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HARBOR SEAL TREND COUNT SURVEYS IN SOUTHERN ALASKA, 1988

Alaska Department of Fish and Game
Anchorage, AK

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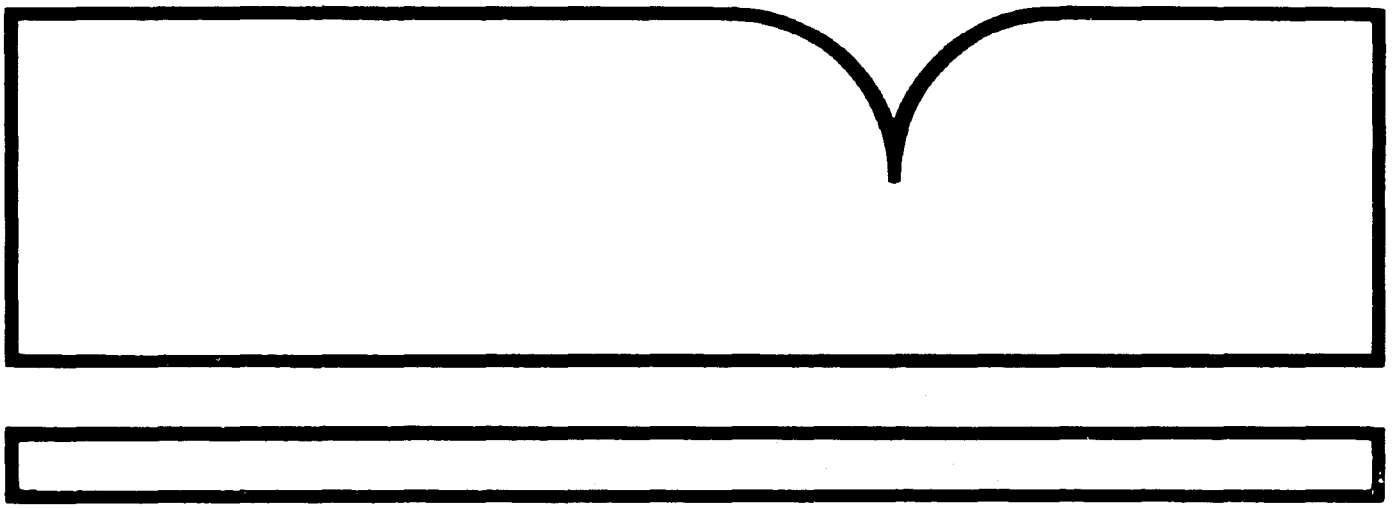

FINAL REPORT

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Marine Mammal Commission
1625 I St., N. W., Rm. 307
Washington, DC 20006

Harbor Seal Trend Count Surveys in Southern Alaska, 1988

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13. ABSTRACT *(Maximum 200 words)*

Harbor seals are an abundant and ubiquitous coastal resident of southern Alaska. Because they occur at thousands of haul-out sites in Alaska and spend much of the time in the ocean, no practical census technique to estimate total population size has been developed. In order to monitor population trends, index count sites have been established at selected haul-out sites within Alaska. These counts serve as a basis for comparisons over time.

In 1987 the Marine Mammal Commission provided funding to the Alaska Department of Fish and Game to conduct surveys during 1988 at selected harbor seal index haul-out sites in order to evaluate recent population trends. The results of those surveys are presented in this report.

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INTRODUCTION

Harbor seals (*Phoca vitulina richardsi*) are an abundant and ubiquitous coastal resident of southern Alaska. Because they occur at thousands of haul-out sites in Alaska and spend much of the time in the ocean, no practical census technique to estimate total population size has been developed. In order to monitor population trends, index count sites have been established at selected haul-out sites within Alaska including the Bering Sea coast of the Alaska Peninsula, Tugidak Island, the Kodiak Island area, Elizabeth Island, Prince William Sound, and the Ketchikan and Sitka areas of southeastern Alaska (Pitcher and Calkins 1979, Calkins and Pitcher 1983, Calkins and Pitcher 1984, Pitcher 1986a, Pitcher 1986b, Pitcher unpubl. data). Repetitive counts were made of hauled-out seals at the selected sites during either the pupping or molting periods, when maximum numbers are usually present (Pitcher and Calkins 1979, Calambokidis et al. 1987). These counts serve as a basis for comparisons over time.

