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Assessment of Pinniped Populations in Oregon

April 1984 to April 1985

April 1988

NOTICE

ASSESSMENT OF PINNIPED POPULATIONS IN OREGON

April 1984 to April 1985

Robin F. Brown

Oregon Department of Fish and Wildlife
Marine Region
Marine Science Drive, Bldg. #3
Newport, Oregon 97365

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National Oceanic and Atmospheric Administration
National Marine Fisheries Service
Northwest and Alaska Fisheries Center
National Marine Mammal Laboratory
Bldg.4, 7600 Sand Point Way N.E.
Seattle, Washington 98115

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ABSTRACT

The results of the first year of a three-year study to assess the status of pinniped populations in Oregon are presented. Monthly aerial photographic surveys of the Oregon coast and the lower Columbia River were made to document the seasonal distributions and abundances of the three major pinniped species occurring here: the Pacific harbor seal (Phoca vitulina richardsi), the California sea lion (Zalophus californianus), and the Steller sea lion (Eumetopias jubatus).

Harbor seals are found in Oregon waters throughout the year and reproductive activities occur at many locations. A maximum count of 5325 harbor seals was made during the winter (February, 1985). Just over 2100 harbor seals were found in the Columbia River at this time, while spring and summer counts in the river were relatively low (250-500). Because a large portion of the Columbia River winter seal population moved north into Washington waters by summer (Beach et al. 1985), total Oregon harbor seal counts were lower during summer months (3500-3800). Late spring/early summer pup counts totaled 647 statewide. Historical notes, expansion into new haul out areas, and increases in survey counts over the previous eight years indicated an overall increase in abundance of harbor seals at an average annual rate of 6-8% per year.

California sea lions are primarily seasonal inhabitants of Oregon waters. Following summer breeding activities in California, this species occupies Oregon waters from mid-August through early June, and with the exception of a very few animals, is absent from late June through early August. A maximum count of 1938 California sea lions was made in September (1984). The major haul out areas were at Cascade Head, Cape Arago, and Rogue and Orford Reefs. California sea lion abundance at these areas declined in early winter as many animals apparently continued to move northward. A second peak in the spring occurred as animals returned southward through Oregon waters. Survey counts of California sea lions made during the present study were greater than any previously recorded for the state of Oregon.

The Steller (or northern) sea lion is the third major pinniped species found in Oregon. Steller sea lions are year-round residents of Oregon waters, with reproductive activities occurring at Rogue and Orford Reefs on the southern coast. June (1984) counts at Rogue and Orford Reefs were 1121 and 650 respectively. In July a total of 340 and 65 pups were counted at Rogue Reef and Orford Reef, respectively. A maximum statewide count of 2352 occurred in late May. No significant change in Steller sea lion abundance in Oregon was apparent over the past seven years.

In addition to the three major pinniped species, small numbers of northern elephant seals (Mirounga angustirostris) haul out on an irregular basis on Shell Island at Cape Arago. One to two elephant seals were found at this site during surveys made in June and July of 1984 and January, February, and March of 1985.

Preliminary examinations of several pinniped/fishery interactions occurring in Oreon waters were made. No serious conflict was found to exist between a commercial herring fishery (purse seine and lampara net) in Yaquina Bay (Newport) and California sea lions that occupy the bay in the winter and feed extensively on herring. A more serious conflict may exist between harbor seals and a winter sturgeon gillnet fishery in the Columbia River, involving fishing gear damage and harbor seal mortalities.

Limited information on interactions between harbor seals and State salmonid hatchery operations has been gathered. At this time these data consist principally of estimates of the number of returning adult salmon and steelhead that have scars indicative of seal or sea lion attacks. Scar rates for salmon (coho and chinook) ranged from 3.3% to 14.0% and from 25% to 38% for winter steelhead.

One result of this first year of study is the recognition that relatively little knowledge of the basic biology of Oregon pinnipeds exists, including abundances, distributions, movements, food, and habitat requirements. A significant amount of effort will be required before the more complex questions regarding the role of these animals in marine biological and human social systems can be addressed, and before sound management policies can be formulated and applied.

ACKNOWLEDGEMENTS

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Steven Jeffries (Washington Department of Game, Marine Mammal Investigations) made inestimable contributions during project initiation, planning, and data collection and analysis. Data on pinniped abundance and distribution on the north Oregon coast and in the Columbia River provided by WDG were responsible for completion of several statewide surveys.

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INTRODUCTION

Throughout its history of wildlife management, the State of Oregon has had no comprehensive research and management plan or program dealing with marine mammals. Between the years of 1925 and 1972 a combination of bounties and contracted seal hunting were in effect at various times in an effort to control numbers of seals and sea lions along the Oregon coast and in the Columbia River. In 1972 the Federal Government implemented Public Law 92-522, the Marine Mammal Protection Act (MMPA). The MMPA established a moratorium on the taking of marine mammals that ended Oregon pinniped control programs and removed all management authority over marine mammals from the State.

During the years 1972-1979 little effort was expended by state or federal wildlife agencies in the area of marine mammal research or management in Oregon. Aerial photographic surveys of Oregon pinnipeds were conducted annually or semi-annually on a contract basis for ODFW by Oregon State University (OSU) beginning in 1976. Between 1980 and 1984 Washington Department of Game (WDG) carried out an investigation of marine mammals occurring in the Columbia River and adjacent waters of Oregon and Washington (Beach et al. 1985). The objectives of the federally funded WDG program were to document the distribution and abundance of marine mammals (particularly the pinnipeds) and to evaluate interactions between fisheries and marine mammals in the study area.

In the years since 1972, use of Oregon estuaries and river systems by pinnipeds, particularly harbor seals (Phoca vitulina) and in some cases California sea lions (Zalophus californianus), has increased dramatically (Brown and Mate 1983; OSU/ODFW unpub data). Some of this increase in observed abundance rsulted from a redistribution of animals into preferred habitat following protection provided by the MMPA. However, breeding populations of California sea lions have increased (DeMaster et al. 1982) and northwest regional populations of harbor seals are on the rise (Beach et al. 1985). A growing concern over actual and perceived competition between man and pinniped for mutually desirable prey species, as well as concern for healthy marine mammal populations, has accompanied these increases in pinniped abundance.

Early in 1984 the Oregon Department of Fish and Wildlife (ODFW) entered into an Agreement of Intent with the National Marine Fisheries Service (NMFS) to seek transfer of marine mammal management to the State of Oregon. In June of 1984, ODFW was contracted by NMFS under a cooperative research agreement to assess the abundance and distribution of pinnipeds in Oregon waters. The determination of the status of Oregon pinniped populations was designated as the first and primary research task under a NMFS/ODFW joint proposal for return of marine mammal management to the State of Oregon (see Appendix A).

AERIAL PHOTOGRAPHIC ASSESSMENT OF PINNIPED ABUNDANCE AND DISTRIBUTION IN OREGON

STUDY AREA AND METHODS

The study area includes all Oregon coastal and estuarine waters (Fig. 1) from the mouth of the Columbia River in the north (46° 15' N, 124° 05' W) to the Oregon-California border in the south (42° 00' N, 124° 13' W). Aerial surveys were flown along the entire Oregon coastline, over offshore rocks and reefs, and throughout embayments and estuaries (east to 123° 31' W in the Columbia River).

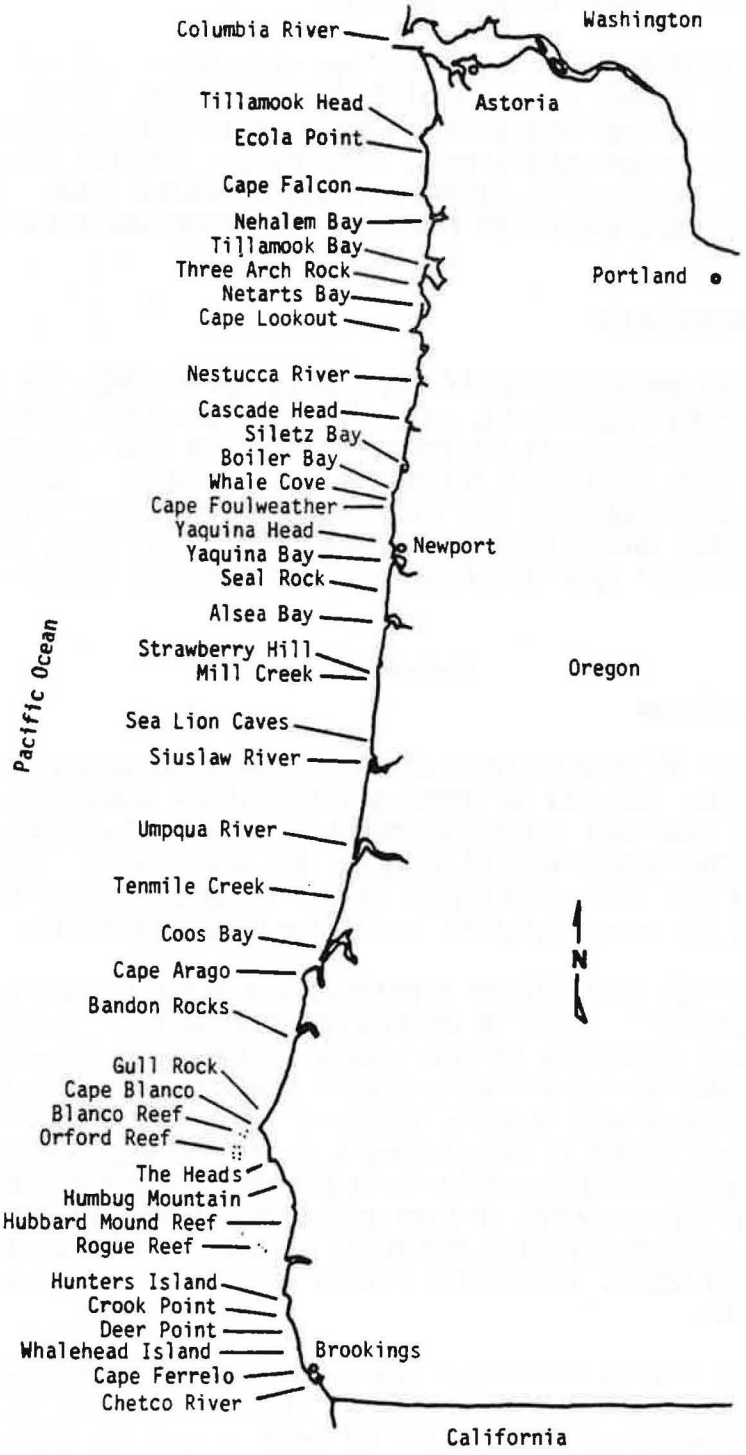
Aerial surveys were scheduled and, as weather conditions allowed, flown on a monthly basis out of Newport. Repetitive surveys were attempted during periods of peak annual haul out and rookery attendance (pupping and molting). Surveys were scheduled to center on mid-day low tides (1000-1400 hrs) when the largest number of animals were expected to be encountered.

Due to the size of the study area, at least two days were required to complete a statewide survey. Recognizing that it is often not possible to fly two consecutive days due to variability in weather, the study area was intitially reduced to encompass the coastline between Cape Arago in the south (43° 18'N) to Tillamook Bay in the north (45° 34' N). If a second day of flying was possible, the southern Oregon coast to California was surveyed. At some time during each survey period the north Oregon coast (Tillamook Bay to the Columbia River) was to be surveyed by the Washington Department of Game (WDG) Marine Mammal Investigations Program. Interstate coordination of surveys in this manner was not always successful and beginning in December of 1984, an attempt was made to cover the entire Oregon coast in two days flying during a typical four-day low tide window.

