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HARBOR PORPOISE (*Phocoena phocoena*): Southeast Alaska Stocks: Northern Southeast Alaska Inland Waters, Southern Southeast Alaska Inland Waters, Yakutat/Southeast Alaska Offshore Waters

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; however, occasionally they occur in deeper waters (Hobbs and Waite 2010). Within the inland waters of Southeast Alaska, harbor porpoise distribution is clumped with the greatest densities observed in the Glacier Bay/Icy Strait region, near Wrangell and Zarembo Islands, and in the adjacent waters of Sumner Strait (Dahlheim et al. 2009, 2015). 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 inland waters off Southeast Alaska (Glacier Bay and 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).

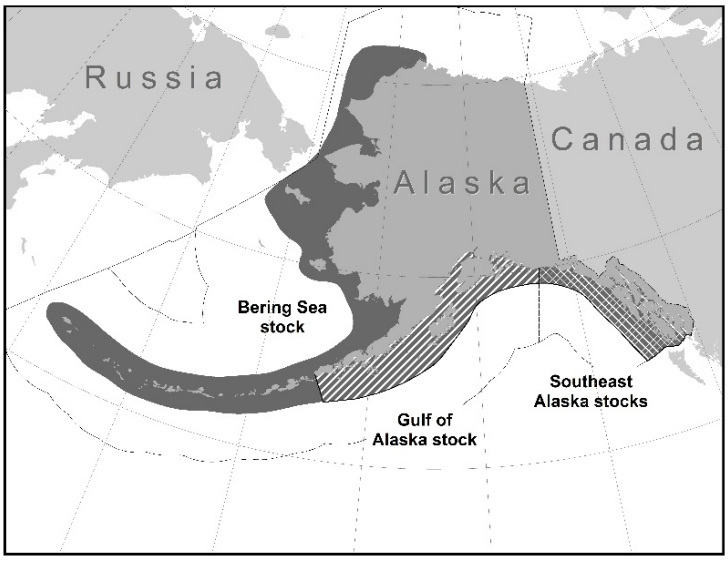

Figure 1. Approximate distribution of harbor porpoise in Alaska waters. See Figure 2 for boundaries of the three stocks in Southeast Alaska. The U.S. Exclusive Economic Zone is delineated by a black line.

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. Despite these two clades overlapping in latitude, the results suggest 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 eight additional samples from Alaska, revealed 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 revealed that harbor porpoise along the west coast of North America are not panmictic and that movement is sufficiently restricted to result in genetic differences between regions (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 was 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 were previously specified, recognizing that the boundaries were identified primarily based upon geography or perceived areas of low porpoise density: 1) the Southeast Alaska stock - occurring from Dixon Entrance

to Cape Suckling, including offshore, coastal, and inland waters, 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 west and 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 a portion of the Southeast Alaska stock.

Dahlheim et al. (2015) proposed that harbor porpoise in the northern and southern inland waters of Southeast Alaska potentially represented different populations due to differences in trends in abundance between the two regions. In addition, there is a possible hiatus in distribution between the two higher-density areas of Frederick Sound and Wrangell/Zarembo, which suggests the range of harbor porpoise from those two regions does not overlap; in fact, many of the passages between these areas have shoal or constricted areas that might serve as physical barriers to movements of harbor porpoise (Zerbini et al. 2022a, 2022b). Results from analyses of environmental DNA (eDNA) from three areas in Southeast Alaska (Glacier Bay and Icy Strait, Keku Strait, and Wrangell and Zarembo Islands) suggested significant genetic differentiation between Wrangell and Zarembo Islands and the two other areas (Parsons et al. 2018), supporting the existence of two different populations within Southeast Alaska inland waters. Connectivity of harbor porpoise in these two regions with those in Gulf of Alaska waters offshore of Southeast Alaska and in the region around Yakutat is poorly understood.

