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HARBOR SEAL (*Phoca vitulina richardsi*): Oregon/Washington Coast Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

Harbor seals inhabit coastal and estuarine waters off Baja California, north along the western coasts of the continental U.S., British Columbia, and Southeast Alaska, west through the Gulf of Alaska and Aleutian Islands, and in the Bering Sea north to Cape Newenham and the Pribilof Islands. They haul out on rocks, reefs, beaches, and drifting glacial ice and feed in marine, estuarine, and occasionally fresh waters. Harbor seals generally are non-migratory, with local movements associated with such factors as tides, weather, season, food availability, and reproduction (Scheffer and Slipp 1944; Fisher 1952; Bigg 1969, 1981). Harbor seals do not make extensive pelagic migrations though some long distance movement of tagged animals in Alaska (174 km) and along the U.S. west coast (up to 550 km) have been recorded (Pitcher and McAllister 1981, Brown and Mate 1983, Herder 1986). Harbor seals have also displayed strong fidelity for haulout sites (Pitcher and Calkins 1979, Pitcher and McAllister 1981).

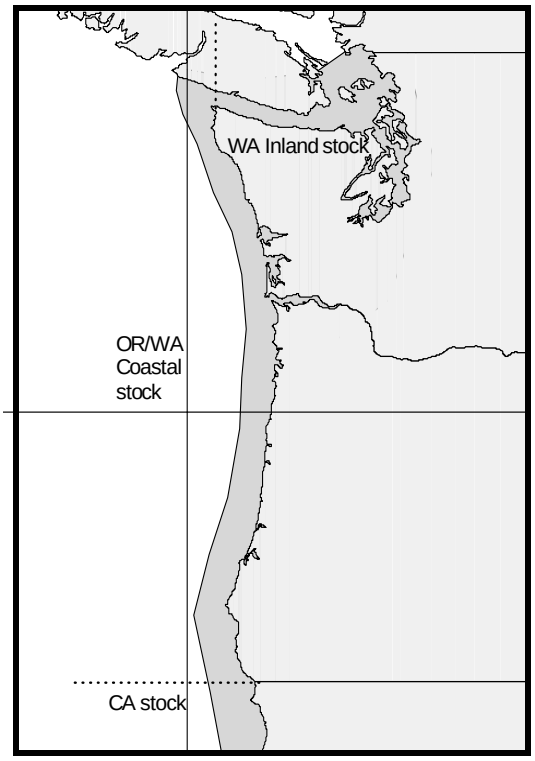

Figure 1. Approximate distribution of harbor seals in the U.S. Pacific Northwest (shaded area). Stock boundaries separating the three stocks are shown.

For management purposes, differences in mean pupping date (Temte 1986), movement patterns (Jeffries 1985, Brown 1988), pollutant loads (Calambokidis et al. 1985) and fishery interactions have led to the recognition of three separate harbor seal stocks along the west coast of the continental U.S. (Boveng 1988): 1) inland waters of Washington State (including Hood Canal, Puget Sound, and the Strait of Juan de Fuca out to Cape Flattery), 2) outer coast of Oregon and Washington, and 3) California (see Fig. 1). Recent genetic analyses provide additional support for this stock structure (Huber et al. 1994, Burg 1996, Lamont et al. 1996). Samples from Washington, Oregon, and California demonstrate a high level of genetic diversity and indicate that the harbor seals of inland Washington waters possess unique haplotypes not found in seals from the coasts of Washington, Oregon, and California (Lamont et al. 1996). This report considers only the Oregon/Washington Coast stock. Harbor seal stocks that occur in the inland and coastal waters of Alaska are discussed separately in the Stock Assessment Reports for the Alaska Region.

POPULATION SIZE

Aerial surveys of harbor seals in Oregon and Washington were conducted by personnel from the National Marine Mammal Laboratory (NMML) and the Oregon and Washington Departments of Fish and Wildlife (ODFW and WDFW) during the 1999 pupping season. Total numbers of hauled-out seals (including pups) were counted during these surveys. In 1999, the mean count of harbor seals occurring along the Washington coast was 10,430 (CV=0.14) animals (Jeffries et al. 2003). In 1999, the mean count of harbor seals occurring along the Oregon coast and in the Columbia River was 5,735 (CV=0.14) animals (Brown 1997; ODFW, unpubl. data). Combining these counts results in 16,165 (CV=0.10) harbor seals in the Oregon/Washington Coast stock.

