, and the Mackenzie Delta (Hazard 1988). It is assumed that most beluga whales from these summering areas overwinter in the Bering Sea, excluding those found in the northern Gulf of Alaska (Shelden 1994). Seasonal distribution is affected by ice cover, tidal conditions, access to prey, temperature, and human interaction (Lowry 1985). During the winter, beluga whales occur in offshore waters associated with pack ice. In the spring, they migrate to warmer coastal estuaries, bays, and rivers for molting (Finley 1982) and calving (Sergeant and Brodie 1969). Annual migrations may cover thousands of kilometers (Reeves 1990).

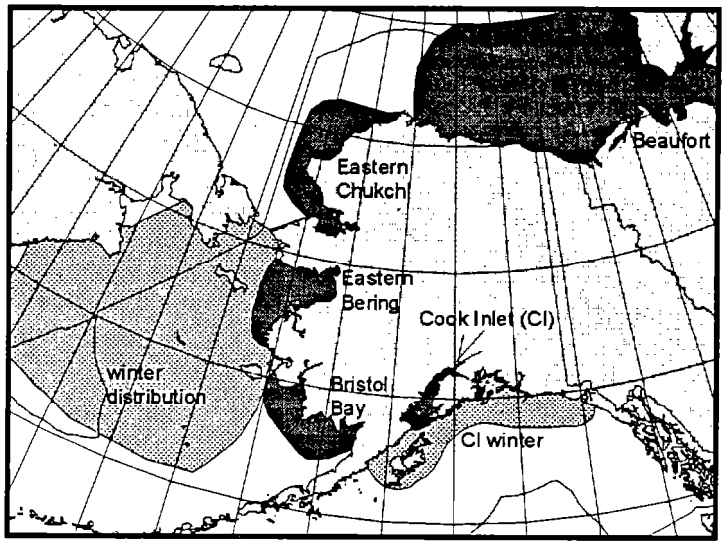

Figure 17. Approximate distribution of beluga whales in Alaska waters. The dark shading displays the summer distributions of the five stocks, Winter distributions are depicted with lighter shading.

The following information was considered in classifying beluga whale stock structure based on the Dizon et al. (I 992) phylogeographic approach: 1) Distributional data: geographic distribution discontinuous in summer (Frost and Lowry 1990), distribution unknown outside of summer; 2) Population response data: possible extirpation of local populations; distinct population trends between regions occupied in summer, 3) Phenotypic data: unknown; and 4) Genotypic data: preliminary mitochondrial DNA analyses indicate distinct differences among summering areas (G. O'Corry-Crowe, unpubl. data, Southwest Fisheries Science Center, P.O. Box 271, La Jolla, CA 92038). Based on this information, 5 stocks of beluga whales are recognized within U. S. waters: I) Cook Inlet, 2) Bristol Bay, 3) Eastern Bering Sea, 4) Eastern Chukchi Sea, and 5) Beaufort Sea (Fig. 17).

POPULATION SIZE

The sources of information to estimate abundance for belugas in the waters of western and northern Alaska have included both opportunistic and systematic observations. Frost and Lowry (1990) compiled data collected from aerial surveys conducted between 1978 and 1987 that were designed to specifically estimate the number of beluga whales. Surveys did not cover the entire habitat of belugas, but were directed to specific areas at the tunes of year when belugas were expected to concentrate. Frost and Lowry (1990) reported an estimate of 1,000-1,500 for Bristol Bay, similar to that reported by Seaman et al. (1985). Most recently, the number of beluga whales in Bristol Bay was estimated at 1,555 in 1994 (Frost and Lowry 1995a). This estimate was based on a count of 503 animals, which was corrected using radio-telemetry data for the proportion of animals that were diving and thus not visible at the surface (2.62, Frost and Lowry 1995b), and for the proportion of newborns and yearlings not observed due to their small size and dark coloration (1.18; Brodie 1971).

Minimum Population Estimate

The survey technique utilized for estimating 'the abundance of beluga whales in this stock is a direct count which incorporates correction factors However, for this stock, it is unlikely that significant numbers of belugas remain in offshore areas or other areas that are not included in the survey area. Given this survey methodology, an estimate of the variance of

abundance is unavailable. Consistent with the recommendations of the Alaska Scientific Review group (DeMaster 1997), a default CV(N) of 0.2 was used in the calculation of the minimum population estimate (N_{MIN}). N_{MIN} for this stock is calculated using Equation 1 from the PBR Guidelines (Wade and Angliss 1997): $N_{MIN} = N/\exp(0.842*[\ln(1+[CV(N)]^2)]^{½})$. Using the population estimate (N) of 1,555 and the default CV (0.2), N_{MIN} for the Bristol Bay stock of beluga whales is 1,316.

Current Population Trend

Abundance estimates from surveys conducted in 1983, 1993, and 1994 are similar to estimates from the 1950s (Brooks 1955), suggesting this stock of beluga whales should be considered stable (Frost and Lowry 1990, 1995a).

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

A reliable estimate of the maximum net productivity rate is currently unavailable for the Bristol Bay stock of beluga whales. Hence, until additional data become available, it is recommended that the cetacean maximum theoretical net productivity rate (R_{MAX} of 4% be employed for this stock (Wade and Angliss 1997).

POTENTIAL BIOLOGICAL REMOVAL

Under the 1994 re-authorized Marine Mammal Protection Act (MMPA), the potential biological removal (PBR) is defined as the product of the minimum population estimate, one-half the maximum theoretical net productivity rate, and a recovery factor: PBR = N_{MIN} x $0.5R_{MAX}$ x F_R. As this stock is considered stable (Frost and Lowry 1990) and because of the regular surveys to estimate abundance and the annual harvest monitoring program supported by the Alaska Beluga Whale Committee (ABWC), the recovery factor (F_R) for this stock is 1.0 (Wade and Angliss 1997, DeMaster 1997; see discussion under PBR for the Eastern Bering Sea stock). Thus, for the Bristol Bay stock of beluga whales, PBR = 26 animals (1,316 x 0.02 x 1.0).

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

Fisheries Information

Three different commercial fisheries that could have interacted with beluga whales in Bristol Bay were monitored for incidental take by NMFS observers during 1990-95: Bering Sea (and Aleutian Islands) groundfish trawl, longline, and pot fisheries. Observers did not report any mortality or serious injury of beluga whales incidental to these groundfish fisheries.

Table 13. Summary of incidental mortality of beluga whales (Bristol Bay stock) due to commercial fisheries from 1990 through 1995 and calculation of the mean annual mortality rate. Mean annual mortality in brackets represents a minimum estimate from logbook reports.

Fishery name	Years	Data type	Range of observer coverage	Reported mortality (in given yrs.)	Estimated mortality (in given yrs.)	Mean annual mortality
Observer program total	90-95					0
Bristol Bay salmon drift gillnet	90-93	logbook	n/a	0, 1, 0, 0	n/a	[≥0.25]
Bristol Bay salmon set gillnet	90-93	logbook	n/a	1, 0, 0, 0	n/a	[≥0.25]
Minimum total annual mortality						≥0.5

An additional source of information on the number of beluga whales killed or injured incidental to commercial fishery operations is the logbook reports maintained by vessel operators/as required by the MMPA interim exemption program. Observers have never monitored the Bristol Bay salmon set gillnet and drift gillnet fisheries which combined are estimated to have over 2,800 active permits. During the 4-year period from 1990 to 1993, logbook reports included 1 mortality in both 1990 and 1991 from these fisheries (see Table 13) resulting man annual mean of 0.5 mortalities from interactions with commercial gear. However, because logbook records are most likely negatively biased (Credle et al. 1994), these are considered to be minimum estimates. The 1990 logbook records from the Bristol Bay set and drift gillnet fisheries

were combined. As a result, the 1990 mortality may have occurred in the drift net fishery. Complete logbook data after 1993 are not available. Larger fishery related mortalities resulting from these fisheries have been recorded in the past. In 1983 the Alaska Department of Fish and Game documented at least 12 beluga whale mortalities in Bristol Bay related to drift and set gillnet fishing (Frost et al. 1984).

The estimated minimum mortality rate incidental to commercial fisheries is 1 animal per year (rounded up from 0.5), based entirely on logbook data. However, a reliable estimate of the mortality rate incidental to commercial fisheries is currently unavailable because of the absence of observer placements in the Bristol Bay gillnet fisheries that are known to interact with this stock Therefore, it is unknown whether the kill rate is insignificant. At present, annual mortality levels less than 2.6 per year (i.e., 10% of PBR) can be considered insignificant and approaching zero mortality and serious injury rate.

Subsistence/Native Harvest Information

The subsistence take of beluga whales from the Bristol Bay stock is provided by the ABWC, who reported that the number of whales harvested for subsistence during 1990, 1991, 1993 and 1994 was 20, 16, 34 and 16 whales, respectively (Frost and Suydam 1995). The 1992 harvest values are unavailable as they were not reported to the ABWC by the Bristol' Bay villages. In 1995, the ABWC reported 9 whales taken from this stock, including 3 (33% of the total take) animals which were struck and lost (ABWC unpubl. data ABWC, P.O. Box 69, Barrow. AK, 99723). Using the data from the most recent 5-year period (excluding the null data from 1992), the subsistence harvest has averaged approximately 19 animals per year during the period from 1990 to 1995.

In the draft stock assessment reports (Hill et al. 1996), subsistence mortality was averaged over the most recent 3-year period for which data were available. This was an attempt to incorporate interannual variability, while still recognizing that mortality rates have declined in recent years. However, based on a request from the ABWC, human-related removals have been averaged over the last 5 years for which data are available for all beluga whale stocks, except the Cook Inlet stock. This request was due to the large amount of interannual variability in harvest levels in most areas (letter from ABWC to Alaska SRG, 20 December 1996).

STATUS OF STOCK

Beluga whales are not listed as "depleted" under the MMPA or listed as "threatened" or "endangered" under the Endangered Species Act Based on currently available data, the estimated annual rate of human-caused mortality and serious injury (20) is not known to exceed the PBR (26). Therefore, the Bristol Bay stock of beluga whales is not classified as a strategic stock. However, as noted previously, the estimate of fisheries-related mortality is unreliable and, therefore, likely to be underestimated. The population size is considered stable, however, at this time it is not possible to assess the status of this stock relative to OSP.

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BELUGA WHALE *(Delphinapterus leucas):* Cook Inlet Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

Beluga whales are distributed throughout seasonally ice-covered arctic and subarctic waters of the Northern Hemisphere (Gurevich 1980). and are closely associated with open leads and polynyas in ice-covered regions (Hazard 1988). Depending on season and region, beluga whales may occur in both offshore and coastal waters, with concentrations in Cook Inlet, Bristol Bay, Norton Sound, Kasegaluk Lagoon, and the Mackenzie Delta (Hazard 1988). It is assumed that most beluga whales from these summering areas overwinter in the Bering Sea, excluding those found in the northern Gulf of Alaska (Shelden 1994). Seasonal distribution is affected by ice cover, tidal conditions, access to prey, temperature, and human interaction (Lowry 1985). During the winter, beluga whales occur in offshore waters associated with pack ice. In the spring, they migrate to warmer coastal estuaries, bays, and rivers for molting (Finley 1982) and calving (Sergeant and Brodie 1969). Annual migrations may cover thousands of kilometers (Reeves 1990).

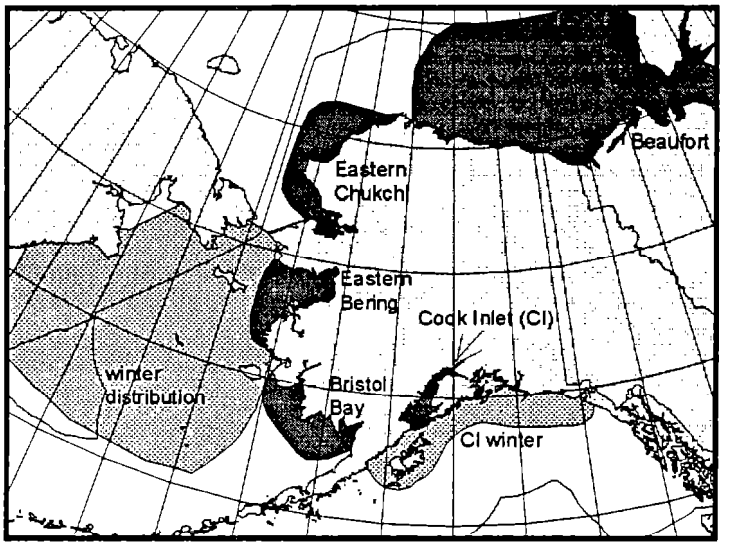

Figure 18. Approximate distribution of beluga whales in Alaska waters. The dark shading displays the summer distributions of the five stocks. Winter distributions are depicted with lighter shading.

The following information was considered in classifying beluga whale stock structure based on the Dizon et al. (1992) phylogeographic approach: 1) Distributional data: geographic distribution discontinuous in summer (Frost and Lowry 1990), distribution unknown outside of summer; 2) Population response data: possible extirpation of local populations, distinct population trends between regions occupied in summer, 3) Phenotypic data: unknown; and 4) Genotypic data: preliminary mitochondrial DNA analyses indicate distinct differences among summering areas (G. O'Corry-Crowe, unpubl. data, Southwest Fisheries Science Center, P.O. Box 271, La Jolla, CA 92038). Based on this information, 5 stocks of beluga whales are recognized within U. S. waters: 1) Cook Inlet, 2) Bristol Bay, 3) Eastern Bering Sea, 4) Eastern Chukchi Sea, and 5) Beaufort Sea (Fig. 18).

POPULATION SIZE

Aerial surveys for beluga whales in Cook Inlet were conducted in June 1994 and July 1995 using an 'approach' survey technique that involves repeated circling of observed groups, and videotape recording. The approach technique differs from 'passing mode' surveys performed for belugas in other stocks, in that during passing surveys the aircraft maintains a straight flight path The approach technique allows each group of whales observed and recorded on video to be corrected for 1) animals that were under the surface, and 2) animals missed by observers yet recorded on video. The sum of median counts for all groups observed in the 1994 and 1995 surveys is 279 and 338 whales, respectively (Rugh et al. 1996). The process of using medians instead of maximum counts reduces the effects of outliers (extremes in high or low counts), makes the results more comparable to other surveys which lack multiple passes over whale groups, and is more appropriate than using maximums when the counts will be corrected for missed whales (Rugh et al. 1996).

An abundance estimate from the 1995 count data has not been derived. However, correcting the 1994 count data to account for subsurface animals (using the formula of McLaren 1961) and animals at the surface that were missed (2.45; CV=0.14) resulted in an abundance estimate of 747 (CV=0.19) beluga whales in Cook Inlet (Hobbs et al. 1995). This abundance estimate has not been corrected for newborns and yearlings not observed due to their small size and dark coloration (R. Hobbs, pers. comm., National Marine Mammal Laboratory, 7600 Sand Point Way NE, Seattle, WA, 98115).

Correcting the 1994 abundance estimate to account for the proportion of newborns and yearlings not observed due to their small size and dark coloration (1.18; Brodie 1971), results in a total corrected abundance estimate of 881 whales (747 x 1.18) for the Cook Inlet stock.

Minimum Population Estimate

The survey technique utilized for estimating the abundance of beluga whales is a direct count which incorporates correction factors. Although a CV for the newborn and yearling correction factor is not available, the Alaska Scientific Review Group concluded that the abundance estimate and associated CV are adequately conservative to serve as an estimate of minimum population size (N_{MIN}) for this stock (DeMaster 1997). N_{MIN} is calculated using Equation 1 from the PBR Guidelines (Wade and Angliss 1997): $N_{MIN}= N/\exp(0.842*[\ln(1+[CV(N)]^2)]^{½})$. Using the population estimate (N) of 881 and its associated CV of 0.19, N_{MIN} for the Cook Inlet stock of beluga whales is 752.

Current Population Trend

In general, uncorrected counts have ranged from 300 to 500 beluga whales within Cook Inlet since the early 1960s. Based on these surveys, there is no evidence that this stock is declining (Shelden 1994).

In addition, median counts of the stock since 1991 reveal relative stability in stock size during this decade. Data from prior National Marine Mammal Laboratory and NMFS Alaska Regional Office studies indicated median counts of 200 beluga whales in June 1991, 255 in June 1992, 344 in June 1993, 287 in July 1993, 157 in September 1993, 279 in June 1994, and 338 in July 1995. Only the 1993-95 surveys provided thorough coverage of Cook Inlet, however, all of the surveys included coverage of the Suisitna River delta where most of the whales occur (Rugh et al. 1996).

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

A reliable estimate of the maximum net productivity rate is currently not available for the Cook Inlet stock of beluga whales. Hence, until additional data become available, it is recommended that the cetacean maximum theoretical net productivity rate (R_{MAX} of 4% be employed for this stock (Wade and Angliss 1997).

POTENTIAL BIOLOGICAL REMOVAL

Under the 1994 re-authorized Marine Mammal Protection Act (MMPA), the potential biological removal (PBR) is defined as the product of the minimum population estimate, one-half the maximum theoretical net productivity rate, and a recovery factor $PBR = N_{MIN} \times 0.5R_{MAX} \times F_R$. As there is no evidence the stock is declining (Shelden 1994) in the presence of a known take, the recovery factor (F_R) for this stock is 1.0 (Wade and Angliss 1997). Thus, for the Cook Inlet stock of beluga whales, PBR = 15 animals (752 x 0.02 x 1.0).

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

Fisheries Information

Three types of commercial fishing gear that could possibly interact with beluga whales occur in Cook Inlet (purse seine, drift gillnet and set gillnet) and are used to catch each of the five species of Pacific salmon, as well as Pacific herring. There are no observer data as NMFS observers have not monitored any of these fisheries within Cook Inlet. An additional source of information on the number of beluga whales killed or injured incidental to commercial fishery operations is the logbook reports maintained by, vessel operators through the MMPA interim exemption program During the 4-year period from 1990 to 1993, logbook reports indicated no mortalities of beluga whales from interactions with commercial fishing operations (Table 14). Complete logbook data after 1993 are not available.

In the past, beluga mortalities have been attributed to Cook Inlet fisheries with the fishing related mortality during the 3-year period from 1981 to 1983 estimated at 3-6 animals per year (Burns and Seaman 1986). Accordingly, though there were no reported logbook mortalities of beluga whales, the Cook Inlet gillnet fisheries (having a combined total of over -1,200 active permits in 1995) have been included in Table 14 because logbook records are most likely negatively biased (Credle et al. 1994).

The estimated minimum mortality rate incidental to commercial fisheries is zero belugas per year. However, a reliable estimate of the mortality rate incidental to commercial fisheries is currently unavailable because of the absence of observer placements in the Cook Inlet fisheries mentioned above. Therefore, it is unknown whether the kill rate is insignificant. At present, annual mortality levels less than 1.5 per year (i.e., 10% of PBR) can be considered insignificant and approaching zero mortality and serious injury rate.

Table 14. Summary of incidental mortality of beluga whales (Cook Inlet stock) due to commercial fisheries from 1990 through 1995 and calculation of the mean annual mortality rate. Mean annual mortality in brackets represents a minimum estimate from logbook reports.

Fishery name	Years	Data type	Range of observer coverage	Reported mortality (in given yrs.)	Estimated mortality (in given yrs.)	Mean annual mortality
Observer program total	90-95					0
Cook Inlet salmon drift gillnet	90-93	logbook	n/a	0, 0, 0, 0	n/a	[0]
Cook Inlet salmon set gillnet	90-93	logbook	n/a	0, 0, 0, 0	n/a	[0]
Minimum total annual mortality						0

Subsistence/Native Harvest Information

The subsistence take of beluga whales from the Cook Inlet stock is provided by the Alaska Beluga Whale Committee (ABWC), who reported that the number of whales harvested for subsistence has averaged approximately 15 during the 5-year period from 1990 to 1994, with 19 whales taken in 1994 (Frost and Suydam 1995). This estimate is based on household surveys, and has been corrected for hunters that did not respond. However, this estimate is negatively biased because there is not a reliable estimate for the percent struck and lost, and it does not include the number of animals taken from this stock by residents from outside Cook Inlet.

A study conducted by the Alaska Department of Fish and Game, in cooperation with the ABWC and the Indigenous People's Council for Marine Mammals, estimated the subsistence take in 1993 at 17 whales based on surveys of 16 of 19 households known to have hunted in 1993 (Stanek 1994). This was considered a minimum estimate, and was increased by adding the estimated number of whales taken from households not surveyed (3) and by hunters from areas outside of Cook Inlet (10) resulting in an estimated total take of 30 (17 + 3 + 10) whales. However, in consultation with native elders from the Cook Inlet region, the Cook Inlet Marine Mammal Council (CIMMC) estimated the annual number of belugas taken by subsistence hunters to be greater than 30 animals (DeMaster 1995: pp. 5).

The most thorough subsistence harvest survey ever completed in Cook Inlet was conducted by the CIMMC during 1995. The CIMMC (through the ABWC) reported 72 whales taken from the stock, including 22 (30.5%) animals which were struck and lost The 1995 take is considered a reliable estimate of the number of animals taken from Cook Inlet. Using the data from the most comprehensive surveys (30 in 1993, 19 in 1994, and 72 in 1995) the annual subsistence take averaged approximately 40 during the 3-year period from 1993 to 1995. Due to the thoroughness of the 1995 harvest report as compared to earlier years, it is not possible to ascertain the trend in subsistence take. Due to the pattern of increasing harvest levels in this area, subsistence mortality for the Cook Inlet stock is averaged over a 3-year period whereas a 5-year period is used for the other beluga whale stocks occurring in this document.

OTHER MORTALITY

Mortalities related to stranding events have been reported in Cook Inlet. For example, in the summer of 1996, four belugas died during a stranding event that included 60 animals (B. Smith, pers. con-m., NMFS, 222 W 7th Ave., Anchorage, AK, 99513). Such mortalities are not likely to be associated with human-related activities.

STATUS OF STOCK

Beluga whales are not listed as "depleted" under the MMPA or listed as "threatened" or "endangered" under the Endangered Species Act. A reliable estimate of the annual rate of mortality incidental to commercial fisheries is unavailable. Based on currently available data the estimated annual level of total human-caused mortality is 40 beluga whales (estimated exclusively from subsistence harvest data) which exceeds the PBR (15) for this stock. Therefore, the Cook Inlet beluga whale stock is classified as a strategic stock. The population size is considered stable, however, at this time it is not possible to assess the status of this stock relative to OSP.

Sustainable harvest levels for this stock will be determined from the analysis of information gathered through the cooperative management process, and will reflect the degree of uncertainty associated with the information obtained for this stock Efforts were initiated in 1995 and 1996 to develop a cooperative approach for management of this stock; however, a final agreement has not been approved to date.

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Revised 8/8/97

KILLER WHALE *(Orcinus orca):* Eastern North Pacific Northern Resident Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

Killer whales have been observed in all oceans and seas of the world (Leatherwood and Dahlheim 1978). Although reported from tropical and offshore waters, killer whales prefer the colder waters of both hemispheres, with greatest abundances found within 800 km of major continents (Mitchell 1975). In Alaska waters, killer whales occur along the entire Alaska coast from the Chukchi Sea, into the Bering Sea, along the Aleutian Islands, Gulf of Alaska, and into Southeast Alaska (Braham and Dahlheim 1982). Their occurrence has been well documented throughout British Columbia and inland waterways of Washington State (Bigg et al. 1990), as well as along the outer coasts of Washington, Oregon, and California (Green et al. 1992, Barlow 1995, Forney et al. 1995). Seasonal and year-round Occurrence has been noted for killer whales throughout Alaska (Braham and Dahlheim 1982) and in the intracoastal waterways of British Columbia and Washington State (Bigg et al. 1990). Through examination of photographs of recognizable individuals and pods, movements of whales between geographical areas have been documented. For example, whales identified in Prince William Sound have been observed near Kodiak Island (Heise et al 1991); whales identified in Southeast Alaska have been observed in Prince William Sound, British Columbia, and Puget Sound (Leatherwood et al. 1990, Dahlheim et al. 1997). Movements of killer whales between the waters of Southeast Alaska and central California have also been documented (Goley and Straley 1994).

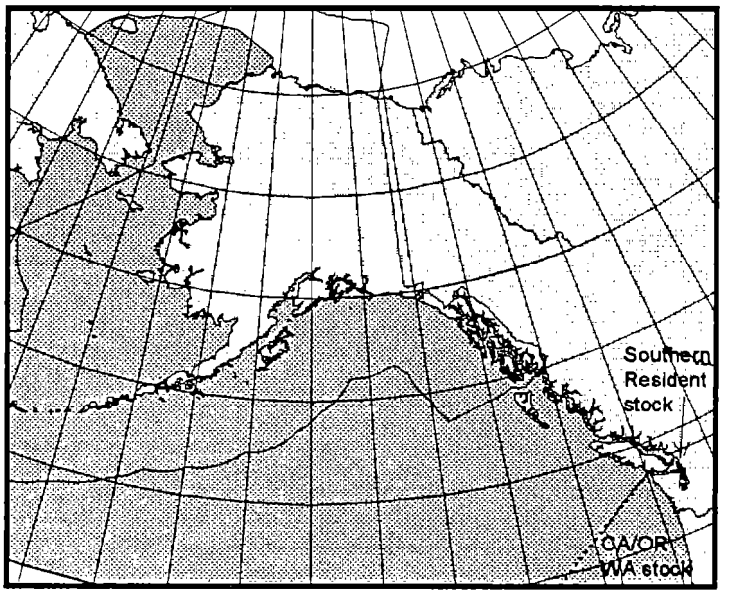

Figure 19. Approximate distribution of killer whales in the eastern North Pacific (shaded area). The distribution of the Eastern North Pacific Northern Resident and Transient stocks are largely overlapping (see text).

Killer whales along British Columbia and Washington State have been labeled as 'resident' and 'transient' (Bigg et al. 1990). Although less is known about killer whales in Alaska, both forms ('resident' and 'transient') have been shown to occur in Alaska waters (Matkin and Saulitis 1994). These two sympatric forms are believed to differ in several aspects of morphology, ecology, and behavior; that is, dorsal fin shape, saddle patch shape, pod size, home range size, diet, travel routes, dive duration, and social integrity of pods. For example, in Pacific Northwest waters, significant differences occur in call repertoires (Ford and Fisher 1982). saddle patch pigmentation (Baird and Stacey 1988) and diet (Baird et al. 1992). Studies on mtDNA restriction patterns provide evidence that the 'resident' and 'transient' pods are genetically distinct (Stevens et al. 1989, Hoezel 1991, Hoelzel and Dover 1991, Hoelzel et al. in press).

Based primarily on data regarding association patterns, acoustics, movements, genetic differences and potential fishery interactions, 4 killer whales stocks are recognized along the west coast of North America from California to, Alaska: 1) the Eastern North Pacific Northern Resident stock - occurring from British Columbia through Alaska, 2) the Eastern North Pacific Southern Resident stock - occurring within the inland waters of Washington state and southern British Columbia, 3) the Eastern North Pacific Transient stock - occurring from Alaska to Cape Flattery, WA, and 4) the California/Oregon/Washington Pacific Coast stock - occurring from Cape Flattery through California (Fig. 19). Because the stock area for the Eastern North Pacific Northern Resident stock is defined as the waters from British Columbia through Alaska, 'resident' whales in Canadian waters are considered part of the Eastern North Pacific Northern Resident stock.. The Stock Assessment Reports for the Pacific Region contain information concerning the Eastern North Pacific Southern

Resident stock, the California/Oregon/Washington Pacific Coast stock, and the Hawaiian stock. The stock structure recommended in this report should be considered preliminary pending a joint review by the Alaska and Pacific Scientific Review Groups.

POPULATION SIZE

In the late 1970s researchers began collecting identification photographs of killer whales in Prince William Sound, Alaska (Hall 1981). The whales were assigned to pods in 1984 (Leatherwood et al. 1984) which resulted in the first catalogue of Prince William Sound killer whales being produced (Ellis 1984). The catalogue was updated in 1987 (Ellis 1987) and again in 1991 (Heise et al. 1991). In 1984, photographic studies on killer whales were also initiated in Southeast Alaska (Leatherwood et al. 1984) with photographs of individual killer whales from Southeast Alaska also included in Ellis (1984, 1987).

