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: two isolated geographic distributions 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 North Pacific stock, which breeds along the west coast of North America (Fig. 30), and the Western North Pacific or "Korean" stock, which apparently breeds off the coast of eastern Asia (Rice 1981, Rice et al. 1984). Most of the Eastern North Pacific stock spends the summer feeding in the northern Bering, Chukchi, and Beaufort Seas (Rice and Wolman 1971, Nerini 1984). However, gray whales have been reported feeding in the summer in waters off of Southeast Alaska, British Columbia, Washington, Oregon, and California (Rice and Wolman 1971, Darling 1984, Nerini 1984, Rice et al. 1984). 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, Mexico. 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). A small, but increasing proportion of newborn calves has been sighted along the California coast during the southward migration (Shelden et al. in press). According to Shelden et al. (in press), the apparent increase in the percentage of calf sightings may be related to a trend toward successively later migrations over the 43-year observation period (see Rugh et al. 1999a, Buckland and Breiwick in press) or it may be due to an increase in spatial and temporal distribution of calving as the population has increased. The northbound migration generally begins in mid-February and continues through May (Rice et al. 1981, 1984; Poole 1984) with cows and newborn calves primarily migrating northward between March and June along the U.S. West Coast.

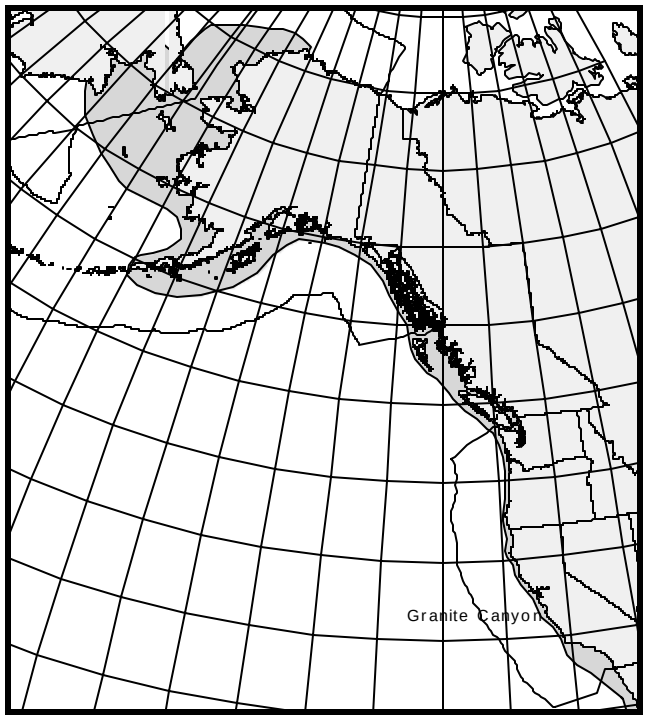

Figure 30. Approximate distribution of the Eastern North Pacific stock of gray whales (shaded area). Excluding some Mexican waters, the entire range of this stock is depicted in the figure.

POPULATION SIZE

Systematic counts of gray whales migrating along the central California coast were conducted by shore-based observers (at Granite Canyon) during the 1997/98 southbound migration (Hobbs and Rugh 1999). The abundance estimate resulting from the 1997/98 census is 26,635(CV=0.1006) whales. This estimate is not significantly larger than the previous estimates of 22,263 (CV=0.0925) whales in 1995/96 (Hobbs et al. in press), 23,109 (CV=0.0542) whales in 1993/94 (Laake et al. 1994), and 21,296 (CV=0.0605) whales in 1987/88 (Buckland et al. 1993); but it is significantly higher than the

estimate of 17,674 (CV=0.0587) whales in 1992/93 (Laake et al. 1994). 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 1997/98 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 1997/98 population estimate of 26,635 and its associated CV of 0.1006, N_{MIN} for this stock is 24,477.

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). Taking account of the harvest, Wade and DeMaster (1996) estimated an underlying annual rate of increase of 0.044 (95% CI: 0.031-0.056) for this same time period. Incorporating the census data through the 1993/94 migration resulted in an annual rate of increase of 2.57% (SE=0.4%: IWC 1995a). Most recently, 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%).

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 in press). 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 in press). The AK SRG 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, the preferred estimate is from the age- and sex-structured model, which had a lower 10th percentile of 0.047. This has the interpretation 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 a R_{max} of 0.047.

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 whales, PBR = 575 animals (24,477 x 0.0235 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 1990-98: 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.

