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Draft Alaska Marine Mammal Stock Assessments ~~2007~~8

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PREFACE

On 30 April 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, when available, 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. These data will be used to evaluate the progress of each fishery towards achieving the MMPA's goal of zero fishery-related mortality and serious injury of marine mammals.

The Stock Assessment Reports should be considered working documents, as they are updated as new information becomes available. The Stock Assessment Reports were originally developed in 1995 (Small and DeMaster 1995). Revisions have been published for the following years: 1996 (Hill et al. 1997), 1998 (Hill and DeMaster 1998), 1999 (Hill and DeMaster 1999), 2000 (Ferrero et al. 2000), 2001 (Angliss et al. 2001), 2002 (Angliss and Lodge 2002), 2003 (Angliss and Lodge 2004), 2005 (Angliss and Outlaw 2005), ~~and~~ 2006 (Angliss and Outlaw 2006), and 2007 (Angliss and Outlaw, 2007). Each stock assessment report is designed to stand alone and is updated as new information becomes available. The MMPA requires stock assessment reports to be reviewed 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. New information for all strategic stocks (Steller sea lions, northern fur seals, Cook Inlet beluga whales, AT1 transient killer whales, harbor porpoises, sperm whales, humpback whales, fin whales, North Pacific right whales, and bowhead whales), were reviewed in 200~~6~~7-200~~7~~8. This review, and a review of other stocks, led to the revision of the following stock assessments for the 200~~7~~8 document: Steller sea lion (western and eastern U.S. stocks), northern fur seal, beluga whale (Beaufort Sea, Eastern Chukchi Sea, Eastern Bering Sea, Bristol Bay, and Cook Inlet stocks), killer whale (AT1 transient), harbor porpoise (southeast Alaska, Gulf of Alaska, and Bering Sea stocks), sperm whale, gray whale ~~("Status of Stock" section)~~, central and western stocks of humpback whales, fin whale, North Pacific right whale, and bowhead whale. The stock assessment reports for all stocks, however, are included in this document to provide a complete reference. 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 are included in this NMFS Stock Assessment Report for your convenience.

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 Scientific Review Group members: Brendan Kelly (chair through 2004), Lance Barrett-Lennard, John Gauvin, ~~Sue Hills (chair from 2004 to present)~~, ~~Charlie Johnson,~~ Lloyd Lowry, Beth Mathews (chair from 2007 to present), Craig Matkin, George Noongwook, Grey Pendleton, Jan Straley, Robert Suydam, and Kate Wynne.

The information contained within the individual stock assessment reports stems from a variety of sources. Where feasible, we have attempted to utilize only published material. When citing information contained in this document, authors are reminded to cite the original publications, when possible.

CONTENTS

Appendices

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

STOCK DEFINITION AND GEOGRAPHIC RANGE

Steller sea lions range along the North Pacific 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 low (NMFS 1995).

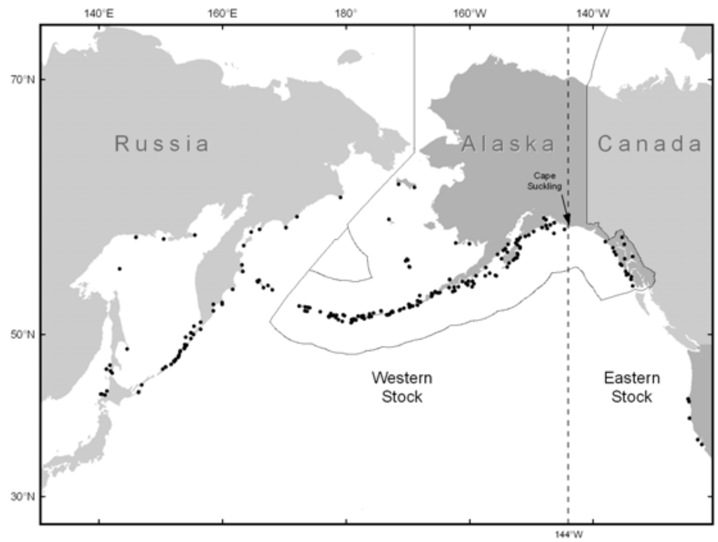

Figure 1. Approximate distribution of Steller sea lions in the North Pacific. Major U.S. haulouts and rookeries (50 CFR 226.202, 27 August 1993) and active Asian haulouts and rookeries (Burkanov and Loughlin, 2005) are depicted (points). Black dashed line (144° W) indicates stock boundary (Loughlin 1997). Note: Haulouts and rookeries in British Columbia are not shown.

Loughlin (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 were 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).

Steller sea lions that breed in Asia have been considered part of the western stock. While Steller sea lions seasonally inhabit coastal waters of Japan in the winter, breeding rookeries are currently only located in Russia (Burkanov and Loughlin, 2005). Analyses of genetic data differ in their interpretation of separation between Asian and Alaskan sea lions. Based on analysis of mitochondrial DNA, Baker et al. (2005) concluded that there was evidence for an additional Asian stock and that Commander Island (Russia) was genetically within the western U.S. stock. However, Hoffman et al. (2006) did not support an Asian/western stock split based on their analysis of nuclear microsatellite markers, which indicated high rates of male gene flow. The Baker et al. (2005) and Hoffman et al. (2006) results are consistent with a social structure in which there is stronger breeding site fidelity for females compared to males (Hoffman et al. 2006). In addition, Hoffman et al. (2006) ~~did~~ concluded that "the three Asian regions are closely related and form a branch separate from all other populations." ~~Further analysis will be needed to determine if designation of an Asian stock is warranted.~~

POPULATION SIZE

The most recent comprehensive estimate (pups and non-pups) of abundance of the western stock of Steller sea lions in Alaska is based on aerial surveys of non-pups in June 2004 (Fritz and Stinchcomb 2005) and aerial and ground-based pup counts in June and July of 2004 and 2005 (NMML unpublished data). Data from these surveys represent actual counts of pups and non-pups at all rookeries and major haulout sites. During the 2004 aerial survey, a total of 29,037 non-pups were counted at 262 rookeries and haulout sites; 13,892 in the Gulf of Alaska and 15,145 in the Bering Sea/Aleutian Islands (Fritz and Stinchcomb 2005). A composite pup count for 2004 and 2005 includes counts from 2 sites in 2004, and 57 sites in 2005. There were 4,518 pups counted in the Gulf of Alaska and 5,433 pups counted in the Bering Sea/Aleutian Islands for a total of 9,951 for the stock. Combining the pup count data from 2004-2005 (9,951) and non-pup count data from 2004 (29,037) results in a minimum abundance estimate of 38,988 Steller sea lions in the western U.S. stock in 2004-2005.

An estimate of the total population size of western Steller sea lion in Alaska may be obtained by multiplying the best estimate of total pup production (9,951) by 4.5 (Calkins and Pitcher 1982), which equals 44,780. This would not be a minimum abundance estimate since it is based on extrapolating total population size from pup counts based on survival and fecundity estimates in a life table. The 4.5 multiplier used for estimating the size of the eastern stock of Steller sea lions may not be appropriate for use in estimating the abundance of the western stock, as it is based on a life history table using age-specific fecundity and survival for the stable, mid-1970s population. The demographics of central Gulf of Alaska populations suggest that these rates have changed considerably since the mid-1970s (Holmes and York 2003).

Holmes and York (2003) and Holmes et al (2007) estimated changes in adult and juvenile survival and natality (females only for all vital rates) that were consistent with time series of pup and non-pup counts, and changes in the juvenile proportion of the population in the central Gulf of Alaska. The analysts found that the rapid decline of the central Gulf sea lion population in the 1980s was associated with a large drop in juvenile survival and smaller drops in adult survival and natality. As the rate of population decline lessened in the 1990s, rates of juvenile and adult survival increased, followed by a return to pre-decline levels in the 1998-2004 period. Rates of natality, however, continued to decline throughout the 1990s and into the 21st century. Thus, the authors conclude, factors that caused the population decline (those contributing to less juvenile survival) are likely quite different from those that may affect recovery (those contributing to lower reproductive rates of adult females).

Methods used to survey Steller sea lions in Russia differ from those used in Alaska, with less use of aerial photography and more use of skiff surveys and ground counts. Burkanov and Loughlin (2005) estimated the current (2005) population (pups and non-pups) of Steller sea lions breeding in Russia at about 16,000. This includes approximately 1,000 animals (674 non-pups and 236 pups counted in 2004) on the Commander Islands that are likely members of the same genetic stock as those breeding west of 144°W in Alaska (Baker et al. 2005).

Minimum Population Estimate

The 2004 count of non-pups (29,037) plus the number of pups in 2004-2005 (9,951) is 38,988, which will be used as the minimum population estimate (N_{MIN}) for the U.S. portion of the western stock of Steller sea lion (Wade and Angliss 1997). This is considered a minimum estimate because it has not been corrected to account for animals that were at sea during the surveys.

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. Those counts 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 110,000 sea lions (no correction factors applied, Table 1). 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 during the early and mid-1980s (Merrick et al. 1987, Byrd 1989). The greatest declines since the 1970s occurred in the eastern Aleutian Islands and western Gulf of Alaska, but

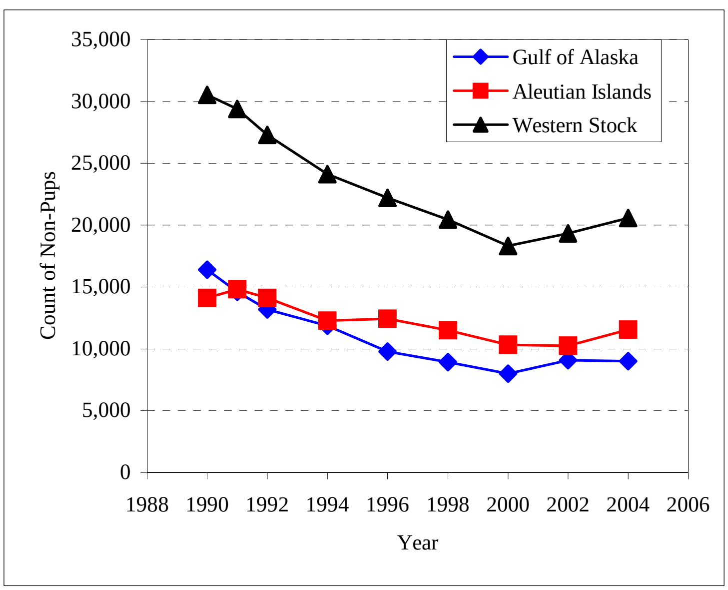

Figure 2. Counts of adult and juvenile Steller sea lions at rookery and haulout trend sites throughout the range of the western U.S. stock, 1990-2004. Correction factor applied to 2004 count for film format differences (Fritz and Stinchcomb 2005).

declines also occurred in the central Gulf of Alaska and central Aleutian Islands. Counts of Steller sea lions at trend sites for the western U. S. stock decreased 40% from 1991 to 2000 (Table 1), an average annual decline of 5.4% (Loughlin and York 2000).

Recently, counts of non-pup Steller sea lions at trend sites for the western U.S. stock increased 5.5% from 2000 to 2002, and at a similar rate between 2002 and 2004 (Table 1, Fig. 2). These were the first region-wide increases for the western stock since standardized surveys began in the 1970s. However, the 2004 count was still 7.4% below the 1996 count and 32.6% below the 1990 count. The long-term, average decline for 1991-04 is 3.1% per year (NMML unpublished data). ~~Counts of non-pups in 2006 were only obtained from a portion of trend sites due to~~Aerial surveys for non-pup Steller sea lions were conducted in 2006 and 2007, but were incomplete due to a court-ordered cessation of research that caus~~ing~~ed a delay~~ed aerial~~ to the start of the survey~~ start date~~ in 2006, and ~~also to subsequent bad weather~~ loss of survey days due to bad weather and aircraft maintenance requirements in both years. Thus, there is ~~no new~~ limited information collected since 2004 to update non-pup abundance trends for the entire western stock of Steller sea lions in Alaska. ~~Counts in 2006 from complete trend-site coverage within the eastern Gulf of Alaska and eastern Aleutian Islands sub-areas, and nearly-complete coverage in the western Gulf of Alaska were nearly unchanged relative to 2004 counts, which may indicate that the decline has stabilized (Fritz et al. 2006). A decline of 19% since 2004 was detected in the western Aleutian Islands (based on a nearly-complete count), suggesting a continued decline (Fritz et al. 2006).~~ Although counts at some trend sites are missing for both 2006 and 2007, available data indicate that the size of the adult and juvenile portion of the western Steller sea lion population throughout much of its range (Cape St. Elias to Tanaga Island, 145°-178° W) in Alaska has remained largely unchanged between 2004 (N=23,107) and 2007 (N=23,118) (Fritz et al. 2007). This conclusion was also reached following the incomplete survey of 2006 (Fritz et al. 2006). However, there are significant regional differences in recent trends: increases between 2004 and 2007 in the eastern Aleutians and western/central Gulf of Alaska have largely been offset by decreases in parts of the central Aleutians and eastern Gulf of Alaska. The relative stability in the Cape St. Elias-Tanaga Island area coupled with the declining trends observed through 2006 west of Amchitka Pass suggest that the overall trend for the western stock in Alaska (through 2007) is either stable or declining slightly.

Table 1. Counts of adult and juvenile Steller sea lions observed at rookery and haulout trend sites by year and geographical area for the western U. S. stock from the late 1970s through 2004 (NMFS 1995, Sease et al. 2001, NMML unpublished data). Counts from 1976 to 1979 (NMFS 1995) were combined to produce complete regional counts that are comparable to the 1990-2004 data. Data from 2004 reflect a 3.5% reduction from actual counts to account for improvements in survey protocol in 2004 relative to previous years (Fritz and Stinchcomb 2005). Actual 2004 trend site counts were: Gulf of Alaska – 9,332; Bering Sea/Aleutian Islands – 11,977; Total – 21,309.

Area	**late 1970s**	**1990**	**1991**	**1992**	**1994**	**1996**	**1998**	**2000**	**2002**	**2004**
Gulf of Alaska	65,296	16,409	14,598	13,193	11,862	9,784	8,937[1]	7,995	9,087	9,005
Bering Sea/Aleutians	44,584	14,116	14,807	14,106	12,274	12.426	11,501	10,330	10,253	11,558
Total	109,880	30,525	29,405	27,299	24,136	22,210	20,438[1]	18,325	19,340	20,563

[1] Identifies 637 non-pups counted at six trend sites in 1999 in the eastern Gulf of Alaska which were not surveyed in 1998.

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

There are no 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).

POTENTIAL BIOLOGICAL REMOVAL

Under the 1994 reauthorized 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 default value for stocks listed as "endangered" under the Endangered Species Act (Wade and Angliss 1997). Thus, for the U.S. portion of the western stock of Steller sea lions, PBR = 234 animals (38,988 × 0.06 × 0.1). When Steller sea lions on the Commander Islands are included, PBR = 239 animals (39,898 × 0.06 × 0.1).

The PBR levels for some stocks of marine mammals in the U.S. have been called "undetermined" (e.g., PBR levels for Cook Inlet beluga whales, Hawaiian monk seals); this has not been proposed for the western stock of Steller sea lions. The PBR management approach was developed with the assumption that direct human-related mortalities would be the primary reason for observed declines in abundance for marine mammal stocks in U. S. waters. For at least this stock, this assumption seems unwarranted. Because direct human-related mortalities are at a low level and are unlikely to either be responsible for the decline or to contribute substantially towards extinction risk, calling the PBR level "undetermined" is unnecessarily conservative for this population of nearly 40,000 animals.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

Fisheries Information

Until 2003, there were six different federally regulated commercial fisheries in Alaska that could have interacted with Steller sea lions. These fisheries were monitored for incidental mortality by fishery observers. As of 2003, changes in fishery definitions in the List of Fisheries have resulted in separating these 6 fisheries into 22 fisheries (69 FR 70094, 2 December 2004). This change does not represent a change in fishing effort, but provides managers with better information on the component of each fishery that is responsible for the incidental serious injury or mortality of marine mammal stocks in Alaska. Between ~~1999~~2002-20~~03~~06, there were incidental serious injuries and mortalities of western Steller sea lions in the following fisheries: Bering Sea/Aleutian Islands Atka mackerel trawl, Bering Sea/Aleutian Islands flatfish trawl, Bering Sea/Aleutian Islands Pacific cod trawl, Bering Sea/Aleutian Islands pollock trawl, Gulf of Alaska Pacific cod trawl, Gulf of Alaska pollock trawl, and Bering Sea/Aleutian Islands Pacific cod longline (Table 2). Estimates of marine mammal serious injury/mortality in each of these observed fisheries are provided in Perez (2006) and Perez (unpubl. ms.).

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: 1-108) 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). The Alaska Peninsula and Aleutian Islands salmon drift gillnet fishery was also monitored during 1990 (roughly 4% observer coverage) and no Steller sea lion mortalities were observed. It is not known whether these incidental mortality levels are representative of the current incidental mortality levels in these fisheries.

An observer program for the Cook Inlet salmon set and drift gillnet fisheries was implemented in 1999 and 2000 in response to the concern that there may be significant numbers of marine mammal injuries and mortalities that occur incidental to these fisheries. Observer coverage in the Cook Inlet drift gillnet fishery was 1.75% and 3.73% in 1999 and 2000, respectively. The observer coverage in the Cook Inlet set gillnet fishery was 7.3% and 8.3% in 1999 and 2000, respectively (Manly in review). There were no mortalities of Steller sea lions observed in the set or drift gillnet fisheries in either 1999 or 2000 (Manly in review). An observer program conducted for a portion of the Kodiak drift gillnet fishery in 2002 did not observe any serious injuries or mortalities of Steller sea lions, although Steller sea lions were frequently observed in the vicinity of the gear (Manly et al. 2003).

Combining the mortality estimates from the Bering Sea and Gulf of Alaska groundfish trawl and Gulf of Alaska longline fisheries presented above (~~9.7~~11.3) with the mortality estimate from the Prince William Sound salmon drift gillnet fishery (14.5) results in an estimated mean annual mortality rate in the observed fisheries of ~~24.2~~25.8 (CV = 0.60) sea lions per year from this stock (Table 2).

Table 2. Summary of incidental mortality of Steller sea lions (western U. S. stock) due to fisheries from ~~2001~~2002 through ~~2005~~2006 (or most recent data available) and calculation of the mean annual mortality rate. Mean annual mortality in brackets represents a minimum estimate from stranding data. The most recent 5 years of available data are used in the mortality calculation when more than 5 years of data are provided for a particular fishery. N/A indicates that data are not available. Details of how percent observer coverage is measured is included in Appendix 6.

Fishery name	Years	Data type	Observer coverage	Observed mortality (in given yrs.)	Estimated mortality (in given yrs.)	Mean annual mortality
Bering Sea/Aleutian Is. Atka mackerel trawl	~~2001~~	obs data	~~82.4~~	~~1~~	~~1.2~~	~~0.49~~ 0.25 (CV = ~~0.31~~0.44)
	2002		98.3	0	0	
	2003		95.3	1	1.2	
	2004		95.6	0	0	
	2005		97.8	0	0	
	2006		96.7	0	0	
Bering Sea/Aleutian Is. flatfish trawl	~~2001~~	obs data	~~57.6~~	4	~~6.4~~	~~2.78~~ 3.01 (CV = ~~0.20~~ 0.23)
	2002		58.4	1	1.6	
	2003		64.1	2	2.7	
	2004		64.3	2	3.1	
	2005		68.3	0	0	
	2006		67.8	4	7.6	
Bering Sea/Aleutian Is. Pacific cod trawl	~~2001~~	obs data	~~57.8~~	~~0~~	~~0~~	0.85 (CV = 0.73)
	2002		47.4	0	0	
	2003		49.9	2	4.3	
	2004		50.4	0	0	
	2005		52.8	0	0	
	2006		50.4	0	0	
Bering Sea/Aleutian Is. pollock trawl	~~2001~~	obs data	~~79.0~~	~~2~~	~~3.3~~	~~2.58~~ 3.83 (CV = ~~0.14~~0.13)
	2002		80.0	3	3.4	
	2003		82.2	0	0	
	2004		81.2	1	1	
	2005		77.3	4	5.2	
	2006		73.0	7	9.5	
Gulf of Alaska Pacific cod trawl	~~2001~~	obs data	~~20.3~~	~~1~~	~~4.7~~	~~0.94~~ 0 ~~(CV = 0.83)~~
	2002		23.2	0	0	
	2003		27.3	0	0	
	2004		27.0	0	0	
	2005		21.4	0	0	
	2006		22.8	0	0	
Gulf of Alaska pollock trawl	~~2001~~	obs data	~~17.6~~	~~0~~	~~0~~	1.33 (CV = 0.66)
	2002		26.0	0	0	
	2003		31.2	1	2.4	
	2004		27.4	0	0	
	2005		24.2	1	4.2	
	2006		26.5	0	0	
Bering Sea/Aleutian Is. Pacific cod longline	~~2001~~	obs data	~~29.5~~	~~0~~	~~0~~	~~0.74~~ 1.98 (CV = ~~0.86~~0.66)
	2002		29.6	1	3.7	
	2003		29.9	0	0	
	2004		23.8	0	0	
	2005		24.6	0	0	
	2006		23.9	1	6.2	
Prince William Sound salmon drift gillnet	1990-	obs data	4-5%	0	0	14.5 (CV = 1.0)
	1991			2	29	

Fishery name	Years	Data type	Observer coverage	Observed mortality (in given yrs.)	Estimated mortality (in given yrs.)	Mean annual mortality
Prince William Sound salmon set gillnet	1990	obs data	3%	0	0	0
Alaska Peninsula/Aleutian Islands salmon drift gillnet	1990	obs data	4%	0	0	0
Cook Inlet salmon set gillnet[1]	1999-2000	obs data	2-5%	0 0	0, 0	0
Cook Inlet salmon drift gillnet[1]	1999-2000	obs data	2-5%	0 0	0, 0	0
Kodiak Island salmon set gillnet	2002	obs data	6.0%	0	0	0
Observer program total						~~24.2~~25.8 (CV = 0.60)
				Reported mortalities		
Alaska sport salmon troll (non-commercial)	1993-2005	strand	N/A	0, 0, 0, 0, 0, 1, N/A, N/A, N/A, 1, N/A, N/A, N/A	N/A	[0.2]
Miscellaneous fishing gear	2001-2005	strand	N/A	N/A, N/A, 1, N/A, N/A	N/A	[0.2]
Minimum total annual mortality						~~24.6~~26.2 (CV = 0.60)

[1] Data from the 1999 Cook Inlet observer program are preliminary.

Reports from the NMFS stranding database of Steller sea lions entangled in fishing gear or with injuries caused by interactions with gear are another source of mortality data. During the 5-year period from 2001 to 2005, there was only one confirmed fishery-related Steller sea lion stranding in the range of the western stock. This sighting involved an animal at Round Island with netting or rope around its neck; no more specific information is available on the type of fishing gear involved. In addition to this incident, a Steller sea lion was entangled in a large flasher/spoon in 1998. It is likely that this injury occurred as a result of a sport fishery, not a commercial fishery (Table 2). There are sport fisheries for both salmon and shark in this area; there is no way to distinguish between them since both fisheries use a similar type of gear (J. Gauvin, Groundfish Forum, Inc., pers. comm.). Fishery-related strandings during 2001-2005 result in an estimated annual mortality of 0.4 animals from this stock. This estimate is considered a minimum because not all entangled animals strand and not all stranded animals are found or reported. Steller sea lions reported in the stranding database as shot are not included in this estimate, as they may result from animals struck and lost in the Alaska Native subsistence harvest.

NMFS studies using satellite tracking devices attached to Steller sea lions suggest that they rarely go beyond the U.S. Exclusive Economic Zone into international waters. Given that the high-seas gillnet fisheries have been prohibited 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 U. S. commercial fisheries is ~~24.6~~26.2 sea lions per year, based on observer data (~~24.2~~25.8) and stranding data (0.4) where observer data were not available. No observers have been assigned to several fisheries that are known to interact with this stock making the estimated mortality a minimum estimate.

Subsistence/Native Harvest Information

Information on the subsistence harvest of Steller sea lions comes via two sources: the Alaska Department of Fish and Game (ADFG) and the Ecosystem Conservation Office (ECO) of the Aleut Community of St. Paul. The ADFG conducts systematic interviews with hunters and users of marine mammals in approximately 2,100 households in about 60 coastal communities within the range of the Steller sea lion in Alaska (Wolfe et al. 2004). The interviews are conducted once per year in the winter (January to March), and cover hunter activities for the previous calendar year. The ECO collects data on the harvest in near real-time on St. Paul Island, and records hunter activities within 36 hours of the harvest (Zavadil et al. 2004). Information on subsistence harvest levels is provided in Table 3a; data from ECO (e.g., Zavadil et al. 2004) are relied upon as the source of data for St. Paul Island and all other data are from the ADFG (e.g., Wolfe et al. 2004).

The mean annual subsistence take from this stock over the 5-year period from 200~~01~~02 through 200~~05~~06 was 198 Steller sea lions/year (Table 3a).

Table 3a. Summary of the subsistence harvest data for the western U. S. stock of Steller sea lions, 200~~1~~2-200~~5~~6.

Year	All areas except St. Paul Island: Number harvested	Number struck and lost	Total	St. Paul Island: Number harvested + struck and lost	Total take
~~2001~~	~~144.1~~	~~30.2~~	~~174.3[1]~~	~~24[6]~~	~~198~~
2002	118.9	22.9	141.8[~~2~~1]	36[~~7~~6]	178
2003	149.7	36.9	186.6[~~3~~2]	18[~~8~~7]	205
2004	136.8	49.1	185.9[~~4~~3]	18[~~9~~8]	204
2005	153.2	27.6	180.8[~~5~~4]	22[~~10~~9]	203
2006	---	---	---[5]	26[10]	---
Mean annual take (200~~1~~2-200~~5~~6)					198

~~[1] Wolfe et al. 2002; [2]~~ [1]Wolfe et al. 2003; ~~[3]~~ [2]Wolfe et al. 2004; [~~4~~3] Wolfe et al. 2005; [~~5~~4] Wolfe et al. 2006; ~~[6] Lestenkof et al. 2003;~~ [5] XXX; [~~7~~6] Zavadil et al. 2003; [~~8~~7] Zavadil et al. 2004; [~~9~~8] Zavadil et al. 2005; [~~10~~9] Lestenkof and Zavadil 2006; [10]Lestenkof et al. 2007

Other Mortality

Illegal shooting of sea lions was thought to be a potentially significant source of mortality prior to the listing of sea lions as "threatened" under the U.S. Endangered Species Act (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 for subsistence take by Alaska Natives or where imminently necessary to protect human life). Records from NMFS enforcement indicate that there were two cases of illegal shootings of Steller sea lions in the Kodiak area in 1998, both of which were successfully prosecuted (NMFS, Alaska Enforcement Division). There have been no cases of successfully prosecuted illegal shootings between 1999 and 2003 (NMFS, Alaska Enforcement Division).

Mortalities may occasionally occur incidental to marine mammal research activities authorized under MMPA permits issued to a variety of government, academic, and other research organizations. Between ~~2000-2005~~2002-2006, there was a total of ~~5~~3 mortalities resulting from research on the western stock of Steller sea lions, which results in an average of ~~0.8~~0.6 mortalities per year from this stock. ~~The 5-year average for the years 2001-2005 is 1 mortality per year.~~

STATUS OF STOCK

The current annual level of incidental U. S. commercial fishery-related mortality (~~24.6~~26.2) exceeds 10% of the PBR (24) and, therefore, cannot be considered insignificant and approaching a zero mortality and serious injury rate. Based on available data, the estimated annual level of total human-caused mortality and serious injury (~~24.6~~26.2 + 198 + ~~1~~0.6 = ~~223.6~~224.8) is below the PBR level (234) for this stock. The western U. S. stock of Steller sea lion is currently listed as "endangered" under the ESA, and therefore designated as "depleted" under the MMPA. As a result, the stock is classified as a strategic stock. However, given that the population ~~is declining~~ has declined for unknown reasons that are not explained by the level of direct human-caused mortality, there is no guarantee that limiting those mortalities to the level of the PBR will reverse the decline, if in fact the population is still declining.

A number of management actions were implemented between 1990 and 1998 to promote the recovery of the western U. S. stock of Steller sea lions, including 3 nautical mile (nmi) no-entry zones around rookeries, prohibition of groundfish trawling within 10-20 nmi of certain rookeries, and spatial and temporal allocation of Gulf of Alaska pollock and Aleutian Island Atka mackerel total allowable catch. Recent modifications finalized in 2002 involve a complex set of regulations that changed the temporal and spatial distribution of the pollock, Pacific cod and Atka mackerel fisheries throughout the range of the western stock in U.S waters, but also removed the blanket prohibition of fishing with trawl gear within 10 (or 20) nmi of rookeries in the western stock in U.S. waters. These measures were reviewed by NMFS (2003).

Habitat Concerns

The unprecedented decline in the western U. S. stock of Steller sea lion caused a change in the listing status of the stock in 1997 from "threatened" to" endangered" under the U. S. Endangered Species Act of 1973. Survey data collected since 2000 suggest that the decline has slowed or stopped in most of the range of the western U. S. stock. Many factors have been suggested as causes of the decline, (e.g., ~~overfishing,~~,competitive effects of fishing, environmental change, disease, killer whale predation~~.~~, incidental take, illegal and legal shooting) but it is not clear which single or combination of factors are most important in causing the decline. However, ~~predation by killer whales and~~ nutritional stress related to competition with commercial fisheries or environmental change ha~~ve~~s been identified as potentially high threats to recovery (NMFS 200~~6~~7). Additional potential threats to Steller sea lion recovery can be found in Table 3b.

Table 3b. Potential threats and impacts to Steller sea lion recovery and associated references. Threats and impact to recovery as described by the Draft Steller Sea Lion Recovery Plan (NMFS 200~~6~~7). Reference examples identify research related to corresponding threats and may or may not support the underlying hypotheses.

Threat	Impact ~~to~~on Recovery	Reference Examples
~~Predation by killer whales~~	~~Potentially high~~	~~DeMaster et al. 2006; Trites et al. 2007; Williams et al. 2004; Springer et al. 2003~~
Environmental variability	Potentially high	Fritz and Hinckley 2005, Trites and Donnelly 2003
Competition with fisheries	Potentially high	Dillingham et al. 2006, Fritz and Brown 2005, Hennen 2004, Fritz and Ferrero 1998
Predation by killer whales	Medium	DeMaster et al. 2006, Trites et al. 2007, Williams et al. 2004, Springer et al. 2003
~~Incidental take by fisheries~~	~~Medium~~	~~Perez 2006; Nikulin and Burkanov 2000; Wynne et al. 1992~~
Toxic substances	Medium	Albers and Loughlin 2003, Lee et al. 1996, Calkins et al. 1994
Incidental take by fisheries	Low	Perez 2006, Nikulin and Burkanov 2000, Wynne et al. 1992
Subsistence harvest	Low	Wolfe et al. 2005, Loughlin and York 2000, Haynes and Mishler 1991
Illegal shooting	Low	NMFS 2001, Loughlin and York 2000
Entanglement in marine debris	Low	Calkins 1985
Disease and parasitism	Low	Burek et al. 2005
Disturbance from vessel traffic and tourism	Low	Kucey and Trites 2006
Disturbance due to research activities	Low	Kucey and Trites 2006, Kucey 2005, Loughlin and York 2000, Calkins and Pitcher 1982

NMFS developed a Biological Opinion (BO) on the groundfish fisheries in the Bering Sea/Aleutian Islands and Gulf of Alaska regions in 2000. In this BO, NMFS determined that the continued prosecution of the groundfish fisheries as described in the Fishery Management Plan for Bering Sea/Aleutian Islands Groundfish and in the Fishery Management Plan for Gulf of Alaska Groundfish was likely to jeopardize the continued existence of the western population of Steller sea lion and to adversely modify critical habitat. NMFS also identified several other factors that could contribute to the decline of the population, including a shift in a large-scale weather regime and predation. To avoid jeopardy, NMFS identified a Reasonable and Prudent Alternative that included components such as 1) adoption of a more precautionary rule for setting "global" harvest limits, 2) extension of 3 nmi protective zones around rookeries and haulouts not currently protected, 3) closures of many areas around rookeries and haulouts to 20 nmi, 4) establishment of 4 seasonal and area catch limits, and 5) establishment of a procedure ("fishing in proportion to biomass") for setting seasonal catch limits on removal levels in critical habitat based on the biomass of the target species residing in critical habitat.

NMFS completed a draft Supplemental Environmental Impact Statement (SEIS) in September 2000 for the groundfish fisheries in the Bering Sea Aleutian Islands and the Gulf of Alaska. Based on the potential for indirect interactions between the groundfish fisheries and Steller sea lions, northern fur seals, and harbor seals, NMFS determined that the current practices involved in the management of the groundfish fishery in Alaska "may have adverse impacts on the western U. S. stock of Steller sea lions, northern fur seals in the Bering Sea, and both the GOA and western stocks of harbor seals". However, the SEIS was determined to be incomplete in a Federal District Court ruling and remanded back to NMFS for further development.

In 2001, NMFS developed a programmatic SEIS to consider the impacts on Steller sea lions of different management regimes for the Alaska groundfish fisheries. A committee composed of 21 members from fishing groups, processor groups, Alaska communities, environmental advocacy groups, and NMFS representatives met to recommend conservation measures for Steller sea lions and to develop a "preferred alternative" for the SEIS. Although consensus was not reached, a "preferred alternative" was identified and included in the SEIS. The preferred alternative included complicated, area-specific management measures (e.g., area restrictions and closures) designed to reduce direct and indirect interactions between the Atka mackerel, pollock, and Pacific cod fisheries and Steller sea lions, particularly in waters within 10 nmi of haulouts and rookeries. The suite of conservation measures, which were implemented in 2002, were developed after working with the: 1) State of Alaska to explore whether there are potential adverse effects of state fisheries on Steller sea lions, and 2) the North Pacific Fishery Management Council (Council) to further minimize overcapitalization of fisheries and concentration of fisheries in time and space. NMFS reinitiated consultation on the groundfish fisheries in 2006 and expects to finalize the BO in fall 2008.

NMFS reconstituted the Steller Sea Lion Recovery Team in 2002 to write a recovery plan for the eastern and western U.S. stocks. The Team's draft plan was reviewed by five independent reviewers in February 2006, prior to its delivery to NMFS, who then released the Plan for public review in May 2006. NMFS addressed the peer and public review comments and released the second draft Plan for another round of public and independent peer (one by the Council of Independent Experts and another commissioned by the Council) review in May 2007.

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

STOCK DEFINITION AND GEOGRAPHIC RANGE

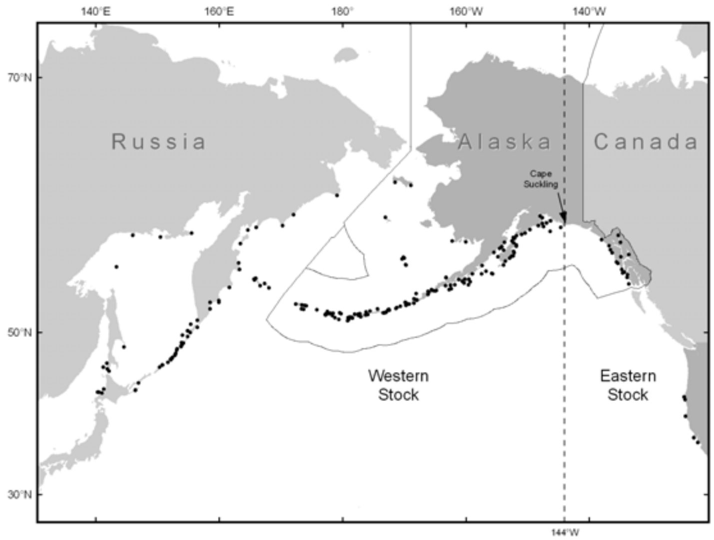

Figure 3. Approximate distribution of Steller sea lions in the North Pacific. Major U.S. haulouts and rookeries (50 CFR 226.202, 27 August 1993) and active Asian haulouts and rookeries (Burkanov and Loughlin, 2005) are depicted (points). Black dashed line (144° W) indicates stock boundary (Loughlin 1997). Note: Haulouts and rookeries in British Columbia are not shown.

Steller sea lions range along the North Pacific 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 low, although males have a higher tendency to disperse than females (NMFS 1995, Trujillo et al. 2004, Hoffman et al. 2006). A northward shift in the overall breeding distribution has occurred, with a contraction of the range in southern California and new rookeries established in southeastern Alaska (Pitcher et al. 2007).

Loughlin (1997) considered the following information when classifying stock structure based upon 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 were 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).

Steller sea lions that breed in Asia have been considered part of the western stock since the two stocks were first delineated in 1997. Since then, analyses of genetic data differ in their interpretation of separation between Asian and Alaskan sea lions. ~~While~~In Asian waters, Steller sea lions seasonally inhabit coastal waters of Japan in the winter, but breeding rookeries are currently only located in Russia (Burkanov and Loughlin, 2005). ~~Analyses of genetic data differ in their interpretation of separation between Asian and Alaskan sea lions.~~ Based on analysis of mitochondrial DNA, Baker et al. (2005) found evidence of a genetic split that includes Commander Island (Russia) within the western U.S. stock. However, Hoffman et al. (2006) did not support this split based on analysis of nuclear microsatellite markers indicating high rates of male gene flow. While all genetic analyses confirm a strong separation between western and eastern stocks, recent work indicates that western stock haplotypes are present in southeast Alaska rookeries (Gelatt et al. 2007).

POPULATION SIZE

The eastern stock of Steller sea lions breeds on rookeries located in southeast Alaska, British Columbia, Oregon, and California; there are no rookeries located in Washington. Counts of pups on rookeries conducted near the end of the birthing season are nearly complete counts of pup production. Calkins and Pitcher (1982) and Pitcher el al. (2007) concluded that the total Steller sea lion population could be estimated by multiplying ~~the~~ pup counts by a factor ~~of 4.5, which was~~ based on the birth rate, ~~and the~~ sex and age structure, and growth rate of the ~~western~~ Steller sea lion population~~ in the central Gulf of Alaska~~. Using the most recent 2002-2005 pup counts available by region from aerial surveys across the range of the eastern stock (total N=10,737), the total population of the eastern stock of Steller sea lions is estimated to be ~~48,519 or 54,989~~within the range of 45,095 to 55,832. Th~~ese are~~is range is based on multiplying the total number of pups counted in southeast Alaska (5,510 in 2005; NMFS 200~~6~~7), British Columbia (~~3,318~~3,281 in 2002; ~~Pitcher et al., 2007~~Olesiuk and Trites 2003), Oregon (~~1,136~~1,128 in 2002; ~~Pitcher et al., 2007~~NMFS, 2007), and California (818 in 2004; NMFS 200~~6~~7) by either ~~4.5 (Calkins and Pitcher 1982) or 5.1 (Trites and Larkin 1996)~~4.2 or 5.2 (Pitcher et al. 2007). Using these pup multipliers, the population estimate is estimated to be within the range of 45,095 (10,737 × 4.2) and 55,832 (10,737 × 5.2). These are not minimum population estimates, since they are extrapolated from pup counts from photographs taken in 2002-2005, and demographic parameters ~~of a stable, equilibrium non-pup population that were estimated for the western Steller sea lion in the mid-1970s (Calkins and Pitcher 1982). Trites and Larkin's (1996) pup multiplier accounts for pups that die and disappear prior to, as well as pups born after, the counts are conducted. A pup multiplier is used for estimating the size of the eastern stock of Steller sea lions, but not the western stock. Since the western stock has declined drastically, the assumption of an equilibrium population in the west is not valid. Because the eastern stock is increasing within most of its range, using a pup multiplier is a reasonable approach to estimating abundance from pup counts.~~estimated for an increasing (at 3.1% per year) eastern Steller sea lion population in equilibrium. The extrapolation factor varied depending on the vital rate parameter that resulted in the increased growth rate: as low as 4.2 if it were due to increased fecundity, and as high as 5.2 if it were due to decreased juvenile mortality. Pitcher et al. (2007) estimated the eastern stock of Steller sea lion to number between 46,000 and 58,000 in 2002 using this same method, but estimated a slightly higher population range because they estimated true fecundity by accounting for pup mortality between birth and when counts were made at approximately 1 month of age.

Minimum Population Estimate

The minimum population estimate ~~will be~~ was calculated by adding the most recent non-pup and pup counts from each trend site listed in Table 3c. ~~from:~~

- ~~Southeast Alaska in 2005 (non-pups: 15,283; pups: 5,510): 20,793,~~
- ~~British Columbia in 2002 (non-pups: 12,121; pups: 3,3183,281): 15,43915,402,~~
- ~~Washington in 20021 (non-pups only): 651516 (Pitcher et al., 2007),~~
- ~~Oregon in 2002 (non-pups: 4,169; pups: 1,1361,128): 5,3055,297, and~~
- ~~California in 2004 (non-pups: 1,578; pups: 818): 2,396.~~

Table 3c. Non-pup and pup counts from rookery and haulout trend sites of eastern U.S. Steller sea lions. The most recent counts for each site were used to calculate the minimum population estimate.

Trend site	Year	Non-pups	Pups	Total count per site
Southeast Alaska	2005	15,283	5,510	20,793
British Columbia	2002	12,121	3,281	15,402
Washington (Pitcher et al., 2007)	2001	516	--	516
Oregon	2002	4,169	1,128	5,297
California	2004	1,578	818	2,396
Minimum population estimate				44,404

This results in an N_{MIN} for the eastern U. S. stock of Steller sea lions of ~~44,584~~44,404. This count has not been corrected for animals which were at sea. Pitcher et al. (2007) counted 45,378 sea lions during the 2002 survey, which represents a minimum population size because not every site was surveyed and animals missing from rookeries and haulout sites were not counted. More recent counts from Southeast Alaska and California sites were used in place of the Pitcher et al. (2007) counts to calculate N_{MIN}.

Current Population Trend

Trend counts (an index to examine population trends) for Steller sea lions in Oregon were relatively stable in the 1980s, with uncorrected counts in the range of 2,000-3,000 sea lions (NMFS 1992). Counts in Oregon have shown a gradual increase since 1976, as the adult and juvenile state-wide count for that year was 1,486 compared to 4,169 in 2002 (NMFS 200~~6~~7).

Steller sea lion numbers in California, especially in southern and central California, have declined from historic numbers. Counts in California between 1927 and 1947 ranged between 4,000 and 6,000 non-pups with no apparent trend, but have subsequently declined by over 50%, remaining between 1,500 and 2,000 non-pups between 1980 and 2004. At Año Nuevo Island off central California, a steady decline in ground counts started around 1970, resulting in an 85% reduction in the breeding population by 1987 (LeBoeuf et al. 1991). Overall, counts of non-pups at trend sites in California and Oregon have been relatively stable or increasing slowly since the 1980s (Table 4, Fig. 4).

Table 4. Counts of adult and juvenile Steller sea lions observed at rookery and haulout trend sites by year and geographical area for the eastern U. S. stock from ~~the~~ 1982 through 2002 (NMFS 1995; Strick et al. 1997; Sease et al. 1999; Sease and Loughlin 1999; Sease et al. 2001; Olesiuk 2003; Brown et al. 2002; NMFS 200~~6~~7; ODF&W unpubl. data, 7118 NE Vandenberg Ave., Corvallis, OR 97330; Point Reyes Bird Observatory, unpubl. data, 4990 Shoreline Hwy., Stinson Beach, CA 94970). Central California data include only Año Nuevo and Farallon Islands. Trend site counts in northern California/Oregon include St. George, Rogue, and Orford Reefs. British Columbia data include counts from all sites.

Area	1982	1990	1991	1992	1994	1996	1998	2000	2002
Central CA	511[1]	655	537	276	508	382	564[3]	349	380
Northern CA/OR	3,094	3,088	3,180	4,274	3,831	4,192	4,464	3,793	4,885
British Columbia	4,713	6,109[2]	--	7,376	8,091	--	9,818	--	12,121
Southeast Alaska	6,898	7,629	8,621	7,555	9,001	8,231	8,693	9,892	9,951
Total	15,216	17,481	--	19,481	21,431	--	23,539	--	27,337

[1] This count includes a 1983 count from Año Nuevo.
[2] This count was conducted in 1987.
[3] This count was conducted in 1999.

