Revised 12/30/2015

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

NOTE – December 2015: In areas outside of Alaska, studies of harbor porpoise distribution have indicated that stock structure is likely more finely-scaled than is reflected in the Alaska Stock Assessment Reports. At this time, no data are available to define stock structure for harbor porpoise on a finer scale in Alaska. However, based on comparisons with other regions, it is likely that several regional and sub-regional populations exist. 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, harbor porpoise range from Point Barrow and offshore areas of the Chukchi Sea, along the Alaska coast, and down the west coast of North America to Point Conception, California (Gaskin 1984, Christman and Aerts 2015). Harbor porpoise primarily frequent the coastal waters of the Gulf of Alaska and Southeast Alaska (Dahlheim et al. 2000, 2009), typically occurring in waters less than 100 m deep (Hobbs and Waite 2010). Within the inland waters of Southeast Alaska harbor porpoise distribution is clumped with greatest densities observed in the Glacier Bay/Icy Strait region and near Zarembo and Wrangell Islands and the adjacent waters of Sumner Strait (Dahlheim et al. 2009). 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 and the adjacent waters of Icy Strait, Yakutat Bay, the Copper River Delta, Sitkalidak Strait (Dahlheim et al. 2000, Hobbs and Waite 2010), and lower Cook Inlet (Shelden et al. 2014).

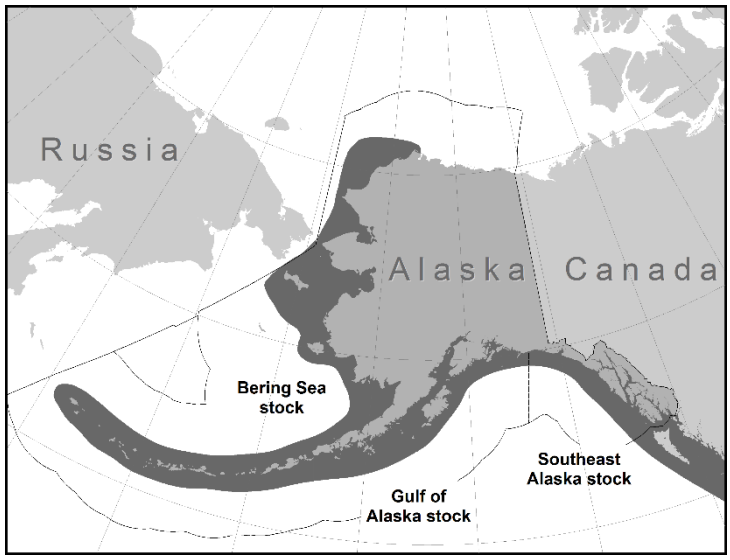

Figure 1. Approximate distribution of harbor porpoise in Alaska waters (dark shaded area).

Stock discreteness in the eastern North Pacific was analyzed using mitochondrial DNA from samples collected along the west coast (Rosel 1992), including one sample from Alaska. Two distinct mitochondrial DNA groupings or clades were found. 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 samples mentioned above, along with a few additional samples including eight more from Alaska, found significant genetic differences for three of the six pair-wise comparisons between the four areas investigated: California, Washington, British Columbia, and Alaska (Rosel et al. 1995). Those results demonstrate that harbor porpoise along the west coast of North America are not panmictic and that movement is sufficiently restricted to result in 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 the Copper River Delta, 5 from Barrow, 5 from Southeast Alaska, and 1 sample each from St. Paul, Adak, Kodiak, and Kenai. Unfortunately, no conclusions could be drawn about the genetic structure of harbor porpoise within Alaska because of the insufficient number of samples from each region. Accordingly, harbor porpoise stock structure in Alaska is unknown at this time.

