

FINAL REPORT

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Att. Dr. Robert DeLong

Assessment of Marine Mammal-Fishery Interactions  
in the Western Gulf of Alaska and Bering Sea:  
Population Status and Trend of Harbor Seals  
in the Southeastern Bering Sea

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## INTRODUCTION

A large harbor seal (*Phoca vitulina richardsi*) population, estimated at 29,000 animals during the period 1975-1977 (Everitt and Braham 1980), occurs in the southeastern Bering Sea. The principal haulout sites for this population are sand and mud bars in the large estuaries along the northern shore of the Alaska Peninsula and include Cinder River, Port Heiden, Seal Islands, Port Moller and Izembeck Lagoon.

Some populations of pinnipeds in the southeastern Bering Sea and the nearby Gulf of Alaska have declined substantially in recent years. These include northern fur seals (*Callorhinus ursinus*) on the Pribilof Islands (Fowler 1985), Steller sea lions (*Eumetopias jubatus*) in the eastern Aleutian Islands (Braham et al. 1980), harbor seals on Tugidak Island (Calkins and Pitcher 1983), and Steller sea lions in the western Gulf of Alaska (Alaska Department of Fish and Game unpublished data). It was not known if the southeastern Bering Sea harbor seal population had also declined as no recent information on population status and trend was available. During this study surveys of major haulout sites were conducted to determine if changes in population size had occurred.

## METHODS

The haulout sites at Port Heiden, Seal Islands, Port Moller and Cinder River (Figure 1.) were surveyed daily between 14 and 21 June 1985 as weather conditions permitted. Surveys were flown in a Piper Supercub aircraft based out of Port Heiden airfield. Surveys were started at Port Moller at about one hour before low tide and then proceeded up the coast concluding at Cinder River. Tidal stage progresses up the coast at about the same rate as the survey aircraft therefore all sites were surveyed at approximately low water. As each haulout site was flown over the seals were photographed with a 35mm motor driven camera with a 105mm lens using high speed film, ASA 400. Seals were photographed from an altitude of 400-800 feet.

Slides were commercially developed and the seals counted from images projected on a paper screen. Data were tabulated individually for the four major haulout sites. Mean numbers of seals hauled out and associated standard deviations were calculated for each site. Mean numbers for each site were summed for each period of analysis to provide mean survey totals.

