Revised 9/27/05

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

STOCK DEFINITION AND GEOGRAPHIC RANGE

The humpback whale is distributed worldwide in all ocean basins, though it is less common in Arctic waters. In winter, most humpback whales occur in the temperate and tropical waters of the North and South Hemispheres (from 10(-23(latitude). Humpback whales in the high latitudes of the North Pacific are seasonal migrants that feed on zooplankton and small schooling fishes (NMFS 1991). 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 (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). Humpback whales have been known to enter the Chukchi Sea (Johnson and Wolman 1984).

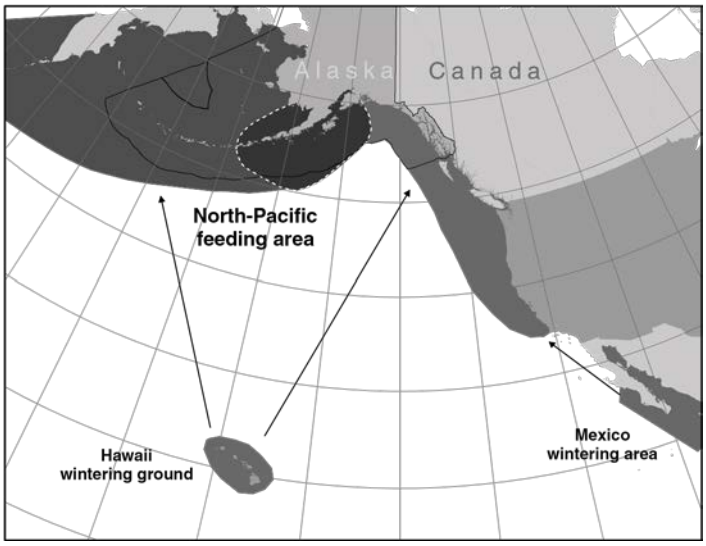

Figure 39. Approximate distribution of humpback whales in the eastern North Pacific (shaded area). Feeding and wintering areas are presented above (see text). Area within the dotted line is known to be an area of overlap with Western North Pacific stock. See Figure 38 for distribution of humpback whales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

The humpback whale population in much of this range was considerably reduced as a result of intensive commercial exploitation during the 20th century.

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 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 of Japan which, based on Discovery Mark information, probably migrate to waters west of the Kodiak Archipelago (the Bering Sea and Aleutian Islands) in summer/fall (Berzin and Rovnin 1966, Nishiwaki 1966, Darling 1991) - referred to as the Western North Pacific stock. Winter/spring populations of humpback whales also occur in Mexico's offshore islands. The migratory destination of those 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). 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 movement between Japan and British Columbia, and Japan and the Kodiak Archipelago (Darling et al. 1996, Calambokidis et al. 1997). Calambokidis et al. (2001) concludes that there are at least 3

subpopulations of humpback whales on the wintering grounds (Hawaii, Japan, and Mexico), and possibly as many as 6 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, 3 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.

The 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 (Brueggeman et al. 1989). 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. Three feeding areas for the Central North Pacific stock that have been studied using photo-identification techniques: southeastern Alaska, Prince William Sound, and Kodiak Island. There has been some exchange of individual whales between these locations. For example, six whales have been sighted in both Prince William Sound and southeastern Alaska since studies began in 1977 (Perry et al. 1990; von Ziegesar et al. 1994; S. Baker, D. McSweeney, J. Straley, O. von Ziegesar, unpubl. data; 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; and two whales have been sighted between Kodiak and southeastern Alaska (Waite et al. 1999). Calambokidis et al. (2001) reports interchange between Kodiak, Prince William Sound, and 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 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 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 that a reduction in the population in the Southeast Alaska feeding area would not be augmented by animals that normally use other feeding areas within a timeframe relevant to managers. Thus, NMFS is considering whether the 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 Southeast Alaska feeding area and included in the report for the entire Central North Pacific humpback whale stock in order to guide managers in prioritizing conservation actions.

The Structure of Populations, Levels of Abundance, and Status of Humpbacks (SPLASH) Project began in 2004 as an international cooperative study to investigate North Pacific humpback whale population structure, status, trends, and potential human impacts. As part of the project the National Marine Fisheries Service sampled humpback summer feeding areas in inland waters of lower Southeast Alaska, the waters around the Aleutian Islands, and the Southeast Bering Sea in 2004. The same areas are scheduled for sampling in 2005 as well as offshore waters in the Gulf of Alaska. SPLASH is the first ever comprehensive field study of North Pacific humpback whales and should result in an increased level of biological understanding.

