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DALL'S PORPOISE (*Phocoenoides dalli*): Alaska Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

Dall's porpoise are widely distributed across the entire North Pacific Ocean (Fig. 1). They are found over the continental shelf adjacent to the slope and over deep (2,500+ m) oceanic waters (Hall 1979). They have been sighted throughout the North Pacific as far north as 65°N (Buckland et al. 1993) and as far south as 28°N in the eastern North Pacific (Leatherwood and Fielding 1974). The only apparent distribution gaps in Alaska waters are upper Cook Inlet and the shallow eastern flats of the Bering Sea. Dall's porpoise are present during all months of the year throughout most of the eastern North Pacific, although there may be seasonal onshore-offshore movements along the west coast of the continental U.S. (Loeb 1972, Leatherwood and Fielding 1974).

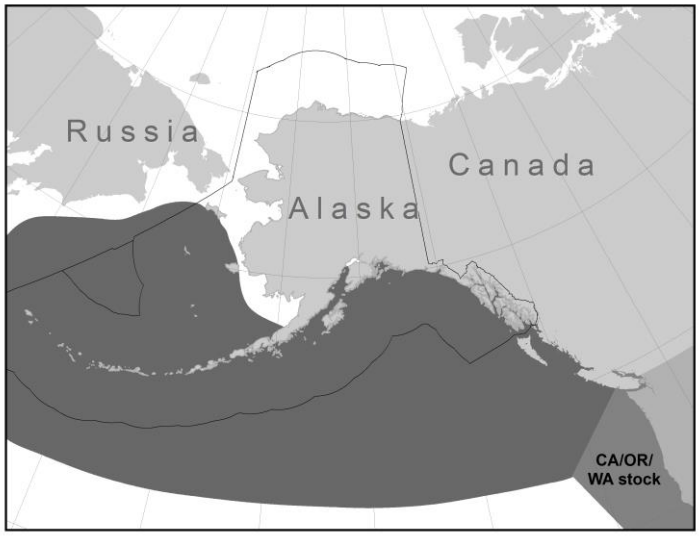

Figure 1. Approximate distribution of Dall's porpoise in the eastern North Pacific Ocean (dark shaded area). The Alaska stock is defined as the portion of the distribution in Alaska waters. The U.S. Exclusive Economic Zone is delineated by a black line.

Surveys on the eastern Bering Sea shelf and slope to the 1,000 m isobath in 1999, 2000, 2002, 2004, 2008, and 2010 provided information about the distribution and relative abundance of Dall's porpoise in that area (Moore et al. 2002; Friday et al. 2012, 2013). Dall's porpoise were sighted on the shelf and slope in waters deeper than 100 m in 2002, 2008, and 2010 with greater densities at the shelf break than in shallower waters (Friday et al. 2013). A 2012 vessel survey conducted between 30 and 62°N in the North Pacific Ocean and the Bering Sea between June and August reported sightings across a wide range of water depths and temperatures with concentrations found near Aleutian passes in water depths less than 1,000 m (Suzuki et al. 2016). During the 2011 Chukchi Acoustic, Oceanographic, and Zooplankton (CHAOZ) vessel survey, Dall's porpoise were sighted in the Bering Strait and along the Aleutian Chain (BOEM 2011).

Vessel surveys in the northeast Gulf of Alaska in 2013 and 2015 recorded Dall's porpoise throughout the study area, including the continental shelf, the slope, offshore waters, and around seamounts. Higher densities were observed on the shelf and slope (Rone et al. 2017). Vessel surveys for Dall's porpoise conducted in Prince William Sound (PWS) from 2007 to 2015 found that animals shifted their distribution and habitat preferences seasonally (Moran et al. 2018). Dall's porpoise were distributed throughout PWS in summer, the passages in fall, and eastern PWS in winter and spring. Additionally, Dall's porpoise were found in deeper water in summer (mean ± 1 SD: 242 ± 132 m) and shallower water in spring (104 ± 93.4 m) (Moran et al. 2018).

The following information was considered in classifying stock structure based on the Dizon et al. (1992) phylogeographic approach, which considers four types of data: 1) Distributional data: geographic distribution continuous; 2) Population response data: differential timing of reproduction between the Bering Sea and western North Pacific; 3) Phenotypic data: unknown; and 4) Genotypic data: unknown. The stock structure of eastern North Pacific Dall's porpoise is not adequately understood at this time; however, it is expected that separate stocks will emerge when data become available (Perrin and Brownell 1994). Based primarily on the population response data (Jones et al. 1986) and genetic analyses (Winans and Jones 1988), a delineation between Bering Sea and western North Pacific stocks has been recognized. However, similar data are not available for the eastern North Pacific; thus, one stock of Dall's porpoise is currently recognized in Alaska waters. Dall's porpoise along the west coast of the continental U.S. from California to Washington comprise a separate stock and are reported in the Stock Assessment Reports for the U.S. Pacific Region.