Surveys of the north coast (Newport to Columbia River) began one hour before predicted slack low tide at Newport and haul out sites were photographed in sequence, south to north. Since slack low tide occurs later to the north, this method allowed each site to be surveyed roughly one hour before slack low tide at that site. Surveys of the south coast (Newport to Brookings) began three hours before predicted low tide at Newport. The south survey leg required an additional hour of flying time and low tide occurs earlier to the south. Beginning at the Umpqua River, haul out sites were photographed in sequence north to south. Sites between the Umpqua River and Newport were photographed south to north on the return trip.

The survey technique was similar to that used in previous studies aimed at assessment of pinniped populations (Mate 1977; Miller 1983; Johnson and Jeffries 1983; Beach et al. 1985). Surveys were flown in a single-engine, high-wing aircraft (Cessna 172) at altitudes of 180-250 m. Data collected during surveys included date, time, location, an estimate of the number of each species present at each site, and a description of existing weather conditions. Photographs of all animals at each site were taken using a hand held 35 mm SLR camera and

Figure 1. Study area: the Oregon coast, with locations of pinniped haul out sites surveyed by aircraft.



a 70-210 mm zoom lens. Kodak Ektachrome high speed color slide film was generally used at the normal exposure ASA of 400, but was occassionally pushed to 800 ASA during low light conditions encountered during some winter surveys.

After processing, the color slides were projected onto the glass of a 32" square framed window that had been painted white on the backside. Each animal was marked with a water-based pen during counting. From these photographs, species and limited sex and age classes (pups, adult males, others) could be identified. Counts made in this manner constitute the reported abundance and distribution data.

RESULTS AND DISCUSSION

During the period 23 April 1984 to 12 April 1985, 39 aerial surveys, totaling 101.9 hours, were flown to document the distribution and abundance of pinnipeds in Oregon (including four surveys totaling eight hours flown by WDG on the north Oregon coast). Counts of pinnipeds at all locations for each survey flown are listed in Appendix B. Haul out site descriptions, including name, latitude, longitude, pinniped species present, and substrate type are listed in Appendix C.

Harbor Seals

Statewide Abundance

A total of 37 general haul out areas were surveyed for harbor seals in Oregon. Several of these general areas consisted of two or more specific haul out sites separated by relatively short distances (eg. most of the estuaries and some of the headlands). Estuarine sand/mud haul out sites comprised 11 of the 36 areas surveyed, while the remaining 26 were shoreline and offshore rocky areas.

The lower Columbia River constitutes a state boundary of water between the marine regions of Oregon and Washington. A regional stock of harbor seals occurring in the coastal waters and estuaries of southern Washington and northern Oregon uses the Columbia River primarily during winter months (Beach et al. 1985). Therefore, winter counts of harbor seals in the Columbia River include large numbers of seals that may reside primarily in Washington waters at other times of the year. For this reason, Oregon statewide counts of harbor seals made during this project are presented in two ways: counts excluding seals in the Columbia River; and counts including seals in the Columbia River.

Statewide counts of harbor seals, excluding the Columbia River, ranged from a low of 1790 to a high of 3567 seals (Fig. 2). Abundance of hauled out seals peaked at 3567 on June 18 and 19, 1984 at the end of the pupping period. This figure included a total of 181 identifiable pups. Harbor seal pup counts peaked at 614 on May 21 and 23, 1984 when a total seal count of 3399 was made. A general picture

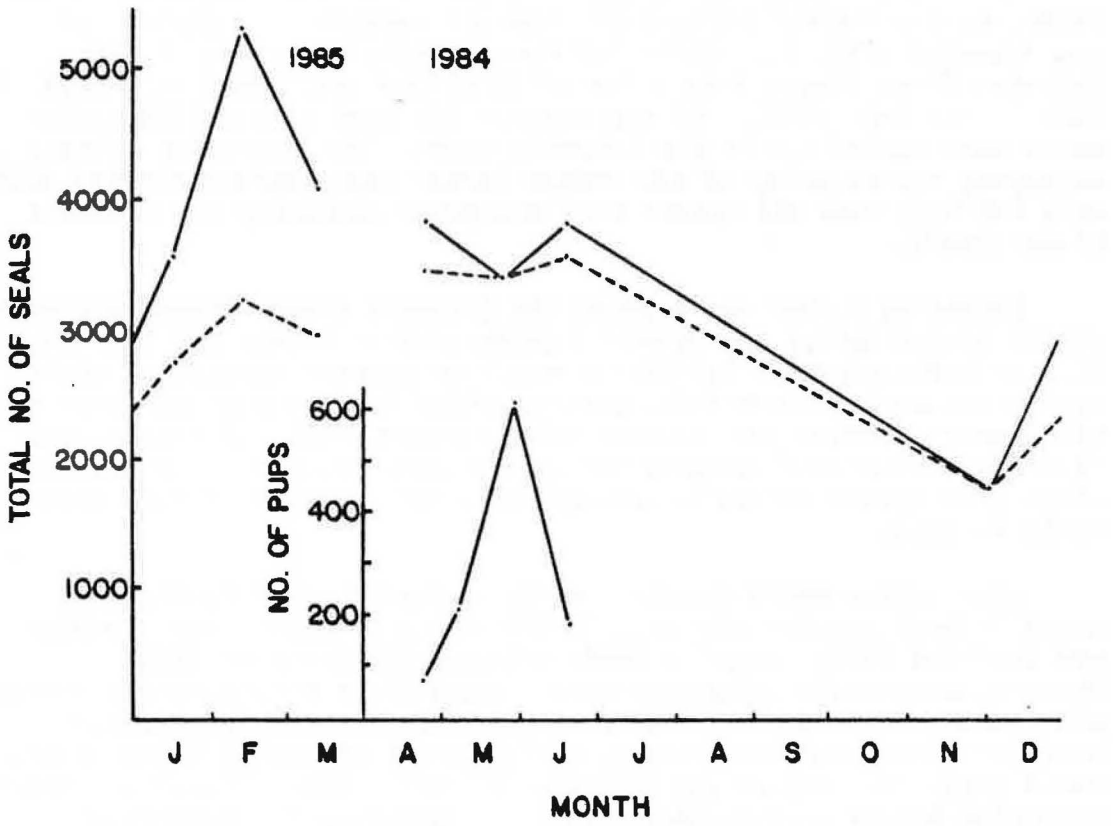


Figure 2. Oregon statewide harbor seal counts, April 1984 through March 1985 (——— including the Columbia River; ---- excluding the Columbia River).

of a fall decline in harbor seal numbers, followed first by a winter low, and then a spring increase to a summer peak in abundance was observed.

When harbor seals using the Columbia River were included in the analysis, a different picture of seasonal abundance in Oregon waters was revealed (Fig. 2). Statewide counts including seals in the Columbia River ranged from a low of 1790 (3-4 Dec. 1984) to a high of 5325 (12-13 Feb. 1985). At the time of the peak count, 2106 harbor seals were hauled out in the Columbia River. The remaining animals occupying the majority of the Oregon harbor seal habitat totaled 3219; only 348 less than the summer peak abundance excluding the Columbia River (3567).

Excluding harbor seals using the Columbia River, Oregon statewide counts peaked during the summer pupping period in May and June (Fig. 2). In Washington and California equal or greater numbers of seals hauled out during the molting period, which follows pupping later in the summer (Johnson and Johnson 1979; Stewart 1981). A similar peak in Oregon harbor seal numbers during the molt may have been missed, since late summer statewide surveys were not conducted during this study in 1984.

High summer month counts have documented a commonly observed trend in haul out attendance by harbor seals in many areas (Johnson and Jeffries 1977; Loughlin 1978; Sullivan 1979; Bayer 1985). However, when seals occupying the Columbia River were considered along with other harbor seals in Oregon waters, peak statewide counts occurred during the late winter, early spring months of February and March (Fig. 2). The unique influence of the Columbia River on Oregon statewide harbor seal abundance was forecasted by the results of a Washington Department of Game study of pinnipeds in this area (Beach et al. 1985). Using aerial surveys and radio tagging studies the WDG project documented seasonal shifts in abundance between the Columbia River and adjacent estuaries, particularly those to the north (Willipa Bay and Grays Harbor). Large numbers of harbor seals occupying these southern Washington estuaries move into the Columbia River during the winter months, presumably to forage on abundant food resources (particularly eulachon), resulting in increased use of Oregon haul out sites at this time (Fig. 2). The importance of the Columbia River as a winter feeding area for large numbers (minimum of 2106) of harbor seals is apparent.

Haul Out Site Use

Harbor seals were the most abundant and ubiquitous of the three major pinniped species found in Oregon. Haul out sites used by this species included estuarine sand and mud flats exposed during low tides and, in at least one case (Alsea Bay), grassy areas above mean high water accessable only during high water conditions. Harbor seals occasionally hauled out on man made objects in estuaries or rested on the bottom in shallow water (both in Siletz Bay). Bottom resting has been noted in Washington waters (Johnson and Jeffries 1983) and may occur in other estuaries in Oregon. Harbor seals also hauled out on

rocky mainland shoreline in Oregon. In these cases the haul out sites were either remote (chance of human disturbance was low) or the site was separated from shore by a narrow, but protective moat of water. The third major substrate used as a haul out areas by seals consisted of nearshore rocks or small islands (less than 5 km offshore). There were ten haul out areas of this type used by harbor seals in Oregon (see Appendix C).

Seasonal patterns of harbor seal abundance at different areas in Oregon varied widely. Winter use of the Columbia River by harbor seals (Fig. 3) and the resulting influence on statewide abundance was described above. Tillamook Bay (Fig. 3) was an example of the frequently described harbor seal haul out area, where peak numbers are found during the spring/summer pupping/molting periods with relatively low abundance the remainder of the year. This same seasonal pattern was seen at the Umpqua River and at several rocky nearshore/offshore areas on the south coast where pup counts were high (Cape Arago, Gull Rock, Dog Rock, and Hunters Island). Harbor seal counts at Alsea Bay (Fig. 3) were high during pupping and molting periods, but also peaked during February. In addition to spring and summer high counts at Netarts Bay (Fig. 4), the maximum count occurred in November (Brown and Mate 1983).

The seasonal haul out pattern of harbor seals using the Siuslaw River (Fig. 4) was also different from that observed in other estuaries. Abundance of hauled out seals here was relatively constant throughout the winter and spring, but was low during the pupping period. Apparently not important as a pupping site, the Siuslaw River was used by large numbers of seals through the winter for other reasons. No harbor seal pups were observed in Siletz Bay (Fig. 4) and no peak in abundance was observed during the pupping period. Maximum numbers seen here in August may have been related to the molt, but the reason for the winter peak in early Febraury is unknown. Seasonal haul out habits of harbor seals at many of the rocky nearshore areas on the north coast resembled that previously described for Siletz Bay; at Tillamook Head, Whale Cove, Cape Foulweather, Yaquina Head, and Seal Rock, numbers peaked in late summer and again in winter.

Weather conditions and sea state are factors that may seasonally influence abundance of seals hauling out on rocky shoreline and offshore sites (Sullivan 1980; Schneider and Payne 1983). On several winter surveys many of these locations in Oregon were partially awash in high seas and were probably avoided by harbor seals. It may be that observed peaks in seal numbers during some winter flights were related principally to good weather conditions during those particular surveys.