POPULATION SIZE

The current 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 entire North Pacific were the largest and most complete during this period. Using Darroch's (1961) method, which uses only data from wintering areas, and averaging the 1991-92, 1992-93, and 1991-93 winter release-recovery 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 Western or Central North Pacific stock.

This 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 8501,000 humpback whales have been identified in British Columbia (J. Ford, Department of Fisheries and Oceans, Canada, pers. comm.); it is not known how many of these animals match with animals identified in U.S. waters.

Different studies have used different approaches to estimate the abundance of animals in 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 capturerecapture 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 southeastern Alaska was 404 animals (95% CI:350-458). Straley et al. (2002) examined data for the northern portion of 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 photoidentification studies have only recently been initiated, and humpbacks are seen pelagically in the Gulf of Alaska. Also, Moore et al. (2002) have documented humpback whales in the Bering Sea, and it is not known whether these animals belong to the Central or Western 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): $N_{MIN} = N/\exp(0.842+[\ln(1+[CV(N)]^2)]^{½})$. 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 Central North Pacific humpback whale stock is 3,698. Although the Southeast 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.

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%. 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 Central stock.

The estimated number of animals in the Southeast Alaska portion of this stock has increased. The 2000 estimate of 961 (Straley et al. 2002) is substantially higher than estimates from the early and mid-1980s. A trend for

the Southeast 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. 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 Southeast 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 a 0.07 as a new, conservative estimate of the maximum net productivity rate.

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: $PBR = N_{MIN} + 0.5R_{MAX} + F_R$. 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 be 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, for the entire Central North Pacific stock of humpback whale, PBR = 12.9 animals (3,698 + 0.035 + 0.1). The PBR level for the Southeast Alaska portion of this stock, PBR = 3.0 animals (868 + 0.035 + 0.1), and the PBR level for the northern portion of the stock is 9.9 animals (12.9 – 3.0).

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 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 1999 and 2003, there were incidental serious injuries and mortalities of Central North Pacific humpback whales in the following observed fisheries in Alaska (Table 42): Bering Sea/Aleutian Islands pollock trawl and Bering Sea/Aleutian Islands sablefish pot. Estimates of marine mammal serious injury/mortality in each of these observed fisheries are provided in Perez (in review).

An additional source of information on the number of humpback whales killed or injured incidental to commercial fishery operations is the self-reported fisheries information required of vessel operators by the MMPA. During the 4-year period between 1990 and 1993, there were no fisher self-reports of humpback whale injuries or mortalities from interactions with commercial fishing gear in any Alaska fishery within the range of the Central North Pacific humpback whale stock. Logbook data are available for part of 1989-94, after which incidental mortality reporting requirements were modified. Under the new system, logbooks are no longer required; instead, fishers provide self-reports. Data for the 1994-95 phase-in period are fragmentary. After 1995, the level of reporting dropped dramatically, such that the records are considered incomplete and estimates of mortality based on them represent minimums (see Appendix 7 for details). In 1994, the incidental take of a humpback whale was reported in the Southeast Alaska salmon purse seine fishery. Another humpback whale is known to have been taken incidentally in this fishery in 1989, but due to its historic nature has not been included in Table 42. In 1996, a humpback whale was reported entangled and trailing gear as a result of interacting with the Southeast Alaska drift gillnet fishery. This whale is presumed to have died. Together, these two mortalities result in an annual mortality rate of 0.4 (0.2 + 0.2) humpback whales based on self-reported fisheries information (Table 42). This is considered to be a minimum estimate because logbook records (fisher self-reports required during 1990-94) are most likely negatively biased (Credle et al. 1994).

Table 42. Summary of incidental mortalities and serious injuries of humpback whales (Central North Pacific stock) due to commercial fisheries from 1990 through 2003 and calculation of the mean annual mortality rate. Mean annual mortality in brackets represents a minimum estimate. For a particular fishery, the most recent 5 years of available data

are used in the mortality calculation when more than 5 years of data are provided. Details of how percent observer coverage is measured is included in Appendix 6. ** 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 SARs. N/A indicates that data are not available.