Previous counts (i.e., those made through 1986) indicated a major decline in abundance at Tugidak Island and a possible decline along the Bering Sea coast of the Alaska Peninsula and the Kodiak area (Calkins and Pitcher 1983, Pitcher 1986b, Pitcher unpubl. data). Counts at other sites suggested stable or increasing numbers of seals (Pitcher 1986a).

When it was established that some harbor seal populations had declined in conjunction with concurrent declines in Steller sea lions (*Eumetopias jubatus*) (Merrick et al. 1987) and northern fur seals (*Callorhinus ursinus*) (York and Kozloff 1987), concerns were raised regarding current status of other Alaskan harbor seal populations. In 1987 the Marine Mammal Commission provided funding to the Alaska Department of Fish and Game to conduct surveys during 1988 at selected harbor seal index haul-out sites in order to evaluate recent population trends. The results of those surveys are presented in this report.

METHODS

A long-term monitoring schedule of selected index haul-out sites was prepared (Appendix I). Three areas were selected for surveys in 1988: Ketchikan, Prince William Sound, and Tugidak Island. Because of limited funding, completion of the Tugidak surveys was contingent on logistical support from the U. S. Coast Guard and a volunteer field biologist from the University of Alaska, Lori Quakenbush.

The Ketchikan and Prince William Sound trend count survey routes, which were established in 1983 and last surveyed in

1984, are composed of 16 and 25 haul-out sites, respectively (Figs. 1 & 2). The routes were surveyed from single engine-aircraft (Cessna 180, 185). As each haul-out site was flown over, the seals were photographed with a handheld 35-mm motor driven camera with a 70-to 210-mm lens. High-speed film (ASA 400) was used. Color slides were commercially developed, and the seals were counted from images projected on a marlite screen.

Surveys were flown daily, as weather permitted, during an approximately 2-week span during the August and September molting period. Survey flights were timed to coincide with daylight low tides, starting within 2 hours before low water and finishing within 2 hours after low tide.

Counts of seals on the major hauling area on Tugidak Island (Fig. 3), near Kodiak Island, were made from atop 30-m bluffs overlooking the beach. Both binoculars and a Polaroid camera were used as aids to counting. Counts were made within 1 hour of daytime low tides during the August-September molting period. Nonrepresentative counts (i.e., those obtained shortly after a major disturbance when many animals had fled into the water or during extremely severe weather conditions) were deleted from the analyses.

Counts were assumed to be linear indicies of population size. The Wilcoxon matched-pairs signed-ranks test was used to compare mean and maximum counts for the haul-out sites on the Ketchikan and Prince William Sound survey routes between years. For the Tugidak Island data, linear regression of the natural logs of mean and maximum annual counts by year was used to determine if trends in seal abundance existed and to calculate r, the observed mean annual exponential rate of increase (Caughley and Birch 1971). The computer statistical package, SPSS/PC+ V2.0 (Norusis 1988), was used for data analysis.

RESULTS AND DISCUSSION

Surveys were conducted in the Ketchikan area from 6 through 16 August (Table 1). While both the total pooled mean and maximum counts from the individual haul-out sites along the survey route were slightly higher in 1988 than in 1984 (Table 2), the last year for which surveys were flown, these differences were not significant (P = 0.1252 and 0.6832, respectively). These data suggest that similar numbers of harbor seals were present in the Ketchikan area in 1984 and 1988. Both the total pooled mean and maximum counts were significantly higher in 1984 than in 1983 (P = 0.0032 and 0.0268, respectively), indicating increasing numbers at that time. I previously suggested that a portion of that observed increase was due to improved survey techniques (Pitcher 1986a).

