Revised 10/15/2009

# HARBOR PORPOISE (*Phocoena phocoena*): San Francisco-Russian River 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 is small-scale subdivision within the U.S. portion of this range (Chivers *et al.*, 2002, 2007).

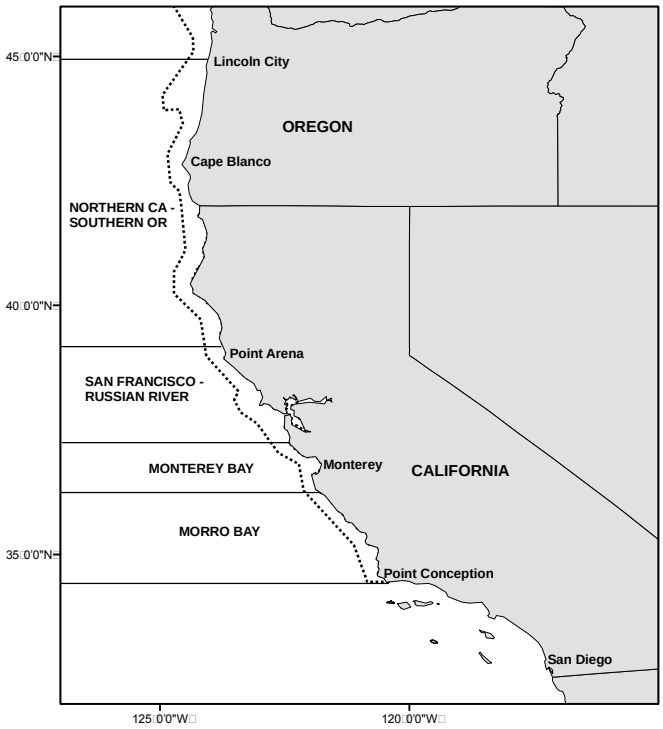


**Figure 1.** Stock boundaries and distributional range of harbor porpoise along the California and southern Oregon coasts. Dashed line represents harbor porpoise habitat (0-200 m) along the U.S. west coast.

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. Based on recent genetic findings (Chivers *et al.*, 2002, 2007), California coast stocks were re-evaluated, and significant genetic differences were found among 4 identified sampling sites. Revised stock boundaries are presented here based on these genetic data and density discontinuities identified from aerial surveys,

resulting in six California/Oregon/Washington stocks where previously there had been four (Carretta *et al*. 2001a). The stock boundaries for animals that occur in California/southern Oregon waters are shown in Figure 1. For the 2002 Marine Mammal Protection Act (MMPA) Stock Assessment Reports, other Pacific coast harbor porpoise stocks include: 1) a Morro Bay stock, 2) a Monterey Bay stock, 3) a northern California/southern Oregon stock, 4) an Oregon/Washington coast stock, 5) an Inland Washington stock, 6) a Southeast Alaska stock, 7) a Gulf of Alaska stock, and 8) a Bering Sea stock. Stock assessment reports for Morro Bay, Monterey Bay, northern California/southern Oregon, Oregon/Washington coast, and Inland Washington waters harbor porpoise appear 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 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.* 2001b). 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). Since 1999, aerial surveys extended farther offshore (to the 200m depth contour or a minimum of 15 nmi from shore in the region of the San Francisco-Russian River stock) to provide a more complete abundance estimate. Based on 2002-2007 aerial surveys under good survey conditions (Beaufort ≤2, cloud cover ≤25%) the estimate of abundance for this stock is 9,189 animals (CV= 0.38) (Carretta et al., 2009 ).

**Minimum Population Estimate**

The minimum population estimate for the San Francisco-Russian River harbor porpoise stock is taken as the lower 20th percentile of the log-normal distribution of the abundance estimated from 2002-2007 aerial surveys, or 6,745 animals.

**Current Population Trend**

Abundance of the San Francisco - Russian River harbor porpoise stock appeared to be stable or declining between 1988-1991 and has steadily increased since 1993, however the slope of the linear regression on the natural logarithm of abundance over time is not statistically significant ($p = 0.14$, Figure 2).

**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, 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 (6,745) times one half the default maximum net growth rate for cetaceans (½ of 4%) times a recovery factor of 0.5 (for a species of unknown status; Wade and Angliss 1997), resulting in a PBR of 67.