Food availability and foraging patterns may influence seasonal abundance in specific areas. Since harbor seals apparently feed year-round and do not undergo periods of fasting characteristic of some other pinniped species (Boulva and McLaren 1979), lower winter food availability in some Oregon estuaries may result in greater foraging effort by seals and lower attendance rates at some haul out sites during winter months (Graybill 1981). Even more interesting then,

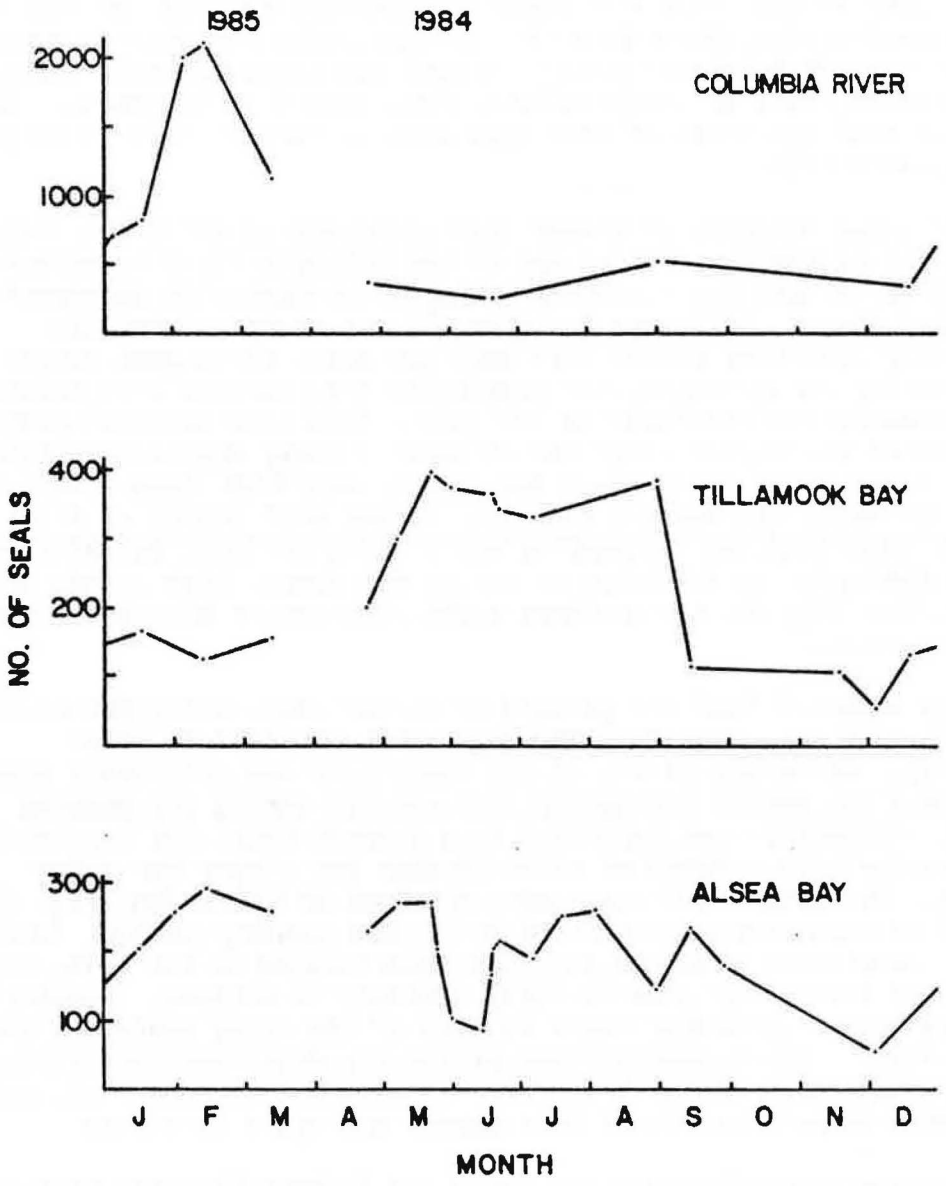


Figure 3. Columbia River, Tillamook Bay, and Alsea Bay harbor seal counts, April 1984 through March 1985.

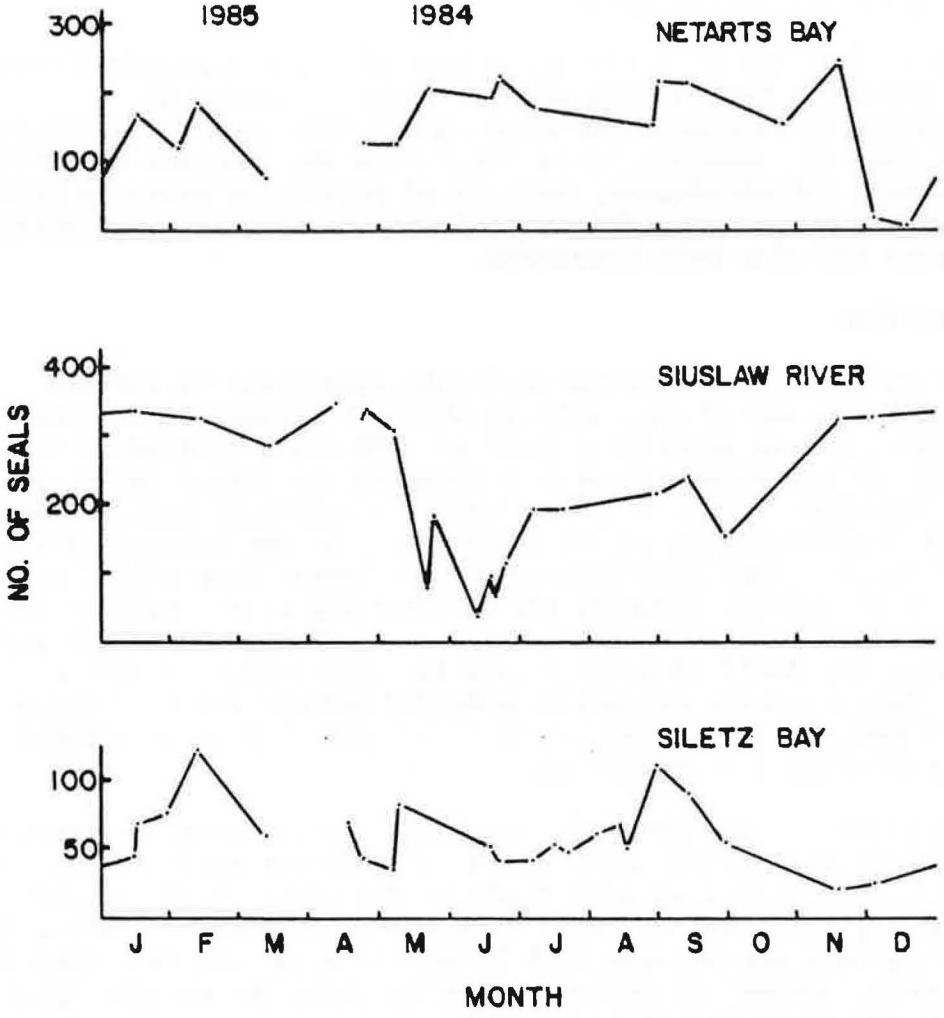


Figure 4. Netarts Bay, Siuslaw River, and Siletz Bay harbor seal counts, April 1984 through March/April 1985.

becomes the peak winter haul out attendance by harbor seals in certain estuaries in Oregon. Winter peaks in seal numbers were found in the Columbia River, Netarts Bay, Siletz Bay, Alsea Bay, and the Siuslaw River. The implication is that these waters may be important winter feeding areas for harbor seals.

During the initial three year phase of Oregon's pinniped research project the major field effort will be largely limited to documentation of abundance and distribution (due to low funding and staffing levels). However, it is clear from the observed variation in seasonal haul out attendance, that use of particular areas by harbor seals can not be correctly interpreted until a seasonal examination of food habits has also been completed.

Pup Production

Statewide counts of harbor seal pups peaked during surveys conducted at the end of May, with an observed maximum of 614 newborn seals, representing 18.1% of a total of 3399 seals counted on that day. Similar percentages have been reported for harbor seals in British Columbia (20.0%) by Bigg (1969), in northern Puget Sound (13.2 to 19.4%) by Calambokidis et al. (1978), and in the Columbia River and adjacent waters, including Netarts and Tillamook Bays (20.0%) by Everitt et al. (1981). Summing the maximum pup counts made at each location, regardless of survey date, results in a total of 647 pups born statewide, April 23 through June 19, 1984 (Tables 1 and 2). Although this estimate assumes no movement between haul out sites of pups born early in the season, it is still likely to be a minimum estimate of total pup production.

The timing of pup births varied latitudinally with more pups born at an earlier date on the south coast. During the April 23-25, 1984 survey 18, 17, and 29 pups were found to the south in the Umpqua River, on Dog Rock, and on Hunter's Island respectively. During the same survey only one pup was seen in each of Alsea and Tillamook Bays to the north. Clinal variation in pupping along the eastern Pacific coastline was described by Bigg (1969) and has been reported in California by Miller (1983).

Bays and estuaries were important sites for harbor seal pup production in Oregon. The majority of seal pups counted in 1984 were found in these protected areas (Table 1). Tillamook Bay, Netarts Bay, Alsea Bay, the Umpqua River, and Coos Bays were the major pup production areas to the north (total 359 pups). Relatively few seal pups were born on rocky shoreline or nearshore rocks in this area (total 28 pups). However from Cape Arago to the south, the major production areas were rocky sites (Table 2); Cape Arago/Simpson's Reef, Gull Rock, Dog Rock, and Hunter's Island (total 235 pups). There is little or no suitable estuarine habitat on the far south coast for use as haul out sites or pupping areas.

Table 1. Harbor seal pup numbers and percent of statewide pup total (647) observed at estuarine haul out sites in Oregon during the 1984 pupping season.

Location	Date	Total No. Seals	No. Pups	% of Statewide Pup Total
Columbia River	6/19	258	9	1.4
Nehalem Bay			0	
Tillamook Bay	5/30	376	119	18.3
Netarts Bay	5/21	208	17	2.6
Nestucca River			0	
Siletz Bay			0	
Yaquina Bay			0	
Alsea Bay	5/21	273	33	5.1
Siuslaw River	5/21	78	3	0.5
Umpqua River	5/23	763	153	23.5
Coos Bay	5/23	174	37	5.7
			371	57.1

Cape Arago, the Umpqua River, and Tillamook Bay were the three most important harbor seal pupping pupping sites on the Oregon coast. Tillamook Bay and the Umpaqua River provide the typically protected inland waters used as pupping sites in many areas. Among the shoreline rocky sites, Cape Arago offers a uniquely large expanse of low lying substrate protected on the windward (seaward) side by Simpson's Reef.

Table 2. Harbor seal pup numbers and percent of statewide pup total (647) observed at shoreline and offshore rocky sites in Oregon during the 1984 pupping season.

Location	Date	Total No. Seals	No. Pups	% of Statewide Pup Total
Tillamook Head	5/30	34	6	0.9
Ecola State Park			0	
Cape Falcon	6/19	60	6	0.9
Cape Lookout	6/19	53	7	1.1
Boiler Bay			0	
Whale Cove			0	
Cape Foulweather	6/18	56	6	0.9
Yaquina Head			0	
Seal Rock			0	
Strawberry Hill	5/18	64	3	0.5
Tenmile Creek			0	
Tenmile Lake Outlet			0	
Cape Arago	5/21	545	169	25.9
Bandon Rocks	5/23	87	3	0.5
Gull Rock	5/23	133	20	3.1
Blanco Reef			0	
Orford Reef			0	
The Head			0	
Humbug Mountain			0	
Dog Rock	4/25	149	17	2.6
Rogue Reef	5/23	49	3	0.5
Hunter's Island	4/25	221	29	4.4
Crook Point	5/23	4	2	0.3
Deer Point			0	
Whalehead Islands	5/23	26	5	0.8
Cape Ferrelo to Chetco Point			0	
			276	42.4

Population Status

All available information on Oregon harbor seal population status and trends indicated that abundance has been increasing since protection was provided by the MMPA (1972). The least quantitative indicator of an increase in harbor seal abundance came from discussions with residents in areas of high visibility of harbor seals, primarily in estuaries. Without contradiction these reports indicate increases in numbers of seals observed on haul out areas. Not all such reports came from persons with special interests in commercial or sport fisheries (J. Lannan, pers. comm.).