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 Islands pollock trawl	1999 2000 2001 2002 2003	obs data	75.2 76.2 79.0 80.0 82.2	1 0 0 0 0	1 0 0 0 0	0.29** (CV = 0.55)
Bering Sea sablefish pot	1999 2000 2001 2002 2003	obs data	44.1 62.6 38.7 40.6 21.7	0 0 0 0 0	0 0 0 1 0	0.20** (N/A)
Observer program total						.49
				Reported mortalities		
Southeast Alaska salmon drift gillnet	90-03	self reports	N/A	0, 0, 0, 0 1994-03: N/A	N/A	[0.2]
Southeast Alaska salmon purse seine	90-03	self reports	N/A	0, 0, 0, 0, 1 1995-03: N/A	N/A	[0.2]
Minimum total annual mortality from observer programs and self reports				North: [0.29 + 0.2 = 0.49] SE: [0.2 + 0.2 0.4]		

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 Central North Pacific stock from 1999 to 2001 are provided in Table 43 and a summary of the information is provided in Table 44. Overall, there were 30 reports of human-related mortalities or injuries during this 5-year period. Of these, there were 21 incidents which involved commercial fishing gear, and 13 of those incidents involved serious injuries or mortalities. An additional seven incidents of human-related mortality or injury involved ship strikes and will be discussed in a forthcoming section. 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 43. Human-related strandings and entanglements of humpback whales (Central North Pacific stock) from stranding reports, 1998-2001. Areas are designated "SE" for Southeast Alaska or "North" for all other feeding areas; "Unk" indicates that the feeding area to which a whale belongs is unknown; it is assumed that the entanglement was reported in the area where the entanglement occurred, and that duplicate sightings have been removed. An asterisk in the "number" column indicates cases that were not considered serious injuries and thus were not included in the summarized information included in Table 44. 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 who reviewed the complete record for each incident. The guidelines for what should constitute a "serious injury" to a large cetacean are to be reviewed and revised, if necessary, by 2006. This review may result in changes to whether the animals identified in this table are considered "seriously injured" in future Stock Assessment Reports.

Year	Number	Area	Condition	Brief description	Area	Severity of injury

7/28/98		Petersburg	Alive, entangled, collision	Trailing possible king crab buoy & line; surfaced under boat; disentangled except for a loop of line around fluke	SE	Not serious
7/18/98		Sitka, AK	Alive; entangled	Thick green net around head & flippers, not impeding progress	SE	Serious
1998		Jakolof Bay	Alive	Disentangled from personal use pot gear (not included in AKR records)	North	Not serious
7/31/98		Ketchikan, AK	Injury; status unknown	Salmon purse seiner net (commercial) torn through, thought to have died	SE	Serious
8/11/98		Juneau, AK	Alive, apparently uninjured	Ship strike; whale surfaced under an idling catamaran; “glancing blow”; whale observed to blow and fluke with no apparent injury	SE	Not serious
8/23/98		Wrangell, AK	Alive	Commercial crab pot buoy removed	SE	Not serious
9/17/98		Homer, AK	Alive	Subsistence/personal use tanner crab pot cut loose	North	Not determinable
9/24/98		Juneau, AK	Injured	Ship strike; 24' vessel ran up dorsal surface of animal; animal observed for some time prior to incident and was behaving normally	SE	Not serious
10/15/98		Sitka, AK	Alive	Commercial crab pot line cut free	SE	Serious
1/6/99		Hawaii, location not reported	Entangled	Line behind blowhole, connects to a single float	Unk	Serious
9/9/99		Homer	Entangled	In personal use crab pot gear; released (not in AKR records)	North	Not serious
6/9/99		Sitka	Entangled	Line, buoy wrapped around whale; animal had no problems diving, breathing or swimming; NMFS vessel had difficulty keeping up	SE	Serious
7/7/99		Sitka	Alive	Ship strike; whale struck 73' wooden sailboat at anchor; made 5' hole in hull; baleen left in area	SE	Not serious
7/28/99		Juneau	Dead	Ship strike; whale found on bow of ship	SE	Dead
9/6/99		Sisters Island	Alive	Ship strike; whale surfaced under sailboat, brought tail down on forward deck; no apparent injury to whale	SE	Not serious
Year	**Number**	**Area**	**Condition**	**Brief description**	**Area**	**Severity of injury**
10/99		Prince of Wales Island	Entangled	In unknown pot gear, released completely by owner of pot gear, whale swam off	SE	Not serious
11/99		Metlakatla	Injury; status unknown	Ship strike; vessel was a recreational bayliner, skin left on bow of vessel	SE	Not determinable

