HARBOR PORPOISE (*Phocoena phocoena*):
Northern California/Southern Oregon Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

In the Pacific, harbor porpoise are found in coastal and inland waters from Point Conception, California to Alaska and across to Kamchatka and Japan (Gaskin 1984). Harbor porpoise appear to have more restricted movements along the western coast of the continental U.S. than along the eastern coast. Regional differences in pollutant residues in harbor porpoise indicate that they do not move extensively between California, Oregon, and Washington (Calambokidis and Barlow 1991). That study also showed regional differences within California (although the sample size was small). This pattern is a sharp contrast with the eastern coast of the U.S. and Canada where harbor porpoise are believed to migrate seasonally from as far south as the Carolinas to the Gulf of Maine and Bay of Fundy (Polacheck *et al*. 1995). A phylogeographic analysis of genetic data from northeast Pacific harbor porpoise did not show complete concordance between DNA sequence types and geographic location (Rosel 1992). However, an analysis of molecular variance (AMOVA) of the same data with additional samples found significant genetic differences for four of the six pair-wise comparisons between the four areas investigated: California, Washington, British Columbia, and Alaska (Rosel *et al*. 1995). These results demonstrated that harbor porpoise along the west coast of North America are not panmictic or migratory, and movement is sufficiently restricted that genetic differences have evolved.
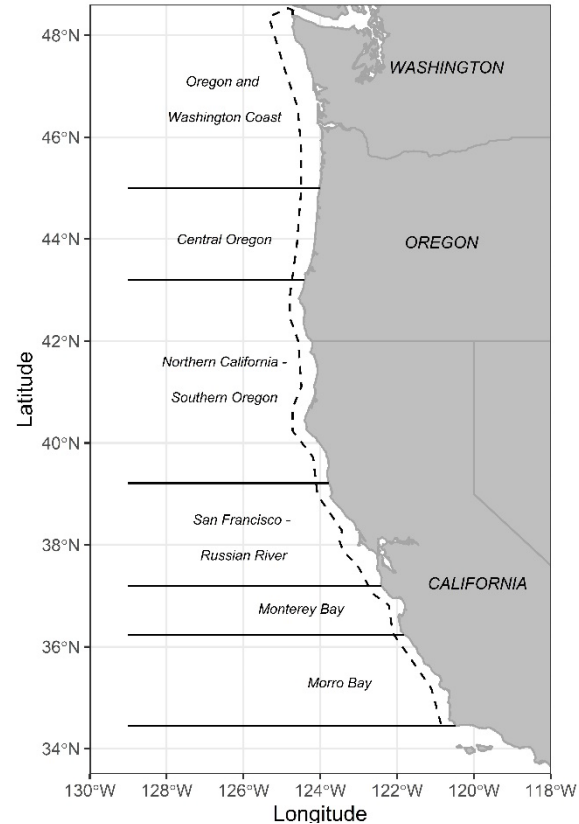

Figure 1. Stock boundaries and distributional range of harbor porpoise along the U.S. West Coast. Dashed line represents an approximate boundary for harbor porpoise habitat (0-200m water depth).

Significant genetic differences have been identified for harbor porpoises along the outer U.S. West Coast and in inland waters of Washington (Chivers *et al*. 2002, 2007; Morin *et al*. 2021), leading to the designation of multiple stocks in this region. The most recent study (Morin *et al.* 2021) identified additional genetic differences between porpoises found off central and southern Oregon, and suggested that a new stock boundary was warranted at approximately 43.2°N latitude. Based on these findings, the northern boundary of the Northern California – Southern Oregon stock has been moved south to 43.2°N, and a new central Oregon stock has been designated between 43.2°N and 45°N (Figure 1).

For the Marine Mammal Protection Act (MMPA) Stock Assessment Reports, the following harbor porpoise stocks are designated in the Pacific Ocean: 1) Morro Bay, 2) Monterey Bay, 3) San Francisco-Russian River, 4) Northern California/Southern Oregon, 5) Central Oregon, 6) Northern Oregon/Washington Coast, 7) Washington Inland Waters, 8) Northern Southeast Alaska Inland Waters, 9) Southern Southeast Alaska Inland Waters, 10) Yakutat/Southeast Alaska Offshore Waters, 11) Gulf of Alaska, and 12) Bering Sea. Reports for harbor porpoise stocks within waters of California, Oregon, and Washington appear in this volume. The five Alaska harbor porpoise stocks are reported separately in the Stock Assessment Reports for the Alaska Region.

POPULATION SIZE

Previous estimates of abundance for California harbor porpoise were based on aerial surveys conducted between the coast and the 50-fm isobath during 1988-95 (Barlow and Forney 1994, Forney 1999). These estimates did not include an unknown number of animals found in deeper waters. Barlow (1988) found that the vast majority of harbor porpoise in California were within the 0-50 fm depth range; however, Green et al. (1992) found that 24% of harbor porpoise seen during aerial surveys of Oregon and Washington were between the 100m and 200m isobaths (55 to 109 fathoms). A systematic ship survey of depth strata out to 90 m in northern California showed that porpoise abundance declined significantly in waters deeper than 60 m (Carretta *et al*. 2001). Since 1999, aerial surveys extended farther offshore (to the 200m depth contour or 15 nmi distance, whichever is farther) to provide a more complete abundance estimate (Forney *et al.* 2014). An analysis of long-term trends in the northern California portion of this harbor porpoise stock between 1989 and 2016 (Forney *et al.* 2020) estimated a northern California population size of 12,160 (CV=0.663) porpoises during 2016. More recently, Forney *et al.* (2023) estimated the abundance of harbor porpoise within the Oregon range of this stock (south of 43.2°N) to be 3,143 (CV = 0.464) based on a habitat-based density model developed from 2021-2022 aerial surveys off Oregon and Washington. Both of these estimates include a correction factor of 3.42 (1/g(0); g(0)=0.292, CV=0.366) (Laake *et al*. 1997) to adjust for groups missed by aerial observers. Combining these two abundance estimates yields an overall abundance estimate of 15,303 (CV = 0.575) for the entire northern California/southern Oregon stock (Forney *et al.* 2023).