In Southeast Alaska, counts of non-pups at trend sites increased by 56% from 1979 to 2002 from 6,376 to 9,951 (Merrick et al. 1992; Sease et al. 2001; NMFS 200~~6~~7). During 1979-2005, counts of pups on the three largest rookeries in Southeast Alaska increased a total of 148%. In British Columbia, counts of non-pups throughout the Province increased at a rate of 3.2% annually from 1971 through 2002 (Olesiuk and Trites 2003). Counts of non-pups at trend sites throughout the range of the eastern Steller sea lion stock are shown in Figure 4. Since the 1970s the average annual population growth rate of Eastern Steller sea lions is 3.1% (Pitcher et al., 2007).

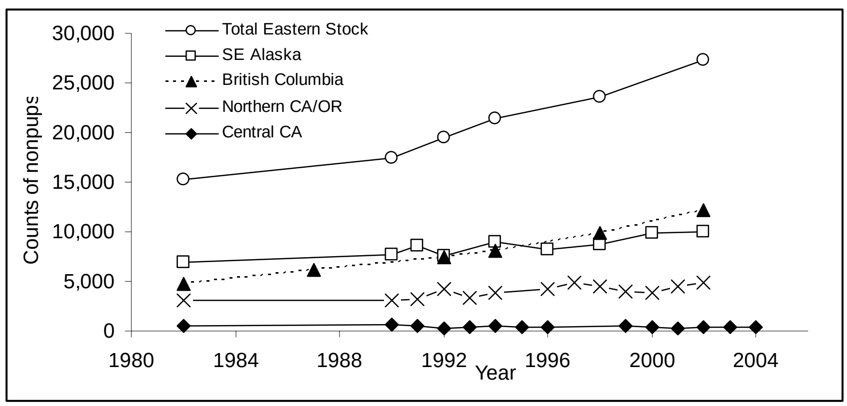

Figure 4. Counts of adult and juvenile Steller sea lions at rookery and haulout trend sites throughout the range of the eastern U.S. stock, 1982-2004. Data from British Columbia include all sites.

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

There are no 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 reauthorized 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 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 recommendations of the Alaska Scientific Review Group. Thus, for the eastern U. S. stock of Steller sea lions, PBR = ~~2,006~~1,998 animals (~~44,584~~44,404 × 0.06 × 0.75).

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

Fisheries Information

Until 2003, there were six different federally regulated commercial fisheries in Alaska that could have interacted with Steller sea lions and were monitored for incidental mortality by fishery observers. As of 2003, changes in fishery definitions in the List of Fisheries have resulted in separating these 6 fisheries into 22 fisheries (69 FR 70094, 2 December 2004). This change does not represent a change in fishing effort, but provides managers with better information on the component of each fishery that is responsible for the incidental serious injury or mortality of marine mammal stocks in Alaska.

Fishery observers monitored four commercial fisheries during the period from 1990 to 2005 in which Steller sea lions from this stock were taken incidentally: the California (CA)/Oregon (OR) thresher shark and swordfish drift gillnet, WA/OR/CA groundfish trawl, Northern Washington (WA) marine set gillnet, and Gulf of Alaska sablefish longline fisheries. The best data available on the rates of serious injury and mortality incidental to these fisheries is presented in Table 5. There have been no observed serious injuries or mortalities incidental to the CA/OR thresher shark and swordfish drift gillnet fishery in recent years (Carretta 2002, Carretta and Chivers 2003, Carretta and Chivers 2004). In the WA/OR/CA groundfish trawl (Pacific whiting component only) one Steller sea lion was observed killed in each year in 2001-03; these observed takes in combination with a mortality that occurred in an unmonitored haul resulted in a mean estimated annual mortality level of 0.8 (Table 5). No data are available after 1998 for the northern Washington marine set gillnet fishery. There have been no observer reported mortalities in the Gulf of Alaska sablefish longline since 2000 (Perez unpubl. ms.). These mortalities result in a mean annual mortality rate of 0.8 (CV = 0.02) Steller sea lions. No mortalities were reported by fishery observers monitoring drift gillnet and set gillnet fisheries in Washington and Oregon this decade; though, mortalities have been reported in the past.

Table 5. Summary of incidental mortality of Steller sea lions (eastern U. S. stock) due to commercial fisheries from 2001 to 2005 (or most recent data available) and calculation of the mean annual mortality rate. Mean annual mortality in brackets represents a minimum estimate from stranding data. The most recent 5 years of available data are used in the mortality calculation when more than 5 years of data are provided for a particular fishery. N/A indicates that data are not available. Details of how percent observer coverage is measured is included in Appendix 6. (Note: incidental mortality data for 2006 have not be obtained.)

Fishery name	Years	Data type	Observer coverage	Observed mortality (in given yrs.)	Estimated mortality (in given yrs.)	Mean annual mortality
WA/OR/CA groundfish trawl (Pacific whiting component)	2000 2001 2002 2003 2004	Obs data	80.3 96.2 66.8 85.5 91.5	0 1 1 1 0	1[1] 1 1 1 0	0.8 (CV = 0.02)
~~Northern WA marine set gillnet (tribal fishery)~~	~~2000-2004~~	~~Obs data~~		~~0~~	~~0~~	~~0~~
Observer program total						0.8 (CV = 0.02)
				Reported mortalities		
Alaska salmon troll	1992-2005	Strand data	N/A	0, 0, 0, 1, 0, 0, N/A, N/A, 1, 1, N/A, N/A, 2, N/A	N/A	[0.6]

Fishery name	Years	Data type	Observer coverage	Observed mortality (in given yrs.)	Estimated mortality (in given yrs.)	Mean annual mortality
British Columbia aquaculture predator control program	2001 2002 2003 2004 2005	Permit reports	N/A	27 15 N/A[2] N/A[2] N/A[2]	N/A	0
Minimum total annual mortality						1.4 (CV = 0.58)

[1] A mortality was seen by an observer, but during an unmonitored haul; because the haul was not monitored, an estimated annual mortality cannot be extrapolated.
[2] Aquaculture facilities are no longer permitted to shoot Steller sea lions.

Strandings of Steller sea lions provide additional information on the level of fishery-related mortality. Estimates of fishery-related mortality from stranding data are considered minimum estimates because not all entangled animals strand, and not all stranded animals are found or reported. In Alaska, during the 5-year period from 2001-2005, there were three situations where a flasher was seen in a Steller sea lion's mouth (NMFS Alaska Region, unpublished data). It is not clear whether entanglements with "flashers" involved the recreational or commercial component of the salmon troll fishery. Based on Angliss and DeMaster (1998), it is appropriate to call these entanglements "serious injuries". Based on Alaska stranding records, this information indicates a rate of incidental mortality of at least 0.6/year from the troll fishery. There were no fishery-related strandings of Steller sea lions in Washington, Oregon, or California between 2001 and 2005.

Due to limited observer program coverage, no data exist on the mortality of marine mammals incidental to Canadian commercial fisheries (i.e., those similar to U.S. fisheries known to take Steller sea lions). As a result, the number of Steller sea lions taken in Canadian waters is not known.

The minimum estimated mortality rate incidental to commercial fisheries (both U.S. and Canadian) is 1.4 sea lions per year, based on observer data (0.8) and stranding data (0.6).

Subsistence/Native Harvest Information

The subsistence harvest of Steller sea lions during 20~~01~~02-20~~05~~06 is summarized in Wolfe et al. (2006). During 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. The average number of animals harvested and struck but lost is 9 animals/year (Table 6).

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 to quantify their respective subsistence harvests, and to identify any effect these harvests may have on the cooperative management process.

Table 6. Summary of the subsistence harvest data for the eastern stock of Steller sea lions, 200~~1~~2-200~~5~~6. The number harvested and number struck and lost do not sum to the estimated number taken due to rounding error in 2003. (Note: 2006 subsistence harvest data pending; highlighted in green. Expected date of release is April, 2008. Mike Turek, Alaska Dep. Fish and Game, pers. Comm.)

Year	Estimated total number taken	Number harvested	Number struck and lost
~~2001~~	~~0~~[1]	~~0~~	~~0~~
2002	7[2]	7	0
2003	7[3]	2	~~4~~5
2004	12[4]	5	7
2005	19[5]	0	19
2006	---	---	---
Mean annual take (20~~01~~02-20~~05~~06)	9	2.8	6

[1] Wolfe et al. 2002; [2] Wolfe et al. 2003; [3] Wolfe et al. 2004; [4] Wolfe et al. 2005; [5] Wolfe et al. 2006

Other Mortality

Illegal shooting of sea lions in U.S. waters 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 for subsistence hunting by Alaska Natives or where imminently necessary to protect human life). Records from NMFS enforcement indicate that there were two cases of illegal shootings of Steller sea lions in Southeast Alaska between 1995 and 1999: the cases involved the illegal shooting of one Steller sea lion near Sitka, and three Steller sea lions in Petersburg. Both cases were successfully prosecuted (NMFS, Alaska Enforcement Division). There are no records of illegal shooting of Steller sea lions from the eastern stock listed in the NMFS enforcement records for 1999-2003 (NMFS, unpublished data).

Steller sea lions were taken in British Columbia during commercial salmon farming operations (Table 5). Preliminary figures from the British Columbia Aquaculture Predator Control Program indicated a mean annual mortality of 45.75 Steller sea lions from this stock over the period from 1999 to 2003 (Olesiuk 2004). As of 2004, aquaculture facilities are no longer permitted to shoot Steller sea lions (P. Olesiuk, Pacific Biological Station, Canada, pers. comm.).

Strandings of Steller sea lions with gunshot wounds do occur, along with strandings of animals entangled in material that is not fishery-related. During the period from 2001 to 2005 strandings of animals with gunshot wounds from this stock occurred in Oregon and Washington (one in 2004 and three in 2005) resulting in an estimated annual mortality of 0.8 Steller sea lions from this stock. This estimate is considered a minimum because not all stranded animals are found, reported, or cause of death determined (via necropsy by trained personnel). In addition, human-related stranding data are not available for British Columbia. Reports of stranded animals in Alaska with gunshot wounds have not been included in the above estimates because it is not possible to tell whether the animal was illegally shot or if the animal was struck and lost by subsistence hunters (in which case the mortality would have been legal and accounted for in the subsistence harvest estimate).

Stranding data may also provide information on additional sources of potential human-related mortality. Between 2001 and 2005 there were three reported non-fishery related serious injuries or mortalities to Steller sea lions in Washington and Oregon: one with a head injury (2001), one with a piece of cargo net around its neck (2003), and one mortality due to blunt trauma (2004). If the number of interactions (3) is averaged over 5 years, the "other" interaction rate would be a minimum of 0.6 animals per year.

Mortalities may occasionally occur incidental to marine mammal research activities authorized under MMPA permits issued to a variety of government, academic, and other research organizations. Between ~~2000-2005~~2002-2006, there were a total of ~~20~~12 incidental mortalities resulting from research on the eastern stock of Steller sea lions, which results in an annual average of ~~3.3~~2.4 mortalities per year from this stock. ~~The 5-year average for the years 2001-2005 is 4 mortalities per year.~~

STATUS OF STOCK

Based on currently available data, the minimum estimated U. S. commercial fishery-related mortality and serious injury for this stock (0.8 + 0.6 = 1.4) is less than that 10% of the calculated PBR (~~201~~200) and, therefore, can be considered to be insignificant and approaching a zero mortality and serious injury rate. The estimated annual level of total human-caused mortality and serious injury (1.4 + 9 + 0.8 + 0.6 + ~~4~~2.4 = ~~15.8~~14.2) does not exceed the PBR (~~2,006~~1998) for this stock. The eastern U.S. stock of Steller sea lion is currently listed as "threatened" under the ESA, and therefore designated as "depleted" under the MMPA. As a result, this stock is classified as a strategic stock. The eastern stock of Steller sea lion has been proposed as a candidate for removal from listing under the ESA by the Steller sea lion recovery team and NMFS (NMFS 200~~6~~7), based on its annual rate of increase of approximately 3% since the mid-1970s. Although the stock size has increased, the status of this stock relative to its Optimum Sustainable Population size is unknown. The overall annual rate of increase of 3.1% throughout most of the range (Oregon to southeastern Alaska) of the eastern U. S. stock has been consistent and long-term, and may indicate that this stock is reaching OSP size (Pitcher et al. 2007).

Habitat Concerns

Unlike the observed decline in the western U. S. stock of Steller sea lion there has not been a concomitant decline in the eastern U. S. stock. The eastern U. S. stock is ~~stable or~~ increasing throughout the northern portion of its range (Southeast Alaska and British Columbia), and stable or increasing slowly in the central (Oregon through central California). In the southern end of its range (Channel Islands in southern California), it has declined considerably since the late 1930s, and several rookeries and haulouts south of Año Nuevo Island have been abandoned. Changes in the ocean environment, particularly warmer temperatures, may be possible factors that have favored California sea lions over Steller sea lions in the southern portion of the Steller's range (NMFS 200~~6~~7). A Draft Revised Recovery Plan reviewing current threats to the eastern and western U.S. stocks and proposing actions and guidelines for recovery was released by NMFS in May 200~~6~~7 (NMFS 200~~6~~7). Responses to public comments were being considered in late 200~~6~~7.

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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 summer breeding season, most of the worldwide population is found on the Pribilof Islands in the southern Bering Sea, with the remaining animals on rookeries in Russia, on Bogoslof Island in the southern Bering Sea, and on San Miguel Island off southern California (Lander and Kajimura 1982; 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 United States, but generally do so outside of the breeding season (Fiscus 1983).

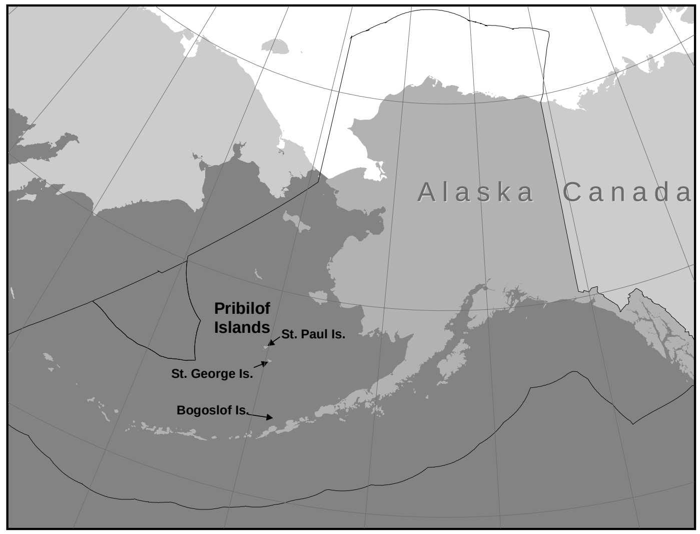

Figure 5. Approximate distribution of northern fur seals in the eastern North Pacific (shaded area).

~~Due to differing requirements d~~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 (Roppel 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 (Ream et al. 2005). 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 in the eastern North Pacific (Kajimura 1984) and the Kuril Islands in the western North Pacific (Loughlin et al. 1999). There is considerable interchange of individuals between rookeries.

~~The following information was considered in classifying stock structure~~Two separate stocks of northern fur seals are recognized within U. S. waters based on the Dizon et al. (1992) phylogeographic approach: 1) Distributional~~ data~~: ~~geographic distribution is~~ continuous during feeding~~, geographic~~ and discontinuous ~~separation~~ during the breeding season, high natal site fidelity (Baker et al. 1995; DeLong 1982); 2) Population response~~ data~~: substantial differences in population dynamics between Pribilof and San Miguel Islands (DeLong 1982, DeLong and Antonelis 1991, NMFS 1993); 3) Phenotypic ~~data~~differentiation: unknown and 4) Genotypic ~~data~~differentiation: little evidence of genetic differentiation among breeding islands in the Bering Sea (Ream 2002). ~~Based on this information, two separate stocks of northern fur seals are recognized within U. S. waters:~~ Thus, an Eastern Pacific stock and a San Miguel Island stock are recognized. 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 4.5. The expansion factor is 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 have been made on Bogoslof Island. Since 1990, pup counts have occurred biennially on St. Paul and St. George Islands, although less frequently on Sea Lion Rock (adjacent to St. Paul Island) and Bogoslof Island (Table 7). The most recent estimate for the number of fur seals in the Eastern Pacific stock, based on pup counts from 2002 on Sea Lion Rock, from 200~~4~~6 on the Pribilof Islands, and from 2005 on Bogoslof Island, is ~~721,935~~665,550 (4.5 × ~~160,430~~147,900). ~~Data from 2006 pup counts were unavailable for inclusion.~~

Table 7. Estimates and/or counts of northern fur seal pups born on the Pribilof Islands and Bogoslof Island. Standard errors ~~and the CV~~ for haulout locations and the CV for total abundance estimates~~, respectively,~~ are provided in parentheses.

	Haulout location				
Year	**St. Paul**	**Sea Lion Rock**	**St. George**	**Bogoslof**	**Total**
1992[1]	182,437 (8,919)	10,217 (568)	25,160 (707)	898 (N/A)	218,712 (0.041)
1994	192,104 (8,180)	12,891 (989)	22,244 (410)	1,472 (N/A)	228,711 (0.036)
1996	170,125 (21,244)	"	27,385 (294)	1,272 (N/A)	211,673 (0.10)
1998	179,149 (6,193)	"	22,090 (222)	5,096 (33)	219,226 (0.029)
2000	~~157,632~~158,736 (17,284)	"	20,176 (271)	"	196,899 (0.089)
2002	145,7~~01~~16 (1,629)	8,262 (191)	17,593 (527)	"	176,~~503~~667 (0.01)
2004	122,825 (1,290)	"	16,876 (415)	"	~~152,895~~153,059 (0.01)
2005	"	"	"	12,631 (335)	160,~~430~~594 (0.01)
2006	109,937 (1,522)	"	17,070 (144)	"	147,900 (0.011)

[1] Incorporates the 1990 estimate for Sea Lion Rock and the 1993 count for Bogoslof Island.

Minimum Population Estimate

A CV(N) that incorporates the variance due to the correction factor is not currently available. Consistent with a recommendation of the Alaska Scientific Review Group (SRG) and recommendations contained in Wade and Angliss (1997), a default CV(N) of 0.2 was used in the calculation of the minimum population estimate (N_{MIN}) for this stock (DeMaster 1998). N_{MIN} is calculated using Equation 1 from the PBR Guidelines (Wade and Angliss 1997): $N_{MIN} = N/\exp(0.842\times[\ln(1+[CV(N)]^2)]^{½})$. Using the population estimate (N) of ~~721,935~~665,550 and the default CV (0.2), N_{MIN} for the Eastern Pacific stock of northern fur seals is ~~709,881~~654,437. This estimate includes the first pup counts on Bogoslof Island in more than 5 years~~,~~ and does not indicate a~~n~~ ~~abundance~~population increase.

Current Population Trend

The Alaska population of northern fur seals increased 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 remained ~~relatively~~ stable between 1981 and 1996 (Fig. 6; York and Fowler 1992). There has been a decline in pup production on St. Paul Island since the mid-1990s. Although there was a slight increase in the number of pups born on St. George Island in 1996, the number of pups born declined between 1996 and 1998, and the 1998 counts were similar to those obtained in 1990, 1992, and 1994 (Fig. 7). During 1998-20~~04~~06, pup production declined 6.~~2~~1% per year (SE = 0.~~78~~45%; P =< 0.01) on St. Paul Island and ~~4.5~~3.4% per year (SE = 0.~~45~~60%; P = 0.01) on St. George Island. The estimated pup production in 20~~04~~06 was below the 191~~9~~8 level on St. Paul Island and below the 1916 level on St. George Island (Towell et al. 2006; NMFS unpubl. data).

~~The northern fur seal was designated as "depleted" under the Marine Mammal Protection Act (MMPA) in 1988 because population levels had declined to less than 50% of levels observed in the late 1950s (1.8 million animals; 53 FR 17888, 18 May 1988) and there was no compelling evidence that carrying capacity (K) had changed substantially since the late 1950s (NMFS 1993). Under the 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; 1,080,000).~~

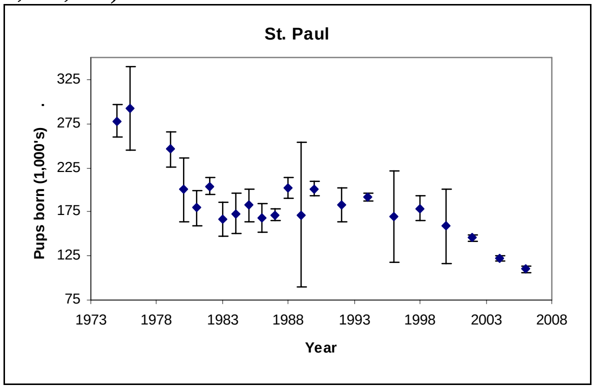

Figure 6. Estimated number of northern fur seal pups born on St. Paul Island, 1970-20~~04~~06 (modified from Towell et al. 2006).

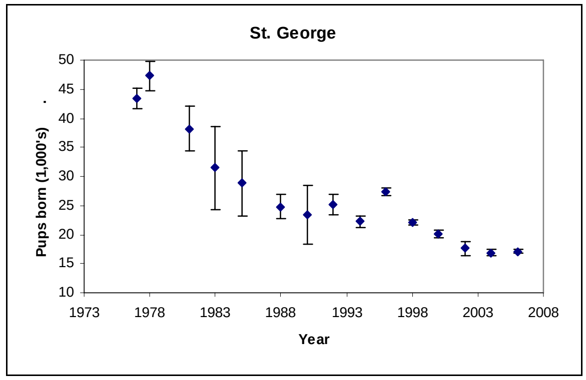

Figure 7. Estimated number of northern fur seal pups born on St. George Island, 1970-20~~04~~06 (modified from Towell et al. 2006).

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

The northern fur seal population increased steadily during 1912-24 after the commercial harvest no longer included pregnant females. During this period, the rate of population growth was approximately 8.6% (SE = 1.47) 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 = 1.29) estimated by Gerrodette et al. (1985). 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 reauthorized 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 depleted stocks under the MMPA (Wade and Angliss 1997). Thus, for the Eastern Pacific stock of northern fur seals, PBR = ~~15,262~~14,070 animals (~~709,881~~654,437 × 0.043 × 0.5).

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

Fisheries Information

Historically, northern fur seals were known to be killed incidentally by both the foreign and the joint U. S.-foreign commercial groundfish trawl fisheries (total estimate of 246 northern fur seals killed between 1978 and 1988), as well as the foreign high seas driftnet fisheries (total take estimate in 1991 was 5,200; 95% CI: 4,500-6,000) (Perez and Loughlin 1991; Larntz and Garrott 1993). These estimates were not included in the mortality rate calculation because the fisheries are no longer operative, although some low level of illegal fishing may still be occurring. 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 (T. Loughlin, NMFS-NMML, pers. comm.).

~~Until 2003, there were six different federally-regulated commercial fisheries in Alaska that could have interacted with northern fur seals and were monitored for incidental mortality by fishery observers.~~ ~~As of~~In 2003, changes in fishery definitions in the List of Fisheries ~~have~~ resulted in separating ~~these~~ six federally-regulated fisheries into 22 fisheries (69 FR 70094, 2 December 2004). This change ~~does~~did not represent a change in fishing effort, but provide~~s~~d managers with better information on the component of each fishery that is responsible for the incidental serious injury or mortality of marine mammal stocks in Alaska. Estimates of marine mammal serious injury/mortality in each of these observed fisheries are provided in Perez (2006) and Perez (unpubl. ms.). The total estimated annual fishery-related incidental mortality in these fisheries is 0.8 (Table 8).

Observer programs for five Alaska commercial fisheries have not documented any takes of fur seals. In 1990 and 1991, observers 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 Islands 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). Observer programs have recently been implemented in the Cook Inlet salmon set and drift gillnet fisheries (Manly ~~in review~~2006) and in a portion of the Kodiak ~~drift~~set gillnet fishery (Manly ~~et al.~~ 200~~3~~7). Observer coverage in the Cook Inlet drift gillnet fishery was 1.75% and 3.73% in 1999 and 2000, respectively. The observer coverage in the Cook Inlet set gillnet fishery was 7.3% and 8.3% in 1999 and 2000, respectively (Manly ~~in review~~2006). Observer coverage in the Kodiak ~~drift~~ set gillnet fishery was ~~7.5~~6.0% (2002) and 4.9% (2005) of the fishing permit days. No serious injuries or mortalities of northern fur seals were observed during the course of either observer program.

Table 8. Summary of incidental mortality of northern fur seals (Eastern Pacific stock) due to commercial fisheries from 2001 through 2005 and calculation of the mean annual mortality rate. Details of how percent observer coverage is measured is included in Appendix 6. * There were no observed serious injuries or mortalities of northern fur seals incidental to this fishery in 2006; an updated mean annual mortality rate will be available in 2009.

Fishery name	**Years**	**Data type**	**Observer coverage**	**Observed mortality (in given yrs.)**	**Estimated mortality (in given yrs.)**	**Mean annual mortality**
Bering Sea/Aleutian Islands flatfish trawl *	2001	obs data	57.6	1	1	0.57 (CV = 0.39)
	2002		58.4	0	0	
	2003		64.1	0	0	
	2004		64.3	0	0	
	2005		68.3	1	1.5	
Bering Sea/Aleutian Islands pollock trawl	~~2001~~	obs data	~~79.0~~	~~0~~	~~0~~	0.21 (CV = 0.21)
	2002		80.0	0	0	
	2003		82.2	0	0	
	2004		92.8	0	0	
	2005		77.3	1	1	
	2006			0	0	
Bering Sea/Aleutian Islands Pacific cod longline	2002	obs data		0	0	1.08 (CV = 0.89)
	2003			0	0	
	2004			0	0	
	2005			0	0	
	2006			1	6.2	
Minimum total annual mortality						~~0.78~~ 1.86 (CV = 0.29)

There are several fisheries which are known to interact with northern fur seals and have not been observed (Appendices 4 and 5). Thus, the estimated mortality rate is likely a minimum estimate. 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 is ~~0.78~~1.9 fur seals per year based on observer data.

Entanglement studies on the Pribilof Islands are another source of information on fishery-specific entanglements. Based on entanglement rates and sample sizes presented in Zavadil et al. (2003), an average of 1.1 fur seals/year on the rookeries were entangled in pieces of trawl netting and an average of 0.1 fur seal/year was entangled in monofilament net.

Stranding reports of northern fur seals entangled in fishing gear or with injuries caused by interactions with gear are another source of mortality data. In September 2001 a northern fur seal stranding was reported near Unalaska as entangled in 8-inch poly trawl web. The animal was cut free and was apparently healthy. The NMFS stranding database also includes reports of five fur seals on St. George that were entangled in fishing gear in 2003; there were no strandings reported in 2004 or 2005. Including these stranding data in an annual average will be delayed until comparisons between these data and those from entanglement studies (e.g., Zavadil et al. 2003) can be cross-referenced.

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. Typically, 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. However, occasional harvest of adult males does occur: in 2004, there were two adult male northern fur seals that were struck but lost, and one was killed (Malavansky et al. 2005). ~~A few females were taken in 1996, 1997, and 1998, but no females are known to have been taken since the late 1990s (Alaska Regional Office 2005).~~In 2006, one adult male and four females were struck and killed (Lestenkof and Zavadil 2006). ~~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).~~ Between 200~~1~~2 and 200~~5~~6, there was an annual average of ~~702~~667 seals harvested per year in the subsistence hunt (Table 9).

Table 9. Summary of the Alaska Native subsistence harvest of northern fur seals on St. Paul and St. George Islands for 200~~1~~2-200~~5~~6.

Year	St. Paul	St. George	Total harvested
~~2001~~	~~597[2]~~	~~184[1]~~	~~781~~
2002	648[~~3~~2]	203[1]	851
2003	522[~~4~~3]	132[1]	654
2004	493[~~5~~4]	123[5]	616
2005	466[~~6~~5]	139[~~6~~5]	605
2006	396[6]	212[7]	608
Mean annual take (200~~0~~2-200~~4~~06)			~~702~~667

[1] D. Cormany, NMFS, pers. comm.; ~~[2] Lestenkof and Zavadil 2001;~~ [~~3~~2] Zavadil and Lestenkof 2003a; [~~4~~3] Zavadil and Lestenkof 2003b; [~~5~~4] Malavansky et al. 2005; [~~6~~5] Lestenkof et al. 2006; [6] Lestenkof and Zavadil 2006; [7] Malavansky and Malavansky 2007

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 for subsistence hunting by Alaska Natives or where imminently necessary to protect human life).

Mortality resulting from entanglement in marine debris has been implicated as a contributing factor in the decline observed in the northern fur seal population on the Pribilof Islands during the 1970s and early 1980s (Fowler 1987, Swartzman et al. 1990, Fowler 2002). Surveys conducted from 1995 to 1997 on St. Paul Island indicate a rate of entanglement among subadult males comparable to the 0.2% rate observed from 1988 to 1992 (Fowler and Ragen 1990, Fowler et al. 1994), which is lower than the rate of entanglement (0.4%) observed during 1976-85 (Fowler et al. 1994). Between 1995 and 2000, responsibility for entanglement studies of northern fur seals shifted gradually from NMML to the Tribal Government of St. Paul's Ecosystem Conservation Office (ECO). ECO has managed the entanglement studies under a co-management agreement with NOAA for northern fur seals since 2000. Entanglement rates of male northern fur seals on St. Paul from 1998 to 2002 were 0.2, 0.26, 0.25, 0.3, and 0.37 (Zavadil et al. 2003). The recent rates of entanglements are close to those recorded in the mid-1980s; however, recent changes in methodology (counting juvenile males vs. all males) make direct comparisons between recent and historical data difficult (Zavadil et al. 2003). In 2002, the composition of entangling debris switched from predominantly packing bands to trawl net fragments (Zavadil et al. 2003).

Mortalities may occasionally occur incidental to marine mammal research activities authorized under MMPA permits issued to a variety of government, academic, and other research organizations. Between 2002-2006, there was a total of 7 mortalities resulting from research on northern fur seals, which results in an average of 1.4 mortalities per year from this stock.

STATUS OF STOCK

Based on currently available data, the minimum estimated U. S. commercial fishery-related mortality and serious injury for this stock (~~0.8~~1.9) is less than 10% of the calculated PBR (~~1526~~1,407) and, therefore, can be considered to be insignificant and approaching a zero mortality and serious injury rate. The estimated annual level of total human-caused mortality and serious injury (0.8 + ~~702~~667 + 1.2 = ~~704~~669) is not known to exceed the PBR (~~15,262~~14,070) for this stock. However, given that the population is declining for unknown reasons, and this decline is ~~that are~~ not explained by the relatively low level of direct human-caused mortality, there is no guarantee that limiting ~~those~~ mortalities to the level of the PBR will reverse the decline. The northern fur seal was designated as “depleted” under the Marine Mammal Protection Act (MMPA) in 1988 because population levels had declined to less than 50% of levels observed in the late 1950s (1.8 million animals; 53 FR 17888, 18 May 1988) and there was no compelling evidence that carrying capacity (K; 1.8 million) had changed substantially since the late 1950s (NMFS 1993). The Eastern Pacific stock of northern fur seal is classified as a strategic stock because it is designated as “depleted” under the 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; 1,080,000).

Habitat Concerns

Northern fur seals forage on a variety of fish species, including pollock (34% of fish species consumed between 1958 and 1974; Perez 1997). As of the 1990s, some prey items, such as capelin, have disappeared entirely from fur seal diet and pollock consumption has tripled (Sinclair et al. 1994, Sinclair et al. 1996, Antonelis et al. 1997). Analyses of scats collected from Pribilof Island rookeries during 1987-2000 found that pollock (46-75% by frequency of occurrence, FO) and gonatid squids dominated in the diet and that other primary prey (FO>5%) included Pacific sand lance, Pacific herring, northern smoothtongue, Atka mackerel, and Pacific salmon (Zeppelin and Ream 2006). These analyses also found that diets associated with rookery complexes reflected patterns associated with foraging in the specific hydrographic domains identified by Robson et al. (2004). Comparison of ingested prey sizes based on scat and spew analysis indicate a much larger overlap in between sizes of pollock consumed by fur seals and those caught by the commercial trawl fishery than was previously known (Gudmundson et al. 2006).

Fishing effort displaced by Steller sea lion protection measures may have moved to areas important to fur seals; recent tagging studies have shown that lactating female fur seals and juvenile males from St. Paul and St. George Islands forage in specific and very different areas (Robson et al. 2004, Sterling and Ream 2004). Relative rates of pollock harvest (catch divided by estimated biomass), which overlap with female foraging areas, by fisheries were approximately five times greater in St. George than St. Paul ~~female foraging areas~~ in summer from 1982 to 2002 (Robson and Fritz in review); this overlap may be result in resource competition between fisheries and foraging Northern fur seals. At the same time, pup production declined on St. George and St. Paul Islands (Figs. 6 and 7). However, it remains unclear whether the pattern of declines in northern fur seal pup production on the two Pribilof Islands is related to the relative distribution of pollock fishery effort in summer on the eastern Bering Sea shelf. Adult female fur seals undertake approximately 8 month long migrations into varied regions of the north Pacific Ocean during winter, and foraging areas are associated with eddies and the subarctic-subtropical transition region (Ream et al. 2005). Thus, environmental changes ~~or other habitat concerns associated with~~ in the north Pacific Ocean could potentially have an effect on fur seals breeding in Alaska.

There is concern that a variety of human activities other than commercial fishing may impact northern fur seals. A draft Conservation Plan for the eastern Pacific stock was released for public comment in May of 2006 (NMFS 2006). This Plan reviews known and potential threats to the recovery of fur seals in Alaska.

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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).

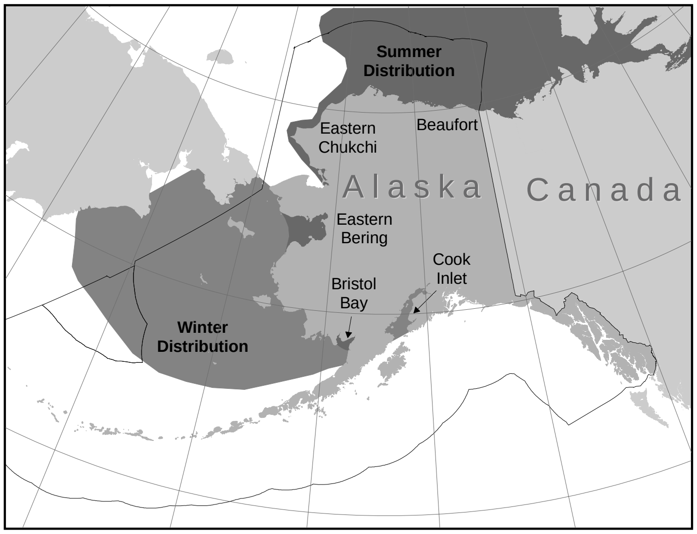

Figure 15. Approximate distribution of beluga whales in Alaska waters. The dark shading displays the summer distribution of the five stocks. Winter distributions are depicted with lighter shading.

The general distribution pattern for beluga whales shows major seasonal changes. During the winter, beluga whalesthey occur in offshore waters associated with pack ice. In the spring, they migrate to warmer coastal estuaries, bays, and rivers for moltingwhere they may molt (Finley 1982) and calvinggive birth to and care for their calves (Sergeant and Brodie 1969). Annual migrations may cover thousands of kilometers (Reeves 1990).

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 poorly known 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: mitochondrial DNA analyses indicate distinct differences among summering areas (O'Corry-Crowe et al. 1997). 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

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, and resulted in an estimate of 19,629 (CV = 0.229) beluga whales in the eastern Beaufort Sea (Harwood et al. 1996). To account for availability bias a correction factor (CF), 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 × 2) animals. A CV for the CF is not available; however, this CF was considered negatively biased by the Alaska SRG considering that aerial survey CFs for this species have been estimated to be 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, $N_{MIN} = N/\exp(0.842\times[\ln(1+[CV(N)]^2)]^{½})$. Using the population estimate (N) of 39,258 and an associated CV(N) of 0.229, N_{MIN} for this stock is 32,453.

Current Population Trend

The current population trend of the Beaufort Sea stock of beluga whales is unknown.

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 reauthorized 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 the stock trend is ~~unknown~~undocumented, the recovery factor (F_R) for this stock is 0.5 (Wade and Angliss 1997). Thus, using the abundance estimate calculated from 1992 surveys, the PBR for the Beaufort Sea stock of beluga whales~~, PBR =~~would be calculated to be 324 animals (32,453 × 0.02 × 0.5). However, the 2005 revisions to the SAR guidelines (NMFS 2005) state that abundance estimates older than 8 years should not be used to calculate PBR due to a decline in confidence in the reliability of an aged abundance estimate. Therefore, the PBR for this stock is considered undetermined.

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.

Subsistence/Native Harvest Information

The subsistence take of beluga whales from this stock within U. S. waters is reported by the Alaska Beluga Whale Committee (ABWC). The most recent Alaska Native subsistence harvest estimates for the Beaufort Sea beluga stock are provided in Table 19 (~~Frost and Suydam 1995; Frost 1998;~~ K. Frost, University of Alaska, Fairbanks, pers. comm. 200~~4~~7). Given these data, the annual subsistence take by Alaska Natives averaged ~~53~~25 belugas during the 5-year period from ~~1999~~2002 to ~~2003~~2006. ~~Recent harvest reports are not considered negatively biased even though they are based on on-site harvest monitoring and harvest reports from well established ABWC representatives. The 1993-95 data are negatively biased because reliable estimates for the number of animals struck and lost are not available prior to 1996.~~

Table 19. Summary of the number of beluga whales landed by the Alaska Native subsistence harvest from the Beaufort Sea stock of beluga whales, ~~1999-2003~~2002-2006. ~~N/A indicates the data are not available.~~

~~Year~~	~~Reported total number taken~~	~~Estimated range of total take~~	~~Reported number harvested~~	~~Estimated number struck and lost~~
~~1999~~	~~45+~~	~~N/A~~	~~35~~	~~10+~~
~~2000~~	~~117~~	~~N/A~~	~~66~~	~~51~~
~~2001~~	~~43~~	~~N/A~~	~~25~~	~~18~~
~~2002~~	~~27~~	~~N/A~~	~~24~~	~~3~~
~~2003~~	~~34~~	~~N/A~~	~~34~~	~~Unknown~~
~~Mean annual take (1999-2003)~~	~~23.6~~			

Year	**Reported total**

	number taken
2002	27
2003	43
2004	32
2005	20
2006	5
Mean annual number of animals landed (2002-2006):	25.4

The subsistence take of beluga whales within Canadian waters of the Beaufort Sea is reported by the Fisheries Joint Management Committee (FJMC). The data are collected by on-site harvest monitoring conducted by the FJMC at Inuvialuit communities in the Mackenzie River delta, Northwest Territories. The most recent Canadian Inuvialuit subsistence harvest estimates for the Beaufort Sea beluga stock are provided in Table 20 (~~Harwood et al. 2002;~~ data for ~~2000-2003~~2002-2006 from FJMC Beluga Monitor Program, Fisheries Joint Management Committee, Inuvik, NT, Canada). Given these data, the annual subsistence take in Canada averaged ~~99~~114 belugas during the 5-year period from ~~1999-2003~~2002-2006. Thus, the mean estimated subsistence take in Canadian and U. S. waters from the Beaufort Sea beluga stock during ~~1999-2003~~2002-2006 is ~~152 (53 + 99)~~ 139 (25 + 114) whales. Data on beluga that were struck and lost have not been quantified and are not included in these estimates.

Table 20. Summary of the Canadian subsistence harvest from the Beaufort Sea stock of beluga whales, ~~1999-2003~~2002-2006. N/A indicates the data are not available.

Year	**Reported total number taken**	~~**Estimated range of total take**~~	~~**Reported number harvested**~~**landed**	~~**Reported number struck and lost**~~
~~1999~~	~~102~~	~~N/A~~	~~86~~	~~16~~
~~2000~~	~~89~~	~~N/A~~	~~82~~	~~7~~
~~2001~~	~~92~~	~~N/A~~	~~86~~	~~6~~
2002	88	~~N/A~~	~~85~~	~~3~~
2003	126	~~N/A~~	~~115~~	~~12~~
2004	122		~~115~~	~~12~~
2005	108		~~106~~	~~2~~
2006	126		~~122~~	~~4~~
Mean annual landed ~~take~~ (~~1999-2003~~2002-2006)	~~99~~ 114			

STATUS OF STOCK

Beaufort Sea beluga whales are not listed as "depleted" under the MMPA or listed as "threatened" or "endangered" under the Endangered Species Act. Based on a lack of reported mortalities, the estimated annual U.S. commercial fishery-related mortality (0) is not known to exceed 10% of the PBR (32) and, therefore, is considered to be insignificant and approaching zero mortality and serious injury rate. Based on currently available data, the estimated annual level of human-caused mortality and serious injury (~~152~~139) is not known to exceed the PBR (324). Therefore, the Beaufort Sea stock of beluga whales is not classified as a strategic stock. At this time it is not possible to assess the status of this stock relative to its Optimum Sustainable Population size.

HABITAT CONCERNS

Evidence indicates that the Arctic climate is changing significantly and that one result of the change is a reduction in the extent of sea ice in at least some regions of the Arctic (ACIA 2004, Johannessen et al 2004). These changes are likely to affect marine mammal species in the Arctic. Ice-associated animals, such as the beluga whale, may be sensitive to changes in Arctic weather, sea-surface temperatures, or ice extent, and the concomitant effect on prey availability. Currently, there are insufficient data to make reliable predictions of the effects of Arctic climate change on beluga whales. Increased human activity in the Arctic, including increasing oil and gas exploration and development, and increased nearshore development, have the potential to impact habitat for beluga whales (Moore et al 2000, Lowry et al 2006), but predicting the type and magnitude of the impacts is difficult at this time.

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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).

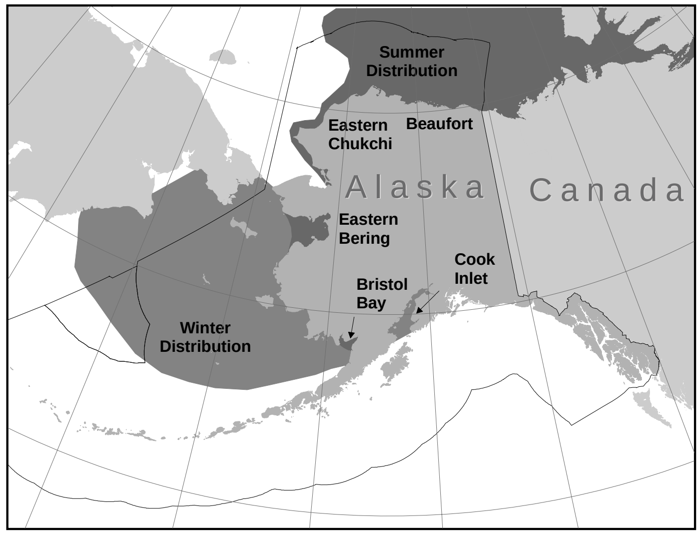

Figure 16. Approximate distribution of beluga whales in Alaska waters. The dark shading displays the summer distribution of the five stocks. Winter distributions are depicted with lighter shading.

The general distribution pattern for beluga whales shows major seasonal changes. During the winter, ~~beluga whales~~they occur in offshore waters associated with pack ice. In the spring, they migrate to warmer coastal estuaries, bays, and rivers ~~for molting~~where they may molt (Finley 1982) and ~~calving~~give birth to and care for their calves (Sergeant and Brodie 1969). Annual migrations may cover thousands of kilometers (Reeves 1990).