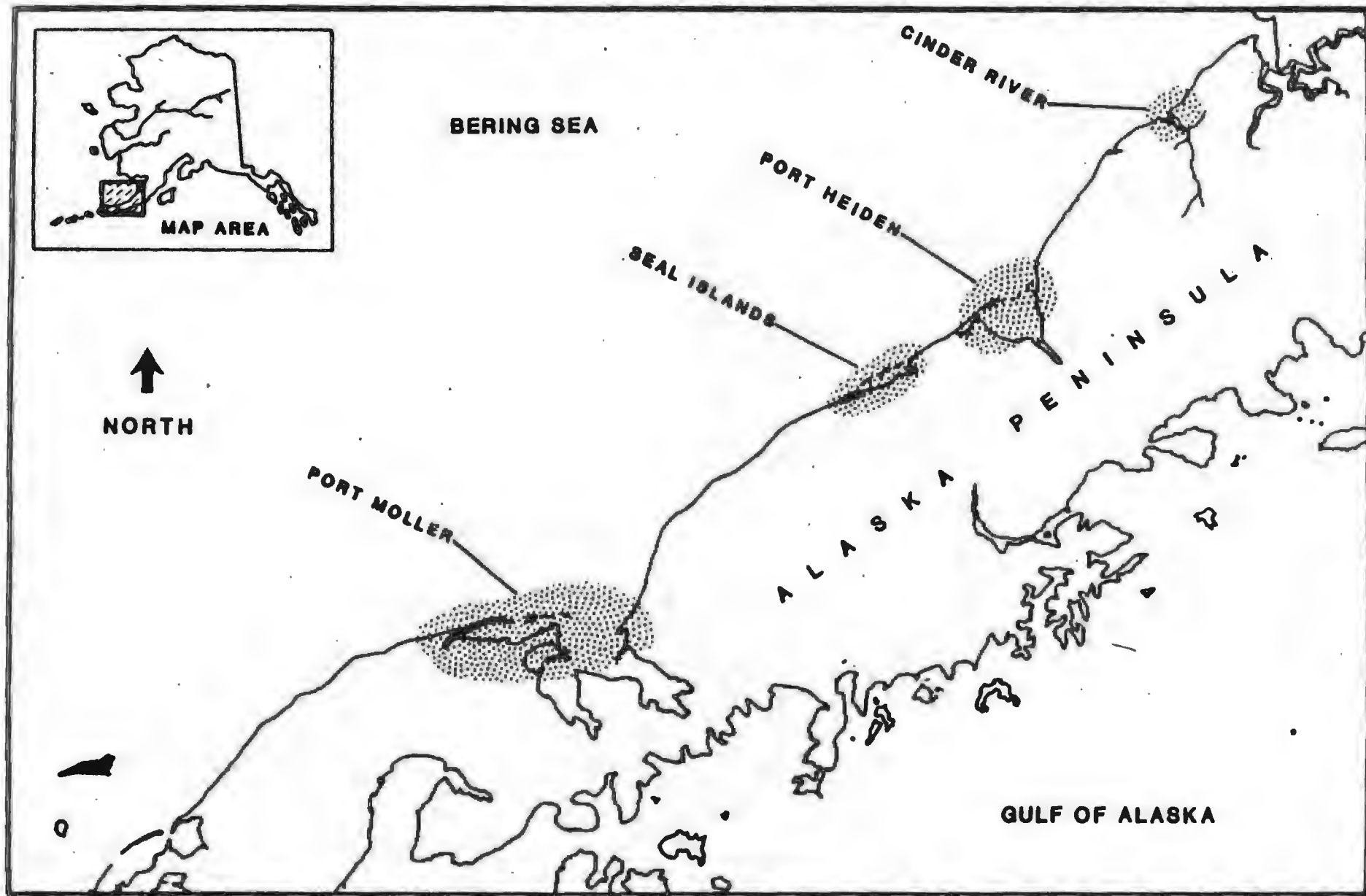


Figure 1. Locations of harbor seal survey sites along the northern shore of the Alaska Peninsula, June 1985.

Data sets from similar seasonal periods used for analytical comparisons included survey results between 1975 and 1977 from National Marine Fisheries Service surveys (Everitt and Braham 1980, Braham et al. 1977, National Marine Fisheries Service unpublished data) and unpublished survey data collected by the Alaska Department of Fish and Game between 1966 and 1973. Data sets were compared by the Mann-Whitney test utilizing SPSS/PC+ (Norusis 1986).

Survey technique and therefore data quality generally appeared to be similar between the 1985 and 1975-77 data sets. However the 1975-77 surveys were designed to count both harbor seals and Steller sea lions and timing of the the harbor seal surveys was not always ideal in relation to tidal stage. Results of one survey (18 June 1976) which was conducted at about high tide were deleted from the analyses.

The earliest data set, counts obtained by the Alaska Department of Fish and Game between 1966 and 1973, is the least precise of the survey data available. Survey technology was not developed to the extent it was during later surveys. The surveys were conducted during years when intense commercial hunting of pups was taking place on the haulouts which caused severe disturbance undoubtedly resulting in low counts. Most counts were visual estimates, particularly during the early years, rather than photographic surveys likely resulting in less precise counts. Because of these factors a strict statistical comparison of these data with the more recent data sets is not warranted.

Estimates of total numbers of seals utilizing the four haulout site were estimated for the periods 1975-77 and 1985 utilizing the method of bounded counts (Overton and Davis 1969, Robson and Whitlock 1964).

## RESULTS AND DISCUSSION

Counts of harbor seals obtained during June 1985 are presented in Table 1. The most striking difference from previous years (Tables 2 and 3) was the near complete absence of seals on the Cinder River haulout site. Cinder River was surveyed seven times in 1985 and only one seal was seen, a pup of the year. Between 1966 and 1977 Cinder River was surveyed 14 times during a comparable seasonal period and seals were present on every occasion, the minimum count being 350 animals.