Radio-tagging studies conducted at six locations (three Washington inland waters sites and three Oregon and Washington coastal sites) collected information on haulout patterns from 63 harbor seals in 1991 and 61 harbor seals in 1992. Haulout data from coastal and inland sites were not significantly different and were thus pooled, resulting in a correction factor of 1.53 (CV=0.065) to account for animals in the water which are missed during the aerial surveys (Huber et al. 2001). Using this correction factor results in a population estimate of 24,732 (16,165 x 1.53; CV=0.12) for the Oregon/Washington Coast stock of harbor seals in 1999 (Jeffries et al. 2003; ODFW, unpubl. data).

Minimum Population Estimate

The log-normal 20th percentile of the 1999 population estimate for this stock is 22,380 harbor seals.

Current Population Trend

Historical levels of harbor seal abundance in Oregon and Washington are unknown. The population apparently decreased during the 1940s and 1950s due to state-financed bounty programs. Approximately 17,133 harbor seals were killed in Washington by bounty hunters between 1943 and 1960 (Newby 1973). More than 3,800 harbor seals were killed in Oregon between 1925 and 1972 by bounty hunters and a state-hired seal hunter (Pearson 1968). The population remained relatively low during the 1960s but, since the termination of the harbor seal bounty program and with the protection provided by the passage of the Marine Mammal Protection Act (MMPA) in 1972, harbor seal counts for this stock have increased from 6,389 in 1977 to 16,165 in 1999 (Jeffries et al. 2003; ODFW, unpubl. data).

Between 1983 and 1996, the annual rate of increase for this stock was 4%, with the peak count of 18,667 seals occurring in 1992. From 1991 to 1996, however, this stock declined 1.6% (t=3.25; p=0.083) annually (Jeffries et al. 1997), which may indicate that this population has exceeded equilibrium levels. Analyzing only the Oregon data (average annual rate of increase was 0.3% from 1988-96) indicates that the Oregon segment of the stock may be approaching equilibrium (Brown 1997).

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

The Oregon/Washington Coast harbor seal stock increased at an annual rate of 7% from 1983 to 1992 and at 4% from 1983 to 1996 (Jeffries et al. 1997). Because the population was not at a very low level by 1983, the observed rates of increase may underestimate the maximum net productivity rate (R_{MAX}). When a logistic model was fit to the Washington portion of the 1975-1999 abundance data, the resulting estimate of R_{MAX} was 18.5% (95% CI = 12.9-26.8%) (Jeffries et al. 2003). This value of R_{MAX} is higher than the default pinniped population growth rate value of 12%; however, since it applies to only a portion of the stock, the actual rate for the entire stock is uncertain. Therefore, until additional data for the entire stock become available, the pinniped default maximum theoretical net productivity rate (R_{MAX}) of 12% will be employed for this harbor seal stock (Wade and Angliss 1997).

POTENTIAL BIOLOGICAL REMOVAL

The potential biological removal (PBR) level for this stock is calculated as the minimum population estimate (22,380) times one-half the default maximum net growth rate for pinnipeds (½ of 12%) times a recovery factor of 1.0 (for stocks thought to be within OSP, Wade and Angliss 1997), resulting in a PBR of 1,343 harbor seals per year.

HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

Fisheries Information

NMFS observers monitored the northern Washington marine set gillnet fishery in 1997, 1998, and 2000. There was no observer coverage in 1999 or 2001; the total fishing effort was four and 46 net days, respectively, in those years and occurred only in inland waters (Gearin et al. 1994, 2000; P. Gearin, unpubl. data). For the entire fishery (coastal + inland waters), observer coverage ranged from approximately 40 to 98% during observed years. Fishing effort is conducted within the range of both stocks of harbor seals (Oregon/Washington Coast and Washington Inland Waters stocks) occurring in Washington State waters. 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 Washington Inland Waters 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 animals between Washington's coastal and inland waters is likely, although data from tagging studies have not shown movement of harbor seals between the two locations (Huber et al. 2001). 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 1997 and 2000. No fishing effort occurred in the coastal portion of the fishery in 1998, 1999, or 2001. The mean estimated mortality for this fishery in 1997-2001 is 3.2 (CV=0.79) harbor seals per year from this stock.