Eastern Chukchi Sea belugas move into coastal areas along Kasegaluk Lagoon in late June and animals are sighted in the area until about mid-July (Frost and Lowry 1990, Frost et al., 1993). Satellite-linked tag~~ging~~s ~~efforts directed at the~~ attached in summer to eastern Chukchi ~~stock of~~ beluga~~ whale~~s occur in Kaseguluk Lagoon ~~and~~ showed that whales ~~tagged in the eastern Chukchi in summer~~ traveled 1,100 km north of the Alaska coastline and to the Canadian Beaufort Sea within 3 months of tagging (Suydam et al. 2001), indicating ~~significant stock~~ an overlap in distribution with the Beaufort Sea stock of beluga whales. Satellite telemetry data from 23 whales tagged during 1998-2002 suggest variation in movement patterns for different age and/or sex classes during July – September (Suydam et al. 2005). Adult males used deeper waters and remained there for the duration of the summer; all belugas that moved into the Arctic Ocean (north of 75°N) were males, and males traveled through 90% pack ice cover to reach deeper waters of the Beaufort Sea and Arctic Ocean (79-80°N) by late July/early August. Adult and immature females remained at or near the shelf break of the Chukchi Sea. After October, only three tags continued to transmit, and those whales migrated south through the Bering Strait into the northern Bering Sea north of Saint Lawrence Island. Data from a whale tagged in the eastern Chukchi Sea in 2007 overwintered in the waters north of Saint Lawrence Island during 2007/2008 and was still transmitting in this location as of April 2008 (Robert Suydam, Department of Wildlife Management, North Slope Borough, Barrow, AK, pers comm. 02 April 2008). ~~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).~~

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: mitochondrial DNA analyses indicate distinct differences among summering areas (O'Corry-Crowe et al. 1997). 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

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, using radio telemetry data, for the proportion of animals that were diving 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 × 2.62 × 1.18).

During 25 June to 6 July 1998, aerial surveys were conducted in the eastern Chukchi Sea (DeMaster et al. 1998). The maximum single day count (1,172 whales) was derived from a photographic count of a large aggregation near Icy Cape (1,018), plus animals (154) counted along an ice edge transect. This count is an underestimate because it was clear to the observers that many more whales were present along and in the ice than they were able to count and only a small portion of the ice edge habitat was surveyed. Furthermore, only one of five belugas equipped with satellite tags a few days earlier remained within the survey area on the day the peak count occurred (DeMaster et al. 1998).

In July 2002, aerial surveys were conducted again in the eastern Chukchi Sea (Lowry and Frost 2002). Those surveys resulted in a peak count of 582 whales. A correction factor for animals that were not available for the count is not available. Offshore sightings during this survey combined with satellite tag data collected in 2001 (Lowry and Frost 2001, Lowry and Frost 2002) indicate that nearshore surveys for beluga will only result in partial counts of this stock.

It is not possible to estimate the abundance for this stock from the 1998 survey. Not only were a large number of whales unavailable for counting, but the large Icy Cape aggregation was in shallow, clear water (DeMaster et al. 1998). Currently, a correction factor (to account for missed whales) does not exist for belugas encountered in such conditions. As a result, the abundance estimate from the 1989-91 surveys (3,710 whales) is still considered to be the most reliable for the eastern Chukchi Sea beluga whale stock.

Minimum Population Estimate

The survey technique used 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 based on satellite tag results (Suydam et al. 2001, Lowry and Frost 2002), then a substantial fraction of the population was likely to have been in offshore waters during the survey period (DeMaster 1997).

Current Population Trend

The maximum 1998 count (1,172 animals) is similar to counts of beluga whales conducted in the same area during the summers of 1989-91 (1,200 animals) and counts of 1,104 and 1,601 in the summer of 1979 (Frost et al. 1993, DeMaster et al. 1998). Based on these data, there is no evidence that the eastern Chukchi Sea stock of beluga whales is declining.

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 reauthorized 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, Wade and Angliss 1997). Using the abundance estimate calculated from 1991 surveys, the PBR ~~F~~for the eastern

Chukchi Sea stock of beluga whales, PBR = 74 would be calculated to be 74 animals (3,710 × 0.02 × 1.0). However, the 2005 revisions to the SAR guidelines (NMFS 2005) state that abundance estimates older than 8 years should not be used to calculate PBR due to a decline in confidence in the reliability of an aged abundance estimate. Therefore, the PBR for this stock is considered undetermined.

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 fishery observers during 1990-97: 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. In the nearshore waters of the southeastern 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.

Based on a lack of reported mortalities, the estimated minimum mortality rate incidental to commercial fisheries is zero belugas per year from this stock.

Subsistence/Native Harvest Information

The subsistence take of beluga whales from the eastern Chukchi Sea stock is provided by the Alaska Beluga Whale Committee (ABWC). The most recent subsistence harvest estimates for the stock are provided in Table 21 (Frost and Suydam 1995; Frost 1998; K. Frost, University of Alaska, Fairbanks, pers. comm. 2007). Given these data, the annual subsistence take by Alaska Natives averaged 6559 belugas landed during the 5-year period 2002-20061999-2003 based on reports from ABWC representatives and on-site harvest monitoring. The 1999-2003 data are for all sites and all years negatively biased because reliable estimates for the number of animals struck and lost are not available prior to 1996. Data on beluga that were struck and lost have not been quantified and are not included in these estimates.

Table 21. Summary of the number of beluga whales landed by the Alaska Native subsistence harvest fromof the eastern Chukchi Sea stock of beluga whales, 1999-20032002-2006. N/A indicates the data are not available.

Year	Reported total number taken	Estimated range of total take	Reported number harvested	Estimated number struck and lost
1999	52	N/A	52	0
2000	5	N/A	2	3
2001	89	N/A	84	5
2002	99	N/A	93	6
2003	78	N/A	74	4
Mean annual take (1999-2003)	65			

Year	**Reported total number landed**
2002	93
2003	74
2004	54
2005	43
2006	31
Mean annual number of animals landed (2002-2006):	59

STATUS OF STOCK

The estimated minimum annual mortality rate incidental to U. S. 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. Based on currently available data, the estimated annual rate of human-caused mortality and serious injury (~~65~~59) is not known to exceed the PBR (74). Eastern Chukchi Sea beluga whales are not listed as "depleted" under the MMPA or listed as "threatened" or "endangered" under the Endangered Species Act. Therefore, the eastern Chukchi Sea stock of beluga whales is not 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 its Optimum Sustainable Population size.

HABITAT CONCERNS

Evidence indicates that the Arctic climate is changing significantly and that one result of the change is a reduction in the extent of sea ice in at least some regions of the Arctic (ACIA 2004, Johannessen et al 2004). These changes are likely to affect marine mammal species in the Arctic. Ice-associated animals, such as the beluga whale, may be sensitive to changes in Arctic weather, sea-surface temperatures, or ice extent, and the concomitant effect on prey availability. Currently, there are insufficient data to make reliable predictions of the effects of Arctic climate change on beluga whales. Increased human activity in the Arctic, including increasing oil and gas exploration and development, and increased nearshore development, have the potential to impact habitat for beluga whales (Moore et al 2000, Lowry et al 2006), but predicting the type and magnitude of the impacts is difficult at this time.

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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 interactions (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).~~

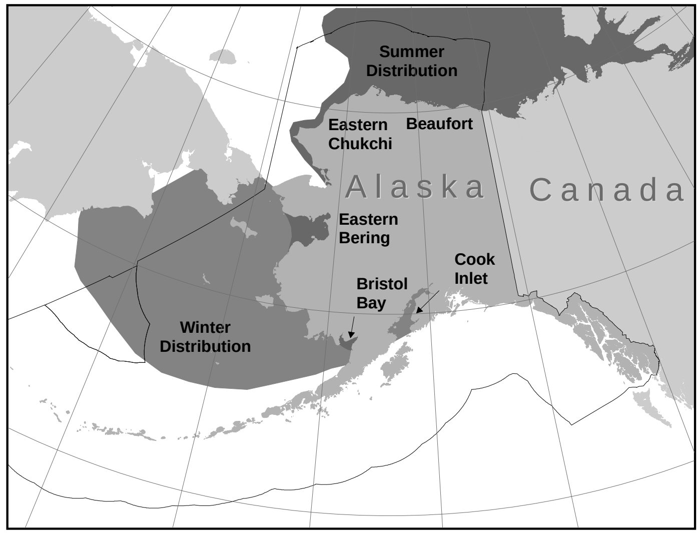

Figure 17. Approximate distribution of beluga whales in Alaska waters. The dark shading displays the summer distribution of the five stocks. Winter distributions are depicted with lighter shading.

The general distribution pattern for beluga whales shows major seasonal changes. During the winter, ~~beluga whales~~they occur in offshore waters associated with pack ice. In the spring, they migrate to warmer coastal estuaries, bays, and rivers ~~for molting~~where they may molt (Finley 1982) and ~~calving~~give birth to and care for their calves (Sergeant and Brodie 1969). Annual migrations may cover thousands of kilometers (Reeves 1990).

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: mitochondrial DNA analyses indicate distinct differences among summering areas (O'Corry-Crowe et al. 1997). 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. 17).

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 22 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 3-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 (CF) 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 × 2.62 × 1.18) beluga whales.

Aerial surveys of Norton Sound were also conducted in 2000. Preliminary analyses indicate that the uncorrected estimate was 5,868 animals; when corrected for animals not visible at the surface and for newborn and yearling animals not observed due to their small size and dark coloration, the estimated population size for Norton Sound is 18,142 (CV = 0.24; R. Hobbs, AFSC-NMML, pers. comm.).

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 1997). Therefore, $N_{MIN} = N/\exp(0.842\times[\ln(1+[CV(N)]^2)]^{½})$. Using the population estimate (N) of 18,142 and an associated CV(N) of 0.24, N_{MIN} for this stock is 14,898 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 considers the CV derived from the abundance estimate (CV = 0.24) as adequate in calculating a minimum population estimate (DeMaster 1996, 1997; see discussion of N_{MIN} for the eastern Chukchi stock of beluga whales).

Current Population Trend

Surveys to estimate population abundance in Norton Sound were not conducted prior to 1992. Annual estimates of population size from surveys flown in 1992-95 and 1999-2000 have varied widely, due partly to differences in survey coverage and conditions between years. Data currently available do not allow an evaluation of population trend for the Eastern Bering Sea stock.

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 reauthorized 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 = 298 animals (14,898 × 0.02 × 1.0).

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

Fisheries Information

In previous assessments, there were three different federally observed commercial fisheries in Alaska that could have had incidental serious injuries or mortalities of eastern Bering Sea beluga whales. In 2004, the definitions of these commercial fisheries were changed to reflect target species; this new definition has resulted in the identification of several observed fisheries in the Bering Sea that use trawl, longline, or pot gear. There have been no observed serious injuries or mortalities in any of these commercial fisheries.

Based on a lack of reported mortalities, the estimated minimum mortality rate incidental to commercial fisheries is zero belugas per year from this stock. The estimated mortality is considered a minimum due to a lack of observer programs in fisheries likely to take beluga .

In the nearshore waters of the eastern Bering Sea, substantial effort occurs in gillnet (mostly set nets), herring, and personal-use fisheries. The only reported beluga mortality in this region occurred in a personal-use king salmon gillnet near Cape Nome in 1996. ~~This mortality results in an annual estimated mortality of 0.2 whales from this stock during 1996-2000. Note that this is not a commercial fishery. As a result, this estimate is considered a minimum because personal-use fishers are not aware of a reporting requirement and there is no established protocol for non-commercial takes to be reported to NMFS. It should also be noted that in this region of western Alaska, any whales taken incidentally to the personal-use fishery are utilized by Alaska Native subsistence users. It~~

is not clear whether the 1996 entanglement was accounted for in the 1996 Alaska Native subsistence harvest report. If so, this particular mortality may have been double-counted. NMFS assumes that all beluga whales takenused for subsistence use, regardless of the method of harvest, are reported to the ABWC and are reflected in the following section on Subsistence/Native Harvest Information; however, some underreporting is known to occur (Unpublished SRG meeting minutes November 2004, available from Robyn Angliss, NMML, 7600 Sand Point Way NE, Seattle, WA 98115).

Subsistence/Native Harvest Information

The subsistence take of beluga whales from the eastern Bering Sea stock is provided by the ABWC. The most recent subsistence harvest estimates for the stock are provided in Table 22 (Frost and Suydam 1995; Frost 1998; Frost 2003; K. Frost, University of Alaska, Fairbanks, pers. comm. 20047). Given these data, the annual subsistence take by Alaska Natives averaged 209197 belugas landed from the eastern Bering Sea stock during the 5-year period 1999-20032002-2006 estimates are based on reports from ABWC representatives. The 1993-97 data are considered negatively biased due to a lack of reporting in several villages prior to 1996. In addition, there is not a reliable estimate for the number of struck and lost prior to 1996.

Table 22. Summary of the number of belugas landed by the Alaska Native subsistence harvest from the eastern Bering Sea stock of beluga whales, 1999-20032002-2006. N/A indicates the data are not available.

Year	**Reported total number taken**	**Estimated range of total take**	**Reported number harvested**	**Estimated number struck and lost**
1999	159	N/A	134	25
2000	212	N/A	188	24
2001	309	N/A	281	28
2002	255	N/A	234	21
2003	109	N/A	101	8
Mean annual take (1999-20032002-2006)	209			

Year	**Reported total number landed**
2002	234
2003	101
2004	132
2005	249
2006	166
Mean annual number of animals landed (2002-2006):	197

STATUS OF STOCK

The estimated minimum annual mortality rate incidental to U.S. commercial fisheries (0) is not known to exceed 10% of the PBR (30) and, therefore, is considered to be insignificant and approaching zero mortality and serious injury rate. Based on currently available data, the estimated annual rate, over the 5-year period from 1999-20032002-2006, of human-caused mortality and serious injury (209197, including the estimated mortality in non-commercial fisheries) is not known to exceed the PBR (298) for this stock. Eastern Bering Sea beluga whales are not listed as "depleted" under the MMPA or listed as "threatened" or "endangered" under the Endangered Species Act. 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 its Optimum Sustainable Population size.

HABITAT CONCERNS

Evidence indicates that the Arctic climate is changing significantly and that one result of the change is a reduction in the extent of sea ice in at least some regions of the Arctic (ACIA 2004, Johannessen et al 2004). These changes are likely to affect marine mammal species in the Arctic. Ice-associated animals, such as the beluga whale, may be sensitive to changes in Arctic weather, sea-surface temperatures, or ice extent, and the concomitant effect on prey availability. Currently, there are insufficient data to make reliable predictions of the effects of Arctic climate change on beluga whales. Increased human activity in the Arctic, including increasing oil and gas exploration and development, and increased nearshore development, have the potential to impact habitat for beluga whales (Moore et al 2000, Lowry et al 2006), but predicting the type and magnitude of the impacts is difficult at this time.

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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).

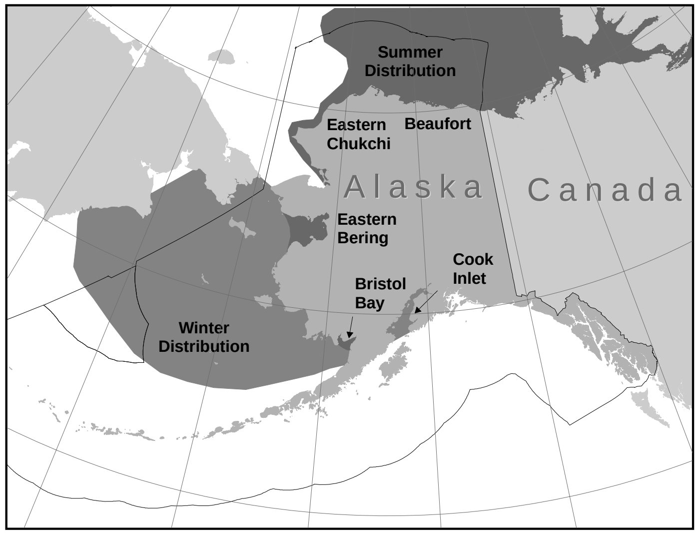

Figure 18. Approximate distribution of beluga whales in Alaska waters. The dark shading displays the summer distribution of the five stocks. Winter distributions are depicted with lighter shading.

The general distribution pattern for beluga whales shows major seasonal changes. During the winter, ~~beluga whales~~they occur in offshore waters associated with pack ice. In the spring, they migrate to warmer coastal estuaries, bays, and rivers ~~for molting~~where they may molt (Finley 1982) and ~~calving~~give birth to and care for their calves (Sergeant and Brodie 1969). Annual migrations may cover thousands of kilometers (Reeves 1990).

Summer movement patterns of Bristol Bay belugas were determined from satellite-linked tags deployed on 10 animals in the Kvichak River during 2002 and 2003, and 5 in the Nushagak River in 2006. Those whales used the shallow upper portions of Kvichak and Nushagak bays between May and August (Quakenbush, 2003) and remained in the nearshore waters of Bristol Bay through the months of September and October (Quakenbush and Citta, 2006). Data from two belugas whose tags lasted into December and January showed that they were in Nushagak and Kvichak bays, suggesting that some belugas do not leave the nearshore waters of Bristol Bay during the winter (Lori Quakenbush, Alaska Department of Fish and Game, Fairbanks, AK, pers comm. 31 March 2008). ~~Annual migrations may cover thousands of kilometers (Reeves 1990~~).

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 poorly ~~un~~known 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: mitochondrial DNA analyses indicate distinct differences among summering areas (O'Corry-Crowe et al. 1997). 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

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 times of year when belugas ~~were expected~~ are known to concentrate during summer. 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~~In 1994, the number of beluga whales in Bristol Bay was estimated at 1,555 ~~in 1994~~ (Lowry and Frost 1998). Th~~is~~at estimate was based on a maximum 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). ~~Surveys flown by the ADFG in 1999 and 2000 resulted in maximum counts of 690 and 531, which can be extrapolated to provide population estimates of 2,133 and 1,642, respectively (L. Lowry, University of Alaska Fairbanks, pers. comm.).~~ The Alaska Department of Fish and Game and the Alaska Beluga Whale Committee conducted beluga surveys in Bristol Bay in 1999, 2000, 2004 and ~~will do so again in~~ 2005, with maximum counts of 690, 531, 794, and 1,067 (Lowry et al. in prep). Using the correction factors described above and the maximum counts for 2004 and 2005 gives population estimates of 2,455 and 3,299 (L. Lowry, University of Alaska Fairbanks, pers. comm.).

Minimum Population Estimate

The survey technique used for estimating the abundance of beluga whales in this stock is a direct count which incorporates correction factors. Given this survey method, estimates of the variance of abundance are unavailable. The abundance estimate is thought to be conservative because ~~1) some whales may have been outside the survey area (i.e., Kuskokwim Bay), 2)~~ no correction has been made for whales that were at the surface but were missed by the observers, and ~~3)~~ the dive correction factor is probably negatively biased (Lowry and Frost 1998). 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 beluga whale stock is calculated using Equation 1 from the PBR Guidelines (Wade and Angliss 1997): $N_{MIN} = N/\exp(0.842 \times [\ln(1+[CV(N)]^2)]^{½})$. Using the average estimate for ~~1999~~2004 and 200~~0~~5 of (N) of ~~1,888~~2,877 and the default CV (0.2), N_{MIN} for the Bristol Bay stock of beluga whales is ~~1,619~~2,467.

Current Population Trend

Population estimates from the 1950s (Brooks 1955, Lensink 1961) suggested there were about 1,000-1,500 belugas in Bristol Bay. Aerial surveys flown in 1983 produced an ~~The first~~ abundance estimate of ~~(~~1,250~~)~~ ~~from aerial surveys was conducted in 1983~~which indicated that there had been little change in population size. A survey program involving replicate aerial counts using standardized methods was conducted during 1993-2005. Data from 28 complete counts of Kvichak and Nushagak bays made in good or excellent survey conditions were analyzed, and results showed that the population had increased by 65% over the 12-year period (Lowry et al. in prep). ~~Consistency in count data and abundance estimates between 1993, 1994, and earlier surveys (Frost and Lowry 1990, 1995a; Lowry and Frost 1998), and the higher counts in 1999 and 2000 suggest that the Bristol Bay stock is at least stable and may be increasing.~~

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.~~The estimated rate of increase in abundance of belugas in Bristol Bay during 1993-2005 was 4.7% per year (95% CI = 2.1%-7.2%; Lowry et al. in prep). ~~Hence, until additional data become available, it is recommended that~~This estimate exceeds the default cetacean maximum ~~theoretical~~ net productivity rate (R_{MAX}) of 4% ~~be employed for this stock~~ (Wade and Angliss 1997). It is currently not clear why this stock should be increasing as such a high rate (Lowry et al. in prep.).

POTENTIAL BIOLOGICAL REMOVAL

Under the 1994 reauthorized 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 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 = ~~32~~49 animals (~~1,619~~2,467 × 0.02 × 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 fishery observers during 1990-97: 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.

Observers have never monitored the Bristol Bay salmon set gillnet and drift gillnet fisheries which combined had over 2,900 active permits in 1996.

The estimated minimum mortality rate incidental to commercial fisheries is 0. However, aA 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 have been known to interact with this stock in the past (Frost et al. 1984).

Subsistence/Native Harvest Information

Data on the subsistence take of beluga whales from the Bristol Bay stock is provided by the ABWC. The most recent subsistence harvest estimates for the stock are provided in Table 23 (Frost and Suydam 1995; Frost 1998; K. Frost, University of Alaska Fairbanks, pers. comm. 20047) Given these data, the annual subsistence take by Alaska Natives averaged 1917 belugas from the Bristol Bay stock during the 5-year period 1999-20032002-2006. This estimate is based on reporting by ABWC representatives and is considered negatively biased because there is not a reliable estimate for the number of struck and lost in 2001 and 2002.

Table 23. Summary of the Alaska Native subsistence harvest from the Bristol Bay stock of beluga whales, 1999-20032002-2006. N/A indicates the data are not available.

Year	**Reported total number taken**	**Estimated range of total take**	**Reported number harvested**	**Estimated number struck and lost**
1999	15	N/A	13	2
2000	25	N/A	24	1
2001	22[1]	N/A	22	N/A
2002	9[1]	N/A	9	N/A
2003	24	N/A	21	3
Mean annual take (1999-2003)	19			

[1] Does not include the number struck and lost.

Year	**Reported total number landed**
2002	9
2003	21
2004	16
2005	19
2006	20
Mean annual number of animals landed (2002-2006):	17

There is substantial effort in a subsistence gillnet fishery for salmon in Bristol Bay. There were 6 reported mortalities of beluga in subsistence salmon gillnet fisheries in 2000 and one reported mortality of a beluga whale in a subsistence gillnet in 2002 reported to the Alaska Beluga Whale Committee. If this level of mortality is averaged over 5 years, an average of 1.4 belugas per year would be caught in subsistence gillnet fisheries in this area. In addition, records indicate that one and two beluga whales were killed incidental to commercial salmon set nets in 2000 and 2002, respectively, and these animals were used for subsistence purposes. Thus, the total subsistence harvest resulting from net entanglements is 2 belugas per year. Note that these mortalities did not occur incidental to a commercial fishery, or did occur incidental to a commercial fishery and were used for subsistence purposes. As a result, this estimate is considered a minimum because personal-use fishers are not aware of a reporting requirement and there is no established protocol for non-commercial takes to be reported to NMFS. It should also be noted that in this region of western Alaska any whales taken incidentally to the personal-use fishery are used by Alaska Native subsistence users. It is not clear whether the mortalities reported in 2000 and 2002 are accounted for in the 2000 and 2002 Alaska Native subsistence harvest report; the subsistence harvest report will be used to document the reported take of beluga whales in Bristol Bay.

STATUS OF STOCK

~~At present, annual U. S. commercial fishery-related mortality levels less than 3.2 per year (i.e., 10% of PBR) can be considered insignificant and approaching zero mortality and serious injury rate.~~ ~~However, i~~It is unknown whether the U. S. commercial fishery-related mortality ~~rate~~ level is insignificant and approaching zero mortality and serious injury rate (i.e., 10% of PBR; less than 4.9 per year) because a reliable estimate of the mortality rate incidental to commercial fisheries is currently unavailable. Bristol Bay 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 (1~~9~~7) is not known to exceed the PBR (~~32~~49). 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.

HABITAT CONCERNS

Evidence indicates that the Arctic climate is changing significantly and that one result of the change is a reduction in the extent of sea ice in at least some regions of the Arctic (ACIA 2004, Johannessen et al 2004). These changes are likely to affect marine mammal species in the Arctic. Ice-associated animals, such as the beluga whale, may be sensitive to changes in Arctic weather, sea-surface temperatures, or ice extent, and the concomitant effect on prey availability. Currently, there are insufficient data to make reliable predictions of the effects of Arctic climate change on beluga whales. Increased human activity in the Arctic, including increasing oil and gas exploration and development, and increased nearshore development, have the potential to impact habitat for beluga whales (Moore et al 2000, Lowry et al 2006), but predicting the type and magnitude of the impacts is difficult at this time.

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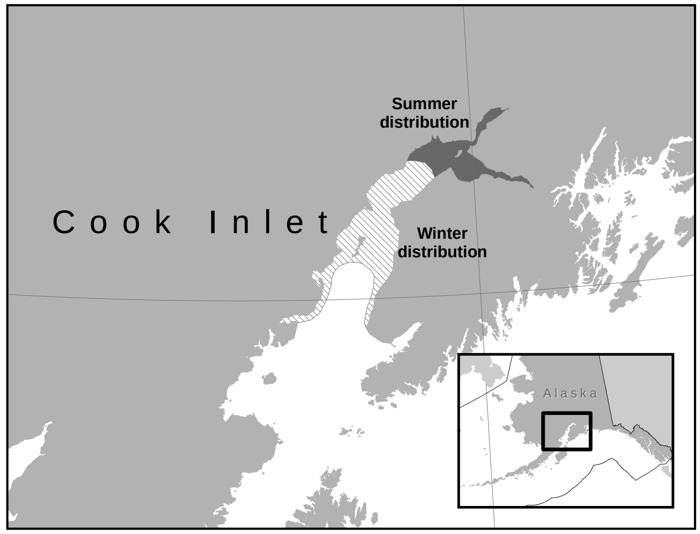

Figure 19. Approximate distribution of beluga whales in Cook Inlet. The dark shading displays the summer distribution. Winter distribution is depicted with dashed shading**.**

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 poorly known 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: mitochondrial DNA analyses indicate distinct differences among summering areas (O'Corry-Crowe et al. 2002). 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.

POPULATION SIZE

Aerial surveys for beluga whales in Cook Inlet have been conducted by the National Marine Fisheries Service each year since 1993. Starting in 1994, the survey protocol included paired, independent observers so that the number of whale groups missed can be estimated. When groups were seen, a series of aerial passes were made to allow each observer to make independent counts at the same time that a video camera was photographing the whale group (Rugh et al. 2000).

The annual abundances of beluga whales in Cook Inlet are estimated from counts by aerial observers and aerial video group counts. Each group size estimate is corrected for subsurface animals (availability correction) and animals at the surface that were missed (sightability correction) based on an analysis of the video tapes (Hobbs et al. 2000b). When video counts are not available, observer's counts are corrected for availability and sightability using a regression of counts and an interaction term of counts with encounter rate against the video group size estimates (Hobbs et al. 2000b). The most recent abundance estimate of beluga whales in Cook Inlet, resulting from the 200~~6~~7 aerial survey is ~~302~~375 (CV = 0.~~16~~21) animals (NMFS unpubl. data). ~~Although~~While this estimate is larger than the estimates of 278 for 2005 and 302 for 2006, it is ~~still below~~equivalent to the average of 370 for the years 1999-2004. ~~and a A trend line fit to the estimates for 1999 to 2006~~7 ~~estimates an average rate of decline of 4.1~~2.8~~% per year (SE = 0.0165~~1~~) which is not significantly different from a constant population level at the 5% level. A Bayesian inference on the data through 2005 gave a modal estimate of the population size in 2005 of 329 (Lowry et al. 2006).~~

Minimum Population Estimate

The minimum population size (N_{MIN}) for this stock is calculated according to Equation 1 from the PBR Guidelines (Wade and Angliss 1997): $N_{MIN} = N/\exp(0.842 \times [\ln(1+[CV(N)]^2)]^{½})$. Using the population estimate (N) of ~~302~~375 and its associated CV(N) of 0.~~16~~21, N_{MIN} for the Cook Inlet stock of beluga whales is ~~264~~314.

Current Population Trend

The corrected abundance estimates for the period 1994-200~~6~~7 are shown in Figure 20. A statistically significant declining trend in abundance was detected between 1994 and 1998 (Hobbs et al. 2000a), although the power was low due to the short time series. A Bayesian inference on the population size estimates for 1994-2005 gave a modal estimate of the current trend of -1.2% per year, with a 71% probability that the population is declining (Lowry et al. 2006). A trend line fit to the estimates for 1999 to 200~~6~~7 estimates an average rate of decline of ~~4.1~~2.8% per year (SE = 0.016~~5~~1) which is not significantly different from a constant population level at the 5% level. A recent review of the status of the population indicated that there is a 65% chance that the population will decline further (Hobbs et al. 2006).

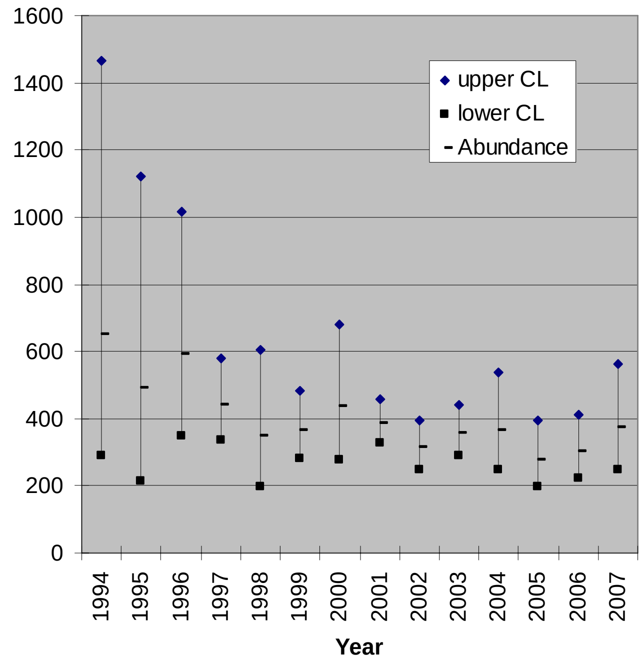

Figure 20. Abundance of beluga whales in Cook Inlet, Alaska 1994-200~~6~~7 (Rugh et al. 2005, NMFS unpublished data). Error bars depict 95% confidence intervals.

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 reauthorized 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 F_R and PBR for the Cook Inlet stock of beluga whale were both undetermined in Small and DeMaster (1995). In reports from 1998 through 2005, NMFS calculated a value for PBR. However, given the low abundance relative to historic estimates and low known levels of human caused mortality since 1999 this stock should have begun to grow at or near its maximum productivity rate, but for unknown reasons the Cook Inlet stock of beluga whale does not appear to be increasing. Because this stock does not meet the assumptions inherent to the use of the PBR, NMFS cannot determine a maximum number that may be removed while allowing the population to achieve OSP. Thus, the PBR is undetermined for the Cook Inlet stock of beluga whale.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

Fisheries Information

In 1999 and 2000, observers were placed on Cook Inlet salmon set and drift gillnet vessels because of the potential for these fisheries to ~~incur incidental mortalities of~~ entangle beluga whales. No mortalities or serious injuries were observed in either year (Manly 2006).

Based on a lack of observed ~~or~~ and reported mortalities, the estimated minimum mortality rate incidental to commercial fisheries is zero belugas per year from this stock.

Subsistence/Native Harvest Information

Subsistence harvest of beluga whales in Cook Inlet has been important to local villages. Between 1993 and 1999, the annual subsistence take ranged from 30 ~~animals~~ to over 100 animals (Mahoney and Shelden 2000). ~~The most thorough subsistence harvest surveys were completed by the Cook Inlet Marine Mammal Council during 1995-97~~6~~; while some of the hunters believe the 1996 estimate was positively biased, the 1995-97 CIMMC take~~harvest ~~estimates are considered reliable.~~ The average annual subsistence harvest ~~between~~ for 1995 and 199~~7~~6 was 87 whales.

Following a significant decline in Cook Inlet beluga whale abundance estimates between 1994 and 1998, the Federal Government took actions to prevent further declines in the abundance of these whales. In 1999 and 2000, Public Laws 106-31 and 106-553 established a moratorium on Cook Inlet beluga whale harvests except for subsistence hunts by Alaska Natives conducted under cooperative agreements between NMFS and affected Alaska Native organizations. ~~Because of the decline in the Cook Inlet beluga whale stock in 1999 Congress imposed a moratorium on beluga harvest in Cook Inlet until NMFS developed a cooperative plan for harvest management with the local Alaska Native organizations.~~ There were no signed co-management agreements in 1999, 2004, and 2007, so no harvest was authorized. ~~Thus, the best estimate of subsistence take in 1999 and 2000 is zero.~~ Harvest from 2001 through 2004 was conducted under harvest regulations (69 FR 17973, 6 April 2004) following an interim harvest management plan developed by the Alaska Native organizations and NMFS~~ (69 FR 17973, 6 April 2004)~~. Three belugas were harvested in Cook Inlet under the interim harvest plan (2001-2004; Table 24). ~~Under that agreement the average take during 200~~1~~3-200~~5~~7 was one whale/year (see Table 24).~~ In August 2004 an administrative law judge hearing occurred ~~before an administrative law judge was~~ to determine a long-term harvest plan. The recommended decision ~~resulting ruling was completed in November 2005. The ruling~~ allows a total of 8 whales to be harvested between 2005 and 2009, followed by the use of a table of allowable harvest levels from 2010 until recovery. This table would set harvest levels dependent on the previous 5-year periods for an average abundance and previous 10-year period to determine the growth rate (increasing, stable, or decreasing). ~~with harvest in subsequent 5-year periods to depend on the average abundance in the previous 5-year period and the observed growth rate of the population.~~ No harvest would be allowed if the 5-year average abundance dropped~~s~~ below 350 beluga. NMFS has set the 2007 harvest to zero because the previous 5-year average abundance ~~2005 and 2006 abundance~~ estimates was~~were~~ below the 350 animal threshold. Harvest levels for 2008 and subsequent years will be decided after public review of the Cook Inlet Beluga Whale Subsistence harvest Draft Supplemental Environmental Impact Statement (72 FR 73798, December 28, 2007). ~~2009 are pending the completion of an EIS on harvest management (B. Mahoney, NMFS Alaska Region, pers. comm.).~~

Table 24. Summary of the Alaska Native subsistence harvest from the Cook Inlet stock of beluga whales, 200~~1~~3-200~~5~~7.

Year	Reported total number taken	Reported number harvested	Estimated number struck and lost
~~2001~~	~~1~~	~~1~~	~~0~~
~~2002~~	~~1~~	~~1~~	~~0~~
2003	0	0	0
2004	0	0	0
2005	2	2	0
2006	0	0	0
2007	0	0	0
Mean annual take (200~~1~~3-200~~5~~7)	~~1~~0.4		

OTHER MORTALITY

Mortalities related to stranding events have been reported in Cook Inlet (Table 25). Since ~~detailed~~ improved recordkeeping was initiated in 1994, there are more reports of stranded belugas in Cook Inlet, including live strandings. ~~have been mass strandings of beluga almost every year.~~ These ~~mass~~live strandings resulted in suspected~~known~~ mortalities of ~~4~~5 animals in 1996, 5 animals in 1999, and ~~6~~5 animals in 2003 (Vos and Shelden 2005) and 1 animal in 2005 (NMFS 2007~~unpublished data~~). Many of the live strandings occurred in Turnagin Arm. Because Turnagin Arm is a shallow, dangerous waterway, it is not frequented by motorized vessels, and thus it is ~~highly~~ unlikely that the strandings resulted from human interactions on the water. Another source of mortality in Cook Inlet is killer whale predation. Killer whale sightings were rare in the upper Inlet prior to the mid-1980s, but have increased ~~to~~and include 18 ~~confirmed~~reported sightings from 1985 to 2002 (Shelden et al. 2003). The three most recent predation events that occurred in the upper Inlet were ~~one~~1) in September 1999 in which the outcome was unknown, ~~and~~ 2) ~~one~~ in September 2000 that involved two lactating females that subsequently died (Shelden et al. 2003), and 3) ~~one~~ in 2003 where a male stranded (Vos and Shelden 2005).

Table 25. Cook Inlet beluga strandings investigated by NMFS (Vos and Shelden 2005; NMFS unpublished data). * Harvested beluga are not included in the number dead. ** Many belugas that strand do not die. Although some mortalities may have been missed by observers, and animals may die later of stranding-related injuries, the majority of animals involved in a stranding event often survive.

Year	~~Total Dead (includes subsistence)~~	Total Dead of Natural or Unknown Cause	Number of Belugas per Live Stranding Event ~~Stranded~~* (associated known mortalities)
1994	~~107~~	7	186 (0)
1995	~~122~~	~~1~~2	N/A
1996	~~1912~~	~~11~~12	63(0), 60(4), 25(1), 1(0), 15(0)
1997	~~63~~	3	N/A
1998	~~2110~~	~~7~~10	30(0), 5(0)
1999	~~1312~~	~~13~~15	58(5), 13(0)
2000	~~13~~	13 (2 killer whale)	8(0), 15-20(0), 2(0)
2001	~~1110~~	10	N/A
2002	~~1413~~	13	N/A
2003	~~2120~~	20 (1 killer whale)	2(0), 46(5), 26(0), 32(0), 9(0)
2004	~~13~~	13	N/A
2005	~~97~~	~~5~~7	7(1~~0~~)
2006	~~8~~	8	12(0)
2007	~~13~~	13	N/A
Total	~~162143~~	~~116~~146	6~~03~~15-6~~08~~20 (1~~5~~6)

STATUS OF STOCK

An analysis of available data on the population size and dynamics of the Cook Inlet beluga whale stock led NMFS to conclude that this stock is currently below its ~~Optimum Sustainable Population~~OSP level. Thus, this stock was designated as "depleted" under the MMPA (65 FR 34590; 31 May 2000). NMFS also made a determination that this stock should not be listed under the ESA at the time (65 FR 38778; 22 June 2000) primarily because the subsistence harvest, which appeared to have been responsible for the majority of the decline ~~in this stock~~, was ~~prohibited~~regulated in 1999 through an act of Congress. Once the subsistence harvest was regulated (65 FR 38778; 22 June 2000)~~ceased~~, the rapid decline in the stock ~~ceased~~ slowed (~~65 FR 38778; 22 June 2000,~~ Hobbs et al. 2000a). However, there has been a lack of recovery, and the most recent analysis suggests that the population is declining slowly. Two Cook Inlet commercial fisheries that could have incurred ~~suspected of possibly incurring~~ incidental serious injuries or mortalities of beluga whales were observed in 1999 and 2000, and no takes of beluga whales were observed. At present, annual U. S. commercial fishery-related mortality levels can be considered insignificant and approaching zero mortality and serious injury rate. Because the PBR for this stock is undetermined, it is not possible to say whether or not the annual level of human caused mortality (0.4~~1.0should this be 0.6 or 1?~~) exceeds the PBR. Because the Cook Inlet beluga whale stock has been designated as "depleted" under the MMPA, it is classified as strategic. In 2006 NMFS published a review of the status of this population (Hobbs et al 2006). In April 2007, NMFS proposed listing Cook Inlet beluga as endangered under the ESA (72 FR 19854). ~~NMFS was also petitioned to list the Cook Inlet stock as endangered under the ESA.~~ A final determination on this action is due in ~~2007~~April 2008.

Efforts to develop co-management agreements with Alaska Native organizations for several marine mammal stocks harvested by Native subsistence hunters across Alaska, including belugas in Cook Inlet, have been underway for several years. An umbrella agreement on co-management among the Indigenous People's Council for Marine Mammals, U.S. Fish and Wildlife Service, and NMFS was signed in August 1997, and an updated co-management agreement was signed in October 2006. During 1998, efforts were initiated to formalize a specific agreement with between local Alaska Native organizations and NMFS regarding the management of Cook Inlet belugas, but without success. In the absence of a co-management agreement, Federal legislation was implemented in May 1999, placing a moratorium on beluga hunting in Cook Inlet except under cooperative agreements between NMFS and affected Alaska Native organizations. until a co-management agreement is completed. Co-management agreements between NMFS and the Cook Inlet Marine Mammal Council have since been signed each year since for 2000-2003 and 2005-2006.

Habitat Concerns

Observation and tagging data both indicate that the northernmost parts of upper Cook Inlet, including the Susitna Delta, Knik Arm, and Chickaloon Bay, are the focus of the stock's distribution in both summer (Rugh et al. 2000; Goetz 2007) and winter (Hobbs et al. 2005). Because of the very restricted range of this stock, Cook Inlet beluga can be assumed to be sensitive vulnerable to human-induced or natural perturbations within their habitat. Although the best available information indicated that human activities, including oil and gas development, had not caused the stock to be in danger of extinction as of 2000 (65 FR 38778; 22 June 2000), potential effects of human activities on recovery remain a concern. Contaminants from a variety of sources, man-made sounds, onshore or offshore development, construction, and competition with fisheries for available prey have the potential to impact this stock or its habitat. Additional concerns which have the potential to impact this stock or its habitat include changes in prey availability due to climate changes; competition with fisheries for available prey; contaminants and sounds associated with oil and gas exploration; vessel traffic; waste management and urban runoff; and physical habitat modifications that may occur as upper Cook Inlet becomes increasingly urbanized (Moore et al. 2000, Lowry et al. 2006). Projects planned that may alter the physical habitat include a highway bridge across Knik Arm, ferry operations in lower Knik Arm, construction and operation of a coal mine near Chuitna, a proposal for a Knik Arm ferry, and improvements to the Port of Anchorage.

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KILLER WHALE (*Orcinus orca*):
AT1 Transient Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

Figure 24. Approximate distribution of killer whales in the eastern North Pacific (shaded area). The distribution of the eastern North Pacific Resident and Transient stocks are largely overlapping (see text).

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 occur at higher densities in colder and more productive waters of both hemispheres, with the greatest densities found at high latitudes (Mitchell 1975, Leatherwood and Dahlheim, 1978, and Forney and Wade, 2006). Killer whales are found throughout the North Pacific. Along the west coast of North America, killer whales occur along the entire Alaskan coast (Braham and Dahlheim 1982), in British Columbia and Washington inland waterways (Bigg et al. 1990), and along the outer coasts of Washington, Oregon, and California (Green et al. 1992; Barlow 1995, 1997; 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, where pods have been labeled as 'resident,' 'transient,' and 'offshore' (Bigg et al. 1990, Ford et al. 2000) based on aspects of morphology, ecology, genetics, and behavior (Ford and Fisher 1982; Baird and Stacey 1988; Baird et al. 1992; Hoelzel et al. 1998, 2002; Barrett-Lennard 2000). 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 (Matkin et al. 1999b) and 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).

Several studies provide evidence that the 'resident', 'offshore', and 'transient' ecotypes are genetically distinct in both mtDNA and nuclear DNA (Hoelzel and Dover 1991; Hoelzel et al. 1998, 2002; Barrett-Lennard 2000). Genetic differences have also been found between populations within the 'transient' and 'resident' ecotypes (Hoelzel et al. 1998, 2002; Barrett-Lennard 2000).

Until recently, transient killer whales in Alaska had only been studied intensively in southeastern Alaska and in the Gulf of Alaska (from Prince William Sound, through the Kenai Fjords, and around Kodiak Island). In the Gulf of Alaska, Matkin et al. (1999) described two genetically distinct communities of transients which were never found in association with one another, the so-called 'Gulf of Alaska' transients and 'AT1' transients. Neither of these communities regularly associates with transient killer whales that range from California to southeastern Alaska, which has been termed the 'west coast' community. 'Gulf of Alaska' transients are seen throughout the Gulf of Alaska, including occasional sightings in Prince William Sound and rare occurrences in southeast Alaska. AT1 transients ~~are primarily seen~~ have only been observed in Prince William Sound and in the Kenai Fjords region, and are therefore partially sympatric with 'Gulf of Alaska' transients. Transients that associate with the 'Gulf of Alaska' community have been found to have two mtDNA haplotypes, neither of which is found in the west coast or AT1 communities. Members of the AT1 community share a single mtDNA haplotype. Transient killer whales from the 'west coast' community have been found to share a single mtDNA haplotype that is not found in the other communities. Additionally, all three communities have been found to have significant differences in nuclear (microsatellite) DNA (Barrett-Lennard 2000). Acoustic differences have been found, as well, as Saulitis et al. (2005) described acoustic differences between 'Gulf of Alaska' transients and AT1 transients. For these reasons, the

'Gulf of Alaska' transients are considered part of a population that is discrete from the AT1 population, and both of these communities are considered discrete from the 'west coast' transients.