Site by site comparisons of counts obtained in 1985 and between 1975 and 1977 indicated significantly fewer seals

Table 1. Harbor seal counts at major haulout sites along the north shore of the Alaska Peninsula, June 1985.

Date	P. Heiden	Seal I.	P. Moller	Cinder R.
14 June	5,529	1,521	2,991	1
15 June	6,143	1,079	3,099	0
16 June	6,031	1,013	3,222	0
17 June	4,700	1,159	4,010	0
18 June	6,196	1,021	no count	0
19 June	4,405	1,002	3,497	no count
20 June	6,035	1,195	3,589	0
21 June	5,782	660	3,850	0
MEAN	5,602.6	1,081.3	3,465.4	0.1
STD	686.7	240.4	382.8	0.3

Table 2. Harbor seal counts at major haulout sites along the north shore of the Alaska Peninsula, June 1975-1977.

Date	P. Heiden	Seal I.	P. Moller	Cinder R.
18 June 1975	4,774	1,137	4,563	925
20 June 1975	5,273	155	6,078	2,867
15 June 1976	4,776	246	5,177	3,062
20 June 1976	10,548	786	7,968	4,503
28 June 1977	6,222	497	4,335	1,530
30 June 1977	no count	119	3,583	no count
MEAN	6,318.6	490.0	5,284.0	2,577.4
STD	2,437.0	403.9	1,559.5	1,401.3

Table 3. Harbor seal counts at major haulout sites along the north shore of the Alaska Peninsula, 13 June-14 July 1966-1973.

Date	P. Heiden	Seal I.	P. Moller	Cinder R.
13 June 1966	no count	400	1,600	1,500
24 June 1966	1,500	500	1,000	1,000
30 June 1966	2,500	1,100	1,000	no count
4 July 1966	1,500	360	no count	no count
6 July 1966	2,500	3,200	8,000	950
2 July 1968	1,200	300	800	600
10 July 1968	2,500	350	1,250	800
27 June 1969	1,400	no count	no count	500
29 June 1969	2,100	no count	2,500	no count
30 June 1969	1,900	900	2,300	no count
4 July 1969	2,100	no count	1,900	no count
8 July 1969	1,300	no count	2,300	no count
14 July 1969	1,500	no count	3,300	no count
20 June 1970	4,000	1,000	2,200	no count
21 June 1970	3,100	1,000	0	no count
2 July 1970	6,500	no count	2,500	3,400
18 June 1971	5,900	1,000	4,100	no count
14 July 1971	1,600	1,550	1,850	350
11 July 1973	4,298	374	1,675	875
MEAN	2,633.2	925.7	2,251.5	1,108.3
STD	1,570.2	786.1	1,768.6	921.6

hauled out at both Port Moller ( $P=0.01$ ) and at Cinder River ( $P=0.002$ ) in 1985 than in 1975-1977. Numbers of seals hauled out at Port Heiden were similar ( $P=0.77$ ) during both periods while more animals were counted at Seal Islands ( $P=0.02$ ) during the 1985 surveys. A comparison of the four haulout sites combined (median counts substituted for missing values) between 1975-77 and 1985 was equivocal ( $P=0.12$ ).

The 20 June 1976 survey produced, by far, the highest counts obtained between 1975 and 1985 at three of the haulout sites (Tables 1 and 2). I was concerned that this extremely high survey might have been atypical and when included in the analyses may have biased the resulting conclusions. Therefore I repeated the analyses deleting the 20 June 1976 survey. On a site by site basis these analyses indicated the same pattern; fewer seals at Port Moller ( $P=0.02$ ) and Cinder River ( $P=0.004$ ) in 1985, more seals at Seal Islands ( $P=0.03$ ) in 1985, and similar numbers at Port Heiden ( $P=0.73$ ) during both periods. When all sites were combined it suggested similar numbers ( $P=0.25$ ) between time periods somewhat contrary to the analysis which included the 20 June 1976 survey ( $P=0.12$ ).