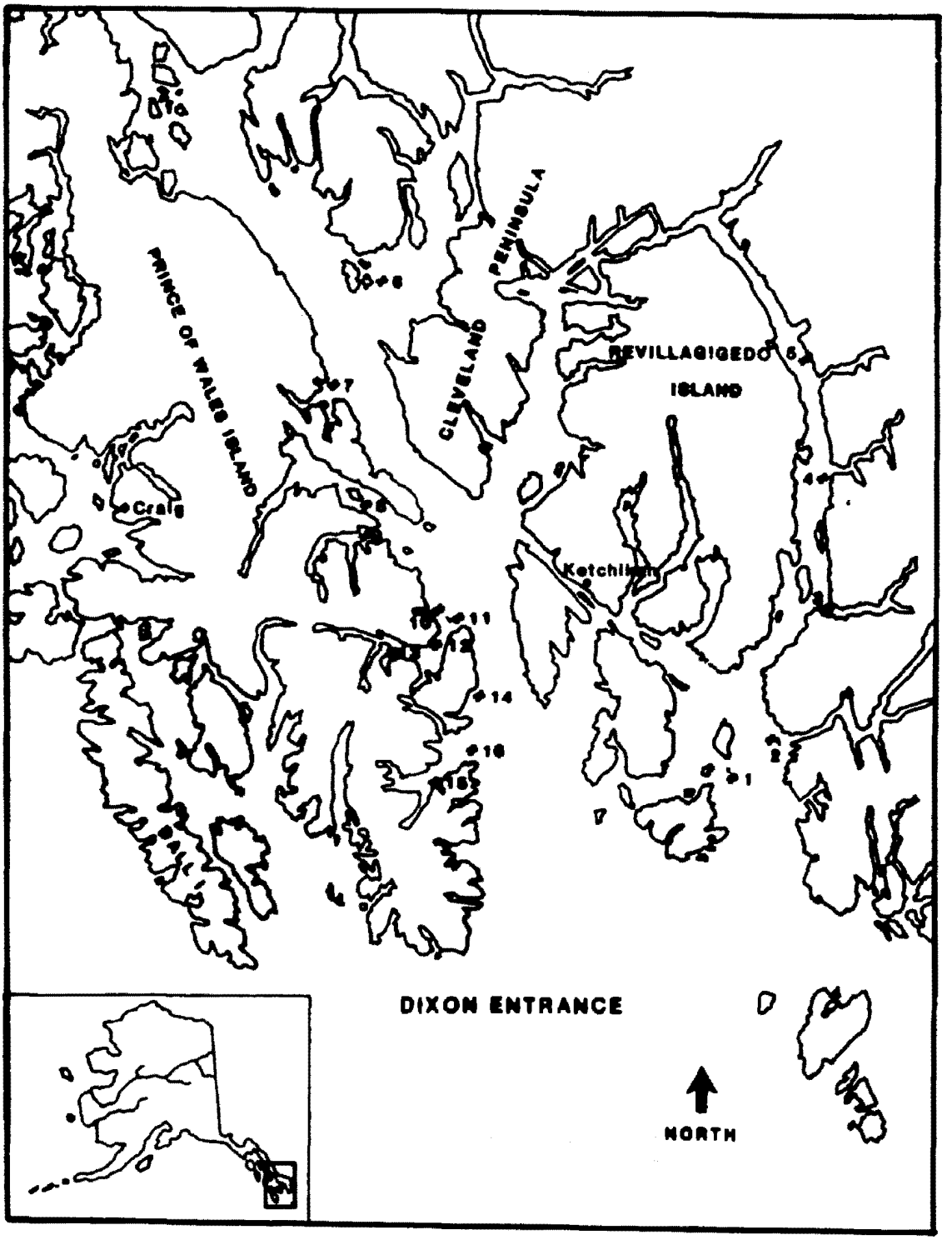

Figure 1. Ketchikan area harbor seal trend count route. Haulout site names and count data are presented in Tables 1 and 2.

