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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).

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 (Fig. 1). Genetic analyses provide additional support for this stock structure (Huber et al. 1994, 2010; 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 Washington inland waters possess unique haplotypes not found in seals from the coasts of Washington, Oregon, and California (Lamont et al. 1996). Recent genetic evidence suggests that the population of harbor seals in Washington inland waters has more structure than is currently recognized (Huber et al. 2010). This report considers only the Oregon/Washington Coast stock. Stock assessment reports for Washington Inland Waters and California harbor seals also appear in this volume. Harbor seal stocks that occur in the inland and coastal waters of Alaska are discussed separately in the Alaska Stock Assessment Reports. Harbor seals occurring in British Columbia are not included in any of the U.S. Marine Mammal Protection Act (MMPA) stock assessment reports.

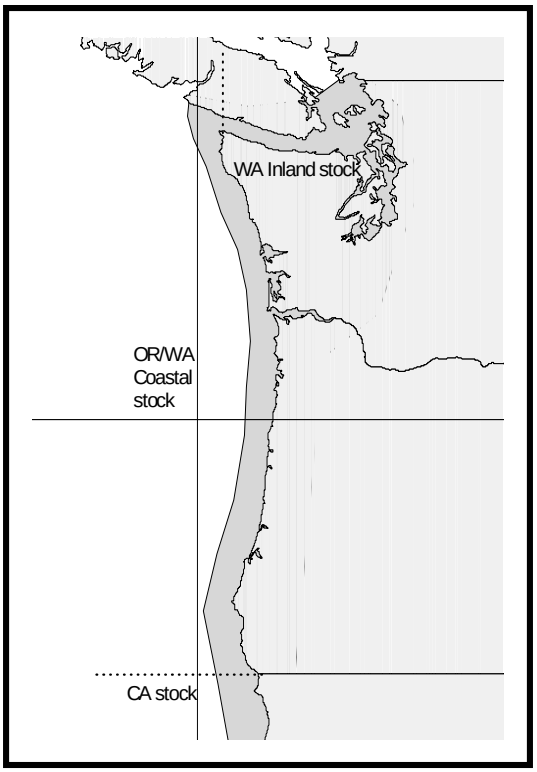

Figure 1. Approximate distribution of harbor seals in the U.S. Pacific Northwest (shaded area). Stock boundaries separating the three stocks are shown.

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, unpublished 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, unpublished data). However, because the most recent abundance estimate is >8 years old, there is no current estimate of abundance available for this stock.

Minimum Population Estimate

No current information on abundance is available to obtain a minimum population estimate for the Oregon/Washington Coast stock of 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 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, unpublished data). Based on the analyses of Jeffries et al. (2003) and Brown et al. (2005), both the Washington and Oregon portions of this stock have reached carrying capacity and are no longer increasing (Fig. 2).