Examination of maximum counts for each of the haulout sites during the three time periods (Table 4) indicated a substantial reduction in numbers in 1985. Major reductions occurred at Cinder River where only one animal was seen hauled in 1985, at Port Moller where the maximum 1985 count was only about 50% of that recorded during both the 1966-1973 and 1975-1977 periods, and Port Heiden which decreased by 41% between 1975-77 and 1985. Seal Islands was the only site which had a higher maximum count in 1985 than 1975-1977 but even higher counts were recorded in the 1966-1973 period.

Population estimates for the four haulout sites produced by the bounded counts method (Table 5) were substantially higher for three of the sites during the 1975-77 period than during 1985. Seal Islands had similar estimates for the two periods.

While not conclusive nearly all indicators suggest a reduction in numbers of harbor seals hauling out along the north shore of the Alaska Peninsula. Fewer seals were counted at the Port Moller ( $P=0.01$ ) and Cinder River ( $P=0.002$ ) sites in 1985 than 10 years previously. Total numbers of seals at the four haulout sites also appeared to decrease between 1975-77 and 1985 ( $P=0.12$ ). One haulout site, Cinder River, which was used consistently in prior years was not used in 1985. Maximum counts, in all but one instance, were lower in 1985 than in earlier years. Population estimates obtained from the bounded counts method were higher for three of the haulout sites in 1975-77 than

in 1985. Totals of mean numbers at each of the sites indicated a decrease of 32% from 1975-77 (1976) to 1985. Totals of maximum counts for the four haulout sites decreased by 51% from 1975-1977 to 1985.

Table 4. Maximum counts of harbor seals at major haulout sites along the north shore of the Alaska Peninsula during three time periods.

Haulout Site	1966-1973	1975-1977	1985
P. Heiden	6,500	10,548	6,196
Seal Is.	3,200	1,137	1,521
P. Moller	8,000	7,968	4,010
Cinder R.	3,400	4,503	1
TOTALS	21,100	24,156	11,728

Table 5. Total population estimates for harbor seals utilizing four haulout sites along the northern Alaska Peninsula for the periods 1975-77 and 1985 generated by the method of bounded counts.

Area	Years	Estimate	Lower Conf. Limit	Upper Conf. Limit
Port Moll.	1975-77	9,548	7,968	43,878
	1985	4,170	4,010	7,050
Seal Is.	1975-77	1,488	1,137	7,806
	1985	1,847	1,521	7,715
Port Heid.	1975-77	14,874	10,548	92,742
	1985	6,249	6,196	7,203
Cinder R.	1975-77	5,944	4,503	31,882
	1985	2	1	20



Observations of a long time Port Heiden resident who is a big game guide, aircraft pilot, commercial fisherman and former seal hunter are similar to the results of these analyses (conversation on 18 June 1985 with Jeff Graham at Port Heiden, Alaska) indicating that seals in Port Heiden appeared to become more abundant for several years after hunting ceased in 1972 but declined thereafter.

The annual rate of increase, based on the total of mean counts from each site, was -3.5% from 1975-77(1976) to 1985. This is somewhat lower than the rate at which other pinniped populations in the southeastern Bering Sea and Gulf of Alaska which have recently declined; -6% for northern fur seals in the Pribilof Islands during the past decade (Fowler 1985), - 6% for Steller sea lions pups on rookeries in the western Gulf of Alaska (Alaska Department of Fish and Game unpublished data), -9% for Ugamak Island in the eastern Aleutian Islands between 1969 and 1985 (telephone conversation on 24 October 1985 with Thomas Loughlin, National Marine Mammal Laboratory, Seattle, Washington), and perhaps as high as -13% for harbor seals between 1976 and 1982 on Tugidak Island in the Gulf of Alaska (Calkins and Pitcher 1983).