Preliminary analysis of photographic data resulted in the following minimum counts for Alaska killer whales (Note: individual whales have been matched between geographical regions and missing animals likely to be dead have been subtracted). Based on data collected from Seward, Alaska, west to Kodiak Island, then westward along the Alaska Peninsula into the southeastern Bering Sea to include the eastern Aleutian Islands (Dahlheim and Waite 1993, Dahlheim 1994, Dahlheim in press), 278 individual whales have been identified. Of these whales, 242 are provisionally considered 'residents' and 36 as 'transients.' Categorizing these killer whale pods as either 'resident' or 'transient' was difficult due to the length of time observing the whales, which at times was only long enough to attain quality photographs (M. Dahlheim, pers. comm., National Marine Mammal Laboratory, 7600 Sand Point Way NE, Seattle, WA, 98115). No follow up studies have been conducted in this region of Alaska to help verify the classification of 'resident' and 'transient' pods. Accordingly, the numbers of 'residents' and 'transients' encountered in the western Gulf of Alaska, southeastern Bering Sea, and eastern Aleutian Islands are considered preliminary at this time. In Prince William Sound, 260 individual whales have been identified, with 205 categorized as 'residents' and 55 as 'transients' (Heise et al. 1991). In Southeast Alaska, 250 individual whales have been identified, with 154 categorized as 'residents' and 96 as 'transients' (Dahlheim and Waite 1993, Dahlheim 1994, Dahlheim et al. 1997). Combining the counts of 'resident' whales gives a total of 601 (242+205+154) killer whales in Alaska waters belonging to the Eastern North Pacific Northern Resident stock,

The Eastern North Pacific Northern Resident stock is a transboundary stock, including killer whales from British Columbia. In British Columbia, 370 individual whales have been identified, with 200 categorized as 'residents' and 170 as 'transients' (Ford et al. 1994). Forty seven of the 200 'resident' whales in British Columbia have also been encountered in Southeast Alaska (M. Dahlheim, pers. comm., National Marine Mammal Laboratory, 7600 Sand Point Way NE, Seattle, WA, 98115) and are included in the 601 animals presented above. Thus, the Canadian component of the Eastern North Pacific Northern Resident stock is comprised of 163 (200-47) killer whales, Therefore, the best estimate of abundance for this stock including the 'resident' killer whales of British Columbia, is 764 animals (601 +163). Photo-identification studies have also occurred in the Queen Charlotte Islands (Canadian waters), but the numbers of unique individuals from that area are not available at this time (see Ford et al. 1994).

Minimum Population Estimate

The survey technique utilized for obtaining the abundance estimate of killer whales is a direct count of individually identifiable animals. Given that researchers continue to identity new whales, the estimate of abundance based on the number of uniquely identified individuals known to be alive is likely conservative. However, the rate of discovering new whales within Southeast Alaska and Prince William Sound is relatively low. Other estimates of the overall population size (i.e., N_{BEST}) and associated CV are not currently available. Thus, the minimum population estimate (N_{MIN}) for the Eastern North Pacific Northern Resident stock of killer whales is 764 animals, which includes animals found in Canadian waters (see PBR Guidelines regarding the status of migratory trans-boundary stocks, Wade and Angliss 1997). Information on the percentage of time animals typically encountered in Canadian waters spend in U. S. waters is unknown. However, as noted above, this minimum population estimate is considered conservative. This approach is consistent with the recommendations of the Alaska Scientific Review Group (DeMaster 1996).

Current Population Trend

Mortality and recruitment rates for 6 'resident' killer whale pods in Prince William Sound from 1985 to 1991 and for 16 pods in northern British Columbia from 1981 to 1986 indicate a 2% annual rate of increase for each region over the years examined (Matkin and Saulitis 1994). However, at present, reliable data on trends in population abundance for the entire Eastern North Pacific Northern Resident stock of killer whales are considered unavailable.

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

A reliable estimate of the maximum net productivity rate is currently unavailable for this stock of killer whales. Studies of 'resident' killer whale pods in the Pacific Northwest resulted in estimated population growth rates of 2.92% and 2.54% over the period from 1973 to 1987 (Olesiuk et al. 1990, Brault and Caswell 1993). However, a population increases at the maximum growth rate (R_{MAX}) only when the population is at extremely low levels; thus, the estimate of 2.92% is not a reliable estimate of R_{MAX}. Hence, until additional data become available, it is recommended that the cetacean maximum theoretical net productivity rate (R_{MAX}) of 4% be employed for this stock (Wade and Angliss 1997).

POTENTIAL BIOLOGICAL REMOVAL

Under the 1994 re-authorized MMPA, the potential biological removal (PBR) is defined as the product of the minimum population estimate, one-half the maximum theoretical net productivity rate, and a recovery factor: $PBR = N_{MIN} \times 0.5R_{MAX} \times F_R$. The recovery factor ($F_R$) for this stock is 0.5, the value for cetacean stocks with unknown population status (Wade and Angliss 1997). Thus, for the Eastern North Pacific Northern Resident killer whale stock, PBR = 7.6 animals (764 **x** 0.02 **x** 0.5).

ANNUAL HUMAN-CAUSED MORTALITY AN-D SERIOUS INJURY

Fisheries Information

Six different commercial fisheries in Alaska that could have interacted with killer whales were monitored for incidental take by NMFS observers from 1990 to 1995: Bering Sea (and Aleutian Islands) and Gulf of Alaska groundfish trawl, longline, and pot fisheries. Of the 6 observed fisheries, killer whale mortalities occurred only in the Bering Sea groundfish trawl and longline fisheries. For the fisheries with observed takes, the range of observer coverage over the 6-year period, as well as the annual observed and estimated mortalities are presented in Table 15. Both the 1991 and 1995 mortalities in the longline fishery occurred during unmonitored hauls and could not be used to estimate total mortality for the fishery in those years (80% and 28% observer coverage in 1991 and 1995, respectively). Accordingly, the estimated mortality in 1991 and 1995 was 1, because at a minimum, one whale is known to have perished in each of those years. The 1993 mortality in the trawl fishery occurred under similarly circumstances and was treated in the same manner (66% observer coverage in 1993). The mean annual (total) mortality was 1.0 (CV=0.45) for the Bering Sea groundfish trawl fishery and 0.4 (CV=0.61) for the combined Bering Sea longline fishery, resulting in a mean annual mortality rate of 1.4 killer whales per year from observed fisheries.

An additional source of information on the number of killer whales killed or injured incidental to commercial fishery operations is the logbook reports maintained by vessel operators as required by the MMPA interim exemption program. During the 4-year period from 1990 to 1993 logbook reports from all Alaska fisheries indicated only one killer whale mortality, which occurred in the Bering Sea groundfish trawl fishery in 1990. That mortality has been included as an estimated mortality in Table 15 even though an observer program was in operation for that fishery (with 74% observer coverage) and did not report any killer whale mortalities during that year. Complete logbook data after 1993 are not available.

Table 15. Summary of incidental mortality of killer whales (Eastern North Pacific Northern Resident stock) due to commercial fisheries from 1990 through 1995 and calculation of the mean annual mortality rate. Data from 1991 to 1995 are used in the mortality calculation when more than 5 years of data are provided for a particular fishery.

Fishery name	Years	Data type	Range of observer coverage	Observed mortality (in given yrs.)	Estimated mortality (in given yrs.)	Mean annual mortality
Bering Sea/Aleutian Is. (BSA) groundfish trawl	90-95	obs data	53-74%	0, 1, 1, 1, 0, 0	1, 2, 2, 1, 0, 0	1.0 (CV=.45)
BSA groundfish longline (incl. misc finfish and sablefish fisheries)	90-95	obs data	28-80%	0, 1, 0, 0, 0, 1	0, 1, 0, 0, 0, 1	0.4 (CV=.61)
Estimated total annual mortality						1.4

The estimated minimum mortality rate incidental to U. S. commercial fisheries recently monitored is 1.4 animals per year, based exclusively on observer data. As the animals which were taken incidental to commercial fisheries have not been identified genetically, it is not possible to determine whether they belonged to the Eastern North Pacific Northern Resident stock or the Eastern North Pacific Transient killer whale stock. Accordingly, these same mortalities can be found in the stock assessment report for the Transient stock. The estimated annual mortality level (1.4) exceeds 10% of the PBR, (i.e., 0.76) and therefore cannot be considered to be insignificant and approaching zero mortality and serious injury rate.

Due to a lack of observer programs, there are few data concerning the mortality of marine mammals incidental to Canadian commercial fisheries, which are analogous to U.S. fisheries that are known to interact with killer whales. The sablefish longline fishery accounts for a large proportion of the commercial fishing/killer whale interactions in Alaska waters. Such interactions have not been reported in Canadian waters where sablefish are taken via a pot fishery Since 1990, there have been no reported fishery related strandings of killer whales in Canadian waters. However, in 1994, one killer whale was reported to have contacted a salmon gillnet but did not entangle (Guenther et al. 1995). Data regarding the level of killer whale mortality related to commercial fisheries in Canadian waters, though thought to be small, are not readily available or reliable which results in an underestimate of the annual mortality for this stock.

Subsistence/Native Harvest Information

There are no reports of subsistence take of killer whales in Alaska or Canada.

Other Mortality

Since 1986, research efforts have been made to assess the nature and magnitude of killer whale/blackcod (sablefish; ***Anoplopoma fimbria)*** interactions (Dahlheim 1988; Yano and Dahlheim 1995). Fishery interactions have occurred each year in the Bering Sea and Prince William Sound, with the number of annual reports varying considerably. Data collected from the Japan/U. S. cooperative longline research surveys operating in the Bering Sea indicate that interactions may be increasing and expanding into the Aleutian Island region (Yano and Dahlheim 1995). During the 1992 surveys conducted in the Bering Sea and western Gulf of Alaska, 9 of 182 (4.9%) individual whales in 7 of the 12 (58%) pods encountered had evidence of bullet wounds (Dahlheim and Waite 1993). The relationship between wounding due to shooting and survival is unknown. In Prince William Sound, the pod responsible for most of the fishery interactions has experienced a high level of mortality: between 1986 and 1991, 22 whales out of a pod of 37 (59%) are missing and considered dead (Matkin et al. 1994). The cause of death for these whales is unknown, but it is likely related to gunshot wounds or effects of the **Exxon *Valdez*** oil spill (Dahlheim and Matkin 1994).

The shooting of killer whales in Canadian waters has also been a concern in the past. However, in recent years the Canadian portion of the stock has been researched so extensively that evidence of bullet wounds would have been noticed if shooting was prevalent (G. Ellis, pers. comm., Pacific Biological Station, Nanaimo, BC, V9R 5K6).

STATUS OF STOCK

Killer whales are not listed as “depleted” under the MMPA or listed as “threatened’ or “endangered” under the Endangered Species Act Recall, that the human-caused mortality has been underestimated due to a lack of information on Canadian fisheries, and that the minimum abundance estimate is considered conservative (because researchers continue to encounter new whales and animals in the vicinity of the Queen Charlotte Islands were not included), resulting in a conservative PBR estimate. However, based on currently available data, the estimated annual level of human-caused mortality and serious injury of 1.4 animals per year is not known to exceed the PBR (7.6). Therefore, the Eastern North Pacific Northern Resident stock of killer whales is not classified as a strategic stock. Population trends and status of this stock relative to OSP are currently unknown.

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Revised 8/8/97

KILLER WHALE *(Orcinus orca):* Eastern North Pacific Transient Stock

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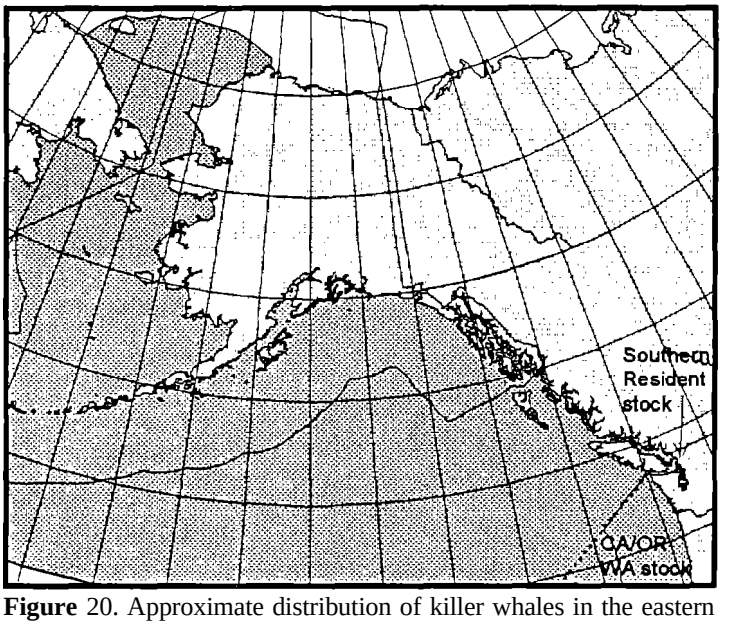
Killer whales have been observed in all oceans and seas of the world (Leatherwood and Dahlheim 1978). Although reported from tropical and offshore waters, killer whales prefer the colder waters of both hemispheres, with greatest abundances found within 800 km of major continents (Mitchell 1975). In Alaska waters, killer whales occur along the entire Alaska coast from the Chukchi Sea, into the Bering Sea, along the Aleutian Islands, Gulf of Alaska, and into Southeast Alaska (Braham and Dahlheim 1982). Their occurrence has been well documented throughout British Columbia and inland waterways of Washington State (Bigg et al. 1990), as well as along the outer coasts of Washington, Oregon, and California (Green et al. 1992, Barlow 1995, Forney et al. 1995). Seasonal and year-round occurrence has been noted for killer whales throughout Alaska (Braham and Dahlheim 1982) and in the intracoastal waterways of British Columbia and Washington State (Bigg et al. 1990). Through examination of photographs of recognizable individuals and pods, movements of whales between geographical areas have been documented. For example, whales identified in Prince William Sound have been observed near Kodiak Island (Heise et al 1991); whales identified in Southeast Alaska have been observed in Prince William Sound, British Columbia, and Puget Sound (Leatherwood et al. 1990, Dahlheim et al. 1997). Movements of killer whales between the waters of Southeast Alaska and central California have also been documented (Goley and Straley 1994.).



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Preliminary analysis of photographic data resulted in the following minimum counts for Alaska killer whales (Note: individual whales have been matched between geographical regions and missing animals likely to be dead have been subtracted). Based on data collected from Seward, Alaska, west to Kodiak Island, then westward along the Alaska Peninsula into the southeastern Bering Sea to include the eastern Aleutian Islands (Dahlheim and Waite 1993, Dahlheim 1994, Dahlheim in press), 278 individual whales have been identified. Of these whales, 242 are provisionally considered 'residents' and 36 as 'transients' Categorizing these killer whale pods as either 'resident' or 'transient' was difficult due to the length of time observing the whales, which at times was only long enough to attain quality photographs (M. Dahlheim, pers. comm., National Marine Mammal Laboratory, 7600 Sand Point Way NE, Seattle, WA, 98115). No follow up studies have been conducted in this region of Alaska to help verify the classification of 'resident' and 'transient' pods. Accordingly, the numbers of 'residents' and 'transients' encountered in the western Gulf of Alaska, southeastern Bering Sea, and eastern Aleutian Islands are considered preliminary at this time. In Prince William Sound, 260 individual whales have been identified, with 205 categorized as 'residents' and 55 as 'transients' (Heise et al. 1991). In Southeast Alaska, 250 individual whales have been identified with 154 categorized as residents' and 96 as 'transients' (Dahlheim and Waite 1993, Dahlheim 1994, Dahlheim et al. 1997). Combining the counts of 'transient' whales gives a total of 187 (36+55+96) killer whales in Alaska waters belonging to the Eastern North Pacific Transient stock.

Genetic analysis and data on whale association indicate the 'transient' killer whale stock may be split into three relatively distinct groups: the British Columbia 'transients' (including Southeast Alaska animals), the Gulf of Alaska 'transients (these animals are currently included in the 'transient' numbers presented above for Prince William Sound), and the Prince William Sound 'transients' (also currently included in the 'transient' numbers presented above for Prince William Sound). It is unclear at this time how the 'transient' whales encountered to the west of Seward (including Kodiak, the Alaska Peninsula, and southeast Bering Sea, and eastern Aleutians) would lit into this scheme.

The Eastern North Pacific Northern Transient stock is a transboundary stock, including killer whales from British Columbia. In British Columbia, 370 individual whales have been identified, with 200 categorized as 'residents' and 170 as 'transients' (Ford et al. 1994). Approximately 43 of the 170 'transient' whales in British Columbia have also been encountered in Southeast Alaska (M. Dahlheim, pers. comm., National Marine Mammal Laboratory, 7600 Sand Point Way NE, Seattle, WA, 98115) and are included in the 187 animals presented above. Thus, the Canadian component of the Eastern North Pacific Transient stock is comprised of 127 (170-43) killer whales. Therefore, the best estimate of abundance for this stock, including 'transient' killer whales off the coast of British Columbia, is 314 animals (187+127). Photo-identification studies have also occurred in the Queen Charlotte Islands (Canadian waters), but the numbers of unique individuals from that area are not available at this time (see Ford et al. 1994).

Minimum Population Estimate

The survey technique utilized for obtaining the abundance estimate of killer whales is a direct count of individually identifiable animals. Given that researchers continue to identify new whales, the estimate of abundance based on the number of uniquely identified individuals known to be alive is likely conservative. However, the rate of discovering new whales within Southeast Alaska and Prince William Sound is relatively low. Other estimates of the overall population size (i.e., N_{BEST}) and associated CV are not currently available. Thus, the minimum population estimate (N_{MIN}) for the Eastern North Pacific Transient stock of killer whales is 314 animals, which includes animals found in Canadian waters (see PBR Guidelines regarding the status of migratory trans-boundary stocks, Wade and Angliss 1997). Information on the percentage of time animals typically encountered in Canadian waters spend in U. S. waters is unknown. However, as noted above, this minimum population estimate is considered conservative. This approach is consistent with the recommendations of the Alaska Scientific Review Group (DeMaster 1996).

Current Population Trend

At present, reliable data on trends in population abundance for the Eastern North Pacific Transient stock of killer whales are unavailable.

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

A reliable estimate of the maximum net productivity rate is currently unavailable for this stock of killer whales. Studies of 'resident' killer whale pods in the Pacific Northwest resulted in estimated population growth rates of 2.92% and 2.54% over the period from 1973 to 1987 (Olesiuk et al. 1990, Brault and Caswell 1993). However, a population increases at the maximum growth rate (R_{MAX}) only when the population is at extremely low levels; thus, the estimate of 2.92% is not a reliable estimate of R_{MAX}. Hence, until additional data become available, it is recommended that the cetacean maximum theoretical net productivity rate (R_{MAX}) of 4% be employed for this stock (Wade and Angliss 1997).

POTENTIAL BIOLOGICAL REMOVAL

Under the 1994 t-e-authorized Marine Mammal Protection Act (MMPA). the potential biological removal (PBR) is defined as the product of the minimum population estimate, one-half the maximum theoretical net productivity rate, and a recovery factor: $PBR = N_{MIN} \times 0.5R_{MAX} \times F_R$. The recovery factor ($F_R$) for this stock is 0.5, the value for cetacean stocks with unknown population status (Wade and Angliss 1997). Thus, for the Eastern North Pacific Transient killer whale stock, PBR = 3.1 animals (314 x 0.02 x 0.5).

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

Fisheries Information

Six different commercial fisheries in Alaska that could have interacted with killer whales were monitored for incidental take by NMFS observers from 1990 to 1995: Bering Sea (and Aleutian Islands) and Gulf of Alaska groundfish trawl, longline, and pot fisheries. Of the 6 observed fisheries, killer whale mortalities occurred only in the Bering Sea groundfish trawl and longline fisheries. For the fisheries with observed takes, the range of observer coverage over the 6-year period, as well as the annual observed and estimated mortalities are presented in Table 16. Both the 1991 and 1995 mortalities in the longline fishery occurred during unmonitored hauls and could not be used to estimate total mortality for the fishery in those years (80% and 28% observer coverage in 1991 and 1995, respectively). Accordingly, the estimated mortality in 1991 and 1995 was 1, because at a minimum, one whale is known to have perished in each of those years, The 1993 mortality in the trawl fishery occurred under similarly circumstances and was treated in the same manner (66% observer coverage in 1993). The mean annual (total) mortality was 1.0 (CV=0.45) for the Bering Sea groundfish trawl fishery and 0.4 (CV=0.61) for the combined Bering Sea longline fishery, resulting in a mean annual mortality rate of 1.4 killer whales per year from observed fisheries.

Table 16. Summary of incidental mortality of killer whales (Eastern North Pacific Northern Transient stock) due to commercial fisheries from 1990 through 1995 and calculation of the mean annual mortality rate. Data from 1991 to 1995 are used in the mortality calculation when more than 5 years of data are provided for a particular fishery.

Fishery name	Years	Data type	Range of observer coverage	Observed mortality (in given yrs.)	Estimated mortality (in given yrs.)	Mean annual mortality
Bering Sea/Aleutian Is. (BSA) groundfish trawl	90-95	obs data	53-74%	0, 1, 1, 1, 0, 0	1, 2, 2, 1, 0, 0	1.0 (CV=.45)
BSA groundfish longline (incl. misc finfish and sablefish fisheries)	90-95	obs data	28-80%	0, 1, 0, 0, 0, 1	0, 1, 0, 0, 0, 1	0.4 (CV=.61)
Estimated total annual mortality						1.4

An additional source of information on the number of killer whales killed or injured incidental to commercial fishery operations is the logbook reports maintained by vessel operators as required by the MMPA interim exemption program. During the 4-year period from 1990 to 1993, logbook reports from all Alaska fisheries indicated only one killer whale mortality, which occurred in the Bering Sea groundfish trawl fishery in 1990. That mortality has been included as an

estimated mortality in Table 16 even though an observer program was in operation for that fishery (with 74% observer coverage) and did not report any killer whale mortalities during that year, Complete logbook data after 1993 are not available.

The estimated minimum mortality rate incidental to U.S. commercial fisheries recently monitored is 1.4 animals per year, based exclusively on observer data. As the animals which were taken incidental to commercial fisheries have not been identified genetically, it is not possible to determine whether they belonged to the Eastern North Pacific Northern Resident stock or the Eastern North Pacific Transient killer whale stock. Accordingly, these same mortalities can be found in the stock assessment report for the Transient stock. The estimated annual mortality level (1.4) exceeds 10% of the PBR (i.e., 0.31) and therefore can not be considered to be insignificant and approaching zero mortality and serious injury rate.

Due to a lack of observer programs, there are few data concerning the mortality of marine mammals incidental to Canadian commercial fisheries, which are analogous to U.S. fisheries that are known to interact with killer whales. The sablefish longline fishery accounts for a large proportion of the commercial fishing/killer whale interactions in Alaska waters. Such interactions have not been reported in Canadian waters where sablefish are taken via a pot fishery. Since 1990, there have been no reported fishery related strandings of killer whales in Canadian waters. However, in 1994, one killer whale was reported to have contacted a salmon gillnet but did not entangle (Guenther et al. 1995). Data regarding the level of killer whale mortality related to commercial fisheries in Canadian waters, though thought to be small, are not readily available or reliable which results in an underestimate of the annual mortality for this stock.

Subsistence/Native Harvest Information

There are no reports of subsistence take of killer whales in Alaska or Canada.

Other Mortality

Since 1986, research efforts have been made to assess the nature and magnitude of killer whale/blackcod (sablefish; ***Anoplopoma fimbria)*** interactions (Dahlheim 1988, Yano and Dahlheim 1995). Fishery interactions have occurred each year in the Bering Sea and Prince William Sound, with the number of annual reports varying considerably. Data collected from the Japan/U. S. cooperative longline research surveys operating in the Bering Sea indicate that interactions may be increasing and expanding into the Aleutian Island region (Yano and Dahlheim 199.5). During the 1992 surveys conducted in the Bering Sea and western Gulf of Alaska, 9 of 182 (4.9%) individual whales in 7 of the 12 (58%) pods encountered had evidence of bullet wounds (Dahlheim and Waite 1993). The relationship between wounding due to shooting and survival is unknown In Prince William Sound, the pod responsible for most of the fishery interactions has experienced a high level of mortality: between 1986 and 1991, 22 whales out of a pod of 37 (59%) are missing and considered dead (Matkin et al. 1994). The cause of death for these whales is unknown, but likely related to gunshot wounds or effects of the ***Exxon Valdez*** oil spill (Dahlheim and Matkin 1994).

The shooting of killer whales in Canadian waters has also been a concern in the past. However, in recent years there have been no reports of shooting incidents in Canadian waters. In fact, The likelihood of shooting incidents involving 'transient' killer whales is thought to be minimal since commercial fishermen are most likely to observe 'transients' feeding on seals or sea lions instead of interacting with their fishing gear (G. Ellis, pers. comm., Pacific Biological Station, Nanaimo, BC, V9R 5K6).

STATUS OF STOCK

Killer whales are not listed as "depleted" under the MMPA or listed as "threatened" or "endangered" under the Endangered Species Act. Recall, that the human-caused mortality has been underestimated due to a lack of information on Canadian fisheries, and that the minimum abundance estimate is considered conservative (because researchers continue to encounter new whales and animals in the vicinity of the Queen Charlotte Islands were not included), resulting in a conservative PBR estimate. However,' based on currently available data, the estimated annual level of human-caused mortality and serious injury of 1.4 animals per year is not known to exceed the PBR (3.1). Therefore, the Eastern North Pacific Transient stock of killer whales is not classified as a strategic stock. Population trends and status of this stock relative to OSP are currently unknown.

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Revised 8/8/97

PACIFIC WHITE-SIDED DOLPHIN *(Lagenorhynchus obliquidens):* Central North Pacific Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

The Pacific white-sided dolphin is found throughout the temperate North Pacific Ocean, north of the coasts of Japan and Baja California, Mexico. In the eastern North Pacific the species occurs from the southern Gulf of California, north to the Gulf of Alaska, west to Amchitka in the Aleutian Islands, and is rarely encountered in the southern Bering Sea. The species is common both on the high seas and along the continental margins, and animals are known to enter the inshore passes of Alaska, British Columbia, and Washington (RIWC 1997).

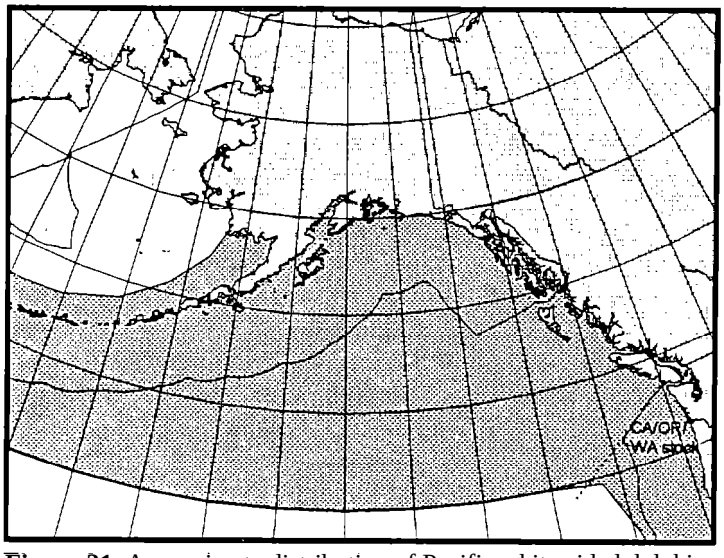

Figure 21. Approximate distribution of Pacific white-sided dolphins in the eastern North Pacific (shaded area).