7/8/00		Lynn Canal	Entangled, status unknown AKR report does not indicate release	Seine gear; completely entangling whale	SE	Serious
12/4/00		Skagway	Entangled, released alive	Shrimp pot gear; released except for a single buoy	SE	Not serious
10/16/00		Uyak Bay	Entangled, released	Unknown line, gear; not clear whether animal was completely released from gear	North	Serious
1/28/01		Hawaii	Injured	Entangled in line/buoy from an AK fishery; released, injured - extent unknown	Unk	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
5/28/01		Resurrection Bay	Entangled, released alive	Swimming freely with multiple lines and buoys attached (not in AKR records)	North	Not serious
6/15/01		Kodiak	Entangled	Attempt to disentangle failed; mother/calf pair (not in AKR records)	North	Serious
7/12/01		Yakutat	Found dead	Entangled in salmon set gillnet; may be same incident as one reported on 7/30/01	North	Dead
7/16/01		Glacier Bay	Found dead, decomposed	Ship strike; fractured skull and premortem hemorrhage	SE	Dead
7/30/01		Bering Glacier	Found dead, decomposed	Entangled in gill net with floats	North	Dead
8/13/01		Hoonah	Entangled, released alive	Shrimp pot gear; wounds on dorsal ridge and tail stock	SE	Not serious
9/18/01		Anchorage	Dead	Ship strike - container ship	North	Dead
9/19/01		Lynn Canal	Entangled, release alive, status unknown	Shrimp pot gear	SE	Not determinable

Table 44. Summary of Central North Pacific humpback whale mortalities and serious injuries caused by entanglement and ship strikes from stranding reports, 1998-2001. A summary of information used to determine whether an injury was serious or non-serious is included in Table 43.

Area	**Human activity/ Fishery**	**Mortalities**	**Serious injuries**	**Not determinable**	**Average annual serious injury/mortality rate, 1998-2001**
Northern					
	Ship strikes	0 0 0 1	0 0 0 0	0 0 0 0	0.25

Area	Human activity/ Fishery	Mortalities	Serious injuries	Not determinable	Average annual serious injury/mortality rate, 1998-2001
	Crab gear	0 0 0 0	0 0 0 0	1 0 0 0	0
	Unspecified fishing gear/line	0 0 0 0	0 0 1 2	0 0 0 0	0.75
	Salmon set gillnet	0 0 0 1	0 0 0 0	0 0 0 0	0.25
			Total		1.0/year fishery only 1.25/year total
Southeast					
	Ship strikes	0 1 0 1	0 0 0 1	1 0 0 0	0.50
	Crab pot gear	0 0 0 0	1 0 0 0	0 0 0 0	0.25
	Unspecified fishing gear/line	0 0 0 0	0 1 0 0	0 0 0 0	0.25
	Unspecified gillnet	0 0 0 0	1 0 0 0	0 0 0 0	0.25
	Salmon purse seine	0 0 0 0	1 0 1 0	0 0 0 0	0.50
			Total		1.25/year fishery only 1.75/year total
Hawaii - summer feeding area either the northern or Southeast areas of Alaska					

	Unspecified fishing gear	0 0 0 0	1 0 0 0	0 0 0 1	0.25/year
			Total		0.25/year fishery only 0.25/year total

The overall fishery-related minimum mortality and serious injury rate for the entire stock is 3.39 humpback whales per year, based on observer data from Alaska (0.49), self reports from Alaska (0.4), stranding records from Alaska (2.25), and stranding records from Hawaii (0.25). The estimated fishery-related minimum mortality and serious injury rate incidental to commercial fisheries for the northern portion of the stock is 1.74 humpback whales per year, based on observer data from Alaska (0.49), stranding records from Alaska (1.0), and stranding data from Hawaii (0.25) (Tables 43 and 44). The estimated minimum mortality and serious injury rate incidental to the commercial fisheries in Southeast Alaska is 1.9 humpback whales per year, based on self reports from Alaska (0.4), stranding records from Alaska (1.25), and stranding data from Hawaii (0.25) (Tables 43 and 44). Note that, because it is unknown whether the stranding reports for Hawaii involve animals from the central or northern portion of the Central North Pacific stock, the level of serious injury/mortality is assessed as if it came from either stock. However, the 0.25 animals per year reported via stranding reports for Hawaii is included once for the entire stock.