Increases in population size may be reflected in utilization of new portions of the available habitat. No previously occupied haul out areas were known to have been abandoned by harbor seals in Oregon, while use of new haul out sites has been documented. The use of Strawberry Hill and Siuslaw River haul out areas by small numbers of seals was first recorded during aerial surveys conducted in 1977. Since that time, up to 110 and 338 harbor seals have been found at these sites, respectively. The Nehalem River haul out site, not used by harbor seals before 1980, was occupied by 121 seals in April, 1984. The rocky shoreline haul out site south of Tenmile Creek was first used in February, 1985 by 26 seals and in March, 1985 a new haul out site in the Nestucca River was occupied by six seals.

Other indications of increased abundance came from pinniped studies or related projects carried out at particular estuaries. Oregon State Fish Commission and Game Commission records reported that Alsea Bay was typically occupied by about 50 harbor seals in the early 1960's. Survey results from the present study showed that nearly 300 seals were commonly found in Alsea Bay. Harbor seal abundance at Netarts Bay increased significantly from 1977 to 1981 (Brown and Mate 1983). Numbers of seals using Netarts Bay recorded during the present study were greater still by roughly 25%. The Columbia River may have been used by less than 100 harbor seals in the late 1960's (Pearson and Verts 1970), while the maximum Columbia River count from the present study was 2106.

Much of the observed increase in harbor seal abundance immediately following the protection provided by the MMPA may have resulted from a redistribution of animals into preferred habitat from which they were previously excluded. However, continued increases in abundance through the late 1970's and into the 1980's probably resulted from a real population increase. Remote, protected portions of estuaries are one of the areas preferred by female harbor seals with newborn pups (Brown and Mate 1983; Beach et al. 1985). Exclusion of seals from these highly productive areas may have had a depressive effect on pup survival and population growth. Conversely, increases in use of these preferred areas may have resulted in increased production and population growth in regional harbor seal stocks.

Comparison of 1984 survey data with harbor seal counts made since 1977 (ODFW/OSU unpub. data) also indicated a statewide increase in abundance. Maximum numbers recorded during the summer showed an overall increase from 2301 in June, 1977 to 3825 in June, 1984 (Table 3). These counts were made during the months of June, July, and August. Since only June surveys included counts of seal pups, total non-pup counts are also presented. Oregon harbor seal counts increased at an average annual rate of between 6% and 8% from 1977 to 1984 (Table 4). In comparison, harbor seal counts (non-pups) from the Columbia River north to Willipa Bay and Grays Harbor, Washington, increased at an average annual rate of 10.7% from 1976 to 1982 (Beach et al. 1985).

Table 3. Oregon statewide counts of harbor seals, 1977-1984.

Month/Year	6/77	6/78	7/80	8/82	6/83	6/84
Total Count	2301	2578	2517	3511	3734	3825
Non-pup Counts	2224	2542	2517	3511	3333	3644

Table 4. Average annual rates of increase (R) in Oregon statewide harbor seal counts, 1977-1984, determined by a linear regression of natural logarithms of counts (r^2 = coefficient of determination)

	R	r^2
All Years Total Count	8%	0.91
All Years Non-pups Only	7%	0.90
All June Counts Non-pups Only	6%	0.98

Similar increases in seal populations following implementation of protective measures have been observed (Bonner 1975; Payne and Schneider 1984). Following protection, increases in regional seal abundance has also been related to unrestricted dispersion of juveniles from highly productive areas (Bonner and Witthames 1974; Payne and Schneider 1984). In the coastal waters of Oregon and southern Washington, the great majority of harbor seal pup production occurs in Grays Harbor and Willapa Bay. It is possible that these southern Washington estuaries have played an important role in growth of regional harbor seal stocks on the Oregon and Washington coasts.

Northern Elephant Seals

Small numbers of northern elephant seals (Mirounga angustirostris) haul out on an irregular basis on Shell Island at Cape Arago. Two elephant seals were found at this site on 6/19/84 and one seal was found during surveys made on 6/21/84, 7/6/84, 7/19/84, 1/15/85, 2/13/85, and 3/13/85. An exponential increase in northern

elephant seal numbers following near extinction of the species before the turn of the century and the progressively northward reestablishment of hauling areas and rookeries along Baja California and California has been well documented (Bartholomew and Hubbs 1952, 1960; Radford et al. 1965; Le Boeuf et al. 1974; Le Boeuf and Mate 1978; Mate 1969). Movements of foraging juveniles of both sexes and adult males northward to Vancouver Island are not uncommon (Condit and Le Boeuf 1984). Small and probably slow increases in numbers of elephant seals using haul out sites in Oregon might be expected.

Steller Sea Lions

Statewide Abundance and Haul Out Site Use

Steller sea lions (Eumetopias jubatus) hauled out at a minimum of ten different locations along the Oregon coast. Only two of these sites, Rogue and Orford Reefs, were found to be rookeries (reproductive areas); the remainder were used as haul out areas with attendance varying throughout the year. Statewide counts of Steller sea lions ranged from 769 to 2352 (Fig. 5). Generally high numbers of Steller sea lions were observed during the spring and summer months, followed by a fall and winter decline.

Statewide counts of Steller sea lions were greatest (2352) during a survey conducted on May 21 and 23 (Fig. 5). Haul out attendance was high at this time at Ecola State Park, Sea lion Caves, Orford Reef, and Rogue Reef, and was relatively low at other sites. Abundance at Rogue and Orford Reefs, the two Oregon rookeries, peaked in May, June, and July. The south jetty of the Columbia River and Three Arch Rock appeared to be used primarily during winter months; Cape Arago during the summer; and Sea Lion Caves during summer and winter with spring and fall lows. Reductions in numbers at rookeries during winter months and other seasonal shifts in use of haul out sites has been noted for Steller sea lions in other areas (Calkins and Pitcher 1982). Oregon statewide low counts of 769 to 1163 occurred in December, January, and March. With the exception of up to 81 animals found at Seal Rock in January, all other haul out sites have been used by Steller sea lions during surveys conducted since 1977.

Pup Production

A total of 405 Steller sea lion pups were counted on Orford and Rogue Reefs on July 13, 1984. The 340 found at Rogue Reef compares reasonably with a maximum ground count of 354 at Rogue Reef on June 30, 1982 (Merrick 1982). A June 26, 1984 count of 273 pups also compares favorably with a June 26, 1982 ground count of 293 (Merrick 1982). The information from these two years of study (1982 and 1984) constitutes the only avaialable data on Steller sea lion pup production in Oregon. Merrick (1982) found that the period and pattern of rookery occupancy by all age and sex classes of sea lions at Rogue Reef to be similar to that reported in other areas (Gentry 1970; Sandegren 1970; Calkins and Pitcher 1982). An estimated range of pup mortality rates of 7-20% (Merrick 1982) was also in agreement

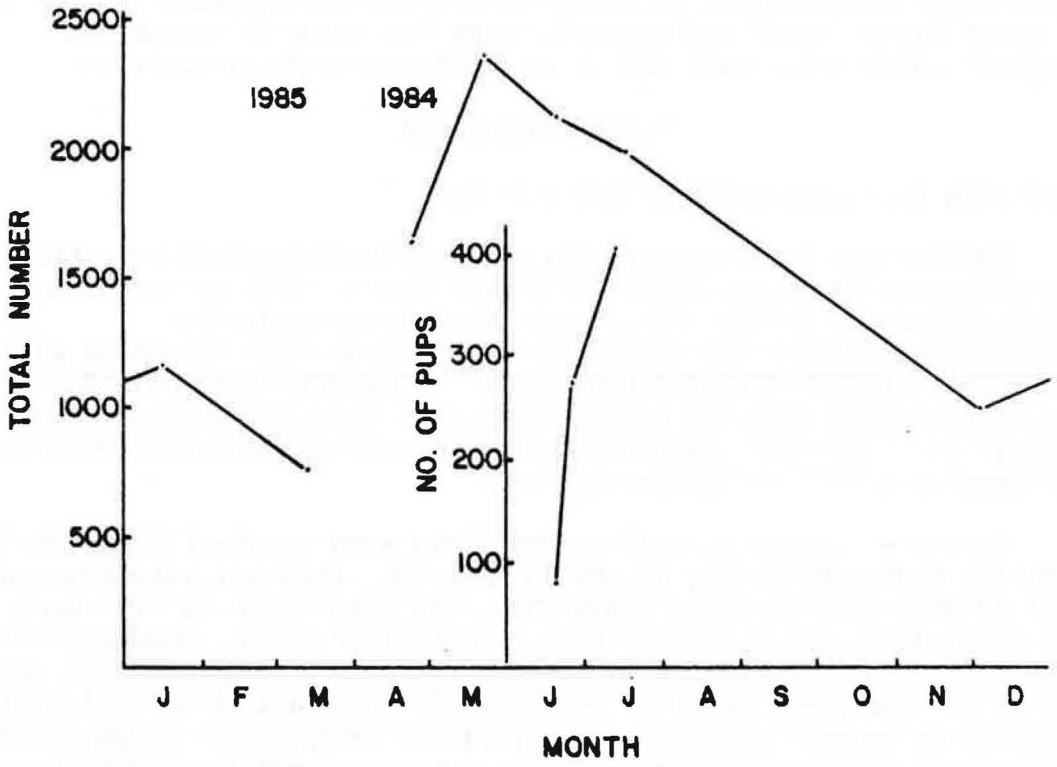


Figure 5. Oregon statewide Steller sea lion counts, April 1984 through March 1985.

with figures of 10-14% reported at other Steller rookeries (Gentry 1970; Sandegren 1970).

Population Status

Statewide aerial survey counts made since 1977 indicate that the Oregon population of Steller sea lions has remained fairly stable over the last seven years (Table 5). Numbers of sea lions found at the Rogue and Orford Reef rookeries, although variable over the past eight years, also seem not to have changed significantly (Table 6). Pup counts from aerial surveys for years prior to 1984 are either absent or are inadequate for comparison. Numbers of sea lions observed at other haul out sites since 1977 are highly variable, and survey coverage was generally not adquate to address trends in use.

Table 5. Oregon statewide counts of Steller sea lions, 1978-1984.

Month/Year	6/78	7/79	7/80	7/81	8/82	6/83	7/84
Total Counts	1886	1580	1632	2161	1834	2147	2083
Non-pup Counts	1812	1554	1632	2108	1718	2076	1678

Table 6. Summer counts of Steller sea lions at Orford and Rogue Reefs.

	Month/Year							
	6/77	6/78	7/79	7/80	7/81	8/82	6/83	7/84
Orford Reef								
Total	371	725	693	482	743	500	603	579
Non-pups	371	677	689	482	736	500	603	514
Rogue Reef								
Total	831	885	403	914	856	881	1022	1094
Non-pups	815	859	373	914	810	765	958	754
Grand Total								
Total	1202	1610	1096	1396	1599	1381	1625	1673
Non-pups	1186	1536	1062	1396	1546	1265	1561	1268

Aerial survey counts at these large rookery areas in Oregon may underestimate actual sea lion numbers. Merrick (1982) reported a maximum ground count 1466 Steller sea lions at Rogue Reef on 28 June 1982. The 1982 aerial survey count reported here for Rogue Reef (881) was made in August when sea lion numbers are lower, however Merrick's ground count is significantly greater than any aerial count to date.

The Oregon Steller sea lion population is unique in that it is the largest reproductive stock in United States waters south of Alaska. The California population has undergone a steady decline since the 1920's (Dohl 1983) and Steller populations in the eastern Aleutians have decreased dramatically since the late 1950's (Braham et al. 1980). Reasons for these declines are not well understood. Prior to 1972, Oregon Steller rookeries were dynamited and sea lions were commonly shot at haul out sites and near the mouths of rivers (ODFW unpub data; C.D. Snow, pers comm). However, Steller sea lions in Oregon are not usually involved in fishery interactions or conflicts. Food habit studies conducted in other parts of its range indicate that Steller sea lions may not cause serious depredation to fish stocks harvested by Oregon coastal fishermen (Calkins and Pitcher 1982; Roffe and Mate 1984). The Steller sea lion in Oregon is a valuable nongame wildlife species. Ongoing studies to monitor population status and trends should receive high priority.

