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

NOTE – March 2008: In areas outside of Alaska, studies of harbor porpoise distribution have shown that stock structure is 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, 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). Harbor porpoise primarily frequent coastal waters and in the Gulf of Alaska and Southeast Alaska (Dahlheim et al. 2000, 2009), they occur most frequently in waters less than 100 m deep (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, and Sitkalidak Strait (Dahlheim et al. 2000, Hobbs and Waite 2010). 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 8 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 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 insufficient samples. Accordingly, harbor porpoise stock structure in Alaska is unknown at this time.

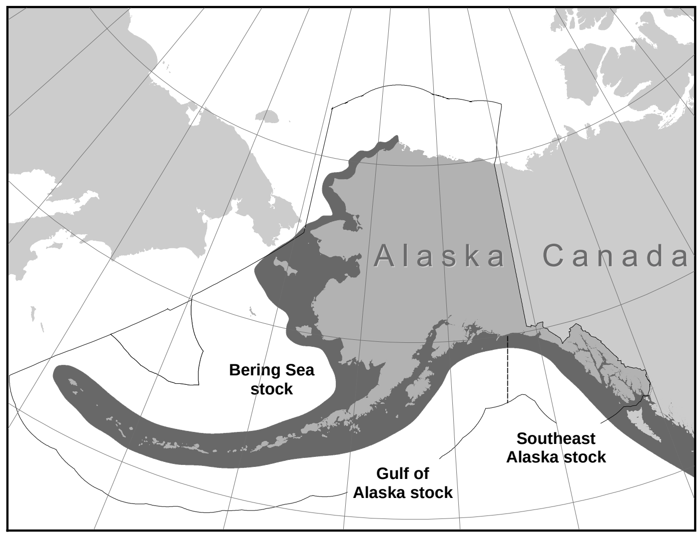

Figure 1. Approximate distribution of harbor porpoise in Alaska waters (shaded area).

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 harbor porpoise stocks in Alaska are recommended, recognizing that the boundaries were set based on geography: 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).

Harbor porpoises 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 (Aerts et al. 2011; Funk et al. 2010, 2011; Reiser et al. 2011). 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-October monitoring period (Funk et al. 2011, Reiser et al. 2011). Over the 2006-2010 industry-sponsored monitoring period, six sightings of 11 harbor porpoises were reported in the Beaufort Sea, suggesting harbor porpoise are occurring more regularly in small numbers 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 for observer perception bias and one to correct for porpoise availability/visibility at the surface. The 1999 survey resulted in an observed abundance estimate for the Bering Sea harbor porpoise stock of 16,289 (CV = 0.132; Hobbs and Waite 2010). The observed abundance estimate includes a correction factor (1.337; CV = 0.062) 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 is 48,215 (16,289 × 2.96 = 48,215; CV = 0.223). The estimate for 1999 can be considered conservative, as the surveyed areas did not include known harbor porpoise range near either the Pribilof Islands or in the waters north of Cape Newenham (approximately 59°N). However, because the survey data are now more than 8 years old, it is not considered a reliable minimum population estimate for calculating a PBR.

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 48,215 and its associated CV of 0.223, N_{MIN} for the Bering Sea stock of harbor porpoise is 40,039 (Hobbs and Waite 2010).

Current Population Trend

The abundance of harbor porpoise in Bristol Bay was estimated in 1991 and 1999. The 1991 estimate was 10,946 (Dahlheim et al. 2000). The 1999 estimate of 48,215 is higher than the 1991 estimate (Hobbs and Waite 2010). However, there are some key differences between surveys which complicate direct comparisons. Transect lines were substantially more dense in 1999 than in 1991 and large numbers of porpoise were observed in 1999 in an area which was not surveyed intensely in 1991 (compare sightings in northeast Bristol Bay depicted in Figure 5 in Hobbs and Waite (2010) with Figure 4 in Dahlheim et al. 2000). In addition, the use of a second correction factor for the 1999 estimate confounds direct comparison. The density of harbor porpoise resulting from the 1999 surveys was still substantially higher than that from 1991 (Dahlheim et al. 2000), but it is unknown whether the increase in density is a result of a population increase or is a result of survey design. Thus, at present, 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 currently available for this 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: $PBR = N_{MIN} \times 0.5R_{MAX} \times F_R$. The recovery factor ($F_R$) for this stock is 0.5, the value for cetacean stocks with unknown population status (Wade and Angliss 1997). However, the 2005 revisions to 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 (NMFS 2005). Therefore, the PBR for this stock is considered undetermined.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