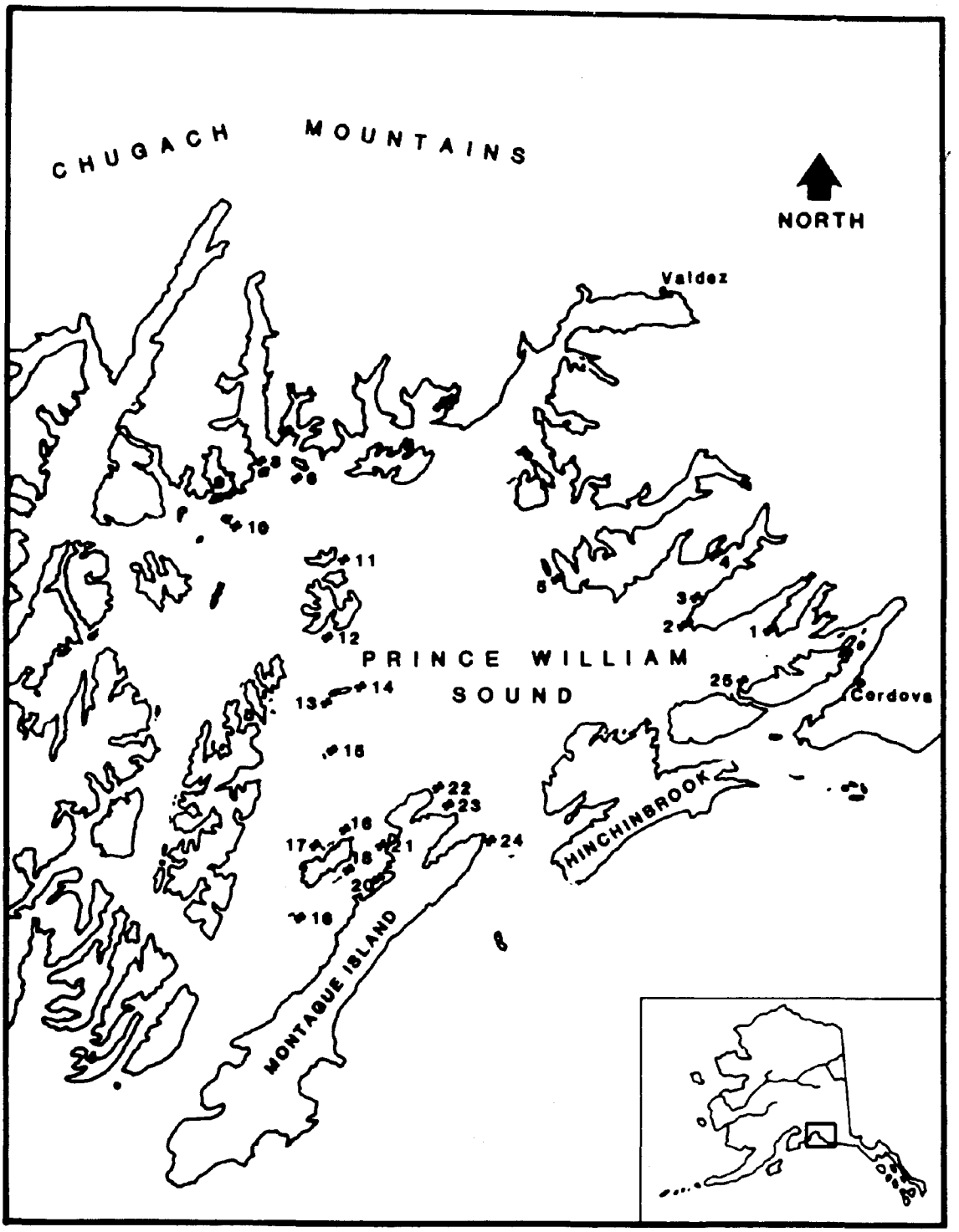

Figure 2. Prince William Sound harbor seal trend count route. Haulout site names and count data are presented in Tables 3 and 4.