Recent research in western Alaska, particularly along the south side of the Alaska Peninsula and in the eastern Aleutian Islands, have identified transient killer whales that use acoustic calls similar to and mtDNA haplotypes identical with the Gulf of Alaska transients (NMML unpublished, NGOS unpublished), however their connection with Gulf of Alaska transients is equivocal considering there has been little documented interchange between these areas and nuclear DNA analysis has not been completed. AT1 haplotypes are also found in western Alaska, but nuclear DNA analysis indicates there is no recent connection ~~with the AT1 population~~between regions that share AT1 haplotypes (Wade 2004). However, samples from the central Aleutian Islands and Bering Sea have identified mtDNA haplotypes not found in Gulf of Alaska transients, suggesting the possibility there is some population structure in western Alaska (P. Wade pers comm.). At this point, there are insufficient data to resolve transient population structure in western Alaska. Therefore, transient-type killer whales from the Aleutian Islands and Bering Sea are considered to be part of a single population that includes 'Gulf of Alaska' transients. Killer whales are seen in the northern Bering Sea and Beaufort Sea, but little is known about these whales.

In summary, within the transient ecotype, association data (Ford et al. 1994, Ford and Ellis 1999, Matkin et al. 1999), acoustic data (Saulitis 1993, Ford and Ellis 1999) and genetic data (Hoelzel et al. 1998, 2002; Barrett-Lennard 2000) confirms that at least three communities of transient whales exist and represent three discrete populations: 1) Gulf of Alaska, Aleutian Islands, and Bering Sea transients, 2) AT1 transients, and 3) West Coast transients.

Based on data regarding association patterns, movements, acoustics, genetic differences and potential fishery interactions, eight killer whale stocks are recognized within the Pacific U.S. EEZ: 1) the Alaska Resident stock - occurring from southeastern Alaska to the Aleutian Islands and Bering Sea, 2) the Northern Resident stock - occurring from British Columbia through part of southeastern Alaska, 3) the Southern Resident stock - occurring mainly within the inland waters of Washington State and southern British Columbia, but also in coastal waters from British Columbia through California, 4) the Gulf of Alaska, Aleutian Islands, and Bering Sea Transient stock - occurring mainly from Prince William Sound through the Aleutian Islands and Bering Sea (see Fig. 24), 5) the AT1 Transient stock - occurring in Alaska from Prince William Sound through the Kenai Fjords, 6) the West Coast Transient stock - occurring from California through southeastern Alaska, 7) the Offshore stock - occurring from California through Alaska, and 8) the Hawaiian stock. 'Transient' whales in Canadian waters are considered part of the West Coast Transient stock. The Stock Assessment Reports for the Alaska Region contain information concerning all the killer whale stocks except the Hawaiian and Offshore stocks.

AT1 killer whales were first identified as a separate, cohesive group in 1984, when 22 transient-type whales were documented in Prince William Sound (Leatherwood et al. 1984, Heise et al. 1991), though individual whales from the group had been photographed as early as 1978. Once the North Gulf Oceanic Society began consistent annual research effort in Prince William Sound, AT1 killer whales were re-sighted frequently. In fact, AT1 killer whales were found to be some of the most frequently sighted killer whales in Prince William Sound (Matkin et al. 1993, 1994, 1999). Gulf of Alaska transients are seen less frequently in Prince William Sound, with periods of several years between resightings not uncommon.

AT1 killer whales have never been seen in association with sympatric resident killer whale pods or with Gulf of Alaska transients (Matkin et al. 1999b). As discussed above, the AT1 group were found to be acoustically and genetically different from other transient killer whales in the North Pacific (Saulitis et al. 2005, Barrett-Lennard 2000). AT1 killer whale transients are considered a population that is discrete from 'Gulf of Alaska' transients, which are part of the Gulf of Alaska, Aleutian Islands, and Bering Sea Transient stock.

The AT1 transients appear to have a more limited geographic range than do other transients. Though seen mostly in Prince William Sound, some AT1s were photographed between Prince William Sound and Resurrection Bay in 1992 (K. Heise, Vancouver Aquarium, pers. comm. in Matkin and Saulitis 1994). It is now known that they can be seen in Prince William Sound and Resurrection and Aialik Bays of the Kenai Fjords year-round (Saulitis et al. 2000). However, they are not known to travel east of Prince William Sound or west of Kenai Fjords, Alaska, an apparent range of at least 200 miles (Matkin et al. 1999b).

POPULATION SIZE

Using photographic identification methods, all 22 individuals in the population were completely censused for the first time in 1984 (Leatherwood et al. 1984). All 22 AT1s were seen annually or biannually from 1984 to 1988 (Matkin et al. 1999~~a~~, Matkin el al 2003). The *Exxon Valdez* oil spill occurred in spring of 1989. Nine individuals from the AT1 group have been missing since 1990 (last seen in 1989), and 2 have been missing since

1992 (last seen in 1990 and 1991). ~~All 11 are presumed dead (Matkin et al. 2000).~~ Three of the missing AT1s ~~that presumably died~~ (AT5, AT7, and AT8) were seen near the *Exxon Valdez* (with AT6) shortly after the spill (Matkin et al. 1993, 1994, Matkin et al. in press). ~~One of the 11 was confirmed dead – AT19 was found dead on a beach in the spring of 1990~~Two whales were found stranded in 1989-1990, both genetically assigned to the AT1 population and one visually recognized as AT19 (Heise et al. 2003, Matkin et al. 1994, Matkin et al. in press). All 11 are presumed dead based on criteria that whales are dead if missing from the population for four or more years (Matkin et al. in press). ~~Two other carcasses of killer whales were found in Prince William Sound in 1990, and one was found in 1992. One was genetically determined to be of the AT1 population (Heise et al 2003). Two of those three were confirmed as transients based on marine mammal parts found in their stomach (Matkin et al. 1994). A fifth killer whale carcass was found on Kayak Island 60 miles southeast of the sound, also with marine mammal parts in its stomach (date not reported) (Matkin et al. 1993). No other killer whale carcasses were found in the Prince William Sound region from 1983 through 1992 (Matkin et al. 1994). In addition, no strandings of killer whales were reported from Prince William Sound from 1975 to 1987 (Zimmerman 1991). In sum, these facts lead to the conclusion that the 11 whales missing since 1991 should be presumed dead, though only one whale was documented to have died.~~

~~In the AT1 group, all 11 individuals confirmed as alive after 1989 were seen nearly every year from 1990-92 (Matkin et al. 1994). The number of individuals seen in subsequent years was 8 in 1993, 5 in 1994, 11 in 1995, 9 in 1996, 6 in 1997, 8 in 1998, and 7 in 1999 (Matkin et al. 2000). Since 1993, only in 1995 was every individual whale seen in every year. However, when considering pairs of years, all 11 individuals were seen again in 1996-97, and all 11 individuals were seen again in 1998-99. Therefore, it can be concluded that no mortalities occurred between 1992 and 1998.~~

~~Using more current unpublished information, no births have occurred since 1999, and four additional individuals have not been seen for at least the past four years.~~ Additional mortalities of four older males include whale AT1 found stranded in 2000, AT13 and AT17 missing in 2002 (one of which was thought to be an AT1 carcass found in 2002), and AT14 missing in 2003. A genetically assigned AT1 stranded whale found in 2003 was probably AT14, but could also have been AT13 (Matkin et al. in press). No births have occurred in this population since 1984 and none of the missing whales have been seen since 2003 and are presumed dead. Therefore, the population size as of the summer of 20~~04~~07 is thought to be seven whales ~~(C. Matkin, North Gulf Oceanic Society, pers. comm.)~~.

Minimum Population Estimate

The abundance estimate of killer whales is a direct count of individually identifiable animals. Only 11 whales were seen between 1990 and 1999. Since then, 4 of those whales have not been seen ~~in recent years~~for four or more consecutive years, so the minimum population estimate is 7 whales (Matkin et al. in press). Fourteen years of annual effort have failed to discover any whales that had not been seen previously, so there is no reason to believe there are additional whales in the population. Therefore, this minimum population estimate may be the total population size.

Current Population Trend

The population counts have declined from a level of 22 whales in 1989 to 7 whales in 200~~6~~7, a decline of 68%. Most of the mortalities apparently occurred in 1989-90.

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). Until additional stock-specific 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 reauthorized 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~~1, ~~the value for cetacean stocks with unknown population status (Wade and Angliss 1997)~~as the stock is considered depleted under the Marine Mammal Protection Act and there has been no recruitment into the stock since 1984. Thus, for the AT1 killer whale stock, PBR = 0 animals (7 × 0.02 × 0.~~5~~1).

HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

Fisheries Information

The known range of the AT1 stock is limited to waters of Prince William Sound and Kenai Fjords. There are no federally managed commercial fisheries in this area. State managed commercial fisheries prosecuted within the range of this stock, such as the Prince William Sound salmon set and drift gillnet fisheries, and various herring fisheries, are not known to incur incidental serious injuries or mortalities of AT1 killer whales.

Subsistence/Native Harvest Information

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

Other Mortality

Collisions with boats may be an occasional source of mortality. One mortality due to a ship strike occurred in 1998, when a killer whale struck the propeller of a vessel in the Bering Sea groundfish trawl fishery. There have been no known mortalities of AT1 killer whales due to ship strikes.

STATUS OF STOCK

The AT1 Transient stock of killer whales was designated as "depleted" under the MMPA. Therefore, the AT1 Transient stock of killer whales is classified as a strategic stock. Based on currently available data, the estimated annual U. S. commercial fishery-related mortality level (0) does not exceed 10% of the PBR (0) and, therefore, can be considered to be insignificant and approaching zero mortality and serious injury rate. At least 11 animals were alive in 1998, but it appears that as of 2006, only 7 individuals ~~may be~~remain alive. Therefore, the AT1 group has been reduced to at least 50% (11/22) of its 1984 level, and has likely been reduced to 32% (7/22) of its 1984 level. The AT1 Transient stock of killer whales is not listed as "threatened" or "endangered" under the Endangered Species Act.

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

NOTE – March 2008: In areas outside of Alaska, studies have shown that stock structure is more fine-scale than is reflected in the Alaska Stock Assessment Reports. At this time, no data are available to reflect stock structure for harbor porpoise in Alaska. However, based on comparisons with other regions, smaller stocks are likely. Should new information on harbor porpoise stocks become available, the harbor porpoise Stock Assessment Reports will be updated.

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 and in the Gulf of Alaska and Southeast Alaska, they occur most frequently in waters less than 100 m in depth (Hobbs and Waite in reviewunpubl. ms). The average density of harbor porpoise in Alaska appears to be less than that reported off the west coast of the continental U.S., although areas of high densities do occur in Glacier Bay, Yakutat Bay, Copper River Delta, and Sitkalidak Strait (Dahlheim et al. 2000, Hobbs and Waite in review). 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), including 1 sample from Alaska. Two distinct mitochondrial DNA groupings or clades exist. One clade is present in California, Washington, British Columbia and the single sample from 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); these results are reinforced by a similar study in the northwest Atlantic (Westgate and Tolley 1999). Further genetic testing of the same data mentioned above along with a few additional samples, including 8 more from Alaska, found significant genetic differences for 43 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 specimens from the North Atlantic (Rosel et al. 1999). Numerous stocks have been delineated with clinal differences over areas as small as the waters surrounding the British Isles (Walton 1997). In a molecular genetic analysis of small-scale population structure of eastern North Pacific harbor porpoise, Chivers et al. (2002) included 30 samples from Alaska, 16 of which were from Copper River Delta, 5 from Barrow, 5 from southeast Alaska, and one sample each from St. Paul, Adak, Kodiak, and Kenia. 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 a single area (Copper River Delta). Accordingly, harbor porpoise stock structure in Alaska remains unknown at this time.

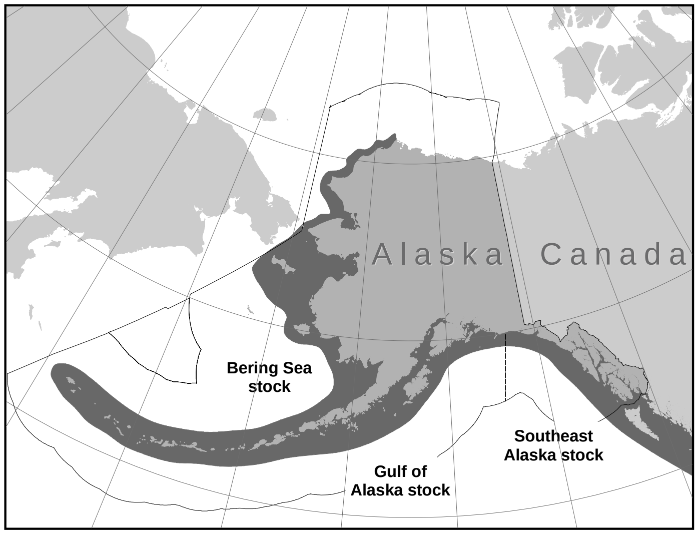

Figure 27. Approximate distribution of harbor porpoise in Alaska waters (shaded area).

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 Scientific Review Group

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). Accordingly, from the above information, three separate harbor porpoise stocks in Alaska are recommended, recognizing that the boundaries were set arbitrarily: 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. 27). Information concerning the 4 harbor porpoise stocks occurring along the west coast of the continental United States (Central California, Northern California, Oregon/Washington Coast, and Inland Washington) is in the Stock Assessment Reports for the Pacific Region.

POPULATION SIZE

In June and July of 1997, an aerial survey covering the waters of the eastern Gulf of Alaska from Dixon Entrance to Cape Suckling and offshore to the 1,000 fathom depth contour resulted in an uncorrected observed abundance estimate of 3,6983,766 (CV = 0.162) animals (Hobbs and Waite in review). Included were tThe inside waters of Southeast Alaska, Yakutat Bay, and Icy Bay were included in addition to the offshore waters. The total area surveyed across inside waters, was 106,087km^2. Only a fraction of the small bays and inlets (< 5.5 km wide) of Southeast Alaska were surveyed and included in this abundance estimate, although the areas omitted represent only a small fraction of the total survey area. The observed abundance estimate was multiplied by includes a correction factors(1.56) for availability bias (to correct for animals not available to be seen because they were diving) and perception bias (to correct for animals not seencounted because they were missednot observed) to obtain a corrected abundance estimate. Laake et al. (1997) estimated the availability bias for aerial surveys of harbor porpoise in Puget Sound to be 2.96 (CV = 0.180); the use of this correction factor is preferred to other published correction factors (e.g., Barlow et al. 1988; Calambokidis et al. 1993) because it is an empirical estimate of perceptionavailability bias. A second independent observer was used to estimate the average availabilityperception bias as 1.56 (CV = 0.108). The estimated corrected abundance from this survey is 17,07611,146 (3,6983,766 × 2.96 × 1.56; CV = 0.2650.242) harbor porpoise for Southeast Alaska.

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 17,07611,146 and its associated CV (0.2650.242), N_{MIN} for this stock is 13,7139,116 (Hobbs and Waite, unpubl. ms).

Current Population Trend

The abundance of harbor porpoise in Southeast Alaska was estimated for 1993 and 1997. The 1993 estimate was 10,301 (Dahlheim et al. 2000). The 1997 estimate of 17,07611,146 is higher than nearly the same as the 1993 estimate (Hobbs and Waite in review). However, these estimates are not directly comparable because the area surveyed in 1997 was larger than that in 1993, and because the 1997 abundance estimation involved direct calculation of perception bias, while the 1993 estimate used a correction factor based on some untested assumptions about observer behavior and visibility of harbor porpoise. Thus, while the estimates are not significantly different, 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 reauthorized 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, using the abundance estimate calculated from 1997 surveys, the PBR for the Southeast Alaska stock of harbor porpoise, PBR = 13791 would be calculated to be 91 animals (13,7139,116× 0.02 × 0.5). However, the 2005 revisions to the SAR guidelines (NMFS 2005) state that abundance estimates older than 8 years should not be used to calculate PBR due to a decline in confidence in the reliability of an aged abundance estimate. Therefore, the PBR for this stock is considered undetermined. Recent survey data are currently being analyzed, and a new abundance estimate and PBR for this stock will be available in the 2009 SARs.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

Fisheries Information

Until 2003, there were three different federally-regulated commercial fisheries in Alaska that could have interacted with the Southeast Alaska stock of harbor porpoise. As of 2003, changes in fishery definitions in the List of Fisheries resulted in separating the GOA groundfish fisheries into many fisheries (69 FR 70094, 2 December 2004). This change does not represent a change in fishing effort, but provides managers with better information on the component of each fishery that is responsible for the incidental serious injury or mortality of marine mammal stocks in Alaska. These fisheries (Pacific cod longline, Pacific halibut longline, rockfish longline, and sablefish longline) were monitored for incidental mortality by fishery observers from 20002 to 20046, although observer coverage has been very low (average percent annual observer coverage for the 2002-2006 period ranged between 3.4-12.6 for these 4 fisheries) in the offshore waters of Southeast Alaska. No mortalities from this stock of harbor porpoise incidental to commercial groundfish fisheries have been observed.

For this stock of harbor porpoise, the estimated minimum annual mortality rate incidental to commercial fisheries is 0. 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.

Subsistence/Native Harvest Information

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

Other mortality

There was an unconfirmed report of an entanglement of a harbor porpoise in a subsistence drift gillnet near Haines in 2001.

STATUS OF STOCK

Harbor porpoise are not listed as "depleted" under the MMPA or listed as "threatened" or "endangered" under the Endangered Species Act. At present, U.S. commercial fishery-related annual mortality levels less than 13.79.1 animals per year (i.e., 10% of PBR) can be considered insignificant and approaching zero mortality and serious injury rate. Based on the best scientific information available, tThe estimated level of human-caused mortality and serious injury (0) is not known to exceed the PBR (13791). However, bBecause the abundance estimates are quite10 years old, long-term survey information suggests a decline in the Southeast Alaska population, and information on the frequency of incidental harbor porpoise mortality in commercial fisheries is not well known, the Southeast Alaska stock of harbor porpoise is classified as a strategic stock. Population trends and status of this stock relative to OSP are currently unknown.

HABITAT CONCERNS

Most harbor porpoise are found in waters less than 100m in depth and often concentrate in near-shore areas, bays, tidal areas and river mouths. As a result, harbor porpoise are more vulnerable to NEARSHORE physical habitat modifications resulting from urban and industrial development, including waste management, nonpoint source runoff; and physical habitat modifications including construction of docks and other over water structures, filling of shallow areas and dredging.

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Revised 5/15/063/31/2008

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

NOTE – March 2008: In areas outside of Alaska, studies have shown that stock structure is more fine-scale than is reflected in the Alaska Stock Assessment Reports. At this time, no data are available to reflect stock structure for harbor porpoise in Alaska. However, based on comparisons with other regions, smaller stocks are likely. Should new information on harbor porpoise stocks become available, the harbor porpoise Stock Assessment Reports will be updated.

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 and in the Gulf of Alaska and Southeast Alaska, they occur most frequently in waters less than 100 m in depth (Hobbs and Waite in reviewunpubl. ms). The average density of harbor porpoise in Alaska appears to be less than that reported off the west coast of the continental U.S., although areas of high densities do occur in Glacier Bay, Yakutat Bay, Copper River Delta, and Sitkalidak Strait (Dahlheim et al. 2000, Hobbs and Waite in review). 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), including 1 sample from Alaska. Two distinct mitochondrial DNA groupings or clades exist. One clade is present in California, Washington, British Columbia and the single sample from 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); these results are reinforced by a similar study in the northwest Atlantic (Westgate and Tolley 1999). Further genetic testing of the same data mentioned above along with a few additional samples, including 8 more from Alaska, found significant genetic differences for 43 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 specimens from the North Atlantic (Rosel et al. 1999). Numerous stocks have been delineated with clinal differences over areas as small as the waters surrounding the British Isles (Walton 1997). In a molecular genetic analysis of small-scale population structure of eastern North Pacific harbor porpoise, Chivers et al. (2002) included 30 samples from Alaska, 16 of which were from Copper River Delta, 5 from Barrow, 5 from southeast Alaska, and one sample each from St. Paul, Adak, Kodiak, and Kenia. 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 a single area (Copper River Delta). Accordingly, harbor porpoise stock structure in Alaska remains unknown at this time.

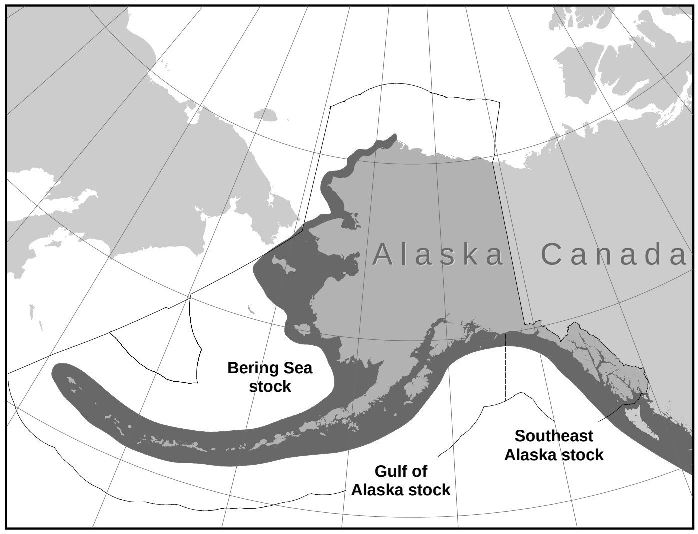

Figure 27. Approximate distribution of harbor porpoise in Alaska waters (shaded area).

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 Scientific Review Group

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). Accordingly, from the above information, three separate harbor porpoise stocks in Alaska are recommended, recognizing that the boundaries were set arbitrarily: 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. 28). Information concerning the four harbor porpoise stocks occurring along the west coast of the continental United States (Central California, Northern California, Oregon/Washington Coast, and Inland Washington) is in the Stock Assessment Reports for the Pacific Region.

POPULATION SIZE

In June and July of 1998 an aerial survey covering the waters of the western Gulf of Alaska from Cape Suckling to Sutwik Island, offshore to the 1,000 fathom depth contour resulted in an uncorrected abundance estimate for the Gulf of Alaska harbor porpoise stock of 10,~~306~~489 (CV = 0.115) animals (Hobbs and Waite in review). The ~~uncorrected~~ observed abundance estimate ~~was multiplied by~~ includes a correction factor~~s~~ (1.372; CV = 0.066) for ~~availability bias (to correct for animals not available to be seen because they were diving) and~~ perception bias ~~(~~to correct for animals not ~~seen~~counted because they were ~~missed)~~not observed~~ to obtain a corrected abundance estimate~~. Laake et al. (1997) estimated the availability bias for aerial surveys of harbor porpoise in Puget Sound to be 2.96 (CV = 0.180); the use of this correction factor is preferred to other published correction factors (e.g., Barlow et al. 1988; Calambokidis et al. 1993) because it is an empirical estimate of availability bias. ~~A second independent observer was used to estimate the average perception bias as 1.372 (CV = 0.066).~~ The estimated corrected abundance estimate from this survey is ~~41,854~~31,046 (10,~~306~~489 × 2.96 ~~× 1.372~~ = ~~41,854~~31,046; CV = 0.2~~2~~14).

Th~~e~~is latest estimate of abundance ~~(41,854~~31,046~~; CV = 0.2~~2~~14) is based on surveys conducted in 1998, and~~ is considerably higher than the ~~previous~~estimate - based on surveys in 1991 to 1993 - in the 1999 stock assessment (8,271; CV = 0.309). This disparity largely stems from changes in the area covered by the two surveys and differences in harbor porpoise density encountered in areas added to, or dropped from, the 1998 survey, relative to the 1991-93 surveys. The survey area in 1998 (119,183 km^2) was greater than the area covered in the composited portions of the 1991, 1992, and 1993 surveys (106,600 km^2). The 1998 survey included the waters of Prince William Sound, the bays, channels, and inlets of the Kenai Peninsula, the Alaska Peninsula, and Kodiak Archipelago whereas the earlier survey included only open water areas. Several of the bays and inlets covered by the 1998 survey had higher harbor porpoise densities than observed in the open waters. In addition, the 1998 estimate provided by Hobbs and Waite (in review) empirically estimates the perception bias, and use this in addition to the correction factor for availability bias. ~~And f~~Finally, the 1998 estimate extrapolates available densities to estimate the number of porpoise which would likely be found in unsurveyed inlets within the study area. The 1998 survey result is probably more representative of the size of the Gulf of Alaska harbor porpoise stock since it included more of the inshore habitat commonly used by harbor porpoise.

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 ~~41,854~~31,046 and its associated CV of 0.2~~2~~14, N_{MIN} for the Gulf of Alaska stock of harbor porpoise is ~~34,740~~25,987.

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 reauthorized 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, using the abundance estimate calculated from 1998 surveys, the PBR for the Gulf of Alaska stock of harbor porpoise would be calculated to be 260 PBR = 347260 animals (34,74025,987 × 0.02 × 0.5). However, the 2005 revisions to the SAR guidelines (NMFS 2005) state that abundance estimates older than 8 years should not be used to calculate PBR due to a decline in confidence in the reliability of an aged abundance estimate. Therefore, the PBR for this stock is considered undetermined.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

Fisheries Information

Prior to 2003, 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: Gulf of Alaska groundfish trawl, longline, and pot fisheries. As of 2003, changes in fishery definitions in the List of Fisheries resulted in separating these 3 GOA fisheries into 10 fisheries (69 FR 70094, 2 December 2004). This change does not represent a change in fishing effort, but provides managers with better information on the component of each fishery that is responsible for the incidental serious injury or mortality of marine mammal stocks in Alaska. 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 one mortality in 1990 and three 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). The Prince William Sound salmon drift gillnet fishery has not been observed since 1991; therefore, no additional data are available for that fishery.

In 1999 and 2000, observers were placed on the Cook Inlet salmon set and drift gillnet vessels because of the potential for these fisheries to incur incidental mortalities of beluga whales. One harbor porpoise mortality was observed in 2000 (Manly in review). This single mortality extrapolates to an estimated mortality level of 31.2 for that year, and an average of 15.6 per year when averaged over the two years of observer data.

In 2002 and 2005, observers were placed on Kodiak Island set gillnet vessels. Two harbor porpoise mortalities were observed in both 2002 and 2005 in this fishery. These mortalities extrapolate to an estimated mortality level of 32.2 35.8 animals per year (Manly et al. 2003Manly 2007).

Table 30. Summary of incidental mortality of harbor porpoise (Gulf of Alaska stock) due to fisheries from 1990 through 20045 and calculation of the mean annual mortality rate. N/A indicates that data were not available.

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	1990-1991	obs data	4-5%	1, 3	8, 32	20 (CV = 0.60)
Cook Inlet salmon drift gillnet	1999 2000	obs data	1.8% 3.7%	0 1	0 31.2	15.6
Cook Inlet salmon set gillnet	1999 2000	obs data	7.3% 8.3%	0 0	0 0	0
Kodiak Island set gillnet	2002 2005	obs data	6.0% 4.9%	2 2	32.2 39.4	32.235.8 (CV = 0.68)
Minimum total annual mortality						67.871.4

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 30. There were no confirmed reports of strandings of harbor porpoise in this area from 1999-2003.

A reliable estimate of the mortality rate incidental to commercial fisheries is considered unavailable because of the absence of observer placements in several salmon gillnet fisheries. However, the estimated minimum annual mortality rate incidental to U. S. commercial fisheries is 68 (Table 30).

Subsistence/Native Harvest Information

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

Other Mortality

In 1995, two harbor porpoise were taken incidentally in subsistence gillnets, one near Homer Spit and the other near Port Graham.

STATUS OF STOCK

Harbor porpoise are not listed as "depleted" under the MMPA or listed as "threatened" or "endangered" under the Endangered Species Act. At present, U.S. commercial fishery-related annual mortality levels less than ~~34.7~~26 animals per year (i.e., 10% of PBR) can be considered insignificant and approaching zero mortality and serious injury rate. ~~Based on the best scientific information available, t~~The estimated level of human-caused mortality and serious injury (~~70~~73; ~~68~~71 mortalities in commercial fisheries plus 2 in subsistence gillnets) ~~is~~does not ~~known to~~ exceed the PBR (~~347~~260). However, because the abundance estimates are ~~quite~~ 10 years old and information on incidental harbor porpoise mortality in commercial fisheries is not well understood, the Gulf of Alaska stock of harbor porpoise is classified as a strategic stock. Population trends and status of this stock relative to OSP are currently unknown.

HABITAT CONCERNS

Most harbor porpoise are found in waters less than 100m in depth and often concentrate in near-shore areas, bays, tidal areas and river mouths. As a result, harbor porpoise are more vulnerable to NEARSHORE physical habitat modifications resulting from urban and industrial development, including waste management, nonpoint source runoff; and physical habitat modifications including construction of docks and other over water structures, filling of shallow areas and dredging.

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

NOTE – March 2008: In areas outside of Alaska, studies have shown that stock structure is more fine-scale than is reflected in the Alaska Stock Assessment Reports. At this time, no data are available to reflect stock structure for harbor porpoise in Alaska. However, based on comparisons with other regions, smaller stocks are likely. Should new information on harbor porpoise stocks become available, the harbor porpoise Stock Assessment Reports will be updated.

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 and in the Gulf of Alaska and Southeast Alaska, they occur most frequently in waters less than 100 m in depth (Hobbs and Waite in reviewunpubl. ms). The average density of harbor porpoise in Alaska appears to be less than that reported off the west coast of the continental U.S., although areas of high densities do occur in Glacier Bay, Yakutat Bay, Copper River Delta, and Sitkalidak Strait (Dahlheim et al. 2000, Hobbs and Waite in review). 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), including 1 sample from Alaska. Two distinct mitochondrial DNA groupings or clades exist. One clade is present in California, Washington, British Columbia and the single sample from 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); these results are reinforced by a similar study in the northwest Atlantic (Westgate and Tolley 1999). Further genetic testing of the same data mentioned above along with a few additional samples, including 8 more from Alaska, found significant genetic differences for 43 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 specimens from the North Atlantic (Rosel et al. 1999). Numerous stocks have been delineated with clinal differences over areas as small as the waters surrounding the British Isles (Walton 1997). In a molecular genetic analysis of small-scale population structure of eastern North Pacific harbor porpoise, Chivers et al. (2002) included 30 samples from Alaska, 16 of which were from Copper River Delta, 5 from Barrow, 5 from southeast Alaska, and one sample each from St. Paul, Adak, Kodiak, and Kenia. 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 a single area (Copper River Delta). Accordingly, harbor porpoise stock structure in Alaska remains unknown at this time.

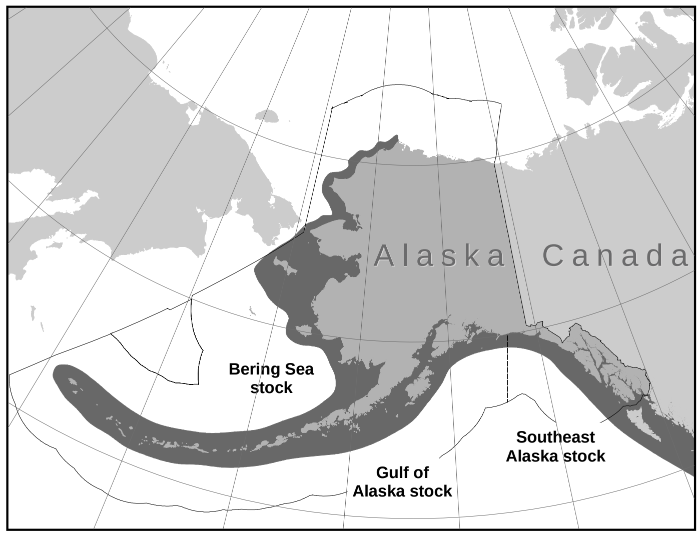

Figure 27. Approximate distribution of harbor porpoise in Alaska waters (shaded area).

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 Scientific Review Group

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). Accordingly, from the above information, three separate harbor porpoise stocks in Alaska are recommended, recognizing that the boundaries were set arbitrarily: 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. 29). Information concerning the ~~four~~six harbor porpoise stocks occurring along the west coast of the continental United States (Central California, Northern California, Oregon/Washington Coast, and Inland Washington) is in the Stock Assessment Reports for the Pacific Region.

POPULATION SIZE

In June and July of 1999, an aerial survey covering the waters of Bristol Bay resulted in an ~~uncorrected~~ observed abundance estimate for the Bering Sea harbor porpoise stock of ~~16,271~~16,289 (CV = 0.132; Hobbs and Waite unpubl. ms). The ~~uncorrected~~observed abundance estimate ~~was multiplied by~~includes a correction factor~~s~~ (1.337; CV = 0.062) for ~~availability bias (to correct for animals not available to be seen because they were diving) and~~ perception bias ~~(~~to correct for animals not ~~seen~~counted because they were ~~missed~~not observed~~) to obtain a corrected abundance estimate~~. Laake et al. (1997) estimated the availability bias for aerial surveys of harbor porpoise in Puget Sound to be 2.96 (CV = 0.180); the use of this correction factor is preferred to other published correction factors (e.g., Barlow et al. 1988; Calambokidis et al. 1993) because it is an empirical estimate of availability bias. ~~A second independent observer was used to estimate the average perception bias as 1.372 (CV = 0.066).~~ The estimated corrected abundance estimate is ~~66,078~~48,215 (~~16,271~~16,289 × 2.96 ~~× 1.372~~ = ~~66,078~~48,215; CV = 0.~~232~~223). The estimate for 1999 can be considered conservative, as the surveyed areas did not include known harbor porpoise range near either the Pribilof Islands or in the waters north of Cape Newenham (approximately 59°N).

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 ~~66,078~~48,215 and its associated CV of 0.~~232~~223), N_{MIN} for the Bering Sea stock of harbor porpoise is ~~54,492~~40,039.

Current Population Trend

The abundance of harbor porpoise in Bristol Bay was estimated in 1991 and 1999. The 1991 estimate was 10,946 (Dahlheim et al. 2000). The 1999 estimate of ~~66,078~~48,215 is higher than the 1991 estimate (Hobbs and Waite in review). However, there are some key differences between surveys which complicate direct comparisons. Transect lines were substantially more dense in 1999 than in 1991 and large numbers of porpoise were observed in 1999 in an area which was not surveyed intensely in 1991 (compare sightings in northeast Bristol Bay depicted in Figure 5 in Hobbs and Waite (in review) with Figure 4 in Dahlheim et al. 2000). In addition, the use of a second correction factor for the 1999 estimate confounds direct comparison. The density of harbor porpoise resulting from the 1999 surveys was still substantially higher than that reported in Dahlheim et al. (2000), but it is unknown whether the increase in density is a result of a population increase or is a result of survey design. Thus, 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 reauthorized 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, using the abundance estimate calculated from 1999 surveys, the PBR for the Bering Sea stock of harbor porpoise~~, PBR = 545400~~ would be calculated to be 400 animals (~~54,492~~40,039 × 0.02 × 0.5). However, the 2005 revisions to the SAR guidelines

(NMFS 2005) state that abundance estimates older than 8 years should not be used to calculate PBR due to a decline in confidence in the reliability of an aged abundance estimate. Therefore, the PBR for this stock is considered undetermined.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

Fisheries Information

Prior to 2003, 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 1990-98: Bering Sea (and Aleutian Islands) groundfish trawl, longline, and pot fisheries. As of 2003, changes in fishery definitions in the List of Fisheries resulted in separating these fisheries into 12 fisheries (69 FR 70094, 2 December 2004). This change does not represent a change in fishing effort, but provides managers with better information on the component of each fishery that is responsible for the incidental serious injury or mortality of marine mammal stocks in Alaska. One harbor porpoise mortality was observed in 2001 in the Bering Sea/Aleutian Islands flatfish trawl. No harbor porpoise mortalities have been observed during the 2002-2006 period. Therefore, ~~T~~the mean annual (total) mortality rate resulting from observed mortalities was 0~~.35 (CV = 0.65)~~.

Table 31. Summary of incidental mortality of harbor porpoise (Bering Sea stock) due to commercial fisheries from 200~~0~~2 through 200~~4~~6 and calculation of the mean annual mortality rate.

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. (BSAI) flatfish trawl	~~2000~~	obs data	~~64.5~~	~~0~~	~~0~~	~~0.35~~0 ~~(CV = 0.65)~~
	~~2001~~		~~57.6~~	~~1~~	~~1.7~~	
	2002		58.4	0	0	
	2003		64.1	0	0	
	2004		64.3	0	0	
	2005		68.3	0	0	
	2006		67.8	0	0	
Minimum total annual mortality						~~0.35~~0 ~~(CV = 0.65)~~

The estimated minimum annual mortality rate incidental to commercial fisheries is 0~~.35~~ animals (Table 31). However, a reliable estimate of the mortality rate incidental to commercial fisheries is currently unavailable because of the absence of observer placements in several salmon gillnet fisheries. Therefore, it is unknown whether the kill rate is insignificant.

Subsistence/Native Harvest Information

Subsistence hunters in Alaska ~~have not been reported~~ are known to occasionally take from this stock of harbor porpoise. Bee and Hall (1956) reported on two entanglements in subsistence nets in Elson Lagoon in 1952. Subsistence fishermen in Barrow state that it is not uncommon for one or two porpoises to be caught each summer (Suydam & George 1992). In 1991, pack ice may have contributed to the relatively high number (4) of porpoises caught in subsistence nets (Suydam & George 1992).

Other Mortality

There have been historic reports of harbor porpoise mortalities in subsistence gillnets in the area from Nome to Unalakleet (Barlow et al. 1994) and near Point Barrow (Suydam and George 1992). The only reports received between 1999 and 2003 were an unconfirmed report of a subsistence entanglement of two animals near Elim, and a third confirmed report of an entangled animal near Emmonak.

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. At present, U.S. commercial fishery-related annual mortality levels less than

~~54.5~~40 animals per year (i.e., 10% of PBR) can be considered insignificant and approaching zero mortality and serious injury rate. ~~Based on the best scientific information available, t~~The estimated level of human-caused mortality and serious injury (0~~.35~~) ~~is~~does not ~~known to~~ exceed the PBR (~~545~~400). However, because the abundance estimates are ~~quite~~10 years old and information on incidental mortality in commercial fisheries is ~~not well understood~~sparse, the Bering Sea stock of harbor porpoise is classified as a strategic stock. Population trends and status of this stock relative to OSP are currently unknown.

HABITAT CONCERNS

Most harbor porpoise are found in waters less than 100m in depth and often concentrate in near-shore areas, bays, tidal areas and river mouths. As a result, harbor porpoise are more vulnerable to NEARSHORE physical habitat modifications resulting from urban and industrial development, including waste management, nonpoint source runoff; and physical habitat modifications including construction of docks and other over water structures, filling of shallow areas and dredging.

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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 also take substantial quantities of large demersal and mesopelagic sharks, skates, and fishes (Rice 1989). In the North Pacific, sperm whales are distributed widely (Fig. 31), with the northernmost boundary extending from Cape Navarin (62°N) to the Pribilof Islands (Omura 1955). 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 (Kasuya and Miyashita 1988). Sightings surveys conducted by NMML in the summer months between 2001 and 2006 have found sperm whales to be the most frequently sighted large cetacean in the coastal waters around the central and western Aleutian Islands (NMML unpublished data). Acoustic surveys detected the presence of sperm whales year-round in the Gulf of Alaska although they appear to be more common in summer than in winter (Mellinger et al. 2004). These seasonal detections are consistent with the hypothesis that sperm whales migrate to higher latitudes in summer and migrate to lower latitudes in winter (Whitehead and Arnbom 1987).

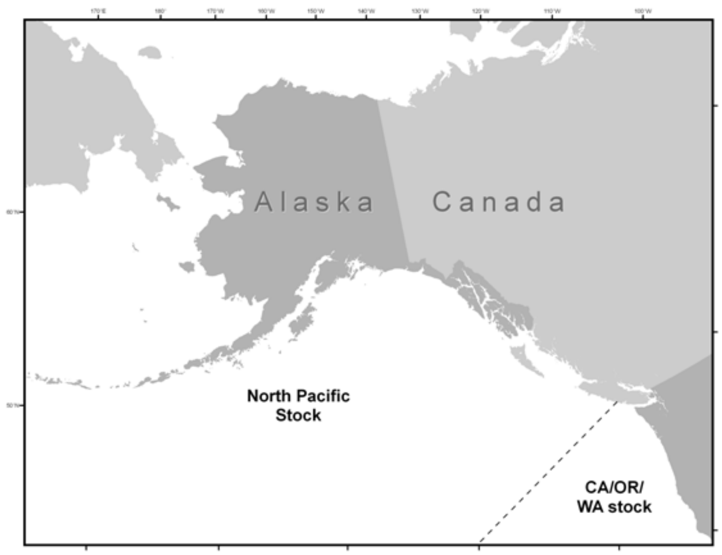

Figure 31. Approximate distribution of sperm whales in the north Pacific includes deep waters south of 62°N to the equator.

Discovery Mark data from the days of commercial whaling (270 recoveries) show extensive movements from U.S. and Canadian coastal waters into the Gulf of Alaska and Bering Sea (Omura and Ohsumi 1964; Ivashin and Rovnin 1967; Ohsumi and Masaki 1975; Wada 1980; Kasuya and Miyashita 1988. Rice (AFSC-NMML, retired, pers. comm.) marked 176 sperm whales during U.S. cruises from 1962-1970, mostly between 32° and 36° N off the California coast. Seven of those marked whales ~~were recovered and the recovery~~ in locations rang~~ed~~ing from offshore California, Oregon, British Columbia waters to the western Gulf of Alaska. A whale marked by Canadian researchers moved from near Vancouver Island, British Columbia to the Aleutian Islands near Adak. A whale marked by Japanese researchers moved from the Bering Sea just north of the Aleutians to waters off Vancouver Island, British Columbia. Based on these data, there appear~~s~~ to be movements along the U.S. west coast into the Gulf of Alaska and Bering Sea/Aleutian Islands region (BSAI).

The following information was considered in classifying stock structure based on the Dizon et al. (1992) phylogeographic approach: 1) Distributional data: geographic distribution continuous though data indicate three “somewhat” discrete population centers (i.e., Hawaii, west coast of the continental United States, 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. 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).

Although Kato and Miyashita (1998) believe their estimate to be upwardly biased, their preliminary analysis indicates 102,112 (CV = 0.155) sperm whales in the western North Pacific. 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 over 8 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 a current estimate of abundance is not available.

Current Population Trend

Reliable information on trends in abundance for this stock is 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 reauthorized 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

~~In previous stock assessments, there were six commercial fisheries monitored by federal observers in Alaska that could have had incidental serious injuries or mortalities of sperm whales. In 2004, the definitions of these commercial fisheries were changed to reflect target species: these new definitions have resulted in the identification of 22 observed fisheries in the Gulf of Alaska and Bering Sea that use trawl, longline, or pot gear (69 FR 70094, 2 December 2004). Of these, there is at least one fishery that has incurred incidental serious injuries or mortalities of sperm whales, the Gulf of Alaska sablefish longline fishery. However, since 2001 there have been no observed mortalities in federally observed Alaska fisheries and therefore the minimum estimated annual mortality rate incidental to U.S. commercial fisheries is zero (Perez in prep).~~

Between 2002 and 2006, there were three observed serious injuries of sperm whales in the Gulf of Alaska sablefish longline fishery (Table xx). Each animal was designated as seriously injured because it became caught in the gear, and was released alive with trailing gear. Estimates of marine mammal serious injury/mortality in observed fisheries are provided in Perez (unpubl. ms.).

Table xx. Summary of incidental mortality of sperm whales due to commercial fisheries and calculation of the mean annual mortality rate. Mean annual takes are based on 2002-2006 data. Details of how percent observer coverage is measured is included in Appendix 6.