Multiple lines of evidence (molecular genetics, density discontinuities) led NMFS to delineate six stocks of harbor porpoise along the coasts of California, Oregon, and Washington. The same lines of evidence, along with additional evidence from trends in abundance, led NMFS to delineate two Demographically Independent Populations and one unit within the Southeast Alaska harbor porpoise stock (Zerbini et al. 2022a), which is now divided into three stocks: 1) the Northern Southeast Alaska (N-SEAK) Inland Waters stock, which includes Cross Sound, Glacier Bay, Icy Strait, Chatham Strait, Frederick Sound, Stephens Passage, Lynn Canal, and adjacent inlets; 2) the Southern Southeast Alaska (S-SEAK) Inland Waters stock, which encompasses Sumner Strait, including areas around Wrangell and Zarembo Islands, Clarence Strait, and adjacent inlets and channels within the inland waters of Southeast Alaska north-northeast of Dixon Entrance; and 3) the Yakutat/Southeast Alaska (Y-SEAK) Offshore Waters stock, which includes offshore habitats in the Gulf of Alaska west of the Southeast Alaska inland waters and the areas around Yakutat Bay (Fig. 2). There is limited information to assess how harbor porpoise in the Y-SEAK Offshore Waters stock relate to animals in inland waters, but it is likely, based on what is known about harbor porpoise stock structure in other areas, that the Y-SEAK Offshore Waters stock includes more than one Demographically Independent Population. Therefore, refinement of the stock structure of Y-SEAK/Offshore Waters stock in future years is likely as new information becomes available in the future (Zerbini et al. 2022a).

POPULATION SIZE

Information on harbor porpoise abundance was collected for coastal and inland waters of Southeast Alaska by the Alaska Fisheries Science Center's Marine Mammal Laboratory (MML), using both aerial and shipboard surveys between 1991 and 2012 (Hobbs and Waite 2010, Dahlheim et al. 2015). Estimates of abundance provided by these surveys are more than 10 years old and are no longer considered reliable as a measure of current abundance and there is no basis for adjusting the abundance estimates to account for potential changes that may have occurred since the last survey (see Current Population Trend section below). Further information on these surveys is available in previous stock assessment reports for Southeast Alaska harbor porpoise (e.g., Muto et al. 2021).

Northern and Southern Southeast Alaska Inland Waters Stocks

A line-transect vessel survey was conducted in the inland waters of Southeast Alaska in July/August 2019 using a combination of line-transect and strip-transect methods (Fig. 2) (Zerbini et al. 2022b). Using the methods of Barlow (2015), an estimate of g(0) = 0.53 (CV = 0.11, 95% CI = 0.43-0.65) was computed for both inland waters stocks from apparent densities in different survey conditions. This parameter corrects for the fraction of animals missed directly on the survey transect line. Estimates of abundance for the N-SEAK and S-SEAK Inland Waters stocks are, respectively, 1,619 (CV = 0.26, 95% CI = 944-2,529) and 890 (CV = 0.37, 95% CI = 385-1,708) harbor porpoise.

Yakutat/Southeast Alaska Offshore Waters Stock

A current estimate of abundance is not available for the Y-SEAK Offshore Waters stock.

Minimum Population Estimate

Northern and Southern Southeast Alaska Inland Waters Stocks

The minimum population estimates (N_{MINs}) for the harbor porpoise stocks in Southeast Alaska inland waters, based on the 2019 vessel survey, were calculated as the 20th percentile of the distribution of the g(0)-corrected

abundance estimates computed using bootstrap methods. The N_{MINs} for the N-SEAK and S-SEAK Inland Waters stocks are, respectively, 1,250 and 610 harbor porpoise.

Yakutat/Southeast Alaska Offshore Waters Stock

A current minimum population estimate is not available for the Y-SEAK Offshore Waters stock.

