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HARBOR SEAL (*Phoca vitulina richardsi*): Washington Inland Waters 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 haul out sites (Pitcher and Calkins 1979, Pitcher and McAllister 1981).

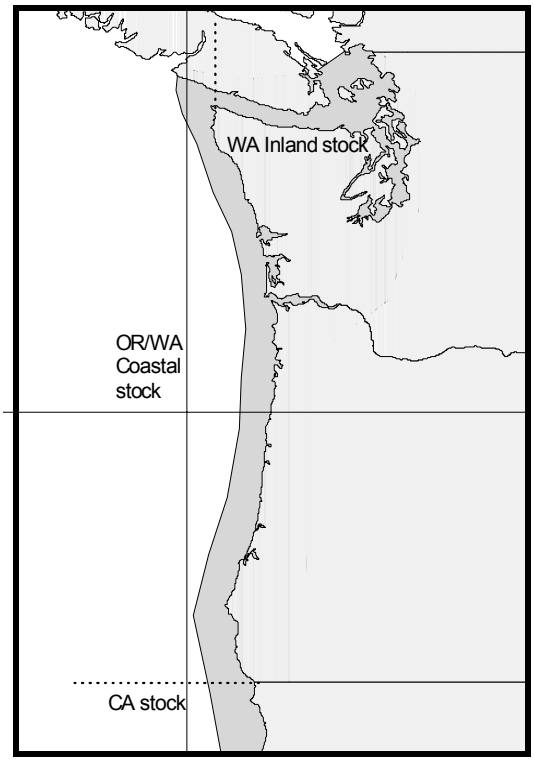

Figure 1. Approximate distribution of harbor seals in the U.S. Pacific Northwest (shaded area). Stock boundaries separating the three stocks are shown.

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 3 separate harbor seal stocks along the west coast of the continental U.S. (Boveng 1988): 1) inland waters of Washington State (including the Hood Canal, Puget Sound, and 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 possess unique haplotypes not found in seals from the coasts of Washington, Oregon, and California (Lamont et al. 1996). This report considers only the Inland Washington stock. Three harbor seal 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 seal stocks are reported separately in the Stock Assessment Reports for the Alaska Region.

POPULATION SIZE

Aerial surveys of harbor seals in Washington were conducted during the pupping season in 1997, during which time the total number of hauled-out seals (including pups) were counted. In 1997 the mean count of harbor seals occurring in Washington's inland waters was 10,494 (CV=0.017) animals (WDFW, unpubl. data; NMML, unpubl. data).

Radio-tagging studies conducted at 6 locations (3 Washington inland waters sites and 3 Oregon and Washington coastal sites) collected information on haulout patterns from 63 harbor seals in 1991 and 61 harbor seals in 1992. 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 1995). Using this correction factor results in a population estimate of 16,056 (10,494 x 1.53; CV=0.067) for the Inland Washington stock of harbor seals (WDFW, unpubl. data; NMML, unpubl. data).

Minimum Population Estimate

The log-normal 20th percentile of the 1997 population estimate for this stock is 15,174 harbor seals.

Current Population Trend

Historical levels of harbor seal abundance in Washington are unknown. The population apparently decreased during the 1940s and 1950s due to bounty hunting. Approximately 17,133 harbor seals were killed in Washington by bounty hunters between 1943 and 1960 (Newby 1973). The population remained relatively low during the 1970s, but since the termination of the harbor seal bounty program in 1960 and with the protection provided by the Marine Mammal Protection Act (MMPA), harbor seal numbers in Washington have increased (Jeffries 1985).

Between 1983 and 1996, the annual rate of increase for this stock was 6%. From 1991 to 1996, this stock increased 10% (t=5.28; p=0.034) annually, with the peak count occurring in 1996. The higher rate of increase in recent years may be due to emigration of harbor seals from the Canadian waters of the Strait of Georgia to the San Juan Islands (Jeffries et al. 1997).

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

From 1991 to 1996, counts of harbor seals in Washington State have increased at an annual rate of 10% (Jeffries et al. 1997). Because the population was not at a very low level, the observed rate of increase will underestimate the maximum net productivity (R_{MAX}). Therefore, until additional data 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 size (15,174) times one-half the default maximum net growth rate for pinnipeds (½ of 12%) times a recovery factor of 1.0 (for stocks of unknown status that are increasing in size, Wade and Angliss 1997), resulting in a PBR of 910 harbor seals per year.

HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

Fisheries Information

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 fishery (coastal + inland waters), observer coverage ranged from approximately 40 to 98% during those years. Fishing effort is conducted within the range of both stocks of harbor seals (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 may have been animals from the coastal stock. Similarly, some of the animals taken in the coastal portion of the fishery (see the Oregon/Washington Coast stock assessment report for details) 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. However, as noted, 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 1995). Accordingly, Table 1 includes data only from that portion of the northern Washington marine set gillnet fishery occurring within the range of the Inland Washington stock (those waters east of Cape Flattery), where observer coverage ranged from 6 to 80% between 1993 and 1998. Data from 1993-1998 are included in Table 1, although the mean estimated annual mortality is calculated using the most recent 5 years of available data. Little effort occurred in the inland portion of the fishery in 1995, 1997, and 1998. No harbor seal mortalities were observed or reported in this fishery from 1995 to 1998. The mean estimated mortality for this fishery is 4 (CV=1.0) harbor seals per year from this stock.

In 1993 as a pilot for future observer programs, NMFS in conjunction with the Washington Department of Fish and Wildlife (WDFW) monitored all non-treaty components of the Washington Puget Sound Region salmon gillnet fishery (Pierce et al. 1994). Observer coverage was 1.3% overall, ranging from 0.9% to 7.3% for the various components of the fishery. Two harbor seal mortalities were reported (Table 1). Pierce et al. (1994) cautioned against extrapolating these mortalities to the entire Puget Sound fishery due to the low observer coverage and potential biases inherent in the data. The area 7/7A sockeye landings represented the majority of the non-treaty salmon landings in 1993, approximately 67%. Results of this pilot study were used to design the 1994 observer programs discussed below.

Table 1. Summary of available information on the incidental mortality and injury of harbor seals (Inland Washington 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 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: inland waters)	93 94 95 96 97 98	obs data	61% n/a 24% 6% 80% 40%	12 n/a 0 0 0 0	20 n/a 0 0 0 0	4.0 (1.0)[1]
WA Puget Sound Region salmon set/drift gillnet (observer programs listed below covered segments of this fishery):	-	-	-	-	-	-
Puget Sound non-treaty salmon gillnet (all areas and species)	93	obs data	1.3%	2	n/a	see text
Puget Sound non-treaty chum salmon gillnet (areas 10/11 and 12/12B)	94	obs data	11%	1	10	10 (n/a)
Puget Sound treaty chum salmon gillnet (areas 12, 12B, and 12C)	94	obs data	2.2%	0	0	0
Puget Sound treaty chum and sockeye salmon gillnet (areas 4B, 5, and 6C)	94	obs data	7.5%	0	0	0
Puget Sound treaty and non-treaty sockeye salmon gillnet (areas 7 and 7A)	94	obs data	7%	1	15	15 (1.0)
				Reported mortalities		
WA Puget Sound Region salmon set/drift gillnet	94-98	self reports	n/a	n/a, n/a, n/a, n/a, n/a	n/a	see text
WA salmon net pens	97-98	self reports	n/a	10, 5	n/a	$7.5 (n/a)
unknown Puget Sound fishery	94-98	strand data	n/a	3, 0, 2, 1, 1	n/a	$1.4 (n/a)
Minimum total annual takes						$37.9 (0.82)

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

In 1994, NMFS in conjunction with WDFW conducted an observer program during the Puget Sound non-treaty chum salmon gillnet fishery (areas 10/11 and 12/12B). A total of 230 sets were observed during 54 boat trips, representing approximately 11% observer coverage of the 500 fishing boat trips comprising the total effort in this fishery as estimated from fish ticket landings (Erstad et al. 1996). One harbor seal was taken in the fishery, resulting in an entanglement rate of 0.02 harbor seals per trip (0.004 harbor seals per set), which extrapolated to approximately 10 mortalities for the entire fishery. The Puget Sound treaty chum salmon gillnet fishery in Hood Canal (areas 12, 12B, and 12C) and Puget Sound treaty sockeye/chum gillnet fishery in the Strait of Juan de Fuca (areas 4B, 5, and 6C) were also monitored in 1994 (NWIFC 1995). No harbor seal mortalities were reported in the observer programs covering these treaty salmon gillnet fisheries, where observer coverage was estimated at 2.2% (based on % of total catch observed) and approximately 7.5% (based on % of observed trips to total landings), respectively.

