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

STOCK DEFINITION AND GEOGRAPHIC RANGE

The gray whale formerly occurred in the North Atlantic Ocean (Fraser 1970), but is currently only found in the North Pacific (Rice et al. 1984). The following information was considered in classifying stock structure of gray whales based on the Dizon et al. (1992) phylogeographic approach: 1) Distributional data: isolated geographic distribution in the North Pacific Ocean; 2) Population response data: increasing in the eastern North Pacific, unknown in the western North Pacific; 3) Phenotypic data: unknown; and 4) Genotypic data: unknown. Based on this limited information, two stocks have been recognized in the North Pacific: the Eastern Pacific stock, which breeds along the west coast of North America (Fig. 30), and the Western Pacific or "Korean" stock, which apparently breeds off the coast of eastern Asia (Rice 1981). Most of the Eastern North Pacific stock spends the summer feeding in the northern Bering, Chukchi, and Beaufort Seas (Rice and Wolman 1971). However, gray whales have been reported feeding in the summer in waters off of Southeast Alaska, British Columbia, Oregon, and Washington. The whales migrate near shore along the coast of North America from Alaska to the central California coast (Rice and Wolman 1971) starting in October or November. After passing Point Conception, California, Rice et al. (1984) reported the majority of the animals take a more direct offshore route across the southern California Bight to northern Baja California. The Eastern North Pacific stock winters mainly along the west coast of Baja California. The pregnant females assemble in certain shallow, nearly landlocked lagoons and bays where the calves are born from early January to mid-February (Rice et al. 1981). Interestingly, a small, but increasing proportion of newborn calves have been sighted along the California coast during the southward migration (Shelden et al. 1995). The northbound migration generally begins in mid-February and continues through May (Rice et al. 1981) with cows and newborn calves primarily migrating northward between March and June along the U. S. west coast.

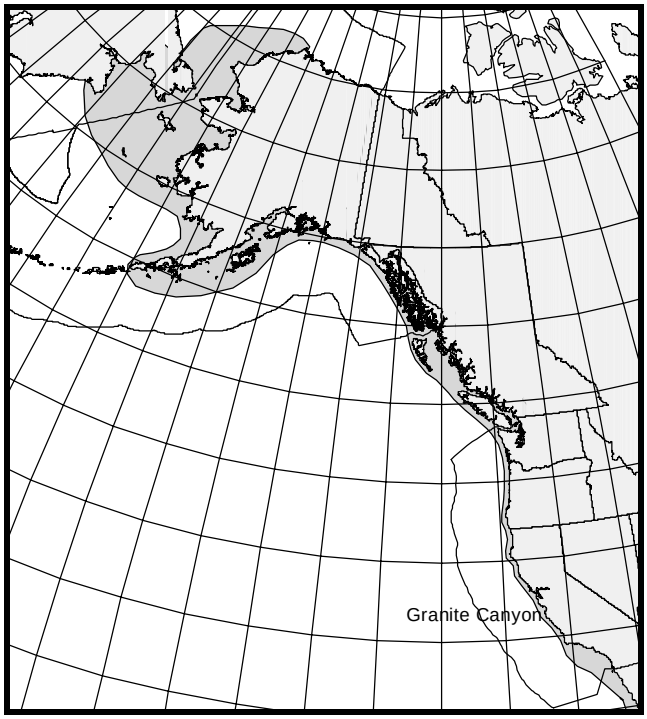

Figure 30. Approximate distribution of the Eastern North Pacific stock of gray whales (shaded area). Excluding some Mexican waters, the entire range of this stock is depicted in the figure.

POPULATION SIZE

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

Minimum Population Estimate

The minimum population estimate (N_{MIN}) for this stock is calculated from Equation 1 from the PBR Guidelines (Wade and Angliss 1997): $N_{MIN} = N/\exp(0.842*[\ln(1 +[CV(N)]^2)]^{½})$. Using the 1995-96 population estimate of 22,571 and its associated CV of 0.0524, N_{MIN} for this stock is 21,597.

Current Population Trend

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

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

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

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

POTENTIAL BIOLOGICAL REMOVAL

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

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

Fisheries Information

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

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

An additional source of information on the number of gray whales killed or injured incidental to commercial fishery operations is the logbook reports maintained by vessel operators as required by the MMPA interim exemption program. During the 4-year period between 1990 and 1993, logbook reports indicated 2 gray whale mortalities related to the Bristol Bay gillnet fisheries in 1990, resulting in an annual mean of 0.5 gray whale mortalities from interactions with commercial fishing gear. In 1990, logbook records from the Bristol Bay set and drift gillnet fisheries were combined. As it is not possible to determine which fishery was responsible for the gray whale mortalities reported in 1990, both fisheries have been included in Table 22. However, because logbook records are most likely negatively biased (Credle et al. 1994), these are considered to be minimum estimates. Complete logbook data after 1993 are not available.