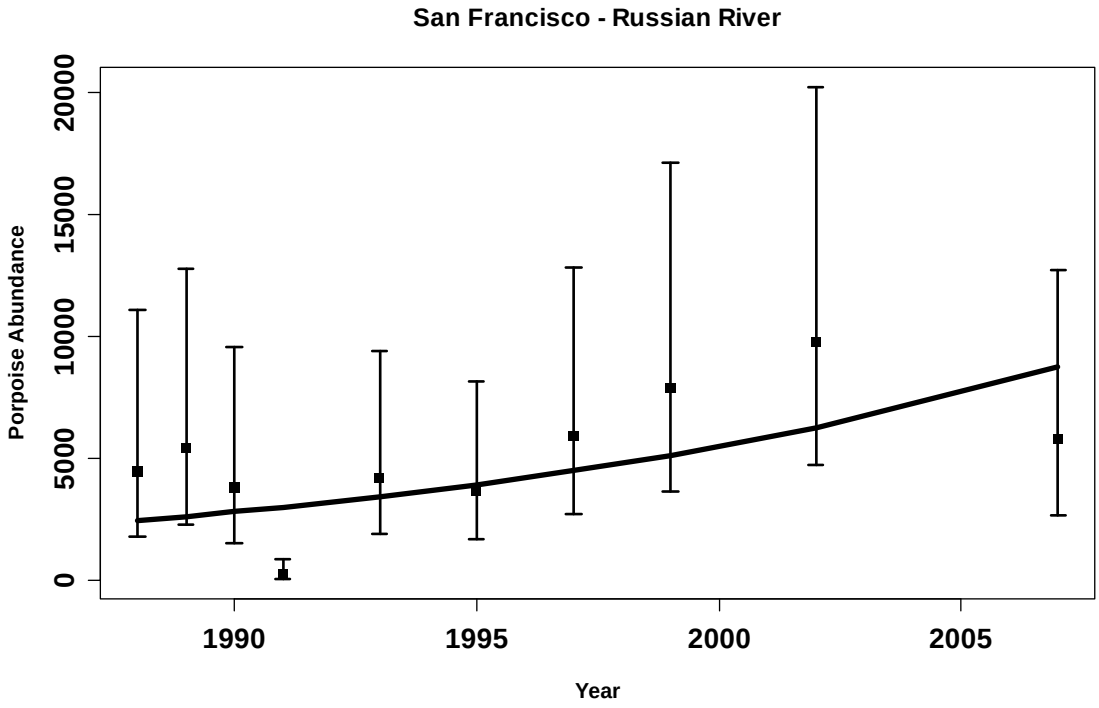


**Figure 2.** Aerial survey annual estimates of abundance for the San Francisco – Russian River stock of harbor porpoise (inshore stratum only), 1988- 2007. Error bars represent lower and upper 95% confidence intervals. Solid line represents a linear regression of the natural logarithim of abundance over time. The slope of this regression line is not statistically significant ($p = 0.24$, $r^2=0.17$)

## HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

### Fishery Information

Although coastal gillnets are prohibited throughout this stock's range, there have been fishery-related strandings in past years. No fishery-related strandings occurred during the most recent five-year period (2003-2007) but did occur to the north and south of this stock's range. It is possible that some of the fishery-related strandings recorded in the Monterey Bay area during the most recent five-year period were killed in the San Francisco – Russian River stratum and drifted south to their observed stranding locations.

**Table 1.** Summary of available information on incidental mortality and injury of harbor porpoise (San Francisco-Russian River stock) in commercial fisheries that might take this species. No fishery takes or fishery-related strandings were reported in this region between 2003 and 2007. n/a indicates that data are not available.

| Fishery Name | Year(s) | Data Type | Percent Observer Coverage | Observed Mortality | Kill/Day | Estimated Mortality (CV in parentheses) | Mean Annual Takes (CV in parentheses) |
|---|---|---|---|---|---|---|---|
| **Unknown fishery** | 2003-2007 | stranding | n/a | none | n/a | n/a | 0 (n/a) |
| **Minimum total annual takes** | | | | | | | 0 (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. Barlow and Hanan (1995) calculate the status of harbor porpoise relative to historic carrying capacity (K) using a technique called back-projection. They calculate that the central California population (including Morro Bay, Monterey Bay, and San Francisco-Russian River stocks) could have been reduced to between 30% and 97% of K by incidental

fishing mortality, depending on the choice of input parameters. They conclude that there is no practical way to reduce the range of this estimate. New information does not change this conclusion, and the status of central California harbor porpoise populations relative to their Optimum Sustainable Population (OSP) levels must be treated as unknown. There are no known habitat issues that are of particular concern for this stock. Because the known human-caused mortality or serious injury (zero harbor porpoise per year) is less than the PBR (67), 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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