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 to take from this stock of humpback whales.

Other Mortality

Ship strikes and other interactions with vessels unrelated to fisheries have also occurred to humpback whales. Those cases are included in Table 43 and summarized in Table 44. Of those, three ship strikes constitute "other sources" of mortality or serious injury; two of these ship strikes occurred in Southeast Alaska and one occurred in the northern portion of this stock's range. It is not known whether the difference in ship strike rates between 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 1998 to 2001, these account for an additional 0.75 humpback whale mortalities per year for the entire stock (0.25 ship strikes/year for the northern portion of the stock, and 0.50 strikes/year for the southeast portion).

HISTORIC WHALING

The number of humpback whales in the North Pacific may have numbered approximately 15,000 individuals prior to exploitation (Rice 1978). Intensive commercial whaling removed more than 28,000 animals from the North Pacific during the 20th century and may have reduced this population to as few as 1,000 before it was placed under international protection after the 1965 hunting season (Rice 1978). This mortality estimate likely underestimates the actual kill as a result of under-reporting of Soviet catches (Yablokov 1994).

STATUS OF STOCK

As the estimated annual mortality and serious injury rate for the entire stock (4.1; 3.4 of which were fishery-related; Table 45) 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 Southeast Alaska (2.4, of which 1.7 were fishery-related) is less than the PBR level if calculated only for the Southeast Alaska portion of the population (3.0). The minimum estimated fishery 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 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 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 45. Summary of serious injury (SI) and mortality (M) levels for the Central North Pacific (CNP) stock of humpback whales.

* The average annual SI/M in HI is 0.25, not 0.5; in the area-specific analysis, 0.25 is added to both the northern and southern portions of the CNP stock because animals from both portions of the stock feed in HI, so it is not known to what portion of the stock this level of SI/M should be assigned. ** This is the sum of the observed SI/M (0.49), the self reports (0.4), the AK strandings (2.25), and the average HI stranding rate (0.25). *** This is the sum of 3.39 + 0.75.

	Data types for fishery-related information							
Area	Observer data	Self reports	AK Strand.	HI Strand.	Total fish.	Ship strikes	Total	"PBR"
Northern	0.49		1.0	0.25	1.74	0.25	2.0	9.9
Southeast		0.4	1.25	0.25	1.9	0.5	2.4	3.0
TOTAL	0.49	0.4	2.25	0.25*	3.39**	0.75	4.14***	12.9

Habitat Concerns

This stock is the focus of a large whalewatching industry in its wintering grounds (Hawaii) and a growing whalewatching 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 whalewatching. In 2001, NMFS issued regulations to prohibit most approaches to humpback whales in Alaska within 100 yards (91.4m; 66 FR 29502; May 31, 2001). The growth of the whalewatching industry, however, is a concern as preferred habitats may be abandoned if disturbance levels are too high.

Noise 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 whalewatching) in Hawaii waters may be of 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 noise (e.g., experiments with LFA sound sources) to Hawaii's marine environment, although reports summarizing the results of recent research are not available.

CITATIONS

Baker, C. S., and L. M. Herman. 1987. Alternative population estimates of humpback whales (*Megaptera novaeangliae*) in Hawaiian waters. Can. J. Zool. 65:2818-2821.

Baker, C. S., A. Perry, and L. M. Herman. 1987. Reproductive histories of female humpback whales (*Megaptera novaeangliae*) in the North Pacific. Mar. Ecol. Prog. Ser. 41:103-114.

Baker, C. S., S. R. Palumbi, R. H. Lambertsen, M. T. Weinrich, J. Calambokidis, and S. J. O'Brien. 1990. Influence of seasonal migration on geographic distribution of mitochondrial DNA haplotypes in humpback whales. Nature 344:238-240.

Baker, C. S., J. M. Straley, and A. Perry. 1992. Population characteristics of individually identified humpback whales in southeastern Alaska: summer and fall 1986. Fish. Bull., U.S. 90:429-437.

Baker, C. S., L. Medrano-Gonzalez, J. Calambokidis, A. Perry, F. Pichler, H. Rosenbaum, J. M. Straley, J. UrbanRamirez, M. Yamaguchi, and O. von Ziegesar. 1998. Population structure of nuclear and mitochondrial DNA variation among humpback whales in the North Pacific. Mol. Ecol. 7(695-707).

