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HARBOR PORPOISE (*Phocoena phocoena*): Oregon/Washington Coast Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

In the eastern North Pacific Ocean, the harbor porpoise ranges from Point Barrow, along the Alaskan coast, and down the west coast of North America to Point Conception, California (Gaskin 1984). Harbor porpoise primarily frequent coastal waters. Harbor porpoise are known to occur year-round in the inland trans-boundary area of Washington and British Columbia, Canada (Osborne et al. 1988), and along the Oregon/Washington coast (Barlow 1988, Barlow et al. 1988, Green et al. 1992). Aerial survey data from coastal Oregon and Washington, collected during all seasons, suggests that harbor porpoise distribution varies by depth (Green et al. 1992). Although distinct seasonal changes in abundance along the west coast have been noted, and attributed to possible shifts in distribution to deeper offshore waters during late winter (Dohl et al. 1983, Barlow 1988), harbor porpoise have also been conspicuously absent in offshore areas in late November (B. Taylor, pers. comm.) leaving a gap in the current understanding of their movements.

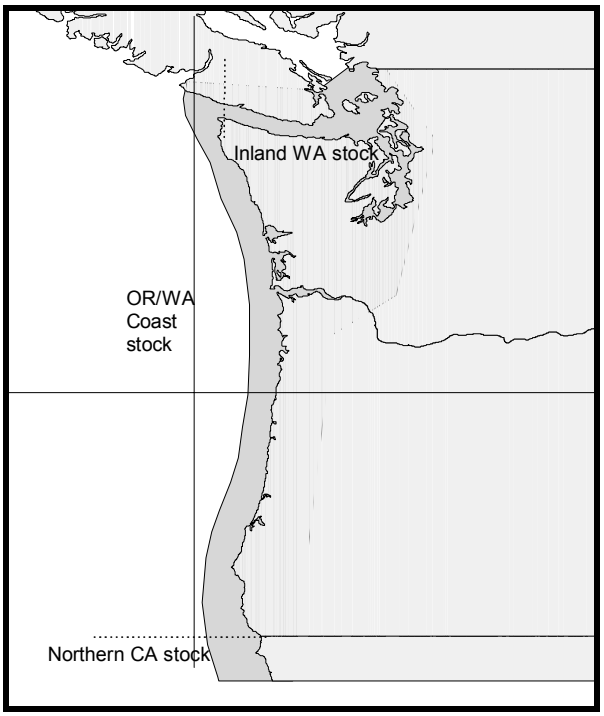

Figure 1. Approximate distribution of harbor porpoise in the U.S. Pacific Northwest (shaded area). Stock boundaries separating the stocks are shown.

Stock discreteness in the eastern North Pacific was analyzed using mitochondrial DNA from samples collected along the west coast (Rosel 1992) and is summarized in Osmek et al. (1994). Two distinct mtDNA groupings or clades exist. One clade is present in California, Washington, British Columbia, and Alaska (no samples were available from Oregon), while the other is found only in California and Washington. Although these two clades are not geographically distinct by latitude, the results may indicate 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). Further genetic testing of the same data mentioned above, along 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 that movement is sufficiently restricted to evolve genetic differences. This is consistent with low movement suggested by genetic analysis of harbor porpoise specimens from the North Atlantic, where numerous stocks have been delineated with clinal differences over areas as small as the waters surrounding the British Isles.

Using the 1990-91 aerial survey data of Calambokidis et al. (1993) for water depths < 50 fathoms, Osmek et al. (1996) found significant differences in harbor porpoise mean densities ($z=5.9$, $p<0.01$) between the waters of coastal Oregon/Washington and inland Washington/southern British Columbia, Canada (i.e., Strait of Juan de Fuca/San Juan Islands). Although differences in density exist between coastal Oregon/Washington and inland Washington, a specific stock boundary line cannot be identified based upon biological or genetic differences. However, because harbor porpoise movements and rates of intermixing within the northeast Pacific are restricted, there has been a significant decline in harbor porpoise sightings within southern Puget Sound since the 1940s and, following a risk averse management strategy, two stocks are recognized to occur in Oregon and Washington waters (the Oregon/Washington Coast stock and the Inland Washington stock), with the boundary at Cape Flattery. Recent genetic evidence suggests that the population of eastern North Pacific harbor porpoise is more finely structured than is currently recognized (S. Chivers, pers. comm.). All relevant data (e.g., genetic samples, contaminant studies, and satellite tagging) will be reviewed to determine whether to adjust the stock boundaries for harbor porpoise in Oregon and Washington waters.