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). For example, the porpoise concentrations found in Glacier Bay/Icy Strait and around Zarembo/Wrangell Islands may represent different subpopulations (Dahlheim et al. 2015) based on analogy with other west coast harbor porpoise populations, differences in trends in abundance of the two concentrations, and a hiatus in distribution between the northern and southern harbor porpoise concentrations. NMFS will consider whether these concentrations should be considered "prospective stocks" in a future Stock Assessment Report (SAR). Incidental takes from commercial fisheries within a small region (e.g., Wrangell and Zarembo Islands area) are of concern because they could impact undefined localized stocks of harbor porpoise which could go easily undetected unless stock structure is identified. The Alaska Scientific Review Group concurred that available data were insufficient to justify recognizing three biological stocks of harbor porpoise in Alaska instead of only one; however, it did not recommend against the establishment of three management units in Alaska (DeMaster 1996, 1997). Accordingly, from the above information, three harbor porpoise stocks in Alaska were recommended, recognizing that the boundaries of these three stocks were identified primarily based upon geography or perceived areas of porpoise low density: 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. 1). To date, there have been no analyses to assess the validity of these stock designations.

POPULATION SIZE

Information on harbor porpoise abundance and relative abundance has been collected by the Alaska Fisheries Science Center's National Marine Mammal Laboratory (NMML) using both aerial and shipboard surveys. Aerial surveys of this stock were conducted in June and July 1997 and resulted in an observed abundance estimate of 3,766 (CV = 0.162) porpoise (Hobbs and Waite 2010); the surveys included a subset of smaller bays and inlets. Correction factors for observer perception bias and porpoise availability at the surface were used to develop an estimated corrected abundance of 11,146 (3,766 × 2.96; CV = 0.242) harbor porpoise in the coastal and inside waters of Southeast Alaska (Hobbs and Waite 2010).

In 1991, researchers initiated harbor porpoise studies aboard the NOAA ship *John N. Cobb* with survey coverage throughout the inland waters of Southeast Alaska. Between 1991 and 1993, line-transect methodology was used to 1) obtain population estimates of harbor porpoise, 2) establish a baseline for detecting trends in abundance, and 3) define overall distributional patterns and seasonality of harbor porpoise. Surveys were carried out each year in the spring, summer, and fall. Annual surveys were continued between 1994 and 2005; however, only two trips per year were conducted, one either in spring or summer and the other in fall. Although standard line-transect methodology was not used, all cetaceans observed were recorded. During this 12-year period, observers reported fewer overall encounters with harbor porpoise. To fully assess abundance and population trends for harbor porpoise, line-transect methodology was used during the survey cruises in 2006 and 2007 (Dahlheim et al. 2009) and in 2010-2012. Previous studies reported no evidence of seasonality for harbor porpoise occupying the inland waters of Southeast Alaska. Thus, we opted to analyze data collected during the summer season only, given the broader spatial coverage and the greater number of surveys completed for this season (i.e., representing a total of eight line-transect vessel surveys). Methods applied to the 2006-2012 surveys were comparable to those employed during the early 1990s; however, because these surveys only covered inland waters and not the entire range of this stock, they are not used to compute a stock-specific estimate of abundance. Each year, greater densities of harbor porpoise were observed in the Glacier Bay/Icy Strait region and near Zarembo and Wrangell Islands and adjacent waters of Sumner Strait. Abundance estimates for inland waters of Southeast Alaska were found to vary across survey periods spanning the 22-year study (1991-2012). Abundance (N = 1,076; 95% CI = 910-1,272) in 1991-1993 was higher than the estimate obtained for 2006-2007 (N = 604; 95% CI = 468-780) but comparable to the estimate for 2010-2012 (N = 975; 95% CI = 857-1,109; Dahlheim et al. 2015). These estimates assume g(0) = 1 (the probability of detection directly on the track line) and, therefore, may be biased low to an unknown degree. A range of possible g(0) values for harbor porpoise vessel surveys in other regions is 0.5-0.8 (Barlow et al. 1988, Palka 1995).