Fishery name	**Years**	**Data type**	**Percent observer coverage**	**Observed mortality**	**Estimated mortality**	**Mean annual takes (CV in parentheses)**
GOA sablefish longline	2002 2003 2004 2005 2006	obs data	 11.2	0 0 0 0 3	0 0 0 0 10	2.01 (CV = 0.49)
Estimated total annual takes						2.01 (CV = 0.49)

Subsistence/Native Harvest Information

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

Other Mortality

Sperm whales were the dominant species killed by the commercial whaling industry as it developed in the North Pacific in the years after the second World War (Mizroch and Rice 2006). Between 1946 and 1967, most of the sperm whales were caught in waters near Japan and in the Bering Sea/Aleutian Islands (BSAI) region. The BSAI catches were dominated by males. After 1967, whalers moved out of the BSAI region and began to catch even larger numbers of sperm whales further south in the North Pacific between 30° and 50° N (Mizroch and Rice 2006, Figs. 7-9). The reported catch of sperm whales taken by commercial whalers operating in the North Pacific between 192~~5~~4 and 1987 was 260,~~285~~583 sperm whales, of which, 258,~~829~~905 were taken between 1946 and ~~1987~~2005 (International Whaling Commission, BIWS catch data, ~~February 2003~~January 2007 version, unpublished). This value underestimates the actual kill in the North Pacific as a result of under-reporting by U.S.S.R. pelagic whaling operations. Brownell et al. (2000) estimated that the U.S.S.R. under-reported catches during 1949-71 by as much as 60%. In addition, new information suggests that Japanese land-based whaling operations also under-reported sperm whale catches during the post-World War II era (Kasuya 1999). The last year that the U.S.S.R reported catches of sperm whales was in 1979 and the last year that Japan reported substantial catches was in 1987, but Japanese whalers reported catches of 36 sperm whales between 2000 and 2005 (International Whaling Commission, BIWS catch data, ~~February 2003~~January 2007 version, unpublished).

Other Issues

NMFS observers aboard longline vessels targeting both sablefish and halibut have documented sperm whales feeding off longline gear in the Gulf of Alaska (Hill and Mitchell 1998, Hill et al., 1999, Perez 2006, Sigler et al. 2008). Fishery observers recorded several instances during 1995-97 in which sperm whales were deterred by fishermen (i.e., yelling at the whales or throwing seal bombs in the water).

Annual longline surveys have been recording sperm whale predation on catch since 1998 (Sigler et al. 2003). Between 1989 and 2003, sperm whale predation on catch has occurred at 38 of the surveyed stations: all events were located in the Gulf of Alaska and none were located in the Bering Sea. The sablefish catch at the stations where predation occurs is lower than at those stations where no predation occurred. Undamaged catches may also occur when sperm whales are present; in these cases, sperm whales apparently feed off the discard. Observer records document that predation on catch is widespread in the Gulf of Alaska (Perez 2006).

STATUS OF STOCK

Sperm whales are listed as “endangered” under the Endangered Species Act of 1973, and therefore designated as “depleted” under the MMPA. As a result, this stock is 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 (Braham 1992). Reliable estimates of the minimum population, population trends, PBR, and status of the stock relative to its Optimum Sustainable Population size are currently not available, although the estimated annual rate of human-caused mortality and serious injury seems minimal for this stock. Because the PBR is unknown, the level of annual U.S. commercial fishery-related mortality that can be considered insignificant and approaching zero mortality and serious injury rate is unknown.

HABITAT CONCERNS

There are no known habitat issues that are of particular concern for this stock.

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~~**NOTE - March 2007: The section entitled "Status of Stock" was updated in this SARs in 2007; other sections of the SAR will be reviewed and updated in 2008.**~~

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

STOCK DEFINITION AND GEOGRAPHIC RANGE

Gray whales formerly occurred in the North Atlantic Ocean (Fraser 1970, Mead and Mitchell 1984), but this species is currently found only in the North Pacific (Rice et al. 1984, Swartz et al. 2006). The following information was considered in classifying stock structure of gray whales based on the phylogeographic approach of Dizon et al. (1992): 1) Distributional data: two isolated geographic distributions in the North Pacific Ocean; 2) Population response data: the eastern North Pacific population has increased, and no evident increase 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 North Pacific stock, which lives along the west coast of North America (Fig. 35), and the Western North Pacific or "Korean" stock, which lives along the coast of eastern Asia (Rice 1981, Rice et al. 1984, Swartz et al. 2006).

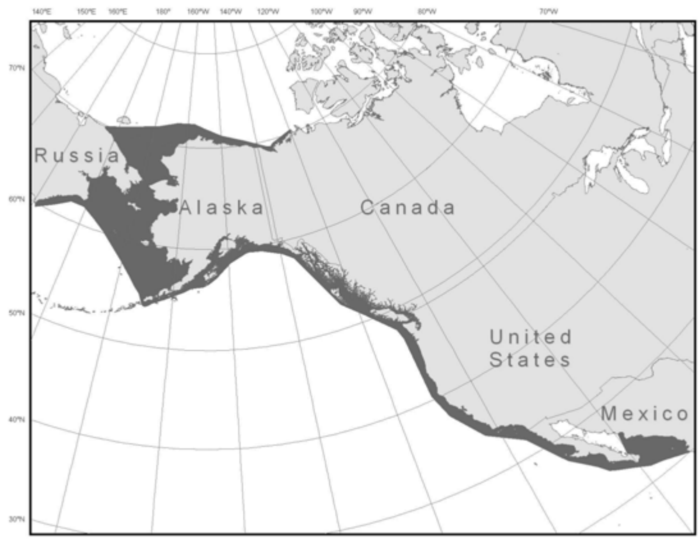

Figure 35. Approximate distribution of the Eastern North Pacific stock of gray whales (shaded area).

Most of the Eastern North Pacific stock spends the summer feeding in the northern and western Bering and Chukchi Seas (Rice and Wolman 1971, Berzin 1984, Nerini 1984). However, gray whales have been reported feeding in the summer in waters ~~off of~~near Kodiak Island, Southeast Alaska, British Columbia, Washington, Oregon, and California (Rice and Wolman 1971, Darling 1984, Nerini 1984, Rice et al. 1984, Moore et al. 2007). Photo-identification studies of these animals indicate that they move widely within and between areas on the Pacific coast, are not always observed in the same area each year, and may have several year gaps between resightings in studied areas (Calambokidis and Quan 1999, Quan 2000, Calambokidis et al. 2002). The so-called "Pacific coast feeding aggregation" defines one of the areas where feeding groups occur. While some animals in this group demonstrate some site-fidelity, available information from sighting records (Calambokidis and Quan 1999, Quan 2000) and genetics (Ramakrishnan et al. 2001, Steeves 1998) indicates that this group is a component of the eastern North Pacific population and is not an isolated population unit. Each fall, the whales migrate south along the coast of North America from Alaska to Baja California, in Mexico (Rice and Wolman 1971), most of them starting in November or December (Rugh et al. 2001). The Eastern North Pacific stock winters mainly along the west coast of Baja California, using certain shallow, nearly landlocked lagoons and bays, and calves are born from early January to mid-February (Rice et al. 1981), often seen on the migration well north of Mexico (Shelden et al. 2004). The northbound migration generally begins in mid-February and continues through May (Rice et al. 1981, 1984; Poole 1984a), with cows and newborn calves migrating northward primarily between March and June along the U.S. West Coast.

~~While most North Pacific gray whales spend the summer in the shallow waters of the northern and western Bering Sea and Arctic Ocean, some animals feed along the Pacific coast. Photo-identification studies of these animals indicate that they move widely within and between areas on the Pacific coast, are not always observed in the same area each year, and may have several year gaps between resightings in studied areas (Calambokidis and Quan 1999, Quan 2000, Calambokidis et al. 2002). The so-called "Pacific coast feeding aggregation" defines one of the areas where feeding groups occur. While some animals in this group demonstrate some site-fidelity, available~~

~~information from sighting records (Calambokidis and Quan 1999, Quan 2000) and genetics (Ramakrishnan et al. 2001, Steeves 1998) indicates that this group is a component of the eastern North Pacific population and is not an isolated population unit.~~

POPULATION SIZE

Systematic counts of gray whales migrating south along the central California coast have been conducted by shore-based observers at Granite Canyon most years since 1967 (Fig. 36). The most recent abundance estimates are based on counts made during the 1997/98, 2000/01, and 2001/02 southbound migrations. Analyses of these data resulted in abundance estimates of 29,758 for 1997/98, 19,448 for 2000/01, and 18,178 for 2001/02 (Rugh et al. 2005). ~~Recent~~Prior estimates were: 22,263 (CV = 9.25%) whales in 1995/96 (Hobbs et al. 2004), 23,109 (CV = 5.42%) whales in 1993/94 (Laake et al. 1994) and 21,296 (CV = 6.05%) whales in 1987/88 (Buckland et al. 1993). Variations in estimates may be due in part to undocumented sampling variation or to differences in the proportion of the gray whale stock migrating as far as the central California coast each year (Hobbs and Rugh 1999). The decline in the 2000/01 and 2001/02 abundance estimates may be an indication that the abundance was responding to environmental limitations as the population approaches the carrying capacity of its environment. Low encounter rates in 2000/01 and 2001/02 may have been due to an unusually high number of whales that did not migrate as far south as Granite Canyon or the abundance may have actually declined following high mortality rates observed in 1999 and 2000 (Gulland et al. 2005, Fig. 37). Visibly emaciated whales (LeBoeuf et al. 2000; Moore et al. 2001) suggest a decline in food resources, perhaps associated with unusually high sea temperatures in 1997 (Minobe 2002). Several factors since this mortality event suggest that the high mortality rate was a short-term, acute event and not a chronic situation or trend: 1) counts of stranded dead gray whales dropped to levels below those seen prior to this event, 2) in 2001 living whales no longer appeared to be emaciated, and 3) calf counts in 2001/02, a year after the event ended, were similar to averages for previous years (W. Perryman, NMFS-SWFSC, pers. comm.; Rugh et al. 2005).

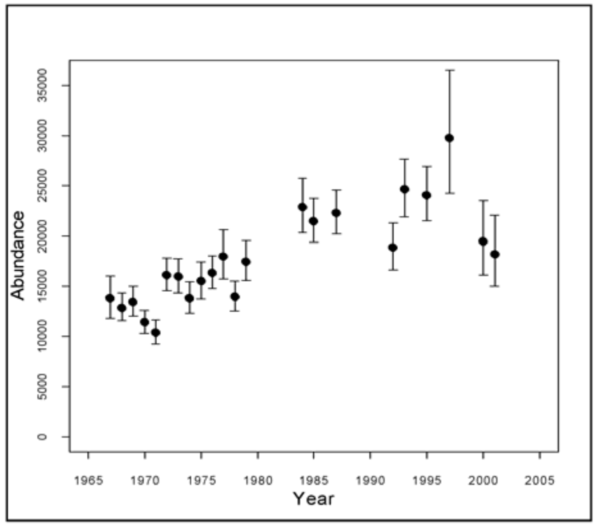

Figure 36. Estimated abundance of Eastern North Pacific gray whales from NMFS counts of migrating whales past Granite Canyon, California. Error bars indicate 95% log-normal CI (after Rugh et al. 2005).

Gray whale calves were counted from Piedras Blancas, a shore site in central California, in 1980-81 (Poole 1984a) and each year since 1994 (Perryman et al. 2002, 2004). In 1980 and 1981, calves passing this site comprised 4.7% to 5.2% of the population (Poole 1984b). From 1994-2000, calf production indices (calf estimate/total population estimate) were 4.2%, 2.7%, 4.8%, 5.8%, 5.5%, 1.7% and 1.1%, respectively (Perryman et al. 2002), and in 2004 the index was 9% (Perryman et al. 2004). Gray whale calves have also been counted from ~~the~~ shore stations along the California coast ~~at Granite Canyon~~ during the southbound migration (Shelden et al. 2004~~1995, Shelden and Rugh 2001~~). Those results have indicated ~~an apparent increase in the percentage of calf sightings from 0.0%-0.2% during 1952-74, 0.1%-0.9% during 1984-95~~ significant increases in average annual calf counts near San Diego in the mid- to late-1970s compared to the 1950s and 1960s, and near Carmel in the mid-1980s through 2002 compared to late-1960s through 1980 (Shelden et al. ~~1995~~2004~~), and 0.3%-1.5% during 1996-2001 (Shelden and Rugh 2001~~). This increase may be related to a trend toward later migrations over the observation period (Rugh et al. 2001, Buckland and Breiwick 2002), or it may be due to an

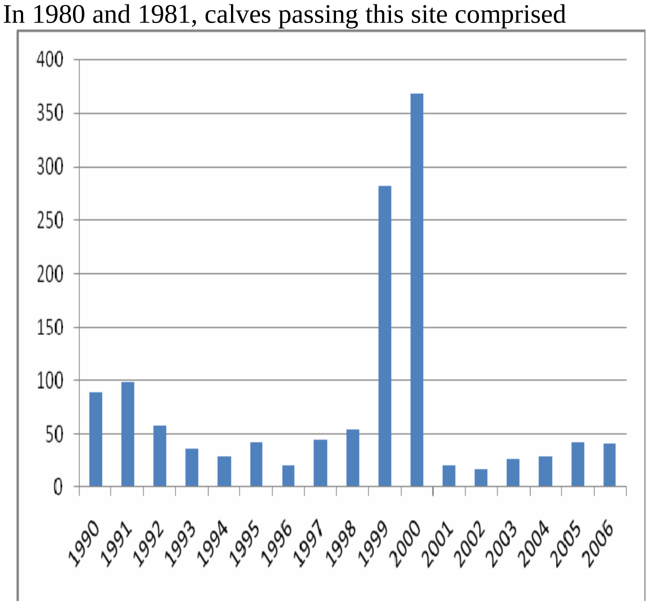

Figure 37. Number of stranded gray whales recorded along the west coast of North America between 1990 and 2006 (data from Brownell et al. 2007).

increase in spatial and temporal distribution of calving as the population increased (Shelden et al. 2004), or it could be due to an increase in the calving rate.

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): $N_{MIN} = N/\exp(0.842\times[\ln(1 + [CV(N)]^2)]^{½})$. Using the mean of the 2000/01 and 2001/02 abundance estimates (not significantly different) of 18,813 and its associated CV of 0.069, N_{MIN} for this stock is 17,752.

Current Population Trend

The population size of the Eastern North Pacific gray whale stock has been increasing over the past several decades. The estimated annual rate of increase, based on shore counts of southward migrating gray whales between 1967 and 1988, is 3.3% with a standard error of 0.44% (Buckland et al. 1993). Taking account of the harvest, Wade and DeMaster (1996) estimated an underlying annual rate of increase of 4.4% (95% CI: 3.1%-5.6%) for this same time period. Incorporating the census data through the 1993/94 migration resulted in an annual rate of increase of 2.6% (SE = 0.4%: IWC 1995). Breiwick (1999) estimated the annual rate of increase from 1967/68 to 1997/98 at 2.52% (95% CI: 2.04%-3.12%), and Wade and DeMaster (1996) estimated the annual rate of increase from 1967/68 to 1995/96 at 2.4% (95% CI: 1.6%-3.2%). Rugh et al. (2005) estimated the rate of increase from 1967/69 through 2001/02 at 1.9% (SE = 0.32%). They also fit a discrete logistic model to the abundance estimates resulting in an estimate of K (carrying capacity) of 26,290 (CV = 0.059).

In 1999 and 2000, a large number of gray whale strandings occurred along the west coast of North America between Baja California, Mexico, and the Bering Sea (Norman et al. 2000, Pérez-Cortés et al. 2000, Brownell et al. 2001, Gulland et al. 2005). A total of 273 gray whale strandings was reported in 1999 and 355 in 2000, compared to an average of 38 per year during the previous four years (Fig. 36). Gray whale strandings occurred throughout the year in both 1999 and 2000, but regional peaks of strandings occurred where and when the whales were in their migration cycle. Since then, stranding rates have been low (21, 18, 27, 30, 43, and 42 whales in 2001-2006, respectively; Brownell et al. 2007). Hypothesized reasons for the increasedhigh stranding rate in recent years1999 and 2000 include starvation, effects of chemical contaminants, natural toxins, disease, direct anthropogenic factors (fishery interactions and ship strikes), increased survey/reporting effort, and effects of wind and currents on carcass deposition (Norman et al. 2000). Since only 16 animals showed conclusive evidence of direct human interaction in 1999-2000, it seems unreasonable that direct anthropogenic factors were responsible for the increase in strandings. In addition, although survey effort has varied considerably in Mexico and Alaska, it has been relatively constant in Washington, Oregon, and California, so the high rates were not a function of increased observational effort. The other hypotheses indicated have not yet been conclusively eliminated. However, assuming a 5% mortality rate for gray whales (Wade and DeMaster 1996), it would be reasonable to expect that approximately 1,300 gray whales would die annually of natural causes; therefore, the high rate of strandings does not seem to be an area of concern. Thus, while the stranding rate was certainly much higher in 1999 and 2000 than in previous years, it may not indicate a higher mortality rate. Preliminary stranding data indicate that the stranding event in 1999 and 2000 is over, as only 21 gray whale strandings were reported in 2001 (T. Rowles, NMFS-F/PR, pers. comm.). Reports from a portion of the stock's range indicate that only 5 and 6 strandings were reported in 2002 and 2003, respectively (C. Allen, NMFS-National Stranding Database, pers. comm.).

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

Using abundance data through 1996, an analysis of the Eastern North Pacific gray whale population led to an estimate of R_{max} of 0.072, with a 90% probability the value was between 0.039 and 0.126 (Wade 2002). This estimate came from the best fitting age- and sex-structured model, which was a density-dependent Leslie model including an additional variance term, with females and males modeled separately. This estimate was higher than the estimate of R_{max} from a logistic model (0.053, 90% probability 0.031 to 0.113), which was not age- and sex-structured (Wade 2002). The Alaska Scientific Review Group recommended the use of the 0.053 point estimate for R_{max}. The difference in the two estimates of R_{max} is due to the bias in the harvest towards females, which is not accounted for in the logistic model. Therefore, NMFS has decided to use the estimate from the age- and sex-structured model, which had a lower 10th percentile of 0.047. This has the interpretation that there is a 90% probability that the true value of R_{max} is greater than 0.047. This is sufficient evidence that R_{max} for Eastern North Pacific gray whales is greater than the default value of 0.04. Therefore, NMFS will use an R_{max} of 0.047.

POTENTIAL BIOLOGICAL REMOVAL

Under the 1994 reauthorized 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 whales, PBR = 417 animals (17,752 × 0.0235 × 1.0).

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

Fisheries Information

In previous stock assessments, there were six different observed federal commercial fisheries in Alaska that could have had incidental serious injuries or mortalities of gray whales. In 2004, the definitions of these commercial fisheries were changed to reflect target species: these new definitions have resulted in the identification of 22 observed fisheries in the Gulf of Alaska and Bering Sea that use trawl, longline, or pot gear (69 FR 70094, 2 December 2004). There were no observed serious injuries or mortalities of gray whales in any of those fisheries.

NMFS observers monitored the northern Washington marine set gillnet fishery (coastal + inland waters), otherwise known as the Makah tribal fishery for Chinook salmon, during 1990-98 and in 2000. There was no observer coverage in this fishery in 1999; however, the total fishing effort was only four net days (in inland waters), and no marine mammals were reported taken. One gray whale was observed taken in 1990 (Gearin et al. 1994) and one in 1995 (P. Gearin, unpubl. data). In July of 1996, one gray whale was entangled in the same tribal set gillnet fishery, but it was released unharmed (P. Gearin, AFSC-NMML, pers. comm.). Data from the most recent 5 years indicates that no gray whales were seriously injured or killed incidental to this fishery.

NMFS observers monitored the California/Oregon thresher shark/swordfish drift gillnet fishery from 1993 to 2003 (Table 34; Julian 1997; Cameron 1998; Julian and Beeson 1998; Cameron and Forney 1999, 2000; Carretta 2001, 2002; Carretta and Chivers 2003, 2004). One gray whale mortality was observed in this fishery in both 1998 and 1999. Overall entanglement rates in the California/Oregon thresher shark/swordfish drift gillnet fishery dropped considerably after the 1997 implementation of a Take Reduction Plan, which included skipper education workshops and required the use of pingers and minimum 6-fathom extenders on buoy lines (Barlow and Cameron 1999). Data from the most recent 5 years indicates that no gray whales were seriously injured or killed incidental to this fishery.

It should be noted that no observers have been assigned to most Alaska gillnet fisheries, including those in Bristol Bay that are known to interact with this stock, making the estimated mortality from U.S. fisheries a minimum figure. 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 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 U. S. commercial fisheries (6.7 whales) is not known to exceed 10% of the PBR (44.2) and, therefore, can be considered to be insignificant and approaching zero mortality and serious injury rate.

Table 34. Summary of incidental mortality of Eastern North Pacific gray whales due to commercial fisheries from 1993-2003 and calculation of the mean annual mortality rate. Mean annual mortality in brackets represents a minimum estimate from stranding data. Data from 1999-2003 (or the most recent 5 years of available data) are used in the mortality calculation. N/A indicates that data are not available.

Fishery name	Years	Data type	Observer coverage	Observed mortality (in given yrs.)	Estimated mortality (in given yrs.)	Mean annual mortality
Unknown west coast fisheries	1993-2003	strand data	N/A	0, 5, 3, 3, 6, 4, 3, 3, N/A, 2, N/A	N/A	[≥3.6]
AK salmon purse seine	1999-2003	strand data	N/A	1, N/A, N/A, N/A, N/A	N/A	[≥0.5]
Pot fisheries	1999-2003	strand data	N/A	1, 2, N/A, N/A, 3	N/A	[≥1.2]

Fishery name	**Years**	**Data type**	**Observer coverage**	**Observed mortality (in given yrs.)**	**Estimated mortality (in given yrs.)**	**Mean annual mortality**
CA yellowtail/ barracuda/white seabass gillnet fishery	1999-2003	strand data	N/A	N/A, 1, N/A, N/A, N/A	N/A	[≥0.2]
Other entanglements	1999-2003	strand data	N/A	1, 2, N/A, 2, 1	N/A	[≥1.2]
Minimum total annual mortality						≥6.7

Strandings and Entanglements

Reports of entangled gray whales found swimming, floating, or stranded with fishing gear attached occur along the U.S. west coast and British Columbia. Details of strandings that occurred in 1993-95 and 1996-98 in the United States and British Columbia are described in Hill and DeMaster (1999) and Angliss et al. (2002), respectively.~~; while~~ Table 35 presents data on strandings that occurred on the U. S. west coast from 1999 to 2003; these data are summarized in Table 34. The strandings resulting from commercial fishing are listed as unknown west coast fisheries in Table 35, unless they could be attributed to particular fisheries. During the 5-year period from 1999 to 2003, stranding network data indicate a minimum annual mean of 6.7 gray whale mortalities resulting from interactions with commercial fishing gear.

Table 35. Human-related gray whale strandings and entanglements, 1999-2003. An asterisk in the "number" column indicates cases that were not considered serious injuries. Note: NMFS convened a workshop in 2007 to review and update the guidelines for what constitutes "serious injury". Changes to the agency's guidelines resulting from this workshop may affect whether injured animals identified are considered "seriously injured" in future SARs.

Year	Number	Area	Condition	Description
1999	1	Port Gravina, PWS, AK	Dead	Entangled in AK salmon purse seine net
1999	1	Bristol Bay, AK	Dead	Entangled
1999	1	Offshore North Coronado Is., CA	Non-fatal injury	Ship strike
1999	1	Wreck Creek, WA	Dead	Net wrapped around flukes
1999	1	Twin Harbors State Park, WA (Grayland)	Dead	Rope through mouth
1999	1	1.5 mi. offshore Rancho Palos Verdes, CA	Injury; status unknown	Pink gillnet & attached float wrapped around flukes; swimming w/difficulty; unable to dive
1999	1	10 mi. offshore Port Hueneme, CA	Dead	Wrapped in pot gear & associated floats
1999	1*	2 mi. offshore Crescent City, CA	Non-fatal injury	Crab pot line wrapped around flukes & mouth; disentangled by rescue team
1999	1*	3 mi. offshore Crescent City, CA	Released alive	Crab pot line wrapped around body; released from entangling gear
1999	1	Pt. Loma, CA	Dead	18 in. harpoon tip embedded in left dorsum
1999	1	Muir Beach, CA	Dead	Ship strike
2000	1	Depoe Bay, OR	Alive	Trailing fish line with longline buoys attached
2000	1	Brookings, OR	Alive	Head entangled in line
2000	1	Offshore Pt. Loma, CA	Status unknown	Trailing lobster pot gear
2000	1	Offshore San Clemente, CA	Status unknown	Yellow polypropylene line wrapped around flukes of free swimming whale
2000	1	Redwood National Park, CA	Dead	Ship strike
2000	1	Offshore Pt. Dume, CA	Status unknown	Line & buoys wrapped around flukes of free swimming whale

2000	1	Vandenberg AFB, CA	Dead	Lobster trap & rope wrapped around flukes
2000	1	Seal Beach, CA	Dead	White sea-bass gillnet wrapped around flukes
2000	1	Offshore Shelter Cove, CA	Injury; status unknown	Free-swimming whale with harpoon in back
2000	1	Offshore Aptos, CA	Status unknown	Fishing gear & floats wrapped around right pectoral flipper of free-swimming whale
2001	1	3 miles offshore Morro Bay	Live, likely mortality	Vessel collision with free-swimming abandoned calf; major injuries to caudal peduncle; flukes completely severed
2002	1*	Offshore Santa Barbara	Live, unknown	Free-swimming animal observed with yellow line wrapped around torso; no disentanglement initiated
2002	1	Offshore Pt. Vicente	Live, unknown	Free-swimming animal observed with yellow line wrapped around caudal peduncle; no disentanglement initiated
2002	1	Grays Harbor, WA	Dead	Yellow fishing gear (lines and net) wrapped around peduncle
2003	1	Offshore Morro Bay	Live, unknown	Free-swimming animal observed with crab pot gear trailing from right side of mouth (crab pot, 75 ft of yellow polypropylene line & 2 buoys); USCG vessel on site; no disentanglement initiated
2003	1	North Island Naval Air Station	Dead	15 foot calf with 3 foot length of yellow polypropylene line lodged in baleen
2003	1	2.5 miles off San Mateo Point	Live	Free-swimming animal observed with 150 ft of crab pot line and associated crab pot wrapped around head, torso & flukes; crew of commercial sportfishing vessel cut most of line and crab pot away; small amount of line remained wrapped around flukes (approximately 4 wraps); animal observed swimming strongly away after disentanglement
2003	1	Lands End Beach	Dead	25 ft calf; probable vessel collision; 2 propeller-like slashes through bone and baleen on right side of rostrum; broken rostrum
2003	1	Tillamook, OR	Dead	Crab pot line and buoy wrapped around flukes and caudal peduncle

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Subsistence/Native Harvest Information

Subsistence hunters in Alaska and Russia have traditionally harvested whales from this stock. The only reported takes by subsistence hunters in Alaska during this decade occurred in 1995, with the take of two gray whales by Alaska Natives (IWC 1997). Russian subsistence hunters reported taking 43 whales from this stock in 1996 (IWC 1998a) and 79 in 1997 (IWC 1999). In 1997, the IWC approved a 5-year quota (1998-2002) of 620 gray whales, with an annual cap of 140, for Russian and U.S. (Makah Indian Tribe) aboriginals based on the aboriginal needs statements from each country (IWC 1998b). The U.S. and Russia have agreed that the quota will be shared with an average annual harvest of 120 whales by the Russian Chukotka people and 4 whales by the Makah Indian Tribe. Russian aboriginals harvested 121 (+2 struck and lost) in 1999 (IWC 2001), 113 (+2 struck and lost) in 2000 (Borodin 2001), 112 in 2001 (Borodin et al. 2002), 131 in 2002 (Borodin 2003), ~~and~~ 126 (+2 struck and lost) in 2003 (Borodin 2004), and 115 in 2005(IWC 2007), while the Makah Tribe harvested 1 whale in 1999 (IWC 2001). Based on this information, the annual subsistence take averaged 122 whales during the 5-year period from 1999 to 2003.

Other Mortality

The nearshore migration route used by gray whales makes ship strikes another potential source of mortality. Between 1999 and 2003, the California stranding network reported 4 serious injuries or mortalities of gray whales caused by ship strikes: 1 each in 1999, 2000, 2001, and 2003 (J. Cordaro, NMFS-SWR, pers. comm.). One ship strike mortality was reported in Alaska in 1997 (B. Fadely, AFSC-NMML, pers. comm.). 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 1.2 gray whales per year due to collisions with vessels represents a minimum estimate from this source of mortality.

In 1999 and 2000, the California stranding network reported gray whale strandings due to harpoon injuries (Table 35). A Russian harpoon tip was found in a dead whale that stranded in 1999 (R. Brownell, NMFS-SWFSC, pers. comm.), and an injured whale with a harpoon in its back was sighted in 2000. Since these whales were likely harpooned during the aboriginal hunt in Russian waters, they would have been counted as “struck and lost” whales in the harvest data.

STATUS OF STOCK

In 1994, due to steady increases in population abundance, the eastern North Pacific stock of gray whales was removed from the List of Endangered and Threatened Wildlife (the List), as it was no longer considered endangered or threatened under the Endangered Species Act (ESA). As required by the ESA, NMFS monitored the status of this stock for 5 years following delisting. A workshop convened by NMFS on 16-17 March 1999 at the AFSC’s National Marine Mammal Laboratory in Seattle, WA, reviewed the status of the stock based on research conducted during the 5-year period following delisting. Invited workshop participants determined that the stock was neither in danger of extinction, nor likely to become endangered within the foreseeable future, therefore there was no apparent reason to reverse the previous decision to remove this stock from the List (Rugh et al. 1999). This recommendation was subsequently adopted by NMFS.

Wade (2002) conducted an assessment of the Eastern North Pacific gray whale stock using survey data through 1995/96. Wade and Perryman (2002) updated the assessment in Wade (2002) to incorporate the abundance estimates from 1997/1998, 2000/2001, and 2001/2002, as well as calf production estimates from the northward migration (1994 to 2001), into a more complete analysis that further increased the precision of the results. All analyses concluded that the population was within the stock's optimum sustainable population (OSP) level (i.e., there was essentially zero probability that the population was below the stock's maximum net population level), and estimated the population in 2002 was between 71% and 102% of current carrying capacity. Similar results were found in a separate assessment (Punt et al. 2004). The Scientific Committee of the International Whaling Commission reviewed both assessments and agreed that management advice could be formulated from the results. Both assessments indicated that the population was above MSYL, and was likely close to or above its unexploited equilibrium level (IWC 2002).

Even though the stock is within OSP, abundance will rise and fall as the population adjusts to natural and man-caused factors affecting the carrying capacity of the environment (Rugh et al. 2005). In fact, it is expected that a population close to or at the carrying capacity of the environment will be more susceptible to fluctuations in the environment (Moore et al. 2001). The recent correlation between gray whale calf production and environmental conditions in the Bering Sea (Perryman et al. 2002) may be an example of this. For this reason, it can be predicted that the population will undergo fluctuations in the future that may be similar to the 2-year event that occurred in 1999-2000 (Norman et al. 2000, Pérez-Cortés et al. 2000, Brownell et al. 2001, Gulland et al. 2005).

Alter et al. (2007) used a genetics approach to estimate that North Pacific gray whales may have numbered ~96,000, including animals in both the western and eastern populations, 1100-1600 years ago. The authors recommend that because the current estimate of the eastern stock of gray whales is at most 28-56% of this historic abundance, that the stock should be designed as "depleted" under the MMPA. Because it is likely that an abundance estimate 1100-1600 years ago is not representative of a historic abundance estimate more relevant to the ocean's current carrying capacity, it is not reasonable to compare the current abundance estimate to an estimate that far in the past to assess current status under the MMPA.

At present, U.S. commercial fishery-related annual mortality levels less than 41.7 animals per year (i.e., 10% of PBR) can be considered insignificant and approaching zero mortality and serious injury rate. Based on currently available data, the estimated annual level of human-caused mortality and serious injury (130), which includes mortalities from commercial fisheries (6.7), Russian harvest (122), and ship strikes (1.2), does not exceed the PBR (417). Therefore, the Eastern North Pacific stock of gray whales is not classified as a strategic stock.

HABITAT CONCERNS

Eastern North Pacific gray whales range from subtropical lagoons in Baja Mexico to arctic seas around Alaska and eastern Russia (Braham 1984). Evidence indicates that the Arctic climate is changing significantly and that one result of the change is a reduction in the extent of sea ice in at least some regions of the Arctic (ACIA 2004, Johannessen et al 2004). These changes are likely to affect marine mammal species in the Arctic, including the gray whale, due to the impacts of a changing Arctic environment on the species' benthic food supply. With the increase in numbers of gray whales (Rugh et al. 2005), in combination with changes in prey distribution (Grebmeier et al. 2006; Moore et al. 2007), some gray whales have moved into new feeding areas, spreading their summer range (Rugh et al. 2001). There are insufficient data to make reliable predictions of the effects of Arctic climate change on gray whales.

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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 in the North Pacific it does not occur in Arctic waters~~. In winter, most humpback whales occur in the subtropical and tropical waters of the Northern and Southern Hemispheres. Humpback whales in the high latitudes of the North Pacific are seasonal migrants that feed on euphausiids and small schooling fishes (~~NMFS 1991~~Nemoto 1957; 1959, Clapham and Mead 1999). The historic feeding 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 and north of the Bering Strait (Zenkovich 1954, Nemoto 1957, Tomlin 1967, Johnson and Wolman 1984). The Asian wintering area extends from the South China Sea east through the Philippines, Ryukyu Retto, Ogasawara Gunto, Mariana Islands, and Marshall Islands (Rice 1998). The humpback whale population in much of this range was considerably reduced as a result of intensive commercial exploitation during the 20th century.

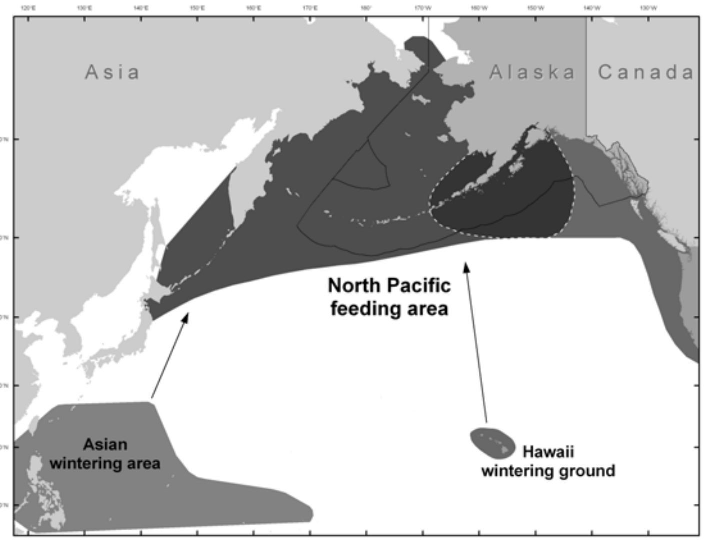

Figure 38. Approximate distribution of humpback whales in the western North Pacific (shaded area). Feeding and wintering grounds are presented above (see text). Area within the dotted line is known to be an area of overlap with the Central North Pacific stock. See Figure 39 for humpback whale distribution in the eastern North Pacific.

~~Recent surveys in the central-eastern and southeastern Bering Sea in 1999 and 2000 resulted in new information about the distribution of humpback whales in these areas (Moore et al. 2002). The only sightings of humpback whales in the central-eastern Bering Sea occurred southwest of St. Lawrence Island.~~ A vessel survey in the central Bering Sea in July of 1999 documented 17 humpback whale sightings, most of which were distributed along the eastern Aleutian Island chain and along the U.S.-Russia Convention Line south of St. Lawrence Island (Moore et al. 2000). A few sightings occurred in the southeastern Bering Sea, primarily outside Bristol Bay and north of the eastern Aleutian Islands (Moore et al. 2002). However, a NOAA survey conducted in 2005 found numerous humpback whales north of the central Aleutian Islands, reinforcing the idea that the Bering Sea is an important feeding area. The historical importance of this area is suggested by the fact that the USSR is known to have killed hundreds of humpback whales in the Bristol Bay area during its illegal whaling operations in the 1960's. Analysis of whaling data show historical catches of humpback whales well into the Bering Sea and catches in the Bering Strait and Chukchi Sea from August-October in the 1930s (Mizroch and Rice 2007 in prep).

Aerial, vessel, and photo-identification surveys and genetic analyses indicate that within the U. S. Exclusive Economic Zone (EEZ) there are at least three populations that migrate between their respective summer/fall feeding areas to winter/spring calving and mating areas (Calambokidis et al. 1997, Baker et al. 1998, Figs. 38 and 39): 1) winter/spring populations in coastal Central America and coastal Mexico which migrate to the coast of California to southern British Columbia in summer/fall (Calambokidis et al. 1989, Steiger et al. 1991, Calambokidis et al. 1993) - referred to as the California/Oregon/Washington and Mexico stock; 2) winter/spring populations of the Hawaiian Islands which migrate to northern British Columbia/Southeast Alaska and Prince William Sound west to Unimak Pass (Baker et al. 1990, Perry et al. 1990, Calambokidis et al. 1997) - referred to as the Central North Pacific stock; and 3) winter/spring populations off ~~Japan~~Asia which, based on ~~Discovery Mark information, probably migrate primarily to waters west of Unimak Pass (the Bering Sea and Aleutian Islands) in~~

summer/fall (Berzin and Rovnin 1966, Nishiwaki 1966, Darling 1991), and possibly to the Kuril Islands, Gulf of Anadyr, and southeastern Chukotka Peninsula (NMML unpublished data). photo-identification and Discovery mark data have been found in the Bering Sea, Eastern Aleutians, and British Columbia (Darling 1991; 1993; Mizroch pers. comm., North Pacific Humpback Whale Working Group,unpublished data) Discovery-type mark recovery data demonstrate long-distance migratory movements between Ogasawara and both the Gulf of Anadyr and the eastern Aleutians near Unimak Pass and between Okinawa and Unimak Pass. Mark recovery data suggest that whales may congregate in the eastern Aleutians early in the season (April-May) and late in the season (September) (Mizroch and Rice 2007abstract). This latter population is referred to as the Western North Pacific stock.

Breeding populations of humpback whales also occur in winter near Mexico's offshore islands in the Revillagigedo Archipelago and there is one confirmed movement (based on photo-identification data) between the Revillagigedo Archipelago and Japan (Mizroch pers. comm., North Pacific Humpback Whale Working Group, unpublished data). The migratory destination of these offshore Mexican whales is not well known (Calambokidis et al. 1993, Calambokidis et al. 1997), but whales photographed in the Revillagigedo Archipelago have also been photographed in California, Washington, British Columbia, Southeast Alaska, Prince William Sound, Kodiak and eastern Aleutians (Witteveen 2004, J. Straley, pers. comm., Mizroch pers. comm., North Pacific Humpback Whale Working Group, unpublished data). Some recent exchange between winter/spring areas has been documented (Darling and McSweeney 1985, Baker et al. 1986, Darling and Cerchio 1993), as well as

mMovement between Japan and British Columbia, and Japan and the Kodiak Archipelago has been documented (Darling et al. 1996, Calambokidis et al. 1997), although recent preliminary photo-id data suggest some of these whales summer in the western Gulf of Alaska and Bering Sea. Calambokidis et al. (2001) concludes that there are at least three subpopulations of humpback whales on the wintering grounds (Hawaii, Japan, and Mexico), and possibly as many as six subpopulations, with subdivisions in Mexico, Japan, and Central America.

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, three stocks of humpback whales (as described above) are recognized within the U.S. EEZ of the North Pacific: one in the eastern North Pacific (the California/Oregon/Washington - Mexico 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. Data from a large-scale study throughout the North Pacific conducted in 2004-06 (the Structure of Populations, Levels of Abundance, and Status of Humpbacks, or SPLASH, project) are expected to provide a much more comprehensive understanding of humpback whale population structure in the North Pacific in the near future.

Available information about feeding areas in U.S. waters for the western stock of humpback whales indicates that there iscould be considerable overlap between the Western North Pacific and Central North Pacific stocks in the Gulf of Alaska between Kodiak Island and the Shumagin Islands. Mizroch et al. (2004) examined photographs taken from 1979-1996 and reported that fewer than 1% of the individual whales photographed in either Southeast Alaska or Prince William Sound moved between areas. Based on photographs taken across all Alaska feeding areas from 1979-1996, fewer than 2% of individuals were seen in more than one area (Mizroch et al. 2004).

Over a 3 years period, Waite et al. (1999) collected photographs of 127 individuals located near Kodiak Island, 22 individuals located near the Shumagin Islands, 8 individuals located offshore to the southeast of the Shumagin Islands, and 7 individuals located near Akutan Island in the eastern Aleutian Islands. Only 7 of these individuals have been documented in Prince William Sound or Southeast Alaska. Witteveen (2003) conducted a photo-identification study in Marmot and Chiniak Bays (on the northeast side of Kodiak Island), documented 103 individual animals, and estimated that the number of humpback whales in that area totaled 157 (95% CI: 114, 241). Witteveen et al. (2004) reported matches between whales photographed at the Shumagin Islands between 1999 and 2002 and whales photographed in Hawaii, offshore Mexico Islands, coastal Mexico waters, and Japan. In addition, a small number of individuals identified off Japan have been resighted in the eastern North Pacific (Darling et al. 1996, Calambokidis et al. 1997).

In summary, new information from a variety of sources indicates that humpback whales from the Western and Central North Pacific stocks mix to a limited extent on summer feeding grounds ranging from British Columbia through the in the central Gulf of Alaska and perhapsup to the Bering Sea.

POPULATION SIZE

The abundance estimate of humpback whales in the North Pacific is based on data collected by nine independent research groups that conducted photo-identification studies of humpback whales in the three wintering areas (Mexico, Hawaii, and Japan). Photographs taken between 1991 and 1993 were used to estimate abundance because samples throughout the North Pacific were the largest and most complete during this period. Using Darroch's (1961) method, which utilizes only data from wintering areas (in this case data provided by two Japanese research groups), and averaging the 1991-92, 1992-93, and 1991-93 winter release-recovery information results in an abundance estimate of 394 (CV = 0.084) for the western North Pacific humpback whale stock (Calambokidis et al. 1997). However, in light of the low geographic coverage of sampling effort for the western North Pacific population during this time, this is likely to represent an underestimate of the stock's true abundance.

A vessel 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). It is unknown whether the humpback whales encountered during this survey belonged to the Western or Central North Pacific stock.

A vessel survey for cetaceans was conducted in the central Bering Sea in July-August 1999 in cooperation with research on commercial fisheries (Moore et al. 2000). The survey included 6,043 nmi of tracklines, most of which were West of St. Matthew Island, north of the 200 m bathymetric contour, and south of the U.S./Russia Convention Line. Ten on-effort sightings of humpback whales occurred during this survey, the majority of which took place along the eastern Aleutian chain and near the U.S./Russian Convention Line just south of St. Lawrence Island. If these localized sightings are extrapolated to the entire survey area, an estimated abundance of 1,175 humpback whales (95% CI: 197-7,009) occur in the central Bering Sea during the summer. However, Moore et al. (2002) determined that these sightings were too clumped in the central-eastern Bering Sea to be used to provide a reliable estimate for the area and decided to improve upon the method used to stratify the data in the analysis. Sightings of humpback whales also occurred during the survey conducted in the eastern Bering Sea in 2000; these sightings resulted in an estimated abundance of 102 (95% CI: 40-262). It is unknown whether these animals belong to the central or western North Pacific stock of humpback whales.

Photo-identification studies initiated to the west of Kodiak Island from 1999 to 2002 ~~have~~ identified 171 individual humpback whales, which resulted in a mark-recapture estimate of 410 (95% CI: 241-683). It is not known how many animals occurring to the west of Kodiak Island belong to the Western or Central North Pacific stock, but matches between animals photographed west of Kodiak Island and animals photographed in Hawaii, offshore Mexico, coastal Mexico, and Japan clearly indicate that overlap between stocks occurs in this area (Witteveen et al. 2004). The Kodiak catalog currently has 738 individuals and the Shumagins catalog has 266 individuals (Witteveen, pers. comm.).