In their assessment of California harbor porpoise, Barlow and Hanan (1995) recommended two stocks be recognized in California, with the stock boundary at the Russian River. Based on the above information, four separate

harbor porpoise stocks are recognized to occur along the west coast of the continental U.S. (see Fig. 1): 1) the Inland Washington stock, 2) the Oregon/Washington Coast stock, 3) the Northern California stock, and 4) the Central California stock. This report considers only the Oregon/Washington Coast stock, with stock assessment reports for the Inland Washington and both California stocks appearing in this volume. Three harbor porpoise stocks are also recognized in the inland and coastal waters of Alaska, including the Southeast Alaska, Gulf of Alaska, and Bering Sea stocks. The three Alaska harbor porpoise stocks are reported separately in the Stock Assessment Reports for the Alaska Region. The harbor porpoise occurring in British Columbia have not been included in any stock assessment report from either the Alaska Region or Pacific Northwest (Oregon/Washington).

POPULATION SIZE

In August and September 1997, an aerial survey of Oregon, Washington, and southern British Columbia coastal waters, from shore to 200 m depth, resulted in an observed abundance of 13,036 (CV=0.11) harbor porpoise in U.S. waters (Laake et al. 1998a). Using a correction factor of 3.42 (1/g(0); g(0)=0.292, CV=0.366) to adjust for groups missed by aerial observers, the corrected estimate of abundance for harbor porpoise in coastal Oregon and Washington waters is 44,644 (CV=0.38). This estimate represents a substantial increase over the 1991 estimate of 26,175 (Osmek et al. 1996) due to: 1) the larger sampling region in the 1997 survey (out to water depths of 200 m vs. 91 m in 1991), and 2) a different estimate of g(0) (Laake et al. 1998a).

Minimum Population Estimate

The minimum population estimate (N_{MIN}) for this stock is calculated using Equation 1 from the PBR Guidelines (Wade and Angliss 1997): $N_{MIN} = N/\exp(0.842*[\ln(1+[CV(N)]^2)]^{½})$. Using the population estimate (N) of 44,644 and its associated CV(N) of 0.38, N_{MIN} for the Oregon/Washington Coast stock of harbor porpoise is 32,769.

Current Population Trend

There are no reliable data on population trends of harbor porpoise for coastal Oregon, Washington, or British Columbia waters.

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

A reliable estimate of the maximum net productivity rate is currently not available for harbor porpoise. Therefore, until additional data become available, it is recommended that the cetacean maximum theoretical net productivity rate (R_{MAX}) of 4% (Wade and Angliss 1997) be employed for the Oregon/Washington Coast harbor porpoise stock.

POTENTIAL BIOLOGICAL REMOVAL

The potential biological removal (PBR) level for this stock is calculated as the minimum population size (32,769) times one-half the default maximum net growth rate for cetaceans (½ of 4%) times a recovery factor of 0.5 (for a stock of unknown status, Wade and Angliss 1997), resulting in a PBR of 328 harbor porpoise per year.

HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

Fisheries Information

Within the EEZ boundaries of coastal Oregon and Washington, human-caused (fishery) mortalities of harbor porpoise are presently known to occur only in the northern Washington marine set gillnet fishery. During 1992-1993 the WA/OR Lower Columbia River, WA Grays Harbor, and WA Willapa Bay drift gillnet fisheries were monitored at observer coverages of approximately 4% and 2%, respectively. There were no observed harbor porpoise mortalities in these fisheries.