The following information was considered in classifying Pacific white-sided dolphin stock structure based on the Dizon et al. (1992) phylogeographic approach: 1) Distributional data: geographic distribution is continuous; 2) Population response data: unknown; 3) Phenotypic data: two morphological forms are recognized (Walker et al. 1986, Chivers et al. 1993); and 4) Genotypic data: preliminary genetic analyses on 116 Pacific white-sided dolphin collected in four areas (Baja California, the west coast of the U. S., British Columbia/southeast Alaska, and offshore) were not statistically significant to support phylogeographic partitioning, though lend credence support the hypothesis that animals from the different regions are sufficiently isolated to treat them as separate management units (RIWC 1997). Based on this limited information, stock structure throughout the North Pacific is poorly defined, yet the northern form occurs north of about 33°N from southern California to Alaska, whereas the southern form ranges from about 36°N southward along the coasts of California and Baja California. The northern and southern forms can not, however, currently be differentiated for abundance and mortality estimation, and are thus managed as a single unit. Because the California and Oregon thresher shark/swordfish drift gillnet fishery operates between 33°N and 45°N and is known to interact with Pacific white-sided dolphins, two stocks are recognized: 1) the California/Oregon/Washington stock, and 2) the Central North Pacific stock. The California/Oregon/ Washington stock is reported separately in the Stock Assessment Reports for the Pacific Region.

POPULATION SIZE

The most recent population abundance estimate for Pacific white-sided dolphins was calculated from line transect analyses applied to the 1987-90 central North Pacific marine mammal sightings survey data (Buckland et al. 1993). The abundance estimate was 931,000 (CV=0900. 95% CI 206,000 - 4,216,000) animals, after a regression adjustment for size-biased sampling of schools. It should be noted, however, that Buckland et al. (1993) suggested that Pacific white-sided dolphins show strong vessel attraction, based on a high concentration of sightings close to the trackline during sampling. A correction factor has not yet been estimated for such vessel attraction behavior for Pacific white-sided dolphins, yet it may be more extreme than the 0.2 determined for Dall's porpoise ***(Phocoenoides dalli).*** In other words, the abundance estimates for Pacific white-sided dolphins may be biased upwards by more than five-fold.

Minimum Population Estimate

The minimum population estimate (N_{MIN}) for this stock is calculated according to Equation 1 from the PBR Guidelines (Wade and Angliss 1997): $N_{MIN} = N/\exp(0.842*[\ln(1+[CV(N)]^2)]^{½})$. Using the population estimate (N) of 931,000 and its associated CV of 0.900, N_{MIN} for the Central North Pacific stock of Pacific white-sided dolphin is 486,719.

Current Population Trend

At present, there is no reliable information on trends in abundance for this stock of Pacific white-sided dolphin.

CURRENT AND MAXIMUM N-ET PRODUCTIVITY RATES

A reliable estimate of the maximum net productivity rate is not currently available for the Central North Pacific stock of Pacific white-sided dolphin. Thus, it is recommended that the cetacean maximum net productivity rate (R_{MAX}) of 4% be employed for this stock (Wade and Angliss 1997).

POTENTIAL BIOLOGICAL REMOVAL

Under the 1994 re-authorized Marine Mammal Protection Act (MMPA), the potential biological removal (PBR) is defined as the product of the minimum population estimate, one-half the maximum theoretical net productivity rate, and a recovery factor: $PBR = N_{MIN} \times 0.5R_{MAX} \times F_R$. The recovery factor ($F_R$) for this stock is 0.5, the value for cetacean stocks of unknown status (Wade and Angliss 1997). Thus, for the Central North Pacific stock of Pacific white-sided dolphin, PBR = 4,867 animals (486,719 x 0.02 x 0.5).

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

Fisheries Information

Between 1978 and 1991, thousands of Pacific white-sided dolphins were killed annually incidental to high seas fisheries. However, these fisheries have not operated in the central North Pacific since 1991.

Six different commercial fisheries in Alaska that could have interacted with Pacific white-sided dolphins were monitored for incidental take by NMFS observers from 1990 to 1995: Bering Sea (and Aleutian Islands) and Gulf of Alaska groundfish trawl, longline, and pot fisheries. For the fisheries with observed takes, the range of observer coverage over the 6-year period, as well as the annual observed and estimated mortalities are presented in Table 17. The mean annual (total) mortality was 0.2 (CV=1.0) in the Bering Sea groundfish trawl fishery and 0.8 (CV=l.0) in the Bering Sea groundfish longline fishery. The 1992 mortality in the Bering Sea groundfish trawl fishery occurred during an unmonitored haul and therefore could not be used to estimate mortality for the entire fishery. Therefore, 1 mortality was used as both the observed mortality and estimated mortality in 1992 for that fishery, and should be considered a minimum estimate. Combining the estimates results in a mean annual (total) mortality rate of 1 Pacific white-sided dolphin in observed fisheries.

The Prince William Sound salmon drift gillnet fishery was also monitored by observers in 1990 and 1991. In 1990, observers boarded 300 (57.3%) of the 524 vessels participating in that fishery, monitoring a total of 3,166 sets, or roughly 4% of the estimated number of sets made by the fleet (Wynne et al. -1991). In 1991, observers boarded 531 (86.9%) of the 611 registered vessels and monitored a total of 5,875 sets, or roughly 5% of the estimated sets made by the fleet (Wynne et al. 1992). The low level of observer coverage for this fishery apparently missed interaction with Pacific-white sided dolphins which had occurred, as logbook mortalities were reported in both years 1990 (see Table 17) which were not recorded by the observer program.

An additional source of information on the number of Pacific white-sided dolphins killed or injured incidental to commercial fishery operations is the logbook reports maintained by vessel operators required by the MMPA interim exemption program During the 4-year period from 1990 to 1993, logbook reports from 3 unobserved fisheries (see Table 17) resulted in an annual mean of 2.25 mortalities from interactions with commercial fishing gear. It is unclear exactly which Bristol Bay fishery caused the 1990 mortalities because the logbook records from the Bristol Bay set and drift gillnet fisheries were combined. They have been attributed to the Bristol Bay drift gillnet fishery due to the more pelagic nature of the fishery, However, because logbook records are most likely negatively biased (Credle et al. 1994), these are considered to be minimum estimates, These totals are based on all available logbook reports for all Alaska fisheries. Complete logbook data after 1993 are not available.

It should be noted that no observers have been assigned several of the gillnet fisheries that are known to interact with this stock, making the estimated mortality unreliable. However, the large stock size makes it unlikely that unreported mortalities from those fisheries would be a significant source of mortality for the stock. The estimated minimum annual

mortality rate incidental to commercial fisheries (4; based on observer data (1) and logbook reports (rounded up to 3) where observer data were not available) is less than 10% of the PBR (487) and, therefore, can be considered to be insignificant and approaching zero mortality and serious injury rate.

Table 17. Summary of incidental mortality of Pacific white-sided dolphins (Central North Pacific stock) due to commercial fisheries from 1990 through 1995 and calculation of the mean annual mortality rate. Mean annual mortality in brackets represents a minimum estimate from logbook reports Data from 1991 to 1995 are used in the mortality calculation when more than 5 years of data are provided-for a particular fishery.

Fishery name	Years	Data type	Range of observer coverage	Observed mortality (in given yrs.)	Estimated mortality (in given yrs.)	Mean annual mortality
Bering Sea/Aleutian Is. (BSA) groundfish trawl	90-95	obs data	53-74%	0, 0, 1, 0, 0, 0	0, 0, 1, 0, 0, 0	0.2 (CV=1.0)
BSA groundfish longline (incl. misc. finfish and sablefish fisheries	90-95	obs data	27-80%	0, 0, 0, 0 0, 1	0, 0, 0, 0 0, 4	0.8 (CV=1.0)
Observer program total						1.0
				Reported mortalities		
Prince William Sound salmon drift gillnet	90-93	logbook	n/a	1, 4, 0, 0	n/a	[≥1.25]
Southeast Alaska salmon drift gillnet	90-93	logbook	n/a	0, 0, 1, 0	n/a	[≥.25]
Bristol Bay salmon drift gillnet	90-93	logbook	n/a	3, 0, 0, 0	n/a	[≥.75]
Minimum total annual mortality						≥3.25

Subsistence/Native Harvest Information

There are no reports of subsistence take of Pacific white-sided dolphins in Alaska

STATUS OF STOCK

Pacific white-sided dolphins are not listed as "depleted" under the MMPA or listed as "threatened" or "endangered" under the Endangered Species Act Based on currently available data, the level of human-caused mortality and serious injury (4) does not exceed the PBR (4,867). Therefore, the Central North Pacific stock of Pacific white-sided dolphins is not classified as a strategic stock. Population trends and status of this stock relative to OSP are currently unknown.

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Revised 8/8/97

HARBOR PORPOISE *(Phocoena phocoena):* Southeast Alaska Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

In the eastern North Pacific Ocean, the harbor porpoise ranges from Point Barrow, along the Alaska coast, and down the west coast of North America to Point Conception, California (Gaskin 1984). The harbor porpoise primarily frequents coastal waters. Relatively high densities of harbor porpoise have been recorded along the coasts of Washington and northern Oregon and California. Relative to the waters off the west coast of the continental U. S., harbor porpoise do not occur in high densities in Alaska waters (Dahlheim et al. submitted). Stock discreteness in the eastern North Pacific was analyzed using mitochondrial DNA from samples collected along the west coast (Rosel 1992) and is summarized in Osmek et al. (1994). Two distinct mitochondrial DNA groupings or clades exist. One clade is present in California, Washington, British Columbia and Alaska (no samples were available from Oregon), while the other is found only in California and Washington. Although these two clades are not geographically distinct by latitude, the results may indicate a low mixing rate for harbor porpoise along the west coast of North America. Investigation of pollutant loads in harbor porpoise, ranging from California to the Canadian border also suggests restricted harbor porpoise movements (Calambokidis and Barlow 1991). Further genetic testing of the same data mentioned above along with additional samples found significant genetic differences for 4 of the 6 pair-wise comparisons between the four areas investigated: California, Washington, British Columbia, and Alaska (Rosel et al. 1995). These results demonstrate that harbor porpoise along the west coast of North America are not panmictic or migratory, and that movement is sufficiently restricted to evolve genetic differences. This is consistent with low movement suggested by genetic analysis of harbor porpoise specimen from the North Atlantic. Numerous stocks have been delineated with clinal differences over areas as small as the waters surrounding the British Isles. Unfortunately, no conclusions can be drawn about the genetic structure of harbor porpoise within Alaska because of insufficient samples, Only 19 samples are available from Alaska porpoise and 12 of these come from a single area (Copper River Delta). Accordingly, harbor porpoise stock structure in Alaska remains unknown at this time.

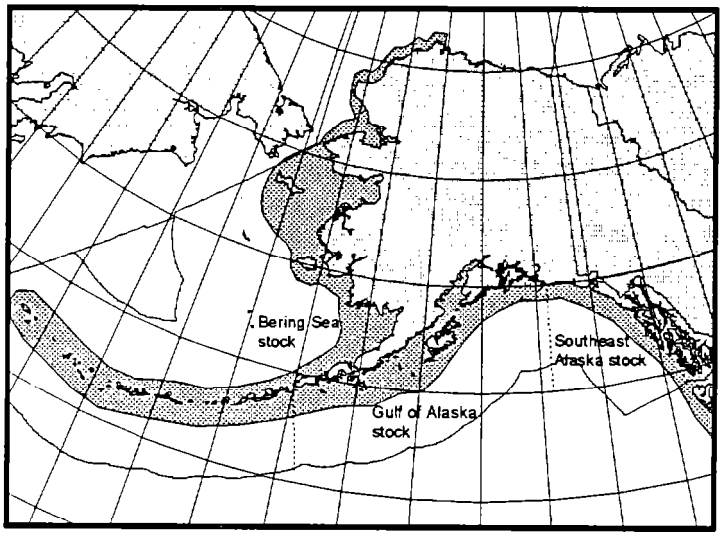

Figure 22. Approximate distribution of harbor porpoise in Alaska waters (shaded area). The distributions of all three stocks found in Alaska waters are shown.

Although it is difficult to determine the true stock structure of harbor porpoise populations in the northeast Pacific, from a management standpoint, it would be prudent to assume that regional populations exist and that they should be managed independently (Rosel et al. 1995, Taylor et al. 1996). The Alaska SRG concurred that while the available data were insufficient to justify recognizing three biological stocks of harbor porpoise in Alaska, it did not recommend against the establishment of three management units in Alaska (DeMaster 1996, 1997). Aerial surveys (Dahlheim et al. 1994) reveal a lower density of harbor porpoise between Yakutat and Cape Suckling. Accordingly, from the above information, three separate harbor porpoise stocks in Alaska are recommended: 1) the Southeast Alaska stock - occurring from the northern border of British Columbia border to Cape Suckling, Alaska, 2) the Gulf of Alaska stock - occurring from Cape Suckling to Unimak Pass, and 3) the Bering Sea stock - occurring throughout the Aleutian Islands and all waters north of Unimak Pass (Fig. 22). Information concerning the 4 harbor porpoise stocks occurring along the west coast of the continental U. S. (Central California, Northern California, Oregon/Washington Coast, and Inland Washington) can be found in the Stock Assessment Reports for the Pacific Region.

POPULATION SIZE

In June of 1993, an aerial survey covering the offshore Alaska waters from Dixon Entrance to Prince William Sound was conducted, resulting in an abundance estimate of 3,982 (CV=0.187) harbor porpoise (Dahlheim et al. submitted). Of the 106 harbor porpoise sightings during the 1993 aerial survey, 71 were encountered east of Cape Suckling (144°w). representing approximately 67% of the sightings. Prorating the abundance estimate to include only the portion of the survey conducted east of Cape Suckling results in an abundance estimate of 2,668 animals from the Southeast Alaska harbor porpoise stock. This estimate is admittedly ad hoc and deemed provisional at this time, pending reanalysis of the 1993 aerial survey data. The coefficient of variation for the entire 1993 survey area (0.187) is considered a reasonable estimate until such reanalysis occurs, Correction factors for aerial surveys of harbor porpoise have been estimated at 3.1 (CV=0.171) (Calambokidis et al. 1993) from Puget Sound, Washington, and 3.2 (Barlow et al. 1988) from the west coast of the continental U.S. The correction factor of 3.1 should be used for this harbor porpoise stock, as both estimates are considered conservative for Alaska aerial surveys due to differences in survey conditions. Thus, the estimated corrected abundance from this survey is 8,271 (2,668 x 3.1; CV=0.255) harbor porpoise for the offshore waters from Dixon Entrance to Cape Suckling.

Systematic vessel surveys of harbor porpoise in the inside waters of Southeast Alaska were conducted in 1991 (Dahlheim et al. 1992). 1992 (Dahlheim et al. 1993), and 1993 (Dahlheim et al. 1994). Three vessel surveys in the spring, summer, and fall of each year were performed with abundance estimates relatively similar in each year (Dahlheim et al. 1994). The June 1993 vessel survey of the inside waters occurred simultaneously with the 1993 aerial survey, mentioned above, and resulted in an abundance estimate of 1,586 (CV=0.392) harbor porpoise. Correction factors for vessel surveys of harbor porpoise have been estimated at 1.28 (CV=0.091) in the Pacific Ocean along the west coast of the U. S. (Barlow 1988) and at 1.9 (CV=0.142) from vessel surveys in the Gulf of Maine (D. Palka, pers. comm., Northeast Fisheries Science Center, P.O. Box 314, Woods Hole, MA 02543). The estimated correction factor from the Pacific Ocean surveys (1.28) should be used for the Alaska vessel surveys because it is more conservative and the techniques used in the Barlow study were more similar to the Alaska surveys than those employed in the Gulf of Maine. Therefore, the total corrected abundance estimate for the inside waters of Southeast Alaska is 2,030 (1,586 x 1.28; CV=0.404) harbor porpoise. Accordingly, the corrected abundance estimate for the Southeast Alaska harbor porpoise stock, from aerial surveys in offshore waters and vessel surveys in inside waters, is 10,301 (8,271+2,030) animals.

In the previous stock assessment, harbor porpoise in Alaska were considered a single stock composed of 29,744 animals (Small and DeMaster 1995). If the abundance estimates for the 3 Alaska stocks of harbor porpoise in this volume are pooled, the resulting estimate would also be 29,744 animals (10,301 + 8,497 + 10,946).

Minimum Population Estimate

For the Southeast Alaska stock of harbor porpoise, the minimum population estimates (N_{MIN}) for the aerial and vessel surveys are calculated separately, using Equation 1 from the PBR Guidelines (Wade and Angliss 1997): $N_{MIN} = N/\exp(0.842*[(\ln(1+[CV(N)]^2)]^{½})$. Using the population estimates (N) of 8,271 and 2,030 along with their associated CVs (0.255 and 0.404, respectively), N_{MIN} for this stock is 8,156 (6,693+1,463).

Current Population Trend

At present, there is no reliable information on trends in abundance for the Southeast Alaska stock of harbor porpoise.

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

A reliable estimate of the maximum net productivity rate (R_{MAX}) is not currently available for the Southeast Alaska stock of harbor porpoise. Hence, until additional data become available, it is recommended that the cetacean maximum theoretical net productivity rate of 4% be employed (Wade and Angliss 1997).

POTENTIAL BIOLOGICAL REMOVAL

Under the 1994 re-authorized Marine Mammal Protection Act (MMPA), the potential biological removal (PBR) is defined as the product of the minimum population estimate, one-half the maximum theoretical net productivity rate, and a recovery factor: $PBR = N_{MIN} \times 0.5R_{MAX} \times F_R$. The recovery factor ($F_R$) for this stock is 0.5, the value for cetacean stocks with unknown population status (Wade and Angliss 1997). Thus, for the Southeast Alaska stock of harbor porpoise, PBR = 82 animals (8,156 x 0.02 x 0.5).

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

Fisheries Information

Some fishing effort by vessels participating in the Gulf of Alaska (GOA) groundfish longline fishery occurs in the offshore waters of Southeast Alaska. Effort levels are insignificant for the portion of the GOA groundfish trawl and pot fisheries operating in these waters, However, during the period from 1990 to 1995, 21-31% of the GOA longline catch occurred within the range of the Southeast Alaska harbor porpoise stock. This fishery has been monitored for incidental take by NMFS observers from 1990 to 1995 (8-21% observer coverage), although observer coverage has been very low in the offshore. waters of Southeast Alaska (<1-4% observer coverage). No mortalities from this stock of harbor porpoise incidental to commercial fisheries have been observed.

The only source of information on the number of harbor porpoise killed or injured incidental to commercial fishery operations is the logbook reports maintained by vessel operators as required by the MMPA interim exemption program. During the 4-year period between 1990 and 1993, logbook reports from the Southeast Alaska salmon drift gillnet fishery (Table 18) resulted in an annual mean of 3.25 mortalities from interactions with commercial fishing gear. However, because logbook records are most likely negatively biased (Credle et al. 1994), this is considered to be a minimum estimate. There were no other logbook mortalities for any other fishery within the range of the Southeast Alaska harbor porpoise stock. Complete logbook data after 1993 are not available.

Table 18. Summary of incidental mortality of harbor porpoise (Southeast Alaska stock) due to commercial fisheries from 1990 through 1995 and calculation of the mean annual mortality rate. Mean annual mortality in brackets represents a minimum estimate from logbook reports.

Fishery name	Years	Data type	Range of observer coverage	Reported mortality (in given yrs.)	Estimated mortality (in given yrs.)	Mean annual mortality
Observer program total	90-95					0
Southeast Alaska salmon drift gillnet	90-93	logbook	n/a	2, 2, 7, 2	n/a	[≥3.25]
Minimum total annual mortality						≥3.25

For this stock of harbor porpoise, the estimated minimum annual mortality rate incidental to commercial fisheries is 4 animals (rounded up from 3.25). based entirely on logbook data. However, a reliable estimate of the mortality rate incidental to commercial fisheries is currently unavailable because of the absence of observer placements in Southeast Alaska fisheries. Therefore, it is unknown whether the kill rate is insignificant. At present, annual mortality levels less than 8.2 animals per year (i.e., 10% of PBR) can be considered to be insignificant and approaching zero mortality and serious injury rate.

Subsistence/Native Harvest Information

Subsistence hunters in Alaska have not been reported to take from this stock of harbor porpoise.

STATUS OF STOCK

Harbor porpoise are not listed as "depleted" under the MMPA or listed as "threatened' or "endangered" under the Endangered Species Act. Logbook records are most likely negatively biased (Credle et al. 1994) resulting in an underestimate of incidental kill. However, based on the best scientific information available, the estimated level of human-caused mortality and serious injury (4) is not known to exceed the PBR (82). Therefore, the Southeast Alaska stock of harbor porpoise is not classified as a strategic stock. Population trends and status of this stock relative to OSP are currently unknown.

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HARBOR PORPOISE *(Phocoena phocoena):* Gulf of Alaska Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

In the eastern North Pacific Ocean, the harbor porpoise ranges from Point Barrow, along the Alaska coast, and down the west coast of North America to Point Conception, California (Gaskin 1984). The harbor porpoise primarily frequents coastal waters. Relatively high densities of harbor porpoise have been recorded along the coasts of Washington and northern Oregon and California. Relative to the waters off the west coast of the continental U. S., harbor porpoise do not occur in high densities in Alaska waters (Dahlheim et al. submitted). Stock discreteness in the eastern North Pacific was analyzed using mitochondrial DNA from samples collected along the west coast (Rosel 1992) and is summarized in Osmek et al. (1994). Two distinct mitochondrial DNA groupings or clades exist. One clade is present in California, Washington, British Columbia and Alaska (no samples were available from Oregon), while the other is found only in California and Washington. Although these two clades are not geographically distinct by latitude, the results may indicate a low mixing rate for harbor porpoise along the west coast of North America. Investigation of pollutant loads in harbor porpoise ranging from California to the Canadian border also suggests restricted harbor porpoise movements (Calambokidis and Barlow 1991). Further genetic testing of the same data mentioned above along with additional samples found significant genetic differences for 4 of the 6 pair-wise comparisons between the four areas investigated: California, Washington, British Columbia, and Alaska (Rosel et al. 1995). These results demonstrate that harbor porpoise along the west coast of North America are not panmictic or migratory, and that movement is sufficiently restricted to evolve genetic differences. This is consistent with low movement suggested by genetic analysis of harbor porpoise specimen from the North Atlantic. Numerous stocks have been delineated with clinal differences over areas as small as the waters surrounding the British Isles. Unfortunately, no conclusions can be drawn about the genetic structure of harbor porpoise within Alaska because of insufficient samples. Only 19 samples are available from Alaska porpoise and 12 of these come from a single area (Copper River Delta). Accordingly, harbor porpoise stock structure in Alaska remains unknown at this time.

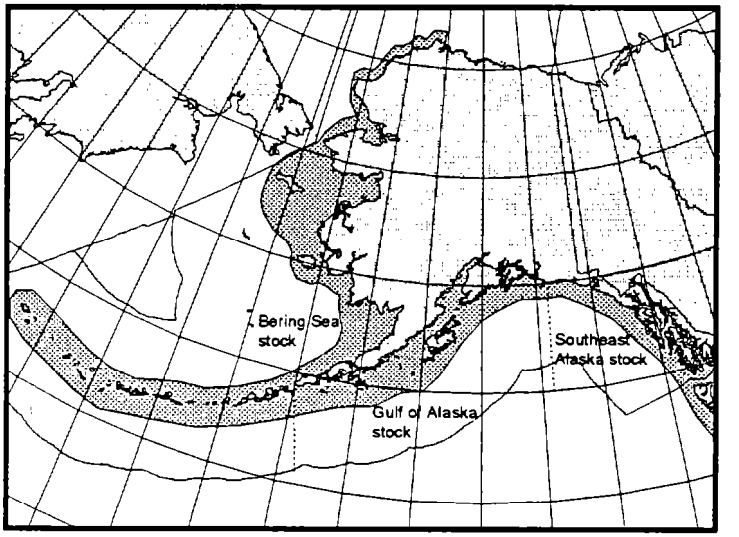

Figure 23. Approximate distribution of harbor porpoise in Alaska waters (shaded area). The 'distributions of all three stocks found in Alaska waters are shown.

Although it is difficult to determine the true stock structure of harbor porpoise populations in the northeast Pacific, from a management standpoint, it would be prudent to assume that regional populations exist and that they should be managed independently (Rosel et al. 1995, Taylor et al. 1996). The Alaska SRG concurred that while the available data were insufficient to justify recognizing three biological stocks of harbor porpoise in Alaska, it did not recommend against the establishment of three management units in Alaska (DeMaster 1996, 1997). Aerial surveys (Dahlheim et al. 1994) reveal a lower density of harbor porpoise between Yakutat and Cape Suckling. Accordingly, from the above information, three separate harbor porpoise stocks in Alaska are recommended: 1) the Southeast Alaska stock - occurring from the northern border of British Columbia border to Cape Suckling, Alaska, 2) the Gulf of Alaska stock - occurring from Cape Suckling to Unimak Pass, and 3) the Bering Sea stock - occurring throughout the Aleutian Islands and all waters north of Unimak Pass (Fig. 23). Information concerning the 4 harbor porpoise stocks occurring along the west coast of the continental U. S. (Central California, Northern California, Oregon/Washington Coast, and Inland Washington) can be found in the Stock Assessment Reports for the Pacific Region.

POPULATION SIZE

Systematic aerial surveys of harbor porpoise covering portions of the Gulf of Alaska were conducted in 1991 (Dahlheim et al. 1992), 1992 (Dahlheim et al. 1993), and 1993 (Dahlheim et al. 1994). The 1991 aerial survey covering Cook Inlet waters resulted in an abundance estimate of 136 (CV=0.632) harbor porpoise (Dahlheim et al. submitted). The 1992 aerial survey covered the waters around Kodiak Island and along the south side of the Alaska Peninsula from Shelikof Strait to the Shumagin Islands. Inclement weather during the 1992 survey prohibited covering the portion of the Alaska Peninsula extending from the Shumagin Islands to Unimak Pass, approximately 160-165°W (Dahlheim et al. 1993). The 1992 survey resulted in an abundance estimate of 740 (CV=0.339) harbor porpoise around Kodiak Island and 551 (CV=0.122) harbor porpoise along the southern Alaska Peninsula (Dahlheim et al. submitted). The 1993 aerial survey covered the offshore Alaska waters from Dixon Entrance to Prince William Sound, resulting in an abundance estimate of 3,982 (CV=0.187) harbor porpoise (Dahlheim et al. submitted). Of the 106 harbor porpoise sightings during the 1993 aerial survey, 35 were encountered west of Cape Suckling (144°W), representing approximately 33% of the sightings. Prorating the abundance estimate to include only the portion of the survey conducted west of Cape Suckling results in an abundance estimate of 1,314 animals from the Gulf of Alaska harbor porpoise stock. This estimate is admittedly ad hoc and deemed provisional at this time, pending reanalysis of the 1993 aerial survey data. Until such reanalysis occurs, the coefficient of variation for the 1993 survey area (0.187) is considered a reasonable estimate for the CV of the portion of the survey conducted to the west of Cape Suckling. Adding the abundance estimates for the portions of the 1991-93, surveys within the range of the Gulf of Alaska harbor porpoise stock results in a total estimated abundance of 2,741 (136+740+551+1314; CV=0.134) animals.

Correction factors for harbor porpoise aerial surveys have been estimated at 3.1 (CV=0.171) (Calambokidis et al. 1993) from Puget Sound, Washington, and 3.2 (Barlow et al. 1988) from the west coast of the continental U. S. The correction factor of 3.1 should be used for this harbor porpoise stock, as both estimates are considered conservative for Alaska aerial surveys due to differences in survey conditions, Therefore, the total corrected abundance estimate for the Gulf of Alaska stock of harbor porpoise is 8,497 (CV=0.218) animals. This abundance estimate is conservative because several areas within the Gulf of Alaska were not included in the 1991-93 aerial surveys. These areas include the region from 160-165°W along the southern Alaska Peninsula (mentioned above) and the coastal waters from western Prince William Sound to the Kenai Peninsula (approximately 148-152°W).

In the previous stock assessment, harbor porpoise in Alaska were considered a single stock composed of 29,744 animals (Small and DeMaster 1995). If the abundance estimates for the 3 Alaska stocks of harbor porpoise in this volume are pooled, the resulting estimate would also be 29,744 animals (10.301+8,497+10,946).

Minimum Population Estimate

The minimum population estimate (N_{MIN}) for this stock is calculated using Equation 1 from the PBR Guidelines (Wade and Angliss 1997): $N_{MIN} = N/\exp(0.842*[\ln(1+[CV(N)]^2)]^{½})$. Using the population estimate (N) of 8,497 and its associated CV of 0.218, N_{MIN} for the Gulf of Alaska stock of harbor porpoise is 7,085.