California Sea Lions

Statewide Abundance and Haul Out Site Use

California sea lions were counted at nine haulout sites and at one water resting/feeding area (Yaquina Bay; see Bayer 1981) in Oregon. Many of these locations were also used simultaneously by Steller sea lions. Statewide haul out attendance by California sea lions increased from a mid-summer low (0) to the maximum recorded number (1938) in September, followed by a late fall and winter decline through February (Fig 6). During the spring months of March and April a second, but smaller peak in abudance (960-1118) was observed, followed in May by a decline to the summer low.

California sea lions do not reproduce in Oregon. Following summer breeding activities in California, adult and subadult male sea lions move northward into Oregon, Washington, and British Columbia. The pulse of northward movement usually peaks during September-October in Oregon and occurs progressively later (November-April) northward to British Columbia (Mate 1975; Bigg 1985). In 1984, the March-April Oregon statewide peak of sea lions may have consisted of a pulse of southward migrating sea lions returning through Oregon waters to the breeding areas in California.

In Oregon, the maximum count of 1938 California sea lions was made on September 13, 1984 (Fig. 6). During a partial survey of the Oregon coast, all 1938 animals were found hauled out at Cape Arago. Since no counts of other important California sea lion haul out sites (eg. Rogue Reef, Orford Reef, Cascade Head) were made at this time, this figure was undoubtedly a minimum estimate of Oregon abundance.

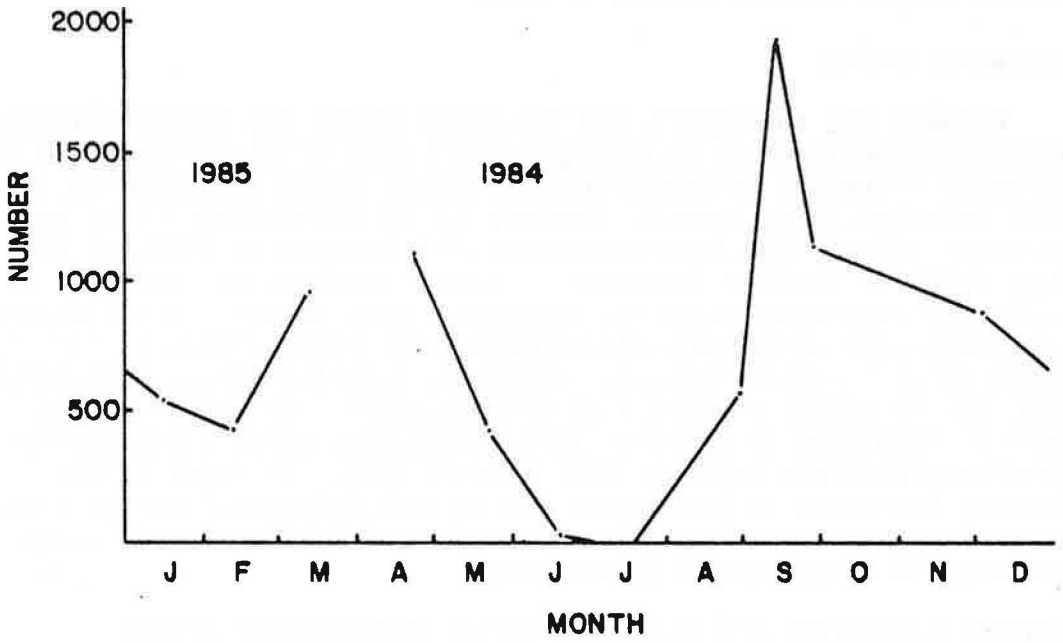


Figure 6. Oregon statewide California sea lion counts, April 1984 through March 1985.

A more accurate estimate of the numbers of California sea lions that passed through Oregon waters between early fall and late spring can be made by summing peak abundances in Oregon, Washington, and British Columbia. Bigg (1985) reported a total of just under 4500 California sea lions in British Columbia in February, 1984. At this same time there were approximately 500 sea lions in Washington waters (S. Jeffries, pers. comm.) and 500 along the Oregon coast (Fig. 6). Therefore a minimum of 5500 California sea lions must have passed through Oregon coastal waters in 1984.

Population Status

Between the mid-1970's and the early 1980's the California sea lion population grew at an average annual rate of 5% per year and is currently estimated to number approximately 70,000 (DeMaster et al. 1982; DeMaster, pers. comm.). Numbers of California sea lions near Vancouver Island, B.C. have increased 10-fold between 1972 and 1984 (Bigg 1975) and similar increases in winter numbers of sea lions in Washington have been noted (S. Jeffries, pers. comm.). There are no comparable data on numbers of California sea lions wintering in Oregon waters prior to 1984. Repeated counts at specific locations have been made, but no series of statewide numbers exist. An aerial survey count of 1121 made in October, 1979 is the only datum available for comparison with the count of 1938 made in 1984. In light of the observed increases in Washington and British Columbia, and the general growth in population size, greater numbers of California sea lions wintering in Oregon might be expected.

PINNIPED POPULATION ASSESSMENT BY AERIAL PHOTOGRAPHIC SURVEY

Aerial photographic survey is the most effective technique available for conducting surveys of large numbers of pinnipeds of several species over a wide geographic area (Eberhardt et al. 1979). The three major pinniped species found in Oregon can be surveyed in eight hours, flying four hours on each of two days. The cost of a statewide aerial survey is reasonable compared to the expense that would be incurred by a land and sea based operation carried out by several field biologists over a much longer period. Aerial photographic surveys provide accurate counts, cause little or no disturbance to the animals, and result in a permanent record of species abundance that can be reviewed and referred to indefinitely.

Disadvantages of aerial surveys include the inability to fly and conduct a census in poor weather conditions that would not necessarily prohibit a land or sea survey. Seasonal coverage of specific sites or large areas may be lost due to inclement weather. Surveys carried out on consecutive days are desirable, to avoid duplicate counts of animals that may move from one survey area to another. This is not always possible and some statewide species totals may consist of a combination of survey data collected over a week or more. It is not believed, however, that significant duplication of counts occurs in these situations.

Enumeration of pinnipeds, particularly harbor seals (adults and pups) and Steller sea lion pups, on rocky habitat is often difficult from aerial survey photographs. The small amount of time spent over each haul out site is inadequate to make direct counts, and may occasionally result in small groups being overlooked and not included in the photographic record. Locating, photographing, and counting harbor seals at estuarine haul out sites is much easier and is accomplished with negligible error.

The short periods of time spent over each haul out location make the affects of human disturbance on pinniped abundance difficult to assess. Often times a regularly used haul out site may have been abandoned by pinnipeds just prior to aerial coverage, resulting in a low count for that particular area during a survey. Because of this problem, important haul out areas with large numbers of animals (e.g. Umpqua River and Cape Arago) should be surveyed as early as possible during the low tide window to reduce the chances of human disturbance.

Finally, the observed abundance from any survey of hauled out pinnipeds is only a minimum estimate of the total number of animals that may be occupying the area. Recent radio tagging studies of harbor seal haul out behavior indicates that roughly one-half of the total numbers of harbor seals in an estuary may be hauled out at any one time (J. Harvey, unpub. data). As an index of population status and trends, however, annual counts of hauled out pinnipeds during reproductive and molting periods are valuable.

The descriptions of seasonal abundances of the three pinniped species offered in this first report are potentially biased in a number of ways by the problems described above. In the absence of substantiating information from other studies (available in limited cases), the observed trends in seasonal abundances of pinnipeds at specific locations, resulting from only a single year of surveys, should be interpreted carefully at this time. A more complete description of haul out area use by pinnipeds in will come from continuing census efforts.

PRELIMINARY IDENTIFICATION OF PINNIPED INTERACTIONS WITH OREGON FISHERIES AND FISH STOCKS

During the first year of the ODFW marine mammal project little time or effort was availble for assessment of existing interactions and conflicts between marine mammal populations and Oregon fisheries. The material presented below represents only general information on several fishery interaction questions that was collected on an opportunistic basis.

Yaquina Bay Herring Fishery/California Sea Lions

Spawning aggregations of Pacific herring are found in Yaquina Bay from mid-January to late April, and generally peak in abundance sometime in February or early March. These fish have been harvested commercially with lampara seines since the early 1960's (J. Butler, pers. comm.). California sea lions, found in Yaquina Bay from September through May, also peak in number in February and March (Bayer 1981). While in Yaquina Bay, these sea lions forage on live fish, consume remains of fish carcasses disposed of by fishermen and fish plants, and rest in large aggregations, or rafts, in the water.

During the mid-1970's, increasing numbers of California sea lions in Yaquina Bay were viewed by fishermen as a threat to the herring fishery. Inexperience in dealing with sea lions during fishing operations resulted a variety of problems. Fishermen reacted to the presence of sea lions in their nets by shooting at the animals or by throwing small explosives into the net. This often resulted in large holes being torn in nets by escaping sea lions or in animals becoming so entangled that they had to be shot and physically cut out of the net.

Presently, the fishery opens each year on February 1 and uses both lampara nets and small purse seines (50 fa maximum length) to take an annual quota of 60 tons. Although variable from year to year, the fishery runs for a relatively short period. In 1985, fishing began on February 1, but heavy catches were not made until February 18. The quota was met on the afternoon of February 19. All reported interactions with California sea lions occurred during the first week of the 1985 fishery, before any significant catches were made (J. Butler, pers. comm.). In an attempt to drive a sea lion out of a net, one animal was shot at and possibly killed. In the only other reported interaction two sea lions were found inside the purse of the net as it was being closed. The larger of the two jumped out over the cork line as the purse became smaller; the younger sea lion safely spilled out of the net after being lifted out of the water by the power block.

At the present time, the small number of fishermen that participate in the Yaquina Bay herring fishery apparently do not view the limited interactions with California sea lions as threatening to their operations. Most have learned that if normal fishing procedures are followed, sea lions in their nets will leave through the bottom or over the cork line before the net is closed. On occasion sea lions

may break up a small spawning aggregation and make the fish more difficult to net, but this was an infrequent complaint. When large numbers of herring entered the bay the quota was quickly met and sea lions may have avoided the high paced fishing activity. However, if the level of interaction with sea lions were to increase and fishing time in such a short fishery was lost due to gear damage and entanglement, the attitude of fishermen regarding the sea lions would rapidly change (J. Butler, pers. comm.).

Columbia River Sturgeon Gillnet Fishery/Harbor Seals

Each year since 1983 a large mesh drift gillnet fishery for sturgeon in the Columbia River has been adopted by the Columbia River Compact. Provisions for the 1983-1984 fisheries were that they be operated as experimental and be thoroughly monitored and evaluated. These evaluations were carried out jointly by Washington Department of Fisheries (WDF) and ODFW (Kreitman and King 1984).

The nets used were both divers and floaters of single wall construction, no more than 250 fa in length with no less than 9" mesh. Although required to be drift nets, most nets were heavily leaded and often did not drift in a conventional manner (Kreitman and King 1984). Seasons ranged from five to eight days and greatest fishing effort and catches occurred in Commercial Fishing Zones 2 and 3. During the 1984 fishery, five harbor seals were observed caught and killed in these nets, all between Woody Island and Longview. Substantial numbers of harbor seals were present in this area and an estimated number of 198 seals may have been handled during the eight day season throughout the fishing area (Kreitman and King 1984).

The timing of the sturgeon gillnet fishery has coincided closely with the winter peak in harbor seal abundance in the Columbia River. While the major haul out sites for harbor seals in the river are in Zone 1, large numbers of seals are known to occupy the river up to Longview during winter months (S. Jeffries, pers. comm.). Interactions between harbor seals and gillnets set in the river at this time would be expected to occur. The causative factors for this interaction are probably different from those related to salmon gillnet fisheries. In the case of salmon fisheries harbor seals may be actively foraging on fish caught in the net and so total numbers of interactions may be greater.