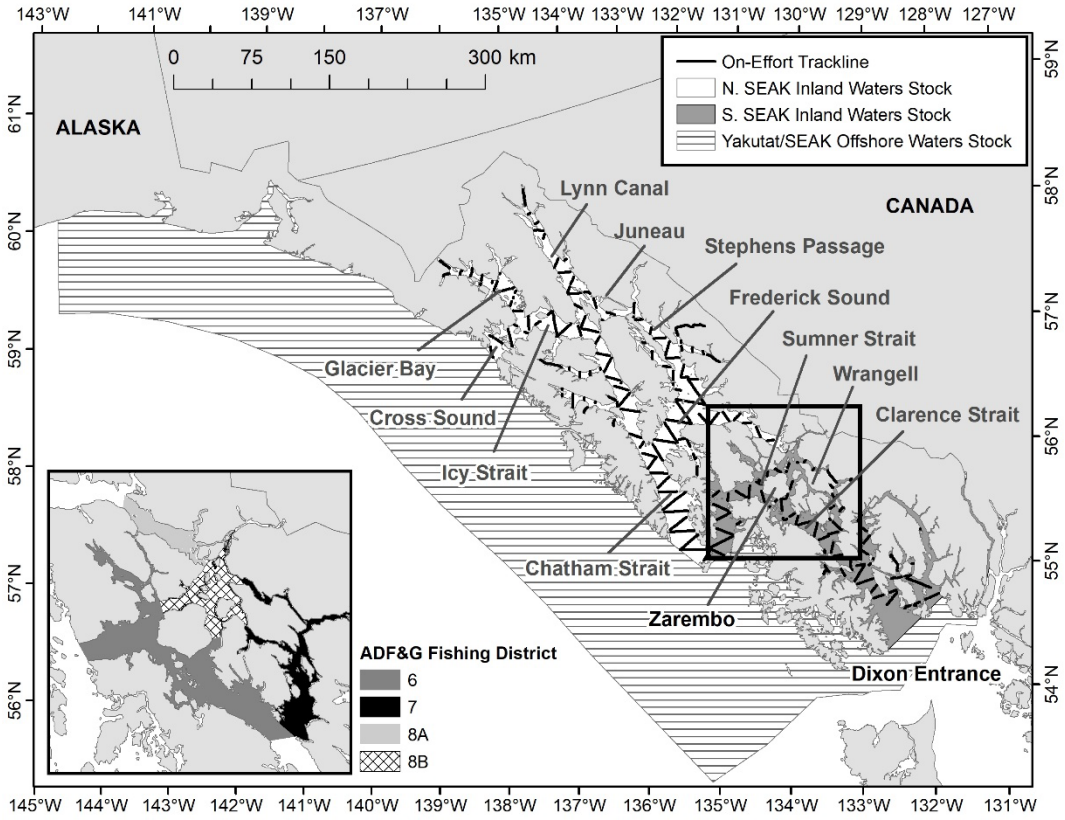

Figure 2. Boundaries for the three newly identified Southeast Alaska harbor porpoise stocks. The on-effort trackline for the 2019 harbor porpoise survey of the inland waters of Southeast Alaska is also shown. Alaska Department of Fish and Game Management Districts 6, 7, and 8 are indicated by gray shading and cross-hatching. The two sub-areas comprising District 8 are differentiated because the N-SEAK Inland Waters stock occurs in sub-area 8A and the S-SEAK Inland Waters stock occurs in sub-area 8B (Zerbini et al. 2022a).

Current Population Trend

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 and highlighted a potentially important conservation issue (Zerbini et al. 2011). However, when data from 2011 and 2012 were added to this analysis, the population decline was no longer significant (Dahlheim et al. 2015). Regionally, abundance was relatively constant in the northern region of the inland waters of Southeast Alaska throughout the survey period, while declines and subsequent increases were documented in the southern region (Dahlheim et al. 2015).

Current estimates of trend in abundance are not available for any of the Southeast Alaska harbor porpoise stocks.

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

A reliable estimate of the maximum net productivity rate (R_{MAX}) is not available for any of the Southeast Alaska stocks of harbor porpoise. Until additional data become available, the cetacean maximum theoretical net productivity rate of 4% will be used (NMFS 2023).

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 the three Southeast Alaska stocks of harbor porpoise is 0.5, the default value for cetacean stocks with unknown population status (NMFS 2023).

Northern and Southern Southeast Alaska Inland Waters Stocks

PBRs for the N-SEAK and the S-SEAK Inland Waters stocks are 13 (1,250 x 0.02 x 0.5) and 6.1 (610 x 0.02 x 0.5) porpoise, respectively.

Yakutat/Southeast Alaska Offshore Waters Stock

Because there is no current estimate of N_{MIN}, 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 2016 and 2020 is listed, by marine mammal stock, in Freed et al. (2022); 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 Southeast Alaska harbor porpoise between 2016 and 2020, by stock, is: 1) N-SEAK Inland Waters stock = 5.6 porpoise in U.S. commercial fisheries (estimated from observer data collected in 2012-2013); 2) S-SEAK Inland Waters stock = 7.4 porpoise in U.S. commercial fisheries (estimated from observer data collected in 2012-2013); and 3) Y-SEAK Offshore Waters stock = 22.2 porpoise in U.S. commercial fisheries (22 estimated from observer data collected in 2007-2008 and 0.2 estimated from a Marine Mammal Authorization Program (MMAP) fisherman self-report in the coastal waters of Southeast Alaska in 2019).