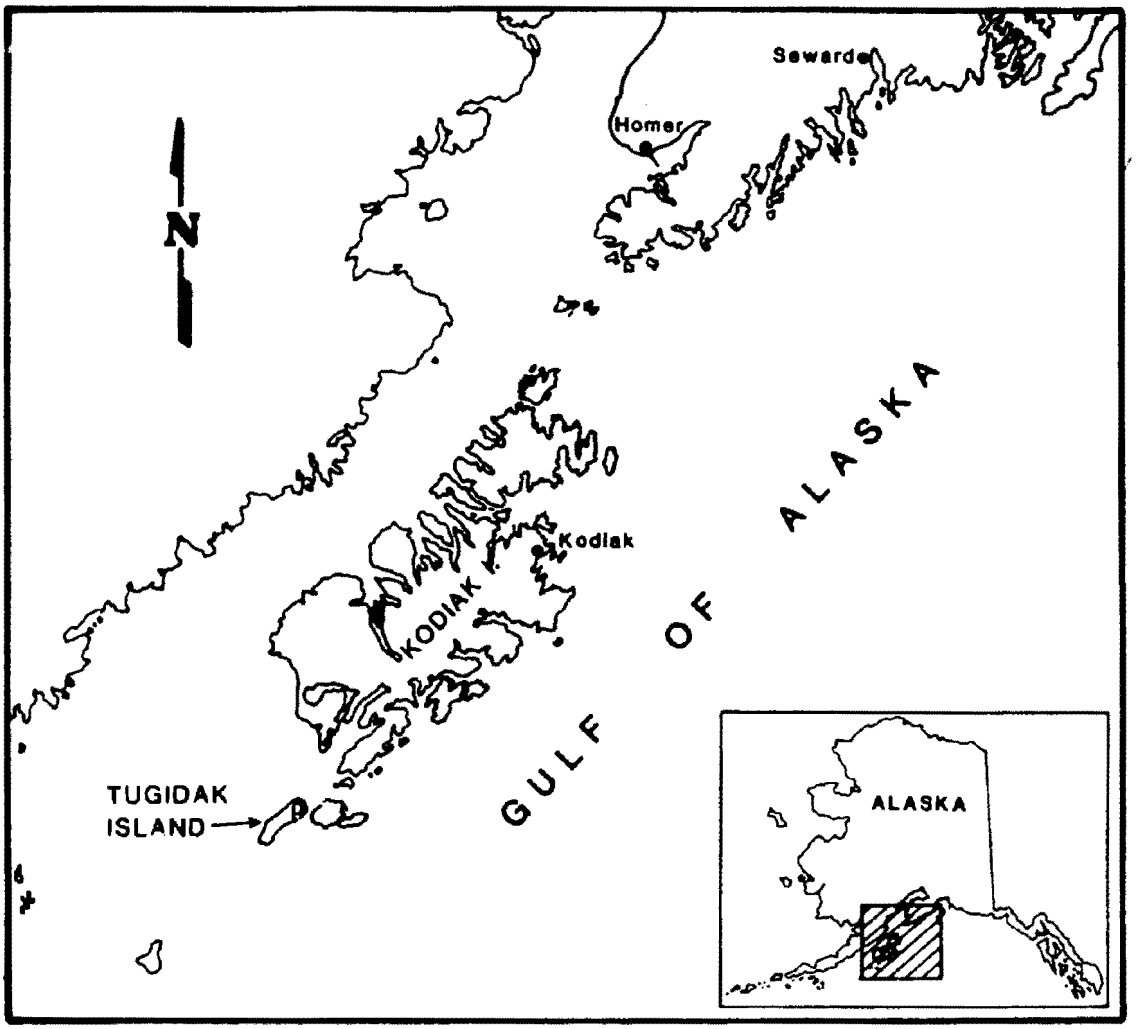

Figure 3. Location of Tugidak Island harbor seal trend count site in the Gulf of Alaska.

Table 1. Repetitive counts of harbor seals on selected haul-out sites in the Ketchikan, Alaska area, 1988.

	Date (Aug.)	6	9	10	11	12	14	15	16
Map#	Site	Counts							
1	Whale R.	115	NS	141	24	NS	85	78	88
2	White R.	214	NS	220	213	NS	297	361	337
3	Carp I.	0	NS	0	0	0	0	0	0
4	New Eddy.	71	NS	56	44	55	98	172	147
5	Channel I.	394	NS	292	162	253	218	337	414
6	Eagle I.	149	NS	155	235	250	270	331	270
7	Tolstoi I.	15	NS	46	NS	59	59	72	60
8	Daisy I.	137	NS	129	NS	136	195	188	265
9	McKenzie I.	217	NS	173	NS	145	97	156	168
10	Clover B.	22	41	52	NS	43	17	3	8
11	Skin I.	0	7	10	NS	10	17	15	12
12	Lancaster C.	8	NS	11	NS	17	NS	17	4
13	Dora Bay	92	76	73	NS	55	93	87	116
14	Wedge I.	163	133	110	NS	105	NS	97	123
15	Moria S.	107	89	82	74	122	NS	122	129
16	W. Rock I.	83	92	56	67	123	NS	75	130

NS = No Survey

Table 2. Summary of mean and maximum counts from haul-out sites on the Ketchikan area harbor seal trend count survey route, 1983, 1984, and 1988.

