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HARBOR PORPOISE (*Phocoena phocoena*): Northern California 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 some regional differences within California (although the sample size was small). This pattern stands as a sharp contrast to 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 demonstrate 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. Recent preliminary genetic analyses of samples ranging from Monterey Bay, California to Vancouver Island, British Columbia indicate that there are at least nine genetically distinct populations (S. Chivers, pers. comm.).

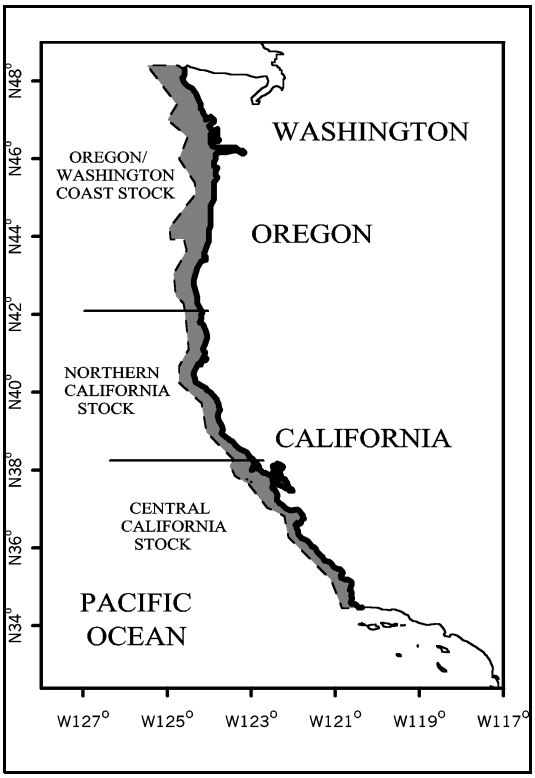

Figure 1. Stock boundaries and distributional range of harbor porpoise along the U.S. west coast. Shaded area represents harbor porpoise habitat (0 - 200 m) along the U.S. west coast.

In their assessment of harbor porpoise, Barlow and Hanan (1995) recommended that the animals inhabiting central California (defined to be from Point Conception to the Russian River) be treated as a separate stock. Their justifications for this were: 1) fishery mortality of harbor porpoise is limited to central California, 2) movement of individual animals appears to be restricted within California, and consequently 3) fishery mortality could cause the local depletion of harbor porpoise if central California is not managed separately. Although geographic structure exists along an almost continuous distribution of harbor porpoise from California to Alaska, stock boundaries are difficult to draw because any rigid line is (to a greater or lesser extent) arbitrary from a biological perspective. Nonetheless, failure to recognize geographic structure by defining management stocks can lead to depletion of local populations. Following the guidance of Barlow and Hanan (1995), we will consider the harbor porpoise in northern California as a separate stock. Based on recent genetic findings (Chivers, pers. comm.), U.S. West coast stocks are likely to be re-evaluated once ongoing analyses have been finalized and peer-reviewed. For the 2000 Marine Mammal Protection Act (MMPA) Stock Assessment Reports, other Pacific coast harbor porpoise stocks include: 1) a central California stock, 2) an Oregon/Washington coast stock, 3) an Inland Washington stock, 4) a Southeast Alaska stock, 5) a Gulf of Alaska stock, and 6) a Bering Sea stock. The stock assessment reports for central California harbor porpoise appears in this volume. Oregon and Washington stock assessment reports appear in Forney et al. (2000) and are also reprinted unrevised in this volume. The three 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 1999a). 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 recent analysis of harbor porpoise trends including oceanographic data suggests that the proportion of California harbor porpoise in deeper waters may vary between years (Forney 1999b; see Current Population Trend below). In 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. Based on pooled 1995-99 aerial survey data including data from both inshore and offshore areas, an updated estimate of abundance for the northern California harbor porpoise stock is 15,198 harbor porpoise (CV=0.39; NMFS, K. Forney, unpublished data, following methods of Forney 1999a). Approximately 2,554 (CV=0.80) of these animals were estimated for the offshore stratum. The estimate for the inshore stratum (12,644, CV=0.38) is similar to the previous estimate of 11,066 (CV=0.39) for 1993-97 (Forney 1999b).

Minimum Population Estimate

The minimum population estimate for harbor porpoise in northern California is taken as the lower 20th percentile of the log-normal distribution of the abundance estimated from the 1995-99 aerial surveys, or 11,054 animals. This estimate includes harbor porpoise within an area extending to the 200m isobath or 15 nmi, whichever is farther from shore.