Minimum Population Estimate

For the Southeast Alaska stock of harbor porpoise, the minimum population estimate (N_{MIN}) for the 1997 aerial surveys is 1,996 calculated using Equation 1 from the potential biological removal (PBR) guidelines (Wade and Angliss 1997): $N_{MIN} = N/\exp(0.842\times[\ln(1+[CV(N)]^2)]^{½})$. However, because the survey data are now more than 8 years old, the N_{MIN} is considered unknown and PBR cannot be determined. The 2010-2012 abundance estimate for harbor porpoise occupying the inland waters of Southeast Alaska of 975 (95% CI = 857-1,109) represents a small

portion of the total number of animals in the stock. Therefore, this number would not be an accurate estimate of N_{MIN} for the entire stock of Southeast Alaska harbor porpoise. Although harbor porpoise in the Wrangell and Zarembo Islands area have not been determined to be a subpopulation or stock, a PBR calculation for this area of the inland waters of Southeast Alaska may provide a frame of reference for the harbor porpoise takes in the portion of the Southeast Alaska salmon drift gillnet fishery, monitored in 2012-2013, which partially overlaps this area. We used the pooled 2010-2012 abundance estimate of 526 (CV = 0.15; assumes g(0) = 1) for the Wrangell and Zarembo Islands area (Dahlheim et al. 2015) to calculate an N_{MIN} of 463 for this area of the inland waters of Southeast Alaska. The porpoise survey area for which the abundance estimate and N_{MIN} were calculated (Area 5: Dahlheim et al. 2015) partially overlaps ADF&G Districts 6 and 8, which are two of the three districts (6, 7, and 8) where the fishery was observed (Manly 2015). Dahlheim et al. (2015) also provide information sufficient to calculate an N_{MIN} for the concentrations of harbor porpoise in the northern and southern regions of the inland waters of Southeast Alaska; this will be provided in a future draft SAR.

Current Population Trend

The abundance of harbor porpoise for the Southeast Alaska stock was estimated in 1993 and 1997. In 1993, abundance estimates were determined from a coastal aerial survey from Prince William Sound to Dixon Entrance and a vessel survey in the inside waters of Southeast Alaska (Dahlheim et al. 2000). These surveys produced abundance estimates of 3,982 and 1,586 for the two areas, respectively, giving a combined estimate for the range of the Southeast Alaska harbor porpoise stock of 5,568. The 1997 abundance estimate was determined with an aerial survey for both the coastal region from Prince William Sound to Dixon Entrance and the inside waters of Southeast Alaska (Hobbs and Waite 2010). The 1997 estimate of 11,146 is double the 1993 estimate; however, these estimates are not directly comparable because of differences in survey methods. The total area for the 1997 survey was greater than in 1993 and included a correction of perception bias.

An analysis of the line-transect vessel survey data collected throughout the inland waters of Southeast Alaska between 1991 and 2010 suggested high probabilities of a population decline ranging from 2 to 4% per year for the whole study area (Zerbini et al. 2011), thus highlighting a potentially important conservation issue. However, when data from 2011 and 2012 were added to this analysis, the population decline was no longer significant (Dahlheim et al. 2015). It is still unclear why the population estimate fluctuation for harbor porpoise in Southeast Alaska occurred. When examined on a more regional scale, abundance was relatively constant in Glacier Bay throughout the survey period. In contrast, declines were documented for the Wrangell and Zarembo Islands area; an area where net fisheries occur.