This stock assessment report currently assesses the abundance of Alaska Dall's porpoise only in the northwestern Gulf of Alaska, which is a small portion of the stock's geographic range; however, there is information on Dall's porpoise abundance (now considered outdated) in other areas of the stock's range (e.g., the Bering Sea and Southeast Alaska). Human-caused mortality and serious injury is estimated throughout the stock's entire range; however, it is likely an underestimate because there is no current observer coverage for the salmon and herring fisheries operating within the range of this stock.

POPULATION SIZE

Data collected from vessel surveys, by both U.S. fishery observers (collected opportunistically during fishing trips) and U.S. researchers from 1987 to 1991, were analyzed to provide population estimates of Dall's porpoise throughout the North Pacific and the Bering Sea (Hobbs and Lerczak 1993). The quality of data used in analyses was determined by the procedures recommended by Boucher and Boaz (1989). Survey effort was not uniformly distributed within the U.S. Exclusive Economic Zone (EEZ) around Alaska and, as a result, Bristol Bay and the northern Bering Sea received little survey effort. Between 1987 and 1991, only three sightings were reported in the northern Bering Sea (Hobbs and Lerczak 1993), resulting in an estimate of 9,000 porpoise (coefficient of variation (CV) = 0.91) in that area. Hobbs and Lerczak (1993) reported 302,000 (CV = 0.11) Dall's porpoise in the U.S. EEZ north and south of the Aleutian Islands and 106,000 (CV = 0.20) in the U.S. EEZ in the Gulf of Alaska. Combining these estimates (9,000 + 302,000 + 106,000) results in a total abundance estimate of 417,000 (CV = 0.097) for the Alaska stock of Dall's porpoise. Turnock and Quinn (1991) estimated a five-fold positive bias in abundance estimates of Dall's porpoise because of vessel attraction behavior. Therefore, a corrected population estimate from 1987 to 1991 could be as low as 83,400 (417,000 × 0.2) for this stock. Because these surveys are more than 8 years old, this abundance estimate for the Alaska stock of Dall's porpoise is no longer considered reliable.

Sighting surveys for cetaceans were conducted opportunistically during NMFS pollock stock assessment surveys in 1999, 2000, 2002, 2004, 2008, and 2010 on the eastern Bering Sea shelf (Moore et al. 2002; Friday et al. 2012, 2013). The entire study area of the survey, which corresponded to only a fraction of the range of the Alaska stock, was fully covered in three of those years (2002, 2008, and 2010). Dall's porpoise abundance estimates were 35,303 (CV = 0.53) in 2002, 14,543 (CV = 0.32) in 2008, and 11,143 (CV = 0.32) in 2010 (Friday et al. 2013). Although the 2010 estimate is the lowest of the three years, it is not statistically different from the 2002 and 2008 estimates (Friday et al. 2013).

Abundance estimates for Dall's porpoise in inland waters of Southeast Alaska were calculated from 19 line-transect vessel surveys from 1991 to 2012 (Jefferson et al. 2019). Abundance across the whole period was estimated at 5,381 (CV = 0.25), 2,680 (CV = 0.20), and 1,637 (CV = 0.23) in the spring, summer, and fall, respectively (Jefferson et al. 2019).

Vessel surveys were carried out in and around a Navy Maritime Activity/Training Area in the northwestern Gulf of Alaska to document abundance and density of cetaceans in 2013 and 2015 (Rone et al. 2017). The surveys covered different, but partially overlapping, areas in the two years and estimated Dall's porpoise abundance as 15,432 (CV = 0.28) in 2013 and 13,110 (CV = 0.22) in 2015.

Estimates of abundance from the NMFS pollock stock assessment surveys in the Bering Sea, the 1991-2012 vessel surveys in Southeast Alaska, and the 2013/2015 vessel surveys in the Gulf of Alaska did not cover the whole range of the stock and were not corrected for responsive movement (vessel attraction), animals missed on the trackline (perception bias), or for animals submerged when the vessel passed (availability bias).