Current Population Trend

At present, there is no reliable information on trends in abundance for the Gulf of Alaska stock of harbor porpoise.

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

A reliable estimate of the maximum net productivity rate (R_{MAX}) is not currently available for the Gulf of Alaska stock of harbor porpoise. Hence, until additional data become available, it is recommended that the cetacean maximum theoretical net productivity rate of 4% be employed (Wade and Angliss 1997).

POTENTIAL BIOLOGICAL REMOVAL

Under the 1994 re-authorized Marine Mammal Protection Act (MMPA), the potential biological removal (PBR) is defined as the product of the minimum population estimate, one-half the maximum theoretical net productivity rate, and a recovery factor: $PBR = N_{MIN} \times 0.5R_{MAX} \times F_R$. The recovery factor ($F_R$) for this stock is 0.5, the value for cetacean stocks with unknown population status (Wade and Angliss 1997). Thus, for the Gulf of Alaska stock of harbor porpoise, PBR = 71 animals (7,085 x 0.02 x 0.5).

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

Fisheries Information

Three different commercial fisheries operating within the range of the Gulf of Alaska stock of harbor porpoise were monitored for incidental take by NMFS observers during 1990-95: Gulf of Alaska groundfish trawl, longline, and pot fisheries. No incidental mortality of harbor porpoise was observed in these fisheries. Observers also monitored the Prince William Sound salmon drift gillnet fishery in 1990 and 1991, recording 1 mortality in 1990 and 3 mortalities in 1991. These mortalities extrapolated to 8 (95% CI 1-23) and 32 (95% CI 3-103) kills for the entire fishery, resulting in a mean kill rate of 20 (CV=0.60) animals per year for 1990 and 1991. In 1990, observers boarded 300 (57.3%) of the 524 vessels that fished in the Prince William Sound salmon drift gillnet fishery, monitoring a total of 3,166 sets, or roughly 4% of the estimated number of sets made by the fleet (Wynne et al. 1991). In 1991, observers boarded 531 (86.9%) of the 611 registered vessels and monitored a total of 5,875 sets, or roughly 5% of the estimated sets made by the fleet (Wynne et al. 1992). Logbook reports from this fishery detail 6, 5, 6, and 1 harbor porpoise mortalities in 1990, 1991, 1992, and 1993, respectively. The extrapolated (estimated) observer mortality accounts for those mortalities, so they do not appear in Table 19. The Prince William Sound salmon drift gillnet fishery has not been observed since 1991; therefore, no additional data are available for that fishery.

An additional source of information on the number of harbor porpoise mortalities incidental to commercial fishing operations is the logbook reports maintained by vessel operators as required by the MMPA interim exemption program. During the 4-year period between 1990 and 1993, logbook reports from 2 unobserved fisheries (see Table 19) resulted in an annual mean of 4.5 mortalities from interactions with commercial fishing gear. In 1990, logbook records from the Cook Inlet set and drift gillnet fisheries were combined. As it is not possible to determine which fishery was responsible for the harbor porpoise mortalities reported in 1990, both fisheries have been included in Table 19. However, because logbook records are most likely negatively biased (Credle et al. 1994), these are considered to be minimum estimates. These totals are based on all available logbook reports for Gulf of Alaska fisheries, except the Prince William Sound salmon drift gillnet fishery for which observer data were presented above. Complete logbook data after 1993 are not available.

Table 19. Summary of incidental mortality of harbor porpoise (Gulf of Alaska stock) due to commercial fisheries from 1990 through 1995 and calculation of the mean annual mortality rate. Mean annual mortality in brackets represents a minimum estimate from logbook reports or stranding data.

Fishery name	Years	Data type	Range of observer coverage	Observed mortality (in given yrs.)	Estimated mortality (in given yrs.)	Mean annual mortality
Prince William Sound salmon drift gillnet	90-91	obs data	4-5%	1, 3	8, 32	20 (CV=.60)
Observer program total						20
				Reported mortalities		
Cook Inlet salmon drift and set gillnet fisheries	90-93	logbook	n/a	3, 0, 0, 0	n/a	[≥0.75]
Kodiak salmon set gillnet	90-93	logbook	n/a	8, 4, 2, 1	n/a	[≥3.75]
Minimum total annual mortality						≥24.5

Strandings of marine mammals with fishing gear attached or with injuries caused by interactions with fishing gear are a final source of mortality data. In the period from 1990 to 1994, 12 harbor porpoise scarred with gillnet marks were discovered stranded in Prince William Sound (Copper River Delta). These stranding reports were likely the result of operations in the Prince William Sound salmon drift gillnet fishery. The extrapolated (estimated) observer mortality for this fishery accounts for these mortalities, so they do not appear in Table 19.

A reliable estimate of the mortality rate incidental to commercial fisheries is considered unavailable because of the absence of observer placements in several gillnet fisheries mentioned above. However, the estimated minimum annual mortality rate incidental to commercial fisheries is 25, based on observer data (20) and logbook reports (rounded to 5) where

observer data were not available. This estimated annual mortality rate is greater than 10% of the PBR (7.1) and, therefore, cannot be considered to be insignificant and approaching zero mortality and serious injury rate.

Subsistence/Native Harvest Information

Subsistence hunters in Alaska have not been reported to take from this stock of harbor porpoise.

STATUS OF STOCK

Harbor porpoise are not listed as "depleted" under the MMPA or listed as "threatened" or "endangered" under the Endangered Species Act. The lack of surveys in a significant portion of the Gulf of Alaska results in a conservative PBR for this stock. Logbook records are most likely negatively biased (Credle et al. 1994) resulting in an underestimate of incidental mortality. However, based on the best scientific information available, the estimated level of human-caused mortality and serious injury (25) is not known to exceed the PBR (7 1). Therefore, the Gulf of Alaska stock of harbor porpoise is not classified as a strategic stock. Population trends and status of this stock relative to OSP are currently unknown.

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HARBOR PORPOISE *(Phocoena phocoena):* Bering Sea Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

In the eastern North Pacific Ocean, the harbor porpoise ranges from Point Barrow, along the Alaska coast, and down the west coast of North America to Point Conception, California (Gaskin 1984). The harbor porpoise primarily frequents coastal waters, Relatively high densities of harbor porpoise have been recorded along the coasts of Washington and northern Oregon and California. Relative to the waters off the west. coast of the continental U.S., harbor porpoise do not occur in high densities in Alaska waters Dahlheim et al. submitted). Stock discreteness in the eastern North Pacific was analyzed using mitochondrial DNA from samples collected along the west coast (Rosel 1992) and is summarized in Osmek et al. (1994). Two distinct mitochondrial DNA groupings or clades exist. One clade is present in California, Washington, British Columbia and Alaska (no samples were available from Oregon), while the other is found only in California and Washington. Although these two clades are not geographically distinct by latitude, the results may indicate a low mixing rate for harbor porpoise along the west coast of North America. Investigation of pollutant loads in harbor porpoise ranging from California to the Canadian border also suggests restricted harbor porpoise movements (Calambokidis and Barlow 1991). Further genetic testing of the same data mentioned above along with additional samples found significant genetic differences for 4 of the 6 pair-wise comparisons between the four areas investigated: California, Washington, British Columbia, and Alaska (Rosel et al. 1995). 'These results demonstrate that harbor porpoise along the west coast of North America are not panmictic or migratory, and that movement is sufficiently restricted to evolve genetic differences. This is consistent with low movement suggested by genetic analysis of harbor porpoise specimen from the North Atlantic. Numerous stocks have been delineated with clinal differences over areas as small as the waters surrounding the British Isles. Unfortunately, no conclusions can be drawn about the genetic structure of harbor porpoise within Alaska because of insufficient samples. Only 19 samples are available from Alaska porpoise and 12 of these come from a single area (Copper River Delta). Accordingly, harbor porpoise stock structure in Alaska remains unknown at this time.

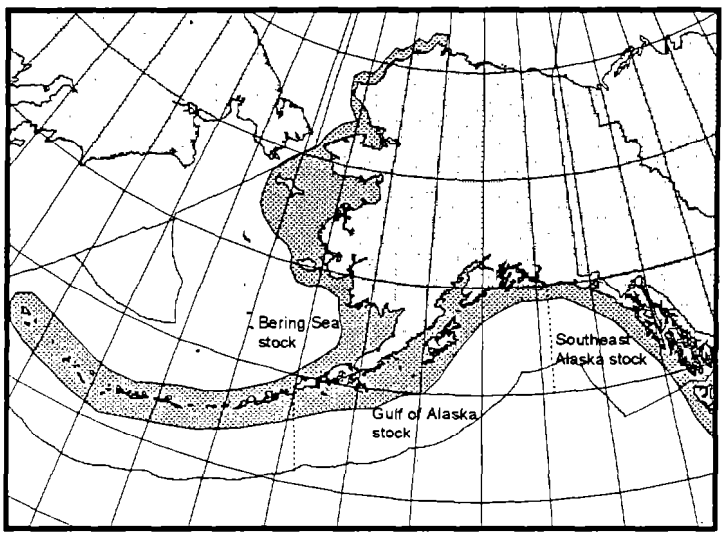

Figure 24. Approximate distribution of harbor porpoise in Alaska waters (shaded area). The distributions of all three stocks found in Alaska waters are shown.

Although it is difficult to determine the true stock structure of harbor porpoise populations in the northeast Pacific, from a management standpoint, it would be prudent to assume that regional populations exist and that they should be managed independently (Rosel et al. 1995, Taylor et al. 1996). The Alaska SRG concurred that while the available data were insufficient to justify recognizing three biological stocks of harbor porpoise in Alaska, it did not recommend against the establishment of three management units in Alaska (DeMaster 1996, 1997). Aerial surveys (Dahlheim et al. 1994) reveal a lower density of harbor porpoise between Yakutat and Cape Suckling. Accordingly, from the above information, three separate harbor porpoise stocks in Alaska are recommended: 1) the Southeast Alaska stock - occurring from the northern border of British Columbia border to Cape Suckling, Alaska, 2) the Gulf of Alaska stock - occurring from Cape Suckling to Unimak Pass, and 3) the Bering Sea stock - occurring throughout the Aleutian Islands and all waters north of Unimak Pass (Fig. 24). Information concerning the 4 harbor porpoise stocks occurring along the west coast of the continental U. S. (Central California Northern California, Oregon/Washington Coast, and Inland Washington) can be found in the Stock Assessment Reports for the Pacific Region.

POPULATION SIZE

In the summer of 1991, an aerial survey covering the Bristol Bay region was conducted resulting in an abundance estimate of 3,531 (CV=0.243) harbor porpoise (Dahlheim et al. submitted). No survey effort was conducted in the vicinity of the Pribilof Islands or along the Aleutian Islands because of the lack of commercial fisheries that could potentially affect harbor porpoise in those areas (Dahlheim et al. 1992). In addition, no survey effort was conducted north of Cape Newenham (approximately 59°N), when harbor porpoise are regular visitors as far north as Point Barrow during the summer months (Suydam and George 1992). Clearly, the 1991 survey covered only a fraction of the range occupied by the Bering Sea stock of harbor porpoise.

Correction factors for harbor porpoise aerial surveys have been estimated at 3.1 (CV=0.171) (Calambokidis et al. 1993) from Puget Sound, Washington, and 3.2 (Barlow et al. 1988) from the west coast of the continental U. S. The correction factor of 3.1 should be used for this harbor porpoise stock, as both estimates are considered conservative for Alaska aerial surveys due to differences in survey conditions. Therefore, the total corrected abundance estimate for the Bering Sea stock of harbor porpoise is 10,946 (3,531 x 3.1; CV=0.300) animals.

In the previous stock assessment, harbor porpoise in Alaska were considered a single stock composed of 29,744 animals (Small and DeMaster 1995). If the abundance estimates for the 3 Alaska stocks of harbor porpoise in this volume are pooled, the resulting estimate would also be 29,744 animals (10,301+8,497+ 10,946).

Minimum Population Estimate

The minimum population estimate (N_{MIN}) for this stock is calculated using Equation 1 from the PBR Guidelines (Wade and Angliss 1997): $N_{MIN} = N/\exp(0.842*[\ln(1+[CV(N)]^2)]^{½})$. Using the population estimate (N) of 10,946 and its associated CV of 0.300, N_{MIN} for the Bering Sea stock of harbor porpoise is 8,549.

Current Population Trend

At present, there is no reliable information on trends in abundance for the Bering Sea stock of harbor porpoise.

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

A reliable estimate of the maximum net productivity rate (R_{MAX}) is not currently available for this stock of harbor porpoise. Hence, until additional data become available, it is recommended that the cetacean maximum theoretical net productivity rate of 4% be employed (Wade and Angliss 1997).

POTENTIAL BIOLOGICAL REMOVAL

Under the 1994 re-authorized Marine Mammal Protection Act (MMPA), the potential biological removal (PBR) is defined as the product of the minimum population estimate, one-half the maximum theoretical net productivity rate, and a recovery factor: $PBR = N_{MIN} \times 0.5R_{MAX} \times F_R$. The recovery factor ($F_R$) for this stock is 0.5, the value for cetacean stocks with unknown population status (Wade and Angliss 1997). Thus, for the Bering Sea stock of harbor porpoise, PBR = 86 animals (8,549 x 0.02 x 0.5).

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

Fisheries Information

Three different commercial fisheries operating within the range of the Bering Sea stock of harbor porpoise were monitored for incidental take by NMFS observers during 1990-95: Bering Sea (and Aleutian Islands) groundfish trawl, longline, and pot fisheries. The harbor porpoise mortality was observed only in the Bering Sea groundfish trawl fishery. The range of observer coverage over the 6-year period, as well as the annual observed and estimated mortalities are presented in Table 20. The mean annual (total) mortality rate resulting from observed mortalities was 0.75 (CV=.67). In 1990, observers also boarded 59 (38.3%) of the 154 vessels participating in the Alaska Peninsula/Aleutian Island salmon drift gillnet fishery, monitoring a total of 373 sets, or roughly 4% of the estimated number of sets made by the fleet (Wynne et al. 1991). The low level of observer coverage for this fishery apparently missed interactions with harbor porpoise which had occurred, as logbook mortalities were reported in 1990 (see Table 20) which were not recorded by the observer program.

An additional source of information on the number of harbor porpoise mortalities incidental to commercial fishery operations is the logbook reports maintained by vessel operators as required by the MMPA interim exemption program. During the 4-year period from 1990 to 1993, logbook reports from 2 unobserved fisheries (see Table 20) resulted in an

annual mean of 1.25 mortalities from interactions with commercial fishing gear. However, because logbook records are most likely negatively biased (Credle et al. 1994), these are considered to be minimum estimates, These totals are based on all available logbook reports for fisheries occurring within the range of the Bering Sea harbor porpoise stock, except the Bering Sea groundfish fisheries for which observer data were presented above. Complete logbook data after 1993 are not available.

Logbook records for three fisheries listed in Table 20 did not report any harbor porpoise mortality over the 1990-93 period. These fisheries have been included above because of the large number of participants and the significant potential for interaction with harbor porpoise. During the period from 1981 to 1987, 7 harbor porpoise mortalities have resulted from gillnet entanglement in the area from Nome to Unalakleet, 3 were reported near Kotzebue from 1989 to 1990, and some take of harbor porpoise is likely in the Bristol Bay gillnet fisheries (Barlow et al. 1994). A similar set gillnet fishery conducted by subsistence fishers incidentally took 6 harbor porpoise in 1991 near Point Barrow, Alaska (Suydam and George 1992).

Table 20. Summary of incidental mortality of harbor porpoise (Bering Sea stock) due to commercial fisheries from 1990 through 1995 and calculation of the mean annual mortality rate. Mean annual mortality in brackets represents a minimum estimate from logbook reports. Data from 1991 to 1995 are used in the mortality calculation when more than 5 years of data are provided for a particular fishery.

Fishery name	Years	Data type	Range of observer coverage	Observed mortality (in given yrs.)	Estimated mortality (in given yrs.)	Mean annual mortality
Bering Sea/Aleutian Is. (BSA) groundfish trawl	90-95	obs data	53-74%	0, 0, 0, 0, 1, 1	0, 0, 0, 0, 2, 1	0.75 (CV=.67)
Observer program total						0.75
				Reported mortalities		
AK Peninsula/Aleutian Island salmon drift gillnet	90-93	logbook	n/a	2, 0, 1, 0	n/a	[≥0.75]
AK Peninsula/Aleutian Island salmon set gillnet	90-93	logbook	n/a	0, 0, 2, 0	n/a	[≥0.5]
Bristol Bay salmon drift gillnet	90-93	logbook	n/a	0, 0, 0, 0	n/a	[0]
Bristol Bay salmon set gillnet	90-93	logbook	n/a	0, 0, 0, 0	n/a	[0]
AK Kuskokwim, Yukon, Norton Sound, Kotzebue salmon gillnet	90-93	logbook	n/a	0, 0, 0, 0	n/a	[0]
Minimum total annual mortality						≥2.0

The estimated minimum annual mortality rate incidental to commercial fisheries is 2 animals, based on observer data (0.75) and logbook reports (1.25) where observer data were not available. However, a reliable estimate of the mortality rate incidental to commercial fisheries is currently unavailable because of the absence of observer placements in the gillnet fisheries discussed above. Therefore, it is unknown whether the kill rate is insignificant. At present, annual mortality levels less than 8.6 animals per year (i.e., 10% of PBR) can be considered to be insignificant and approaching zero mortality and serious injury rate.

Subsistence/Native Harvest Information

Subsistence hunters in Alaska have not been reported to take from this stock of harbor porpoise.

STATUS OF STOCK

Harbor porpoise are not listed as "depleted" under the MMPA or listed as "threatened" or "endangered' under the Endangered Species Act The lack of surveys in a significant portion of this stock's range results in a conservative PBR for this stock. Logbook records are most likely negatively biased (Credle et al. 1994) resulting in an underestimate of incidental kill However, based on the best scientific information available, the estimated level of human-caused mortality and serious

injury (2) is not known to exceed the PBR (86). Therefore, the Bering Sea stock of harbor porpoise is not classified as a strategic stock. Population trends and status of this stock relative to OSP are currently unknown.

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Revised 8/8/97

DALL'S PORPOISE *(Phocoenoides dalli):* Alaska Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

Dall's porpoise are widely distributed across the entire North Pacific Ocean (Fig. 25). They are found over the continental shelf adjacent to the slope and over deep (2,500+m) oceanic waters (Hall 1979). They have been sighted throughout the North Pacific as far north as 65°N (Buckland et al. 1993), and as far south as 28°N in the eastern North Pacific (Leatherwood and Fielding 1974). The only apparent distribution gaps in Alaska waters are upper Cook Inlet and the shallow eastern flats of the Bering Sea. Throughout most of the eastern North Pacific they are present during all months of the year, although there may be seasonal onshore-offshore movements along the west coast of the continental U. S. (Loeb 1972, Leatherwood and Fielding 1974). and winter movements of populations out of Prince William Sound (Hall 1979) and areas in the Gulf of Alaska and Bering Sea (NMFS unpubl. data, National Marine Mammal Laboratory, 7600 Sand Point Way, NE, Seattle, WA 98115).

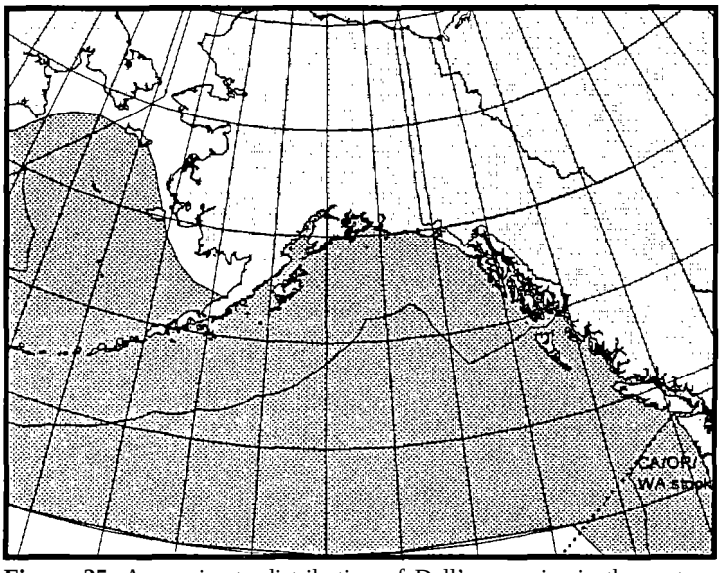

Figure 25. Approximate distribution of Dall's porpoise in the eastern North Pacific (shaded area).

The following information was considered in classifying stock structure based on the Dizon et al. (1992) phylogeographic approach: 1) Distributional data: geographic distribution continuous, 2) Population response data: differential timing of reproduction between the Bering Sea and western North Pacific; 3) Phenotypic data: unknown; and 4) Genotypic data: unknown. The stock structure of eastern North Pacific Dall's porpoise is not adequately understood at this time, but based on patterns of stock differentiation in the western North Pacific, where they have been more intensively studied, it is expected that separate stocks will emerge when data become available (Perrin and Brownell 1994). Based primarily on the population response data, a delineation between Bering Sea and western North Pacific stocks has been recognized (Jones et al. 1986). However, similar data are not available for the eastern North Pacific, thus one stock of Dall's porpoise is recognized in Alaska waters. Dall's porpoise along the west coast of the continental U.S. from California to Washington comprise a separate stock and are reported separately in the Stock Assessment Reports for the Pacific Region.

POPULATION SIZE

Data collected from vessel surveys, performed by both U.S. fishery observers and U. S. researchers from 1987 to 1991, were analyzed to provide population estimates of Dall's porpoise throughout the North Pacific and the Bering Sea (Hobbs and Lerczak 1993). The quality of data used in analyses was determined by the procedures recommended by Boucher and Boaz (1989). Survey effort was not well distributed throughout the U.S. Exclusive Economic Zone (EEZ) in Alaska, and as a result, Bristol Bay and the north Bering Sea received little survey effort. Only 3 sightings were reported in this area by Hobbs and Lerczak (1993), resulting in an estimate of 9,000 (CV=0.91). In the U. S. EEZ north and south of the Aleutian Islands, Hobbs and Lerczak (1993) reported an estimated abundance of 302,000 (CV=0.11), whereas for the Gulf of Alaska EEZ, they reported 106,000 (CV=0.20) Combining these three estimates (9,000 + 302,000,+ 106,000) results in a total abundance estimate of 417,000 (CV=0.097) for the Alaska stock of Dall's porpoise. Turnock and Quinn (1991) estimate that abundance estimates of Dall's porpoise are inflated by as much as 5 times because of vessel attraction behavior. Therefore, a corrected population estimate is 83,400 (417,000 x 0.2) for this stock. No reliable abundance estimates for British Columbia are currently available.

Minimum Population Estimate

The minimum population estimate (N_{MIN}) for this stock is calculated using Equation 1 from the PBR Guidelines (Wade and Angliss 1997): $N_{MIN} = N/\exp(0.842*[\ln(1+[CV(N)]^2)]^{½})$. Using the population estimate (N) of 83,400 and its associated CV of 0.097, N_{MIN} for the Alaska stock of Dall's porpoise is 76,874.

Current Population Trend

At present, there is no reliable information on trends in abundance for the Alaska stock of Dall's porpoise.

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

A reliable estimate of the maximum net productivity rate is not currently available for the Alaska stock of Dall's porpoise. Hence, until additional data become available, it is recommended that the cetacean maximum theoretical net productivity rate (R_{MAX}) of 4% be employed for the Alaska stock of Dall's porpoise (Wade and Angliss 1997).

POTENTIAL BIOLOGICAL REMOVAL

Under the 1994 re-authorized Marine Mammal Protection Act (MMPA), the potential biological removal (PBR) is defined as the product of the minimum population estimate, one-half the maximum theoretical net productivity rate, and a recovery factor: $PBR = N_{MIN} \times 0.5R_{MAX} \times F_R$. As this stock is considered to be within optimum sustainable population (Buckland et al. 1993) the recovery factor (F_R) for this stock is 1.0 (Wade and Angliss 1997). Thus, for the Alaska stock of Dall's porpoise, PBR = 1,537 animals (76,874 x 0.02 x 1.0).

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

Fisheries Information

Six different commercial fisheries operating within the range of the Alaska stock of Dall's porpoise were monitored for incidental take by NMFS observers during 1990-95: Bering Sea (and Aleutian Islands) groundfish trawl, longline, and pot fisheries, and Gulf of Alaska groundfish trawl, longline, and pot fisheries. No mortalities of Dall's porpoise were observed by NMFS observers in either pot fishery or the Gulf of Alaska longline fishery. For the fisheries with observed takes, the range of observer coverage over the 6-year period, as well as the annual observed and estimated mortalities are presented in Table 21. The mean annual (total) mortality was 4.6 (CV=0.20) for the Bering Sea groundfish trawl fishery, 0.6 (CV=1.0) for the Gulf of Alaska groundfish trawl fishery, and 1.6 (CV=.61) for the Bering Sea groundfish longline fishery

The Alaska Peninsula and Aleutian Island salmon driftnet fishery was monitored in 1990. Observers boarded 59 (38.3%) of the 154 vessels participating in the fishery, monitoring a total of 373 sets, or less than 4% of the estimated number of sets made by the fleet (Wynne et al. 1991). One Dall's porpoise mortality was observed which extrapolated to an annual (total) incidental mortality rate of 28 Dall's porpoise. Combining the estimates from the Bering Sea and Gulf of Alaska fisheries presented above (4.6+0.6+1.6=6.8) with the estimate from the Alaska Peninsula and Aleutian Island salmon drift gillnet fishery (28) results in an estimated annual incidental kill rate in observed fisheries of 34.8 porpoise per year from this stock.

The Prince William Sound driftnet fishery was also monitored by observers during 1990 and 1991, with no incidental mortality of Dall's porpoise reported. In 1990, observers boarded 300 (57.3%) of the 524 vessels that fished in the Prince William Sound salmon drift gillnet fishery, monitoring a total of 3,166 sets, or roughly 4% of the estimated number of sets made by the fleet (Wynne et al. 1991). In 1991, observers boarded 531 (86.9%) of the 611 registered vessels and monitored a total of 5,875 sets, or roughly 5% of the estimated sets made by the fleet (Wynne et al. 1992). The low level of observer coverage for this fishery apparently missed interaction with Dall's porpoise which had occurred, as logbook mortalities were reported in 1991 (see Table 21) which were not recorded by the observer program.

An additional source of information on the number of Dall's porpoise killed or injured incidental to commercial fishery operations is the logbook reports maintained by vessel operators as required by the MMPA interim exemption program. During the 4-year period between 1990 and 1993, logbook reports from 4 unobserved fisheries (see Table 21) resulted in an estimated annual mean of 6.5 mortalities from interactions with commercial fishing gear. In 1990, logbook records from the Cook Inlet set and drift gillnet fisheries were combined. As a result, the Dall's porpoise mortality reported in 1990 may have occurred in the Cook Inlet set gillnet fishery an not the drift gillnet fishery as reported in Table 21. However, because logbook records are most likely negatively biased (Credle et al. 1994), these are considered to be minimum estimates. These estimates are based on all available logbook reports for Alaska fisheries, except for those

fisheries which observer data were presented above. The Southeast Alaska salmon drift gillnet fishery accounted for the majority of the reported incidental take in unobserved fisheries. Complete logbook data after 1993 are not available.

Table 21. Summary of incidental mortality of Dall's porpoise (Alaska stock) due to commercial fisheries from 1990 through 1994 and calculation of the mean annual mortality rate. Mean annual mortality in brackets represents a minimum estimate from logbook reports.