New Serious Injury Guidelines

NMFS updated its serious injury designation and reporting process, which uses guidance from previous serious injury workshops, expert opinion, and analysis of historic injury cases to develop new criteria for distinguishing serious from non-serious injury (Angliss and DeMaster 1998, Andersen et al. 2008, NOAA 2012). NMFS defines serious injury as an "*injury that is more likely than not to result in mortality*." Injury determinations for stock assessments revised in 2013 or later incorporate the new serious injury guidelines, based on the most recent 5-year period for which data are available.

Fisheries Information

Prior to 2003, three different federally-managed commercial fisheries operating within the range of the Bering Sea stock of harbor porpoise were monitored for incidental take by NMFS observers during 1990-1998: Bering Sea (and Aleutian Islands) groundfish trawl, longline, and pot fisheries. As of 2003, changes in fishery definitions in the List of Fisheries resulted in separating these fisheries into 12 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. There were no harbor porpoise mortalities from the Bering Sea stock reported in commercial fisheries during 2008-2012.

The estimated minimum annual mortality rate incidental to commercial fisheries is 0 animals. However, a reliable estimate of the mortality rate incidental to commercial fisheries is currently unavailable because of the absence of observer placements in several salmon gillnet fisheries. Therefore, it is unknown whether the kill rate is insignificant.

A single report of a harbor porpoise entanglement in a subsistence gillnet occurred in 2012 (mean annual mortality = 0.2) (Table 1).

Table 1. Summary of the Bering Sea stock of harbor porpoise mortalities and serious injuries by year and type reported to the Alaska Regional Office, marine mammal stranding database, for the 2008-2012 period (Allen et al. 2014, 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	2008	2009	2010	2011	2012	Mean Annual Mortality
Entangled in subsistence gillnet	0	0	0	0	1	0.2
Minimum total annual mortality						0.20

Subsistence/Native Harvest Information

There have been historic reports of harbor porpoise mortalities from bycatch in subsistence gillnets in the area from Nome to Unalakleet (Barlow et al. 1994) and near Point Barrow (Suydam and George 1992). Bee and Hall (1956) reported on two entanglements in subsistence nets in Elson Lagoon, near Barrow, in 1952. More recently, subsistence fishermen in Barrow state that it is not uncommon for one or two porpoise to be caught each summer (Suydam and George 1992). In 1991, pack ice may have contributed to the relatively high number (4) of porpoise caught in subsistence nets (Suydam and George 1992). One confirmed report of an entangled animal near Emmonak occurred between 1999 and 2003, and in 2007, 2 harbor porpoise were found dead in a subsistence net in Nome, AK (NMFS, Alaska Regional Office, Marine Mammal Stranding Database).

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 unknown, the level of annual U.S. commercial fishery-related mortality that can be considered insignificant and approaching zero mortality and serious injury rate is unknown. The minimum estimate of mean annual mortality (0 from commercial fisheries and 0.2 from subsistence fisheries) is 0.2; the estimated annual level of human-caused mortality and serious injury relative to PBR is unknown. Because the abundance estimates are more than 8 years old and information on incidental mortality in commercial fisheries is sparse, the Bering Sea 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 100 m 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. Climate change and changes to sea ice coverage may be opening up new habitats, or resulting in shifts in habitat, as evident by an increase in the number of reported sightings of harbor porpoises in the Chukchi Sea (Funk et al. 2010). Shipping and noise from oil and gas activities may also be a habitat concern for harbor porpoises, particularly in the Chukchi Sea.

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