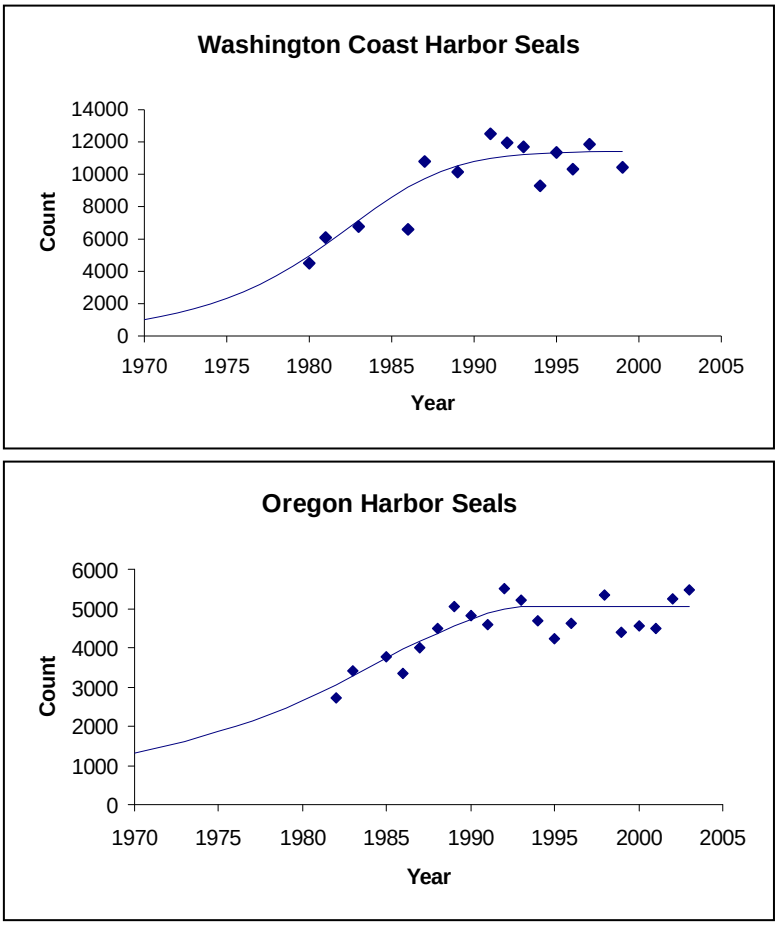

Figure 2. Generalized logistic growth curves of Washington Coast (Jeffries et al. 2003) and Oregon (Brown et al. 2005) harbor seals.

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). When a logistic model was fit to the Oregon portion of the 1977-2003 abundance data, estimates of R_{MAX} ranged from 6.4% (95% CI = 4.6-27%) for the south coast of Oregon to 10.1% (95% CI = 8.6-20%) for the north coast (Brown et al. 2005). Until a combined analysis for the entire stock is completed, the pinniped default maximum theoretical net productivity rate (R_{MAX}) of 12% will be used for this harbor seal stock (Wade and Angliss 1997).

POTENTIAL BIOLOGICAL REMOVAL

Because there is no current estimate of minimum abundance, a potential biological removal (PBR) cannot be calculated for this stock.

HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

Fisheries Information

Fishing effort in the northern Washington marine gillnet tribal fishery is conducted within the range of both stocks of harbor seals (Oregon/Washington Coast and Washington Inland Waters) occurring in Washington State waters. 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). For the purposes of this stock assessment report, the animals taken in waters south and west of Cape Flattery, WA, are assumed to have belonged to the Oregon/Washington Coast stock, and Table 1 includes data only from that portion of the fishery. Fishing effort in the coastal marine set gillnet tribal fishery has declined since 2004. There was one fisher self-report of a harbor seal death in a set gillnet in coastal waters in 2004 (Makah Fisheries Management, unpublished data). A test set gillnet fishery, with 100% observer coverage, was conducted in coastal waters in 2004 and 2008. This test fishery required the use of nets equipped with acoustic alarms, and observers reported five harbor seal deaths in 2004 and one harbor seal death in 2008 (Makah Fisheries Management, unpublished data). The mean estimated mortality for the marine set gillnet tribal fishery in 2004-2008 is 1.2 (CV=0) harbor seals per year from observer data plus 0.2 seals per year from fisher self-reports.

The Washington/Oregon/California (WA/OR/CA) groundfish trawl fishery (Pacific hake at-sea processing component) was monitored for incidental take during 2002-2006 (NWFSC 2008), and harbor seal deaths were observed in 2005 and 2006. The mean estimated mortality for this fishery in 2002-2006 is 0.4 (CV=0.30) harbor seals per year.

Table 1. Summary of available information on the incidental mortality and serious 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. Mean annual takes are based on 2004-2008 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 test fishery in coastal waters)	2004	observer data	100%	5	5 (0)	1.2 (0)
	2005		no fishery	0	0 (0)	
	2006		no fishery	0	0 (0)	
	2007		no fishery	0	0 (0)	
	2008		100%	1	1 (0)	
Northern WA marine set gillnet (tribal fishery in coastal waters)	2004	fisher self-reports		1	n/a	≥0.2 (n/a)
WA/OR/CA groundfish trawl (Pacific hake at-sea processing component)	2002	observer data	100%[1]	0	0 (0)	0.4 (0.30)
	2003		100%[1]	0	0 (0)	
	2004		100%[1]	0	0 (0)	
	2005		100%[1]	1	1 (0.42)	
	2006		100%[1]	1	1 (0.44)	
WA Grays Harbor salmon drift gillnet[2]	1991-1993	observer data	4-5%	0, 1, 1	0, 10, 10	see text[2]
WA Willapa Bay drift gillnet[2]	1991-1993	observer data	1-3%	0, 0, 0	0, 0, 0	see text[2]
WA Willapa Bay drift gillnet[2]	1990-1993	fisher self-reports	n/a	0, 0, 6, 8	n/a	see text[2]
Unknown West Coast fisheries	2004-2008	stranding data	n/a	0, 0, 0, 0, 0	n/a	0
Minimum total annual takes						≥1.8 (0.08)

[1]Percent observer coverage equals percent of vessels with observers.
[2]This fishery has not been observed since 1993 (see text); these data are not included in the calculation of recent minimum total annual takes.