The estimates of mortality and serious injury provided above are considered minimums because the majority of the salmon and herring fisheries (salmon and herring gillnet and purse seine and salmon hook and line) operating within the range of these stocks are not observed. The potential threat most likely to result in direct human-caused mortality or serious injury of these stocks is entanglement in fishing gear. There are no other known causes of human-caused mortality and serious injury for these stocks.

Fisheries Information

Information for federally-managed and state-managed U.S. commercial fisheries in Alaska waters is available in Appendix 3 of the Alaska Stock Assessment Reports (observer coverage) and in the NMFS List of Fisheries (LOF) and the fact sheets linked to fishery names in the LOF (observer coverage and reported incidental takes of marine mammals: https://www.fisheries.noaa.gov/national/marine-mammal-protection/marine-mammal-protection-act-list-fisheries, accessed May 2023).

Northern and Southern Southeast Alaska Inland Waters Stocks

No mortality or serious injury of harbor porpoise from the N-SEAK or S-SEAK Inland Waters stocks was observed incidental to federally-managed U.S. commercial fisheries in Alaska between 2016 and 2020. In 2012 and 2013, the Alaska Marine Mammal Observer Program (AMMOP) placed observers on independent vessels in the state-managed Southeast Alaska salmon drift gillnet fishery in Alaska Department of Fish and Game (ADF&G) Management Districts 6, 7, and 8 to assess mortality and serious injury of marine mammals (Manly 2015). Specifically, the program observed sub-areas 6A, 6B, 7A, 8A, and 8B within Districts 6, 7, and 8; sub-areas are referenced herein only if relevant to identifying specific harbor porpoise interactions or assigning interactions to a stock. 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. No mortality or serious injury of harbor porpoise was observed in 2012. However, in 2013, four harbor porpoise were observed entangled and released.

A previous estimate of harbor porpoise mortality and serious injury from these observed interactions was 23 harbor porpoise for 2012-2013 (an average of 12 individuals per year) (Manly 2015). That estimate is revised here

because of an error in the assignment of injury severity for two of the bycaught individuals. Upon review of the data, it was determined that one of the two porpoise that were caught in sub-area 8A and reported to have serious injuries (Manly 2015) should have been classified as having a non-serious injury (Helker et al. 2015), and the porpoise caught in sub-area 6A and classified as having a non-serious injury (Manly 2015) was in fact seriously injured (Helker et al. 2015). These corrections required a review of the estimated bycatch in these sub-areas. Following the same methods used by Manly (2015), mortality and serious injury in sub-areas 6A and 8A were estimated, respectively, as 14.8 (CV = 1.0) and 11.2 (CV = 0.7) porpoise. Total mortality and serious injury estimated for the observed sub-areas of Districts 6, 7, and 8 was estimated at 26 porpoise (CV = 0.5) for 2012-2013, which results in a mean annual mortality and serious injury rate of 13 porpoise.

Total annual mortality and serious injury was then divided between the inland waters stocks based on the locations of the observed mortalities and serious injuries. As shown in Figure 2, sub-area 8A occurs within the range of the N-SEAK Inland Waters stock, thus the estimated mortality and serious injury in sub-area 8A was assigned to the N-SEAK Inland Waters stocks; similarly, sub-areas 6A, 6B, 7A, and 8B overlap with the range of the S-SEAK Inland Waters stock and thus the estimated mortality and serious injury in sub-area 6A was assigned to the S-SEAK Inland Waters stock. Based on the revised estimates, the mean annual mortality and serious injury rate for the N-SEAK and S-SEAK Inland Waters stocks is estimated to be 5.6 and 7.4 porpoise, respectively (Table 1). It is important to note that these are minimum estimates of mortality and serious injury for these stocks in the Southeast Alaska salmon drift gillnet fishery because they only apply to the sub-areas in which the fishery was observed (ADF&G sub-areas 6A, 6B, 7A, 8A and 8B), not to other districts where the salmon driftnet fishery is known to operate (e.g., Lynn Canal, Taku/Snettisham, and Tree Point) but was not observed. In addition, there are no estimates of mortality and serious injuries for fisheries other than the salmon drift gillnet fishery.