Fishery name	Years	Data type	Range of observer coverage	Observed mortality (in given yrs.)	Estimated morality (in given yrs.)	Mean annual mortality
Bering Sea/Aleutian Is. (BSA) groundfish trawl	90-95	obs data	53-74%	6, 1, 5, 4, 4, 2	7, 2, 6, 5, 7, 3	4.6 (CV=.20)
Gulf of Alaska (GOA) groundfish trawl	90-95	obs data	33-55%	0, 0, 0, 1, 0, 0	0, 0, 0, 3, 0, 0	0.6 (CV=1.0)
BSA groundfish longline (incl. misc finfish and sablefish fisheries)	90-95	obs data	27-80%	0, 0, 0, 0, 1, 1	0, 0, 0, 0, 4, 4	1.6 (CV=.61)
AK Peninsula/ Aleutian Island salmon drift gillnet	90	obs data	4%	1	28	28 (CI 1-81)
Observer program total						34.8
				Reported mortalities		
Prince William Sound salmon drift gillnet	90-93	logbook	n/a	0, 2, 0, 0	n/a	[≥0.5]
Southeast Alaska salmon drift gillnet	90-93	logbook	n/a	6, 6, 4, 6	n/a	[≥5.5]
Cook Inlet set and drift gillnet fisheries	90-93	logbook	n/a	1, 0, 1, 0	n/a	[≥0.5]
Minimum total annual mortality						≥41.3

Note that no observers have been assigned several of the gillnet fisheries that are known to interact with this stock, making the estimated mortality unreliable. However, the large stock size makes it unlikely that unreported mortalities from those fisheries would be a significant source of mortality for the stock. The estimated minimum annual mortal@-rate incidental to commercial fisheries (42 animals; based on observer data (35) and logbook reports (rounded to 7) where observer data were not available) is not known to exceed 10% of the PBR (154) and, therefore can be considered to be insignificant and approaching zero mortality and serious injury rate.

Subsistence/Native Harvest Information

There are no reports of subsistence take of Dall's porpoise in Alaska

STATUS OF STOCK

Dall's porpoise are not listed as "depleted" under the MMPA or listed as "threatened" or "endangered" under the Endangered Species Act. Based on currently available data, the level of human-caused mortality and serious injury (42) does not exceed the PBR (1,537). Therefore, the Alaska stock of Dall's porpoise is not classified as a strategic stock. Population trends and status of this stock relative to OSP are currently unknown

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SPERM WHALE *(Physeter macrocephalus):* North Pacific Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

The sperm whale is one of the most widely distributed of any marine mammal species, perhaps only exceeded by the killer whale (Rice 1989). They feed primarily on medium-sized to large-sized squids but may also feed on large demersal and mesopelagic sharks, skates, and fishes (Gosho et al. 1984). In the North Pacific, sperm whales are distributed widely (Fig. 25), with the northernmost boundary extending from Cape Navarin (62°N) to the Pribilof Islands (Omura 1955). The shallow continental shelf apparently bars their movement into the north-eastern Bering Sea and Arctic Ocean (Rice 1989). Females and young sperm whales usually remain in tropical and temperate waters year-round, while males are thought to move north in the summer to feed in the Gulf of Alaska, Bering Sea, and waters around the Aleutian Islands. In the winter, sperm whales are typically distributed south of 40°N (Gosho et al 1984). However, discovery tag data from the days of commercial whaling revealed a great deal of east-west movement between Alaska waters and the Western North Pacific (Japan and the Bonin Islands), with little evidence of north-south movement in the Eastern North Pacific. For example, of several hundred sperm whales tagged off San Francisco (Calif.), none were recovered in the Gulf of Alaska despite large takes there (B. Taylor, pers. comm., Southwest Fisheries Science Center, P.O. Box 271, La Jolla, CA, 92038). Therefore, seasonal movement of sperm whales in the North Pacific is unclear at this time.

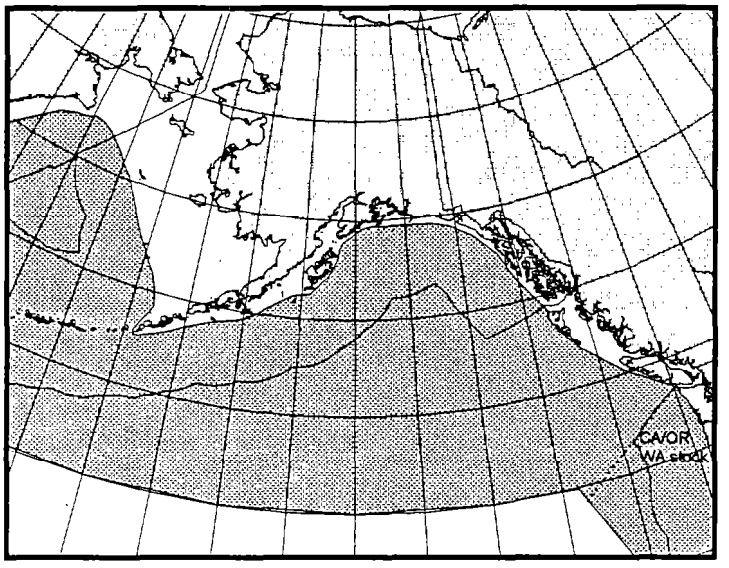

Figure 26. Approximate distribution of sperm whales in the eastern North Pacific (shaded area).

The following information was considered in classifying stock structure based on the Dizon et al. (1992) phylogeographic approach: I) Distributional data: geographic distribution continuous though indicates three "somewhat" discrete population centers (i.e., Hawaii, west coast of the continental U.S., and Alaska); 2) Population response data: unknown; 3) Phenotypic data: unknown; and 4) Genotypic data: unknown. For management purposes, the International Whaling Commission (IWC) recognizes two management units of sperm whales in the North Pacific (eastern and western). However, the IWC has not reviewed its sperm whale stock boundaries in recent years (Donovan 1991). Based on this limited information, and lacking additional data concerning population structure, sperm whales of the eastern North Pacific have been divided into three separate stocks as dictated by the U. S. waters in which they are found: 1) Alaska (North Pacific stock), 2) California/Oregon/Washington, and 3) Hawaii. The California/Oregon/Washington and Hawaii sperm whale stocks are reported separately in the Stock Assessment Reports for the Pacific Region.

POPULATION SIZE

Current and historic estimates for the abundance of sperm whales in the North Pacific are considered unreliable. Therefore, caution should be exercised in interpreting published estimates of abundance. The abundance of sperm whales in the North Pacific was reported to be 1,260,000 prior to exploitation, which by the late 1970s was estimated to have been reduced to 930,000 whales (Rice 1989). Confidence intervals for these estimates were not provided. Further, recent information indicates that these estimates are positively biased. These estimates include whales from the California/Oregon/Washington stock, for which a separate abundance estimate is currently available (see Stock Assessment Reports for the Pacific Region). The number of sperm whales of the North Pacific occurring within Alaska waters is unknown. As the data used in estimating the abundance of sperm whales in 'the entire North Pacific are well over 5 years

old at this time and there are no available estimates for numbers of sperm whales in Alaska waters, a reliable estimate of abundance for the North Pacific stock is not available.

Minimum Population Estimate

At this time, it **is** not possible to produce a reliable estimate of minimum abundance for this stock, as current estimates of abundance are not available.

Current Population Trend

Reliable information on trends in abundance for this stock are currently not available (Braham 1992).

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

A reliable estimate of the maximum net productivity rate is not currently available for the North Pacific stock of sperm whale. Hence, until additional data become available, it is recommended that the cetacean maximum net productivity rate (R_{MAX}) of 4% be employed for this stock at this time (Wade and Angliss 1997).

POTENTIAL BIOLOGICAL REMOVAL

Under the 1994 re-authorized Marine Mammal Protection Act (MMPA), the potential biological removal (PBR) is defined as the product of the minimum population estimate, one-half the maximum theoretical net productivity rate, and a recovery factor: $PBR = N_{MIN} \times 0.5R_{MAX} \times F_R$. The recovery factor ($F_R$) for this stock is 0.1, the value for cetacean stocks which are classified as endangered (Wade and Angliss 1997). However, because a reliable estimate of minimum abundance N_{MIN} is currently not available, the PBR for this stock is unknown.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

Fisheries Information

Six different commercial fisheries operating within the range of the North Pacific stock of sperm whale were monitored for incidental take by NMFS observers during 1990-95: Bering Sea (and Aleutian Islands) groundfish trawl, longline, and pot fisheries, and Gulf of Alaska groundfish trawl, longline, and pot fisheries. No mortalities of sperm whale were observed by NMFS observers in any observed fishery. However, it appears that sperm whale interactions with fisheries operating in the Gulf of Alaska are known to occur and may be increasing in frequency. In the first 6 months of 1996, NMFS observers aboard longline vessels targeting both sablefish and halibut have documented sperm whales feeding off the longline gear in the Gulf of Alaska (NMFS Observer Program, unpubl. data, NMFS, AFSC, 7600 Sand Point Way NE, Seattle, WA, 98115).

An additional source of information on the number of sperm whales killed or injured incidental to commercial fishery operations is the logbook reports maintained by vessel operators as required by the MMPA interim exemption program. During the 4-year period from 1990 to 1993, logbook reports indicated no mortalities of sperm whales from interactions with commercial fishing gear. Complete logbook data after 1993 are not available.

The estimated annual mortality rate incidental to commercial fisheries is zero. Therefore, the annual human-caused mortality level is considered to be insignificant and approaching a zero mortality and serious injury rate.

Subsistence/Native Harvest Information

Sperm whales have never been reported to be taken by subsistence hunters (Rice 1989).

Other Mortality

A total of 258,000 sperm whales were reported to have been taken by commercial whalers operating in the North Pacific between 1947 and 1987 (C. Allison, pers. comm, International Whaling Commission, The Red House, Station Road, Histon, Cambridge, UK). This estimate likely underestimates the actual kill as a result of under-reporting of the Soviet catches (Yablokov 1994). The final season for large-scale pelagic whaling in the North Pacific was 1979, nearly a decade before imposition of the IWC's commercial whaling moratorium in 1988.

STATUS OF STOCK

Sperm whales are listed as "endangered' under the Endangered Species Act of 1973 and this stock is, therefore, classified as a strategic stock. However, on the basis of total abundance, current distribution, and regulatory measures that

are currently in place, it is unlikely that this stock is in danger of extinction or threatened with becoming endangered in the foreseeable future (Braham 1992). Reliable estimates of the minimum population, population trends, PBR, and human-caused mortality and serious injury are currently not available, although the estimated annual rate of human-caused mortality and serious injury seems minimal for this stock.

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BAIRD'S BEAKED WHALE *(Berardius bairdii):* Alaska Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

Baird's beaked, or giant bottlenose, whale inhabits the North Pacific Ocean and adjacent seas (Bering Sea, Okhotsk Sea, Sea of Japan, and the Sea of Cortez in the southern Gulf of California, Mexico), with the best-known populations occurring in the coastal waters around Japan (Balcomb 1989). Within the North Pacific Ocean, Baird's beaked whales have been sighted in virtually all areas north of 35°N, particularly in regions with submarine escarpments and seamounts (Ohsumi 1983, Kasuya and Ohsumi 1984). The range of the species extends north to at least the Pribilof Islands where individuals have been found stranded (Rice 1986, Fig. 27). An apparent break in distribution occurs in the eastern Gulf of Alaska, but from the mid-Gulf to the Aleutian Islands and in the southern Bering Sea there are numerous sighting records (Kasuya and Ohsumi 1984). Tomilin (1957) reported that in the Sea of Okhotsk and the Bering Sea, Baird's beaked whales arrive in April-May, and are particularly numerous during the summer. They are the most commonly seen beaked whales within their range, perhaps because they are relatively large and gregarious, traveling in schools of a few to several dozen, which makes them more noticeable to, observers than other beaked whale species. Baird's beaked whales are migratory, arriving in continental slope waters during summer and fall months when surface water temperatures are the highest (Dohl et al. 1983, Kasuya 1986).

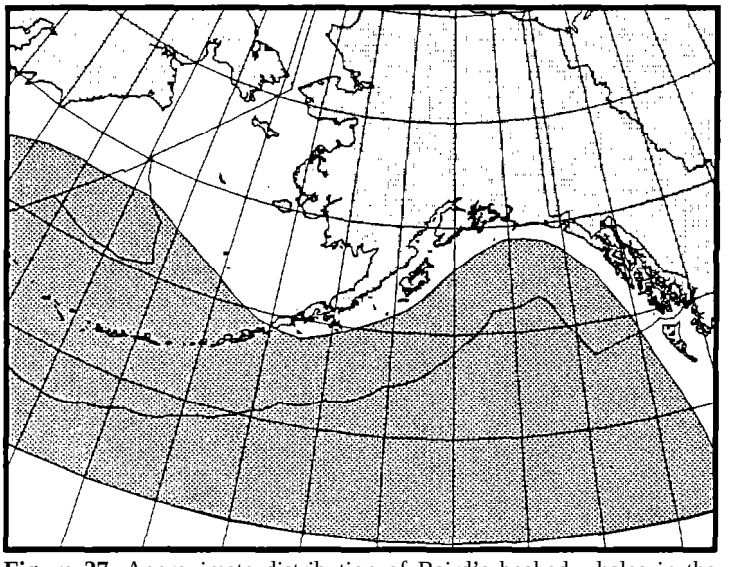

Figure 27. Approximate distribution of Baird's beaked whales in the eastern North Pacific (shaded area).

There are insufficient data to apply the phylogeographic approach to stock structure (Dizon et al. 1992) for Baird's beaked whale. Therefore, Baird's beaked whale stocks are defined as the two non-contiguous areas within Pacific U. S. waters where they are found: 1) Alaska and 2) California/Oregon/Washington. These two stocks were defined in this manner because of 1) the large distance between the two areas in conjunction with the lack of any information about whether animals move between the two areas, 2) the somewhat different oceanographic habitats found in the two areas, and 3) the different fisheries that operate within portions of those two areas, with bycatch of Baird's beaked whales only reported from the California/Oregon thresher shark and swordfish drift gillnet fishery. The California/Oregon/Washington Baird's beaked whale stock is reported separately in the Stock Assessment Reports for the Pacific Region.

POPULATION SIZE

Reliable estimates of abundance for this stock are currently unavailable.

Minimum Population Estimate

At this time, it is not possible to produce a reliable minimum population estimate (N_{MIN}) for this stock, as current estimates of abundance are unavailable.

Current Population Trend

At present, reliable data on trends in population abundance are unavailable.

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

A reliable estimate of the maximum net productivity rate is currently unavailable for the Alaska stock of Baird's beaked whale. Hence, until additional data become available, it is recommended that the cetacean maximum theoretical net productivity rate (R_{MAX}) of 4% be employed (Wade and Angliss 1997).

POTENTIAL BIOLOGICAL REMOVAL

Under the 1994 re-authorized Marine Mammal Protection Act (MMPA), the potential biological removal (PBR) is defined as the product of the minimum population estimate, one-half the maximum theoretical net productivity rate, and a recovery factor: PBR = N_{MIN} x $0.5R_{MAX}$ x F_R. The recovery factor (F_R) for these stocks is 0.5, the value for cetacean stocks with unknown population status (Wade and Angliss 1997). However, in the absence of a reliable estimate of minimum abundance, the PBR for this stock is unknown,

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

Fisheries Information

Six different commercial fisheries operating within the range of the Alaska stock of Baird's beaked whale were monitored for incidental take by NMFS observers during 1990-95: Bering Sea (and Aleutian Islands) groundfish trawl, longline, and pot fisheries, and Gulf of Alaska groundfish trawl, longline, and pot fisheries. No Baird's beaked whale mortalities were observed by NMFS observers in any observed fishery.

An additional source of information on the number of Baird's beaked whales killed or injured incidental to commercial fishery operations is the logbook reports maintained by vessel operators as required by the MMPA interim exemption program. During the 4-year period from 1990 to 1993, logbook reports indicated no mortalities of Baird's beaked whales from interactions with commercial fishing gear. Complete logbook data after 1993 are not available.

The estimated annual mortality rate incidental to commercial fisheries is zero. Therefore, the annual human-caused mortality level is considered to be insignificant and approaching a zero mortality and serious injury rate.

Subsistence/Native Harvest Information

There is no known subsistence harvest of Baird's beaked whales by Alaska Natives.

Other Mortality

The Japanese have reported taking 54 Baird's beaked whales annually off their coasts during the 3-year period between 1992 and 1994 (RIWC 1996). Due to the unknown stock structure and migratory patterns in the North Pacific, it is unclear whether these animals belong to the Alaska stock of Baird's beaked whales.

STATUS OF STOCK

Baird's beaked whales are not listed as "depleted" under the MMPA or listed as "threatened" or "endangered" under the Endangered Species Act. Reliable estimates of the minimum population, population trends, PBR, and status of the stock relative to OSP are currently not available. However, the estimated annual rate of human-caused mortality and serious injury seems minimal for this stock. Thus, the Alaska stock of Baird's beaked whale is not classified as strategic.

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CUVIER'S BEAKED WHALE *(Ziphius cavirostris):* Alaska Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

The distribution of Cuvier's beaked, or goosebeak, whale (Pig. 28) is known primarily from strandings, which indicate that it is the most widespread of the beaked whales and is distributed in all oceans and most seas except in the high polar waters (Moore 1963). In the Pacific, they range north to southeastern Alaska, the Aleutian Islands, and the Commander Islands (Rice 1986). In the northeastern Pacific from Alaska to Baja California, no obvious pattern of seasonality to strandings has been identified (Mitchell 1968). Strandings of Cuvier's beaked whales are the most numerous of all beaked whales, indicating that they are probably not as rare as originally thought (Heyning 1989). Observations reveal that the blow is low, diffuse, and directed forward (Backus and Schevill 1961, Norris and Prescott 1961), making sightings more difficult, and there is some evidence that they avoid vessels by diving (Heyning 1989).

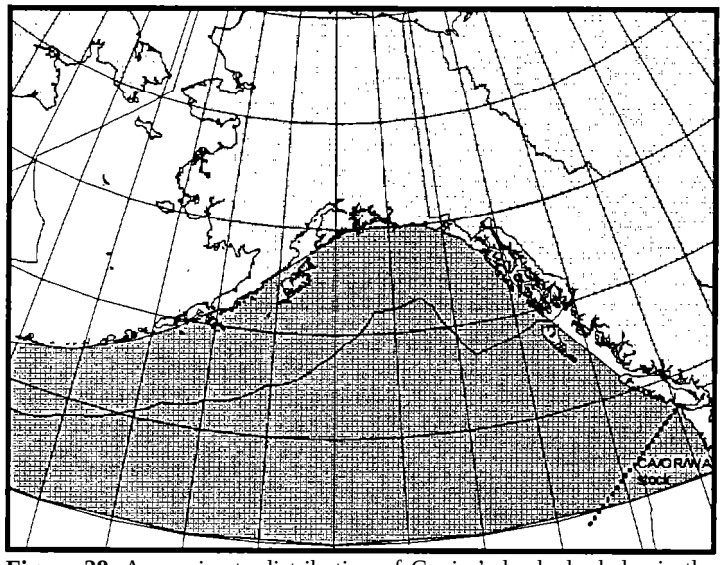

Figure 28. Approximate distribution of Cuvier's beaked whales in the eastern North Pacific (shaded area).

Mitchell (1968) examined skulls of stranded whales for geographical differences and thought that there was probably one panmictic population in the northeastern Pacific. Otherwise, there are insufficient data to apply the phylogeographic approach to stock structure (Dizon et al. 1992) for the Cuvier's beaked whale. Therefore, Cuvier's beaked whale stocks are defined as the three non-contiguous areas within Pacific U. S. waters where they are found: 1) Alaska, 2) California/Oregon/Washington, and 3) Hawaii. These three stocks were defined in this way because of 1) the large distance between the areas in conjunction with the lack of any information about whether animals move between the three areas. 2) the different oceanographic habitats found in the three areas, and 3) the different fisheries that operate within portions of those three areas, with bycatch of Cuvier's beaked whales only reported from the California/Oregon thresher shark and swordfish drift gillnet fishery. The California/Oregon/Washington and Hawaii Baird's beaked whale stocks are reported separately in the Stock Assessment Reports for the Pacific Region,

POPULATION SIZE

Reliable estimates of abundance for this stock are currently unavailable

Minimum Population Estimate

At this time, it is not possible to produce a reliable minimum population estimate (N_{MIN}) for this stock, as current estimates of abundance are unavailable.

Current Population Trend

At present, reliable data on trends in population abundance are unavailable.

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

A reliable estimate of the maximum net productivity rate is currently unavailable for the Alaska stock of Cuvier's beaked whale. Hence, until additional data become available, it is recommended that the cetacean maximum theoretical net productivity rate (R_{MAX}) of 4% be employed (Wade and Angliss 1997).

POTENTIAL BIOLOGICAL REMOVAL

Under the 1994 re-authorized Marine Mammal Protection Act (MMPA), the potential biological removal (PBR) is defined as the product of the minimum population estimate, one-half the maximum theoretical net productivity rate, and a recovery factor: PBR = N_{MIN} x $0.5R_{MAX}$, x F_R. The recovery factor (F_R) for this stock is 0.5, the value for cetacean stocks with unknown population status (Wade and Angliss 1997). However, in the absence of a reliable estimate of minimum abundance, the PBR for this stock is unknown.

ANNUALHUMAN-CAUSED MORTALITY AND SERIOUS INJURY

Fisheries Information

Six different commercial fisheries operating within the range of the Alaska stock of Cuvier's beaked whale were monitored for incidental take by NMFS observers during 1990-95: Bering Sea (and Aleutian Islands) groundfish trawl, longline, and pot fisheries, and Gulf of Alaska groundfish trawl, longline, and pot fisheries. No Cuvier's beaked whale mortalities were observed by NMFS observers in any observed fishery.

An additional source of information on the number of Cuvier's beaked whales killed or injured incidental to commercial fishery operations is the logbook reports maintained by vessel operators as required by the MMPA interim exemption program, During the 4-year period from 1990 to 1993, logbook reports indicated no mortalities from interactions with commercial fishing gear. Complete logbook data after 1993 are not available.

The estimated annual mortality rate incidental to commercial fisheries is zero. Therefore, the annual human-caused mortality level is considered to be insignificant and approaching a zero mortality and serious injury rate.

Subsistence/Native Harvest Information

There is no known subsistence harvest of Cuvier's beaked whales.

STATUS OF STOCK

Cuvier's beaked whales are not listed as "depleted" under the MMPA or listed as "threatened" or "endangered" under the Endangered Species Act. Reliable estimates of the minimum population, population trends, PBR, and status of the stock relative to OSP are currently not available. However, the estimated annual rate of human-caused mortality and serious injury seems minimal for this stock. Thus, the Alaska stock of Cuvier's beaked whale is not classified as strategic.

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STEJNEGER'S BEAKED WHALE *(Mesoplodon stejnegeri):* Alaska Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

Stejneger's, or Bering Sea, beaked whale is rarely seen at sea, and its distribution generally has been inferred from stranded specimens (Loughlin and Perez 1985, Mead 1989). It is endemic to the cold-temperate waters of the North Pacific Ocean, Sea of Japan, and deep waters of the southwest Bering Sea (Fig. 29). The range of Stejneger's beaked whale extends along the coast of North America from Cardiff, California, north through the Gulf of Alaska to the Aleutian Islands, into the Bering Sea to the Pribilof Islands and Commander Islands, and, off Asia, south to Akita Beach on Noto Peninsula, Honshu, in the Sea of Japan (Loughlin and Perez 1985). Near the central Aleutian Islands, groups of 3-15 Stejneger's beaked whales have been sighted on a number of occasions (Rice 1986). The species is not known to enter the Arctic Ocean and is the only species of ***Mesoplodon*** known to occur in Alaska waters. The distribution of ***M. stejnegeri*** in the North Pacific corresponds closely, in occupying the same cold-temperate niche and position, to that of ***M. bidens*** in the North Atlantic. It lies principally between 50° and 60°N and extends only to about 45°N in the eastern Pacific, but to about 40°N in the western Pacific (Moore 1963, Moore 1966).

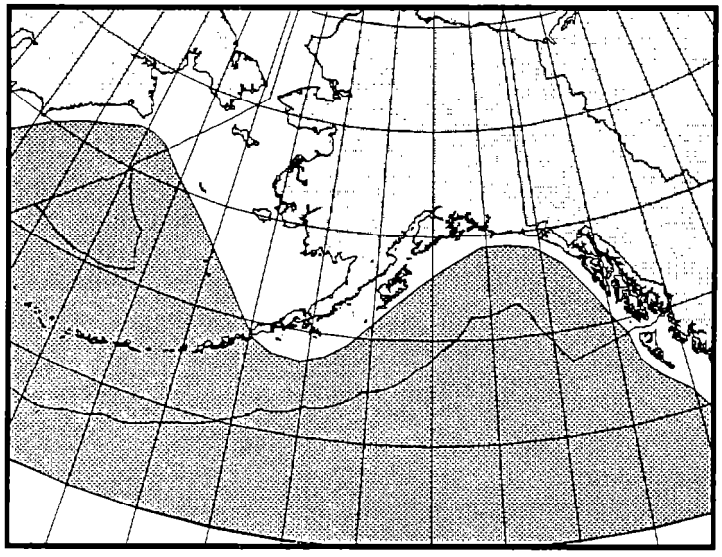

Figure 29. Approximate distribution of Stejneger's beaked whales in the eastern North Pacific (shaded area).

There are insufficient data to apply the phylogeographic approach to stock structure (Dizon et al. 1992) for Stejneger's beaked whale. The Alaska Stejneger's beaked whale stock is recognized separately from other ***Mesoplodon*** spp. along the west coast of the continental U.S. because 1) the distribution of Stejneger's beaked whale and the different oceanographic habitats found in the two areas, 2) the large distance between the two non-contiguous areas of U. S. waters in conjunction with the lack of any information about whether animals move between the two areas, and 3) the different fisheries that operate within portions of those two areas, with bycatch of ***Mesoplodon*** spp. only reported from the California/Oregon thresher shark and swordfish drift gillnet fishery.

POPULATION SIZE

Reliable estimates of abundance for this stock are currently unavailable.

Minimum Population Estimate

At this time, it is not possible to produce a reliable minimum population estimate (N_{MIN}) for this stock, as current estimates of abundance are unavailable.

Current Population Trend

At present, reliable data on trends in population abundance are unavailable

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

A reliable estimate of the maximum net productivity rate is currently unavailable for the Alaska stock of Stejneger's beaked whale. Hence, until additional data become available, it is recommended that the cetacean maximum theoretical net productivity rate (R_{MAX}) of 4% be employed (Wade and Angliss 1997).

POTENTIAL BIOLOGICAL REMOVAL

Under the 1994 re-authorized Marine Mammal' Protection Act (MMPA), the potential biological removal (PBR) is defined as the product of the minimum population estimate, one-half the maximum theoretical net productivity rate, and a recovery factor: $PBR = N_{MIN} \times 0.5R_{MAX} \times F_R$. The recovery factor ($F_R$) for this stock is 0.5, the value for cetacean stocks with unknown population status (Wade and Angliss 1997). However, in the absence of a reliable estimate of minimum abundance, the PBR for this stock is unknown.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

Fisheries Information

Six different commercial fisheries operating within the range of the Alaska stock of Stejneger's beaked whale were monitored for incidental take by NMFS observers during 1990-95: Bering Sea (and Aleutian Islands) groundfish trawl, longline, and pot fisheries, and Gulf of Alaska groundfish trawl, longline, and pot fisheries. No Stejneger's beaked whale mortalities were observed by NMFS observers in any observed fishery.

An additional source of information on the number of Stejneger's beaked whales killed or injured incidental to commercial fishery operations is the logbook reports maintained by vessel operators as required by the MMPA interim exemption program. During the 4-year period between 1990 and 1993, logbook reports indicated no mortalities from interactions with commercial fishing gear. Complete logbook data after 1993 are not available.

The estimated annual mortality rate incidental to commercial fisheries is zero. Therefore, the annual human-caused mortality level is considered to be insignificant and approaching a zero mortality and serious injury rate.

Subsistence/Native Harvest Information

There is no known subsistence harvest of Stejneger's beaked whales.

STATUS OF STOCK

Stejneger's beaked whales are not listed as "depleted" under the MMPA or listed as "threatened" or "endangered" under the Endangered Species Act. Reliable estimates of the minimum population, population trends, PBR, and status of the stock relative to OSP are currently not available. However, the estimated annual rate of human-caused mortality and serious injury seems minimal for this stock. Thus, the Alaska stock of Stejneger's beaked whale is not classified as strategic.