NMFS observers monitored the northern Washington marine set gillnet fishery, otherwise known as the Makah tribal fishery for chinook salmon, during 1990-98. Data from 1990-98 are included in Table 24a, although the mean estimated annual mortality is calculated using the most recent 5 years of available data. One gray whale was observed taken in 1990 (Gearin et al. 1994) and one observed taken 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, pers. comm., National Marine Mammal Laboratory, AFSC, NMFS, 7600 Sand Point Way NE, Seattle, WA 98115-0070.).

NMFS observers also monitored the California/Oregon thresher shark/swordfish drift gillnet fishery from 1993 to 1998 (Table 24a; Julian 1997, Cameron 1998, Julian and Beeson 1998, Cameron and Forney 1999). One gray whale mortality was observed in this fishery in 1998.

The mean annual mortality was 0.2 (CV=1.0) for the northern Washington marine set gillnet fishery and 1.0 (CV=1.0) for the California/Oregon thresher shark/swordfish drift gillnet fishery, resulting in a mean annual mortality rate of 1.2 (CV=0.85) gray whales per year from observed fisheries.

An additional source of information on the number of gray whales killed or injured incidental to commercial fishery operations is the logbook/self-reported fisheries information required of vessel operators by the MMPA. During the period between 1990 and 1998, logbook/fisher self-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 24a. However, because logbook records are most likely negatively biased (Credle et al. 1994), these are considered to be minimum estimates. Logbook data are available for part of 1989-1994, 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 is 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 4 for details).

Table 24a. Summary of incidental mortality of gray whales (Eastern North Pacific stock) due to commercial and tribal fisheries from 1990 through 1998 and calculation of the mean annual mortality rate. Mean annual mortality in brackets represents a minimum estimate from logbook/self-reports or stranding data. Data from 1994 to 1998 (or 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.

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)	90-98	obs data	47-98%	1, 0, 0, 0, 0, 1, 0, 0, 0	1, 0, 0, 0, 0, 1, 0, 0, 0	0.2 (CV=1.0)
CA/OR thresher shark/swordfish drift gillnet	93-98	obs data	12-23%	0, 0, 0, 0, 0, 1	0, 0, 0, 0, 0, 5	1.0 (CV=1.0)
Observer program total						1.2 (CV=0.85)
				Reported mortalities		
Bristol Bay salmon drift and set gillnet fisheries	90-98	logbook/self-reports	n/a	2, 0, 0, 0, n/a, n/a, n/a, n/a, n/a	n/a	[$0.5]
Unknown west coast fisheries	93-98	strand data	n/a	0, 5, 3, 3, 6, 4	n/a	[$4.2]

Fishery name	Years	Data type	Range of observer coverage	Observed mortality (in given yrs.)	Estimated mortality (in given yrs.)	Mean annual mortality
Minimum total annual mortality						$5.9

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. Details of strandings that occurred between 1993 and 1995 in the U.S. and British Columbia are described in Hill and DeMaster (1999), while Table 24b presents data on strandings that occurred on the U. S. West Coast from 1996 to 1998. These stranding data are included in Table 24a (listed as unknown west coast fisheries) as they resulted from commercial fishing; however, the mortalities have not been attributed to particular fisheries. An additional 1995 mortality, caused by entanglement in gear from an unknown west coast fishery, was discovered in the Washington stranding database and has been added to Table 24a, resulting in a total of 3 mortalities for 1995 (1 in California and 2 in Washington state) Therefore, during the 5-year period from 1994 to 1998, stranding network data indicate a minimum annual mean of 4.2 gray whale mortalities resulting from interactions with commercial fishing gear.

Table 24b. Human-related gray whale strandings and entanglements, 1996-1998. An asterisk in the "number" column indicates cases that were not considered serious injuries.

Year	Number	Area	Condition	Description
1996	1	Del Norte County, CA	Dead	Floating offshore entangled in crab pot gear.
1996	1*	Orange County, CA	Released alive	Released from gillnet trailing from flukes.
1996	2	Santa Barbara County, CA	Dead	Cow/calf pair entangled in gillnets.
1996	1*	Humboldt County, CA	Released alive	Released from crab pot line.
1997	1	55°02'N, 131°00'W, Kah Shakes Cove, AK	Dead	Ship strike
1997	1	60°34'N, 148°10.3'W, AK	Dead	Commercial netting from unknown fishery wrapped around tail peduncle (apparently before death).
1997	1	20 mi. north of U.S. - Mexico border	Possible injury; status unknown	Towing pot gear.
1997	1	Offshore El Capitan State Park, CA	Injury; status unknown	Towing 50 ft. of gillnet gear and buoy.
1997	1	1 mi. offshore Goleta Pier, CA	Injury; status unknown	Gillnet wrapped around flukes.

