Revised 12/30/2019

HARBOR PORPOISE (*Phocoena phocoena*): Bering Sea Stock

NOTE – December 2015: In areas outside of Alaska, studies of harbor porpoise distribution have indicated that stock structure is likely more fine-scaled than is reflected in the Alaska Stock Assessment Reports. 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, the harbor porpoise ranges 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; however, occasionally they occur in deeper waters (Hobbs and Waite 2010). 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, 2009, 2015; Hobbs and Waite 2010), and lower Cook Inlet (Shelden et al. 2014).

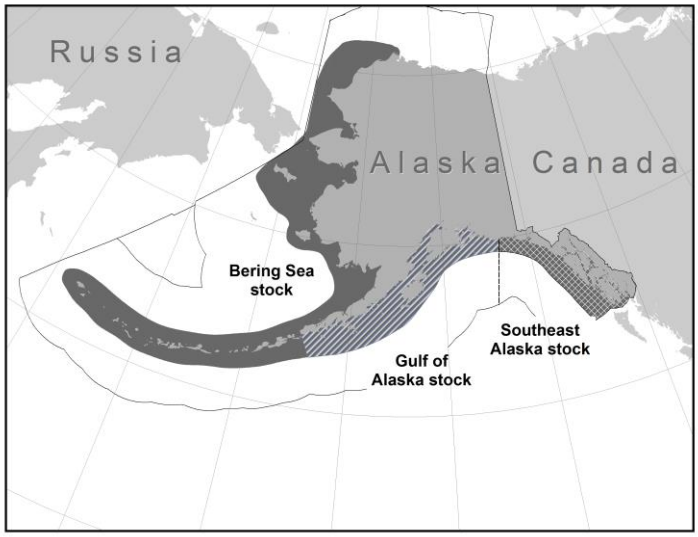

Figure 1. Approximate distribution of harbor porpoise in Alaska waters: crosshatched area - Southeast Alaska stock; striped area - Gulf of Alaska stock; dark shaded area - Bering Sea stock. The U.S. Exclusive Economic Zone is delineated by a black line.

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 differences between some of the four areas investigated, California, Washington, British Columbia, and Alaska, but inference was limited by small sample size (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 (Walton 1997). This is consistent with low movement suggested by genetic analysis of harbor porpoise specimens from the North Atlantic (Rosel et al. 1999). In a 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 defined by geographic areas.

Although it is difficult to determine the true stock structure of harbor porpoise populations in the northeast Pacific, from a management standpoint it is prudent to assume that regional populations exist and that they should be managed independently (Rosel et al. 1995, Taylor et al. 1996). Based on the above information, three harbor porpoise stocks in Alaska are currently specified, recognizing that the boundaries of these three stocks are inferred primarily based upon geography or perceived areas of low porpoise density: 1) the Southeast Alaska stock - occurring from Dixon Entrance 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). There have been no analyses to assess the validity of these stock designations and research to assess substructure is ongoing only within the Southeast Alaska stock (see the Southeast Alaska harbor porpoise Stock Assessment Report).

Harbor porpoise have been sighted during seismic surveys of the Chukchi Sea conducted in the nearshore and offshore waters by the oil and gas industry between July and November from 2006 to 2010 (Funk et al. 2010, 2011; Reiser et al. 2011; Aerts et al. 2013). Harbor porpoise were the third most frequently sighted cetacean species in the Chukchi Sea, after gray and bowhead whales, with most sightings occurring during the September to October monitoring period (Funk et al. 2011, Reiser et al. 2011). Over the 2006 to 2010 industry-sponsored monitoring period, six sightings of 11 harbor porpoise were reported in the Beaufort Sea, suggesting harbor porpoise regularly occur in both the Chukchi and Beaufort seas (Funk et al. 2011).