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Revised 8/8/97

GRAY WHALE *(Eschrichtius robustus):* Eastern North Pacific Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

The gray whale formerly occurred in the North Atlantic Ocean (Fraser 1970), but is currently only found in the North Pacific (Rice et al. 1984). The following information was considered in classifying stock structure of gray whales based on the Dizon et al. (1992) phylogeographic approach: 1) Distributional data: isolated geographic distribution in the North Pacific Ocean; 2) Population response data: increasing in the eastern North Pacific, unknown in the western North Pacific; 3) Phenotypic data: unknown; and 4) Genotypic data: unknown. Based on this limited information, two stocks have been recognized in the North Pacific: the Eastern Pacific stock, which breeds along the west coast of North America (Fig. 30), and the Western Pacific or "Korean" stock, which apparently breeds off the coast of eastern Asia (Rice 1981). Most of the Eastern North Pacific stock spends the summer feeding in the northern Bering, Chukchi, and Beaufort Seas (Rice and Wolman 1971). However, gray whales have been reported feeding in the summer in waters off of Southeast Alaska, British Columbia, Oregon, and Washington. The whales migrate near shore along the coast of North America from Alaska to the central California coast (Rice and Wolman 1971) starting in October or November. After passing Point Conception, California, Rice et al. (1984) reported the majority of the animals take a more direct offshore route across the southern California Bight to nor-them Baja California. The Eastern North Pacific stock winters mainly along the west coast of Baja California. The pregnant females assemble in certain shallow, nearly landlocked lagoons and bays where the calves are born from early January to mid-February (Rice et al. 1981), Interestingly, a small, but increasing proportion of newborn calves have been sighted along the California coast during the southward migration (Shelden et al. 1995). The northbound migration generally begins in mid-February and continues through May (Rice et al. 1981) with cows and newborn calves primarily migrating northward between March and June along the U. S. west coast.

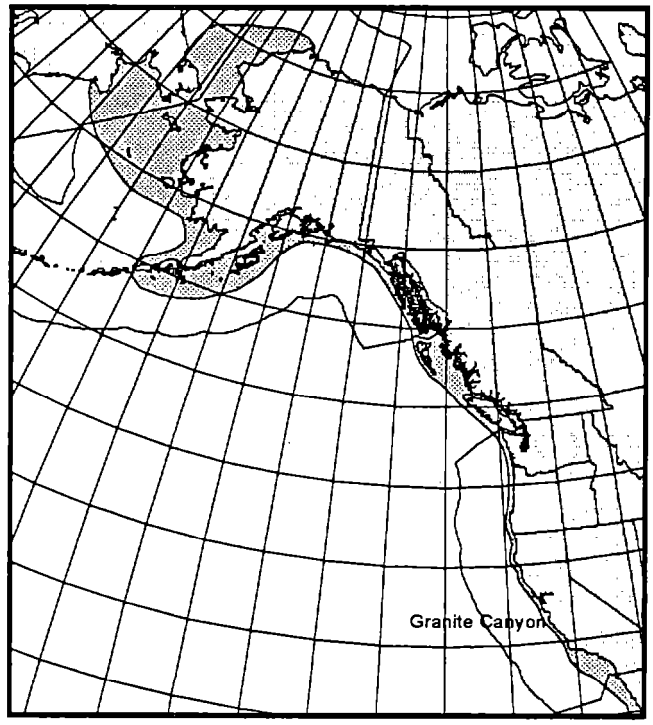

Figure 30. Approximate distribution of the Eastern North Pacific stock of gray whales (shaded area). Excluding some Mexican waters, the entire range of this stock is depicted in the figure.

POPULATION SIZE

Systematic counts of gray whales migrating along the central California coast were conducted by shore-based observers (at Granite Canyon) through the entire duration of the 1995-96 southbound migration (Hobbs et al. 1996). The preliminary abundance estimate resulting from the 1995-96 census is 22,571 (CV=.0524) whales. This estimate is similar to the 1993/1994 abundance estimate of 23,109 (CV=.0542) whales (RIWC 1995), slightly higher than the 1987-88 estimate of 21,296 (CV=.0605) whales (Buckland et al. 1993), and significantly higher than the 1992-93 estimate of 17,674 (CV=.0587) whales (RIWC 1995). Variations in estimates may be due in part to undocumented sampling variation due to differences in the proportion of the gray whale stock migrating as far as the central California coast each year (Hobbs et al. 1996). The 1995-96 abundance estimate is the most recent and is considered a reliable estimate of abundance for this stock.

Minimum Population Estimate

The minimum population estimate (N_{MIN}) for this stock is calculated from Equation 1 from the PBR Guidelines (Wade and Angliss 1997): $N_{MIN} = N/\exp(0.842*[\ln(1+[CV(N)]_2)]^{½})$. Using the 1995-96 population estimate of 22,571 and its associated CV of 0.0524, N_{MIN} for this stock is 21,597.

Current Population Trend

The population size of Eastern North Pacific gray whale stock has been increasing over the past several decades. The estimated annual rate of increase, baaed on shore counts of southward migrating gray whales between 1967 and 1988 is 3.29% with a standard error of 0.44% (Buckland et al. 1993). Incorporating the census data through the 1993-94 migration resulted in an annual rate of increase of 2.57% (SE = 0.4%: RIWC 1995). Most recently, Breiwick (1996) and Wade and DeMaster (1996) estimated the annual rate of increase from 1967-68 to 1995-96 at 2.5% (95% CI: 2.37-2.61%) and 2.4% (95% CI: 1.6%-3.2%), respectively.

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

Wade (1994) reported that based on a Bayesian analysis of the census data between 1967-68 and 1993-94, the Eastern North Pacific stock of gray whales was between 0.51 and 0.97 of its carrying capacity and that the rate of net production at the maximum net productivity level was 0.033 (95% CI: 0.023-0.044). However, this conclusion was regarded as questionable at the 1994 Scientific Committee meetings of the International Whaling Commission (IWC) because the analysis may have been unduly influenced by the 1992 census and because the variance of the abundance estimate was likely underestimated (i.e., negative biased).

When incorporating the 1995-96 abundance estimate, Wade and DeMaster (1996) estimated R_{MAX} from the period between 1967-68 and 1995-96 at 0.044 (95% CI: 0.031-0.056). This estimate is not significantly different than the cetacean maximum net productivity rate (R_{MAX}) of 4% (Wade and Angliss 1997). Therefore, it is recommended that the 4% R_{MAX} be employed for this stock. Because this stock is thought to be midway between the lower limit of its optimum sustainable population (OSP) level and carrying capacity (K), the observed rate of increase is likely to be substantially less than R_{MAX}. In addition, it should be noted that the estimated R_{MAX} was calculated during a period in which gray whales from this stock were being harvested by Russian aboriginals.

POTENTIAL BIOLOGICAL REMOVAL

Under the 1994 re-authorized Marine Mammal Protection Act (MMPA), the potential biological removal (PBR) is defined as the product of the minimum population estimate, one-half the maximum theoretical net productivity rate, and a recovery factor: $PBR = N_{MIN} \times 0.5R_{MAX} \times F_R$. The recovery factor ($F_R$) for this stock is 1.0, the upper limit of the range (0.5-1.0) of values for non-listed stocks which are increasing while undergoing removals due to subsistence hunters (Wade and Angliss 1997). Thus, for the Eastern North Pacific stock of gray whale, PBR = 432 animals (21,597 x 0.02 x 1.0).

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

Fisheries Information

Six different commercial fisheries operating in Alaska waters within the range of the Eastern North Pacific gray whale stock were monitored for incidental take by NMFS observers during 1990-95: Bering Sea (and Aleutian Islands) groundfish trawl, longline, and pot fisheries, and Gulf of Alaska groundfish trawl, longline, and pot fisheries, No gray whale mortalities were observed for any of these Alaska fisheries,

Between 1990 and 1995, NMFS observers also monitored the northern Washington marine set gillnet fishery, otherwise known as the Makah tribal fishery for chinook salmon. No data for 1994 are presented in Table 22 because no fishery observer program occured during that year. Accordingly, when calculating the mean annual mortality, the 1994 data omission will be accounted for (e.g., the summed estimated mortality will be divided by 4, not 5). One gray whale was observed taken in 1990 (Gearin et al. 1994) and one observed taken in 1995 (P. Gearin unpubl. data, NMFS, 7600 Sand Point Way NE, Seattle, WA, 98115), resulting in a mean annual mortality of 0.5 gray whales from observed fisheries. In July of 1996, one gray whale was entangled in the same tribal set gillnet fishery though released unharmed (P. Gearin, pers. comm., NMFS, 7600 Sand Point Way NE, Seattle, WA, 98115).

An additional source of information on the number of gray whales killed or injured incidental to commercial fishery operations is the logbook reports maintained by vessel operators as required by the MMPA interim exemption program.

During the 4-year period between 1990 and 1993, logbook reports indicated 2 gray whale mortalities related to the Bristol Bay gillnet fisheries in 1990, resulting in an annual mean of 0.5 gray whale mortalities from interactions with commercial fishing gear. In 1990, logbook records from the Bristol Bay set and drift gillnet fisheries were combined. As it is not possible to determine which fishery was responsible for the gray whale mortalities reported in 1990, both fisheries have been included in Table 22. However, because logbook records are most likely negatively biased (Credle et al. 1994), these are considered to be minimum estimates. Complete logbook data after 1993 are not available.

Table 22. Summary of incidental mortality of gray whales (Eastern North Pacific stock) due to commercial fisheries from 1990 through 1995 and calculation of the mean annual mortality rate. Mean annual mortality in brackets represents a minimum estimate from logbook reports.

Fishery name	Years	Data type	Range of observer coverage	Observed mortality (in given yrs.)	Estimated mortality (in given yrs.)	Mean annual mortality
Northern Washington marine set gillnet (tribal)	90-95	obs data	47-87%	1, 0, 0, n/a, 1	1, 0, 0, n/a, 1	0.5 (CV=.61)
Observer program total						0.5
				Reported mortalities		
Bristol Bay salmon drift and set gillnet fisheries	90-93	logbook	n/a	2, 0, 0, 0	n/a	[≥0.5]
unknown west coast fisheries	93-95	strand data	n/a	0, 5, 2	n/a	[≥2.3]
Minimum total annual mortality						≥3.3

Other Alaska fisheries (not included in Table 22) may interact with gray whales as strandings of individuals entangled in gillnets have been reported, including a 1987 stranding along the Alaska Peninsula and a 1988 stranding near Yakutat. These strandings have not been attributed to a particular fishery and have not been included in the annual mortality rate calculation because they occurred prior to 1990.

Reports of entangled gray whales found swimming, floating, or stranded with fishing gear attached also occurs along the west coast of the continental U.S. and British Columbia. In U. S. waters there are confirmed reports of 3 gray whale mortalities in 1994 (2 in San Diego County and 1 in Del Norte County) and 2 mortalities in 1995 (1 in Santa Barbara county, and 1 in Washington State). There were no confirmed mortalities in 1993 (J. Cordaro, pers. comm., NMFS Southwest Region, 501 West Ocean Blvd. Ste. 4200, Long Beach, CA, 90802). In 1994, two gray whale mortalities related to fisheries were reported in British Columbia (Guenther et al. 1995). Other entangled gray whales were reported, though only cofirmed mortalities have been included here. These stranding data are included in Table 22 (listed as unknown west coast fisheries) as they resulted from commercial fishing. However, the mortalities have not been attributed to particular fisheries and their locations suggest that some may have been related to Mexican or Canadian, but not U. S. fisheries. Therefore, during the 3-year period from 1993 to 1995, stranding network data indicate a minimum annual mean of 2.3 gray whale mortalities resulting from interactions with commercial fishing gear

It should be noted that no observers have been assigned to most Alaska gillnet fisheries, including those in Bristol Bay which are known to interact with this stock, making the estimated mortality from U.S. fisheries unreliable. Further, due a lack of observer programs there are few data concerning the mortality of marine mammals incidental to Canadian commercial fisheries, which are analogous to U.S. fisheries that are known to interact with gray whales. Data regarding the level of gray whale mortality related to commercial fisheries in Canadian waters, though thought to be small, are not readily available or reliable which results in an underestimate of the annual mortality for this stock. However, the large stock size and observed rate of increase over the past 20 years makes it unlikely that unreported mortalities from those fisheries would be a significant source of mortality for the stock. The estimated minimum annual mortality rate incidental to commercial fisheries (rounded to 4; based on observer data (0.5) and logbook reports (0.5) or stranding reports (2.3) where observer data were not available) is not known to exceed 10% of the PBR (43) and, therefore, can be considered to be insignificant and approaching zero mortality and serious injury rate.

Subsistence/Native Harvest Information

Subsistence hunters in Alaska and Russia have traditionally harvested whales from this stock. There have been no reported takes by subsistence hunters in Alaska during this decade, with the most recent reported harvest occurring in 1989 (RIWC 1991). Russian subsistence hunters reported taking no whales from this stock during 1993 (RIWC 1995), 44 in 1994 (RIWC 1996), and 85 in 1995 (RIWC 1997). The 1995 harvest consisted of 40 females, 44 males, and 1 whale reported struck and lost Based on this information, the annual subsistence take averaged 43 whales during the 3-year period from 1993 to 1995. This level of take is well below the 1968-93 average of 159 whales per year (RIWC 1995), during which time the population size increased. The current IWC quota for gray whales taken by aboriginals is 140 animals per year.

In 1995, the Makah Indian Tribe in Washington state officially requested for an annual quota of 5 gray whales per year for subsistence and ceremonial purposes. At the 1996 IWC meetings, the U. S. delegation requested the quota on behalf of the Makah, which was subsequently withdrawn during the same meeting. It is anticipated that the Makah Indian Tribe will seek an annual quota of 5 whales in 1997 and thereafter.

Other mortality

The near shore migration route used by gray whales makes ship strikes another potential source of mortality. There are confirmed reports from the California stranding network of ship strikes causing one gray whale mortality per year over the 3-year period from 1993 to 1995 (J. Cordaro, pers. comm., NMFS Southwest Region, 501 West Ocean Blvd. Ste. 4200, Long Beach, CA, 90802). Additional mortality from ship strikes probably goes unreported because the whales either do not strand or do not have obvious signs of trauma. Therefore, it is not possible to quantify the actual mortality of gray whales from this source and the annual mortality rate of 1 gray whale per year due to collisions with vessels represents a minimum estimate from this source of mortality.

STATUS OF STOCK

The eastern North Pacific stock of gray whale has been increasing in recent years while being subjected to known subsistence harvests by Russian subsistence hunters Based on currently available data, the estimated annual level of human-caused mortality and serious injury (48), which includes mortality from commercial fisheries (4), takes by Russian subsistence hunters (43), and ship strikes (1) does not exceed the PBR (432). Therefore, the Eastern North Pacific stock of gray whale is not classified as a strategic stock. It should be noted that in 1994 this stock was removed from the List of Endangered and Threatened Wildlife (i.e., it is no longer considered endangered or threatened under the Endangered Species Act).

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HUMPBACK WHALE *(Megaptera novaeangliae):* Western North Pacific Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

The humpback whale is distributed worldwide in all ocean basins, though it is less common in Arctic waters. In winter, most humpback whales occur in temperate and tropical waters of both hemispheres (10°-23° latitude). Humpback whales in the North Pacific are seasonal migrants that feed on zooplankton and small schooling fishes in the cool, coastal waters of the western U. S., western Canada, and the Russian Far East (NMFS 1991). The historic summering range of humpback whales in the North Pacific encompassed coastal and inland waters around the Pacific rim from Point Conception, California, north to the Gulf of Alaska and the Bering Sea, and west along the Aleutian Islands to the Kamchatka Peninsula and into the Sea of Okhotsk (Tomlin 1967, Nemoto 1957, Johnson and Wolman 1984). Humpback whales have been known to enter the Chukchi Sea (Johnson and Wolman 1984). The humpback whale population in much of this range was considerably reduced as a result of intensive commercial exploitation during this century

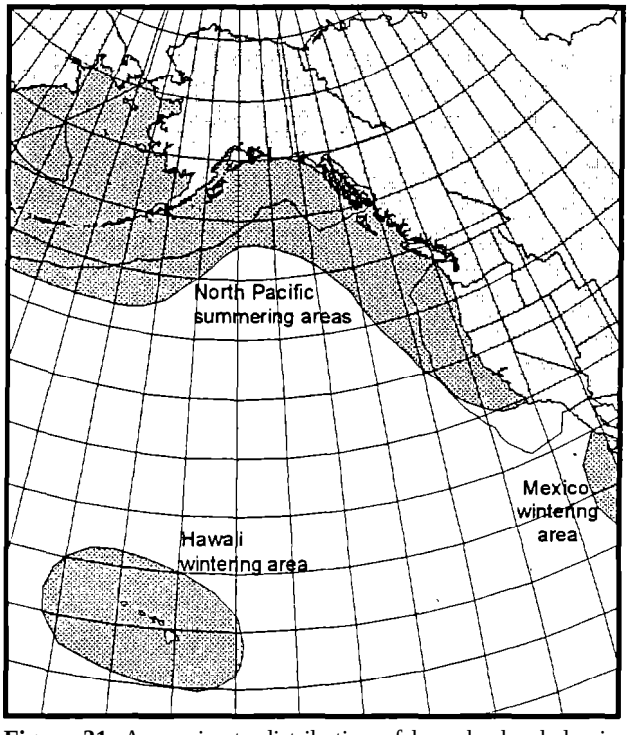

Figure 31. Approximate distribution of humpback whales in the eastern North Pacific (shaded area). Summering and wintering areas are presented above (see text).

Aerial, vessel, and photo-identification surveys indicate that there may be four relatively separate populations that migrate between their respective summer/fall feeding areas to winter/spring calving and mating areas (Barlow 1994, Fig. 31): 1) winter/spring populations in coastal Central America and Mexico which migrate to the coast of California to southern British Columbia in summer/fall (Steiger et al. 1991, Calambokidis et al. 1989, Calambokidis et al. 1993) - referred to as the California/Oregon/Washington and Mexico stock; 2) winter/spring populations of Mexico's offshore islands whose migratory destination is not well known but which do not migrate to the west coast of the continental U. S. (Calambokidis et al. 1993) - referred to as the Mexico offshore island stock; 3) winter/spring populations of the Hawaiian Islands which migrate to northern British Columbia/Southeast Alaska and Prince William Sound (Baker et al. 1990, Perry et al. 1990) - referred to as the Central North Pacific stock; and 4) winter/spring populations of Japan which probably migrate to waters west of the Kodiak Archipelago (the Bering Sea and Aleutian Islands) in summer/fall (Berzin and Rovnin 1966, Nishiwaki 1966, Darling 1991) - referred to as the Western North Pacific stock. However, some exchange between winter/spring areas has been documented (Darling and McSweeney 1985, Baker et al. 1986, Darling and Cerchio 1993), as well as movement between Japan and La Perouse Bank, off British Columbia (Darling et al. 1996). Currently, there are insufficient data to apply the Dizon et al. (1992) phylogeographic approach to classify population structure in humpback whales. Until further information becomes available, 4 management units of humpback whales (as described above) are recognized in the North Pacific: two in the Eastern North Pacific (the California/Oregon/Washington - Mexico stock, and the Mexico offshore island stock), one in the Central North Pacific, and one in the Western North Pacific. The California/Oregon/Washington - Mexico humpback whale stock is reported separately in the Stock Assessment Reports for the Pacific Region. As whales from the Mexico offshore island stock do not seem to frequent U.S. waters, a report for this stock has not been included in either the Pacific or Alaska Region Stock Assessment Reports.

The feeding areas for the Western North Pacific humpback whales stock are unknown. Therefore, no numbers of whales can be assigned to specific feeding areas.

POPULATION SIZE

A reliable estimate of abundance is currently not available for the Western North Pacific stock of humpback whale. Photo-identification of humpback whales in Japanese waters have resulted in the positive identification of 167 individual whales off Ogaswara and 44 individual whales off Okinawa (Uchida et al. 1991). Six sightings cruises during the winters of 1993 to 1995 covering a total of 10,896 nautical miles in the western North Pacific and eastern South China Sea encountered only 26 humpback whale groups, consisting of 54 individual animals (Miyashita et al. 1996).

A survey conducted in August of 1994 covered 2,050 nautical miles of trackline south of the Aleutian Islands encountered humpback whales in scattered aggregations (57 sightings) throughout the study area (Forney and Brownell 1996). At this time, it is unclear whether the humpback whales encountered during this survey belong to the Western or Central North Pacific stock.

Minimum Population Estimate

At this time, it is not possible to produce a reliable estimate of minimum abundance for this stock, as current estimates of abundance are not available.

Current Population Trend

The number of humpback whales in the North Pacific may have numbered approximately 15,000 individuals prior to exploitation (Rice 1978). Intensive commercial whaling removed more than 28,000 animals from the North Pacific during the 20th century (Rice 1978). Reliable information on trends in abundance for the Western North Pacific humpback whale stock are currently not available.

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

Observed rates of increase have been estimated for humpback whale stocks in the Atlantic and have ranged from 3.0% to 14.6%. However, there are no estimates of the growth rate of humpback whale populations in the North Pacific (Best 1993). Hence, until additional data become available, it is recommended that the cetacean maximum net productivity rate (R_{MAX}) of 4% be employed for this stock (Wade and Angliss 1997).

POTENTIAL BIOLOGICAL REMOVAL

Under the 1994 re-authorized Marine Mammal Protection Act (MMPA), the potential biological removal (PBR) is defined as the product of the minimum population estimate, one-half the maximum theoretical net productivity rate, and a recovery factor: $PBR = N_{MIN} \times 0.5R_{MAX} \times F_R$. The recovery factor ($F_R$) for this stock is 0.1, the value for cetacean stocks which are listed as endangered (Wade and Angliss 1997). However, because a reliable estimate of minimum abundance is currently not available, the PBR for this stock is unknown

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

Fisheries Information

Six different commercial fisheries operating in Alaskan waters within the range of this stock were monitored for incidental take by NMFS observers during 1990-95: Bering Sea (and Aleutian Islands) groundfish trawl, longline, and pot fisheries, and Gulf of Alaska groundfish trawl, longline, and pot fisheries. No humpback whale mortalities were observed for any of these fisheries.

An additional source of information on the number of humpback whales killed or injured incidental to commercial fishery operations is the logbook reports maintained by vessel operators as required by the MMPA interim exemption program During the 4-year period between 1990 and 1993, there were no logbook reports of humpback whale injuries or mortalities from interactions with commercial fishing gear in any Alaska fishery within the presumed range of the Western North Pacific humpback whale stock. Complete logbook data after 1993 are not available.

The estimated mortality rate incidental to commercial fisheries is zero whales per year from this stock. Therefore, the annual human-caused mortality level is considered to be insignificant and approaching a zero mortality and serious injury rate.

Subsistence/Native Harvest Information

Subsistence hunters in Alaska and Russia have not been reported to take humpback whales from this stock.

STATUS OF STOCK

The humpback whale is listed as "endangered' under the Endangered Species Act. Therefore, the Western North Pacific humpback whale stock is classified as a strategic stock. There are currently insufficient data to reliably estimate minimum population size, population trends, PBR, and status of the stock relative to OSP.

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Revised 8/8/97

HUMPBACK WHALE *(Megaptera novaeangliae):* Central North Pacific Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

The humpback whale is distributed worldwide in all ocean basins, though it is less common in Arctic waters. In winter, most humpback whales occur in temperate and tropical waters of both hemispheres (10°-23° latitude). Humpback whales in the North Pacific are seasonal migrants that feed on zooplankton and small schooling fishes in the cool, coastal waters of the western U. S., western Canada, and the Russian Far East (NMFS 1991). The historic summering range of humpback whales in the North Pacific encompassed coastal and inland waters around the Pacific rim from Point Conception, California, north to the Gulf of Alaska and the Bering Sea, and west along the Aleutian Islands to the Kamchatka Peninsula and into the Sea of Okhotsk (Tomlin 1967, Nemoto 1957, Johnson and Wolman 1984). Humpback whales have been known to enter the Chukchi Sea (Johnson and Wolman 1984). The humpback whale population in much of this range was considerably reduced as a result of intensive commercial exploitation during this century.

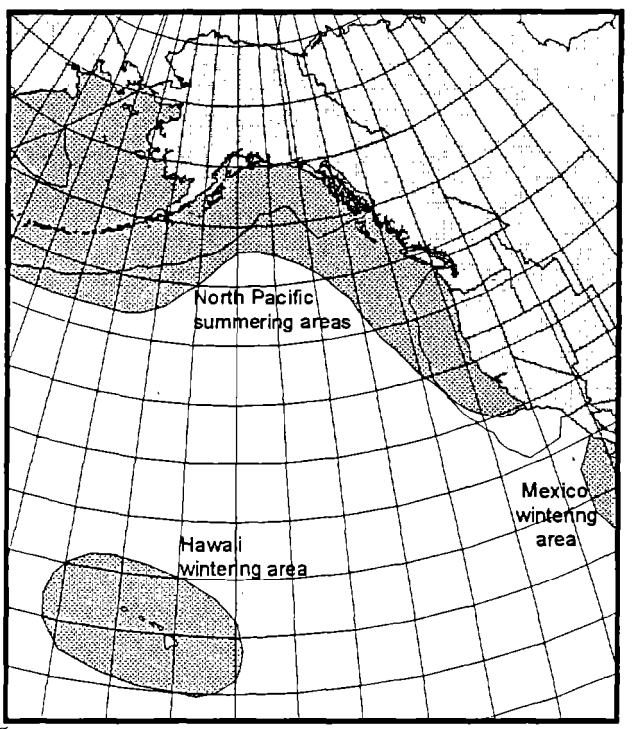

Figure 32. Approximate distribution of humpback whales in the eastern North Pacific (shaded area). Summering and wintering areas are presented above (see text).

Aerial, vessel, and photo-identification surveys indicate that there may be four relatively separate populations that migrate between their respective summer/fall feeding areas to winter/spring calving and mating areas (Barlow 1994, Fig. 32): 1) winter/spring populations in coastal Central America and Mexico which migrate to the coast of California to southern British Columbia in summer/fall (Steiger et al. 1991, Calambokidis et al. 1989, Calambokidis et al. 1993) - referred to as the California/Oregon/Washington and Mexico stock; 2) winter/spring populations of Mexico's offshore islands whose migratory destination is not well known but which do not migrate to the west coast of the continental U. S. (Calambokidis et al. 1993) - referred to as the Mexico offshore island stock; 3) winter/spring populations of the Hawaiian Islands which migrate to northern British Columbia/Southeast Alaska and Prince William Sound (Baker et al. 1990, Perry et al. 1990) - referred to as the Central North Pacific stock; and 4) winter/spring populations of Japan which probably migrate to waters west of the Kodiak Archipelago (the Bering Sea and Aleutian Islands) in summer/fall (Berzin and Rovnin 1966, Nishiwaki 1966, Darling 1991) - referred to as the Western North Pacific stock. However, some exchange between winter/spring areas has been documented (Darling and McSweeney 1985, Baker et al. 1986, Darling and Cerchio 1993), as well as movement between Japan and La Perouse Bank, off British Columbia (Darling et al. 1996). Currently, there are insufficient data to apply the Dizon et al. (1992) phylogeographic approach to classify population structure in humpback whales. Until further information becomes available, 4 management units of humpback whales (as described above) are recognized in the North Pacific: two in the Eastern North Pacific (the California/Oregon/Washington - Mexico stock, and the Mexico offshore island stock), one in the Central North Pacific, and one in the Western North Pacific. The California/Oregon/Washington - Mexico humpback whale stock is reported separately in the Stock Assessment Reports for the Pacific Region. As whales from the Mexico offshore island stock do not seem to frequent U.S. waters, a report for this stock has not been included in either the Pacific or Alaska Region Stock Assessment Reports.

The Central North Pacific stock of humpback whale consists of feeding aggregations that are essentially discrete and geographically isolated. Fidelity to these areas is maternally directed; that is, whales return to the feeding areas where

their mothers first brought them as calves (Martin et al. 1984, Baker et al. 1987). The two known feeding areas for the Central North Pacific stock are Prince William Sound and southeastern Alaska. There has been little documented exchange of individual whales between the two locations; only six whales have been sighted in both areas since studies began in 1977 (Perry et al. 1990, von Zeigesar et al. 1994; S. Baker, D. McSweeny, J. Straley, and O. von Zeigesar, unpubl. data). Using photographs of the unique markings on the underside of each whales' flukes, there were 148 individual humpback whales identified in Prince William Sound from 1977 to 1991 (von Zeigesar 1992) and 648 individual humpback whales identified in southeastern Alaska from 1985 to 1992 (Straley 1994). However, in any given year not all whales seen across years were sighted in each area. For example, in 1989 there were 66 whales identified in Prince William Sound and 500 whales identified in southeastern Alaska (von Zeigesar et al. 1994). The difference in the annual number versus the total number across years could be attributed to 1) whales being missed, 2) whales failing to return every year, or 3) death.