There are no reliable estimates for the abundance of humpback whales in feeding areas for this stock because surveys of the known feeding grounds are incomplete, and because not all feeding areas are known.

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): $N_{MIN} = N/\exp(0.842\times[\ln(1+[CV(N)]^2)]^{½})$. Using the population estimate (N) of 394 and its associated CV(N) of 0.084, N_{MIN} for this humpback whale stock is 367.

Current Population Trend

Reliable information on trends in abundance for the Western North Pacific humpback whale stock ~~are~~is currently not available.

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

Utilizing a birth-interval model, Barlow and Clapham (1997) have estimated a population growth rate of 6.5% (SE = 1.2%) for the well-studied humpback whale population in the Gulf of Maine, although there are indications that this rate has slowed in recent years (Clapham et al. 2003). Mobley et al. (2001) estimated a trend of 7% for 1993-00 using data from aerial surveys that were conducted in a consistent manner for several years across all of the Hawaiian Islands and were developed specifically to estimate a trend for the Central North Pacific stock. Although there is no estimate of the maximum net productivity rate for the Western stock, it is reasonable to assume that R_{MAX} for this stock would be at least 7%. Hence, until additional data become available from the Western North Pacific humpback whale stock, it is recommended that 7% be employed as the maximum net productivity rate (R_{MAX}) for this stock (Wade and Angliss 1997).

POTENTIAL BIOLOGICAL REMOVAL

Under the 1994 reauthorized 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 (Wade and Angliss 1997). Thus, using the abundance estimate calculated from 1993 surveys, the PBR for the Western North Pacific stock of humpback whale, PBR = 1.3 would be calculated to be 1.3 animals (367 × 0.035 × 0.1). However, the 2005 revisions to the SAR guidelines (NMFS 2005) state that abundance estimates older than 8 years should not be used to calculate PBR due to a decline in confidence in the reliability of an aged abundance estimate. Therefore, the PBR for this stock is considered undetermined. Data collected between 2004-2006 during SPLASH surveys are currently being analyzed, and a new abundance estimate and PBR for this stock will be calculated from these data.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

Fisheries Information

Until 2004, there were six different federally-regulated commercial fisheries in Alaska that occurred within the range of the Western North Pacific humpback whale stock that were monitored for incidental mortality by fishery observers. As of 2004, changes in fishery definitions in the List of Fisheries have resulted in separating these six fisheries into 22 fisheries (69 FR 70094, 2 December 2004). This change does not represent a change in fishing effort, but provides managers with better information on the component of each fishery that is responsible for the incidental serious injury or mortality of marine mammal stocks in Alaska. Estimates of marine mammal serious injury/mortality in each of these observed fisheries are provided in Perez (2006) and Perez (unpubl. ms.). Between 200002 and 200406, there were incidental serious injuries and mortalities of Western North Pacific humpback whales in the Bering Sea/Aleutian Islands sablefish pot fishery (Table 36). Average annual mortality from observed fisheries was 0.20 humpbacks from this stock (Table 36). Note, however, that the stock identification is uncertain and the mortality may have involved a whale from the central North Pacific stock of humpback whales. Thus, this mortality is assigned to both the central and western stocks.

Strandings of humpback whales entangled in fishing gear or with injuries caused by interactions with gear are another source of mortality data. The only fishery-related humpback stranding in an area thought to be occupied by animals from this stock was reported by a U. S. Coast Guard vessel in late June 1997 operating near the Bering Strait. The whale was found floating dead entangled in netting and trailing orange buoys (National Marine Mammal Laboratory, Platforms of Opportunity Program, unpubl. data, 7600 Sand Point Way NE, Seattle, WA 98115). With the given data it is not possible to determine which fishery (or even which country) caused the mortality. Note, that this mortality has been attributed the Western North Pacific stock, but without a tissue sample (for genetic analysis) or a photograph (for matching to known Japanese animals) it is not possible to be for certain (i.e., it may have belonged to the Central North Pacific stock). No strandings or sightings of entangled humpback whales of this stock were reported between 2001 and 2005; however, effort in western Alaska is low.

Table 36. Summary of incidental mortality and serious injury of humpback whales (Western North Pacific stock) due to commercial fisheries from 20012 to 20056 and calculation of the mean annual mortality rate. Mean annual mortality in brackets represents a minimum estimate. Details of how percent observer coverage is measured is included in Appendix 6. N/A indicates that data are not available.

Fishery name	**Years**	**Data type**	**Observer coverage**	**Observed mortality (in given yrs.)**	**Estimated mortality (in given yrs.)**	**Mean annual mortality**
Bering Sea sablefish pot	~~2001~~ 2002 2003 2004 2005 2006	obs data	~~38.7~~ 40.6 21.7 49.1 39.2 35.3	~~0~~ 0 0 0 0 0	~~0~~ 1[1] 0 0 0 0	0.20[2] (N/A)
Observer program total						0.20
				Reported mortalities		
~~Unknown fishery (Bering Sea)~~	~~2001-2005~~	~~strand data~~	~~N/A~~	~~0, 0, 0, 0, 0~~	~~≥0.0~~	~~[≥0.0]~~
Minimum total annual mortality						[≥0.2]

[1] Mortality was seen by an observer but not during an "observed set"; thus quantification of effort cannot be accomplished and the single record cannot be extrapolated to provide a total estimated mortality level.
[2] These mortalities occurred in an area of known overlap with the Central North Pacific stock of humpback whales. Since the stock identification is unknown, the mortalities are reflected in both stock assessments.

The estimated annual mortality rate incidental to U. S. commercial fisheries is 0.2 whales per year from this stock based on 0.2 from observed fisheries. However, this estimate is considered a minimum because there are no data concerning fishery-related mortalities in Japanese, Russian, or international waters. In addition, there is a small probability that fishery interactions discussed in the assessment for the Central North Pacific stock may have involved animals from this stock because the only known matches to feeding areas come from areas typically used by the Central North Pacific stock. Finally, much information on fishery interaction with the Central North Pacific stock is based on information reported to the Alaska Region as stranding data. However, very few stranding reports are received from areas west of Kodiak.

Brownell et al. (2000) compiled records of bycatch in Japanese and Korean commercial fisheries between 1993 and 2000. During the period 1995-99, there were six humpback whales indicated as "bycatch". In addition, two strandings were reported during this period. Furthermore, analysis of four samples from meat found in markets indicated that humpback whales are being sold. At this time, it is not known whether any or all strandings were caused by incidental interactions with commercial fisheries; similarly, it is not known whether the humpback whales identified in market samples were killed as a result of incidental interactions with commercial fisheries. It is also not known which fishery may be responsible for the bycatch. Regardless, these data indicate a minimum mortality level of 1.1/year (using bycatch data only) to 2.4/year (using bycatch, stranding, and market data) in the waters of Japan and Korea. Because many mortalities pass unreported, the actual rate in these areas is likely much higher.

Subsistence/Native Harvest Information

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

HISTORICAL WHALING

Rice (1978) estimated that the number of humpback whales in the North Pacific may have been approximately 15,000 individuals prior to exploitation; however, this was based upon incomplete data and, given the level of known catches (legal and illegal) since World War II, may be an underestimate. Intensive commercial whaling removed more than 28,000 animals from the North Pacific during the 20th century (Rice 1978). From 1961 to 1971, an additional 6,793 humpback whales were killed illegally by the USSR. Many animals during this period were taken from the Gulf of Alaska and Bering Sea (Doroshenko 2000); however, additional illegal catches were made across the North Pacific, from the Kuril Islands to the Queen Charlotte Islands, and other takes in earlier years may have gone unrecorded. Humpback whales in the North Pacific were theoretically protected in 1965, but illegal catches by the USSR continued until 1972 (Ivashchenko et al. 2007).

STATUS OF STOCK

The estimated human-related annual mortality rate (0.2) is less than the PBR level for this stock (1.3). The estimated human-related mortality rate is based solely on mortalities that occurred incidental to U. S. commercial fisheries therefore, the estimated fishery mortality and serious injury rate exceeds 10% of the PBR (0.1). The rate cannot be considered insignificant and approaching zero. The humpback whale is listed as "endangered" under the Endangered Species Act, and therefore designated as "depleted" under the MMPA. As a result, the Western North Pacific stock of humpback whale is classified as a strategic stock. Reliable population trend data and the status of this stock relative to its Optimum Sustainable Population size are currently unknown.

HABITAT CONCERNS

Elevated levels of sound from the U. S. Navy's Low Frequency Active Sonar program and other anthropogenic sources (e.g., shipping) is a potential concern for humpback whales in the North Pacific, but no specific habitat concerns have been identified for this stock.

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

STOCK DEFINITION AND GEOGRAPHIC RANGE

The humpback whale is distributed worldwide in all ocean basins~~, though in the North Pacific region it does not occur in Arctic waters~~. In winter, most humpback whales occur in the subtropical and tropical waters of the Northern and Southern Hemispheres. Humpback whales in the high latitudes of the North Pacific are seasonal migrants that feed on euphausiids and small schooling fishes (~~NMFS 1991~~Nemoto 1957, Clapham and Mead 1999). The historic feeding 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 and north of the Bering Strait (Zenkovich 1954, Nemoto 1957, Tomlin 1967, Johnson and Wolman 1984). A vessel survey in the central Bering Sea in July of 1999 documented 17 humpback whale sightings, most of which were distributed along the eastern Aleutian Island chain and along the U.S.-Russia Convention Line south of St. Lawrence Island (Moore et al. 2000). A few sightings occurred in the southeastern Bering Sea, primarily outside Bristol Bay and north of the eastern Aleutian Islands (Moore et al. 2002). However, a NOAA survey conducted in 2005 found numerous humpback whales north of the central Aleutian Islands, reinforcing the idea that the Bering Sea is an important feeding area. The historical importance of this area is suggested by the fact that the USSR is known to have killed hundreds of humpback whales in the Bristol Bay area during its illegal whaling operations in the 1960s. Analysis of whaling data show historical catches of humpback whales well into the Bering Sea and catches in the Bering Strait and Chukchi Sea from August-October in the 1930s (Mizroch and Rice in prep). ~~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 the 20th century.

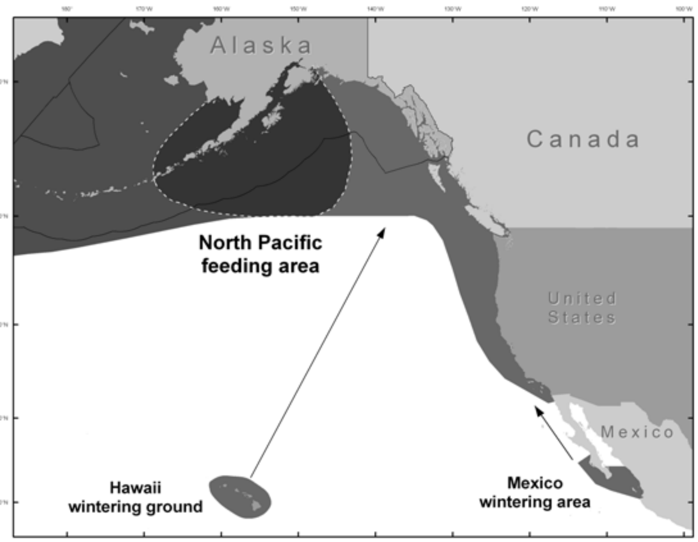

Figure 39. Approximate distribution of humpback whales in the eastern North Pacific (shaded area). Feeding and wintering areas are presented above (see text). Area within the dotted line is known to be an area of overlap with Western North Pacific stock. See Figure 38 for distribution of humpback whales in the western North Pacific.

Aerial, vessel, and photo-identification surveys and genetic analyses indicate that within the U. S. Exclusive Economic Zone (EEZ) there are at least three relatively separate populations that migrate between their respective summer/fall feeding areas to winter/spring calving and mating areas (Calambokidis et al. 1997, Baker et al. 1998; Figs. 38 and 39): 1) winter/spring populations in coastal Central America and coastal Mexico which migrate to the coast of California to southern British Columbia in summer/fall (Calambokidis et al. 1989, Steiger et al. 1991, Calambokidis et al. 1993) - referred to as the California/Oregon/Washington and Mexico stock; 2) winter/spring populations of the Hawaiian Islands which migrate to northern British Columbia/Southeast Alaska and Prince William Sound west to Unimak Pass (Baker et al. 1990, Perry et al. 1990, Calambokidis et al. 1997) - referred to as the Central North Pacific stock; and 3) winter/spring populations off ~~Japan~~Asia which, based on ~~Discovery Mark information, probably migrate primarily to waters west of the Kodiak Archipelago (the Bering Sea and Aleutian Islands) in summer/fall (Berzin and Rovnin 1966, Nishiwaki 1966, Darling 1991), and possibly to the Kuril Islands, Gulf of Anadyr, and southeastern Chukotka Peninsula (NMML unpublished data).~~ photo-identification and Discovery mark data have been found in the Bering Sea, Eastern Aleutians, and British Columbia (Darling 1991; 1993; Mizroch pers. comm., North Pacific Humpback Whale Working Group, unpublished data).

Discovery-type mark recovery data demonstrate long-distance migratory movements between Ogasawara and both the Gulf of Anadyr and the eastern Aleutians near Unimak Pass and between Okinawa and Unimak Pass. Mark recovery data suggest that whales may congregate in the eastern Aleutians early in the season (April-May) and late in the season (September) (Mizroch and Rice in prep). This latter population is referred to as the ~~W~~western North Pacific stock.

Breeding populations of humpback whales also occur in winter near Mexico's offshore islands in the Revillagigedo Archipelago. The migratory destination of ~~those~~these offshore Mexico whales is not well known (Calambokidis et al. 1993, Calambokidis et al. 1997), ~~although some whales from the Revillagigedo Archipelago have been matched to animals seen west of Kodiak, Alaska (Witteveen et al. 2004), Prince William Sound, and Southeast Alaska (J. Straley, pers. comm.)~~ but whales photographed in the Revillagigedo Archipelago have also been photographed in California, Washington, British Columbia, Southeast Alaska, Prince William Sound, Kodiak and eastern Aleutians (Witteveen 2004, J. Straley, pers. comm., Mizroch pers. comm., North Pacific Humpback Whale Working Group, unpublished data). ~~Some recent exchange between breeding areas has been~~Movements between offshore Mexico and Hawaii have been documented (Darling and McSweeney 1985, Baker et al. 1986~~, Darling and Cerchio 1993~~)~~., as well as m~~

Movements between Japan and Hawaii (Darling and Cerchio 1993) have been documented, as well as movements between Japan and British Columbia, and Japan and the Kodiak Archipelago (Darling et al. 1996, Calambokidis et al. 1997)~~, although recent preliminary data suggest some of these whales summer in the western Gulf of Alaska and Bering Sea (Witteveen et al. 2004)~~.

Movements between Southeast Alaska and British Columbia have also been documented (J. Straley, Univ. Alaska Southeast, Sitka, AK; pers. comm.). Calambokidis et al. (2001) concludes that there are at least three subpopulations of humpback whales on the wintering grounds (Hawaii, Japan, and Mexico), and possibly as many as six subpopulations, with subdivisions in Mexico, Japan, and Central America.

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, three stocks of humpback whales are recognized within the U. S. EEZ of the North Pacific: one in the eastern North Pacific (the California/Oregon/Washington - Mexico 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. Data from a large-scale study throughout the North Pacific conducted in 2004-06 (the Structure of Populations, Levels of Abundance, and Status of Humpbacks, or SPLASH, project) are expected to provide a much more comprehensive understanding of humpback whale population structure in the North Pacific in the near future.

The ~~C~~central North Pacific stock of humpback whales consists of feeding aggregations along the northern Pacific Rim, and some humpbacks are present offshore in the Gulf of Alaska, Bering Sea and above the Bering Strait (Brueggeman et al. 1989; Mizroch and Rice, 2007abstract, Moore et al. 2002). ~~Humpback whales are also present in the Bering Sea (Moore et al. 2002); it is not conclusively known whether those animals belong to the Western or Central North Pacific stocks, or to a separate, unnamed stock.~~ There was a photo-identification match between the Bering Sea and Japan (Mizroch pers. comm., North Pacific Humpback Whale Working Group, unpublished data). ~~Three~~Four feeding areas for the Central North Pacific stock ~~that~~ have been studied using photo-identification techniques: ~~S~~southeast Alaska, Prince William Sound, ~~and~~ Kodiak Island, and the eastern Aleutians/Shumagins area. There has been some exchange of individual whales between these locations. For example, five whales have been sighted in both Prince William Sound and ~~S~~southeast Alaska since studies began in 1977 (Perry et al. 1990; von Ziegesar et al. 1994; Mizroch et al. 2004); nine whales have been sighted between Kodiak Island, including the area adjacent to Kodiak along the Kenai Peninsula, and Prince William Sound; two whales have been sighted between Kodiak and ~~S~~southeast Alaska (Waite et al. 1999). Calambokidis et al. (2001) reports interchange between Kodiak, Prince William Sound, and ~~S~~southeast Alaska, although the number of individuals seen in multiple locations is small. Mizroch et al. (2004) examined photographs from 1979 to 1996 and reported that less than 1% of the individual whales photographed in either ~~S~~southeast Alaska or Prince William Sound moved between areas. Based on sightings across all Alaska feeding areas, fewer than 2% of the individuals were seen in more than one area (Mizroch et al. 2004). Fidelity to feeding 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).

As noted above, there is very little interchange documented between the ~~S~~southeast Alaska feeding area and the Prince William Sound, Kodiak, and Shumagin Islands feeding areas to the north. Because of the documented lack of interchange, it is ~~possible~~likely that a reduction in the population in the ~~S~~southeast Alaska feeding area would not be augmented by animals that normally use other feeding areas within a timeframe relevant to manage~~rs~~ment. Thus, NMFS is considering whether the ~~S~~southeast Alaska feeding area, and possibly other feeding areas in the North Pacific, should be formally designated as separate stocks under the MMPA. In preparation for this decision, a PBR level and annual mortality rates will be calculated for the ~~S~~southeast Alaska feeding area and included in the report for the entire ~~C~~central North Pacific humpback whale stock in order to guide managers in prioritizing conservation actions.

POPULATION SIZE

The current abundance estimate of humpback whales in the North Pacific is based upon data collected by nine independent research groups that conducted photo-identification studies of humpback whales in the three wintering areas (Mexico, Hawaii, and Japan). Photographs taken between 1991 and 1993 were used to estimate abundance because samples throughout the entire North Pacific were the largest and most complete during this period. Using Darroch's multi-strata (1961) method, which uses data only from wintering areas, and averaging the 1991-92, 1992-93, and 1991-93 winter ~~release-recovery~~mark-recapture information results in an abundance estimate of 4,005 (CV = 0.095) for the entire central North Pacific humpback whale stock (Calambokidis et al. 1997).

Photo-identification methods were used to identify 315 individual humpback whales in Prince William Sound from 1977 to 2001 (von Ziegesar 1992, Waite et al. 1999, von Ziegesar et al. 2004). Waite et al. (1999) identified 127 individuals in the Kodiak area between 1991 and 1994, and calculated a total annual abundance estimate of 651 (95% CI: 356-1,523) for the Kodiak region. Witteveen et al. (2004) conducted a mark-recapture study near the Shumagin Islands from 1999-2002 and estimated a total population size of 410 (95% CI: 241-683). It is not known how many animals occurring in the Shumagin Islands belong to the ~~W~~western or ~~C~~central North Pacific stock. The Kodiak catalog currently has 738 individuals and the Shumagin catalog has 266 individuals (Witteveen, pers. comm.).

Th~~is~~e central North Pacific stock of humpback whales winters in Hawaiian waters (Baker et al. 1986). Baker and Herman (1987) used capture-recapture methods in Hawaii 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 methods in conjunction with a small sample size. Further, the data used to produce this estimate were collected between 1980 and 1983. Mobley et al. (2001) conducted aerial surveys throughout the main Hawaiian Islands during 1993, 1995, 1998, and 2000. Abundance during these surveys was estimated as 2,754 (95% CI: 2,044-3,468), 3,776 (95% CI: 2,925-4627), 4,358 (95% CI: 3,261-5,454), and 4,491 (95% CI: 3,146-5,836). These estimates, which are based on line transect methods, are slightly more conservative than the estimates determined using mark-recapture techniques, perhaps due to computational problems associated with the assumption that there is a heterogeneous sighting probability across different regions of Hawaii.

In the northern British Columbia region (primarily near Langara Island), 275 humpback whales were photo-identified from 1992 to 1998 (G. Ellis, Pacific Biological Station, pers. comm.). As of 2003, approximately 850-1,000 humpback whales have been identified in British Columbia (J. Ford, Department of Fisheries and Oceans, Canada, pers. comm.); the extent to which the range of these animals also includes U.S. waters is not known.

Different studies have used different approaches to estimate the abundance of animals in ~~S~~southeast Alaska. Baker et al. (1992) estimated an abundance of 547 (95% CI: 504-590) using data collected from 1979 to 1986. Straley (1994) recalculated the estimate using a different analytical approach (Jolly-Seber open model for capture-recapture data) and obtained a mean population estimate of 393 animals (95% CI: 331-455) using the same 1979 to 1986 data set. Using data from 1986 to 1992 and the Jolly-Seber approach, Straley et al. (1995) estimated that the annual abundance of humpback whales in Southeast Alaska was 404 animals (95% CI: 350-458). Straley et al. (~~2002~~in press) examined data for the northern portion of ~~S~~southeast Alaska from 1994 to 2000 and provided an updated abundance estimate of 961 (95% CI: 657-1,076).

~~The sum of the available estimates for the known feeding areas is 2,036 (149 in PWS, 651 in Kodiak, 961 in Southeast, and 275 in British Columbia), which is well below the Calambokidis et al. (1997) estimate of 4,005 based on data collected from 1991 to 1993. However, the estimate for Southeast Alaska is known to be a minimum estimate because there is little to no photo-identification effort in the lower half of Southeast Alaska (south of Frederick Sound). In addition, many humpback whales feed seasonally near the Shumagin Islands, where photo-identification studies have only recently been initiated, and humpbacks are seen pelagically in the Gulf of Alaska. Abundance estimates based on photo-identification studies will underrepresent true abundance because photo-identification studies cover only a small portion of the range of humpback whales in the North Pacific. For example, there is very little geographic overlap between humpback whale distribution based on pelagic catches and the areas~~

of the long-term photo-identification humpback whale studies which have been conducted in the North Pacific since the late 1970s. Most of the long-term photo-ID studies are conducted nearshore from small vessels. Most of the pelagic whaling operations and the areas where whales were marked and recovered are further offshore than can be surveyed from small boats (Mizroch and Rice in prep). Also, Moore et al. (2002) have documented humpback whales in the Bering Sea, and it is not known whether these animals belong to the Ccentral or Wwestern North Pacific humpback whale stock.

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): $N_{MIN} = N/\exp(0.842\times[\ln(1+[CV(N)]^2)]^{½})$. Using the population estimate (N) of 4,005 (estimated in 1993; Calambokidis et al. 1997) and its associated CV(N) of 0.095, N_{MIN} for the entire Ccentral North Pacific humpback whale stock is 3,698. Although the Ssoutheast Alaska feeding aggregation is not being formally considered a stock, the calculation of a PBR for this area may be useful for management purposes. Using the population estimate (N) of 961 and its associated CV(N) of 0.12, N_{MIN} for this aggregation is 868. This is a minimum estimate based on part of the southeast Alaska/ northern British Columbia feeding aggregation.

Current Population Trend

Comparison of the estimate for the entire stock provided by Calambokidis et al. (1997) with the 1981 estimate of 1,407 (95% CI: 1,113-1,701) from Baker and Herman (1987) suggests that the stock increased in abundance between the early 1980s and early 1990s. However, the robustness of the Baker and Herman (1987) estimate is questionable due to the small sample size and opportunistic nature of the survey. Mizroch et al. (2004) calculate an annual population rate of increase of 10% (95% CI: 3%-16%). This is within the range of 8.8 to 14.4% reported by Best (1993) for humpback whales off South Africa, and is identical to the 10% value reported by Bannister and Hedley (2001) for humpback whales off western Australia. Mobley et al. (2001) estimated an annual increase of 7% for 1993-2000 using data from aerial surveys that were conducted in a consistent manner for several years across the main Hawaiian Islands and were developed specifically to estimate a trend for the Ccentral North Pacific stock. Zerbini et al. (2006) used line transect data from sequential surveys to estimate an increasing trend of 6.6% per year (95% CI: 4.7-8.4%).

The estimated number of animals in the Ssoutheast Alaska portion of this stock has increased. The 2000 estimate of 961 (Straley et al. 2002in press) is substantially higher than estimates from the early and mid-1980s. A trend for the Ssoutheast Alaska portion of this stock cannot be estimated from the data, however, because of differences in methods and areas covered.

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

Using a birth-interval model, Barlow and Clapham (1997) have estimated a population growth rate of 6.5% (SE = 1.2%) for the well-studied humpback whale population in the Gulf of Maine, although there are indications that this rate has slowed in recent yearsover the last decade (Clapham et al. 2003). Mobley et al. (2001) conducted annual surveys of the humpback whale breeding grounds in Hawaii and estimated a rate of increase of 7% for the period 1993-2000. Furthermore, it is clear that the abundance has increased in Ssoutheast Alaska in recent years. While 7% is the best available estimate of current rate of increase, and may or may not be the same as the stock's maximum net productivity rate, it seems reasonable to use 0.07 is being used as a new, conservative estimate of the maximum net productivity rate (R_{MAX}).

POTENTIAL BIOLOGICAL REMOVAL

Under the 1994 reauthorized 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 recommended value for cetacean stocks listed as endangered under the Endangered Species Act (Wade and Angliss 1997). The default value of 0.04 for the maximum net productivity rate will beis replaced by 0.07, which is the best estimate of the current rate of increase and is considered a conservative estimate of the maximum net productivity rate. Thus, using the abundance estimate calculated from 1993 surveys, the PBR for the entire Ccentral North Pacific stock of humpback whale, PBR = 12.9 would be calculated as 12.9 animals (3,698 × 0.035 × 0.1). The PBR level for the Southeast Alaska portion of this stock, PBR = would be 3.0 animals (868 × 0.035 × 0.1), and the PBR level for the northern portion of the stock is would be 9.9 animals (12.9 – 3.0). However, the 2005 revisions to the SAR guidelines (NMFS 2005) state that abundance estimates older than 8 years should not be used to calculate PBR due to a decline in confidence in the reliability of an aged abundance estimate. Therefore, the PBR for this stock is considered undetermined. Data collected between 2004-2006 during SPLASH surveys are currently being analyzed, and a new abundance estimate and PBR for this stock will be calculated from these data.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

Fisheries Information

Until 2004, there were four different federally-regulated commercial fisheries in Alaska that occurred within the range of the ~~C~~central North Pacific humpback whale stock that were monitored for incidental mortality by fishery observers. As of 2004, changes in fishery definitions in the List of Fisheries have resulted in separating these four fisheries into 17 fisheries (69 FR 70094, 2 December 2004). This change does not represent a change in fishing effort, but provides managers with better information on the component of each fishery that is responsible for the incidental serious injury or mortality of marine mammal stocks in Alaska. Between 200~~1~~2 and 200~~5~~6, there were incidental serious injuries and mortalities of ~~C~~central North Pacific humpback whales in the Bering Sea/Aleutian Islands sablefish pot fishery (Table 37). Estimates of marine mammal serious injury/mortality in observed fisheries are provided in Perez (2006) and Perez (unpubl. ms.).

Table 37. Summary of observer reported incidental mortalities and serious injuries of humpback whales (Central North Pacific stock) due to commercial fisheries from 200~~1~~2 to 200~~5~~6 and calculation of the mean annual mortality rate. Details of how percent observer coverage is measured is included in Appendix 6.

Fishery name	Years	Data type	Observer coverage	Observed mortality (in given yrs.)	Estimated mortality (in given yrs.)	Mean annual mortality
Bering Sea sablefish pot	~~2001~~ 2002 2003 2004 2005 2006	obs data	~~38.7~~ 40.6 21.7 49.1 39.2 35.3	~~0~~ 0 0 0 0 0	~~0~~ ~~0~~1[1] ~~1~~0 0 0 0	0.20[2] (N/A)
Minimum total annual mortality				North: 0.2 SE: 0.0 Total: 0.2		

[1] Mortality was seen by an observer but not during an "observed set"; thus quantification of effort cannot be accomplished and the single record cannot be extrapolated to provide a total estimated mortality level.
[2] These mortalities occurred in an area of known overlap with the Western North Pacific stock of humpback whales. Since the stock identification is unknown, the mortalities are reflected in both stock assessments.

Reports of entangled humpback whales found swimming, floating, or stranded with fishing gear attached occur in both Alaskan and Hawaiian waters. All reports of mortalities or injuries of humpback whales from the ~~C~~central North Pacific stock from 2001 to 2005 are provided in Appendix 8 and a summary of the information is provided in Table 38. Overall, there were 54 reports of human-related mortalities or injuries during this 5-year period. Of these, there were 40 incidents which involved commercial fishing gear, and 15 of those incidents involved serious injuries or mortalities. This estimate is considered a minimum because not all entangled animals strand and not all stranded animals are found, reported, or cause of death determined.

Table 38. Summary of ~~C~~central North Pacific humpback whale mortalities and serious injuries caused by entanglement and ship strikes from stranding reports, 2001-2005. A summary of information used to determine whether an injury was serious or non-serious is included in Appendix 8. Fisheries with zero average annual mortality indicate historical marine mammal interactions.

Area	Human activity/fishery	Year	Mortality	Serious	Not determinable	Average annual serious injury/mortality rate (2001-2005)
North	Ship strike	2001 2002	1 0	0 0	0 0	0.4

Area	Human activity/fishery	Year	Mortality	Serious	Not determinable	Average annual serious injury/mortality rate (2001-2005)
		2003	0	0	0	
		2004	0	0	0	
		2005	1	0	1	
	Unspecified gear	2001	0	2	0	0.4
		2002	0	0	0	
		2003	0	0	0	
		2004	0	0	0	
		2005	0	0	1	
	Salmon set gillnet	2001	0	0	0	0
		2002	0	0	0	
		2003	0	0	0	
		2004	0	0	0	
		2005	0	0	0	
	Unspecified gillnet	2001	1	0	0	0.4
		2002	0	0	0	
		2003	0	0	0	
		2004	0	0	0	
		2005	0	1	0	
	Purse seine	2001	0	0	0	0.0
		2002	0	0	0	
		2003	0	0	0	
		2004	0	0	0	
		2005	0	0	0	
	Unspecified pot gear	2001	0	0	0	0.0
		2002	0	0	0	
		2003	0	0	0	
		2004	0	0	0	
		2005	0	0	0	
	Crab pot gear	2001	0	0	0	0.0
		2002	0	0	0	
		2003	0	0	0	
		2004	0	0	0	
		2005	0	0	0	
	Yakutat salmon set gillnet	2001	1	0	0	0.2
		2002	0	0	0	
		2003	0	0	0	
		2004	0	0	0	
		2005	0	0	0	
	Cook Inlet salmon set gillnet	2001	N/A	N/A	N/A	0.2
		2002	N/A	N/A	N/A	
		2003	N/A	N/A	N/A	
		2004	N/A	N/A	N/A	
		2005	0	1	0	
	Kodiak salmon purse seine	2001	N/A	N/A	N/A	0.2
		2002	N/A	N/A	N/A	

Area	**Human activity/fishery**	**Year**	**Mortality**	**Serious**	**Not determinable**	**Average annual serious injury/mortality rate (2001-2005)**
		2003	N/A	N/A	N/A	
		2004	N/A	N/A	N/A	
		2005	1	0	0	
	Lower Cook Inlet salmon purse seine	2001	N/A	N/A	N/A	0.2
		2002	N/A	N/A	N/A	
		2003	N/A	N/A	N/A	
		2004	N/A	N/A	N/A	
		2005	1	0	0	
	Average annual serious injury/mortality rate fishery only					1.6
	Average annual serious injury/mortality rate total					2.0
SE	Ship strike	2001	1	0	0	1.4
		2002	0	0	0	
		2003	1	0	0	
		2004	2	1	0	
		2005	1	1	0	
	Unspecified gear	2001	0	0	0	0.4
		2002	0	0	2	
		2003	0	0	0	
		2004	0	2	1	
		2005	0	0	1	
	Salmon set gillnet	2001	0	0	0	0.0
		2002	0	0	0	
		2003	0	0	0	
		2004	0	0	0	
		2005	0	0	0	
	Unspecified gillnet	2001	0	0	0	0.2
		2002	0	0	0	
		2003	0	0	0	
		2004	0	0	0	
		2005	0	1	1	
	Purse seine	2001	0	0	0	0.0
		2002	0	0	0	
		2003	0	0	0	
		2004	0	0	0	
		2005	0	0	0	
	Unspecified pot gear	2001	0	0	1	0.0
		2002	0	0	0	
		2003	0	0	0	
		2004	0	0	0	
		2005	0	0	0	
	Crab pot gear	2001	0	0	0	0.6
		2002	0	0	0	
		2003	0	1	0	
		2004	0	0	1	
		2005	0	2	2	
	SE salmon drift gillnet	2001	N/A	N/A	N/A	0.2

Area	Human activity/fishery	Year	Mortality	Serious	Not determinable	Average annual serious injury/mortality rate (2001-2005)
		2002	N/A	N/A	N/A	
		2003	N/A	N/A	N/A	
		2004	N/A	N/A	N/A	
		2005	1	0	0	
	Average annual serious injury/mortality rate fishery only					1.4
	Average annual serious injury/mortality rate total					2.8
Hawaii	Unspecified gear	2001	0	0	1	0.0
		2002	0	0	0	
		2003	0	0	0	
		2004	0	0	0	
		2005	0	0	0	
	Average annual serious injury/mortality rate fishery only					0.0
	Average annual serious injury/mortality rate total					0.0

The overall U. S. commercial fishery-related minimum mortality and serious injury rate for the entire stock is 3.2 humpback whales per year, based on observer data from Alaska (0.2~~0~~), stranding records from Alaska (3.0), and stranding records from Hawaii (0). The estimated fishery-related minimum mortality and serious injury rate incidental to commercial fisheries for the northern portion of the stock is 1.8 humpback whales per year, based on observer data from Alaska (0.2~~0~~), stranding records from Alaska (1.6) and stranding data from Hawaii (0) (Table 38). The estimated minimum mortality and serious injury rate incidental to the commercial fisheries in ~~S~~southeast Alaska is 1.4 humpback whales per year, based on stranding records from Alaska (1.4), and stranding data from Hawaii (0) (Table 38).

As mentioned previously, these estimates of serious injury/mortality levels should be considered a minimum. No observers have been assigned to several fisheries that are known to interact with this stock, making the estimated mortality rate unreliable. Further, due to limited Canadian observer program data, mortality incidental to Canadian commercial fisheries (i.e., those similar to U.S. fisheries known to interact with humpback whales) is uncertain. Though interactions are thought to be minimal, data regarding the level of humpback whale mortality related to commercial fisheries in northern British Columbia are not available, again indicating that the estimated mortality incidental to commercial fisheries is underestimated for this stock.

Subsistence/Native Harvest Information

Subsistence hunters in Alaska ~~have not been reported~~ are not authorized to take from this stock of humpback whales, and no takes have been reported.

Other Mortality

Ship strikes and other interactions with vessels unrelated to fisheries have also occurred to humpback whales. Those cases are included in Appendix 8 and summarized in Table 38. Of those, nine ship strikes constitute “other sources” of mortality or serious injury; seven of these ship strikes occurred in ~~S~~southeast Alaska and two occurred in the northern portion of this stock’s range. It is not known whether the difference in ship strike rates between ~~S~~southeast Alaska and the northern portion of this stock is due to differences in reporting, amount of vessel traffic, densities of animals, or other factors. Averaged over the year period from 2001 to 2005, these account for an additional 1.8 humpback whale mortalities per year for the entire stock (0.4 ship strikes/year for the northern portion of the stock, and 1.4 strikes/year for the southeast portion).

HISTORICAL WHALING

Rice (1978) estimated that the number of humpback whales in the North Pacific may have been approximately 15,000 individuals prior to exploitation; however, this was based upon incomplete data and, given the level of known catches (legal and illegal) since World War II, may be an underestimate. Intensive commercial whaling removed more than 28,000 animals from the North Pacific during the 20th century. From 1961 to 1971, an additional 6,793 humpback whales were killed illegally by the U.S.S.R. Many animals during this period were taken from the Gulf of Alaska and Bering Sea (Doroshenko 2000); however, catches occurred across the North Pacific, from the Kuril Islands to the Queen Charlottes, and additional illegal catches in earlier years may have gone unrecorded. Humpback whales in the North Pacific were theoretically protected in 1965, but illegal catches by the U.S.S.R. continued until 1972 (Ivashchenko et al. 2007).

STATUS OF STOCK

As the estimated annual mortality and serious injury rate for the entire stock (5.0; 3.2 of which were fishery-related; Table 39) is considered a minimum, it is unclear whether the level of human-caused mortality and serious injury exceeds the PBR level (12.9) for the entire stock. The estimated annual mortality and serious injury rate in ~~S~~southeast Alaska (2.8, of which 1.4 were fishery-related) is less than the PBR level if calculated only for the ~~S~~southeast Alaska portion of the population (3.0). The minimum estimated U. S. commercial fishery-related mortality and serious injury for this stock is not less that 10% of the calculated PBR for either the entire stock or the portion of the stock in ~~S~~southeast Alaska and, therefore, can not be considered to be insignificant and approaching a zero mortality and serious injury rate. The humpback whale is listed as "endangered" under the Endangered Species Act, and therefore designated as "depleted" under the MMPA. As a result, the ~~C~~central North Pacific stock of humpback whale is classified as a strategic stock. However, the status of the entire stock relative to its Optimum Sustainable Population size is unknown.

Table 39. Summary of serious injury (SI) and mortality (M) levels for the ~~C~~central North Pacific (CNP) stock of humpback whales.

Area	Data types for fishery-related information				Ship strikes	Total	"PBR"
	Observer data	AK Strand.	HI Strand.	Total fish.			
Northern	0.2	1.6	0	1.8	0.4	2.2	9.9
Southeast	N/A	1.4	0	1.4	1.4	2.8	3.0
TOTAL	0.2	3.0	0[1]	3.2[2]	1.8	5.0~~[3]~~	12.9

[1] The average annual SI/M in HI is 0.
[2] This is the sum of the observed SI/M (0.2), the AK strandings (3.0), and the average HI stranding rate (0).
~~[3] This is the sum of 3.2 + 1.8.~~

Habitat Concerns

This stock is the focus of a large whale watching industry in its wintering grounds (Hawaii) and a growing whale watching industry in its summering grounds (Alaska). Regulations concerning minimum distance to keep from whales and how to operate vessels when in the vicinity of whales have been developed for Hawaii waters in an attempt to minimize the impact of whale watching. Additional concerns have been raised about the impact of jet skis and similar fast waterborne tourist-related traffic, notably in nearshore areas inhabited by mothers and calves. In 2001, NMFS issued regulations to prohibit most approaches to humpback whales in Alaska within 100 yards (91.4 m; 66 FR 29502; 31 May 2001). The growth of the whale watching industry, however, is a concern as preferred habitats may be abandoned if disturbance levels are too high.

Elevated levels of sound from the Acoustic Thermometry of Ocean Climate (ATOC) program, the U.S. Navy's Low Frequency Active (LFA) sonar program, and other anthropogenic sources (i.e., shipping and whale watching) in Hawaii waters is of potential concern for this stock. Results from experiments in 1996 off Hawaii indicated only subtle responses of humpback whales to ATOC-like transmissions (Frankel and Clark 1998). Frankel and Clark (2002) indicated that there were also slight shifts in humpback whale distribution in response to ATOC. Efforts are underway to evaluate the relative contribution of sound (e.g., experiments with LFA sound sources) to Hawaii's marine environment, although reports summarizing the results of recent research are not available.

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

STOCK DEFINITION AND GEOGRAPHIC RANGE

Within the U.S. waters in the Pacific, fin whales are found seasonally off the coast of North America and in the Bering Sea during the summer (Fig. 40). Recent information on seasonal fin whale distribution has been gleaned from the reception of fin whale calls by bottom-mounted, offshore hydrophone arrays along the U.S. Pacific coast, in the central North Pacific, and in the western Aleutian Islands (Moore et al. 1998, Watkins et al. 2000). Moore et al. (1998) and Watkins et al. (2000) both documented high levels of fin whale call rates along the U.S. Pacific coast beginning in August/September and lasting through February, suggesting that th~~is~~ese may be ~~an~~ important breeding and/or feeding areas during the winter. While peaks in call rates occurred during fall and winter in the central North Pacific and the Aleutian Islands, there were also a few calls recorded during the summer months. While seasonal differences in recorded call rates are generally consistent with the results of aerial surveys which have documented seasonal whale distribution, it is not known whether these differences in call rates reflect true seasonal differences in whale distribution, differences in calling rates, or differences in oceanographic properties (Moore et al. 1998). Fin whale calls have also been well-documented off of Hawaii during the winter (McDonald and Fox 1999), although aerial and shipboard surveys have found relatively few animals in Hawaiian waters (Mobley et al. 1996).

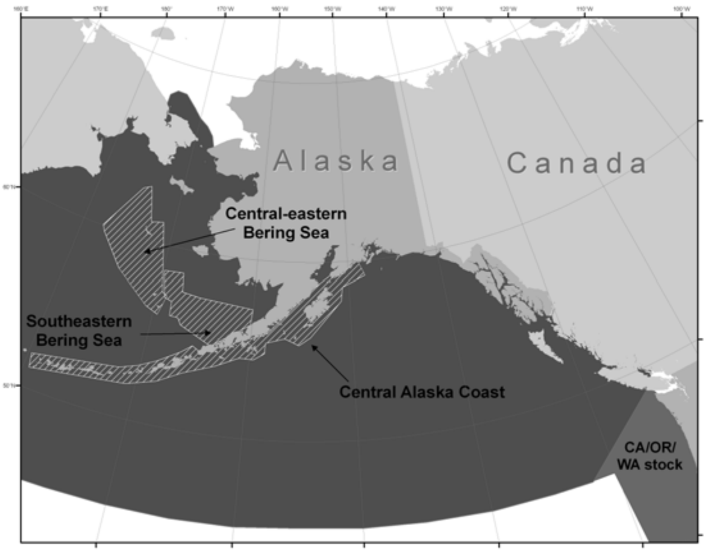

Figure 40. Approximate distribution of fin whales in the eastern North Pacific (shaded area). Striped areas indicate where vessel surveys occurred in 1999-2000 (Moore et al. 2002) and 2001-2003 (Zerbini et al. 2006).

Recent surveys in the central-eastern and southeastern Bering Sea in 1999 and 2000 and in coastal waters of the Aleutian Islands and the Alaska Peninsula from 2001 to 2003 resulted in new information about the distribution and relative abundance of fin whales in these areas (Moore et al. 2000, 2002; Zerbini et al. 2006). Fin whale abundance estimates were nearly five times higher in the central-eastern Bering Sea than in the southeastern Bering Sea (Moore et al. 2002), and most sightings in the central-eastern Bering Sea occurred in a zone of particularly high productivity along the shelf break (Moore et al. 2000).

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 those authors cited additional evidence that supported the establishment of subpopulations in the North Pacific. Further, Fujino (1960) described an eastern and a western group, which are isolated though may intermingle around the Aleutian Islands. Discovery Mark 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 southern Baja California (Leatherwood et al. 1982). As a result, stock structure of fin whales remains uncertain.

Mizroch et al. (~~in review~~submitted) provided a comprehensive summary of whaling catch data, Discovery Mark recoveries, and opportunistic sightings data and found evidence ~~of at least two migratory stocks, similar to Fujino's (1960) eastern and western groups~~that suggests there are at least 4 populations of fin whales: 2 that are migratory (eastern and western North Pacific) and two or three more that are resident year-round in peripheral seas such as the Gulf of California, East China Sea, and the Sea of Japan/ Sanriku-Hokkaido area. Winter distribution and location of primary wintering areas (if any) are poorly known and need further study. However, iIt appears likely that the two migratory stocks mingle in the Bering Sea in July and August, rather than in the Aleutian Islands as Fujino (1960) concluded. Mizroch et al. (in review) also found strong evidence of at least one additional non-migratory resident group of fin whales in the Sea of Japan/Sanriku-Hokkaido area, in addition to known resident groups in the Gulf of California and the East China Sea.