Baker, C. S., L. M. Herman, A. Perry, W. S. Lawton, J. M. Straley, A. A. Wolman, G. D. Kaufman, H. E. Winn, J. D. Hall, J. M. Reinke, and J. Ostman. 1986. Migratory movement and population structure of humpback

whales (*Megaptera novaeangliae*) in the central and eastern North Pacific. Mar. Ecol. Prog. Ser. 31:105119.

Bannister, J. L. and S. L. Hedley. 2001. Southern Hemisphere group IV humpback whales: their status from recent aerial surveys. Memoirs of the Queensland Museum. 47:578-598.

Barlow, J., and P. J. Clapham. 1 997. A new birth-interval approach to estimating demographic parameters of humpback whales. Ecol. 78(2):535-546.

Berzin, A. A., and A. A. Rovnin. 1966. The distribution and migrations of whales in the northeastern part of the Pacific, Chukchi and Bering Seas. Izvestiya Tikhookeanskogo Nauchno-Issledovatel'skogo Institut Rybnogo Khozyaistva I Okeanografii 58:179-207. (Translated by Bureau of Commercial Fisheries, U. S. Fish and Wildlife Service, Seattle, 1968, pp. 103-136. *In* K. I. Panin (ed.), Soviet Research on Marine Mammals of the Far East.)

Best, P. B. 1993. Increase rates in severely depleted stocks of baleen whales. ICES J. Mar. Sci. 50:169-186.

Brueggeman, J. J., G. A. Green, R. A. Grotefendt, and R. W. Tressler. 1989. Marine mammal habitat use on the north Aleutian Basin, St. George Basin, and Gulf of Alaska. Pp. 97-108 *In* L. E. Jarvela and L. K. Thorsteinson (eds.), Proceedings of the Gulf of Alaska, Cook Inlet, and North Aleutian Basin Information Update Meeting. U.S. Dep. Commer., NOAA, NOS, Office of Ocean. and Mar. Assess., 222 W. Eighth Ave., Anchorage, AK.

Calambokidis, J., G. H. Steiger, J. C. Cubbage, K. C. Balcomb III, and P. Bloedel. 1989. Biology of humpback whales in the Gulf of the Farallones. Report to Gulf of the Farallones National Marine Sanctuary, San Francisco, CA by Cascadia Research Collective, 218½ West Fourth Avenue, Olympia, WA. 93 pp.

Calambokidis, J., G. H. Steiger, and J. R. Evenson. 1993. Photographic identification and abundance estimates of humpback and blue whales off California in 1991-92. Final Contract Report 50ABNF100137 to Southwest Fisheries Science Center, P.O. Box 271, La Jolla, CA 92038. 67 pp.

Calambokidis, J., G. H. Steiger, J. M. Straley, L. M. Herman, S.Cerchio, D. R. Salden, J. Urb n R., J. K. Jacobsen, O. von Ziegesar, K.C. Balcomb, C. M. Gabriele, M. E. Dahlheim, S. Uchida, G. Ellis, Y.Miyamura, P. Ladr¢n de Guevara P., M. Yamaguchi, F. Sato, S. A. Mizroch, L. Schlender, K. Rasmussen, J. A. Y. Barlow and T. J. Quinn, II. 2001. Movements and population structure of humpback whales in the North Pacific. Mar. Mammal Sci. 17(4): 769-794.

Calambokidis, J., G. H. Steiger, J. M. Straley, T. Quinn, L. M. Herman, S. Cerchio, D. R. Salden, M. Yamaguchi, F. Sato, J. R. Urban, J. Jacobson, O. Von Zeigesar, K. C. Balcomb, C. M. Gabriele, M. E. Dahlheim, N. Higashi, S. Uchida, J. K. B. Ford, Y. Miyamura, P. Ladrón de Guevara, S. A. Mizroch, L. Schlender, and K. Rasmussen. 1997. Abundance and population structure of humpback whales in the North Pacific basin. Final Contract Report 50ABNF500113 to Southwest Fisheries Science Center, P.O. Box 271, La Jolla, CA 92038. 72 pp.