POPULATION SIZE

This stock of humpback whales winters in Hawaiian waters (Baker et al. 1986). Baker and Herman (1987) used capture-recapture methodology to estimate the population at 1,407 (95% CI 1,113- 1,701), which they considered an estimate for the entire stock (NMFS 1991). However, the robustness of this estimate is questionable due to the opportunistic nature of the survey methodology in conjunction with a small sample size. Further, the data used to produce this estimate were collected between 1980 and 1983. A current abundance estimate is considered unknown though the stock is believed to have increased since the time those data were collected.

Minimum Population Estimate

The minimum population estimate (N_{MIN}) for this stock was not calculated according to Equation 1 from the PBR Guidelines (Wade and Angliss 1997): $N_{MIN} = N/\exp(0.842*[\ln(1+[CV(N)]^2)]^{½})$. Rather, because a reliable abundance estimate for this stock is not currently available, the population estimate based on studies from the early 1980s (1,407 whales) is considered a reasonable alternative for N_{MIN}. Applying Equation 1 from the PBR Guidelines to the estimate of abundance and the associated CV from the early 1980s, given the likelihood that this stock has increased, seems unnecessarily conservative.

Current Population Trend

The number of humpback whales in the North Pacific may have numbered approximately 15,000 individuals prior to exploitation (Rice 1978). Intensive commercial whaling removed more than 28,000 animals from the North Pacific during the 20th century and may have reduced this population to as few as 1,000 before it was placed under international protection after the 1965 hunting season (Rice 1978). Currently, a reliable estimate of trend in abundance for the Central North Pacific humpback whale stock is unavailable. However, this stock is currently thought to be increasing (Johnson and Wolman 1984; DeMaster 1995: pp. 23).

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

Observed rates of increase have been estimated for humpback whale stocks in the Atlantic and have ranged from 3.0% to 14.6%. However, there are no estimates of the growth rate of humpback whale populations in the North Pacific (Best 1993). Hence, until additional data become available, it is recommended that the cetacean maximum net productivity rate (R_{MAX}) of 4% be employed for this stock (Wade and Angliss 1997).

POTENTIAL BIOLOGICAL REMOVAL

Under the 1994 re-authorized Marine Mammal Protection Act (MMPA), the potential biological removal (PBR) is defined as the product of the minimum population estimate, one-half the maximum theoretical net productivity rate, and a recovery factor: $PBR = N_{MIN} \times 0.5R_{MAX} \times F_R$. The recovery factor ($F_R$) for this stock is 0.1, the value for cetacean stocks listed as endangered under the Endangered Species Act (ESA) (Wade and Angliss 1997). Thus, for the Central North Pacific stock of humpback whale, PBR = 2.8 animals (1,407 x 0.02 x 0.1).

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

Fisheries Information

Three different commercial fisheries operating in Alaskan waters within the range of the Central North Pacific humpback whale were monitored for incidental take by NMFS observers during 1990-95: Gulf of Alaska groundfish trawl,

longline, and pot fisheries. No humpback whale mortalities were observed for any of these Alaska fisheries. NMFS observers also monitored the Hawaii swordfish, tuna, billfish, mahi mahi, wahoo, oceanic shark longline/setline fishery during the same period. The range of observer coverage over the 6-year period, as well as the annual observed and estimated mortalities are presented in Table 23. The observer program in the Hawaii fishery was voluntary from 1990 through 1993, leading to very low levels of observer coverage during those years (<1%). In 1994. the observer program became mandatory and observer coverage has been approximately 5% since that time. NMFS observers recorded one humpback whale entangled in longline gear in 1991. The fate of this animal is unknown, though it is presumed to have died. The mortality rate was not estimated from the 1991 mortality due to the low level of observer coverage in that year (<1%). Therefore, that single mortality also appears as the estimated mortality for 1991 and should be considered a minimum estimate. It should be noted that another humpback whale was reported by fishers and whalewatch operators entangled in longline gear off Maui in during 1993 (E. Nitta, pers. comm, Southwest Fisheries Science Center, Honolulu Laboratory, 2570 Dole St., Honolulu, HI, 96822). The fate of this animal is also unknown This has not been included in the calculation of mean annual mortality, thus emphasizing that the estimated mean annual mortality rate in observed fisheries of 0.2 (CV=1.0) humpback whales per year from this stock is a minimum estimate.

An additional source of information on the number of humpback whales killed or injured incidental to commercial fishery operations is the logbook reports maintained by vessel operators as required by the MMPA interim exemption program During the 4-year period between 1990 and 1993, there were no logbook reports of humpback whale injuries or mortalities from interactions with commercial fishing gear in any Alaska fishery within the range of the Central North Pacific humpback whale stock. Complete logbook data after 1993 are not available.

Under the MMPA interim exemption program, Category III fisheries were not required to submit complete logbooks, but only to report mortalities of marine mammals incidental to fishing operations. From 1990 to 1994, the only incidental take a humpback whale was reported in the Southeast Alaska salmon purse seine fishery during 1994, resulting in a mean annual mortality of 0.2 (Table 23). This is considered to be a minimum estimate because of the similarity between logbook reports and MMPA Category III mortality reports in conjunction with the fact that logbook records are most likely negatively biased (Credle et al. 1994). Another humpback whale is known to have been taken incidentally in this fishery in 1989, but due to its historic nature has not been included in Table 23 or the mortality rate calculation for this fishery. Under the 1994 MMPA amendments, annual logbooks are no longer a requirement. Instead, beginning in 1995, all owners or operators of commercial vessels in all fisheries must report the incidental injury or death of marine mammals to NMFS within 48 hours after the end of each fishing trip.

Table 23. Summary of incidental mortality of humpback whales (Central North Pacific stock) due to commercial fisheries from 1990 through 1995 and calculation of the mean annual mortality rate. Mean annual mortality in brackets represents a minimum estimates. Data from 1991 to 1995 are used in the mortality calculation when more than 5 years of data are provided for a particular fishery

Fishery name	Years	Data type	Range of observer coverage	Observed mortality (in given yrs.)	Estimated mortality (in given yrs.)	Mean annual mortality
Hawaii swordfish, tuna, billfish, mahi, oceanic shark longline/setline	90-95	obs data	<1-5%	0, 1, 0, 0, 0, 0	0, 1, 0, 0, 0, 0	[≥0.2] (CV=1.0)
Observer program total						[≥0.2]
				Reported mortalities		
Southeast Alaska salmon purse seine	90-94	Cat III reports	n/a	0, 0, 0, 0, 1	n/a	[≥0.2]
Southeast Alaska salmon drift gillnet	90-95	strand data	n/a	0, 0, 1, 0, 1, 0	n/a	[≥0.4]
Minimum total annual mortality						[≥0.8]

Strandings of humpback whales wrapped in fishing gear or with injuries caused by interactions with gear are a final source of mortality data, Fishery-related humpback strandings in Southeast Alaska have been reported in 1992 and 1994. An entanglement of a humpback whale occurred in the Southeast Alaska salmon drift gillnet fishery in 1992 and was reported as a stranding. In 1994, a humpback whale was reported in a weakened condition entangled in a fishing net with floats attached and is presumed to have died. The 1994 entanglement could not be attributed to a particular fishery Due to the location of the report (Chatham Strait), the mortality has been included along with the data for the Southeast Alaska salmon drift gillnet fishery (Table 23), when it may have resulted from operations in the Southeast Alaska salmon purse seine fishery. There have been no reports of fishery-related strandings in northern British Columbia this decade.

The estimated minimum mortality rate incidental to commercial fisheries is 0.8 humpback whales per year, based on observer data (0.2), and MMPA reporting (0.2) or stranding data (0.4) where observer data were not available. As mentioned previously, this estimate should be considered a minimum, It should be noted that no observers have been assigned several of the gillnet fisheries that are known to interact with this stock, making the estimated mortality unreliable'. Further, due to a lack of observer programs there are few data concerning the mortality of marine mammals incidental to Canadian commercial fisheries, which are analogous to U.S. fisheries that are known to interact with humpback whales. Though interactions are thought to be minimal, the lack of data regarding the level of humpback whale mortality related to commercial fisheries in northern British Columbia are not available, again reinforcing the point that the estimated mortality incidental to commercial fisheries is underestimated for this stock. Given that 10% of the PBR is approximately zero (i.e., 0.28) in conjunction with the low number of observed or reported mortalities incidental to commercial fishing, the kill rate can not be considered to be insignificant and approaching zero mortality and serious injury rate.

Subsistence/Native Harvest Information

Subsistence hunters in Alaska have not been reported to take from this stock of humpback whales.

Other Mortality

Ship strikes and interactions with vessels unrelated to fisheries have also occurred to humpback whales. There have been no reported mortalities of whales from this stock related to ship strikes over the period from 1993 to 1995. In 1995, a humpback whale was reported in Hawaiian waters trailing line which did not appear to be related to a fishery. This animal then entangled in a mooring line, but was successfully released. However, the whale was subsequently attacked and killed by sharks. The extent to which the entanglement contributed to the shark predation is unknown (E. Nitta, pers. comm., Southwest Fisheries Science Center, Honolulu Laboratory, 2570 Dole St., Honolulu, HI, 96822). Averaging this mortality over the period from 1993 to 1995 results in a mortality rate of 0.33 whales per year from this stock resulting from ship strikes or entanglement in line (other than fishing gear).

STATUS OF STOCK

As the estimated annual mortality rate (1.1; 0.8 of which was fishery related) is considered a minimum, it is unclear whether the level of human-caused mortality and serious injury exceeds the PBR (2.8). Recall also that the PBR was calculated from an N_{MIN} considered conservative and the stock is thought to be increasing. The humpback whale is listed as "endangered" under the Endangered Species Act. Therefore, the Central North Pacific stock of humpback whale is classified as a strategic stock. Reliable population trend data and status of this stock relative to OSP are not available.

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Revised 8/8/97

FIN WHALE *(Balaenoptera physalis):* Northeast Pacific Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

In the North Pacific Ocean, fin whales can be found from above the Arctic Circle. to lower latitudes of approximately 20°N (Leatherwood et al. 1982). There are few data concerning the location of the winter breeding grounds of fin whales because migrations from summer feeding areas back to their winter feeding grounds tend to occur in the open ocean rather than near the coast (Mizroch et al. 1984). Within U.S. waters in the Pacific, fin whales are distributed seasonally off the coast of North America (Fig. 33) and near and around the waters of Hawaii. The following information was considered in classifying stock structure based on the Dizon et al. (1992) phylogeographic approach: 1) Distributional data: geographic distribution continuous in winter, possibly isolated in summer; 2) Population response data: unknown; 3) Phenotypic data: unknown; and 4) Genotypic data: unknown. Based on this limited information, the International Whaling Commission considers fin whales in the North Pacific to all belong to the same stock (Mizroch et al 1984), although Mizroch et al. cited additional evidence that supports the establishment of subpopulations in the North Pacific. Further, Fujino (1960) describes an eastern and a western group, which are isolated though may intermingle around the Aleutian Islands. Tag recoveries reported by Rice (1974) indicate that animals wintering off the coast of southern California range from central California to the Gulf of Alaska during the summer months, Fin whales along the Pacific coast of North America have been reported during the summer months from the Bering Sea to as far south as central Baja California (Leatherwood et al. 1982). Stock structure of fin whales is considered equivocal. Based on a conservative management approach, three stocks are recognized: 1) Alaska (Northeast Pacific), 2) California/Washington/Oregon, and 3) Hawaii. The California/Oregon/Washington and Hawaii fin whale stocks are reported separately in the Stock Assessment Reports for the Pacific Region.

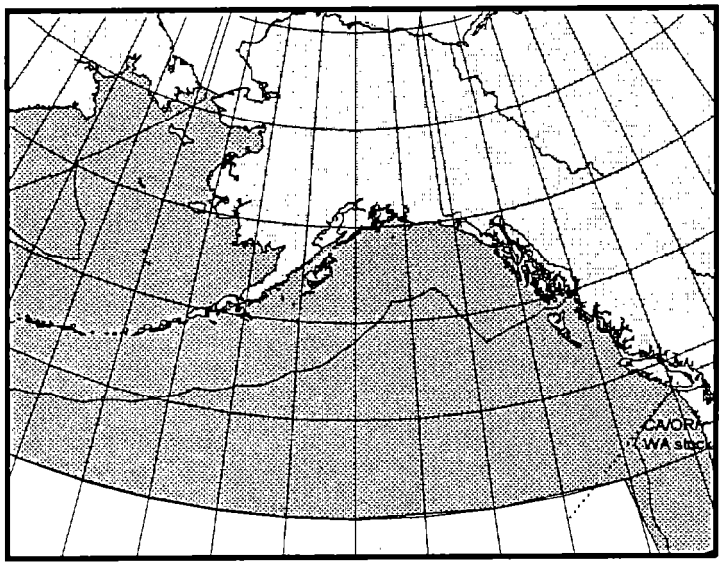

Figure 33. Approximate distribution of fin whales in the eastern North Pacific (shaded area).

POPULATION SIZE

Reliable estimates of current and historical abundance for the Northeast Pacific fin whale stock are currently not available. Reported population ranges for the entire North Pacific prior to exploitation and in the early 1970s are 42,000 to 45,000 and 14,620 to 18,630, respectively (Ohsumi and Wada 1974), representing 32% to 44% of the precommercial whaling population size (Braham 1984). These estimates were based on population modeling, incorporating catch and observation data and include whales from the California/Oregon/Washington stock for which a separate abundance estimate is currently available.

A survey conducted in August of 1994 covering 2,050 nautical miles of trackline south of the Aleutian Islands encountered only 4 fin whale groups (Forney and Brownell 1996). However, this survey did not include all of the waters off Alaska where fin whale sightings have been reported.

Minimum Population Estimate

At this time, it is not possible to produce a reliable estimate of minimum abundance for this stock, as current estimates of abundance are not available.

Current Population Trend

Reliable information on trends in abundance for the Alaska stock of fin whales are currently not available. There are no published reports indicating recovery of this stock has or is taking place (Braham 1992).

CURRENT AND MAXIMUM N-ET PRODUCTIVITY RATES

A reliable estimate of the maximum net productivity rate is currently unavailable for the Northeast Pacific fin whale stock. Hence, until additional data become available, it is recommended that the cetacean maximum net productivity rate (R_{MAX}) of 4% be employed for this stock (Wade and Angliss 1997).

POTENTIAL BIOLOGICAL REMOVAL

Under the 1994 re-authorized Marine Mammal Protection Act (MMPA), the potential biological removal (PBR) is defined as the product of the minimum population estimate, one-half the maximum theoretical net productivity rate, and a recovery factor: $PBR = N_{MIN} \times 0.5R_{MAX} \times F_R$. The recovery factor ($F_R$) for this stock is 0.1, the value for cetacean stocks which are listed as endangered (Wade and Angliss 1997). However, because a reliable estimate of minimum abundance is currently not available, the PBR for this stock is unknown,

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

Fisheries Information

There have been no reports of incidental mortalities of fin whales related to commercial fishery operations in the North Pacific during this decade, from either observed fisheries or the logbook reports maintained by vessel operators as required by the MMPA interim exemption program The estimated mortality rate incidental to commercial fisheries is zero whales per year from this stock. Therefore, the annual human-caused mortality level is considered to be insignificant and approaching a zero mortality and serious injury rate.

Subsistence/Native Harvest Information

Subsistence hunters in Alaska and Russia have not been reported to take fin whales from this stock.

STATUS OF STOCK

The fin whale is listed as "endangered" under the Endangered Species Act of 1973, and a result this stock is classified as a strategic stock. Reliable estimates of the minimum population size, population trends, PBR, and status of the stock relative to OSP are currently not available. However, the estimated annual rate of human-caused mortality and serious injury seems minimal for this stock.

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MINKE WHALE *(Balaenoptera acutorostrata):* Alaska Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE:

In the North Pacific, minke whales occur from the Bering and Chukchi Seas south to near the equator (Leatherwood et al. 1982). The following information was considered in classifying stock structure according to the Dizon et al. (1992) phylogeographic approach: 1) Distributional data: geographic distribution continuous, 2) Population response data: unknown; 3) Phenotypic data: unknown; and 4) Genotypic data: unknown. Based on this limited information, the International Whaling Commission (IWC) recognizes 3 stocks of minke whales in the North Pacific: one in the Sea of Japan/East China Sea, one in the rest of the western Pacific west of 180°N, and one in the "remainder" of the Pacific (Donovan 1991). The "remainder" stock designation reflects the lack of exploitation in the eastern Pacific and does not indicate that only one population exists in this area (Donovan 1991). In the "remainder" area, minke whales are relatively common in the Bering and Chukchi Seas and in the inshore waters of the Gulf of Alaska (Mizroch 1992), but are not considered abundant in any other part of the eastern Pacific (Leatherwood et al. 1982, Brueggeman et al. 1990). Minke whales are known to penetrate loose ice during the summer, and some individuals venture north of the Bering Strait (Leatherwood et al. 1982). In the northern part of their range minke whales are believed to be migratory, whereas they appear to establish home ranges in the inland waters of Washington and along central California (Dorsey et al. 1990). Because the "resident" minke whales from California to Washington appear behaviorally distinct from migratory whales farther north, minke whales in Alaska are considered a separate stock from minke whales in California, Oregon, and Washington, Accordingly, two stocks of minke whales are recognized in U. S. waters: 1) Alaska, and 2) California/Washington/Oregon (Fig. 34). The California/Oregon/Washington minke whale stock is reported separately in the Stock Assessment Reports for the Pacific Region.

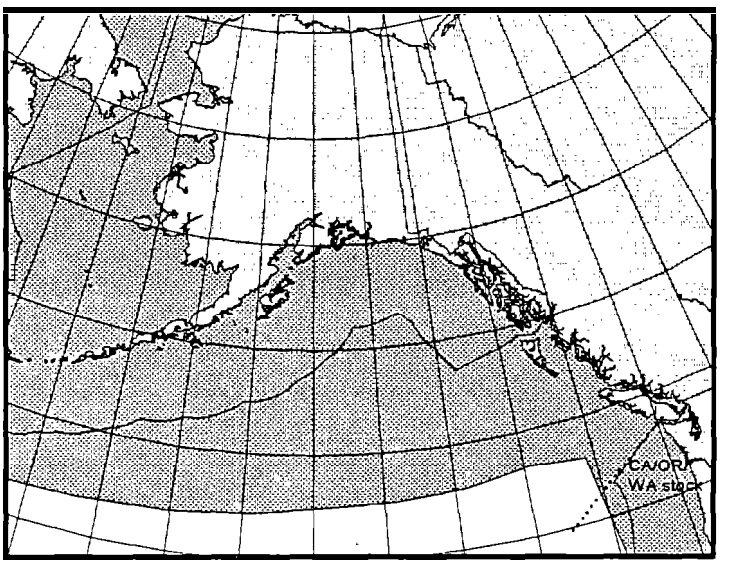

Figure 34. Approximate distribution of minke whales in the eastern North Pacific (shaded area).

POPULATION SIZE

No estimates have been made for the number of minke whales in the entire North Pacific nor are estimates available for the number of minke whales that occur within the waters of Alaska.

Minimum Population

At this time, it is not possible to produce a reliable estimate of minimum abundance for this stock, as current estimates of abundance are not available.

Current Population Trend

There are no data on trends in minke whale abundance in Alaska waters.

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

There are no estimates of the growth rate of minke whale populations in the North Pacific (Best 1993). Hence, until additional data become available, it is recommended that the cetacean maximum net productivity rate (R_{MAX}) of 4% be employed for this stock (Wade and Angliss 1997).

POTENTIAL BIOLOGICAL REMOVAL

The potential biological removal (PBR) for this stock is calculated as the product of minimum population size, 0.5 maximum net productivity, and a recovery factor. Given the status of this stock is unknown, the appropriate recovery factor is 0.5 (Wade and Angliss 1997). However, because an estimate of minimum abundance is not available, it is not possible to estimate a PBR for the Alaska minke whale stock at this time.

ANNUAL HUMAN-CAUSED MORTALITY

Fishery Information

Six different commercial fisheries operating in Alaska waters within the range of the Alaska minke whale stock were monitored for incidental take by NMFS observers during 1990-95: Bering Sea (and Aleutian Islands) groundfish trawl, longline, and pot fisheries, and Gulf of Alaska groundfish trawl, longline, and pot fisheries. No minke whale mortalities were observed for any of these fisheries, In 1989, one minke whale mortality (extrapolated to 2 mortalities) was observed in the Bering Sea/Gulf of Alaska joint-venture groundfish trawl fishery. the predecessor to the current Alaska groundfish trawl fishery.

In the past, minke whales have been caught in both coastal set gillnets and offshore drift gillnets (Small and DeMaster 1995). However, based on logbook reports maintained by vessel operators required by the MMPA interim exemption program during the 4-year period between 1990 and 1993, no injuries or mortalities of minke whales from interactions with commercial gear were reported for any Alaska fishery. Complete logbook data after 1993 are not available.

The estimated annual mortality rate incidental to commercial fisheries is zero. Therefore, the annual human-caused mortality level is considered to be insignificant and approaching a zero mortality and serious injury rate.

Subsistence/Native Harvest Information

No minke whales were ever taken by the modem shore-based whale fishery in the eastern North Pacific which lasted from 1905 to 1971 (Rice 1974). Subsistence takes of minke whales by Alaska Natives are rare, but have been known to occur. Only seven minke whales are reported the have been taken for subsistence by Alaska Natives between 1930 and 1987 (C. Allison, pers. comm., International Whaling Commission, The Red House, Station Road, Histon, Cambridge, UK). The most recent harvest (2 whales) in Alaska occurred in 1989 (RIWC 1991). Based on this information, the annual subsistence take averaged zero minke whales during the 3-year period from 1993 to 1995.

STATUS OF STOCK

Minke whales are not listed as “depleted” under the MMPA or listed as “threatened” or “endangered” under the Endangered Species Act. The greatest uncertainty regarding the status of the Alaska minke whale stock has to do with the uncertainty pertaining to the stock structure of this species in the eastern North Pacific. Because minke whales are considered common in the waters off Alaska and because the number of human-related removals is currently thought to be minimal, this stock is not considered a strategic stock. Reliable estimates of the minimum population size, population trends, PBR, and status of the stock relative to OSP are currently not available.

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Revised 8/8/97

NORTHERN RIGHT WHALE *(Eubalaena glacialis):* North Pacific Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

The following information was considered in classifying stock structure according to the Dizon et al. (1992) phylogeographic approach: I) Distributional data: geographic distribution continuous; 2) Population response data: unknown; 3) Phenotypic data: unknown; and 4) Genotypic data: unknown. Based on this limited information, two stocks of northern right whales are currently recognized: a North Atlantic stock and a North Pacific Stock (Scarff 1986, Schevill 1986). In the eastern North Pacific south of 50°N, only 29 reliable sightings have been recorded since 1900 (Scarff 1986, Scarff 1991, Carretta et al. 1994). Whaling records indicate that right whales in the North Pacific range across the entire North Pacific north of 35°N and occasionally occur as far south as 20°N (Fig. 35). Sightings have been reported as far south as central Baja California in the eastern North Pacific. as far south as Hawaii in the central North Pacific, and as far north as the sub-Arctic waters of the Bering Sea and Sea of Okhotsk in the summer (Herman et al. 1980, Berzin and Doroshenko 1982, NMFS 1991). Migratory patterns of the North Pacific stock are unknown.

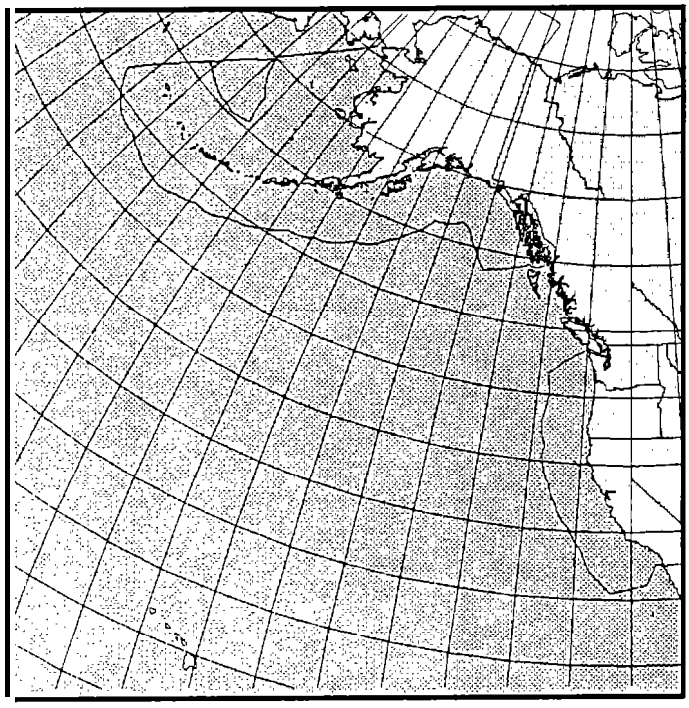

Figure 35. Approximate distribution of right whales in the eastern North Pacific (shaded area)

POPULATION SIZE

The pre-exploitation size of this stock exceeded 11,000 animals (NMFS I991). Based on sighting data, Wada (1973) estimated a total population of 100-200 in the North Pacific. Rice (I 974) stated that only a few individuals remained in the eastern North Pacific stock, and that for all practical purposes was extinct because no sightings of a cow with calf have been confirmed since 1900 (D. Rice, pers. comm., National Marine Mammal Laboratory, 7600 Sand Point Way, NE. Seattle, WA, 98115). Two notable bright points concerning right whales in the North Pacific recently occurred. On April 2, 1996 a right whale was sighted off of Maui (D. Salden, pers. comm, Hawaii Whale Research Foundation, P.O. Box 1296, Lahaina, HI, 96767). This was the first documented sighting of a right whale in Hawaiian waters since 1979 (Herman et al. 1980, Rowntree et al. 1980). More importantly, a group of 3-4 right whales was sighted in western Bristol Bay (July 30, 1996) which appears to have included a juvenile animal (Goddard and Rugh, in press).

A reliable estimate of abundance for the North Pacific right whale stock is currently not available.

Minimum Population Estimate

At this time, it is not possible to produce a reliable estimate of minimum abundance for this stock, as current estimates of abundance are not available

Current Population Trend

A reliable estimate of trend in abundance ix currently not available

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

Due to insufficient information, it is recommended that the default cetacean maximum net productivity rate (R_{MAX}) of 4% be employed for this stock (Wade and Angliss 1997). However, this default rate is likely an underestimate based on the work reported by Best (1993).

POTENTIAL BIOLOGICAL REMOVAL

Under the 1994 re-authorized Marine Mammal Protection Act (MMPA), the potential biological removal (PBR) is defined as the product of the minimum population estimate, one-half the maximum theoretical net productivity rate, and a recovery factor: $PBR = N_{MIN} \times 0.5R_{MAX} \times F_R$. The recovery factor ($F_R$) for this stock is 0.1, the value for cetacean stocks which are listed as endangered (Wade and Angliss 1997). However, because a reliable estimate of minimum abundance is currently not available, the PBR for this stock is unknown

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

Fisheries Information

In June of 1983, a right whale was reported to be incidentally killed in a gillnet in Russian waters (NMFS 1991). Gillnets were also implicated in the death of another right whale off the Kamchatka Peninsula (Russia) in October of 1989 (Kornev 1994). No other incidental takes of right whales have occurred in the North Pacific. Any mortality incidental to commercial fisheries would be considered significant.

Subsistence/Native Harvest Information

Subsistence hunters in Alaska and Russia are not reported to take animals from this stock.

STATUS OF STOCK

The right whale is listed as "endangered" under the Endangered Species Act of 1973, and a result this stock is class&d as a strategic stock. Reliable estimates of the minimum population size, population trends, and PBR are currently not available.