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

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

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

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

It should be noted that no observers have been assigned to most Alaska gillnet fisheries, including those in Bristol Bay which are known to interact with this stock, making the estimated mortality from U. S. fisheries unreliable. Further, due 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 commercial fisheries (rounded to 4; based on observer data (0.5) and logbook reports (0.5) or stranding reports (2.3) where observer data were not available) is not known to exceed 10% of the PBR (43) and, therefore, can be considered to be insignificant and approaching zero mortality and serious injury rate.

Subsistence/Native Harvest Information

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

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

Other Mortality

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

STATUS OF STOCK

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

REFERENCES

Anon. 1991. International Whaling Commission Report. Rep. Int. Whal. Commn. 41: 1-2.

Anon. 1995. Report of the Scientific Committee. Rep. Int. Whal. Commn. 45: 53-95.

Anon. 1996. Report of the Scientific Committee. Rep. Int. Whal. Commn. 46: 51-97.

Anon. 1997. Review of the sub-committee on Aboriginal Subsistence Whaling. Rep. Int. Whal. Commn. 47: in press.

Breiwick, J. W. 1996. Eastern Pacific gray whale status: ROI and RY. Unpubl. doc. submitted to Int. Whal. Commn. (SC/48/AS7). 6 pp.

Buckland, S. T., J. M. Breiwick, K. L. Cattanach and J. L. Laake. 1993. Estimated population size of the California gray whale. Mar. Mammal Sci. 9(3):235-249.

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.

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.

Fraser, F. C. 1970. An early 17th century record of the California gray whale in Icelandic waters. Invest. Cetacea 2:13-20.

Gearin, P. J., S. R. Melin, R. L. DeLong, H. Kajimura, and M. A. Johnson. 1994. Harbor porpoise interactions with a chinook salmon set-net fishery in Washington state. Rep. Int. Whal. Commn. (Special Issue 15):427-438.

Guenther, T. J., R. W. Baird, R. L. Bates, P. M. Willis, R. L. Hahn, and S. G. Wischniowski. 1995. Strandings and fishing gear entanglements of cetaceans of the west coast of Canada in 1994. Unpubl. doc. submitted to Int. Whal. Commn. (SC/47/O6). 7pp.

Hobbs, R. C., D. J. Rugh, J. M. Waite, J. M. Breiwick, and D. P. DeMaster. 1996. Preliminary estimate of the abundance of gray whales in the 1995/96 southbound migration. Unpubl. doc. submitted to Int. Whal. Commn. (SC/48/AS 9). 11 pp.

Rice, D. W. 1981. Status of the eastern Pacific (California) stock of the gray whale. Pp. 181-187, In Food and Agriculture Organization. 1981. Mammals in the Seas. vol. III. General Papers and Large Cetaceans. Food and Agriculture Organization, Rome, Italy.

Rice, D. W., and A. A. Wolman. 1971. The life history and ecology of the gray whale, *Eschrichtius robustus*. Am. Soc. Mammal. Spe. Publ. 3. 142 pp.

Rice, D. W., A. A. Wolman, and H. W. Braham. 1984. The gray whale, *Eschrichtius robustus*. Mar. Fish. Rev. 46(4):7-14.

Rice, D. W., A. A. Wolman, D. E. Withrow, and L. A. Fleischer. 1981. Gray whales on the winter grounds in Baja California. Rep. Int. Whaling Commn. 31:477-493.

Shelden, K. E. W., D. J. Rugh, and S. A. Boeve 1995. Gray whale calf sightings collected by the National Marine Mammal Laboratory during southbound migrations, 1952-95. Unpubl. doc. submitted to Int. Whal. Commn. (SC/47/AS 4). 25 pp.

Wade, P. R. 1994. Estimates of population parameters for the eastern Pacific gray whale, *Eschrichtius robustus,* using a Bayesian method. Unpubl. doc. submitted to Int. Whal. Commn. (SC/46/AS16). 30 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-OPR-12, 93 pp.

Wade, P. R., and D. P. DeMaster. 1996. A Bayesian analysis of eastern Pacific gray whale population dynamics. Unpubl. doc. submitted to Int. Whal. Commn. (SC/48/AS3). 21 pp.