Minimum Population Estimate

The minimum population estimate for harbor porpoise in the northern California/southern Oregon stock is calculated as the lower 20th percentile of the log-normal distribution of the abundance estimate given above, or 9,759 animals.

Current Population Trend

A hierarchical Bayesian analysis of harbor porpoise trends for the northern California portion of this stock between 1989 and 2016 (Forney *et al.* 2020) suggests largely stable population during this period, although there is considerable uncertainty in the estimates because of limited survey coverage (Figure 2). No trend estimates are available for the entire northern California/southern Oregon range of this stock.
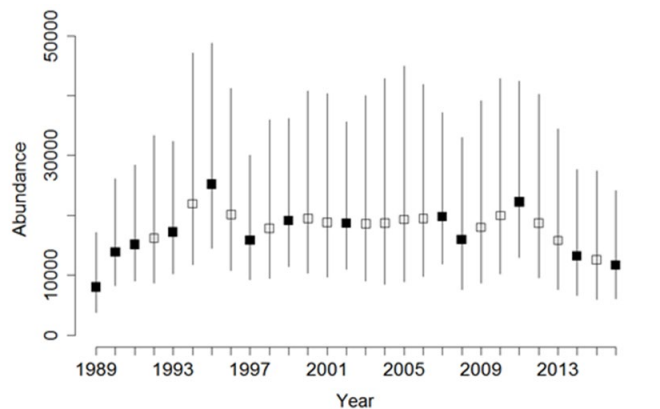

Figure 2. Population trends for the northern California portion of the Northern California / Southern Oregon harbor porpoise stock, 1989-2016 (from Forney *et al.* 2020). Estimates represent median abundance (with 95% credible intervals) for years with survey effort (solid symbols) and without survey effort (open symbols).

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

Based on what are argued to be biological limits of the species (i.e. females give birth first at age 4 and produce one calf per year until death), the theoretical, maximum-conceivable growth rate of a closed harbor porpoise population was estimated as 9.4% per year based on a human survivorship curve (Barlow and Boveng 1991). This is very similar to the growth rate of 9.6% per year (95% credible interval: 6.2% - 13.0%) estimated by Forney *et al.* (2020) for the Morro Bay harbor porpoise stock between 1991 and 2012, based on long-term aerial surveys. Because a reliable estimate of the maximum net productivity rate is not available for the Northern California / Southern Oregon harbor porpoise stock, we use the default maximum net productivity rate (R_{MAX}) of 4% for cetaceans (Wade and Angliss 1997).

POTENTIAL BIOLOGICAL REMOVAL

The potential biological removal (PBR) level for this stock is calculated as the minimum population size (9,759) <u>times</u> one half the default maximum net growth rate for cetaceans (½ of 4%) <u>times</u> a recovery factor of 1.0 (for a species within its Optimal Sustainable Population; see Status of Stock section; Wade and Angliss 1997), resulting in a PBR of 195.

HUMAN-CAUSED MORTALITY
Fishery Information
There were no harbor porpoise strandings in this stock's range with evidence of fishery interactions during 2017-2021 (Carretta *et al.* 2023).

Table 1. Summary of available information on incidental mortality and injury of harbor porpoise (northern California/southern Oregon stock) in commercial fisheries that might take this species during 2017-2021 (Carretta *et al.* 2023). n/a indicates that data are not available.

Fishery Name	Year(s)	Data Type	Percent Observer Coverage	Observed Mortality	Estimated Mortality (CV in parentheses)	Mean Annual Takes (CV in parentheses)
Unknown fishery	2017-2021	Stranding	-	none	n/a	0 (n/a)
Minimum total annual takes						0 (n/a)

STATUS OF STOCK
Harbor porpoise in northern California/southern Oregon are not listed as threatened or endangered under the Endangered Species Act nor as depleted under the Marine Mammal Protection Act. The northern California portion of this harbor porpoise stock was determined to be within their Optimum Sustainable Population (OSP) level in the mid-1990s (Barlow and Forney 1994), based on a lack of significant anthropogenic mortality. Because there is no known human-caused mortality or serious injury, this stock is not considered a "strategic" stock under the MMPA, and fishery mortality can be considered insignificant and approaching zero mortality and serious injury rate.

OTHER FACTORS THAT MAY BE AFFECTING THE STOCK
Harbor porpoises are sensitive to disturbance by a variety of anthropogenic sound sources, and the limited range of several U.S. West Coast harbor porpoise stocks makes them particularly vulnerable to potential impacts (Forney *et al*. 2017). A recent habitat concern along the U.S. West coast includes the use of acoustic deterrent devices ('seal bombs') that are used in commercial fishing activities off California (Simonis *et al*. 2020), especially in the Monterey Bay region.

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