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BOWHEAD WHALE *(Balaena mysticetus):* Western Arctic Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

Bowhead whales are distributed in seasonally ice-covered waters of the Arctic and near-Arctic, generally north of 54°N and south of 75°N in the western Arctic Basin (Braham 1984). For management purposes, five stocks are currently recognized by the International Whaling Commission (RIWC 1992). Small stocks occur in the Sea of Okhotsk, Davis Strait, Hudson Bay, and Spitsbergen. These small bowhead stocks are comprised of only a few tens to a few hundreds of individuals (Braham 1984, Shelden and Rugh 1996). The largest remnant population, and only stock that is found within U. S. waters, is the Western Arctic stock (Fig. 36). The Western Arctic stock migrates annually from wintering areas (November to March) in the northern Bering Sea, through the Chukchi Sea in the spring (March through June), to the Beaufort Sea where they spend much of the summer (mid-May through September) before returning again to the Bering Sea in the fall (September through November) to overwinter (Braham et al. 1980; Moore and Reeves 1993). The bowhead spring migration follows fractures in the sea ice around the coast of Alaska, generally in the shear zone between the shorefast ice and the mobile polar pack ice. There is evidence of whales following each other, even when their route does not take advantage of large ice-free areas, such as polynyas (Rugh and Cubbage 1980). As the whales travel east past Point Barrow, Alaska, their migration is somewhat funneled between shore and the polar pack ice, making for an optimal location from which to study this stock (Krogman 1980). Most of the year, bowhead whales are closely associated with sea ice (Moore and DeMaster 1996). Only during the summer is this population in relatively ice-free waters in the southern Beaufort Sea, an area often exposed to industrial activity related to petroleum exploration (Richardson et al. 1985).

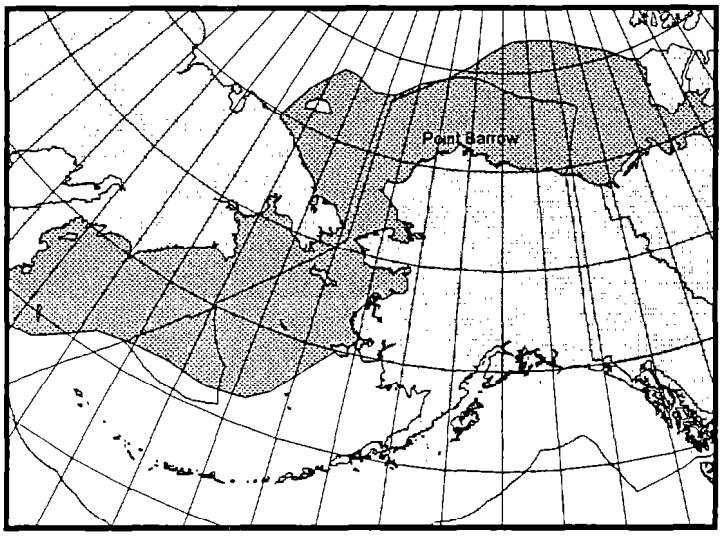

Figure 36. Approximate distribution of the Western Arctic stock of bowhead whales. The shaded area includes regions used during both the winter and summer by whales from this stock.

POPULATION SIZE

All stocks of bowhead whales were severely depleted during intense commercial whaling prior to the 20th century, starting in the early 16th century near Labrador and spreading to the Bering Sea in the mid-19th century (Braham 1984). Woodby and Botkin (1993) summarized previous efforts to approximate how many bowheads there were prior to the onset of commercial whaling. They reported a minimum worldwide population estimate of 50,000, with 10,400-23,000 in the Western Arctic stock (dropping to less than 3,000 at the end of commercial whaling).

Since 1978, counts of bowhead whales have been conducted from sites on sea ice north of Point Barrow, Alaska, during the whales' spring migration (Krogman et al. 1989). These counts have been corrected for whales missed due to distance offshore (through acoustical methods, described in Clark et al. 1994), whales missed when no watch was in effect, and whales missed during a watch (estimated as a function of visibility, number of observers, and distance offshore) (Zeh et al. 1994). However, in some years a small proportion of the population may not migrate past Point Barrow in spring, resulting in estimates which could be negatively biased. In 1993, unusually good counting conditions resulted in a population estimate for this stock of 8,000 (CV = 0.073) animals, with a 95% confidence interval from 6,900 to 9,200 (Zeh et al. 1994). A refined and larger sample of acoustic data from 1993 has resulted in an estimate of 8,200 animals (95% CI = 7,200-9,400), and is considered a better abundance estimate for the Western Arctic stock (RIWC 1996). The CV for this abundance estimate is 0.069 (Zeh et al. 1995).

Minimum Population Estimate

The minimum population estimate (N_{MIN}) for this stock is calculated from Equation 1 from the PBR Guidelines (Wade and Angliss 1997): $N_{MIN} = N/\exp(0.842*[\ln(1+[CV(N)]^2)]^{½})$. Using the population estimate (N) of 8,200 and its associated CV of 0.069, N_{MIN} for the Western Arctic stock of bowhead whales is 7,738.

Current Population Trend

Raftery et al. (1995) reported the Western Arctic stock of bowhead whales increased at a rate of 3:1% (95% CI = 1.4-4.7%) from 1978 to 1993, when abundance increased from approximately 5,000 to 8,000 whales. This rate of increase takes into account whales that passed beyond the viewing range of the ice-based observers. Inclusion of the revised 1993 abundance estimate 1978-93 data has results in a similar, though slightly higher rate of population increase 3.2% (95% CI = 1.4-5.1%) during the 1978-93 period (RIWC 1996).

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

The current estimate for the rate of increase for this stock of bowhead whales (3.2%) should not be used as an estimate of (R_{MAX}) because the population is currently being harvested and because the population has recovered to population levels where the growth is expected to be significantly less than R_{MAX}. Thus, until additional data become available, it is recommended that the cetacean maximum theoretical net productivity rate (R_{MAX}) of 4% be employed for the Western Arctic stock of bowhead whale (Wade and Angliss 1997).

POTENTIAL BIOLOGICAL REMOVAL

Under the 1994 re-authorized Marine Mammal Protection Act (MMPA), the potential biological removal (PBR) is defined as the product of the minimum population estimate, one-half the maximum theoretical net productivity rate, and a recovery factor: $PBR = N_{MIN} \times 0.5R_{MAX} \times F_R$. The recovery factor ($F_R$) for this stock is 0.5 rather than the default value of 0.1 for endangered species because population levels are increasing in the presence of a known take (Wade and Angliss 1997). Thus, for the Western Arctic stock of bowhead whale PBR = 77 animals (7,738 x 0.02 x 0.5). The development of a PBR for the Western Arctic bowhead stock is required by the MMPA even though the Alaska Eskimo subsistence harvest of bowhead whales is managed under the authority of the International Whaling Commission (IWC). Accordingly, the IWC bowhead whale quota takes precedence over the PBR estimate for the purpose of managing the Alaska Native subsistence harvest from this stock. The IWC quotas authorize Alaska Natives to strike up to 67 bowhead whales in 1996, 66 in 1997, and 65 in 1998 (RIWC 1995).

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

Fisheries Information

There are no observer program records of bowhead whale mortality incidental to commercial fisheries in Alaska. In addition, logbook reports maintained by vessel operators required by the MMPA interim exemption program during the 4-year period between 1990-93 reported no injuries or mortalities of bowhead whales for any Alaska fishery. Complete logbook data after 1993 are not available.

Rare cases of rope or net entanglement have been reported from whales taken in the subsistence hunt (Philo et al. 1993), but this species association with sea ice limits the amount of fisheries activity occurring in bowhead habitat. The estimated annual mortality rate incidental to commercial fisheries (0; based on observer data (0) and logbook reports (0) where observer data were not available) is not known to exceed 10% of the PBR (8) and, therefore, can be considered to be insignificant and approaching a zero mortality and serious injury rate.

Subsistence/Native Harvest Information

Eskimos have been taking bowhead whales for at least 2,000 years (Marquette and Bockstoce 1980, Stoker and Krupnik 1993). Subsistence takes have been regulated by a quota system under the authority of the IWC since 1977. Alaska Native subsistence hunters take approximately 0.1-0.5% of the population per annum, primarily from 9 Alaska communities (Philo et al. 1993). Since 1977, the number of kills has ranged between 14-72 per year, depending in part on changes in management strategy and in part to higher estimates of bowhead whale abundance in recent years (Stoker and Krupnik 1993). Between 1973 and 1992, the sex ratio of bowheads taken in the hunt was equal; the proportion of adult females taken in the hunt increased from 5% in the early 1970s to over 20% in the late 1980s and early 1990s; approximately 80% of the catch was immature animals prior to 1978 and since has been approximately 60%; and modem Native whalers appear to

harvest larger bowheads than precontact (prior to 1849) Native whalers (Braham 1995). More recently the total take, including struck and lost was reported to be S I whales in 1993 (Suydam et al. 1994), 46 in 1994 (RIWC 1996), and 57 in 1995 (RIWC 1997), resulting in an annual average subsistence take of 51 during the 3-year period from 1993 to 1995.

Canadian Natives are also known to take whales from this stock. Hunters from the western Canadian Arctic community of Aklavik last killed a whale from this stock in 1991. There were no takes reported by Canadian hunters during the 3-year period from 1993 to 1995.

STATUS OF STOCK

Based on currently available data, the level of human-caused mortality and serious injury (51) is not known to exceed the PBR (77) nor the IWC quota for 1995 (68). The Western Arctic bowhead whale stock has been increasing in recent years. However, the stock is classified as a strategic stock because bowhead whale is listed as "endangered" under the Endangered Species Act (ESA). The development of criteria for classifying this stock under the ESA is currently underway and will be used in the next S-year evaluation of stock status (Shelden and Rugh 1996).

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Appendix Table 1.--Summary of changes to 1996 stock assessments. Sections marked with an 'X' denote significant changes from the 1995 stock assessment for that stock.

Stock	Stock definition	Population size	PBR	Fishery mortality	Subsistence mortality	Status
Steller sea lion (western US)			X	X	X	X
Steller sea lion (eastern US)		X	X	X	X	
Northern fur seal				X	X	
Harbor seal (SE Alaska)		X	X	X	X	
Harbor seal (GOA)	X	X	X	X	X	X
Harbor seal (Bering Sea)	X	X	X	X	X	
Spotted seal				X	X	
Bearded seal				X		
Ringed seal				X		
Ribbon seal				X		
Beluga whale (Beaufort)		X	X		X	
Beluga whale (E. Chukchi)					X	
Beluga whale (E. Bering Sea)		X	X		X	X
Beluga whale (Bristol Bay)		X	X	X	X	
Beluga whale (Cook Inlet)		X	X		X	X
Killer whale (resident)	X	X		X		
Killer whale (transient)	X	X	X	X		
Pacific white-sided dolphin				X		
Harbor porpoise (SE Alaska)	X	X	X	X		
Harbor porpoise (GOA)	X	X	X	X		
Harbor porpoise (Bering Sea)	X	X	X	X		
Dall's porpoise				X		
Sperm whale				X		
Baird's beaked whale					X	
Cuvier's beaked whale						
Stejneger's beaked whale						
Gray whale		X	X	X	X	
Humpback whale (western)						
Humpback whale (central)				X		
Fin whale						
Minke whale					X	
Northern Right whale		X				
Bowhead whale		X	X		X	

Appendix Table 2. --Stock summary table

Species	Stock	N (est)	CV	C.F.	CV C.F.	Comb. CV	N(min)	0.5 Rmax	F(r)	PBR	Fishery mort.	Subsist mort.	Status
Baird's beaked whale	Alaska	n/a					n/a	0.02	0.50	n/a	0	see txt	NS
Bearded seal	Alaska	n/a					n/a	0.06	0.50	n/a	2	n/a	NS
Beluga whale	Beaufort Sea	39,258	0.229	2.00	n/a	0.229	32,453	0.02	1.00	649	0	160	NS
Beluga whale	East. Chukchi Sea	3,710	n/a	3.09	n/a	n/a	3,710	0.02	1.00	74	0	54	NS
Beluga whale	East. Bering Sea	7,986	0.26	3.09	n/a	0.26	6,439	0.02	1.00	129	0*	127	NS
Beluga whale	Bristol Bay	1,555	n/a	3.09	n/a	0.20	1,316	0.02	1.00	26	1*	19	NS
Beluga whale	Cook Inlet	881	0.19	2.89	0.14	0.19	752	0.02	1.00	15	0*	40	S
Bowhead whale	Western Arctic	8,200	0.069			0.069	7,738	0.02	0.50	77	0	51	S
Cuvier's beaked whale	Alaska	n/a					n/a	0.02	0.50	n/a	0	0	NS
Dall's porpoise	Alaska	83,400	0.097			0.097	76,874	0.02	1.00	1,537	42	0	NS
Fin whale	Northeast Pacific	n/a					n/a	0.02	0.10	n/a	0	0	S
Gray whale	Eastern No Pacific	22,571	0.0524			0.0524	21,597	0.02	1.00	432	4	43	NS
Harbor porpoise	Southeast Alaska	10,301	see txt	see txt	see txt	see txt	8,156	0.02	0.50	82	4*	0	NS
Harbor porpoise	Gulf of Alaska	8,497	0.134	3.10	0.171	0.218	7,085	0.02	0.50	71	25	0	NS
Harbor porpoise	Bering Sea	10,946	0.243	3.10	0.171	0.300	8,549	0.02	0.50	86	2	0	NS
Harbor seal	Southeast Alaska	37,450	0.026	1.74	0.068	0.073	35,226	0.06	1.00	2,114	36*	1,668	NS
Harbor seal	Gulf of Alaska	23,504	0.028	1.50	0.047	0.056	22,427	0.06	0.50	673	36	850[1]	NS
Harbor seal	Bering Sea	13,312	0.062	1.50	0.047	see txt	12,648	0.06	0.50	379	31	178	NS

Appendix Table 2. --(cont.).

Species	Stock	N (est)	CV	C.F.	CV C.F.	Comb. CV	N(min)	0.5 Rmax	F(r)	PBR	Fishery mort.	Subsist mort.	Status
Humpback whale	Western No Pacific	n/a					n/a	0.02	0.10	n/a	0	0	S
Humpback whale	Central No Pacific	1,407	0.107			see txt	1,407	0.02	0.10	2.8	0.8	0	S
Killer whale	Eastern No Pacific Northern resident	764	n/a			see txt	764	0.02	0.50	7.6	1.4	0	NS
Killer whale	Eastern No Pacific Transient	314	n/a				314	0.02	0.50	3.1	1.4	0	NS
Minke whale	Alaska	n/a					n/a	0.02	0.50	n/a	0	0	NS
Northern right whale	North Pacific	n/a					n/a	0.02	0.10	n/a	0	0	S
Northern fur seal	Eastern No Pacific	1,019,192	0.0593	4.475	n/a	0.0593	969,595	0.043	0.50	20,846	18	1713	S
Pac white-sided dolphin	North Pacific	931,000	0.900				486,719	0.02	0.50	4,867	4	0	NS
Ribbon seal	Alaska	n/a					n/a	0.06	0.50	n/a	1	n/a	NS
Ringed seal	Alaska	n/a					n/a	0.06	0.50	n/a	1	n/a	NS
Sperm whale	North Pacific	n/a					n/a	0.02	0.10	n/a	0	0	S
Spotted seal	Alaska	n/a					n/a	0.06	0.50	n/a	2*	see txt	NS
Stejneger's beaked whale	Alaska	n/a					n/a	0.02	0.50	n/a	0	0	NS
Steller sea lion	Eastern U. S.	37,746	0.0184	see txt	n/a	0.0184	37,166	0.06	0.75	1,672	15	2	S
Steller sea lion	Western U. S.	43,200	0.0184	see txt	n/a	0.0184	42,536	0.06	0.15	383	35	412	S

C.F. = correction factor; CV C.F. = CV of correction factor; Comb. CV = combined CV; Status: S=Strategic, NS=Not Strategic, n/a = not available.

* = No reported take by NMFS observers; however, observer coverage was minimal or nonexistent.

see txt = see text for details.

[1] - the total removal of female animals from this stock is less than one-half the PBR.

Appendix Table 3a. --Summary table for Alaska category 2 commercial fisheries.

Fishery (area and gear type)	Target species	# of permits issued/fished 1995	Soak time	Landings per day	Sets per day	Season duration	Fishery trends (1990-1996)
Southeast AK drift gillnet	salmon	483 issued 452 fished	20 min - 3 hrs; day / night	1	6 - 20	June 18 to early Oct	# vessels stable but may vary some with price of salmon; catch - high
Southeast AK purse seine	salmon	418 issued 373 fished	20 min-45 min; mostly daylight fishing, except at peak	1	6 - 20	end of June to early Sept	# vessel stable but may vary some with price of salmon; catch - high
Yakutat set gillnet	salmon	171 issued 147 fished	continuous soak during opener; day / night	1	net picked every 2 - 4 hrs/day or continuous during peak	June 4 to mid - Oct	# sites fished stable; catch - variable
Prince William Sound drift gillnet	salmon	542 issued 518 fished	15 min - 3 hrs; day / night	1 or 2	10 - 14	mid - May to end of Sept	# vessels stable; catch - stable
Cook Inlet drift gillnet	salmon	582 issued 577 fished	15 min - 3 hrs or continuous; day only	1	6 - 18	June 25 to end of Aug	# vessels stable; catch - variable
Cook Inlet (CI) set gillnet	salmon	745 issued 625 fished	continuous soak during opener, but net dry during low tide; upper CI -day / night lower CI -day only except during fishery extensions	1	upper CI - picked on slack tide lower CI - picked every 2 - 6 hrs/day	June 2 to mid - Sept	# sites fished stable; catch - up for sockeye and kings, down for pinks
Kodiak set gillnet	salmon	189 issued 173 fished	continuous during opener; day only	1 or 2	picked 2 or more times	June 9 to end of Sept	# sites fished stable; catch - variable
Alaska Peninsula/Aleutians drift gillnet	salmon	164 issued 164 fished	2 -5 hrs; day / night	1	3 - 8	mid - June to mid - Sept	# vessels stable; catch up
Alaska Peninsula/Aleutians set gillnet	salmon	114 issued 109 fished	continuous during opener; day / night	1	every 2 hrs	June 18 to mid Aug	# sites fished stable; catch - up since 90; down in 96
Bristol Bay drift gillnet	salmon	1888 issued 1882 fished	continuous soaking of part of net while other parts picked; day / night	2	continuous	June 17 to end of Aug or mid - Sept	# vessels stable; catch - variable
Bristol Bay set gillnet	salmon	1,019 issued 967 fished	continuous during opener, but net dry during low tide; day / night	1	2 or continuous	June 17 to end of Aug or mid - Sept	# sites fished stable; catch - variable
AK pair trawl	misc finfish	2 issued 0 fished					new fishery

Appendix Table 3b. --Interaction table for Alaska category 2 commercial fisheries.

Fishery (area and gear type)	Observer program	Species recorded as taken incidentally in this fishery (records dating back to 1988)	Data type
Southeast AK drift gillnet	never observed	Steller sea lion, harbor seal, harbor porpoise, Dall's porpoise, Pacific white-sided dolphin, humpback whale (strand)	logbook and stranding
Southeast AK purse seine	never observed	humpback whale	MMPA reports
Yakutat set gillnet	never observed	harbor seal, gray whale (strand)	logbook and stranding
Prince William Sound drift gillnet	1990 1991	Steller sea lion (obs), northern fur seal, harbor seal (obs), harbor porpoise (obs), Dall's porpoise, Pacific white-sided dolphin	observer and logbook
Cook Inlet drift gillnet	never observed	Steller sea lion, harbor seal, harbor porpoise, Dall's porpoise	logbook
Cook Inlet set gillnet	never observed	harbor seal, harbor porpoise, Dall's porpoise	logbook
Kodiak set gillnet	never observed	harbor seal, harbor porpoise	logbook
Alaska Peninsula/Aleutians drift gillnet	1990	northern fur seal, harbor seal, harbor porpoise, sea otter Dall's porpoise (obs)	observer and logbook
Alaska Peninsula/Aleutians set gillnet	never observed	Steller sea lion, harbor porpoise	logbook
Bristol Bay drift gillnet	never observed	Steller sea lion, northern fur seal, harbor seal, spotted seal, Pacific white-sided dolphin, beluga whale, gray whale	logbook
Bristol Bay set gillnet	never observed	northern fur seal, harbor seal, spotted seal, Pacific white-sided dolphin, beluga whale, gray whale	logbook
AK pair trawl	never observed	none documented	none

Note: Only species with positive records of being taken incidentally in a fishery since 1988 (the first year of the MMPA interim exemption program) have been included in this table. A species' absence from this table does not necessarily mean it is not taken in a particular fishery. Rather, in most fisheries, only logbook or stranding data are available which resulted in many reports of unidentified or misidentified marine mammals.

Appendix Table 3c. --Interaction table for Alaska category 3 commercial fisheries.

Fishery name	# of permits issued/fished 1995	Observer program	Species recorded as taken incidentally in this fishery (records dating back to 1990)	Data type
Prince William Sound salmon set gillnet	30 issued 27 fished	1990	Steller sea lion, harbor seal	logbook
Kuskokwim, Yukon, Norton Sound, Kotzebue salmon gillnet	2026 issued 1690 fished	never observed	none documented	none
AK roe herring and food/bait herring gillnet	16 issued 0 fished	never observed	none documented	none
AK miscellaneous finfish set gillnet	11 issued # fished n/a	never observed	Steller sea lion	logbook
AK salmon purse seine (except for Southeast AK)	962 issued 763 fished	never observed	harbor seal	logbook
AK salmon beach seine	34 issued 8 fished	never observed	none documented	none
AK roe herring and food/bait herring purse seine	750 issued 480 fished	never observed	none documented	none
AK roe herring and food/bait herring beach seine	10 issued 7 fished	never observed	none documented	none
Metlakatla purse seine	10 issued 10 fished	never observed	none documented	none
AK octopus/squid purse seine	6 issued 0 fished	never observed	none documented	none
AK miscellaneous finfish purse seine	7 issued 0 fished	never observed	none documented	none
AK miscellaneous finfish beach seine	1 issued 0 fished	never observed	none documented	none
AK salmon troll (includes hand and power troll)	2494 issued 1278 fished	never observed	Steller sea lion	logbook
AK state waters sablefish longline/set line	1095 issued # fished n/a	never observed	none documented	none
AK miscellaneous finfish/groundfish longline/set line (state / federal)	1220 / 1789 issued n/a / 1007 fished	1989-present (federal)	Steller sea lion, harbor seal, northern elephant seal, Dall's porpoise	observer
Southern Bering Sea, Aleutian Islands, and Western Gulf of AK sablefish longline/set line (federally regulated waters)	1019 issued 735 fished	1989-present	Steller sea lion (MMPA), killer whale (obs), Pacific white sided dolphin (obs), northern elephant seal (log)	observer, logbook, and MMPA reports
AK halibut longline/set line (state and federal waters)	8302 issued 5068 fished	never observed	Steller sea lion	MMPA reports
AK octopus/squid longline	2 issued 0 fished	never observed	none documented	none

Note: Only species with positive records of being taken incidentally in a fishery since 1990 (the first year of the MMPA interim exemption logbook program) have been included in this table. A species' absence from this table does not necessarily mean it is not taken in a particular fishery. Rather, in most fisheries, only logbook or stranding data are available which resulted in many reports of unidentified or misidentified marine mammals.

Appendix Table 3c. --(cont.).

Fishery name	# of permits issued/fished 1995	Observer program	Species recorded as taken incidentally in this fishery (records dating back to 1990)	Data type
AK shrimp otter and beam trawl (statewide and Cook Inlet)	88 issued 42 fished	never observed	none documented	none
Gulf of Alaska groundfish trawl	325 issued 209 fished	1989 to present	Steller sea lion, harbor seal, northern elephant seal, Dall's porpoise	observer
Bering Sea and Aleutian Island groundfish trawl	294 issued 186 fished	1989 to present	Steller sea lion, northern fur seal, harbor seal, spotted seal, bearded seal, ribbon seal, ringed seal, northern elephant seal, Dall's porpoise, harbor porpoise, Pacific white-sided dolphin, killer whale, sea otter, walrus	observer
State waters of Kachemak Bay Cook Inlet, Prince William Sound, Southeast AK groundfish trawl	0 issued 0 fished	never observed	none documented	none
AK miscellaneous finfish otter or beam trawl	391 issued # fished n/a	never observed	none documented	none
AK food/bait herring trawl (Kodiak area only)	4 issued 3 fished	never observed	none documented	none
AK crustacean pot	2215 issued 1511 fished	1988 to present	none documented	observer
AK Bering Sea and Gulf of Alaska finfish pot	486 issued 266 fished	1990 to present	harbor seal, sea otter	observer
AK North Pacific halibut handline and mechanical jig	319 issued 119 fished	never observed	none documented	none
AK other finfish handline and mechanical jig	598 issued 172 fished (jig only)	never observed	none documented	none
AK octopus/squid handline	2 issued 0 fished	never observed	none documented	none
Southeast AK herring food/bait pound net	4 issued 0 fished	never observed	none documented	none
Coastwise scallop dredge	16 issued 10 fished	never observed	none documented	none
AK abalone (hand pick/dive)	180 issued 44 fished	never observed	none documented	none
AK dungeness crab (hand pick/dive)	2 issued 2 fished	never observed	none documented	none
AK herring spawn-on-kelp (hand pick/dive)	329 issued 212 fished	never observed	none documented	none
AK urchin and other fish/shellfish (hand pick/dive)	104 issued 17 fished	never observed	none documented	none

Note: Only species with positive records of being taken incidentally in a fishery since 1990 (the first year of the MMPA interim exemption logbook program) have been included in this table. A species' absence from this table does not necessarily mean it is not taken in a particular fishery. Rather, in most fisheries, only logbook or stranding data are available which resulted in many reports of unidentified or misidentified marine mammals

Appendix Table 3c. --(cont.).

Fishery name	# of permits issued/fished 1995	Observer program	Species recorded as taken incidentally in this fishery (records dating back to 1990)	Data type
AK clam hand shovel	94 issued 53 fished	never observed	none documented	none
AK clam mechanical hydraulic	145 issued 104 fished	never observed	none documented	none
AK commercial passenger fishing vessel	16,276 issued # fished n/a	never observed	none documented	none
AK octopus/squid "other"	1 issued 1 fished	never observed	none documented	none

Note: Only species with positive records of being taken incidentally in a fishery since 1990 (the first year of the MMPA interim exemption logbook program) have been included in this table. A species' absence from this table does not necessarily mean it is not taken in a particular fishery. Rather, in most fisheries, only logbook or stranding data are available which resulted in many reports of unidentified or misidentified marine mammals.

Appendix Table 3d. --Observer coverage in Alaska commercial fisheries 1990-95.

Fishery name	1990	1991	1992	1993	1994	1995
Gulf of Alaska (GOA) groundfish trawl	55%	38%	41%	37%	33%	44%
GOA longline	21%	15%	13%	13%	8%	18%
GOA finfish pots	13%	9%	9%	7%	7%	7%
Bering Sea/Aleutian Island (BSA) groundfish trawl	74%	53%	63%	66%	64%	67%
BSA longline	80%	54%	35%	30%	27%	28%
BSA finfish pots	43%	36%	34%	41%	27%	20%
Prince William Sound salmon drift gillnet	4%	5%	not observed	not observed	not observed	not observed
Prince William Sound salmon set gillnet	3%	not observed	not observed	not observed	not observed	not observed
Alaska Peninsula/Aleutian Island salmon drift gillnet (South Unimak area only)	4%	not observed	not observed	not observed	not observed	not observed

Note: Observer coverages in the groundfish fisheries (trawl, longline, and pots) were determined by the percentage of tons caught which were observed. Observer coverage in the groundfish fisheries is assigned according to vessel length; where vessels greater then 125' have 100% coverage, vessels 60-125' have 30% coverage, and vessels less than 60' are not observed. Observer coverages in the drift gillnet fisheries were calculated as the percentage of the estimated sets that were observed. Observer coverages in the set gillnet fishery was calculated as the percentage of estimated setnet hours (determined by number of permit holders and the available fishing time) that were observed.

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