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

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

POTENTIAL BIOLOGICAL REMOVAL

Under the 1994 reauthorized Marine Mammal Protection Act (MMPA), the PBR is defined as the product of the minimum population estimate, one-half the maximum theoretical net productivity rate, and a recovery factor: $PBR = N_{MIN} \times 0.5R_{MAX} \times F_R$. The recovery factor ($F_R$) for this stock is 0.5, the value for cetacean stocks with unknown population status (Wade and Angliss 1997). The SAR guidelines (Wade and Angliss 1997) 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 (NMFS 2005). A putative PBR level calculation for the Wrangell and Zarembo Islands area of the inland waters of Southeast Alaska may provide a frame of reference for the observed takes of harbor porpoise in this area of the Southeast Alaska salmon drift gillnet fishery in 2012-2013. However, some of the observed takes in this fishery were outside of the area for which this putative PBR level is calculated. This PBR calculation, based on the pooled 2010-2012 abundance estimate of 526 (CV = 0.15) and its corresponding N_{MIN} of 463, for the Wrangell and Zarembo Islands area of the inland waters of Southeast Alaska, is 4.6 harbor porpoise.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

Fisheries Information

Detailed information on U.S. commercial fisheries in Alaska waters (including observer programs, observer coverage, and observed incidental takes of marine mammals) is presented in Appendices 3-6 of the Alaska Stock Assessment Reports.

Until 2003, there were three different federally-regulated commercial fisheries in Alaska that could have interacted with the Southeast Alaska stock of harbor porpoise. As of 2003, changes in fishery definitions in the MMPA List of Fisheries resulted in separating the Gulf of Alaska (GOA) groundfish fisheries into many fisheries (69 FR 70094, 2 December 2004). This change does not represent a change in fishing effort but provides managers with better information on the component of each fishery responsible for the incidental serious injury or mortality of marine mammal stocks in Alaska. These fisheries (GOA Pacific cod longline, Pacific halibut longline, rockfish longline, and sablefish longline) were monitored for incidental mortality by fishery observers from 2009 to 2013, although observer coverage has been very low in the offshore waters of Southeast Alaska (Appendix 6; Breiwick 2013; NMML, unpubl. data). No mortality or serious injury has been observed from this stock of harbor porpoise incidental to commercial groundfish fisheries. There is no consistent observer coverage for fisheries operating within the inside waters of Southeast Alaska. A reliable estimate of the mortality and serious injury rate incidental to commercial fisheries is currently unavailable because of the limited observer placements in Southeast Alaska fisheries. Therefore, it is unknown whether the mortality and serious injury rate is insignificant.

In 2007 and 2008, the Alaska Marine Mammal Observer Program (AMMOP) placed observers in four regions where the state-managed Yakutat salmon set gillnet fishery operates (Manly 2009). These regions included the Alsek River area, the Situk area, the Yakutat Bay area, and the Kaliakh River and Tsiu River areas. Based on observed mortality and serious injury during these 2 years, the estimated mean annual mortality and serious injury rate in the Yakutat salmon set gillnet fishery was 22 harbor porpoise (Table 1).

In 2012 and 2013, the AMMOP placed observers on independent vessels in the state-managed Southeast Alaska salmon drift gillnet fishery in ADF&G Management Districts 6, 7, and 8 to assess mortality and serious injury of marine mammals (Manly 2015). These Management Districts cover areas of Frederick Sound, Sumner Strait, Clarence Strait, and Anita Bay which include, but are not limited to, areas around and adjacent to Petersburg and Wrangell and Zarembo Islands. In 2013, four harbor porpoise were entangled and released: two were determined to be seriously injured and two were determined to be not seriously injured. Based on the two observed serious injuries, 23 serious injuries were estimated for Districts 6, 7, and 8 in 2013, resulting in an estimated mean annual mortality and serious injury rate of 12 harbor porpoise in 2012-2013 (Table 1). Since these three districts represent only a portion of the overall fishing effort in this fishery, we expect this to be a minimum estimate of mortality for the fishery.

Table 1. Summary of incidental mortality and serious injury of harbor porpoise from the Southeast Alaska stock due to U.S. commercial fisheries in 2009-2013 (or the most recent data available) and calculation of the mean annual mortality and serious injury rate (Manly 2009, 2015). Methods for calculating percent observer coverage are described in Appendix 6 of the Alaska SARs.

