Revised 3/31/2008

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

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

STOCK DEFINITION AND GEOGRAPHIC RANGE

In the eastern North Pacific Ocean, the harbor porpoise ranges from Point Barrow, along the Alaska coast, and down the west coast of North America to Point Conception, California (Gaskin 1984). The harbor porpoise primarily frequents coastal waters and in the Gulf of Alaska and Southeast Alaska, they occur most frequently in waters less than 100 m in depth (Hobbs and Waite unpubl. ms). The average density of harbor porpoise in Alaska appears to be less than that reported off the west coast of the continental U.S., although areas of high densities do occur in Glacier Bay, Yakutat Bay, Copper River Delta, and Sitkalidak Strait (Dahlheim et al. 2000, Hobbs and Waite unpubl. ms). Stock discreteness in the eastern North Pacific was analyzed using mitochondrial DNA from samples collected along the West Coast (Rosel 1992), including 1 sample from Alaska. Two distinct mitochondrial DNA groupings or clades exist. One clade is present in California, Washington, British Columbia and the single sample from Alaska (no samples were available from Oregon), while the other is found only in California and Washington. Although these two clades are not geographically distinct by latitude, the results may indicate a low mixing rate for harbor porpoise along the west coast of North America. Investigation of pollutant loads in harbor porpoise ranging from California to the Canadian border also suggests restricted harbor porpoise movements (Calambokidis and Barlow 1991); these results are reinforced by a similar study in the northwest Atlantic (Westgate and Tolley 1999). Further genetic testing of the same data mentioned above along with a few additional samples, including 8 more from Alaska, found significant genetic differences for 3 of the 6 pair-wise comparisons between the four areas investigated: California, Washington, British Columbia, and Alaska (Rosel et al. 1995). These results demonstrate that harbor porpoise along the west coast of North America are not panmictic, and that movement is sufficiently restricted to evolve genetic differences. This is consistent with low movement suggested by genetic analysis of harbor porpoise specimens from the North Atlantic (Rosel et al. 1999). Numerous stocks have been delineated with clinal differences over areas as small as the waters surrounding the British Isles (Walton 1997). In a molecular genetic analysis of small-scale population structure of eastern North Pacific harbor porpoise, Chivers et al. (2002) included 30 samples from Alaska, 16 of which were from Copper River Delta, 5 from Barrow, 5 from southeast Alaska, and one sample each from St. Paul, Adak, Kodiak, and Kenia. Unfortunately, no conclusions can be drawn about the genetic structure of harbor porpoise within Alaska because of insufficient samples. Accordingly, harbor porpoise stock structure in Alaska remains unknown at this time.

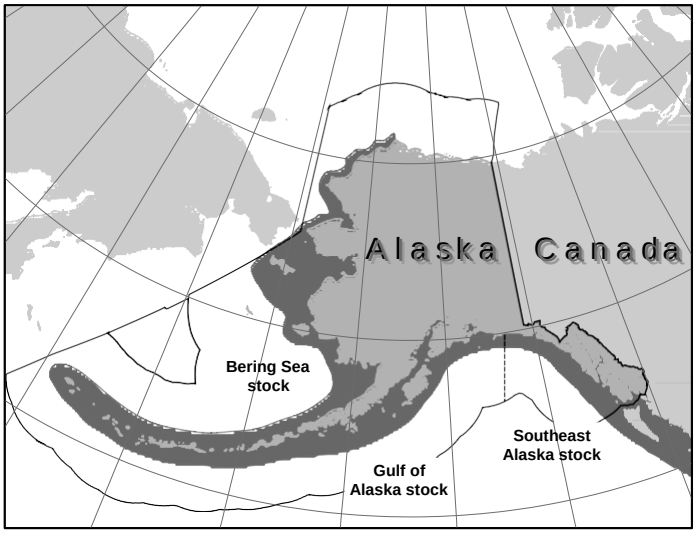

Figure 27. Approximate distribution of harbor porpoise in Alaska waters (shaded area).