Yakutat/Southeast Alaska Offshore Waters Stock

No mortality or serious injury of harbor porpoise from any of the Southeast Alaska stocks was observed incidental to federally-managed U.S. commercial fisheries in Alaska between 2016 and 2020. In 2007 and 2008, the 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 a total of four mortalities and serious injuries observed 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). Although these observer data are dated, they are considered the best available data on mortality and serious injury levels for this stock in this fishery.

Mortality of one harbor porpoise in the Y-SEAK Offshore Waters stock due to entanglement in a commercial Southeast Alaska salmon cost recovery drift gillnet was reported in an MMPA fisherman self-report in 2019 (Table 2; Freed et al. 2022), resulting in a minimum mean annual mortality and serious injury rate of 0.2 harbor porpoise for this stock in this fishery between 2016 and 2020. 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 or are self-reported nor are all stranded animals found, reported, or have the cause of death determined.

Fisheries Summary

Based on observed mortality and serious injury in two commercial fisheries in 2007-2008 and 2012-2013 (Table 1) and an MMAP fisherman self-report in 2019 (Table 2), the minimum estimated mean annual mortality and serious injury rate incidental to U.S. commercial fisheries between 2016 and 2020, by stock, is: 1) N-SEAK Inland Waters stock = 5.6 harbor porpoise from observed fisheries, 2) S-SEAK Inland Waters stock = 7.4 harbor porpoise from observed fisheries; and 3) Y-SEAK Offshore Waters stock = 22 harbor porpoise from observed fisheries and 0.2 from an MMAP fisherman self-report. These are likely underestimates because the majority of the salmon and herring fisheries (salmon and herring gillnet and purse seine and salmon hook and line) operating within the range of these stocks are not observed and not all entangled animals strand or are self-reported nor are all stranded animals found, reported, or have the cause of death determined. Thus, given the known occurrence of fisheries-caused mortality and serious injury of harbor porpoise in gillnet fisheries in Alaska and the lack of thorough and/or recent observation, the total fisheries-caused mortality and serious injury of these stocks is likely greater than is reported here.

Table 1. Summary of incidental mortality and serious injury of Southeast Alaska harbor porpoise due to U.S. commercial fisheries, by stock, between 2016 and 2020 (estimated from data collected in 2007-2008 and 2012-2013) and the mean annual mortality and serious injury rate (Manly 2009, 2015; see text for information on re-analysis of estimates from Manly 2015). Observer coverage levels shown for the Southeast Alaska salmon drift gillnet fishery are specific to individual observed ADF&G sub-areas and do not represent the level of coverage of the entire Southeast Alaska salmon drift gillnet fishery.

Fishery name	Years	Data type	Percent observer coverage	Observed mortality	Estimated mortality	Mean estimated annual mortality
Northern Southeast Alaska Inland Waters stock						
Southeast Alaska salmon drift gillnet (ADF&G sub-area 8A)	2012 2013	obs data	6.9 8.9	0 1	0 11.2	5.6 (CV = 0.7)
Southern Southeast Alaska Inland Waters stock						
Southeast Alaska salmon drift gillnet (ADF&G sub-area 6A)	2012 2013	obs data	7.3 6.7	0 1	0 14.8	7.4 (CV = 1.0)
Yakutat/Southeast Alaska Offshore Waters stock						
Yakutat salmon set gillnet	2007 2008	obs data	5.3 7.6	1 3	16.1 27.5	22 (CV = 0.54)
Minimum total estimated annual mortality N-SEAK Inland Waters stock S-SEAK Inland Waters stock Y-SEAK Offshore Waters stock						 5.6 (CV = 0.7) 7.4 (CV = 1.0) 22 (CV = 0.54)

Table 2. Summary of Southeast Alaska harbor porpoise mortality and serious injury, by year and type, reported to the NMFS Alaska Region marine mammal stranding network and in MMAP fisherman self-reports between 2016 and 2020 (Freed et al. 2022). Only cases of serious injury were recorded in this table; animals with non-serious injuries have been excluded.