The WA/OR/CA groundfish trawl fishery (Pacific whiting component) was monitored for incidental take during 1997-2001 (Perez 2003). The only harbor seal mortalities occurred in 1997 and 2000. The mortality in 1997 occurred during an unmonitored haul and therefore was not used to estimate mortality for the entire fishery that year. However, observer coverage (based on observed tons) was 66% in 1997, observers monitored 100% of the vessels during the fishery, and the reported mortality is thought to be the only harbor seal mortality in the fishery that year. In 1997-2001,

the mean estimated mortality in this fishery is 0.8 (CV=1.0) harbor seals per year (from monitored hauls), plus 0.2 animals per year (from unmonitored haul data).

Table 1. Summary of available information on the incidental mortality and injury of harbor seals (Oregon/Washington Coast stock) in commercial and tribal fisheries that might take this species and calculation of the mean annual mortality rate; n/a indicates that data are not available. All entanglements resulted in the death of the animal. Mean annual takes are based on 1997-2001 data unless otherwise noted.

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 in coastal waters: areas 4 and 4A)	97 98 99 00 01	obs data	100% no fishery no fishery 100% no fishery	13 0 0 3 0	13 0 0 3 0	3.2 (0.79)
WA/OR/CA groundfish trawl (Pacific whiting component)	97 98 99 00 01 97	obs data unmonitored hauls	65.7% 77.3% 68.6% 80.6% 96.2%	0 0 0 2 0 1	0 0 0 4 0	0.8 (1.0) 0.2 (n/a)
WA Grays Harbor salmon drift gillnet	91-93	obs data	4-5%	0, 1, 1	0, 10, 10	6.7 (0.50)
WA Willapa Bay drift gillnet	91-93	obs data	1-3%	0, 0, 0	0, 0, 0	0
WA Willapa Bay drift gillnet	90-93	self reports	n/a	0, 0, 6, 8	n/a	$\geq$ 3.5 (n/a) see text
Unknown west coast fisheries	97-01	strand data	n/a	0, 0, 1, 0, 0		$\geq$ 0.2 (n/a)
Minimum total annual takes						$\geq$ 14.6 (0.4)

The Washington and Oregon Lower Columbia River drift gillnet fishery was monitored during the entire year in 1991-1993 (Brown and Jeffries 1993, Matteson et al. 1993c, Matteson and Langton 1994a). Harbor seal mortalities, incidental to the fishery, were observed only in the winter season and were extrapolated to estimate total harbor seal mortality. However, the structure of the fishery has changed substantially since the 1991-1992 fishing seasons, and this level of take no longer applies to the current fishery (see Appendix 1). The Oregon Department of Fish and Wildlife (ODFW) conducted test fisheries in the lower Columbia River in 2000-2002 to evaluate the use of small-mesh (3½"-6") tangle (tooth) nets in commercial, spring chinook fisheries to effectively harvest target stocks, while allowing the live release of non-target stocks and species (G. Whisler, pers. comm.). An experimental commercial permit fishery and a full-fleet commercial demonstration fishery were also conducted in 2001 and 2002, respectively, to test the small-mesh gear. Data on marine mammal interactions (predation, entanglement), recorded by observers during the permit and demonstration fisheries, have not yet been summarized; however, no marine mammal mortalities or serious injuries were reported to NMFS by vessel operators. The test fishery in the lower Columbia River is expected to continue in 2003.

The Washington Grays Harbor salmon drift gillnet fishery was also monitored in 1991-1993 (Herczeg et al. 1992a; Matteson and Molinaar 1992; Matteson et al. 1993a; Matteson and Langton 1994b, 1994c). During the 3-year period, 98, 307 and 241 sets were monitored, representing approximately 4-5% observer coverage in each year. No mortalities were recorded in 1991. In 1992, observers recorded one harbor seal mortality incidental to the fishery, resulting in an extrapolated estimated total kill of 10 seals (CV=1.0). In 1993, observers recorded one harbor seal mortality incidental to the fishery, though a total kill was not extrapolated. Similar observer coverage in 1992 and 1993 (4.2% and 4.4%, respectively) suggests that 10 is also a reasonable estimate of the total kill in 1993. Thus, the mean

estimated mortality for this fishery in 1991-1993 is 6.7 (CV=0.50) harbor seals per year (Table 1). No observer data are available for this fishery after 1993, however, harbor seal takes are unlikely to have increased since the fishery was last observed, due to reductions in the number of participating vessels and available fishing time (see details in Appendix 1). Fishing effort and catch have declined throughout all salmon fisheries in the region due to management efforts to recover ESA-listed salmonids.