Although it is difficult to determine the true stock structure of harbor porpoise populations in the northeast Pacific, from a management standpoint, it would be prudent to assume that regional populations exist and that they should be managed independently (Rosel et al. 1995, Taylor et al. 1996). The Alaska Scientific Review Group concurred that while the available data were insufficient to justify recognizing three biological stocks of harbor porpoise in Alaska, it did not recommend against the establishment of three management units in Alaska (DeMaster

1996, 1997). Accordingly, from the above information, three separate harbor porpoise stocks in Alaska are recommended, recognizing that the boundaries were set arbitrarily: 1) the Southeast Alaska stock - occurring from the northern border of British Columbia to Cape Suckling, Alaska, 2) the Gulf of Alaska stock - occurring from Cape Suckling to Unimak Pass, and 3) the Bering Sea stock - occurring throughout the Aleutian Islands and all waters north of Unimak Pass (Fig. 28). Information concerning the four harbor porpoise stocks occurring along the west coast of the continental United States (Central California, Northern California, Oregon/Washington Coast, and Inland Washington) is in the Stock Assessment Reports for the Pacific Region.

POPULATION SIZE

In June and July of 1998 an aerial survey covering the waters of the western Gulf of Alaska from Cape Suckling to Sutwik Island, offshore to the 1,000 fathom depth contour resulted in an uncorrected abundance estimate for the Gulf of Alaska harbor porpoise stock of 10,489 (CV = 0.115) animals (Hobbs and Waite unpubl. ms). The observed abundance estimate includes a correction factor (1.372; CV = 0.066) for perception bias to correct for animals not counted because they were not observed. Laake et al. (1997) estimated the availability bias for aerial surveys of harbor porpoise in Puget Sound to be 2.96 (CV = 0.180); the use of this correction factor is preferred to other published correction factors (e.g., Barlow et al. 1988; Calambokidis et al. 1993) because it is an empirical estimate of availability bias. The estimated corrected abundance estimate from this survey is 31,046 (10,489 H 2.96 31,046; CV = 0.214).

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

Minimum Population Estimate

The minimum population estimate (N_{MIN}) for this stock is calculated using Equation 1 from the PBR Guidelines (Wade and Angliss 1997): $N_{MIN} = N/\exp(0.842*[\ln(1+[CV(N)]^2)]^{½})$. Using the population estimate (N) of 31,046 and its associated CV of 0.214, N_{MIN} for the Gulf of Alaska stock of harbor porpoise is 25,987.

Current Population Trend

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

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

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

POTENTIAL BIOLOGICAL REMOVAL

Under the 1994 reauthorized Marine Mammal Protection Act (MMPA), the potential biological removal (PBR) is defined as the product of the minimum population estimate, one-half the maximum theoretical net productivity rate, and a recovery factor: $PBR = N_{MIN} H 0.5R_{MAX} H F_R$. The recovery factor ($F_R$) for this stock is 0.5, the value for cetacean stocks with unknown population status (Wade and Angliss 1997). Thus, using the abundance estimate calculated from 1998 surveys, the PBR for the Gulf of Alaska stock of harbor porpoise would be calculated to be 260 animals (25,987 H 0.02 H 0.5). However, the 2005 revisions to the SAR guidelines (NMFS 2005) state that abundance estimates older than 8 years should not be used to calculate PBR due to a decline in confidence in the reliability of an aged abundance estimate. Therefore, the PBR for this stock is considered undetermined.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

Fisheries Information

Prior to 2003, three different commercial fisheries operating within the range of the Gulf of Alaska stock of harbor porpoise were monitored for incidental take by NMFS observers: Gulf of Alaska groundfish trawl, longline, and pot fisheries. As of 2003, changes in fishery definitions in the List of Fisheries resulted in separating these 3 GOA fisheries into 10 fisheries (69 FR 70094, 2 December 2004). This change does not represent a change in fishing effort, but provides managers with better information on the component of each fishery that is responsible for the incidental serious injury or mortality of marine mammal stocks in Alaska. No incidental mortality of harbor porpoise was observed in these fisheries. Observers also monitored the Prince William Sound salmon drift gillnet fishery in 1990 and 1991, recording one mortality in 1990 and three mortalities in 1991. These mortalities extrapolated to 8 (95% CI: 1-23) and 32 (95% CI: 3-103) kills for the entire fishery, resulting in a mean kill rate of 20 (CV = 0.60) animals per year for 1990 and 1991. In 1990, observers boarded 300 (57.3%) of the 524 vessels that fished in the Prince William Sound salmon drift gillnet fishery, monitoring a total of 3,166 sets, or roughly 4% of the estimated number of sets made by the fleet (Wynne et al. 1991). In 1991, observers boarded 531 (86.9%) of the 611 registered vessels and monitored a total of 5,875 sets, or roughly 5% of the estimated sets made by the fleet (Wynne et al. 1992). The Prince William Sound salmon drift gillnet fishery has not been observed since 1991; therefore, no additional data are available for that fishery.