Cause of injury		2016	2017	2018	2019	2020	Mean annual mortality
Yakutat/Southeast Alaska Offshore Waters stock							
Entangled in commercial Southeast Alaska salmon cost recovery drift gillnet		0	0	0	1*	0	0.2
Total in commercial fisheries Y-SEAK Offshore Waters stock							 0.2

*MMAP fisherman self-report.

Alaska Native Subsistence/Harvest Information

Subsistence hunters in Alaska have not been reported to take from these stocks of harbor porpoise.

STATUS OF STOCK

None of the stocks of Southeast Alaska harbor porpoise are designated as depleted under the Marine Mammal Protection Act or listed as threatened or endangered under the Endangered Species Act.

Northern and Southern Southeast Alaska Inland Waters Stocks

The minimum mean annual level of human-caused mortality and serious injury estimated for the N-SEAK Inland Waters stock (5.6 porpoise, based on data collected from an observer program in ADF&G sub-area 8A) does not exceed the calculated PBR (13); therefore, the stock is not strategic. However, because only a portion of the Southeast Alaska salmon drift gillnet fishery was monitored by AMMOP, it is possible that the actual level of human-caused mortality and serious injury is underestimated, and NMFS is evaluating the feasibility of observing the fishery

throughout the stock's range. The minimum estimated mean annual U.S. commercial fishery-related mortality and serious injury rate (5.6 porpoise) is more than 10% of the calculated PBR (10% of PBR = 1.3 porpoise), so it is not considered insignificant and approaching a zero mortality and serious injury rate. Population trends and status of this stock relative to its Optimum Sustainable Population are currently unknown.

The minimum mean annual level of human-caused mortality and serious injury estimated for the S-SEAK Inland Waters stock (7.4 porpoise, based on data collected from an observer program in ADF&G sub-areas 6A, 6B, 7A, and 8B) exceeds the calculated PBR (6.1); therefore, the stock is strategic. The minimum estimated mean annual U.S. commercial fishery-related mortality and serious injury rate (7.4 porpoise) is more than 10% of the calculated PBR (10% of PBR = 0.6 porpoise), so it is not considered insignificant and approaching a zero mortality and serious injury rate. Population trends and status of this stock relative to its Optimum Sustainable Population are currently unknown.

Yakutat/Southeast Alaska Offshore Waters Stock

The current abundance for this stock is unknown because the existing estimate is more than 10 years old and, based on available data, cannot be corrected to account for potential changes in abundance since the last survey. Without an estimate of N_{MIN}, the PBR level is considered undetermined. Because the PBR is undetermined, it is unknown if the minimum estimate of the mean annual mortality and serious injury rate (22.2 porpoise) in U.S. commercial fisheries can be considered insignificant and approaching a zero mortality and serious injury rate. NMFS considers this stock not strategic at this time because the PBR level is undetermined and a comparison between the level of mortality and serious injury and a PBR level is thus not possible. However, based on information about the range of harbor porpoise stocks in other areas, the Y-SEAK Offshore stock is likely to comprise multiple stocks, and if this is the case, a mortality and serious injury level of 22.2 harbor porpoise from a portion of the total area of this stock is likely to be of concern. Population trends and status of this stock relative to its Optimum Sustainable Population are unknown.

Uncertainties

There are key uncertainties in the assessment of the Southeast Alaska stocks of harbor porpoise. It is unclear whether there is connectivity between the N-SEAK and S-SEAK Inland Waters stocks and the Y-SEAK Offshore Waters stock. Trends in abundance of harbor porpoise in these regions are unclear; an early decline in inland waters appears to have reversed in recent years. Several commercial fisheries overlap with the range of these stocks and have not been observed since at least 2013; thus, the estimates of commercial fishery mortality and serious injury are expected to be minimum estimates. Estimates of human-caused mortality and serious injury from stranding data and fisherman self-reports are underestimates because not all animals strand or are self-reported, nor are all stranded animals found, reported, or have the cause of death determined.

HABITAT CONCERNS

Harbor porpoise are mostly found in nearshore areas and inland waters, including bays, tidal areas, and river mouths (Dahlheim et al. 2000, 2009, 2015; 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).

Algal toxins are a growing concern in Alaska marine food webs, in particular the neurotoxins domoic acid and saxitoxin. While saxitoxin was not detected in harbor porpoise samples collected in Alaska, domoic acid was found in 40% (2 of 5) of the samples and, notably, in maternal transfer to a fetus (Lefebvre et al. 2016).

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