Minimum Population Estimate

The minimum population estimate (N_{MIN}) for this stock is assumed to correspond to the point estimate of the 2015 vessel-based abundance computed by Rone et al. (2017) in the Gulf of Alaska (N = 13,110; CV = 0.22). The study area of this survey corresponds to a small fraction of the range of the stock and, despite the caveats noted in the previous section, it is reasonable to assume the stock size is equal to or greater than that estimate.

Current Population Trend

There is no reliable information on trends in abundance for the Alaska stock of Dall's porpoise.

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

A reliable estimate of the maximum net productivity rate (R_{MAX}) is not available for the Alaska stock of Dall's porpoise. Until additional data become available, the cetacean maximum theoretical net productivity rate of

4% will be used (NMFS 2016). However, based on life-history analyses by Ferrero and Walker (1999), Dall's porpoise reproductive strategy is not consistent with the delphinid pattern on which the default maximum theoretical net productivity rate for cetaceans is based. In contrast to the delphinids, Dall's porpoise mature earlier and reproduce annually (Ferrero and Walker 1999), which suggests that a higher R_{MAX} may be warranted.

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). Using the N_{MIN} of 13,110 (based on the 2015 abundance estimate for Dall's porpoise in the Gulf of Alaska), PBR is 131 Dall's porpoise ($13{,}110 \times 0.02 \times 0.5$).

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 2015 and 2019 is listed, by marine mammal stock, in Freed et al. (2021); however, only the mortality and serious injury data are included in the Stock Assessment Reports. The total estimated annual level of human-caused mortality and serious injury for the Alaska stock of Dall's porpoise between 2015 and 2019 is 37 porpoise: 37 in U.S. commercial fisheries (estimated from observer data collected in 1990 and 2012-2013) and 0.2 in unknown (commercial, recreational, or subsistence) fisheries. This estimate is considered a minimum because there is no current observer coverage for the salmon and herring fisheries (salmon and herring gillnet and purse seine and salmon hook and line) operating within the range of this stock. 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 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 December 2021).

Based on historical reports and the stock's geographic range, Dall's porpoise mortality and serious injury is known to occur in gillnet fisheries and, to a lesser extent, in trawl and purse seine fisheries. While trawl fisheries have relatively high levels of observation, gillnet and purse seine fisheries do not. There has only been limited observation of gillnet fisheries in discrete years, and mortality and serious injury of Dall's porpoise was documented only in the Southeast Alaska salmon drift gillnet fishery in 2012 and 2013 and the Alaska Peninsula/Aleutian Islands salmon drift gillnet fishery in 1990. Given the known occurrence of fishery-caused mortality and serious injury of Dall's porpoise in gillnet fisheries in Alaska and the lack of thorough and/or recent observation, the potential for fisheries-caused mortality and serious injury may be greater than is reflected in existing observer data.

No mortality or serious injury of the Alaska stock of Dall's porpoise was observed incidental to federally-managed U.S. commercial fisheries between 2015 and 2019.

The state-managed Alaska Peninsula/Aleutian Islands salmon drift gillnet fishery was monitored by Alaska Marine Mammal Observer Program (AMMOP) observers in 1990 (Wynne et al. 1991). One Dall's porpoise mortality was observed, which extrapolated to an annual (total) incidental mortality and serious injury rate of 28 Dall's porpoise (Table 1). Although these observer data are dated, they are considered the best available data on mortality and serious injury levels in this fishery.

In 2012 and 2013, the AMMOP placed observers on independent vessels in the state-managed Southeast Alaska salmon drift gillnet fishery to assess mortality and serious injury of marine mammals. Areas around and adjacent to Wrangell and Zarembo Islands (ADF&G Districts 6, 7, and 8) were observed during the 2012-2013 program (Manly 2015). In 2012, one Dall's porpoise was seriously injured. Based on the one observed serious injury, 18 serious injuries were estimated for Districts 6, 7, and 8 in 2012. No mortality or serious injury was observed in 2013, resulting in an estimated mean annual mortality and serious injury rate of 9 Dall's 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. Note that the AMMOP has not observed the Southeast Alaska salmon drift gillnet fishery in the other districts; additionally, NMFS has not observed several other gillnet fisheries that are known to interact with this stock; therefore, the total estimated mortality and serious injury is unavailable. Combining the estimates from the Alaska Peninsula/Aleutian Islands salmon drift gillnet

fishery (28) and the Southeast Alaska salmon drift gillnet fishery (9) results in a minimum estimated mean annual mortality and serious injury rate of 37 Dall's porpoise from this stock.