During the 1985 sturgeon gillnet fishery, spot checks rather than intensive sampling were conducted for incidental catch of salmonids and seals. On Jauary 30, interviews with operators of seven different boats fishing from Longview downriver to the Woody Island Drift (Aldrich Point) indicated that interations including pinniped entanglement and fishing gear damage was a problem. Although some entangled animals could be freed, most either drowned or were shot. The incidental take of marine mammals during commercial gillnet fishing is allowed under a general permit when operating with a current Certifcate of Inclusion. The number of harbor seals killed during eight days of salmon gillnet fishing in the Columbia River in late February of 1982 was estimated at 210 (Beach et al. 1982). An

additional eight days of sturgeon gillnetting may add significantly to the incidental take of harbor seals in Columbia River gillnet fisheries.

ODFW Salmonid Hatchery Operations/ Harbor Seals

The effects of pinniped predation on free-swimming salmonids in the open ocean are considered minimal (Fiscus 1980). However, pinnipeds foraging in the enclosed or restricted waters of estuaries and rivers may encounter concentrations of fish that are more susceptible to predation. Predator scars on adult salmon and steelhead observed in creel samples, passing by fish counting stations, and handled at fish hatcheries are common (Beach et al. 1985; ODFW unpub. data). Seals and sea lions foraging primarily within estuary and river systems are believed to be responsible for this damage. Scarring rates observed at the Winchester Dam on the Umpqua River ranged from 2.0% for coho, to 9.8% for chinook, to 15.1% for steelhead (Beach et al. 1985). Scarred fish returning to other Oregon hatcheries ranged from 0.6% for combined coho and chinook at Fall Creek to 38.2% for winter steelhead at the Salmon River hatchery (Table 7). Harbor seals are suspected as the primary predator in these situations.

Table 7. Summary of observed rates of harbor seal predation scars on salmonids (percent of examined fish with scars) at four ODFW hatcheries on three coastal river systems. Figures in ( ) are for winter steelhead; others are combined chinook and coho (as originally compiled by D. Snow, ODFW).

Year	Salmon River	Siletz River	Fall Creek (Alsea system)	Alsea River
82/83	11.4%	3.3%	0.6%	11.3%
83/84	14.0%	--	--	--
84/85	11.2% (38.2%)	--	--	(25%)*

*Estimate from creel survey (S. Trask, ODFW)

The relationships between scarring rates and successful seal or sea lion predation are generally unknown. However, collection of scar data at hatcheries may provide an indication of the relative levels of interaction in different river systems and could possibly identify fish species most susceptible to predation by pinnipeds.

It might be expected that increasing use of estuaries and river systems by growing numbers of harbor seals may result in greater interaction between adult salmonids and foraging seals. Great energy

and expense has been directed toward increasing salmonid production at hatcheries, improving habitat conditions for wild stocks, and managing harvests of a variety of anadromous fish species. Yet at the present, little is known about the affects of inland water foraging by pinnipeds on these fish stocks.

Similarly, a great number of other fish species occurring in nearshore and estuarine waters are susceptible to pinniped predation during many stages of their life histories. Many of these species are harvested in sport or commercial fisheries, and all play some role in the balance of coastal marine food webs. An assessment of food habits of pinnipeds foraging in estuaries and rivers would provide a greater understanding of these trophic relationships.

SUMMARY

The first comprehensive examination of seasonal abundances and distributions, and of the status and trends of pinniped populations in Oregon was begun during the first year of this program (April, 1984 through April, 1985). Complete coverage of Oregon pinniped habitat was accomplished by aerial photographic survey. Monthly statewide censuses were attempted but not always completed due to inclement weather. Reported abundance consists of counts of seals and sea lions on rookeries and/or hauling grounds.

Total counts of harbor seals in Oregon peaked at 5325 in February. At this time 2106 seals were found in the lower Columbia River and 3219 occupied other haul out sites in Oregon. The maximum summer count occurred in late June, at the end of the pupping period, when 3825 harbor seals were recorded statewide. Just 258 seals were observed in the Columbia River during this summer survey. Highly seasonal use of the Columbia River by a regional population of harbor seals in Oregon and Washington was observed (see also Beach et al. 1985). Ratios of newborn pups to total counts during the reproductive period are similar to those reported from other areas. An increase in total numbers of harbor seals, at a rate of approximately 7% per year, since 1977 is apparent.

Numbers of California sea lions occuppying Oregon waters peaked in September at 1938. This count is nearly twice the highest previous count made in the fall of 1979. A second smaller peak in abundance was observed during spring months as the sea lions apparently return southward prior to breeding activities in California.

The maximum statewide count of 2352 Steller sea lions occurred in May. A maximum count of 340 pups born on Rogue Reef, the major rookery for Steller sea lions in Oregon, agreed closely with a ground count of 354 in 1982 (Merrick 1982). Numbers of Steller sea lions in Oregon, including occupancy of the two rookeries (Rogue and Orford Reefs) appeared to be fairly stable during the past decade.

Preliminary identifications of existing and potential conflicts between certain fisheries and pinniped populations were made. This early effort indicates that there may be situations in which pinniped mortalities are high (gillnet fisheries); other cases where pinniped depredation may be significant (inland waters/hatchery operations); and other interactions that do not propose a threat to either the fishery or the pinniped involved (Yaquina Bay herring fishery).

RECOMMENDATIONS

1. Monthly aerial surveys of Oregon pinnipeds should be continued during the next two years to adequately describe distribution, abundance, and seasonal trends in habitat use. Following this period, based upon identification of critical assessment periods, fewer annual surveys may be required to monitor population status.

2. Assessment of regional harbor seal populations (abundance, distribution, movements, food habits, fishery interactions), from planning of field work to identification of management goals, should be addressed cooperatively with the State of Washington.

3. In light of declining numbers of Steller sea lions in other areas, efforts to monitor Oregon's reproductive population should be increased. Knowledge of reproductive rates, causes of mortality, and food and habitat requirements is necessary to insure continuation of a healthy population.

4. Feeding habits and dietary requirements of harbor seals, Steller sea lions, and California sea lions should be examined so that a determination of their trophic role in Oregon's coastal marine and estuarine ecosystems can be made.

5. Areas of direct interaction with fisheries should be identified, and the impacts of such conflict on the fishery, fish stocks, and pinniped populations should be determined. Methods to reduce critical interactions should be developed and implemented.

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APPENDICES

Appendix A

Oregon Department of Fish and Wildlife;
Northwest Region, National Marine Fisheries Service
Northwest and Alaska Fisheries Center

Joint Proposal for

Return of Marine Mammal Management to Oregon

I. Planning and Investigative Phase

1. Oregon Department of Fish and Wildlife (ODFW) will hire a marine mammal specialist by April 1, 1984

2. ODFW will submit a research proposal to Northwest and Alaska Fisheries Center (NWAFC) to cover the period from April 1, 1984 to March 31, 1985

3. ODFW will assess the status and trend of harbor seals from April 1, 1984 to July 31, 1986

4. ODFW will assess the status and trend of northern sea lions from April 1, 1984 to July 31, 1986

5. ODFW will assess peak abundance of California sea lions, and abundance of animals at areas of interactions from December 1, 1984 to May 15, 1986

6. ODFW will identify areas and types of pinniped interactions and evaluate mitigative measures

7. ODFW will identify and evaluate management options

8. ODFW will conduct a literature review by December 31, 1984

9. Northwest Region (NWR) will review the existing Oregon Revised Statutes by December 31, 1985

10. ODFW will participate in the Stranding Network

11. ODFW will analyze data to determine OSP by August 31, 1986

II. Administrative and Funding Phase

1. NWR will instigate interagency coordination meetings as necessary beginning May 1, 1984

2. NWR and NWAFC will submit a coordinated initiative for FY '86 for Section 109 and request Section 110 funds for FY '85

3. NWR and ODFW will match costs by State FY '87

4. NWAFC will initiate a research cooperative agreement with Washington State

III. Decision Phase

1. ODFW will draft the State Plan by August 31, 1986

2. ODFW staff will obtain Oregon Department of Fish and Wildlife Commission approval of the plan by September 30, 1986

3. ODFW will approach the Oregon State Legislature if any State Statutes need to be modified

IV. Request, Approval, and Implimentation Phase

1. ODFW will submit a request for return of management to NMFS by October 31, 1986

2. National Marine Fisheries Service (NMFS) will make an initial determination within 45 days of request submitted

3. NMFS will publish a notice of initial determination in the Federal Register followed by a 60 day public comment period

4. ODFW will make an initial OSP determination by November 30, 1986

5. NMFS will publish a final determination on the State Plan in the Federal Register by February 1, 1987

6. ODFW will hold a formal OSP determination hearing in February, 1987

7. ODFW will make a final OSP determination by March 31, 1987

8. The Oregon Department of Fish and Wildlife Commission will enact such rules and policies as is deemed necessary in the State Plan

9. ODFW will enter into a cooperative allocation agreement with NMFS

10. ODFW will impliment the State Plan on July 1, 1987

Appendix B1. Aerial survey counts of harbor seals in Oregon ("--" indicates area not surveyed). Pup counts are in parentheses and are included in total counts.

	4/23/84	4/25/84	5/7/84	5/21/84	5/23/84	5/30/84	5/31/84
Columbia River	369	--	--	--	--	Ø	--
Tillamook Head	46	--	--	--	--	34(6)	--
Ecola Point	4	--	--	--	--	Ø	--
Cape Falcon	3	--	--	--	--	24(2)	--
Nehalem River	121	--	103	--	--	2	--
Tillamook Bay	201(1)	--	302	393(71)	--	376(119)	--
Netarts Bay	127	--	127(1)	208(17)	--	--	--
Cape Lookout	44	--	26	41(4)	--	--	--
Nestucca River	--	--	--	--	--	--	--
Siletz Bay	43	--	35	2	--	--	--
Boiler Bay	--	--	Ø	Ø	--	--	--
Whale Cove	43	--	Ø	26	--	--	--
Cape Foulweather	42	--	32(1)	23(4)	--	--	--
Yaquina Head	56	--	Ø	14	--	--	--
Yaquina Bay	12	--	13	Ø	--	--	--
Seal Rock	10	16	12	5	--	--	--
Alsea Bay	230(1)	--	271(22)	273(33)	205(21)	--	106(13)
Strawberry Hill	63	79	64(3)	52(1)	--	--	--
Mill Creek	--	--	--	--	--	--	--
Siuslaw River	329	338	309	78(3)	186(2)	--	--
Umpqua River	562(6)	646(18)	657(90)	743(149)	763(153)	--	--
Tenmile Creek	--	--	--	--	--	--	--
Coos Bay	91(1)	--	74(4)	161(26)	174(37)	--	--
Cape Arago	401(6)	--	493(89)	545(169)	601(88)	--	--
Bandon Rocks	--	162(2)	--	--	87(3)	--	--
Gull Rock	--	113	--	--	133(20)	--	--
Blanco Reef	--	Ø	--	--	Ø	--	--
Orford Reef	--	41	--	--	Ø	--	--
The Heads	--	41	--	--	Ø	--	--
Humbug Mountain	--	8	--	--	Ø	--	--
Hubbard Mound Reef	--	149(17)	--	--	72(8)	--	--
Rogue Reef	--	122	--	--	49(3)	--	--
Hunters Island	--	221(29)	--	--	207(25)	--	--
Crook Point	--	64(1)	--	--	4(2)	--	--
Deer Point	--	Ø	--	--	Ø	--	--
Whalehead Islands	--	12	--	--	26(5)	--	--
Cape Ferrelo to Chetco River	--	Ø	--	--	Ø	--	--

Appendix B1 (cont). Aerial survey counts of harbor seals in Oregon ("--" indicates area not surveyed). Pup counts are in parentheses and are included in total counts.