For management purposes, however, and until further information becomes available to resolve the uncertainties described above, three stocks of fin whales are currently recognized in U.S. waters: 1) Alaska (Northeast Pacific), 2) California/Washington/Oregon, and 3) Hawaii. New information from Mizroch et al. (submitted) suggests that this structure should be reviewed and updated, if appropriate, to reflect current data. The California/Oregon/Washington and Hawaii fin whale stocks are reported separately in the Stock Assessment Reports for the Pacific Region.

POPULATION SIZE

Reliable estimates of current and historical abundance for the entire Northeast Pacific fin whale stock are currently not available. Two recent studies provide some information on the distribution and occurrence of fin whales, although they do not provide estimates of population size. A survey conducted in August of 1994 covering 2,050 nautical miles of trackline south of the Aleutian Islands encountered only four 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, thus, no population estimate can be made. Passive acoustics were used off the island of Oahu, Hawaii, to document a minimum density estimate of 0.081 fin whales/1,000km^2 from peak call rates during the winter (McDonald and Fox 1999). This density estimate is well below the population density of 1.1 animals/1,000 km^2 documented off the coast of California (Barlow 1995, Forney et al. 1995) but does indicate thatthe presence of at least a few fin whales in waters off of Hawaii are used seasonally by fin whales.

A visual survey for cetaceans was conducted in the central-eastern Bering Sea in July-August 1999 and in the southeastern Bering Sea in June-July 2000 in cooperation with research on commercial fisheries (Moore et al. 2002). The survey included 1,761 km and 2,194 km of effort in 1999 and 2000, respectively. Aggregations of fin whales were often sighted in 1999 in areas where the ship's echosounder identified large aggregations of zooplankton, euphausiids, or fish (Moore et al. 2000). One aggregation of fin whales which occurred during an off-effort period involved greater than 100 animals and occurred in an area of dense fish echosign. Results of the surveys in 1999 and 2000 in the central-eastern Bering Sea and southeastern Bering Sea provided provisional estimates of 3,368 (CV = 0.29) and 683 (CV = 0.32), respectively (Moore et al. 2002). These estimates are considered provisional because they have not been corrected for animals missed on the trackline, animals submerged when the ship passed, and responsive movement. However, the provisional estimate for fin whales in each area is expected to be robust as previous studies have shown that only small correction factors are needed for this species. The Moore et al. (2002) estimate for 1999 is different than that of Moore et al. (2000) because it covers the south-eastern Bering Sea as well as the central-eastern Bering Sea. Additionally, the region covered by Moore et al. (2000) did not have consistent effort and thus could be inaccurate. This estimate cannot be used as an estimate of the entire Northeast Pacific stock of fin whales because it is based on a survey in only part of the stock's range.

Dedicated line transect cruises were conducted in coastal waters of western Alaska and the eastern and central Aleutian Islands in July-August 2001-2003 (Zerbini et al. 2006). Over 9,053 km of tracklines were surveyed in coastal waters (as far as 85 km offshore) between the Kenai Peninsula (150^{o}W) and Amchitka Pass (178^{o}W). Fin whale sightings (n = 276) were observed from east of Kodiak Island to Samalga Pass, with high aggregations recorded near the Semidi Islands. Zerbini et al. (2006) estimated that 1,652 (95% CI: 1,142-2,389) whales occurred in the area.

Minimum Population Estimate

Information on abundance of fin whales in Alaskan waters has improved considerably in the past few years. Although the full range of the northeast Pacific stock of fin whales in Alaskan waters has not been surveyed, a rough estimate of the size of the population west of the Kenai Peninsula could include the sums of the estimates from Moore et al. (2002) and Zerbini et al. (2006). Using this approach, the initial provisional estimate of the fin whale population west of the Kenai Peninsula would be 5,700. This is a minimum estimate for the entire stock because it was estimated from surveys which covered only a small portion of the range of this stock.

Current Population Trend

Zerbini et al. (2006) estimated rates of increase of fin whales in coastal waters south of the Alaska Peninsula (Kodiak and Shumagin Islands). An annual increase of 4.8% (95% CI: 4.1-5.4%) was estimated for the period 1987-2003. This estimate is the first available for North Pacific fin whales and is consistent with other estimates of population growth rates of large whales. It should be used with ~~some~~ caution, however, due to ~~some of the~~ uncertainties in the initial population estimate for the first trend year (1987) and due to uncertainties about the population structure of the fin whales in the area. Also, the study ~~are~~ represented only a small fraction of the range of the northeast Pacific stock.

CURRENT AND MAXIMUM NET 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 reauthorized 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} $0.5R_{MAX} \times F_R$. The recovery factor (F_R) for this stock is 0.1, the recommended value for cetacean stocks which are listed as endangered (Wade and Angliss 1997). Thus, the PBR level for this stock is 11.4 (5,700 × 0.02 × 0.1).

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

Fisheries Information

~~Prior to 1999, there were no observed or reported mortalities of fin whales incidental to commercial fishing operations within the range of this stock. However, in 1999, one fin whale was killed incidental to the Gulf of Alaska pollock trawl fishery. Because there have been no reported serious injuries or mortalities in this fishery for the period 2001-2005 (Perez in prep), the mean annual mortality and serious injury rate for fin whales in this fishery is 0. There were no reported strandings of fin whales between 2001 and 2005 (NMFS unpublished data).~~

~~The total estimated mortality and serious injury incurred by this stock as a result of interactions with U. S. commercial fisheries is zero.~~

Between 2002 and 2006, there was one observed incidental mortality of a fin whale in the Bering Sea/Aleutian Island pollock trawl fishery (Table xx). Estimates of marine mammal serious injury/mortality in observed fisheries are provided in Perez (unpubl. ms.).

Table xx. Summary of incidental mortality of fin whales due to commercial fisheries and calculation of the mean annual mortality rate. Mean annual takes are based on 2002-2006 data. Details of how percent observer coverage is measured is included in Appendix 6.

Fishery name	Years	Data type	Percent observer coverage	Observed mortality	Estimated mortality	Mean annual takes (CV in parentheses)
BSAI pollock trawl	2002 2003 2004 2005 2006	obs data	 73.0	0 0 0 0 1	0 0 0 0 1.1	0.23 (CV = 0.34)
Estimated total annual takes						0.23 (CV = 0.34)

Subsistence/Native Harvest Information

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

Other Mortality

Between 1925 and 1975, 47,645 fin whales were reported killed throughout the North Pacific (International Whaling Commission, BIWS catch data, February 2003 version, unpublished), although newly revealed information about illegal Soviet catches indicates that the Soviets over-reported catches of about 1,200 fin whales, presumably to hide catches of other protected species (Doroshenko 2000). There are no reports of direct human-related injuries or mortalities to fin whales in Alaska waters included in the Alaska Region stranding database for 2001-2005 (NMFS unpublished data). ~~Thus, the total estimated mortality and serious injury incurred by this stock is zero.~~

STATUS OF STOCK

The fin whale is listed as "endangered" under the Endangered Species Act of 1973, and therefore designated as "depleted" under the MMPA. As a result, the Northeast Pacific stock is classified as a strategic stock. While reliable estimates of the minimum population size, population trends, and PBR are available for a portion of this stock, much of the North Pacific range has not been surveyed. Therefore the status of the stock relative to its Optimum Sustainable Population size is currently not available. The estimated annual rate of mortality and serious injury incidental to U. S. commercial fisheries for this stock (~~0~~0.2) does not exceed the PBR level for the stock (11.4). Thus, fishery-related mortality levels can be determined to have met a zero mortality and serious injury rate.

HABITAT CONCERNS

There are no known habitat issues that are of particular concern for this stock.

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NORTH PACIFIC RIGHT WHALE (*Eubalaena japonica*):
Eastern North Pacific Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

A comprehensive review of all 20th century sighting, catches, and strandings of North Pacific right whales was conducted by Brownell et al. (2001). Data from this review were subsequently combined with historical whaling records to map the known distribution of the species (Clapham et al. 2004, Shelden et al. 2005). Whaling records indicate that right whales ranged across the entire North Pacific north of 35°N and occasionally as far south as 20°N (Scarff 1986, 1991; Fig. 42). Before right whales in the North Pacific were heavily exploited by commercial whalers, concentrations were found in the Gulf of Alaska, eastern Aleutian Islands, south-central Bering Sea, Sea of Okhotsk, and Sea of Japan (Braham and Rice 1984). During 1965-99, following large illegal catches by the U.S.S.R., there were only 82 sightings of right whales in the entire eastern North Pacific, with the majority of these occurring in the Bering Sea and adjacent areas of the Aleutian Islands (Brownell et al. 2001). 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, Brownell et al. 2001).

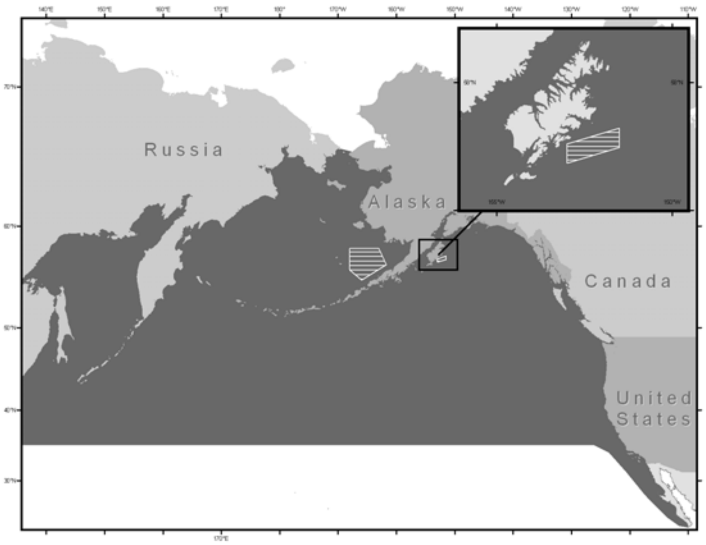

Figure 42. Approximate historical distribution of North Pacific right whales in the eastern North Pacific (shaded area). Striped areas indicate northern right whale critical habitat (71 FR 38277, 6 July 2006).

North Atlantic (*E. glacialis*) and Southern Hemisphere (*E. australis*) right whales calve in coastal waters during the winter months. However, in the eastern North Pacific no such calving grounds have ever been found (Scarff 1986). Migratory patterns of the North Pacific stock are unknown, although it is thought the whales migrate from high-latitude feeding grounds in summer to more temperate waters during the winter, possibly offshore (Braham and Rice 1984, Scarff 1986, Clapham et al. 2004).

Information on the current seasonal distribution of right whales is available from dedicated vessel and aerial surveys, bottom-mounted acoustic recorders, and vessel surveys for fisheries ecology and management which have also included dedicated marine mammal observers. Aerial and vessel surveys for right whales have occurred in recent years in a portion of the southeastern Bering Sea (Fig. 42) where right whales have been observed ~~each~~ most summers since 1996 (Goddard and Rugh 1998). North Pacific right whales are observed consistently in this area, although it is clear from historical and Japanese sighting survey data that right whales often range outside this area and occur elsewhere in the Bering Sea (Clapham et al. 2004, LeDuc et al. 2001, Moore et al. 2000, Moore et al. 2002, NMFS unpublished data). Bottom-mounted acoustic recorders were deployed in the southeastern Bering Sea and the northern Gulf of Alaska starting in 1999 to document the seasonal distribution of right whale calls (Mellinger et al. 2004). Preliminary analysis of the data from the recorders indicates that right whales remain in the southeastern Bering Sea from May through November with peak call detection in September (Munger and Hildebrand 2004). Right whale calls were rarely detected in the northwestern Gulf of Alaska in the late summer (Mellinger et al. 2004). Right whales have not been observed outside the localized area in the southeastern Bering Sea during surveys conducted for fishery management purposes which covered a broader area of Bristol Bay and the Bering Sea (Moore et al. 2000, 2002; see Fig. 40 for locations of tracklines for these surveys).

In 2004, a right whale was successfully tagged with a satellite-monitored transmitter for 40 days, during which time the animal moved over a large part of the southeastern Bering Sea including the outer shelf area (Wade et al. 2006). In September 2004, information from the tag was used together with acoustic detections to find the largest aggregation of right whales observed in the eastern North Pacific since Soviet whaling. A minimum of 17 individuals were identified by photo-id and by genotyping from skin biopsies.

There are fewer recent sightings of right whales in the Gulf of Alaska than in the Bering Sea (Brownell et al. 2001), although little survey effort has been conducted in this region. Waite et al. (2003) summarized sightings from the Platforms of Opportunity Program from 1959-97. Seven sightings of right whales were reported, but only one sighting of four right whales at the mouth of Yakutat Bay in 1979 could be positively confirmed (Waite et al. 2003). Sightings of a single right whale off eastern Kodiak Island occurred in July 1998 during an aerial survey (Waite et al. 2003), and additional ~~singletons~~lone animals were observed off Kodiak Island in the Barnabas Canyon area from NOAA surveys in August 2004, 2005, and 2006 (available Alex Zerbini, NOAA, AFSC, NMML, 7600 Sand Point Way, Seattle, WA; unpublished data). Acoustic monitoring at seven sites in the Gulf of Alaska has detected right whale calls at only two: one off eastern Kodiak (detection distance 20-50 km) and the other in deep water south of the Alaska Peninsula (detection distance 10s of kilometers) (Mellinger et al. 2004).

Many of the illegal Soviet catches of right whales occurred across a large area to the south of Kodiak, where right whales were found in tight feeding concentrations (primarily in 1963 and 1964, Doroshenko 2000). Whether this region remains an important habitat for this species, ~~and~~or whether cultural memory of its existence has been lost, is currently unknown.

The following information was considered in classifying stock structure according to the Dizon et al. (1992) phylogeographic approach: 1) Distributional data: distinct geographic distribution; 2) Population response data: unknown; 3) Phenotypic data: unknown; and 4) Genotypic data: unknown. Based on this limited information, two stocks of North Pacific right whales are currently recognized: a Western North Pacific and an Eastern North Pacific stock (Rosenbaum et al. 2000, Brownell et al. 2001). The former is believed to feed primarily in the Sea of Okhotsk.

POPULATION SIZE

Based on sighting data, Wada (1973) estimated a total population of 100-200 in the North Pacific. Rice (1974) stated that only a few individuals remained in the eastern North Pacific stock, and that for all practical purposes the stock was extinct because no sightings of a mature female with a calf had been confirmed since 1900. However, ~~recent~~ confirmed sightings in 2004 and 2005 in the Bering Sea have invalidated this view (Wade et al. 2006). Brownell et al. (2001) suggested from a review of sighting records that the abundance of this species in the western North Pacific was likely in the "low hundreds". A reliable estimate of abundance for the North Pacific right whale stock is currently not available.

There were several sightings of North Pacific right whales in the mid-1990s which renewed interest in conducting dedicated surveys for this species. In April 1996 a right whale was sighted off Maui (Salden and Mickelsen 1999). This was the first documented sighting of a right whale in Hawaiian waters since 1979 (Herman et al. 1980, Rowntree et al. 1980), although there is no reason to believe that either Hawaii or tropical Mexico have ever been anything except extra-limital habitats for this species (Brownell et al. 2001). A group of 3-4 right whales was sighted in western Bristol Bay, southeastern Bering Sea, in July 1996 which may have included a juvenile animal (Goddard and Rugh 1998). During July 1997, a group of 4-5 individuals was encountered one evening in Bristol Bay, followed by a second sighting of 4-5 whales the following morning in approximately the same location (Tynan 1999). During dedicated surveys in July 1998, July 1999, and July 2000, 5, 6, and 13 right whales, were again found in the same general region of the southeastern Bering Sea (Leduc et al. 2001). Biopsy samples of right whales encountered in the southeastern Bering Sea were taken in 1997 and 1999. Genetic~~s~~ analyses identified three individuals in 1997 and four individuals in 1999; of the animals identified, one was identified in both years, resulting in a total genetic count of six individuals (LeDuc et al. 2001). Genetic analyses on samples from all six whales sampled in 1999 determined that the animals were male (LeDuc et al. 2001). Two right whales were observed during a vessel-based survey in the central Bering Sea in July 1999 (Moore et al. 2000).

Right whales can be individually identified by photographs of the unique callosity patterns on their heads. Aerial photogrammetric analyses indicated that ~~one of the animals~~ the same individual was seen in 1997, 1998, and 1999 (LeDuc et al. 2001). Body lengths of 12 animals ranged from 14.7 to 17.6 m (LeDuc et al. 2001); since body length at sexual maturity has been estimated at about 15 m, LeDuc et al. (2001) suggest that all measured animals may have been sexually mature.

Information fromDuring the Bristol Bay survey in 2002, indicates that there were seven sightings of right whales (LeDuc 2004). One of the sightings in 2002 included a right whale calf; this is the first confirmed sighting of a calf in decades (a possible calf or juvenile sighting was also reported in Goddard and Rugh 1998). The concentration of right whales found in the summer of 2004 (above) included a minimum of 17 individuals, as determined by both photo-identification and genotyping from skin biopsies. Among these, at least one male had been previously photographed and four animals biopsied in other years; the latter included the only female seen prior to this encounter (Wade et al. 2006). This concentration also included two probable calves.

Minimum Population Estimate

At this time, it is not possible to produce a reliable estimate of minimum abundance for this stock, as a current estimate of abundance is not available. However, of 13 individual animals photographed during aerial surveys in 1998, 1999, and 2000, two have already been rephotographed (LeDuc et al. 2001). This photographic recapture rate is consistent with a very small population size. This conclusion is supported by a preliminary genotype-based comparison of the 17 individuals biopsied in the Bering Sea in the summer of 2004 which also revealed at least four matches to animals biopsied in previous years (Wade et al. 2006).

Current Population Trend

A reliable estimate of trend in abundance is 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, given the small apparent size and low observed calving rate of this population, this rate may be unrealistically high.

POTENTIAL BIOLOGICAL REMOVAL

Under the 1994 reauthorized 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 recommended value for cetacean stocks which are listed as endangered (Wade and Angliss 1997). A reliable estimate of minimum abundance is not available for this stock but it is certainly very small. The PBR level for this stock is considered zero.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

Fisheries Information

Gillnets were implicated in the death of a right whale off the Kamchatka Peninsula (Russia) in October of 1989 (Kornev 1994). No other incidental takes of right whales are known to have occurred in the North Pacific. Collisions with vessels is considered the primary source of human-caused mortality of right whales in the Atlantic (Cole et al. 2005). Any mortality incidental to commercial fisheries would be considered significant. Entanglement in fishing gear, including lobster pot and sink gillnet gear, is a significant source of mortality for the North Atlantic right whale stock (Waring et al. 2004). An analysis of right whale photographs to estimate entanglement rate from scarring data is currently under way.

Based on the available recordsThere are no records of fisheries mortalities of North Pacific right whales. Thus, the estimated annual mortality rate incidental to U. S. commercial fisheries approaches 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 are not reported to take animals from this stock.

Other Mortality

Right whales are large, slow-swimming, whales which tend to congregate in coastal areas., and have a Their thick layer of blubber which results in their floatingcauses them to float when killed. These attributes made them an easy and profitable species for early (pre-modern) whalers. By the time the modern whale fishery (harpoon cannons and steam powered catcher boats) began in the late 1800s, right whales were rarely encountered (Braham and Rice 1984). Best (1987) estimated that between 1835 and 1909 15,374 right whales were taken from the North Pacific by American-registered whaling vessels, with most of those animals taken prior to 1875. Scarff (2001) updated that analysis with adjustments for struck-and-lost whales and whaling conducted by citizens of countries other than the U.S.; he estimated that 26,500-37,000 right whales were killed during the period 1839-1909, with the great majority taken in the single decade of 1840-49. From 1900 to 1999, a total of 742 right whales were killed by whaling; of those, 331 were killed in the western North Pacific and 411 in the eastern North Pacific (Brownell et al. 2001). The latter total includes 372 whales killed illegally by the U.S.S.R. in the period 1963-67, primarily in the Gulf of Alaska and Bering Sea (Doroshenko 2000, Brownell et al. 2001).

Ship strikes are significant sources of mortality for the North Atlantic stock of right whales, and it is possible that right whales in the North Pacific are also vulnerable to this source of mortality. However, due to their rare occurrence and scattered distribution it is impossible to assess the threat of ship strikes to the North Pacific stock of right whales at this time.

STATUS OF STOCK

The right whale is listed as "endangered" under the Endangered Species Act of 1973, and therefore designated as "depleted" under the MMPA. As a result, the stock is classified as a strategic stock. Reliable estimates of the minimum population size, population trends, and PBR are currently not available. Though reliable numbers are not known, the abundance of this stock is considered to represent only a small fraction of its precommercial whaling abundance (i.e., the stock is well below its Optimum Sustainable Population size). The estimated annual rate of human-caused mortality and serious injury seems minimal for this stock. The reason(s) for the apparent lack of recovery for this stock is (are) unknown. Brownell et al. (2001) noted the devastating impact of extensive illegal Soviet catches in the eastern North Pacific in the 1960s, and suggested that the prognosis for right whales in this area was "poor". Biologists working aboard the Soviet factory ships which killed right whales in the eastern North Pacific in the 1960s considered that the fleets had caught close to 100% of the animals they encountered (N.V. Doroshenko, pers. comm.); accordingly, it is quite possible that the Soviets wiped out the great majority of the animals in the population at that time. In its review of the status of right whales worldwide, the International Whaling Commission expressed "considerable concern" over the status of this population (IWC 2001), which is arguably the most endangered stock of large whales in the world.

HABITAT CONCERNS

~~On 4 October 2000, NMFS received a petition from the Center for Biological Diversity to designate critical habitat for this stock. Petitioners asserted that the southeast Bering Sea shelf from 55-60° N latitude should be considered critical habitat. On 1 June 2001, NMFS found the petition to have merit (66 FR 29773). On 20 February 2002, NMFS announced a decision to not designate critical habitat for North Pacific right whales (67 FR 7660) at this time. NMFS concluded that the information available did not indicate that the physical or biological features essential to the conservation of the species exist throughout the petitioned area, and that a smaller area may contain essential physical and biological features, but the boundary of this smaller area could not yet be defined. Thus, NMFS determined that critical habitat was undeterminable at that time. In June 2005, a federal judge found this reasoning invalid and directed the agency to publish a proposed rule designating critical habitat. The agency subsequently~~ NMFS conducted an analysis of right whale distribution in historic times and in recent years, and stated that the ~~Primary Constituent Elements of Critical Habitat~~ habitat requirements for right whales were the dense concentrations of prey ~~required by right whales~~ (Clapham et al. 2006), and on this basis proposed two areas of critical habitat: one in the southeastern Bering Sea and another south of Kodiak Island (70 FR 66332, 2 November 2005). In 2006, NMFS issued a final rule designating two areas as northern right whale critical habitat, one in the Gulf of Alaska and one in the Bering Sea (71 FR 38277, 6 July 2006; Fig. 42).

There are ~~currently~~ no known current threats to the habitat of this population, although this partly reflects a lack of information about the current distribution and habitat requirements of right whales in the eastern North Pacific, as well as about the location and nature of any potential threats to the animal or its environment. However, there has been recent interest in oil/gas exploration and possibly development in the "North Aleutian Basin" area, which occurs in Bristol Bay and overlaps and extends beyond designated North Pacific right whale critical habitat. The Mineral Management Service is supporting a series of surveys from 2007-2009 to better understand right whale distribution in this area so that potential impacts and mitigation measures can be better assessed.

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

STOCK DEFINITION AND GEOGRAPHIC RANGE

Western Arctic bowhead whales are distributed in seasonally ice-covered waters of the Arctic and near-Arctic, generally north of 60°N and south of 75°N in the western Arctic Basin (Braham 1984, Moore and Reeves 1993). For management purposes, five stocks of bowhead whales have been recognized worldwide by the International Whaling Commission (IWC 1992). Small stocks occur in the Sea of Okhotsk, and the offshore waters of Spitsbergen, comprised of only a few tens to a few hundreds of individuals (Shelden and Rugh 1995, Zeh et al. 1993). Until recently, available evidence indicated that only a few hundred bowheads were in the Hudson Bay and Davis Strait stocks, but it now appears these should be considered one instead of two stocks based on genetics (Postma et al. 2006), aerial surveys (Cosens et al. 2006), and tagging data (Dueck et al. 2006; Heide-Jørgensen et al. 2006), and the abundance may be ~~in the~~ over a thousand~~s~~ (Heide-Jørgensen et al. 2007). The only stock ~~that is~~ found within U. S. waters, is the Western Arctic stock (Figs. 43 and 44), also know as the Bering-Chukchi-Beaufort stock (Rugh et al. 2003) or Bering Sea stock (Burns et al. 1993). Although Jorde et al. (2004) suggested there might be multiple stocks of bowhead whales in US waters, recent work concluded (George et al. 2007; Taylor et al. 2007) that data are most consistent with one bowhead stock that migrates around northern and western Alaska waters (IWC, 2008).

The majority of 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 (Fig. 43) where they spend much of the summer (mid-May through September) before returning again to the Bering Sea (Fig. 44) in the fall (September through November) to overwinter (Braham et al. 1980, Moore and Reeves 1993). Most of the year, bowhead whales are closely associated with sea ice (Moore and Reeves 1993). The bowhead spring migration follows fractures in the sea ice around the coast of Alaska, generally in the

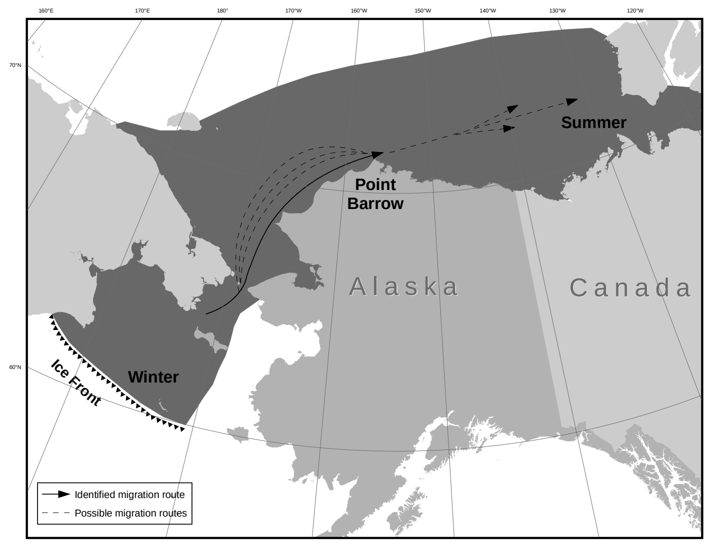

Figure 43. Shaded areas depict the approximate distribution of the western Arctic stock of bowhead whales. The spring migration represented here by lines and arrows, follows a route from the Bering Sea wintering area to the Beaufort Sea summering area, mostly along a coastal tangent that constricts somewhat as it goes east past Point Barrow.

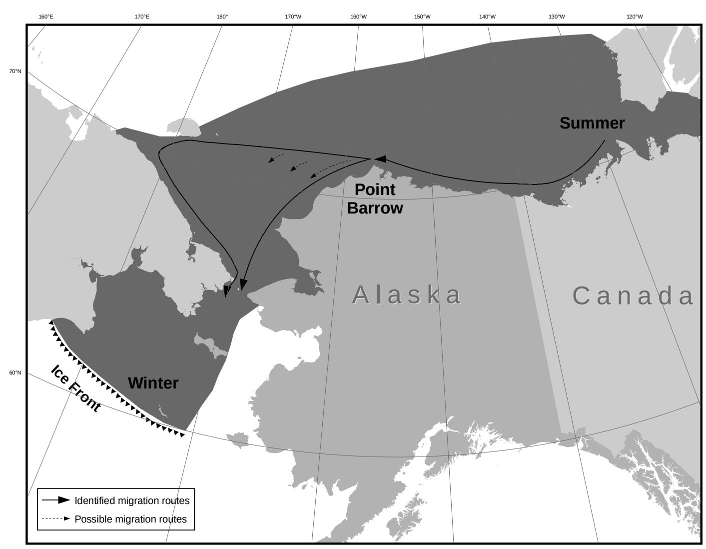

Figure 44. Shaded areas depict the approximate distribution of the western Arctic stock of bowhead whales. The fall migration of is represented here by lines and arrows showing generalized routes used to travel from the Beaufort Sea (summering area) to the Bering Sea (wintering area).

shear zone between the shorefast ice and the mobile pack ice. During the summer, most of the population is in relatively ice-free waters in the southern Beaufort Sea, an area often exposed to industrial activity related to petroleum exploration and extraction (e.g., Richardson et al. 1987, Davies 1997). During the autumn migration, bowheads select shelf waters in all but "heavy ice" conditions, when they select slope habitat (Moore 2000). Sightings of bowhead whales do occur in the summer near Barrow (Moore 1992, Moore and DeMaster 2000) and are consistent with suggestions that certain areas near Barrow are important feeding grounds (Lowry et al. 2004). Some bowheads are found in the Chukchi and Bering Seas in summer, and these are thought to be a part of the expanding Western Arctic stock (Rugh et al. 2003). ~~However, more research needs to be done to determine whether or not there are substocks within the Western Arctic stock (IWC 2004).~~

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 (Ross 1993) and spreading to the Bering Sea in the mid-19th century (Braham 1984, Bockstoce and Burns 1993). 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, systematic counts of bowhead whales have been conducted from sites on sea ice north of Point Barrow 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 (through interpolations from sampled periods), and whales missed during a watch (estimated as a function of visibility, number of observers, and distance offshore; Zeh et al. 1993). A summary of the resulting abundance estimates is provided in Table 41 and Figure 45. However, these estimates of abundance have not been corrected for a small portion of the population that may not migrate past Point Barrow during the period when counts are

Table 41. Summary of population abundance estimates for the western Arctic stock of bowhead whales. The historical estimates were made by back-projecting using a simple recruitment model. All other estimates were developed by corrected ice-based census counts. Historical estimates are from Woodby and Botkin (1993); 1978-2001 estimates are from George et al. (2004) and Zeh and Punt (2004).

Year	Abundance estimate (CV)	Year	Abundance estimate (CV)
Historical estimate	10,400-23,000	1985	5,762 (0.253)
End of commercial whaling	1000-3000	1986	8,917 (0215)
1978	4,765 (0.305)	1987	5,298 (0.327)
1980	3,885 (0.343)	1988	6,928 (0.120)
1981	4,467 (0.273)	1993	8,167 (0.017)
1982	7,395 (0.281)	2001	10,545 (0.128)
1983	6,573 (0.345)		

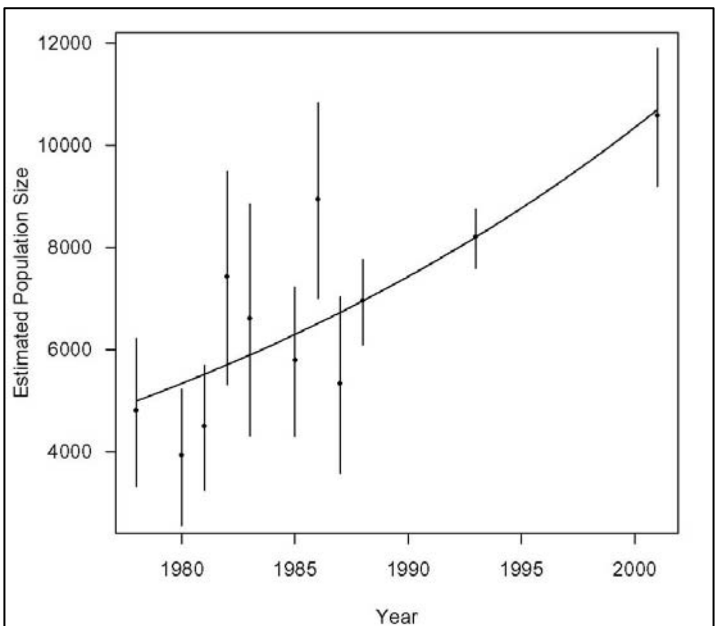

Figure 45. Population abundance estimates for the western Arctic stock of bowhead whales, 1977-2001 (George et al. 2004), as computed from ice-based counts, acoustic locations, and aerial transect data collected during bowhead whale spring migrations past Barrow, AK. Error bars show +/- 1 standard error.

made. The most recent abundance estimate, based on surveys conducted in 2001, is 10,545 (CV = 0.128).

Bowhead whales were identified from aerial photographs taken in 1985 and 1986 and the results used in a capture-recapture analysis. This approach provided estimates of 4,719 (95% CI: 2,382 - 9,343) to 7,022 (95% CI: 4,701 - 12,561), depending on the model used (daSilva et al. 2000). These population estimates and their associated error ranges are comparable to the estimates obtained from the combined ice-based visual and acoustic data for 1985 (5,762) and 1986 (8,917). ~~This study demonstrates that t~~The use of photo-identification to estimate bowhead whale population size provides a reasonable alternative to the traditional ice-based census and acoustic techniques.

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): $N_{MIN} = N/\exp(0.842 \times [\ln(1+[CV(N)]^2)]^{½})$. Using the 2001 population estimate (N) of 10,545 and its associated CV(N) of 0.128, N_{MIN} for the Western Arctic stock of bowhead whales is 9,472.

Current Population Trend

Raftery et al. (1995) reported that the Western Arctic stock of bowhead whales increased at a rate of 3.1% (95% CI: 1.4-4.7%) from 1978 to 1993, during which time abundance increased from approximately 5,000 to approximately 8,000 whales. This rate of increase takes into account whales that passed beyond the viewing range of the ice-based observers. The inclusion of the estimate for 2001 results in a rate of increase of 3.5% (95% CI: 2.2 -4.9%; Brandon and Wade 2004) or 3.4% (95% CI: 1.7-5% George et al. 2004). The count of 121 calves during the 2001 census was the highest yet recorded and was likely caused by a combination of variable recruitment and the large population size (George et al. 2004). The calf count provides corroborating evidence for a healthy and increasing population.

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

The current estimate for the rate of increase for this stock of bowhead whales (3.4-3.5%) 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}. It is recommended that the cetacean maximum theoretical net productivity rate (R_{MAX}) of 4% be used for the Western Arctic stock of bowhead whale (Wade and Angliss 1997).

POTENTIAL BIOLOGICAL REMOVAL

Under the 1994 reauthorized Marine Mammal Protection Act (MMPA), the potential biological removal (PBR) level 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 (see guidelines Wade and Angliss 1997). Thus, PBR = 95 animals (9,472 × 0.02 × 0.5). The calculation of a PBR level for the Western Arctic bowhead stock is required by the MMPA even though the subsistence harvest quota 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. For 200~~2~~8~~-07~~12, a block quota of 280 bowhead strikes will be allowed, of which 67 (plus up to 15 unharvested in the previous year) could be taken each year. This quota includes an allowance of 5 animals to be taken by Chukotka Natives in Russia.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

Fisheries Information

Several cases of rope or net entanglement have been reported from whales taken in the subsistence hunt (Philo et al. 1993)~~, including those summarized in Table 42~~. Further, preliminary counts of similar observations based on reexamination of bowhead harvest records indicate entanglements or scarring attributed to ropes may include over 20 cases (Craig George, Department of Wildlife Management, North Slope Borough, pers. comm.).

There are no observer program records of bowhead whale mortality incidental to commercial fisheries in Alaska. However, some bowhead whales have historically had interactions with crab pot gear~~ (Table 42), at least one in 1993 and one in 1999~~. There are several documented cases of bowheads having ropes or rope scars. Alaska Region stranding reports document ~~two~~ three bowhead whale entanglements between 2001 and 2005. In 2003 a bowhead whale was found dead in Bristol Bay entangled in line around the peduncle and both flippers; the origin of the line is unknown. In 2004 a bowhead whale near Point Barrow was observed with fishing net and line around the head. The estimated average annual rate of known entanglement in U.S. commercial fishing gear is ~~0.2 for 2001-2005, based on the entangled whale observed off Point Barrow in 2004~~currently not available. ~~T~~~~Using these data, the total estimated annual rate of known entanglement in marine debris/gear for the past 5 years is 0.4.~~

~~**Table 42.** Reported scarring of bowhead whales attributed to entanglement in ropes and ship strikes and description of observations collected during subsistence harvests in Alaska since 1978. All scars referred to in the table are from entanglement in ropes or strikes from a boat, such as cuts from a propeller.~~

~~**Year**~~	~~**Number of whales**~~	~~**Location**~~	~~**Description**~~
~~1978[1]~~	~~1~~	~~Wainwright~~	~~6 scars on caudal peduncle~~
~~1986[1]~~	~~1~~	~~Kaktovik~~	~~Scars on caudal peduncle and anterior margin of flukes~~
~~1989[1]~~	~~1~~	~~Barrow~~	~~12 scars on ridges of caudal peduncle~~
~~1989[1]~~	~~1~~	~~south of Gambell~~	~~Rope wrapped around head, through mouth and baleen~~
~~1989[2]~~	~~1~~	~~Barrow~~	~~Rope ~32m long trailing from mouth~~
~~1990[1]~~	~~1~~	~~Barrow~~	~~Scars on caudal peduncle; 2 ropes trailing from mouth.~~
~~1991[2]~~	~~1~~	~~Barrow~~	~~Apparent rope scar from mouth, across back~~
~~1993[3]~~	~~1~~	~~Barrow~~	~~Large female with crab pot line wrapped around flukes~~
~~1998[3]~~	~~1~~	~~NW of Kotzebue; near Red Dog Mine dock~~	~~Stranded (dead) with line on it~~
~~1999[3]~~	~~1~~	~~Barrow~~	~~Whale entangled in confirmed crab gear. Line wrapped through gape of mouth, flipper, and peduncle. Severe injuries.~~
~~2003[3]~~	~~1~~	~~Near Ugashik~~	~~Stranded with rope tied around the peduncle; possibly entangled?before the whale died~~
~~2003[2]~~	~~1~~	~~Near Barrow~~	~~Whale entangled with rope coming out both sides of the mouth and trailing past the flukes~~
~~2004[3]~~	~~1~~	~~Kaktovik~~	~~Boat propeller marks~~

~~[1] Philo et al. 1993~~
~~[2] D. Rugh, personal communication, National Marine Fisheries Service~~
~~[3] C. George, personal communication, North Slope Borough~~

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 ~~nine~~ten Alaska communities (Philo et al. 1993). Under this quota, the number of kills has ranged between 14 and 72 per year, depending in part on changes in management strategy and in part on higher abundance estimates in recent years (Stoker and Krupnik 1993). Suydam and George (2004) summarize Alaskan subsistence harvests of bowheads from 1974 to 2003 reporting a total of 832 whales landed by hunters from 11 villages~~. ~~with Barrow land~~ed~~ing the most whales (n = 418) while Little Diomede and Shaktoolik each landed only one. Since ~~then~~the summary done through 2003, Alaska Natives landed 36 bowheads in 2004 (Suydam et al. 2005)~~ and~~, 68 in 2005 (Suydam et al. 2006), and 31 in 2006 (Suydam et al. 2007). The number of whales landed at each village varies greatly from year to year, as success is influenced by village size and ice and weather conditions. The efficiency of the hunt (the percent of whales struck that are retrieved) has increased since the implementation of the bowhead quota in 1978. In 1978 the efficiency was about 50% and is currently about 85%. The size of landed whales differs among villages~~. Gambell and Savoonga, villages on St. Lawrence Island, and Wainright harvest larger whales than Point Hope and Barrow. These differences are ~~and is likely due to hunter selectivity and/or whale availability.

Canadian and Russian Natives are also known to take whales from this stock. Hunters from the western Canadian Arctic community of Aklavik ~~killed~~harvested one whale in 1991 and one in 1996. ~~One animal was ~~Eight whales were harvested by Russian subsistence hunters ~~in each of ~~between 1999 ~~and ~~-200~~0~~5~~, three in 2003~~ (Borodin 2004~~), and one in 2004 (~~, Borodin 2005, IWC 2007). No catches were reported by either Canadian or Russian hunters for 2006-2007 (IWC in press). The annual average subsistence take (by Natives of Alaska, Russia, and Canada) during the 5-year period from 200~~1~~2 to 200~~5~~6 is ~~46.0~~42.4 bowhead whales.

Other Mortality

Pelagic commercial whaling for bowheads principally occurred in the Bering Sea from 1848 to 1919. Within the first two decades of the fishery (1850-1870), over 60% of the estimated pre-whaling abundance was harvested, although effort remained high into the 20th century (Braham 1984). It is estimated that the pelagic whaling industry harvested 18,684 whales from this stock (Woodby and Botkin 1993). During 1848-1919, shore-based whaling operations (including landings as well as struck and lost estimates from U. S., Canadiana, and Russian shores) took an additional 1,527 animals (Woodby and Botkin 1993). An unknown percentage of the animals taken by the shore-based operations were harvested for subsistence and not commercial purposes. The estimated mortality likely underestimates the actual killharvest as a result of under-reporting of the Soviet catches (Yablokov 1994) and the lack of reports on struck and lost animals.

STATUS OF STOCK

Based on currently available data, the estimated annual mortality rate incidental to U. S. commercial fisheries (0.2) is not known to exceed 10% of the PBR (9.4), and therefore can be considered to be insignificant. The annual level of human-caused mortality and serious injury (4643) is not known to exceed the PBR (95) nor the IWC annual maximum (67). The Western Arctic bowhead whale stock has been increasing in recent years; the current estimate of 10,545 is between 19% and 105% of the pre-exploitation abundance (estimates ranging roughly from 10,000 to 55,000) and this stock may now be approaching its carrying capacity (Brandon and Wade 2004). However, the stock is classified as a strategic stock because the bowhead whale is listed as "endangered" under the Endangered Species Act and therefore also designated as "depleted" under the MMPA. NMFS intends to use recovery criteria developed for large whales in general (Angliss et al. 2002) and bowhead whales in particular (Shelden et al. 2001) in the next 5-year evaluation of stock status.

Habitat Issues

Increasing oil and gas development in the Arctic has led to an increased risk of various forms of pollution to bowhead whale habitat, including oil spills, toxic, and nontoxic waste. Sound produced by increased levels of vessel traffic resulting from exploration and drilling operations areis also of concern. Evidence indicates that bowhead whales are sensitive to sound from offshore drilling platforms and seismic survey operations (Richardson and Malme 1993, Richardson 1995, Davies 1997), and that the presence of an active drill rig (Schick and Urban 2000) or seismic operations (Miller et al. 1999) will cause bowhead whales to avoid the vicinity. Figure 2b in Schick and Urban (2000) demonstrates, however, that the area of disturbance was localized in this instance. Studies conducted as part of a monitoring program for the Northstar project (a drilling facility located on an artificial island in the Beaufort Sea) indicate that, in one of the 3 years of monitoring efforts, the southern edge of the bowhead whale fall migration path may have been slightly (2-3 mi) further offshore during periods when higher sound levels were recorded; there was no significant effect of sound detected on the migration path during the other two monitored years (Richardson et al. 2004). Evidence indicated that deflection of the southern portion of the migration in 2001 occurred during periods when there were certain vessels in the area and did not occur as a result of sound emanating from the Northstar facility itself. Because the bowhead whale population is approaching its pre-exploitation population size and has been documented to be increasing at a roughly constant rate for over 20 years, the impacts of oil and gas industry on individual survival and reproduction in the past have likely been minor. However, the potential impacts of widespread offshore industry exploration and possibly development in both the Beaufort and Chukchi Seas is unknown.However, since 2006 there has been elevated interest in exploiting petroleum reserves in the seas around Alaska, including most areas where bowheads feed or migrate. The accumulation of impacts from vessels, seismic exploration, and drilling are of concern across the North Slope of Alaska.

Another element of concern is the potential for Arctic climate change, which is predictedhas started to 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 1997). Ice-associated animals, such as the bowhead whale, may be sensitive to changes in Arctic weather, sea-surface temperatures, or ice extent, and the concomitant effect on prey availability. TCurrently, there are insufficient data to make reliable predictions of the effects of Arctic climate change on bowhead whales. A study reported in George et al. (2006) showed that landed bowheads had better body condition during years of light ice cover. This, together with high calf production in recent years, suggests that the stock is tolerating the recent ice-retreat at least for the moment.