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

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

Table 30. Summary of incidental mortality of harbor porpoise (Gulf of Alaska stock) due to fisheries from 1990 through 2005 and calculation of the mean annual mortality rate.

Fishery name	Years	Data type	Range of observer coverage	Observed mortality (in given yrs.)	Estimated mortality (in given yrs.)	Mean annual mortality
Prince William Sound salmon drift gillnet	1990-1991	obs data	4-5%	1, 3	8, 32	20 (CV = 0.60)
Cook Inlet salmon drift gillnet	1999 2000	obs data	1.8% 3.7%	0 1	0 31.2	15.6
Cook Inlet salmon set gillnet	1999 2000	obs data	7.3% 8.3%	0 0	0 0	0
Kodiak Island set gillnet	2002 2005	obs data	6.0% 4.9%	2 2	32.2 39.4	35.8 (CV = 0.68)
Minimum total annual mortality						71.4

Strandings of marine mammals with fishing gear attached or with injuries caused by interactions with fishing gear are a final source of mortality data. In the period from 1990 to 1994, 12 harbor porpoise scarred with gillnet marks were discovered stranded in Prince William Sound (Copper River Delta). These stranding reports were likely the result of operations in the Prince William Sound salmon drift gillnet fishery. The extrapolated (estimated) observer mortality for this fishery accounts for these mortalities, so they do not appear in Table 30. There were no confirmed reports of strandings of harbor porpoise in this area from 1999-2003.

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

Subsistence/Native Harvest Information

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

Other Mortality

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

STATUS OF STOCK

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

HABITAT CONCERNS

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

CITATIONS

Barlow, J., C. W. Oliver, T. D. Jackson, and B. L. Taylor. 1988. Harbor porpoise, *Phocoena phocoena*, abundance estimation for California, Oregon, and Washington: II. Aerial surveys. Fish. Bull., U.S. 86:433-444.

Calambokidis, J., and J. Barlow. 1991. Chlorinated hydrocarbon concentrations and their use for describing population discreteness in harbor porpoises from Washington, Oregon, and California. Eds: John E. Reynolds III and Daniel K. Odell. Proceedings of the Second Marine Mammal Stranding Workshop: 3-5 December 1987. Miami, Florida. U.S. Dep. Commer., NOAA Tech. Rep. NMFS-98:101-110.

Calambokidis, J., J. R. Evenson, J. C. Cubbage, S. D. Osmek, D. Rugh, and J. L. Laake. 1993. Calibration of sighting rates of harbor porpoise from aerial surveys. Final report to the National Marine Mammal Laboratory, AFSC, NMFS, NOAA, 7600 Sand Point Way, NE, Seattle, WA 98115. 55 pp.

Chivers, S.J., Dizon, A.E., Gearin, P J. and K.M. Robertson. 2002. Small-scale population structure of eastern North Pacific harbor porpoise (*Phocoena phocoena*) indicated by molecular genetic analyses. J. Cetacean Res. Manage. 4(2):111-122.

Dahlheim, M., A. York, R. Towell, J. Waite, and J. Breiwick. 2000. Harbor porpoise (*Phocoena phocoena*) abundance in Alaska: Bristol Bay to southeast Alaska, 1991-1993. Mar. Mammal Sci. 16:28-45.