Fishery name	Years	Data type	Percent observer coverage	Observed mortality	Estimated mortality	Mean estimated annual mortality
Yakutat salmon set gillnet	2007 2008	obs data	5.3 7.6	1 3	16.1 27.5	22 (CV = 0.54)
SE Alaska salmon drift gillnet (Districts 6, 7, and 8)	2012 2013	obs data	6.4 6.6	0 2	0 23	12 (CV = 1.0)
Minimum total estimated annual mortality						34 (CV = 0.77)

Two harbor porpoise mortalities, due to entanglement in Yakutat salmon set gillnets, were reported to the NMFS Alaska Region, one each in 2009 and 2010; however, the AMMOP mean estimated annual mortality for the fishery accounts for these mortalities (Table 1).

A harbor porpoise mortality, due to entanglement in a subsistence king salmon set gillnet, was reported to the NMFS Alaska Region in 2009, resulting in an estimated minimum mean annual mortality and serious injury rate of 0.2 harbor porpoise in this fishery from 2009 to 2013 (Table 2).

Table 2. Summary of incidental mortality and serious injury of the Southeast Alaska stock of harbor porpoise, by year and type, reported to the NMFS Alaska Region, marine mammal stranding database, in 2009-2013 (Helker et al. 2015). Only cases of serious injury were recorded in this table; animals with non-serious injuries have been excluded.

Cause of injury	2009	2010	2011	2012	2013	Mean annual mortality
Caught in Yakutat subsistence king salmon set gillnet	1	0	0	0	0	0.2

Alaska Native Subsistence/Harvest Information

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

STATUS OF STOCK

Harbor porpoise are not designated as "depleted" under the MMPA or listed as "threatened" or "endangered" under the Endangered Species Act. Because the PBR is undetermined, the annual level of U.S. commercial fishery-related mortality and serious injury that can be considered insignificant and approaching zero mortality and serious injury rate is unknown. The total estimated annual level of human-caused mortality and serious injury based on observer data (34) and stranding data (0.2) is 34 harbor porpoise from this stock. Because the abundance estimates are more than 8 years old (with the exception of the 2010-2012 abundance estimates provided for the inland waters of Southeast Alaska and for the Wrangell and Zarembo Islands area) and the frequency of incidental mortality and serious injury in U.S. commercial fisheries throughout Southeast Alaska is not known, the Southeast Alaska stock of harbor porpoise is classified as a strategic stock. Population trends and status of this stock relative to its Optimum Sustainable Population are currently unknown.

HABITAT CONCERNS

Harbor porpoise are mostly found in waters less than 100 m deep and they often concentrate in nearshore areas and inland waters, including bays, tidal areas, and river mouths (Dahlheim et al. 2000, 2009; Hobbs and Waite 2010). As a result, harbor porpoise are vulnerable to physical modifications of nearshore habitats resulting from urban and industrial development (including waste management and nonpoint source runoff) and activities such as construction of docks and other over-water structures, filling of shallow areas, dredging, and noise (Linnenschmidt et al. 2013).

CITATIONS

Barlow, J. 1988. Harbor porpoise, *Phocoena phocoena*, abundance estimation for California, Oregon, and Washington: I. Ship surveys. Fish. Bull., U.S. 86:417-432.

Breiwick, J. M. 2013. North Pacific marine mammal bycatch estimation methodology and results, 2007-2011. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-AFSC-260, 40 p.

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

Chivers, S. J., A. E. Dizon, P. J. Gearin, 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.

Christman, C. L., and L. M. Aerts. 2015. Harbor porpoise (*Phocoena phocoena*) sightings from shipboard surveys in the Chukchi Sea during summer and fall, 2008-2014. Pp. 197 *In* Book of Abstracts, 2015 Alaska Marine Science Symposium, Anchorage, Alaska, January 19-23, 2015.

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.