1997	1	Offshore Patrick's Pt., CA	Possible injury; status unknown	Towing pot gear.
1997	1*	3 mi. offshore Anacapa Is., CA	Non-fatal injury; released alive	Released from gillnet wrapped around flukes.
1997	1	Vandenberg AFB, CA	Dead	Carcass wrapped in gillnet.
1998	1	Yakutat, AK	Dead	Pot gear/buoy/line embedded in tail stock.
1998	1	Nome, AK	Alive, entangled	Trailing net + 2 buoys.
1998	1	Kodiak, AK	Dead	Entangled in pot/line gear (tentatively dungeness pot lines).
1998	1	Offshore Pt. Fermin, CA	Injury; status unknown	Ship strike; six 1-ft. gashes on side.
1998	1	Between San Pedro & Catalina Is., CA	Injury; status unknown	Entangled in gillnet or pot gear.
1998	1	Offshore Pt. Loma, CA	Dead	Ship strike (USN-USS *Shiloh*)
1998	1	Offshore Pt. Loma, CA	Dead	Ship strike (USN-USS *Milius*)
1998	1*	Los Angeles Harbor, CA	Non-fatal injury	Released from pot gear.
1998	1*	Mission Bay, CA	Non-fatal injury	Released from lobster pot 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 6; based on observer data (1.2) and logbook/self-reports (0.5) or stranding reports (4.2) where observer data were not available) is not known to exceed 10% of the PBR (49) 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. The only reported takes by subsistence hunters in Alaska during this decade occurred in 1995, with the take of two gray whales by Alaskan natives (IWC 1997). Russian subsistence hunters reported taking no whales from this stock during 1993 (IWC 1995a), 44 in 1994 (IWC 1996), 90 in 1995 (Russian Federation 1997, Blokhin in press) [the IWC reports a take of 85 for 1995 (IWC 1997)], 43 in 1996 (IWC 1998a), 79 in 1997 (IWC 1999), and 122 in 1998 (R. Brownell, pers. comm.). Based on this

information, the annual subsistence take averaged 76 whales during the 5-year period from 1994 to 1998. This level of take is well below the 1968-93 average of 159 whales per year (IWC 1995b), during which time the population size increased.

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 United States 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. In 1998, Russian aboriginals harvested gray whales and none were harvested by the Makah Tribe.

Other Mortality

The near shore migration route used by gray whales makes ship strikes another potential source of mortality. Between 1993 and 1998, the California stranding network reported 5 gray whale mortalities caused by ship strikes: 1 per year from 1993 to 1995 and 2 in 1998 (J. Cordaro, pers. comm., National Marine Fisheries Service, 501 West Ocean Blvd. Long Beach, CA 90802-4213). And 1 ship strike mortality was reported in Alaska in 1997 (B. Fadely, pers. comm., National Marine Mammal Laboratory, AFSC, NMFS, 7600 Sand Point Way NE, Seattle, WA 98115-0070.). 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 whales has been increasing in recent years while being subjected to known harvests. Based on currently available data, the estimated annual level of human-caused mortality and serious injury (83), which includes mortalities from commercial fisheries (6), Russian harvest (76), and ship strikes (1) does not exceed the PBR (649). Therefore, the Eastern North Pacific stock of gray whales is not classified as a strategic stock. In 1994, this stock 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, followed a review of 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. 1999b). This recommendation was subsequently adopted by NMFS.

CITATIONS

Blokhin, S. A. In press. Some aspects of modern whaling of gray whales by natives of Chukotka. J. Cetacean Res. Manage. (Special Issue 2). (SC/49/AS16).

Breiwick, J. W. 1999. Gray whale abundance estimates, 1967/68 - 1997/98: *ROI*, *RY*, and *K*. Pp. 62, *In* D. J. Rugh, M. M. Muto, S. E. Moore, and D. P. DeMaster, Status review of the Eastern North Pacific stock of gray whales. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-AFSC-103, 96 pp.

Brownell, R. L, Jr. Southwest Fisheries Science Center, NMFS, P.O. Box 271, La Jolla, CA 92038-0271.

Buckland, S. T., and J. M. Breiwick. In press. Estimated trends in abundance of eastern Pacific gray whales from shore counts, 1967/68 to 1995/96. J. Cetacean Res. Manage. (Special Issue 2). (SC/A90/G9).

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.

Cameron, G. 1998. Cetacean mortality in California gillnet fisheries: preliminary estimates for 1997. Unpubl. doc. submitted to Int. Whal. Comm. (SC/50/SM2). 15pp.