Information is generally lacking in regard to population limiting factors of Bering Sea harbor seals. It is known that walleye pollock (*Theragra chalcogramma*) stocks have declined in the Bering Sea (Bakkala et al. 1985). Pollock was the top-ranked prey of harbor seals from the Gulf of Alaska (Pitcher 1980). Perhaps carrying capacity for harbor seals has declined in the Bering Sea in recent years. While entanglement in marine debris has been reported as a probable factor in the decline of northern fur seals on the Pribilof Islands (Fowler 1985) it has not been reported as a problem with harbor seals. Disease, particularly chlamydiosis, was considered a possible contributing factor in the decline of sea lions in the Gulf of Alaska (Goodwin and Calkins 1985). An epizootic of pneumonia killed large numbers of harbor seals in New England in 1979-80 (Geraci et al. 1982). If disease was a factor in Bering Sea harbor seals it probably affected reproductive performance rather than postnatal mortality as large numbers of beachcast animals have not been reported from the area. Certainly some killing of seals by commercial fisherman, particularly salmon gill netters, has occurred in the eastern Bering Sea. However this has taken place for decades and no recent increase in killing rates has been observed that would explain a decline in harbor seal numbers. Only very limited subsistence hunting of seals is thought to occur in the region and could not be responsible for reduced numbers. Predation on harbor seals by Steller sea lions (Pitcher and Fay 1982), sharks (Ainley et al. 1981, LeBoeuf et al. 1982)

and killer whales (*Orcinus orca*) (Scheffer and Slipp 1944) has been reported. There are no indications that increased levels of predation could be responsible for the decline.

Newly born harbor seals pups were commercially hunted in Port Heiden, Port Moller and occasionally Cinder River between about 1963 and 1972 when the Marine Mammal Protection Act was enacted. Between 1965 and 1972 about 27,000 seals (Table 5) were reported killed (Alaska Department of Fish and Game unpublished data). Records of harvest were not kept prior to 1965 however it is likely that several thousand seal pups were killed in 1963 and 1964. Therefore the total harvest probably approximated 30,000 animals most of which were pups in their first month of life. Hunting took place over a ten year period so the average annual harvest was about 3,000. Data on reproductive performance and population composition presented by Bigg (1969) and Pitcher and Calkins (1979) indicated that about 20% of a post-pupping population will be composed of pups. If these parameters are similar for southeastern Bering Sea harbor seals the Everitt and Braham (1980) estimate of 29,000 animals would include about 5,800 pups. The average annual harvest therefore amounted to about 50% of pup production. If this level of harvest was excessive it could have resulted in a delayed decline characterized by poor production as the weak age cohorts reached productive maturity. However by the time these surveys were conducted 13 years had passed since the last commercial harvest and considerable recovery would be expected.

Table 6. Historical harvest of harbor seals along the north shore of the Alaska Peninsula.

Year	Port Heiden	Port Moller
1965	2,200	1,800
1966	3,100	2,300
1967	2,278	1,935
1968	2,180	1,091
1969	2,940	1,230
1970	804	858
1971	1,746	945
1972	1,900	0

A history of commercial harvests is a common, but possibly irrelevant, factor among the southeastern Bering Sea and Gulf of Alaska pinniped populations which have recently declined. The type and intensity of harvests varied greatly. Harbor seals on Tugidak Island were exploited in a similar manner as those in the southeastern Bering Sea however they experienced a much more severe decline. Steller sea lions in the western Gulf of Alaska and the eastern Aleutian Islands also underwent exploitation of pups on some rookeries which have since declined in numbers. However other rookeries have also declined which were not hunted. Harvests of northern fur seals on the Pribilof Islands have been nearly exclusively juvenile males since 1968 yet the population continues to decline.

A similar series of surveys should be conducted in the next two to three years to determine if southeastern Bering Sea harbor seals are continuing to decline. The surveys should be conducted during a similar seasonal period (about 14-21 June) and timed to coincide with low tides. Daily tidal patterns for the Bering Sea coast of the Alaska Peninsula generally include one large and one small low tide. Tides in the large tide series which ranged between +0.2 and +0.8 feet during the 1985 surveys appeared to provide adequate haulout space. One attempt to fly a survey during a small tide (+8.2 feet) was unsuccessful as most haulout sites were covered with water and few seals were hauled out. Planning for future surveys in the area should include consideration of tides. Certain periods are unsuitable for surveys as the large tides occur during night when light is unsuitable for aerial photography. It is not known at what point tide size begins to affect number of seals hauled out but I would avoid conducting surveys during the small daily tides unless additional information becomes available indicating that counts are not affected.

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