Dahlheim, M., P. A. White, and J. Waite. 2009. Cetaceans of Southeast Alaska: distribution and seasonal occurrence. J. Biogeogr. 36(3):410-426.

Dahlheim, M. E., A. N. Zerbini, J. M. Waite, and A. S. Kennedy. 2015. Temporal changes in abundance of harbor porpoise (*Phocoena phocoena*) inhabiting the inland waters of Southeast Alaska. Fish. Bull., U.S. 113(3):242-255.

DeMaster, D. P. 1996. Minutes from the 11-13 September 1996 meeting of the Alaska Scientific Review Group, Anchorage, Alaska. 20 pp. + appendices. Available from Alaska Fisheries Science Center, NMFS, 7600 Sand Point Way NE, Seattle, WA 98115.

DeMaster, D. P. 1997. Minutes from the fifth meeting of the Alaska Scientific Review Group, 7-9 May 1997, Seattle, Washington. 21 pp. + appendices. Available from Alaska Fisheries Science Center, NMFS, 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.

Helker, V. T., B. A. Allen, and L. A. Jemison. 2015. Human-caused injury and mortality of NMFS-managed Alaska marine mammal stocks, 2009-2013. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-AFSC-300, 94 p.

Hobbs, R. C., and J. M. Waite. 2010. Abundance of harbor porpoise (*Phocoena phocoena*) in three Alaskan regions, corrected for observer errors due to perception bias and species misidentification, and corrected for animals submerged from view. Fish. Bull., U.S. 108(3):251-267.

Linnenschmidt, M., J. Teilmann, T. Akamatsu, R. Dietz, and L. A. Miller. 2013. Biosonar, dive, and foraging activity of satellite tracked harbor porpoises (*Phocoena phocoena*). Mar. Mammal Sci. 29(2):77-97.

Manly, B. F. J. 2009. Incidental catch of marine mammals and birds in the Yakutat salmon set gillnet fishery, 2007 and 2008. Final Report to NMFS Alaska Region. 96 pp.
Available online: https://alaskafisheries.noaa.gov/sites/default/files/yakutat07-08.pdf. Accessed December 2015.

Manly, B. F. J. 2015. Incidental takes and interactions of marine mammals and birds in districts 6, 7, and 8 of the Southeast Alaska salmon drift gillnet fishery, 2012 and 2013. Final Report to NMFS Alaska Region. 52 pp. Available online: https://alaskafisheries.noaa.gov/sites/default/files/incidentaltakes2012-2013.pdf. Accessed December 2015.

NMFS (National Marine Fisheries Service). 2005. Revisions to guidelines for assessing marine mammal stocks. 24 pp. Available online: http://www.nmfs.noaa.gov/pr/pdfs/sars/gamms2005.pdf. Accessed December 2015.

Palka, D. 1995. Abundance estimate of the Gulf of Maine harbor porpoise. Rep. Int. Whal. Comm. (Special Issue 16):27-50.

Rosel, P. E. 1992. Genetic population structure and systematic relationships of some small cetaceans inferred from mitochondrial DNA sequence variation. Ph.D. Diss., University of California 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.

Shelden, K. E. W., B. A. Agler, J. J. Brueggeman, L. A. Cornick, S. G. Speckman, and A. Prevel-Ramos. 2014. Harbor porpoise, *Phocoena phocoena vomerina*, in Cook Inlet, Alaska. Mar. Fish. Rev. 76(1-2):22-50.

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 p.

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. Ser. 177:255-268.

Zerbini, A. N., M. E. Dahlheim, J. M. Waite, A. S. Kennedy, P. R. Wade, and P. J. Clapham. 2011. Evaluation of population declines of harbor porpoise (*Phocoena phocoena*) in Southeastern Alaska inland waters. Pp. 23 *In* Book of Abstracts, 19th Biennial Conference on the Biology of Marine Mammals, Tampa, Florida, USA, 28 November-2 December 2011.