POPULATION SIZE

In June and July of 1999, an aerial survey covered the waters of Bristol Bay. Two types of corrections were needed for these aerial surveys: one to correct for animals available but not counted because they were missed by the observer (perception bias) and another to correct for porpoise that were submerged and not available at the surface (availability bias). The 1999 survey resulted in an observed abundance estimate for the Bering Sea harbor porpoise stock of 16,289 (CV = 0.13: Hobbs and Waite 2010), which includes the perception bias correction factor (1.337; CV = 0.06) obtained during the survey using an independent belly window observer. Laake et al. (1997) estimated the availability bias correction factor for aerial surveys of harbor porpoise in Puget Sound to be 2.96 (CV = 0.18); 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. Applying the Laake et al. (1997) correction factor, the corrected abundance estimate is 48,215 porpoise (16,289 × 2.96 = 48,215; CV = 0.22). The estimate for 1999 can be considered conservative for that time period, as the surveyed areas did not include known harbor porpoise range along the Aleutian Island chain, near the Pribilof Islands, or in the waters north of Cape Newenham (approximately 59°N).

Shipboard visual line-transect surveys for cetaceans were conducted on the eastern Bering Sea shelf in association with pollock stock assessment surveys in June and July of 1999, 2000, 2002, 2004, 2008, and 2010 (Moore et al. 2002; Friday et al. 2012, 2013). The entire range of the survey was completed in three of those years (2002, 2008, and 2010) and harbor porpoise abundance estimates were calculated for each of these surveys (Friday et al. 2013); however, correction factors were not applied for perception bias, availability bias, or responsive movement to the ship. The abundance estimate was 1,971 porpoise (CV = 0.46) for 2002, 4,056 (CV = 0.40) for 2008, and 833 (CV = 0.66) for 2010. Although the 2010 estimate is the lowest of the three years, it is not significantly different from the 2002 and 2008 estimates (Friday et al. 2013). These surveys are useful for showing distribution throughout the southeastern Bering Sea and the relationship to hydrographic domains; however, because the surveys were not designed to estimate abundance of harbor porpoise and no correction factors to account for groups missed on the trackline or responsive movement are available, these estimates are not used to calculate minimum population estimates.

Minimum Population Estimate

The minimum population estimate (N_{MIN}) for this stock is calculated using Equation 1 from the potential biological removal (PBR) guidelines (NMFS 2016): $N_{MIN} = N/\exp(0.842\times[\ln(1+[CV(N)]^2)]^{½})$. Using the 1999 partial population estimate (N) of 48,215 and its associated coefficient of variation (CV) of 0.22, N_{MIN} for the Bering Sea stock of harbor porpoise is 40,150. However, because the survey data are more than 8 years old, N_{MIN} is considered unknown.

Current Population Trend

There is no reliable information on trends in abundance for the Bering Sea stock of harbor porpoise.

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

A reliable estimate of the maximum net productivity rate (R_{MAX}) is not available for this stock of harbor porpoise. Until additional data become available, the cetacean maximum theoretical net productivity rate of 4% will be used (NMFS 2016).

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 0.5, the value for cetacean stocks with unknown population status (NMFS 2016). However, the 2016 guidelines for preparing Stock Assessment Reports (NMFS 2016) 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

Information for each human-caused mortality, serious injury, and non-serious injury reported for NMFS-managed Alaska marine mammals between 2013 and 2017 is listed, by marine mammal stock, in Delean et al. (2020); however, only the mortality and serious injury data are included in the Stock Assessment Reports. The minimum estimated mean annual level of human-caused mortality and serious injury for Bering Sea harbor porpoise between 2013 and 2017 is 0.2 porpoise in U.S. commercial fisheries; however, this estimate is considered a minimum because most of the fisheries likely to interact with this stock of harbor porpoise have never been monitored. Potential threats most likely to result in direct human-caused mortality or serious injury of this stock include entanglement in fishing gear.

Fisheries Information

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.

Harbor porpoise mortality and serious injury is known to occur in gillnet (both drift gillnet and set gillnet) and trawl fisheries. While much of the trawl fleet has observer coverage, there are several gillnet fisheries in the Bering Sea that do not. Given the occurrence of fishery-caused mortality and serious injury of harbor porpoise in other gillnet fisheries in Alaska, it is likely that gillnet fisheries within the range of this stock also incur mortality and serious injury of harbor porpoise.