Cameron, G. A. and K. A. Forney. 1999. Preliminary estimates of cetacean mortality in the California gillnet fisheries for 1997 and 1998. Unpubl. doc. submitted to Int. Whal. Comm. (SC/51/O4). 14 pp.

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.

Cordaro, J. NMFS Southwest Region, 501 West Ocean Blvd., Long Beach, CA, 90802.

Darling, J. D. 1984. Gray whales off Vancouver Island, British Columbia. Pp. 267-287, *In* M. L. Jones, S. L. Swartz, and S. Leatherwood, The Gray Whale, *Eschrichtius robustus.* Academic Press, Inc., Orlando. xxiv + 600 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.

Fadely, B. NMFS Alaska Region, P.O. Box 21668, Juneau, AK 99802-1668.

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. Comm. (Special Issue 15):427-438.

Hill, P. S., and D. P. DeMaster. 1999. Alaska marine mammal stock assessments, 1999. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-AFSC-110. 166 pp.

Hobbs, R. C., and D. J. Rugh. 1999. The abundance of gray whales in the 1997/98 southbound migration in the eastern North Pacific. Unpubl. doc. submitted to Sci. Comm. Int. Whal. Comm. (SC/51/AS10). 18 pp.

Hobbs, R. C., D. J. Rugh, J. M. Waite, J. M. Breiwick, and D. P. DeMaster. In press. Abundance of gray whales in the 1995/96 southbound migration in the eastern North Pacific. J. Cetacean Res. Manage. (Special Issue 2). (SC/48/AS9).

International Whaling Commission. 1995a. Report of the Scientific Committee. Rep. Int. Whal. Comm. 45:53-95.

International Whaling Commission. 1995b. Report of the Sub-Committee on Aboriginal Subsistence Whaling. Rep. Int. Whal. Comm. 45:142-164.

International Whaling Commission. 1996. Report of the Scientific Committee. Rep. Int. Whal. Comm. 46:51-97.

International Whaling Commission. 1997. International Whaling Commission Report 1995-96. Rep. Int. Whal. Comm. 47:1-2.

International Whaling Commission. 1998a. International Whaling Commission Report 1996-97. Rep. Int. Whal. Comm. 48:1-2.

International Whaling Commission. 1999. International Whaling Commission Report 1997-98. Annual Report of the International Whaling Commission 1998:1-2.

Julian, F. 1997. Cetacean mortality in California gillnet fisheries: preliminary estimates for 1996. Unpubl. doc. submitted to Int. Whal. Comm. (SC/49/SM2). 13 pp.

Julian, F., and M. Beeson. 1998. Estimates of marine mammal, turtle, and seabird mortality for two California gillnet fisheries: 1990-1995. Fish. Bull. 96(2):271-284.

Laake, J. L., D. J. Rugh, J. A. Lerczak, and S. T. Buckland. 1994. Preliminary estimates of population size of gray whales from the 1992/93 and 1993/94 shore-based surveys. Unpubl. doc. submitted to Int. Whal. Comm. (SC/46/AS7). 13 pp.

Nerini, M. 1984. A review of gray whale feeding ecology. Pp. 423-450, *In* M. L. Jones, S. L. Swartz, and S. Leatherwood, The Gray Whale, *Eschrichtius robustus.* Academic Press, Inc., Orlando. xxiv + 600 pp.

Poole, M. M. 1984. Migration corriders of gray whales along the central California coast, 1980-1982. Pp. 389-407, *In* M. L. Jones, S. L. Swartz, and S. Leatherwood, The Gray Whale, *Eschrichtius robustus*. Academic Press, Inc., Orlando. xxiv + 600 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. Special Publication 3. 142 pp.

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 Comm. 31:477-493.

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

Rugh, D. J., K. E. W. Shelden, and A. Schulman-Janiger. 1999a. Timing of the southbound migration of gray whales in 1998/99. Unpubl. doc. submitted to Int. Whal. Comm. (SC/51/AS11). 11 pp.

Rugh, D. J., M. M. Muto, S. E. Moore, and D. P. DeMaster. 1999b. Status review of the Eastern North Pacific stock of gray whales. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-AFSC-103, 96 pp.

Russian Federation. 1997. Feasibility study for the aboriginal gray whaling in 1998-2002. Unpubl. doc. submitted to Sci. Comm. of Int. Whal. Comm. (IWC/49/AS2). 26 pp.

Shelden, K. E. W., D. J. Rugh, and S. A. Boeve. In press. Gray whale calf sightings during southbound migrations, 1952-95. J. Cetacean Res. Manage. (Special Issue 2). (SC/47/AS 4).

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. Comm. (SC/48/AS3). 21 pp.