Calambokidis, J., G. H. Steiger, J. M. Straley, L. M. Herman, S. Cerchio, D. R. Salden, J. Urban, J. K. Jacobsen, O. von Ziegesar, K. C. Balcomb, C. M. Gabriele, M. E. Dahlheim, S. Uchida, G. Ellis, Y. Miyamura, P. Ladrón de Guevara, M. Yamaguchi, F. Sato, S. A. Mizroch, L. Schlender, K. Rasmussen, J. Barlow, and T. J. Quinn II. 2001. Movements and population structure of humpback whales in the north pacific. Mar. Mamm. Sci. 17(4): 769-794.

Credle, V. R., D. P. DeMaster, M. M. Merklein, M. B. Hanson, W. A. Karp, and S. M. Fitzgerald (eds). 1994. NMFS observer programs: minutes and recommendations from a workshop held in Galveston, Texas, November 10-11, 1993. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-OPR-94-1, 96 pp.

Darling, J. D. 1991. Humpback whales in Japanese waters. Ogasawara and Okinawa. Fluke identification catalog 1987-1990. Final Contract Report, World Wide Fund for Nature, Japan. 22 pp.

Darling, J. D., J. Calambokidis, J., K. C. Balcomb, P. Bloedel, K. Flynn, A. Mochizuki, K. Mori, F. Sato, and M. Yamaguchi. 1996. Movement of a humpback whale (*Megaptera novaeangliae*) from Japan to British Columbia and return. Mar. Mammal Sci. 12(2):281-287.

Darling, J. D., and S. Cerchio. 1993. Movement of a humpback whale (*Megaptera novaeangliae*) between Japan and Hawaii. Mar. Mammal Sci. 1:84-89.

Darling, J. D., and D. J. McSweeney. 1985. Observations on the migrations of North Pacific humpback whales (*Megaptera novaeangliae*). Can. J. Zool. 63:308-314.

Darroch, J. N. 1961. The two-sample capture-recapture census when tagging and sampling are stratified. Biometrika 48:241-260.

Dizon, A. E., C. Lockyer, W. F. Perrin, D. P. DeMaster, and J. Sisson. 1992. Rethinking the stock concept: a phylogeographic approach. Conserv. Biol. 6:24-36.

Frankel, A. S., and C. W. Clark. 1998. Results of low-frequency playback of M-sequence noise to humpback whales, *Megaptera novaeangliae*, in Hawai'i. Can. J. Zool. 76:521-535.

Frankel, A.S. and C. W. Clark. 2002. ATOC and other factors affecting the distribution and abundance of humpback whales (*Megaptera novaeangliae*) off the North Shore of Hawaii. Mar. Mam. Sci. 18(3):644662.

Johnson, J. H., and A. A. Wolman. 1984. The humpback whale, *Megaptera novaeangliae*. Mar. Fish. Rev. 46:3037.

Martin, A. R., S. K. Katona, D. Mattila, D. Hembree, and T. D. Waters. 1984. Migration of humpback whales between the Caribbean and Iceland. J. Mamm. 65:330-333.

Mizroch, S. A., L. M. Herman, J. M. Straley, D. Glockner-Ferrari, C. Jurasz, J. Darling, S. Cerchio, C. Gabriele, D. Salden, O. von Ziegesar. 2004. Estimating the adult survival rate of central North Pacific humpback whales. J. Mammal. 85(5):963-972.

Mobley, J. M., S. Spitz, R.Grotefendt, P. Forestell, A.Frankel, and G. Bauer. 2001. Abundance of humpback whales in Hawaiian waters: Results of 1993-2000 aerial surveys. Report to the Hawaiian Islands Humpback Whale National Marine Sanctuary. 16 pp.

Moore, S. E., J. M. Waite, L. L. Mazzuca, and R. L. Hobbs. 2000. Mysticete whale abundance observations of prey associations on the Central Bering Sea Shelf. J. Cetacean Research and Management 2(3): 227-234.

Moore, S. E., J. M. Waite, N. A. Friday and T. Honkalehto. 2002. Distribution and comparative estimates of cetacean abundance on the central and south-eastern Bering Sea shelf with observations on bathymetric and prey associations. Progr. Oceanogr. 55(1-2):249-262.

National Marine Fisheries Service. 1991. Recovery plan for the humpback whale (*Megaptera novaeangliae*). Prepared by the humpback recovery team for the National Marine Fisheries Service, Silver Spring, MD. 105 pp.

Nemoto, T. 1957. Foods of baleen whales in the northern Pacific. Sci. Rep. Whales Res. Inst. Tokyo 12:33-89.