	6/13/84	6/18/84	6/19/84	6/21/84	6/26/84	7/1/84	7/6/84	7/19/84
Columbia River	--	236(3)	258(9)	--	--	--	--	--
Tillamook Head	--	91(5)	94(5)	--	--	--	--	--
Ecola Point	--	4	3	--	--	--	--	--
Cape Falcon	--	30(3)	60(6)	--	--	--	--	--
Nehalem River	--	7	--	--	--	--	--	--
Tillamook Bay	--	367(63)	339(60)	343	--	--	332	--
Netarts Bay	--	193(10)	97(8)	222	--	--	180	--
Cape Lookout	--	45(4)	53(7)	28	--	--	28	--
Nestucca River	--	Ø	--	Ø	--	--	Ø	--
Siletz Bay	--	51	--	41	--	--	42	--
Boiler Bay	--	Ø	--	--	--	--	Ø	53
Whale Cove	--	Ø	--	37	--	--	14	5
Cape Foulweather	--	58	--	42	--	--	48	2
Yaquina Head	--	24	--	36	--	--	78	53
Yaquina Bay	--	9	--	Ø	--	--	Ø	Ø
Seal Rock	5	14	11	9	--	--	15	14
Alsea Bay	87(4)	168(4)	205	219	--	--	192	254
Strawberry Hill	50	Ø	69	94	--	--	81	94(1)
Mill Creek	--	--	--	--	--	--	--	--
Siuslaw River	36	96	68	115(1)	--	--	193	193
Umpqua River	276(23)	455(20)	506	650	--	--	503	628(4)
Tenmile Creek	20	Ø	--	--	--	--	--	--
Coos Bay	Ø	68(3)	92	119	--	--	Ø	--
Cape Arago	177(16)	479(38)	400	352(32)	--	--	484(8)	546(5)
Bandon Rocks	--	--	150	--	--	--	--	--
Gull Rock	--	--	90	--	--	--	--	--
Blanco Reef	--	--	Ø	--	--	--	--	--
Orford Reef	--	--	Ø	--	--	--	--	--
The Heads	--	--	35	--	--	--	--	--
Humbug Mountain	--	--	--	--	--	--	--	--
Hubbard Mound Reef	--	--	150	--	--	--	--	--
Rogue Reef	--	--	221(2)	--	175(5)	199(5)	--	9
Hunters Island	--	--	172	--	--	--	--	--
Crook Point	--	--	40(2)	--	--	--	--	--
Deer Point	--	--	Ø	--	--	--	--	--
Whalehead Islands	--	--	23(5)	--	--	--	--	--
Cape Ferrelo to Chetco River	--	--	--	--	--	--	--	--

Appendix B1 (cont). Aerial survey counts of harbor seals in Oregon ("--" indicates area not surveyed). Pup counts are in parentheses and are included in total counts.

	8/3/84	8/29/84	8/31/84	9/13/84	9/28/84	11/18/84	12/3/84
Columbia River	--	--	525	--	--	--	--
Tillamook Head	--	--	114	--	--	--	--
Ecola Point	--	--	13	--	--	--	--
Cape Falcon	--	--	119	101	--	--	--
Nehalem River	--	--	2	--	--	--	--
Tillamook Bay	--	387	356	113	--	109	--
Netarts Bay	--	151	218	215	--	243	--
Cape Lookout	--	11	12	22	--	--	--
Nestucca River	--	Ø	--	Ø	--	Ø	--
Siletz Bay	62	111	--	90	54	21	--
Boiler Bay	Ø	Ø	--	11	14	Ø	--
Whale Cove	Ø	24	--	80	54	Ø	--
Cape Foulweather	76	29	--	34	20	--	--
Yaquina Head	43	18	--	30	15	6	--
Yaquina Bay	Ø	23	--	14	15	Ø	--
Seal Rock	14	Ø	--	Ø	9	8	7
Alsea Bay	261	149	--	239	182	Ø	56
Strawberry Hill	104(2)	50	--	72	--	35	84
Mill Creek	--	--	--	--	--	--	--
Siuslaw River	--	215	--	240	151	323	325
Umpqua River	--	60	--	63	Ø	Ø	311
Tenmile Creek	--	Ø	--	--	Ø	--	--
Coos Bay	--	40	--	128	31	69	8
Cape Arago	--	287	--	394	377	55	313
Bandon Rocks	--	--	--	--	--	--	128
Gull Rock	--	--	--	--	--	--	78
Blanco Reef	--	--	--	--	--	--	Ø
Orford Reef	--	--	--	--	--	--	Ø
The Heads	--	--	--	--	--	--	11
Humbug Mountain	--	--	--	--	--	--	11
Hubbard Mound Reef	--	--	--	--	--	--	91
Rogue Reef	--	--	--	--	--	--	Ø
Hunters Island	--	--	--	--	--	--	--
Crook Point	--	--	--	--	--	--	--
Deer Point	--	--	--	--	--	--	--
Whalehead Islands	--	--	--	--	--	--	--
Cape Ferrelo to Chetco River	--	--	--	--	--	--	--

Appendix B1 (cont). Aerial survey counts of harbor seals in Oregon ("--" indicates area not surveyed).

	12/4/84	12/17/84	12/18/84	1/3/85	1/15/85	1/16/85	1/31/85
Columbia River	--	224	333	713	--	821	--
Tillamook Head	Ø	--	36	--	--	22	--
Ecola Point	18	--	13	--	--	8	--
Cape Falcon	Ø	--	26	--	--	7	--
Nehalem River	Ø	--	Ø	--	--	40	--
Tillamook Bay	53	--	133	--	--	165	--
Netarts Bay	18	--	5	--	--	170	--
Cape Lookout	30	--	--	--	--	45	--
Nestucca River	Ø	--	--	--	--	Ø	--
Siletz Bay	25	--	--	--	45	69	77
Boiler Bay	Ø	--	--	--	Ø	1	1
Whale Cove	53	--	--	--	59	60	54
Cape Foulweather	62	--	--	--	71	71	76
Yaquina Head	103	--	--	--	102	49	77
Yaquina Bay	Ø	--	--	--	Ø	Ø	1
Seal Rock	--	--	--	--	8	30	31
Alsea Bay	--	--	--	--	206	204	258
Strawberry Hill	--	--	--	--	100	108	87
Mill Creek	--	--	--	--	Ø	Ø	--
Siuslaw River	--	--	--	--	338	--	--
Umpqua River	--	--	--	--	326	--	--
Tenmile Creek	--	--	--	--	--	--	--
Coos Bay	--	--	--	--	28	--	--
Cape Arago	--	--	--	--	353	--	--
Bandon Rocks	--	--	--	--	167	--	--
Gull Rock	--	--	--	--	34	--	--
Blanco Reef	--	--	--	--	10	--	--
Orford Reef	--	--	--	--	58	--	--
The Heads	--	--	--	--	20	--	--
Humbug Mountain	--	--	--	--	23	--	--
Hubbard Mound Reef	--	--	--	--	120	--	--
Rogue Reef	--	--	--	--	77	--	--
Hunters Island	--	--	--	--	85	--	--
Crook Point	--	--	--	--	--	--	--
Deer Point	--	--	--	--	--	--	--
Whalehead Islands	--	--	--	--	--	--	--
Cape Ferrelo to Chetco River	--	--	--	--	--	--	--

Appendix B1 (cont). Aerial survey counts of harbor seals in Oregon ("--" indicates area not surveyed). Pup counts are in parentheses and are included in total counts.

	2/4/85	2/12/85	2/13/85	3/12/85	3/13/85	4/12/85
Columbia River	2003	2106	1381	1127	--	--
Tillamook Head	--	121	--	Ø	--	--
Ecola Point	--	6	--	Ø	--	--
Cape Falcon	--	4	--	24	--	--
Nehalem River	36	1	--	5	80	--
Tillamook Bay	--	126	--	158	--	--
Netarts Bay	120	186	--	78	--	--
Cape Lookout	--	Ø	--	12	--	--
Nestucca River	--	Ø	--	6	--	--
Siletz Bay	--	122	--	60	--	--
Boiler Bay	--	Ø	--	Ø	--	--
Whale Cove	--	48	--	24	--	--
Cape Foulweather	--	55	--	25	--	--
Yaquina Head	--	62	--	39	--	--
Yaquina Bay	--	Ø	Ø	12	--	--
Seal Rock	--	--	13	--	3	7
Alsea Bay	--	--	292	--	260	167
Strawberry Hill	--	--	73	--	92	58
Mill Creek	--	--	26	--	22	18
Siuslaw River	--	--	327	--	285	347
Umpqua River	--	--	558	--	612	658(1)
Tenmile Creek	--	--	Ø	--	5	--
Coos Bay	--	--	150	--	145	90
Cape Arago	--	--	350	--	229	369
Bandon Rocks	--	--	224	--	198	212
Gull Rock	--	--	78	--	46	113
Blanco Reef	--	--	--	--	5	18
Orford Reef	--	--	--	--	39	39
The Heads	--	--	49	--	49	5
Humbug Mountain	--	--	19	--	8	5
Hubbard Mound Reef	--	--	144	--	182	--
Rogue Reef	--	--	100	--	120	--
Hunters Island	--	--	86	--	153	177(2)
Crook Point	--	--	--	--	33	--
Deer Point	--	--	--	--	20	--
Whalehead Islands	--	--	--	--	15	--
Cape Ferrelo to Chetco River	--	--	--	--	--	--

Appendix B2. Aerial survey counts of Steller sea lions in Oregon ("--" indicates area not surveyed). Pup counts are in parentheses and are included in total counts.

Date	Columbia River Jetty	Ecola Point	Three Arch Rocks	Cascade Head	Seal Rock	Sea Lion Caves	Cape Arago	Blanco Reef	Orford Reef	Rogue Reef
4/23/84	9	113	159	--	Ø	30	19	--	--	--
4/25/84	--	--	--	--	--	--	--	Ø	553	765
5/7/84	--	--	Ø	--	--	200	87	--	--	--
5/21/84	--	--	17	--	--	464	12	--	--	--
5/23/84	--	--	--	--	--	--	Ø	1	906	772
6/13/84	--	--	--	--	--	215	5	--	--	--
6/18/84	--	225	9	Ø	--	206	26	--	--	--
6/19/84	--	133	--	--	--	300	35	50	650	856 (81)
6/26/84	--	--	--	--	--	--	--	--	--	1121 (273)
7/1/84	--	--	--	--	--	--	--	--	--	933
7/6/84	--	--	20	--	--	300	64	--	--	--
7/13/84	--	30	70	--	--	--	--	--	579 (65)	1094 (340)
7/19/84	--	--	--	--	--	200	110	--	--	--
8/29/84	--	--	116	--	--	Ø	55	--	--	--
8/31/84	4	1	152	--	--	--	--	--	--	--
9/13/84	--	--	82	--	--	2	98	--	--	--
9/28/84	--	--	--	--	--	--	37	--	--	--
11/18/84	--	--	135	--	--	Ø	1	--	--	--
12/3/84	--	--	--	--	--	1	3	Ø	372	450
12/4/84	4	Ø	174	--	--	--	--	--	--	--
12/17/84	11	--	--	--	--	--	--	--	--	--
12/18/84	5	Ø	246	--	--	--	--	--	--	--
1/3/85	Ø	--	--	--	--	--	--	--	--	--
1/15/85	--	--	--	--	55	315	Ø	Ø	193	280
1/16/85	7	Ø	237	50	81	--	--	--	--	--
1/31/85	--	--	--	--	16	--	--	--	--	--
2/4/85	46	--	--	--	--	--	--	--	--	--
2/12/84	6	Ø	290	8	--	--	--	--	--	--
2/13/85	--	--	--	--	Ø	10	Ø	--	--	--
3/12/85	55	Ø	198	69	--	--	--	--	--	--
3/13/85	--	--	--	--	Ø	10	3	Ø	3	431
4/12/85	--	--	--	--	Ø	335	4	Ø	17	--

Appendix B3. Aerial survey counts of California sea lions in Oregon ("--" indicates area not surveyed). Sea lions at Yaquina Bay were in water (not hauled out) and some counts were made during shore or boat surveys.