Current Population Trend

Forney (1999b) examines trends in relative harbor porpoise abundance in central and northern California based on aerial surveys from 1989-95. No significant trends were evident over this time period for the Northern California Stock. The 1997-99 survey results continue to show no trend in relative abundance (Figure 2).

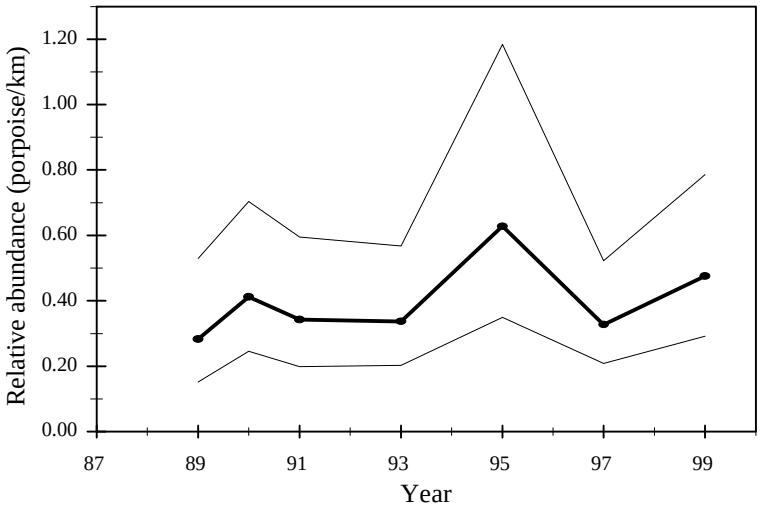

Figure 2. Relative abundance (+/- one standard error) of northern California harbor porpoise, 1989-99, adjusted for sea state and cloud cover (following methods of Forney 1995).

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 (Barlow and Boveng 1991). This maximum theoretical rate may not be achievable for any real population. [Woodley and Read (1991) calculate a maximum growth rate of approximately 5% per year, but their argument for this being a maximum (i.e. that porpoise survival rates cannot exceed those of Himalayan thar) is not well justified.] Population growth rates have not actually been measured for any harbor porpoise population. Because a reliable estimate of the maximum net productivity rate is not available for northern California harbor porpoise, it is recommended that the cetacean maximum theoretical net productivity rate (R_{MAX}) of 4% (Wade and Angliss 1997) be employed.

POTENTIAL BIOLOGICAL REMOVAL

The potential biological removal (PBR) level for this stock is calculated as the minimum population size

(11,054) times one half the default maximum net growth rate for cetaceans (½ of 4%) times a recovery factor of 1.0 (for a species within its Optimal Sustainable Population; Wade and Angliss 1997), resulting in a PBR of 221.

HUMAN-CAUSED MORTALITY

Fishery Information

The incidental capture of harbor porpoise in California is largely limited to set gillnet fisheries in central California. Coastal setnets are not allowed in northern California (to protect salmon resources there). However, one harbor porpoise mortality was documented from stranding reports for the Klamath River tribal salmon gillnet fishery in 1995 (NMFS, Southwest Region, unpublished data). Additionally, in 1998, two harbor porpoise strandings near Bodega Head were attributed to fishery-related mortality, but the responsible fishery is unknown. Although the stranding location falls within the range of the central California harbor porpoise stock and this is probably the source stock for the mortalities, it is possible that these animals were taken from the northern California stock and subsequently drifted southward to the stranding location. Efforts are underway to identify fisheries that may have been responsible.

Table 1. Summary of available information on incidental mortality and injury of harbor porpoise (northern CA stock) in fisheries that might take this species. 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)
CA Klamath River tribal salmon gillnet fishery	1995-99	Stranding reports	n/a	1(1995)	$\geq$ 1	$\geq$ 0.2 (n/a)
Minimum total annual takes						$\geq$ 0.2 (n/a)

STATUS OF STOCK

Harbor porpoise in California are not listed as threatened or endangered under the Endangered Species Act nor as depleted under the Marine Mammal Protection Act. There are no known habitat issues that are of particular concern for this stock. Because of the lack of recent or historical sources of human-caused mortality, the harbor porpoise stock in northern California has been concluded to be within their Optimum Sustainable Population (OSP) level (Barlow and Forney 1994). Because the known human-caused mortality or serious injury (0.2 harbor porpoise per year) is less than the PBR (221), this stock is not considered a "strategic" stock under the MMPA. Because average annual fishery mortality is less than 10% of the PBR, the fishery mortality can be considered insignificant and approaching zero mortality and serious injury rate.

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