Combining the estimates from the northern Washington marine set gillnet (3.2), WA/OR/CA groundfish trawl (0.8 from monitored hauls + 0.2 from unmonitored haul data), and Washington Grays Harbor salmon drift gillnet (6.7) fisheries results in an estimated mean mortality rate in observed fisheries of 10.9 harbor seals per year from this stock.

The Washington Willapa Bay drift gillnet fishery was also monitored at low levels of observer coverage in 1991-1993 (Herczeg et al. 1992a, 1992b; Matteson and Molinaar 1992; Matteson et al. 1993b; Matteson and Langton 1994c, 1994d). In those years, 752, 576 and 452 sets were observed representing approximately 2.5%, 1.4% and 3.1% observer coverage, respectively. No harbor seal mortalities were reported by observers. However, because mortalities were self-reported by fishers in 1992 and 1993, the low level of observer coverage failed to document harbor seal mortalities which had apparently occurred. Due to the low level of observer coverage for this fishery, the self-reported fishery mortalities have been included in Table 1 and represent a minimum mortality estimate resulting from that fishery (3.5 harbor seals per year). Harbor seal takes are unlikely to have increased since the fishery was last observed in 1993, due to reductions in the number of participating vessels and available fishing time (see details in Appendix 1). Fishing effort and catch have declined throughout all salmon fisheries in the region due to management efforts to recover ESA-listed salmonids.

An additional source of information on the number of harbor seals 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 1997 and 2001, there were no fisher self-reports of any harbor seal mortalities. 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. Logbook data are available for part of 1989-1994, after which incidental mortality reporting requirements were modified. Under the new system, logbooks are no longer required; instead, fishers provide self-reports. Data for the 1994-1995 phase-in period is fragmentary. After 1995, the level of reporting dropped dramatically, such that the records are considered incomplete and estimates of mortality based on them represent minimums (see Appendix 7 in Angliss et al. 2001 for details).

Strandings of harbor seals entangled in fishing gear or with injuries caused by interactions with gear are a final source of fishery-related mortality information. One fishery-related stranding was reported in 1999 (B. Norberg, pers. comm.) and, since it could not be attributed to a particular fishery, it is listed in Table 1 as occurring in an unknown west coast fishery. Fishery-related strandings during 1997-2001 resulted in an estimated annual mortality of 0.2 harbor seals from this stock. This estimate is considered a minimum because not all stranded animals are found, reported, or examined for cause of death (via necropsy by trained personnel).

Other Mortality

According to Northwest Marine Mammal Stranding Network records, maintained by the NMFS Northwest Region, a total of eight human-caused harbor seal mortalities or serious injuries were reported from non-fisheries sources in 1997-2001. Seven animals were shot (one each in 1997, 1999, and 2000 and two each in 1998 and 2001) and one animal was struck by an off-road-vehicle (in 1997), resulting in an estimated mortality of 1.6 harbor seals per year from this stock. This estimate is considered a minimum because not all stranded animals are found, reported, or examined for cause of death (via necropsy by trained personnel).

Subsistence Harvests by Northwest Treaty Indian Tribes

Several Pacific Northwest treaty Indian tribes have promulgated tribal regulations allowing tribal members to exercise treaty rights for subsistence harvest of harbor seals. There have been only a few reported takes of harbor seals from directed tribal subsistence hunts. It is possible that very few seals have been taken in directed hunts because tribal fishers use seals caught incidentally to fishing operations, in the northern Washington marine set gillnet fishery, for their subsistence needs before undertaking a ceremonial or subsistence hunt. From communications with the tribes, the NMFS Northwest Regional Office (J. Scordino, pers. comm.) believes that 5-10 harbor seals from this stock may be taken annually in directed subsistence harvests.

STATUS OF STOCK

Harbor seals are not considered to be "depleted" under the MMPA or listed as "threatened" or "endangered" under the Endangered Species Act. Based on currently available data, the level of human-caused mortality and serious injury (14.6 + 1.6 + 5-10 = 21.2-26.2) is not known to exceed the PBR (1,343). Therefore, the Oregon/Washington Coast stock of harbor seals is not classified as a "strategic" stock. The minimum total fishery mortality and serious injury for this stock (14.6: based on observer data (10.9) and self-reported fisheries information (3.5) or stranding data (0.2) where observer data were not available or failed to detect harbor seal mortality) appears to be less than 10% of the calculated PBR (134) and, therefore, appears to be insignificant and approaching zero mortality and serious injury rate. The stock size increased until 1992, but has declined in recent years. At this time it is not possible to assess the status of this stock relative to its Optimum Sustainable Population (OSP) level.

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