No mortality or serious injury of Bering Sea harbor porpoise was observed incidental to U.S. federal commercial fisheries between 2013 and 2017. However, strandings of marine mammals with fishing gear attached or with injuries caused by interactions with fishing gear provide some mortality data. One harbor porpoise mortality due to entanglement in a commercial salmon set gillnet in Kotzebue, Alaska, was reported to the NMFS Alaska Region stranding network in 2013 (Table 1; Delean et al. 2020), resulting in a minimum average annual mortality and serious injury rate of 0.2 Bering Sea harbor porpoise in U.S. commercial fisheries between 2013 and 2017 (Table 1). This mortality and serious injury estimate results from an actual count of verified human-caused deaths and serious injuries and is a minimum because not all entangled animals strand nor are all stranded animals found, reported, or have the cause of death determined. A complete estimate of the total mortality and serious injury rate incidental to U.S. commercial fisheries is unavailable for this stock because of the absence of an observer program for all of the salmon and herring fisheries operating within the range of the stock.

Table 1. Summary of incidental mortality and serious injury of Bering Sea harbor porpoise, by year and type, reported to the NMFS Alaska Region marine mammal stranding network between 2013 and 2017 (Delean et al. 2020).

Cause of injury	2013	2014	2015	2016	2017	Mean annual mortality
Entangled in Kotzebue commercial salmon set gillnet	1	0	0	0	0	0.2
Total in commercial fisheries						0.2

Alaska Native Subsistence/Harvest Information

Subsistence hunters in Alaska have not been reported to hunt from this stock of harbor porpoise; however, when porpoise are caught incidental to subsistence or commercial fisheries, subsistence hunters may claim the carcass for subsistence use (R. Suydam, North Slope Borough, pers. comm.).

STATUS OF STOCK

Bering Sea harbor porpoise are not designated as depleted under the Marine Mammal Protection Act or listed as threatened or endangered under the Endangered Species Act. The abundance estimate for this stock is unknown because the existing estimate is more than 8 years old and so the PBR level is considered undetermined. Because the PBR is undetermined and most of the fisheries likely to interact with this stock have never been observed, it is unknown if the minimum estimate of the mean annual mortality and serious injury rate (0.2 porpoise from stranding data) in U.S. commercial fisheries can be considered insignificant and approaching a zero mortality and serious injury rate. NMFS considers this stock strategic because the level of mortality and serious injury would likely exceed the PBR level for this stock if we had accurate information on stock structure, a newer abundance estimate, and complete observer coverage. Population trends and status of this stock relative to its Optimum Sustainable Population are unknown.

There are key uncertainties in the assessment of the Bering Sea stock of harbor porpoise. This stock likely comprises multiple, smaller stocks based on analogy with harbor porpoise populations that have been the focus of specific studies on stock structure. The most recent surveys were more than 8 years ago and, given the lack of information on population trend, the abundance estimates are not used to calculate an N_{MIN} and the PBR level is undetermined. Several commercial fisheries overlap with the range of this stock and most have never been observed; thus, the estimate of commercial fishery mortality and serious injury is expected to be a minimum estimate. Coastal subsistence fisheries will occasionally cause incidental mortality or serious injury of a harbor porpoise; tracking these subsistence takes is challenging because there is no reporting mechanism. Estimates of human-caused mortality and serious injury from stranding data are underestimates because not all animals strand nor are all stranded animals found, reported, or have the cause of death determined.

HABITAT CONCERNS

Harbor porpoise are found over the shelf waters of the southeastern Bering Sea (Dahlheim et al. 2000, Hobbs and Waite 2010). In the nearshore waters of this region, 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). Climate change and changes to sea-ice coverage may be opening up new habitats, or resulting in shifts in distribution, as evident by an increase in the number of reported sightings of harbor porpoise in the Chukchi Sea (Funk et al. 2010, 2011). Shipping and noise from oil and gas activities may also be a habitat concern for harbor porpoise, particularly in the Chukchi Sea.

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