DeMaster, D. P. 1996. Minutes from the 11-13 September 1996 meeting of the Alaska Scientific Review Group. Anchorage, Alaska. 20 pp. + appendices. (Available upon request - Alaska Fish. Sci. Cent., 7600 Sand Point Way, NE, Seattle, WA 98115).

DeMaster, D. P. 1997. Minutes from fifth meeting of the Alaska Scientific Review Group, 7-9 May 1997, Seattle, Washington. 21 pp. + appendices. (Available upon request – Alaska Fish. Sci. Cent., 7600 Sand Point Way, NE, Seattle, WA 98115).

Gaskin, D. E. 1984. The harbor porpoise *Phocoena phocoena* (L.): Regional populations, status, and information on direct and indirect catches. Rep. Int. Whal. Comm. 34:569-586.

Hobbs, R. C., and J. M. Waite. Unpubl. ms. Harbor porpoise abundance in three Alaska stocks, 1997-1999. Available upon request from J. Waite, National Marine Mammal Laboratory, 7600 Sand Point Way NE, Seattle, WA 98115.

Laake, J. L., J. Calambokidis, S. D. Osmek, and D. J. Rugh. 1997. Probability of detecting harbor porpoise from aerial surveys: Estimating g(0). J. Wildl. Manage. 61(1):63-75

Manly, B. F. J. 2006. Incidental catch and interactions of marine mammals and birds in the Cook Inlet salmon driftnet and setnet fisheries, 1999-2000. Final report to NMFS Alaska Region. 98 pp. (http://www.fakr.noaa.gov/protectedresources/observers/bycatch/1999-2000cookinlet.pdf)

Manly, B. F. J. 2007. Incidental Take and Interactions of Marine Mammals and Birds in the Kodiak Island Salmon Set Gillnet Fishery, 2002 and 2005. Final report to NMFS Alaska Region. 221 pp. (http://www.fakr.noaa.gov/protectedresources/observers/bycatch/kodiakreport02_05.pdf)

NMFS. 2005. Guidelines for Preparing Stock Assessment Reports Pursuant to Section 117 of the Marine Mammal Protection Act, SAR Guidelines Revisions, June 2005, 24 pp.

Rosel, P. E. 1992. Genetic population structure and systematic relationships of some small cetaceans inferred from mitochondrial DNA sequence variation. Ph.D. Dissertation, Univ. Calif. San Diego. 191 pp.

Rosel, P. E., A. E. Dizon, and M. G. Haygood. 1995. Variability of the mitochondrial control region in populations of the harbour porpoise, *Phocoena phocoena*, on inter-oceanic and regional scales. Can J. Fish. Aquat. Sci. 52:1210-1219.

Rosel, P. E., R. Tiedemann, and M. Walton. 1999. Genetic evidence for limited trans-Atlantic movements of the harbor porpoise *Phocoena phocoena*. Mar. Biol. 133: 583-591.

Taylor, B. L., P. R. Wade, D. P. DeMaster, and J. Barlow. 1996. Models for management of marine mammals. Unpubl. doc. submitted to Int. Whal. Comm. (SC/48/SM50). 12 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.

Walton, M. J. 1997. Population structure of harbour porpoises *Phocoena phocoena* in the seas around the UK and adjacent waters. Proc. R. Soc. Lond. B 264: 89-94.

Westgate, A. J. and K. A. Tolley. 1999. Geographical differences in organochlorine contaminants in harbour porpoises *Phocoena phocoena* from the western North Atlantic. Mar. Ecol. Prog. Series 177:255-268.

Wynne, K. M., D. Hicks, and N. Munro. 1991. 1990 salmon gillnet fisheries observer programs in Prince William Sound and South Unimak Alaska. Annual Rept. NMFS/NOAA Contract 50ABNF000036. 65 pp. (available upon request - Alaska Region, Office of Marine Mammals, P.O. Box 21668, Juneau, AK 99802).

Wynne, K. M., D. Hicks, and N. Munro. 1992. 1991 Marine mammal observer program for the salmon driftnet fishery of Prince William Sound Alaska. Annual Rept. NMFS/NOAA Contract 50ABNF000036. 53 pp. (available upon request - Alaska Region, Office of Marine Mammals, P.O. Box 21668, Juneau, AK 99802).