Date	Columbia River Jetty	Ecola Point	Three Arch Rocks	Cascade Head	Yaquina Bay	Sea Lion Caves	Cape Arago	Blanco Reef	Orford Reef	Rogue Reef
4/23/84	152	Ø	Ø	--	--	70	120	--	--	--
4/25/84	--	--	--	--	--	--	--	Ø	61	708
5/7/84	--	--	--	--	--	232	294	--	--	--
5/21/84	--	--	Ø	Ø	--	14	214	--	--	--
5/23/84	--	--	--	--	--	--	100	6	32	157
6/13/84	--	--	--	--	--	1	20	--	--	--
6/18/84	--	Ø	Ø	--	--	Ø	2	--	--	--
6/19/84	--	Ø	--	--	--	Ø	1	--	--	6
6/21/84	--	--	Ø	--	--	--	--	--	--	--
6/26/84	--	--	--	--	--	--	--	--	--	Ø
7/1/84	--	--	--	--	--	--	--	--	Ø	Ø
7/2/84	--	--	--	--	--	--	--	--	Ø	Ø
7/6/84	--	--	Ø	--	--	Ø	Ø	--	--	--
7/13/84	--	--	--	--	--	--	--	--	Ø	Ø
7/19/84	--	--	--	--	--	Ø	Ø	--	--	--
8/29/84	--	--	Ø	--	--	150	397	--	--	--
8/31/84	18	1	Ø	--	--	--	--	--	--	--
9/13/84	--	--	Ø	--	--	Ø	1938	--	--	--
9/28/84	--	--	--	--	--	--	1138	--	--	--
11/18/84	--	--	Ø	--	--	Ø	85	--	--	--
12/3/84	--	--	--	--	--	Ø	3	--	372	450
12/4/84	53	--	3	--	--	--	--	--	--	--
12/17/84	102	--	--	--	--	--	--	--	--	--
12/18/84	98	Ø	1	--	--	--	--	--	--	--
1/3/85	55	--	--	--	39	--	--	--	--	--
1/15/84	--	--	--	--	45	30	Ø	Ø	12	3
1/16/84	82	Ø	1	250	72	--	--	--	--	--
2/4/84	132	--	--	--	90	--	--	--	--	--
2/12/84	88	Ø	Ø	191	100	--	--	--	--	--
2/13/84	--	--	--	--	100	40	Ø	--	--	--
3/12/84	277	Ø	Ø	406	100	--	--	--	--	--
3/13/84	--	--	--	--	--	20	Ø	Ø	31	126
4/12/84	--	--	--	--	--	108	57	Ø	79	--

Appendix C. Pinniped haulout sites in Oregon.

Location Name	Species	N Latitude	W Longitude	Type	Substrate
Columbia River					
S. Jetty	Pv,Ej,Zc	46° 14' 00"	124° 04' 00"	Jty	Rk
Chinook Entrance Sands	Pv	46° 15' 48"	123° 57' 30"	Est	Sd
		46° 16' 05"	123° 57' 51"		
Desdemona Sands	Pv	46° 12' 47"	123° 52' 42"	Est	Sd
Sands N. of Tongue Pt.	Pv	46° 13' 52"	123° 45' 45"	Est	Sd
Grays Bay	Pv	46° 15' 56"	123° 43' 50"	Est	Sd
		46° 16' 36"	123° 43' 33"		
		46° 16' 02"	123° 42' 15"		
S. of Miller Sands	Pv	46° 13' 52"	123° 38' 40"	Est	Sd
Seal and Green Isls.	Pv	46° 12' 33"	123° 38' 57"	Est	Md/Sd/Gs
Tillamook Head	Pv			Shl	Rk
West Tip		45° 56' 47"	123° 59' 30"		
S. Side of Bald Mtn.		45° 56' 12"	123° 59' 20"		
Ecola Point					
Sea Lion Rock	Ej,Zc	45° 54' 29"	123° 58' 20"	Nsh	Rk
Seal Rocks	Pv	45° 54' 31"	123° 58' 12"	Shl	Rk
Cape Falcon	Pv				
West Tip		45° 46' 03"	123° 58' 50"	Shl	Rk
N. Side Cove		45° 46' 05"	123° 58' 45"	Shl	Rk/Sd
Nehalem River	Pv	45° 40' 32"	123° 55' 33"	Est	Sd
		45° 39' 44"	123° 55' 56"		
Tillamook Bay	Pv	45° 32' 50"	123° 54' 50"	Est	Sd
		45° 32' 36"	123° 55' 45"		
		45° 32' 27"	123° 55' 50"		
		45° 32' 00"	123° 55' 00"		
		45° 31' 34"	123° 55' 50"		
		45° 31' 22"	123° 56' 08"		
Three Arch Rocks					
Seal Rock	Ej	45° 27' 50"	123° 58' 56"	Osh	Rk
Netarts Bay	Pv	45° 26' 06"	123° 57' 11"	Est	Sd
		45° 25' 49"	123° 57' 06"		
		45° 25' 39"	123° 56' 30"		
		45° 25' 17"	123° 56' 27"		
		45° 25' 06"	123° 56' 38"		
		45° 24' 47"	123° 56' 19"		
Cape Lookout	Pv	45° 20' 30"	124° 00' 00"	Shl	Rk
		45° 20' 30"	123° 59' 30"	Shl	Rk/Sd
Nestucca River	Pv	45° 09' 53"	123° 57' 50"	Est	Sd

Appendix C (cont). Pinniped haulout sites in Oregon.

Location Name	Species	N Latitude	W Longitude	Type	Substrate
Cascade Head	Ej,Zc				
Sea Lion Rocks		45° 03' 58"	124° 01' 00"	Nsh	Rk
Hart Cove		45° 04' 05"	124° 00' 30"	Shl	Rk
Siletz Bay	Pv	44° 55' 30"	124° 01' 25"	Est	Sd
		44° 54' 30"	124° 01' 30"	Est	Dk
Boiler Bay	Pv	44° 50' 00"	124° 03' 30"	Shl	Rk
Whale Cove	Pv	44° 47' 17"	124° 04' 02"	Shl	Rk
Cape Foulweather	Pv				
Cape Rocks		44° 45' 27"	124° 04' 00"	Nsh	Rk
Gull Rock		44° 45' 04"	124° 04' 25"	Osh	Rk
Seal Rocks		44° 44' 38"	124° 04' 06"	Osh	Rk
Yaquina Head	Pv	44° 40' 33"	124° 04' 40"	Nsh	Rk
Yaquina Bay	Pv				
Finger Jetty		44° 37' 10"	124° 03' 28"	Jty	Rk
Sally's Bend		44° 37' 21"	124° 01' 04"	Est	Md/Sd
Seal Rock					
	Pv	44° 29' 27"	124° 05' 05"	Nsh	Rk
		44° 29' 38"	124° 05' 00"		
Seal Rocks	Ej	44° 30' 28"	124° 05' 29"	Osh	Rk
Alsea Bay	Pv	44° 25' 24"	124° 04' 08"	Est	Sd
		44° 26' 30"	124° 02' 42"	Est	Sd/Md
		44° 26' 12"	124° 02' 06"	Est	Md/Sd
		44° 25' 09"	124° 01' 58"	Est	Md/Gs
Strawberry Hill	Pv	44° 15' 36"	124° 06' 40"	Nsh	Rk
		44° 15' 25"	124° 06' 40"	Shl	Rk
Mill Creek	Pv	44° 13' 10"	124° 06' 50"	Shl	Rk
Siuslaw River	Pv	44° 00' 19"	124° 07' 33"	Est	Sd
		43° 59' 11"	124° 07' 38"	Est	Sd/Md
Umpqua River	Pv	43° 42' 38"	124° 09' 35"	Est	Sd
		43° 42' 42"	124° 09' 32"	Est	Sd/Md
		43° 44' 16"	124° 09' 16"	Est	Sd/Md
Tenmile Creek	Pv	43° 33' 40"	124° 13' 55"	Shl	Sd
Coos Bay	Pv			Est	Sd/Md
Clam Isl.		43° 23' 16"	124° 17' 37"		
Pigeon Pt.		43° 22' 02"	124° 18' 05"		

Appendix C (cont). Pinniped haulout sites in Oregon.

Location Name	Species	N Latitude	W Longitude	Type	Substrate
Cape Arago					
Squaw Isl.	Pv	43° 20' 20"	124° 22' 46"	Shl	Rk
Shell Isl. Area	Pv,Ej Zc,Ma	43° 18' 45"	124° 24' 00"	Nsh	Rk
Simpsons Reef	Pv,Ej,Zc	43° 18' 55"	124° 24' 30"	Osh	Rk
South Cove	Pv	43° 18' 06"	124° 23' 55"	Nsh	Rk
Bandon Rocks	Pv				
Coquille Pt.		43° 06' 54"	124° 26' 15"	Nsh	Rk
Cat and Kittens Rocks		43° 06' 29"	124° 26' 36"	Osh	Rk
Gull Rock	Pv	42° 51' 05"	124° 33' 22"	Osh	Rk
Blanco Reef	Pv,Ej,Zc	42° 49' 41" 42° 45' 25"	124° 35' 00" 124° 34' 57"	Osh	Rk
Orford Reef				Osh	Rk
Best Rock	Ej,Zc	42° 47' 28"	124° 35' 40"		
Seal Rock	Ej,Zc	42° 47' 14"	124° 35' 35"		
	Ej	42° 47' 18"	124° 35' 55"		
Arch Rock	Pv,Ej,Zc	42° 46' 43"	124° 35' 45"		
West Conical Rock	Pv,Ej,Zc	42° 46' 39"	124° 36' 00"		
Steamboat Rock	Ej	42° 46' 35"	124° 36' 10"		
Large Brown Rock	Ej,Zc	42° 47' 32"	124° 36' 00"		
Long Brown Rock	Ej,Zc	42° 47' 28"	124° 36' 18"		
The Heads	Pv	42° 44' 20"	124° 30' 52"	Nsh	Rk
Humbug Mountain	Pv	42° 40' 34"	124° 27' 01"	Shl	Rk
Hubbard Mound Reef	Pv	42° 28' 45"	124° 26' 15"	Osh	Rk
Rogue Reef				Osh	Rk
S. Seal Rocks	Pv	42° 26' 09"	124° 27' 44"		
Pyramid Rock Area	Pv,Ej,Zc	42° 26' 42"	124° 28' 03"		
Needle Rock	Ej,Zc	42° 26' 54"	124° 28' 57"		
Double Rock	Ej,Zc	42° 26' 58"	124° 29' 15"		
Hunters Island	Pv	42° 18' 52"	124° 25' 30"	Osh	Rk
Crook Point	Pv	42° 15' 00"	124° 24' 40"	Nsh	Rk
Deer Point	Pv	42° 11' 30"	124° 22' 20"	Nsh	Rk
Whalehead Island	Pv	42° 08' 21"	124° 21' 37"	Osh	Rk
Cape Ferrelo	Pv	42° 06' 12"	124° 21' 10"	Shl/	Rk
to Chetco River		42° 02' 30"	124° 17' 23"	Nsh	Rk

Pv = *Phoca vitulina*, Ej = *Eumetopias jubatus*, Zc = *Zalophus californianus*, Ma = *Mirounga angustirostris*, Shl = shoreline, Nsh = nearshore, Osh = offshore, Est = estuary, Jty = Jetty, Sd = sand, Md = mud, Rk = rock, Gs = grass, Dk = dock