Nishiwaki, M. 1966. Distribution and migration of the larger cetaceans in the North Pacific as shown by Japanese whaling results. Pp. 172-191 *In* K. S. Norris (ed.), Whales, Dolphins and Porpoises, University of California Press, Berkeley, CA. Academic Press, New York.

Perez, M. A. In review. Analysis of marine mammal bycatch data from the trawl, longline, and pot groundfish fisheries of Alaska, 1998-2004, defined by geographic area, gear type, and target groundfish species. NOAA Tech. Memo. NMFS-AFSC-xxx.

Perry, A., C. S. Baker, and L. M. Herman. 1990. Population characteristics of individually identified humpback whales in the central and eastern North Pacific: a summary and critique. Rep. Int. Whal. Comm. (Special Issue 12):307-317.

Rice, D. W. 1978. The humpback whale in the North Pacific: distribution, exploitation and numbers. Appendix 4. Pp. 29-44 *In* K. S. Norris and R.R. Reeves (eds.), Report on a workshop on problems related to humpback whales (*Megaptera novaeangliae*) in Hawaii. U.S. Dep. Commer., Nat. Tech. Info. Serv. PB-280 794. Springfield, VA.

Steiger, G. H., J. Calambokidis, R. Sears, K. C. Balcomb, and J. C. Cubbage. 1991. Movement of humpback whales between California and Costa Rica. Mar. Mammal Sci. 7:306-310.

Straley, J. M. 1994. Seasonal characteristics of humpback whales (*Megaptera novaeangliae*) in southeastern Alaska. Master's thesis, University of Alaska - Fairbanks, Fairbanks, Alaska, 99775. 121 pp.

Straley, J. M., C. M. Gabriele, and C. S. Baker. 1995. Seasonal characteristics of humpback whales (*Megaptera novaengliae*) in southeastern Alaska. Pp. 229-237 *In* D. R. Engstrom, ed. Proceedings of the Third Glacier Bay Science Symposium, 1993. National Park Service, Anchorage, AK.

Straley, J. M., T. J. Quinn II, and C. Gabriele. 2002. Estimate of the abundance of humpback whales in Southeastern Alaska 1994-2000. Unpublished final report submitted to NOAA Fisheries. 19 pp.

Tomlin, A. G. 1967. Mammals of the USSR and adjacent countries. vol. 9, Cetacea. Israel Program Sci. Transl. No. 1124, Natl. Tech. Info. Serv. TT 65-50086. Springfield, VA. 717 pp. (Translation of Russian text published in 1957).

von Ziegesar, O. 1992. A catalogue of Prince William Sound humpback whales identified by fluke photographs between the years 1977 and 1991. North Gulf Oceanic Society, P. O. Box 15244, Homer, AK. 29 pp.

von Ziegesar, O., B. Goodwin, and R. Devito. 2004. A catalog of humpback whales in Prince William Sound Alaska, 1977-2001. Eye of the Whale Research, Fritz Creek, Alaska.

von Zeigesar, O., E. Miller, and M. E. Dahlheim. 1994. Impacts on humpback whales in Prince William Sound. Pp. 173-191 *In* T. R. Loughlin (ed.), Marine Mammals and the *Exxon Valdez*. Academic Press Inc., San Diego, CA. Wade, P. R., and R. Angliss. 1997. Guidelines for assessing marine mammal stocks: report of the GAMMS workshop April 3-5, 1996, Seattle, Washington. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-OPR-12, 93 pp.

Wade, P. R., and R. Angliss. 1997. Guidelines for assessing marine mammal stocks: report of the GAMMS workshop April 3-5, 1996, Seattle, Washington. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-OPR12, 93 pp.

Waite, J. M., M. E. Dahlheim, R. C. Hobbs, S. A. Mizroch, O. von Ziegesar-Matkin, J. M. Straley, L. M. Herman, and J. Jacobsen. 1999. Evidence of a feeding aggregation of humpback whales (*Megaptera novaeangliae*) around Kodiak Island, Alaska. Mar. Mammal Sci. 15:210-220.

Witteveen, B. H., J. M. Straley, O. Ziegesar, D. Steel, and C. S. Baker. 2004. Abundance and mtDNA differentiation of humpback whales (*Megaptera novaeangliae*) in the Shumagin Islands, Alaska. Can. J. Zool. 82:1352-1359.

Yablokov, A. V. 1994. Validity of whaling data. Nature 367:108.