Also in 1994, NMFS in conjunction with WDFW and the Tribes monitored the Puget Sound treaty and non-treaty sockeye salmon gillnet fishery (areas 7 and 7A). During this fishery observers monitored 2,205 sets, representing approximately 7% of the estimated number of sets in the fishery (Pierce et al. 1996). There was one observed harbor seal mortality (two others were entangled and released unharmed), resulting in a mortality rate of 0.00045 harbor seals per set, which extrapolated to 15 mortalities (CV=1.0) for the entire fishery. In 1996, Washington Sea Grant Program conducted a test fishery in the non-treaty sockeye salmon gillnet fishery (area 7) to compare entanglement rates of seabirds and marine mammals and catch rates of salmon using three experimental gears and a control (monofilament mesh net). The experimental nets incorporated highly visible mesh in the upper quarter (50 mesh gear) or upper eighth (20 mesh gear) of the net or had low-frequency sound emitters attached to the corkline (Melvin et al. 1997). In 642 sets during 17 vessel trips, there were two harbor seal mortalities (one other was released alive with no apparent injuries).

Combining the estimates from the northern Washington marine set gillnet (4), Puget Sound non-treaty chum salmon gillnet in areas 10/11 and 12/12B (10), and Puget Sound treaty and non-treaty sockeye salmon gillnet in areas 7 and 7A (15) fisheries results in an estimated minimum annual mortality rate in observed fisheries of 29 harbor seals per year from this stock. It should be noted that the 1994 observer programs did not sample all segments of the entire Washington Puget Sound Region salmon set/drift gillnet fishery, and further, the extrapolations of total kill did not include effort for the unobserved segments of this fishery. Therefore, 29 is an underestimate of the harbor seal mortality due to the entire fishery. It is not possible to quantify what percentage of the Washington Puget Sound Region salmon set/drift gillnet fishery was actually observed in 1994. However, the areas having the highest salmon catches and in which a majority of the vessels operated in 1994 were covered by the 1994 observer programs (J. Scordino, pers. comm.).

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. Fisher self-reports from 1994-1998 for the Washington Puget Sound Region salmon set and drift gillnet fishery are shown in Table 1. Unlike the 1994 observer program data, the self-reported fishery data cover the entire fishery (including treaty and non-treaty components) and have thus been included in the table. There were fisher self-reports of 15 harbor seal mortalities due to entanglement in Washington salmon net pens, 10 in 1997 and 5 in 1998 (Table 1), resulting in an annual mortality of 7.5 harbor seals from this stock in those two years. 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).

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. During the period from 1994 to 1998, small numbers of fishery-related strandings of harbor seals have occurred in most years. As the strandings could not be attributed to a particular fishery, they have been included in Table 1 as occurring in an unknown Puget Sound fishery. Fishery-related strandings during 1994-1998 result in an estimated annual mortality of 1.4 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).

The minimum estimated fishery mortality and serious injury for this stock is 37.9 (rounded to 38) harbor seals per year, based on observer program data (29), fisher self-reports (7.5), and stranding data (1.4). However, a reliable estimate of the total mortality rate incidental to commercial fisheries is currently unavailable due to the absence of observer placements in segments of the Washington Puget Sound Region salmon set and drift gillnet fishery.

Other Mortality

Strandings of harbor seals resulting from collisions with boats, from gunshot injuries, or entanglement in line unrelated to fisheries are another source of mortality data. During the 5-year period from 1994 to 1998, human-related mortalities occurred each year, with reports of 7, 1, 8, 7, and 2 animals for those years, respectively. These mortalities resulted in an estimated annual mortality of 5 harbor seals from this stock during 1994-1998. This estimate is considered a minimum because not all stranded animals are found, reported, or cause of death determined (via necropsy by trained personnel).

Subsistence Harvests by Northwest Treaty Indian Tribes

Several Northwest Indian tribes have developed, or are in the process of developing, regulations for ceremonial and subsistence harvests of harbor seals and for the incidental take of marine mammals during tribal fisheries. The tribes have agreed to cooperate with NMFS in gathering and submitting data on takes of marine mammals.

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 (38 + 5 = 43) does not exceed the PBR (910). Therefore, the Inland Washington stock of harbor seals is not classified as a strategic stock. At present, the minimum estimated fishery mortality and serious injury for this stock (38) is less that 10% of the calculated PBR (91) and, therefore, can be considered to be insignificant and approaching zero mortality and serious injury rate. The stock size has increased in recent years, although at this time it is not possible to assess the status of the stock relative to its Optimum Sustainable Population (OSP) level.

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