On 22 February 2000, NMFS received a petition from the Center for Biological Diversity and Marine Biodiversity Protection Center to designate critical habitat for the Western Arctic bowhead stock. Petitioners asserted that the nearshore areas from the U.S.-Canada border to Barrow, Alaska should be considered critical habitat. On 22 May 2001, NMFS found the petition to have merit (66 FR 28141). On 30 August 2002 (67 FR 55767), NMFS announced the decision to not designate critical habitat for this population. NMFS found that designation of critical habitat was not necessary because the population is known to be approaching its pre-commercial whaling population size, the population is increasing, there are no known habitat issues which are slowing the growth of the population, and because activities which occur in the petitioned area are already managed to minimize impacts to the population.

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APPENDICES

Appendix 1. Summary of changes to the 200~~7~~8 stock assessments. An 'X' indicates sections where the information presented has been updated since the 200~~6~~7 stock assessments were released (last revised ~~11/01/06~~04/10/2008).

Stock	Stock definition	Population size	PBR	Fishery mortality	Subsistence mortality	Status
Steller sea lion (western US)				X	X	
Steller sea lion (eastern US)		X	X	~~X~~	X	
Northern fur seal		X	X	X	X	
Harbor seal (SE Alaska)						
Harbor seal (GOA)						
Harbor seal (Bering Sea)						
Spotted seal						
Bearded seal						
Ringed seal						
Ribbon seal						
Beluga whale (Beaufort)			X		X	
Beluga whale (E. Chukchi)			X		X	
Beluga whale (E. Bering Sea)					X	
Beluga whale (Bristol Bay)					X	
Beluga whale (Cook Inlet)		X		~~X~~	X	
Killer whale (Alaska Resident)						
Killer whale (Northern Resident)						
Killer whale (AT1 Transient)		~~X~~				
Killer whale (Gulf of Alaska, Bering Sea, Aleutian Islands Transient)						
Killer whale (West Coast Transient)						
Pacific white-sided dolphin						
Harbor porpoise (SE Alaska)		X	X			
Harbor porpoise (GOA)		X	X	X		
Harbor porpoise (Bering Sea)		X	X			
Dall's porpoise						
Sperm whale				X		
Baird's beaked whale						
Cuvier's beaked whale						
Stejneger's beaked whale						
Gray whale						~~X~~
Humpback whale (western)			X	X		
Humpback whale (central)			X	X		
Fin whale		X		X		
Minke whale						
North Pacific right whale						
Bowhead whale	X			X	X	

Appendix 2. Stock summary table (last revised 4/~~30~~14/0~~7~~8). Stock assessment reports for those stocks in boldface were updated in the 200~~7~~8 draft stock assessments. N/A indicates data are unknown. UNDET (undetermined) PBR indicates data are available to calculate a PBR level but a determination has been made that calculating a PBR level using those data is inappropriate (see stock assessment for details).

Species	Stock	N (est)	CV	N(min)	Survey interval/ year of last survey	Rmax	F(r)	PBR	Fishery mort.	Subsist. mort.	Total mort.	Status
Baird's beaked whale	Alaska	N/A		N/A		0.04	0.50	N/A	0	0	0	NS
Bearded seal	Alaska	N/A		N/A		0.12	0.50	N/A	0.68	6,788	6,789	NS
Beluga whale	**Beaufort Sea**	**39,258**	**0.23**	**32,453**	**~~13~~14/1992**	**0.04**	**0.50**	**~~324~~ UNDET**	**0**	**~~152~~ 139**	**~~152~~ 139**	**NS**
Beluga whale	**E. Chukchi Sea**	**3,710**	**N/A**	**3,710**	**~~3~~17/~~2002~~1991**	**0.04**	**1.00**	**~~74~~ UNDET**	**0**	**~~65~~ 59**	**~~65~~ 59**	**NS**
Beluga whale	**E. Bering Sea**	**18,142**	**0.24**	**14,898**	**~~5~~8/2000**	**0.04**	**1.00**	**298**	**0**	**~~209~~ 197**	**~~209~~ 197**	**NS**
Beluga whale	**Bristol Bay**	**~~1,888~~ 2,877**	**0.2**	**~~1,619~~ 2,467**	**~~5~~8/200~~0~~5**	**0.04**	**1.00**	**~~32~~ 49**	**0**	**~~19~~ 17**	**~~19~~ 17**	**NS**
Beluga whale	**Cook Inlet**	**~~302~~ 375**	**~~0.186~~ 0.21**	**~~264~~ 314**	**1/200~~6~~7**	**0.04**	**0.30**	**UNDET**	**0**	**~~1~~ 0.4**	**~~1~~ 0.4**	**S**
Bowhead whale	**W. Arctic**	**10,545**	**0.13**	**9,472**	**~~5~~7/2001**	**0.04**	**0.50**	**95**	**0.2**	**~~45~~ 42**	**~~46~~ 43**	**S**
Cuvier's beaked whale	Alaska	N/A		N/A		0.04	0.50	N/A	0	0	0	NS
Dall's porpoise	Alaska	83,400	0.097	N/A	~~5~~15/~~2000~~1993	0.04	1.00	UNDET	30	0	30	NS
Fin whale	**NE Pacific**	**~~5,703~~ 5,700**	**N/A**	**~~5,703~~ 5,700**	**~~2~~5/2003**	**0.04**	**0.10**	**11.4**	**~~0~~ 0.23**	**0**	**~~0~~ 0.23**	**S**
Gray whale	**E. N. Pacific**	**18,813**	**0.07**	**17,752**	**~~3~~6/2002**	**0.047**	**1.00**	**417**	**6.7**	**122**	**130**	**NS**
Harbor porpoise	**SE Alaska**	**~~17,076~~ 11,146**	**~~0.265~~ 0.242**	**~~13,713~~ 9,116**	**~~8~~11/1997**	**0.04**	**0.50**	**~~137~~ UNDET**	**0[1]**	**0**	**0**	**S**
Harbor porpoise	**Gulf of Alaska**	**~~41,854~~ 31,046**	**~~0.224~~ 0.214**	**~~34,740~~ 25,987**	**~~7~~10/1998**	**0.04**	**0.50**	**~~347~~ UNDET**	**~~68~~ 71**	**0**	**~~70~~ 73**	**S**
Harbor porpoise	**Bering Sea**	**~~66,078~~ 48,215**	**~~0.232~~ 0.223**	**~~54,492~~ 40,039**	**~~6~~9/1999**	**0.04**	**0.50**	**~~545~~ UNDET**	**~~0.35~~**	**0**	**~~0.35~~**	**S**
Harbor seal	SE Alaska	112,391[2]	0.04	108,670	~~6~~10/1997-1998	0.12	0.5	3,260	0	1,092	1,094	NS
Harbor seal	Gulf of Alaska	45,975[2]	0.04	44,453	~~6~~9/~~2000~~1996; 1999	0.12	0.50	1,334	24	795	820	NS

Species	Stock	N (est)	CV	N(min)	Survey interval/ year of last survey	Rmax	F(r)	PBR	Fishery mort.	Subsist. mort.	Total mort.	Status
Harbor seal	Bering Sea	21,651[2]	0.10	20,109	~~6~~8/~~1996; 1999~~2000	0.12	0.50	603	1.3	174	177	NS
Humpback whale	**W. N. Pacific**	394	0.08	367	~~6+~~15+/199~~9~~3	0.07	0.10	~~1.3~~ UNDET	0.2	0	0.2	S
Humpback whale	**CNP - entire stock**	4,005	0.095	3,698	~~12~~14/1993	0.07	0.10	~~12.9~~ UNDET	3.2	0	5.0	S
	CNP - SEAK feeding area	961	0.12	868		0.07	0.10	~~3~~ UNDET	1.4	0	2.8	N/A
Killer whale	Alaska Resident	1,123[3]	N/A	1,123	8+/2003	0.04	0.50	11.2	1.5	0	1.5	NS
Killer whale	Northern Resident (British Columbia)	216[3]	N/A	216		0.04	0.5	2.16	0	0	0	NS
Killer whale	**AT1 transient**	7[3]	N/A	7		0.04	~~0.50~~ 0.10	0	0	0	0	S
Killer whale	GOA, AI, BS Transient	314[3]	N/A	314	8+/2003	0.04	0.5	3.1	0.4	0	0.4	NS
Killer whale	West Coast Transient	314[3]	N/A	314		0.04	0.5	3.1	0	0	0	NS
Minke whale	Alaska	N/A		N/A		0.04	0.50	N/A	0.32	0	0.32	NS
Right whale	**E. N. Pacific**	N/A	N/A	N/A	N/A	0.04	0.10	~~N/A~~0	0	0	0	S
Northern fur seal	**E. North Pacific**	~~721,935~~ 665,550	N/A	~~709,881~~ 654,437	2/~~2004~~2006	0.086	0.50	~~15,262~~ 14,070	~~0.8~~ 1.9?	~~702~~ 667	~~704~~ 669	S
Pacific white-sided dolphin	Cent. N. Pacific	26,880	N/A	N/A	12+/1990	0.04	0.50	UNDET	0	0	0	NS
Ribbon seal	Alaska	N/A		N/A		0.12	0.50	N/A	0.8	193	194	NS
Ringed seal	Alaska	N/A		N/A		0.12	0.50	N/A	0.71	9,567	9,568	NS
Sperm whale	**N. Pacific**	N/A		N/A		0.04	0.10	N/A	~~0.5~~ 2	0	~~0.5~~ 2	S
Spotted seal	Alaska	N/A		N/A		0.12	0.50	N/A	0.88	5,265	5,266	NS
Stejneger's beaked whale	Alaska	N/A		N/A		0.04	0.50	N/A	0	0	0	NS
Steller sea lion	**E. U. S.**	~~48,519~~ 45,095-55,832		~~44,584~~ 44,404	~~2~~3/2005	0.12	0.75	~~2,006~~ 1,998	1.4	9	15.8	S

Species	**Stock**	**N (est)**	**CV**	**N(min)**	**Survey interval/ year of last survey**	**Rmax**	**F(r)**	**PBR**	**Fishery mort.**	**Subsist. mort.**	**Total mort.**	**Status**
Steller sea lion	**W. U. S.**	**38,988**		**38,988**	**~~2~~3/200~~4~~5**	**0.12**	**0.10**	**234**	**~~24.6~~ 26.2**	**~~198~~ ?**	**~~223.6~~ ?**	**S**

C.F. = correction factor; CV C.F. = CV of correction factor; Comb. CV = combined CV; Status: S = Strategic, NS = Not Strategic.

[1] No or minimal reported take by fishery observers; however, observer coverage was minimal or nonexistent.

[2] Recent changes in the abundance estimates do not indicate a major population increase. Instead, these increases are due to new analytical methods that take environmental covariates into account and thus provide an improved estimate of harbor seal abundance.

[3] N(est) based on counts of individual animals identified from photo-identification catalogs. Surveys for abundance estimates of these stocks are conducted infrequently.

Appendix 3. Summary table for Alaska **Category 2** commercial fisheries (last updated ~~11/06/06~~04/03/2008). Source: 7~~1~~2 FR ~~48802~~66048; 2~~2~~7 ~~August~~November 200~~6~~7 and the Alaska Commercial Fisheries Entry Commission (200~~6~~8). Notice of continuing effect of list of fisheries.

Fishery (area and gear type)	Target species	Permits issued or fished (200~~5~~7)	Soak time	Landings per day	Sets per day	Season duration	Fishery trends (1990-1997)
Southeast AK drift gillnet	salmon	~~478~~476	20 min - 3 hrs; day / night	1	6 - 20	June 18 to Early Oct	# vessels stable but may vary with price of salmon; catch - high
Southeast AK purse seine	salmon	415	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	16~~8~~6	continuous soak during opener; day / night	1	net picked every 2 - 4hrs/day or continuous during peak	June 4 to mid-Oct	# sites fished stable; catch - variable
Prince William Sound drift gillnet	salmon	53~~8~~7	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	571	15 min - 3 hrs or continuous; day only	1	6 - 18	June 25 to end of Aug	# vessels stable; catch - variable
Cook Inlet set gillnet	salmon	73~~7~~8	continuous soak during opener, but net dry with 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	188	continuous during opener; day only	1 or 2	picked 2 or more times	June 9 to end of Sept	# sites fished stable; catch - variable
AK Peninsula/Aleutians drift gillnet	salmon	162	2 -5 hrs; day / night	1	3 - 8	mid-June to mid-Sept	# vessels stable; catch up
AK Peninsula/Aleutians set gillnet	salmon	115	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	1862	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	98~~8~~3	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	salmon	0					new fishery
Metlakatla/Annette Island drift gillnet	salmon	10					
AK Bering Sea, Aleutian islands flatfish trawl	flatfish	~~26~~34					
AK Bering Sea, Aleutian Islands pollock trawl (subsistence)	pollock	~~120~~95					
AK Bering Sea, Aleutian Islands Pacific cod longline	Pacific cod	~~114~~154					

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Appendix 4. Interaction table for Alaska **Category 2** commercial fisheries (last revised ~~11/06/06~~04/03/2008). Source: 7~~1~~2 FR ~~48802~~66048; 2~~2~~7 ~~August~~November 200~~6~~7, Perez (2006), Manly (~~in review~~2006), Manly et al. (2003), and the Alaska Commercial Fisheries Entry Commission (200~~6~~8). Notice of continuing effect of list of fisheries.

Fishery (area and gear type)	**# of permits issued or fished (200~~5~~7)**	**Observer program**	**Species recorded as taken incidentally in this fishery (records dating back to 1988)**	**Data type**
Southeast AK drift gillnet	47~~8~~6	never observed	Steller sea lion, harbor seal, harbor porpoise, Dall's porpoise, Pacific white-sided dolphin, humpback whale (self)	logbook and self reports
Southeast AK purse seine	415	never observed	humpback whale	self reports and stranding
Yakutat set gillnet	16~~8~~6	never observed	harbor seal, gray whale (stranding)	logbook and stranding
Prince William Sound drift gillnet	53~~8~~7	1990 1991	Steller sea lion (obs), northern fur seal, harbor seal (obs), harbor porpoise (obs), Dall's porpoise, Pacific white-sided dolphin, sea otter	observer and logbook
Cook Inlet drift gillnet	571	1999	Steller sea lion, harbor seal, harbor porpoise, Dall's porpoise, Cook Inlet beluga Note: observer program in 1999 and 2000 recorded one incidental mortality/serious injury of a harbor porpoise	observer and logbook
Cook Inlet set gillnet	73~~7~~8	1999	harbor seal, harbor porpoise, Dall's porpoise, Cook Inlet beluga Note: observer program in 1999 and 2000 recorded one incidental mortality/serious injury of a harbor porpoise	observer and logbook
Kodiak set gillnet	188	2002	harbor seal, harbor porpoise, sea otter	observer and logbook
Alaska Peninsula/Aleutians drift gillnet	162	1990	northern fur seal, harbor seal, harbor porpoise, Dall's porpoise (obs)	observer and logbook
Alaska Peninsula/Aleutians set gillnet	115	never observed	Steller sea lion, harbor porpoise	logbook
Bristol Bay drift gillnet	1862	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	98~~8~~3	never observed	northern fur seal, harbor seal, spotted seal, beluga whale, gray whale	logbook
Metlakatla/Annette Island drift gillnet	10	never observed	none documented	none
AK pair trawl	0	never observed	none documented	none
AK Bering Sea, Aleutian islands flatfish trawl	~~26~~34	200~~4~~6	Bearded seal, harbor porpoise (Bering Sea), harbor seal (Bering Sea), killer whale (Alaska Resident), northern fur seal, spotted seal, Steller sea lion (Western U.S.), walrus	observer
AK Bering Sea, Aleutian Islands pollock trawl	~~120~~95	200~~4~~6	Dall's porpoise, harbor seal, humpback whale (Central North Pacific), Humpback whale (Western North Pacific), killer whale (GOA, Aleutian Islands, and Bering Sea Transient), minke whale, ribbon seal, spotted seal, Steller sea lion (western U.S.),	observer
AK Bering Sea, Aleutian Islands Pacific cod longline	~~114~~54	200~~4~~6	Killer whale (Alaska Resident), killer whale (GOA, Aleutian Islands, and Bering Sea Transient), ribbon seal, Steller sea lion (western U.S.)	observer
AK Bering Sea, Aleutian Islands sablefish pot	10	2006	humpback whale (Central North Pacific), humpback whale (Western North Pacific)	observer

Note: Only species with positive records of being taken incidentally in a fishery since 1988 (the first year of the Marine Mammal Protection Act 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. Observer program indicates most recent year of observer data included in these reports.

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Appendix 5. Interaction table for Alaska **Category 3** commercial fisheries (last revised ~~11/06/06~~04/03/2008). 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. Source: 7~~1~~2 FR ~~48802~~66048; 2~~2~~7 ~~August~~November 200~~6~~7, Perez (2006), and the Alaska Commercial Fisheries Entry Commission (200~~6~~8). Notice of continuing effect of list of fisheries.

Fishery name	**# of permits issued or fished 200~~5~~7**	**Observer program**	**Species recorded as taken incidentally in this fishery (records dating back to 1990)**	**Data type**
Prince William Sound salmon set gillnet	30	1990	Steller sea lion, harbor seal	logbook
Kuskokwim, Yukon, Norton Sound, Kotzebue salmon gillnet	18~~55~~24	never observed	harbor porpoise	none
AK roe herring and food/bait herring gillnet	~~1158~~986	never observed	none documented	none
AK miscellaneous finfish set gillnet	0	never observed	Steller sea lion	logbook
AK salmon purse seine (except for Southeast AK)	9~~40~~36	never observed	harbor seal	logbook
AK salmon beach seine	31	never observed	none documented	none
AK roe herring and food/bait herring purse seine	3~~89~~61	never observed	none documented	none
AK roe herring and food/bait herring beach seine	4	never observed	none documented	none
Metlakatla purse seine (tribal)	10	never observed	none documented	none
AK octopus/squid purse seine	0	never observed	none documented	none
AK miscellaneous finfish purse seine	~~1~~3	never observed	none documented	none
AK miscellaneous finfish beach seine	0	never observed	none documented	none
AK salmon troll (includes hand and power troll)	20~~69~~45	never observed	Steller sea lion	logbook
AK north Pacific halibut/bottom fish troll	~~126~~102	never observed	none documented	none
AK state waters groundfish longline /set line (incl. sablefish/ rockfish/misc. finfish)	1~~673~~448	never observed	none documented	none
AK Gulf of Alaska halibut longline	1,302	200~~5~~6	none documented	observer
AK Gulf of Alaska rockfish longline	~~440~~0	200~~5~~6	none documented	observer
AK Gulf of Alaska rockfish longline	~~421~~0	200~~5~~6	none documented	observer
AK Gulf of Alaska sablefish longline	~~412~~291	200~~5~~6	Steller sea lion, ~~possible~~ sperm whale	observer
AK Bering Sea, Aleutian Islands Greenland turbot longline	~~36~~29	200~~5~~6	Killer whale (Eastern North Pacific resident), Killer whale (Eastern North Pacific transient)	observer
AK Bering Sea, Aleutian islands rockfish longline	~~17~~0	200~~5~~6	none documented	observer
AK Bering Sea, Aleutian Islands sablefish longline	~~63~~28	200~~5~~6	none documented	observer
AK halibut longline/set line (state and federal waters)	~~2632~~2521	never observed	Steller sea lion	self reports
AK octopus/squid longline	~~4~~2	never observed	none documented	none
AK shrimp otter and beam trawl (statewide and Cook Inlet)	~~38~~32	never observed	none documented	none
AK Gulf of Alaska flatfish trawl	~~52~~41	200~~5~~6	none documented	observer
AK Gulf of Alaska Pacific cod trawl	~~101~~62	200~~5~~6	Steller sea lion	observer
AK Gulf of Alaska pollock trawl	~~83~~62	200~~5~~6	Steller sea lion, fin whale, northern elephant seal, Dall's porpoise	observer
AK Gulf of Alaska rockfish trawl	~~45~~34	200~~5~~6	none documented	observer
AK Bering Sea, Aleutian Islands Atka mackerel trawl	~~8~~9	200~~5~~6	Steller sea lion (Western U.S.)	observer
AK Bering Sea, Aleutian Islands Pacific cod trawl	~~87~~93	200~~5~~6	Harbor seal, Steller sea lion	observer
AK Bering Sea, Aleutian Islands rockfish trawl	~~9~~10	200~~5~~6	none documented	observer
State waters of Kachemak Bay Cook Inlet, Prince William Sound, Southeast AK groundfish trawl	2	never observed	none documented	none

Fishery name	**# of permits issued or fished 20~~05~~7**	**Observer program**	**Species recorded as taken incidentally in this fishery (records dating back to 1990)**	**Data type**
AK miscellaneous finfish otter or beam trawl	~~293~~317	never observed	none documented	none
AK food/bait herring trawl (Kodiak area only)	4	never observed	none documented	none
~~AK Aleutian Islands sablefish pot~~	~~8~~	~~2005~~	~~none documented~~	~~observer~~
AK Bering Sea, Aleutian Islands Pacific cod pot	~~76~~68	200~~5~~6	possible harbor seal	observer
AK Bering Sea, Aleutian Islands crab pot	~~329~~297	200~~5~~6	none documented	observer
AK Gulf of Alaska crab pot	300	200~~5~~6	none documented	observer
AK Gulf of Alaska Pacific cod pot	154	200~~5~~6	harbor seal	observer
AK Southeast Alaska crab pot	~~N/A~~433	never observed	none documented	observer
AK Southeast Alaska shrimp pot	~~N/A~~283	never observed	none documented	observer
AK octopus/squid pot	~~60~~27	never observed	none documented	none
AK snail pot	1	never observed	none documented	none
AK statewide misc finfish pot	~~0~~293	never observed	none documented	none
AK shrimp pot	~~0~~15	never observed	none documented	none
AK North Pacific halibut handline and mechanical jig	~~57~~228	never observed	none documented	none
AK other finfish handline and mechanical jig	~~495~~445	never observed	none documented	none
AK octopus/squid handline	0	never observed	none documented	none
AK ~~Prince William Sound herring roe/food/bait~~ statewide Herring spawn on kelp (pound net)	~~449~~415	never observed	none documented	none
Southeast AK herring food/bait pound net	~~13~~16	never observed	none documented	none
Coastwise scallop dredge	~~7~~12	never observed	none documented	none
AK Dungeness crab (hand pick/dive)	2	never observed	none documented	none
AK herring spawn-on-kelp (hand pick/dive)	26~~7~~6	never observed	none documented	none
AK urchin and other fish/shellfish (hand pick/dive)	5~~43~~70	never observed	none documented	none
AK commercial passenger fishing vessel	2,702 (may contain freshwater vessels, will be updated later)	never observed	none documented	none
AK octopus/squid "other"	0	never observed	none documented	none
AK statewide herring spawn on kelp (pound net)	~~0~~415	never observed	none documented	none

Note: Observer program indicates most recent year of observer data included in these reports.

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Alaska Commercial Fisheries Entry Commission (CFEC). 200~~6~~8. Fishery Participation & Earnings. Accessed on ~~07/31/2006~~04/02/2008. http://www.cfec.state.ak.us/.

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Appendix 6. Observer coverage in Alaska commercial fisheries 1990-2005 (last revised 11/14/06). Sources: Manly in review, Manly et al. 2003, Perez 2006, Perez unpubl. ms., Wynne et al. 1991, and Wynne et al. 1992.

Fishery name	Method for calculating observer coverage	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Gulf of Alaska (GOA) groundfish trawl		55%	38%	41%	37%	33%	44%	37%	33%	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
GOA flatfish trawl	% of observed biomass	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	39.2%	35.8%	36.8%	40.5%	35.9%	40.6%	76.9%	29.2%
GOA Pacific cod trawl	% of observed biomass	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	20.6%	16.4%	13.5%	20.3%	23.2%	27.0%	82.5%	21.4%
GOA pollock trawl	% of observed biomass	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	37.5%	31.7%	27.5%	17.6%	26.0%	31.4%	96.1%	24.2%
GOA rockfish trawl	% of observed biomass	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	51.4%	49.8%	50.2%	51.0%	37.2%	48.4%	74.1%	51.4%
GOA longline		21%	15%	13%	13%	8%	18%	16%	15%	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
GOA Pacific cod longline	% of observed biomass	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	3.8%	5.7%	6.1%	4.9%	11.4%	12.6%	21.4%	3.7%
GOA Pacific halibut longline	% of observed biomass	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	51.3%	47.1%	51.1%	43.0%	41.4%	9.6%	36.4%	6.5%
GOA rockfish longline	% of observed biomass	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	1.0%	1.4%	0.2%	1.3%	4.9%	2.5%	0%	0%
GOA sablefish longline	% of observed biomass	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	16.9%	14.0%	15.2%	12.4%	13.7%	9.4%	37.7%	10.4%
GOA finfish pots		13%	9%	9%	7%	7%	7%	5%	4%	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
BSAI finfish pots	% of observed biomass	43%	36%	34%	41%	27%	20%	17%	18%	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
BSAI Pacific cod pot	% of observed biomass	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	14.6%	16.2%	8.5%	14.7%	12.1%	12.4%	33.1%	14.4%
BS sablefish pot	% of observed biomass	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	42.1%	44.1%	62.6%	38.7%	40.6%	21.4%	72.5%	44.3%
AI sablefish pot	% of observed biomass	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	100%	50.3%	68.2%	60.6%	69.4%	47.5%	51.2%	64.4%
GOA Pacific cod pot	% of observed biomass	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	6.7 %	5.7%	7.0%	5.8%	7.0%	4.0%	40.6%	3.8%
Bering Sea/Aleutian Islands (BSAI) groundfish trawl		74%	53%	63%	66%	64%	67%	66%	64%								
BSAI Atka mackerel trawl	% of observed biomass	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	65.0%	77.2%	86.3%	82.4%	98.3%	95.4%	96.6%	97.8%
BSAI flatfish trawl	% of observed biomass	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	59.4%	66.3%	64.5%	57.6%	58.4%	63.9%	68.2%	68.3%
BSAI Pacific cod trawl	% of observed biomass	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	55.3%	50.6%	51.7%	57.8%	47.4%	49.9%	75.1%	52.8%
BSAI pollock trawl	% of observed biomass	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	66.9%	75.2%	76.2%	79.0%	80.0%	82.2%	92.8%	77.3%
BSAI rockfish trawl	% of observed biomass	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	85.4%	85.6%	85.1%	65.3%	79.9%	82.6%	94.1%	71.0%
BSAI longline		80%	54%	35%	30%	27%	28%	29%	33%	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
BSAI Greenland turbot longline	% of observed biomass	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	31.6%	30.8%	52.8%	33.5%	37.3%	40.9%	39.3%	33.7%
BSAI Pacific cod longline	% of observed biomass	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	34.4%	31.8%	35.2%	29.5%	29.6%	29.8%	25.7%	24.6%
BSAI Pacific halibut longline	% of observed biomass	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	38.9%	48.4%	55.3%	67.2%	57.4%	20.3%	44.5%	27.9%
BSAI rockfish longline	% of observed biomass	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	41.5%	21.4%	53.0%	26.9%	36.0%	74.9%	37.9%	36.3%
BSAI sablefish longline	% of observed biomass	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	19.5%	28.4%	24.4%	18.9%	30.3%	10.4%	50.9%	19.3%
Prince William Sound salmon drift gillnet	% of estimated sets observed	4%	5%	not obs.	not obs.	not obs.	not obs.	not obs.	not obs.	not obs.	not obs.	not obs.	not obs.	not obs.	not obs.	not obs.	not obs.
Prince William Sound salmon set gillnet	% of estimated sets observed	3%	not obs.	not obs.	not obs.	not obs.	not obs.	not obs.	not obs.	not obs.	not obs.	not obs.	not obs.	not obs.	not obs.	not obs.	not obs.
Alaska Peninsula/Aleutian Islands salmon drift gillnet (South Unimak area only)	% of estimated sets observed	4%	not obs.	not obs.	not obs.	not obs.	not obs.	not obs.	not obs.	not obs.	not obs.	not obs.	not obs.	not obs.	not obs.	not obs.	not obs.

Fishery name	Method for calculating observer coverage	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Cook Inlet salmon drift gillnet	% of fishing days observed	not obs.	not obs.	not obs.	not obs.	not obs.	not obs.	not obs.	not obs.	not obs.	1.8%	3.7%	not obs.	not obs.	not obs.	not obs.	not obs.
Cook Inlet salmon set gillnet	% of fishing days observed	not obs.	not obs.	not obs.	not obs.	not obs.	not obs.	not obs.	not obs.	not obs.	7.3%	8.3%	not obs.	not obs.	not obs.	not obs.	not obs.
Kodiak Island salmon set gillnet	% of fishing days observed	not obs.	not obs.	not obs.	not obs.	not obs.	not obs.	not obs.	not obs.	not obs.	not obs.	not obs.	not obs.	6.0%	not obs.	not obs.	not obs.

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 feet have 100% coverage, vessels 60-125 feet have 30% coverage, and vessels less than 60 feet are not observed. Observer coverage in the groundfish fisheries varies by statistical area; the pooled percent coverage for all areas is provided here. 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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Appendix 7. Self-reported fisheries information.

The Marine Mammal Exemption Program (MMEP) was initiated in mid-1989 as a result of the 1988 amendments to the Marine Mammal Protection Act (MMPA). The MMEP required fishers involved in Category I and II fisheries to register with NMFS and to complete annual logbooks detailing each day's fishing activity, including: date fished, hours fished, area fished, marine mammal species involved, injured and killed due to gear interactions, and marine mammal species harassed, injured and killed due to deterrence from gear or catch. If the marine mammal was deterred, the method of deterrence was required, as well as indication of its effectiveness. Fishers were also required to report whether there were any losses of catch or gear due to marine mammals. These logbooks were submitted to NMFS on an annual basis, as a prerequisite to renewing their registration. Fishers participating in Category III fisheries were not required to submit complete logbooks, but only to report mortalities of marine mammals incidental to fishing operations. Logbook data are available for part of 1989 and for the period covering 1990-1993. Logbook data received during the period covering part of 1994 and all of 1995 was not entered into the MMEP logbook database in order for NMFS personnel to focus their efforts on implementing the 1994 amendments to the MMPA. Thus, aside from a few scattered reports from the Alaska Region, self-reported fisheries information is not available for 1994 and 1995.

In 1994, the MMPA was amended again to implement a long-term regime for managing mammal interactions with commercial fisheries (the Marine Mammal Authorization Program, or MMAP). Logbooks are no longer required. Instead, vessel owners/operators in any commercial fishery (Category I, II, or III) are required to submit one-page pre-printed reports for all interactions resulting in an injury or mortality to a marine mammal. The report must include the owner/operator's name and address, vessel name and ID, where and when the interaction occurred, the fishery, species involved, and type of injury (if animal was released alive). These postage-paid report forms are mailed to all Category I and II fishery participants that have registered with NMFS, and must be completed and returned to NMFS within 48 hours of returning to port for trips in which a marine mammal injury or mortality occurred. This reporting requirement was implemented in April 1996. During 1996, only 5 mortality/injury reports were received by fishers participating in all of Alaska's commercial fisheries. This level of reporting was a drastic drop in the number of reports compared to the numbers of interactions reported in the annual logbooks. As a result, the Alaska Scientific Review Group (SRG) considers the MMAP reports unreliable and has recommended that NMFS not utilize the reports to estimate marine mammal mortality (see June 1998 Alaska SRG meeting minutes; DeMaster 1998). As of the stock assessment reports for 2006, these records are no longer used to estimate annual fishery-related mortalities.

Fishery	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**Minimum estimated mortality**
Steller sea lion (Western U.S. stock)																
Alaska Peninsula/Aleutian Islands salmon set gillnet	0	1	1	1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.75
Bristol Bay salmon drift gillnet	0	4	2	8	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	3.5
Prince William Sound set gillnet	0	0	2	0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.5
Alaska miscellaneous finfish set gillnet	0	1	0	0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.25
Alaska halibut longline (state and federal waters)	0	0	0	0	1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.2
Kodiak salmon set gillnet	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	2	2
Steller sea lion (Eastern U. S. stock)																
Southeast Alaska salmon drift gillnet	0	1	2	2	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	1.25
Northern fur seal (Eastern Pacific stock)																
Prince William Sound salmon drift gillnet	1	1	0	0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.5
Alaska Peninsula/Aleutian Islands salmon drift gillnet	2	0	0	0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.5
Bristol Bay salmon drift gillnet	5	0	49	0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	13.5
Alaska misc. finfish pair trawl	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	1	1

Fishery	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**Minimum estimated mortality**
Harbor seal (Southeast Alaska stock)																
Southeast Alaska salmon drift gillnet	8	1	4	2	N/A	N/A	N/A	N/A	N/A	N/A	N/A	1	N/A	N/A	N/A	3.2
Yakutat salmon set gillnet	0	18	31	61	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	27.5
Harbor seal (Gulf of Alaska stock)																
Cook Inlet salmon set gillnet	6	0	1	0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	1.75
Prince William Sound set gillnet	0	0	0	1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.25
Kodiak salmon set gillnet	3	0	0	0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.75
Alaska salmon purse seine (except for Southeast)	0	0	0	2	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.5
Alaska Peninsula/Aleutian Islands salmon drift gillnet	9	2	12	5	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	7
Harbor seal (Bering Sea stock)																
Bristol Bay salmon drift gillnet	38	23	2	42	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	26.25
Bristol Bay salmon set gillnet	0	0	1	1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.5
AK misc. finfish pair trawl	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	1	N/A	N/A	1
Spotted seal (Alaska stock)																
Bristol Bay salmon drift gillnet	5	1	0	0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	1.5
Beluga whale (Bristol Bay stock)																
Bristol Bay salmon drift gillnet	0	1	0	0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.25
Bristol Bay salmon set gillnet	1	0	0	0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.25
Pacific white-sided dolphin (North Pacific stock)																
Prince William Sound salmon drift gillnet	1	4	0	0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	1.25
Southeast Alaska salmon drift gillnet	0	0	1	0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.25
Bristol Bay salmon drift gillnet	3	0	0	0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.75
Harbor porpoise (Southeast Alaska stock)																
Southeast Alaska salmon drift gillnet	2	2	7	2	N/A	N/A	2	N/A	1	N/A	N/A	N/A	N/A	N/A	N/A	2.7
Harbor porpoise (Gulf of Alaska stock)																
Cook Inlet salmon drift and set gillnet fisheries	3	0	0	0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	1	N/A	0.8
AK Peninsula/Aleutian Island salmon drift gillnet	2	0	1	0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.75
Kodiak salmon set gillnet	8	4	2	1	N/A	N/A	N/A	N/A	1	N/A	N/A	N/A	N/A	N/A	N/A	3.2
Harbor porpoise (Bering Sea stock)																
AK Peninsula/Aleutian Island salmon set gillnet	0	0	2	0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.5
Bristol Bay salmon drift gillnet	0	0	0	0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0
Bristol Bay salmon set gillnet	0	0	0	0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0
AK Kuskokwim, Yukon, Norton Sound, Kotzebue salmon gillnet	0	0	0	0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0
Dall's porpoise (Alaska stock)																
Prince William Sound salmon drift gillnet	0	2	0	0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.5
Southeast Alaska salmon drift gillnet	6	6	4	6	N/A	N/A	N/A	1	N/A	1	N/A	1	N/A	?	N/A	3.6
Cook Inlet set and drift gillnet fisheries	1	0	1	0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.5
Eastern North Pacific gray whale																
Bristol Bay salmon drift and set gillnet fisheries	2	0	0	0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.5
WA/OR/CA crab pot	0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	1	N/A	N/A	N/A	N/A	0.5
Humpback whale (Central North Pacific stock)																
Southeast Alaska salmon drift gillnet	0	0	0	0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0

Fishery	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**Minimum estimated mortality**
Southeast Alaska salmon purse seine	0	0	0	0	1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.2

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Appendix 8: Humpback whale entanglement and other human impact records.

This appendix provides a list of human-related events involving injury or mortality of humpback whales (Central North Pacific stock) from reports provided to the NMFS Alaska Region, 2001-2005. Areas are designated “SE” for Southeast Alaska or “North” for all other feeding areas; it is assumed that the entanglement was reported in the area where the entanglement occurred, and that duplicate sightings have been removed. This table includes summaries of the information on each incident; for detailed reports, contact the NMFS Alaska Region. The determination whether each injury should be considered serious, not serious, or not determinable (ND) was made by a subcommittee of the Alaska Scientific Review Group (SRG) who reviewed the complete record for each incident. A subsequent review was conducted by NMFS Alaska Region staff to ensure consistency with NMFS’ existing guidelines for serious injury; this review resulted in three changes from the SRG’s recommendations.

Date	Area	Condition	Brief description	Area	Severity of injury
5/28/01	Resurrection Bay	Entangled, released alive	Swimming freely with multiple lines and buoys attached	North	Not serious
6/15/01	Kodiak	Entangled	Attempt to disentangle failed; mother/calf pair	North	Serious*
7/12/01	Yakutat	Found dead	Entangled in Yakutat salmon set gillnet	North	Mortality
7/30/01	Bering Glacier/Yakutaga	Found dead, decomposed	Entangled in salmon set gillnet with floats	North	Mortality
9/18/01	Anchorage	Dead	Ship strike - container ship	North	Mortality
3/13/05	Kenai River	Dead	Fresh stranding; confirmed collision/blunt trauma	North	Mortality
3/16/05	Sadie Cove; Kachemak Bay	Entangled	Fishing gear remnants and buoys attached to flukes; confirmed Pacific cod pot gear, fully disentangled	North	Not serious
6/14/05	Sadie Cove; Kachemak Bay	Entangled	Fishing net remnants and buoys attached to flukes; confirmed Cook Inlet salmon set gillnet	North	Serious
6/17/05	Stevenson Entrance; Kodiak	Entangled	Gillnet on head with three white, pink, orange buoys attached; unknown gillnet	North	Serious
6/21/05	Kachemak Bay	Collision	Whale surfaced by propeller, felt “thump”, and saw blood in water	North	Not determinable
6/25/05	Alitak Bay	Dead	Mesh or webbing scars of most of stranded body; confirmed Kodiak salmon purse seine	North	Mortality
7/8/05	Kachemak Bay	Dead	Animal killed in purse seine; confirmed lower Cook Inlet salmon purse seine	North	Mortality
7/26/05	Kodiak Harbor	Partially disentangled	Entangled and immobilized in crab pot gear	North	Not serious
9/14/05	Kodiak	Entangled	Animal entangled in long line gear; partially disentangled	North	Not determinable
6/19/01	Dixon Entrance	Possibly injured	Probable ship strike; whale surfaced immediately in front of large vessel, vessel backed down and stopped, crew heard a “thump” just prior to backing down	SE	Not serious
7/16/01	Glacier Bay	Found dead, decomposed	Ship strike; fractured skull and pre-mortem hemorrhage	SE	Mortality
8/13/01	Hoonah	Entangled, released alive	Shrimp pot gear; wounds on dorsal ridge and tail stock	SE	Not serious

Date	Area	Condition	Brief description	Area	Severity of injury
9/19/01	Lynn Canal	Entangled, release alive, status unknown	Shrimp pot gear	SE	Not determinable
6/22/02	Fern Harbor	Alive, collision	62 ft. recreational charter coasted into whale. Whale surfaced parallel to port side, rolled under, and reappeared with partner on starboard side. Whales continued, moving away from the boat. No visible injury to whale or vessel.	SE	Not serious
7/13/02	Taku Inlet	Entangled	Entangled with fishing gear, unknown condition.	SE	Not determinable
7/21/02	Petersburg	Entangled, released alive	Crab trap in the mouth of whale. Buoy side of line went around top of head and tangled with pot side of line. Coast Guard and NMFS Special Agent removed trap and line from whale.	SE	Not serious
8/15/02	Kupreanof Island	Entangled	Green mesh trawl gear wrapped around the left pectoral fin.	SE	Not determinable
9/7/02	Ketchikan	Entangled, released alive	Whale entangled in shrimp pot gear. Line through mouth and around pectoral fin. Citizen disentangled whale and released.	SE	Not serious
5/03	Icy Bay	Dead	53 ft. female humpback with skull completely disarticulated from the vertebrae	SE	Mortality
8/2/03	Auke Bay	Entangled, self release	Whale disentangled itself from crab pot.	SE	Not serious
8/28/03	Auke Bay	Entangled	Humpback calf entangled in crab pot line. Line across back, wrapped tightly on both sides, forward of pectoral fins, and just behind blowhole.	SE	Serious
8/31/03	Sitka Sound	Entangled	Humpback calf entangled in commercial fishing gear. Confirmed ID, sighted in October with ventral fluke scarring but no other signs of entanglement.	SE	Not serious
5/15/04	Pt. Couverden	Entangled	Humpback reported entangled with 250 ft. of rope, 2 cone-shaped buoys, and 1-2 ft. of wood between buoys.	SE	Serious
5/27/04	Benjamin Island	Collision	Humpback collided with drifting fishing boat. 18-24 in. piece of whale blubber retrieved from vessel and taken to NOAA enforcement.	SE	Serious
7/8/04	Cape Fanshaw	Entangled, released alive	Humpback calf entangled with ¼ in. poly pro line around its upper tail fluke and left pectoral fin. Calf was later disentangled.	SE	Not serious
7/30/04	Glacier Bay	Dead	Humpback calf found beached; died due to blunt trauma.	SE	Mortality
8/13/04	Douglas Island	Dead	Humpback calf found beached with severe trauma to right shoulder area.	SE	Mortality
8/17/04	Icy Strait	Entangled	Entangled humpback found floating and not swimming. Line around tail and 100 ft. trailing with red buoy. Multiple sightings/partial disentanglement.	SE	Not determinable
8/31/04	Keku Strait	Entangled	Entangled humpback with crab pot buoys trailing. Unable to relocate whale.	SE	Not determinable
11/11/04	Eckholms Islands	Entangled	Entangled humpback with 5/8 in. yellow poly line across body forward of dorsal fin, possibly dragging a pot	SE	Serious
5/18/05	Wrangell-Petersberg	Dead	Net entanglement with drift gillnet; confirmed SE salmon drift gillnet	SE	Mortality
5/30/05	George Inlet	Collision	Whale struck by ship	SE	Not serious

Date	Area	Condition	Brief description	Area	Severity of injury
6/6/05	Juneau	Entangled	Green gillnet (approx. 3 in. mesh) wrapped around head/rostrum area	SE	Not determinable
6/19/05	Portage Bay	Entangled	Adult and calf entangled together in unknown crab pot gear	SE	Serious[1]
6/29/05	Olga Point	Entangled	Net and buoy wrapped around head and blowhole; unknown gillnet	SE	Serious
7/7/05	Icy Strait	Collision	Calf struck by 26 ft. fiberglass cabin cruiser	SE	Not serious
8/8/05	Juneau	Entangled	Whale swimming slowly, entangled in crab pot gear	SE	Not determinable
8/13/05	Frederick Sound	Collision	Whale struck by 28 ft. aluminum boat at approx 25 knots	SE	Not serious
8/15/05	Eastern Channel	Entangled, self release	Line and buoy wrapped around tail, came free while observer watched	SE	Not serious
8/15/05	N of Auke Bay	Entangled	Section of mooring line entangled around pectoral fin	SE	Not serious
8/16/05	Chatham Strait	Entangled	Entanglement around tail	SE	Not determinable
8/25/05	Stephens Passage	Collision	Vessel passenger reported “pretty hard” impact with animal	SE	Serious
9/8/05	Stephens Passage	Collision	Possible ship strike, ship observed whale off bow and felt pressure wave hit hull	SE	Not serious
9/9/05	Favorite Channel	Entangled	Calf trailing recreational king crab pot gear	SE	Not serious
10/15/05	Peril Strait	Dead	Internal hemorrhaging – see necropsy report; confirmed collision	SE	Mortality
12/6/05	St. Nicholas Bay	Entangled	Two green buoys and one red/white torpedo crab buoy trailing from whale	SE	Not determinable
1/28/01	Hawaii	Injured	Entangled in line/buoy from an AK fishery; released, injured - extent unknown	Unk	Not determinable

* Two or more animals involved in interaction.

Appendix 9. Stock Assessment Reports published by the U.S. Fish and Wildlife Service.