NMFS observers monitored the northern Washington marine set gillnet fishery during 1993-1998 (Gearin et al. 1994, 2000; P. Gearin, unpubl. data); 1994 observer data recently became available and will be included in a future stock assessment report. For the entire area fished (coastal + inland waters), observer coverage ranged from approximately 40 to 98% during those years. Fishing effort is conducted within the range of both harbor porpoise stocks (Oregon/Washington Coast and Inland Washington stocks) occurring in Washington State waters. Some of the animals taken in the inland waters portion of the fishery (see the Inland Washington stock assessment report for details) may have been animals from the coastal stock. Similarly, some of the animals taken in the coastal portion of the fishery may have been from the inland stock. For the purposes of this stock assessment report, the animals taken in the inland portion of the fishery are assumed to have belonged to the Inland Washington stock and the animals taken in the coastal

portion of the fishery are assumed to have belonged to the Oregon/Washington Coast stock. Some movement of harbor porpoise between Washington's coastal and inland waters is likely, but it is currently not possible to quantify the extent of such movements. Accordingly, Table 1 includes data only from that portion of the northern Washington marine set gillnet fishery occurring within the range of the Oregon/Washington Coast stock (those waters south and west of Cape Flattery), where observer coverage was 100% in 1995-1997. No fishing effort occurred in the coastal portion of the fishery in 1993 or 1998. Data from 1993 to 1998 are included in Table 1, although the mean estimated annual mortality is calculated using the most recent 5 years of available data. The mean estimated mortality for this fishery is 12.4 (CV=0.46) harbor porpoise per year from this stock.

Table 1. Summary of incidental mortality of harbor porpoise (Oregon/Washington Coast stock) in commercial and tribal fisheries and calculation of the mean annual mortality rate; n/a indicates that data are not available. Mean annual takes are based on 1994-98 data unless noted otherwise.

Fishery name	Years	Data type	Percent observer coverage	Observed mortality	Estimated mortality	Mean annual takes (CV in parentheses)
Northern WA marine set gillnet (tribal fishery: coastal waters)	93	obs data	no fishery	0	0	12.4 (0.46)[1]
	94		n/a	n/a	n/a	
	95		100%	20	20	
	96		100%	29	29	
	97		100%	13	13	
	98		no fishery	0	0	
Estimated total annual takes						12.4 (0.46)

[1]1993 and 1995-98 mortality estimates are included in the average.

The 1995-1997 data for the northern Washington marine set gillnet fishery were collected as part of an experiment, conducted in cooperation with the Makah Tribe, designed to explore the merits of using acoustic alarms to reduce bycatch of harbor porpoise in salmon gillnets. Results in 1995-1996 indicated that the nets equipped with acoustic alarms had significantly lower entanglement rates, as only 2 of the 49 mortalities occurred in alarmed nets (Gearin et al. 1996, 2000; Laake et al. 1997). Harbor porpoise were displaced by an acoustic buffer around the net, but it is unclear whether the porpoise were repelled by the alarms or whether it was their prey that were repelled (Kraus et al. 1997, Laake et al. 1998b). Because this fishery is likely to have acoustic devices on all nets in the future, the mean mortality estimated from non-alarmed nets may not be applicable. In 1997, 13 mortalities were observed (100% observer coverage) in this fishery and 96% of the sets were equipped with acoustic alarms (Gearin et al. 2000; P. Gearin, unpubl. data).

An additional source of information on the number of harbor porpoise killed or injured incidental to commercial fishery operations is the self-reported fisheries information required of vessel operators by the MMPA. During the period between 1994 and 1998, there were no fisher self-reports of harbor porpoise mortalities from any fisheries operating within the range of the Oregon/Washington Coast stock. However, because logbook records (fisher self-reports required during 1990-94) are most likely negatively biased (Credle et al. 1994), these are considered to be minimum estimates. Self-reported fisheries data are incomplete for 1994, not available for 1995, and considered unreliable after 1995 (see Appendix 4 in Hill and DeMaster 1998).

There have been no fishery-related strandings of harbor porpoise from this stock dating back to at least 1990.

STATUS OF STOCK

Harbor porpoise are not listed as "depleted" under the MMPA or listed as "threatened " or "endangered" under the Endangered Species Act. Based on the currently available data, the level of human-caused mortality and serious injury (12) does not exceed the PBR (328). Therefore, the Oregon/Washington Coast stock of harbor porpoise is not classified as strategic. The total fishery mortality and serious injury for this stock (12; based on observer data) is not known to exceed 10% of the calculated PBR (33) and, therefore, can be considered to be insignificant and approaching zero mortality and serious injury rate. The status of this stock relative to its Optimum Sustainable Population (OSP) level and population trends is unknown.

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