Table 1. Summary of observed incidental mortality and serious injury of the Alaska stock of Dall's porpoise due to U.S. commercial fisheries between 2015 and 2019 (estimated from data collected in 1990 and 2012-2013) and calculation of the mean annual mortality and serious injury rate (Wynne et al. 1991; Breiwick 2013; Manly 2015; MML, unpubl. data). Methods for calculating percent observer coverage are described in Appendix 6 of the Alaska Stock Assessment Reports.

Fishery name	Years	Data type	Percent observer coverage	Observed mortality	Estimated mortality	Mean estimated annual mortality
Southeast Alaska salmon drift gillnet (Districts 6, 7, 8)	2012 2013	obs data	6.4 6.6	1 0	18 0	9 (CV = 1.0)
Alaska Peninsula/Aleutian Is. salmon drift gillnet	1990	obs data	4	1	28	28 (CV = 0.585)
Minimum total estimated annual mortality						37 (CV = 0.505)

Mortality of one Dall's porpoise due to entanglement in unknown (commercial, recreational, or subsistence) pot gear was reported in a Marine Mammal Authorization Program (MMAP) fisherman self-report in 2019 (Table 2; Freed et al. 2021), resulting in a minimum mean annual mortality and serious injury rate of 0.2 Dall's porpoise between 2015 and 2019. There were no Dall's porpoise entanglements reported to the Alaska Region marine mammal stranding network between 2015 and 2019. Mortality and serious injury estimates from stranding data and fisherman self-reports result from an actual count of verified human-caused deaths and serious injuries and are minimums because not all entangled animals strand or are self-reported nor are all stranded animals found, reported, or have the cause of death determined.

Table 2. Summary of Alaska Dall's 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 2015 and 2019 (Freed et al. 2021). Only cases of serious injury were recorded in this table; animals with non-serious injuries have been excluded.

Cause of injury	2015	2016	2017	2018	2019	Mean annual mortality
Entangled in unknown pot gear*	0	0	0	0	1[a]	0.2
*Total in unknown (commercial, recreational, or subsistence) fisheries						0.2

[a]MMAP fisherman self-report.

Based on observed mortality and serious injury in two commercial fisheries in 1990 and 2012-2013 (Table 1), the minimum estimated mean annual mortality and serious injury rate incidental to commercial fisheries between 2015 and 2019 is 37 Dall's porpoise from this stock. This is likely an underestimate because there is no current observer coverage for the salmon and herring fisheries (salmon and herring gillnet and purse seine and salmon hook and line) operating within the range of this stock and not all entangled animals strand or are self-reported nor are all stranded animals found, reported, or have the cause of death determined.

Alaska Native Subsistence/Harvest Information

There are no reports of subsistence take of Dall's porpoise in Alaska.

STATUS OF STOCK

Dall's porpoise are not designated as depleted under the Marine Mammal Protection Act or listed as threatened or endangered under the Endangered Species Act. The minimum estimated mean annual level of human-

caused mortality and serious injury for this stock (37 porpoise) is less than the calculated PBR (131 porpoise). The Alaska stock of Dall's porpoise is not classified as strategic. The minimum estimated mean annual mortality and serious injury rate (37 porpoise) in U.S. commercial fisheries is more than 10% of the calculated PBR (10% of PBR = 13 porpoise), so it is not considered insignificant and approaching a zero mortality and serious injury rate. However, the calculated PBR is likely biased low for the entire stock because it is based on an estimate from a 2015 survey of only a small portion of the stock's range, whereas the estimate of mortality and serious injury is for the stock's entire range, although there is no current observer coverage for the salmon and herring fisheries operating within the range of this stock. Population trends and status of this stock relative to its Optimum Sustainable Population are unknown.

There are key uncertainties in the assessment of the Alaska stock of Dall's porpoise. The most recent surveys of the entire range of this stock were more than 8 years ago, and the abundance estimate used to calculate an N_{MIN} and PBR level is based on a survey that covered only a small portion of the stock's range and was not corrected for various biases. There is no information on population trend. Several commercial fisheries overlap with the range of this stock and are not observed or have not been observed in a long time; thus, the estimate of commercial fishery mortality and serious injury is expected to be a minimum estimate. 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

Dall's porpoise are widely distributed in the North Pacific, ranging from shallow continental shelf waters (Friday et al. 2013) to deep central North Pacific waters (Ohizumi et al. 2003) and deep nearshore waters (Jefferson 1988, 2008). Thus, they are vulnerable to a variety of habitat impacts, including physical modifications from urban and industrial development (including waste management and non-point source runoff). Additionally, nearshore habitats are also subject to increased construction of docks and other overwater structures, filling of shallow areas, and 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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