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 mortality, incidental to the fishery, was observed only in the winter season and was 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. Due to high steelhead bycatch in the 2002 fishery, harvest managers used in-season test fishing during the 2003 and 2004 fishing seasons to determine the optimum timing and gear requirements for each subsequent full-fleet commercial fishing period. Both large-mesh (8-9.75") and small-mesh tangle net (≤4.25") fishing periods were adopted in each year, although the 2003 season was severely curtailed to limit the catch of spring chinook stocks listed under the Endangered Species Act (ESA). With the focus on greater selectivity in winter/spring commercial salmon fisheries, levels of observer coverage were much higher in 2002-2004 than in previous years. To meet management needs, this increased level of observer coverage in test fisheries and full-fleet commercial fisheries is expected to continue into the foreseeable future (J. North and G. Whisler, pers. comm.). Data on marine mammal interactions (predation, entanglement) recorded by observers during the permit and demonstration commercial fisheries in 2001-2002 and the full-fleet commercial fisheries in 2003-2004 have not yet been summarized; however, no marine mammal deaths or serious injuries were reported to NMFS by vessel operators.

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 mortality was recorded in 1991. In 1992, observers recorded one harbor seal death incidental to the fishery, resulting in an extrapolated estimated total kill of 10 seals (CV=1.0). In 1993, observers recorded one harbor seal death 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. 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.

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 mortality was reported by observers. However, because mortality was self-reported by fishers in 1992 and 1993, the low level of observer coverage failed to document harbor seal mortality that had apparently occurred. Due to the low level of observer coverage for this fishery, the self-reported fishery mortality has been included in Table 1 and represents 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).

Combining recent estimates from the northern Washington marine set tribal gillnet (1.2 from observer data + 0.2 from fisher self-reports) and WA/OR/CA groundfish trawl (0.4 from observer data) fisheries results in an estimated mean mortality rate of 1.8 harbor seals per year from these fisheries.

The Marine Mammal Authorization Program (MMAP) fisher self-reports, required of commercial vessel operators by the MMPA, are an additional source of information on the number of harbor seals killed or seriously injured incidental to commercial fishery operations. Between 2002 and 2006, there were two fisher self-reports of harbor seal deaths in the WA/OR/CA groundfish trawl (Pacific hake at-sea processing) fishery. Since this is an observed fishery, these deaths are not included in Table 1. Although these reports are considered incomplete (see details in Appendix 1), they represent a minimum mortality.

Strandings of harbor seals entangled in fishing gear or with serious injuries caused by interactions with gear are a final source of fishery-related mortality information. According to Northwest Marine Mammal Stranding Network records, maintained by the NMFS Northwest Region (NMFS, Northwest Regional Office, unpublished data), there were no fishery-related strandings of harbor seals from this stock reported in 2004-2008, resulting in an

average annual mortality of zero harbor seals. 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 (NMFS, Northwest Regional Office, unpublished data), a total of 10 human-caused harbor seal deaths or serious injuries were reported from non-fisheries sources in 2004-2008. Seven animals were shot, two animals were struck by boats, and one animal was entangled in line, resulting in an estimated mortality of 2.0 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

Tribal subsistence takes of this stock may occur, but no data on recent takes are available.

STATUS OF STOCK

Harbor seals are not considered to be "depleted" under the MMPA or listed as "threatened" or "endangered" under the ESA. Based on currently available data, the level of human-caused mortality and serious injury is 3.8 (1.8 + 2.0) harbor seals per year. A PBR cannot be calculated for this stock because there is no current abundance estimate. The previous estimate of PBR was 1,343 (Carretta et al. 2009). Human-caused mortality relative to PBR is unknown, but it is considered to be small relative to the stock size. 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 (based on recent observer data (1.6) and self-reported fisheries information (0.2) or stranding data (0) where observer data were not available or failed to detect harbor seal mortality) is 1.8. Since a PBR cannot be calculated for this stock, fishery mortality relative to PBR is unknown. The stock is within its Optimum Sustainable Population (OSP) level (Jeffries et al. 2003, Brown et al. 2005).

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