Site No.	1983 Mean	1983 Max.	1984 Mean	1984 Max.	1988 Mean	1988 Max.
1	30.7	56.0	89.1	139.0	88.5	141.0
2	141.0	213.0	213.1	264.0	273.7	361.0
3	9.4	23.0	0.0	0.0	0.0	0.0
4	103.7	213.0	92.3	142.0	91.9	172.0
5	188.7	341.0	328.3	541.0	295.7	414.0
6	107.1	188.0	143.9	213.0	237.1	331.0
7	15.1	35.0	11.7	35.0	51.8	72.0
8	85.9	148.0	102.7	196.0	175.0	265.0
9	118.9	194.0	174.6	245.0	159.3	217.0
10	40.6	72.0	47.0	78.0	26.6	52.0
11	15.3	52.0	40.0	69.0	10.1	17.0
12	4.4	8.0	7.7	20.0	11.4	17.0
13	47.4	121.0	71.0	116.0	84.6	116.0
14	75.1	158.0	94.6	172.0	121.8	163.0
15	39.9	90.0	69.7	135.0	103.6	129.0
16	36.2	86.0	67.5	106.0	89.4	130.0
Totals	1,059.4	1,998.0	1,553.2	2,471.0	1,820.5	2,597.0

In Prince William Sound, surveys were conducted from 28 August through 15 September (Table 3). Both the total pooled mean and maximum counts (Table 4) for the haul-out sites on the survey route were substantially lower in 1988 than in 1984, when surveys were last flown, (P = 0.0002 and P = 0.0001, respectively). Pooled mean and maximum counts declined by 41% and 42%, respectively, between 1984 and 1988. The observed exponential rate of increase (r) between 1984 and 1988 was -0.132, based on the pooled mean counts, and -0.137, based on the pooled maximum counts. No differences were noted in either the pooled mean (P = 0.459) or the pooled maximum (P = 0.609) counts between 1983 and 1984.

Table 3. Repetitive counts of harbor seals on selected haul-out sites in Prince William Sound, Alaska, 1988.

Date (Aug., Sept.)		28	2	5	6	7	8	9	13	14	15
Map#	Site	Counts									
1	Sheep B.	4	3	4	6	8	13	28	31	11	NS
2	Gravina I.	21	0	0	1	3	2	37	38	10	NS
3	Gravina R.	36	31	49	41	19	35	52	65	52	NS
4	Olson B.	129	68	95	72	25	63	98	84	82	NS
5	Porcupine	10	0	0	0	0	0	16	6	0	NS
6	Fairmont	72	74	68	1	14	35	28	NS	NS	NS
7	Payday	2	0	0	1	0	0	0	9	3	NS
8	Olsen I.	18	20	9	5	14	1	12	15	13	NS
9	P. Pellew	32	28	28	25	22	21	0	8	12	NS
10	L. Axel	13	14	19	19	9	32	13	21	26	NS
11	Storey I.	3	5	1	0	2	7	10	14	2	NS
12	Agnes I.	41	37	40	56	NS	48	13	35	43	NS
13	L. Smith	52	60	31	13	NS	11	3	43	33	38
14	B. Smith	60	78	54	96	NS	81	NS	78	76	98
15	Seal I.	82	79	85	61	NS	52	NS	82	61	59
16	Applegate	99	166	219	185	NS	NS	NS	127	125	NS
17	Green I.	13	66	55	50	NS	29	NS	38	38	48
18	Channel I.	195	75	59	52	NS	47	NS	81	NS	70
19	L. Green	NS	95	NS	67	NS	NS	NS	55	13	24
20	P. Chalmers	NS	98	51	61	NS	73	NS	68	76	59
21	Stockdale	23	76	51	46	NS	36	NS	50	52	36
22	Montague P.	24	35	30	46	NS	44	NS	18	29	33
23	Rocky B.	0	24	7	9	NS	4	NS	23	20	2
24	Schooner P.	20	66	78	84	NS	86	NS	68	76	54
25	Canoe P.	0	32	78	6	NS	22	0	91	62	NS

NS = No Survey

Table 4. Summary of mean and maximum counts from haul-out sites on the Prince William Sound harbor seal trend count survey route, 1983, 1984, and 1988.

Site No.	1983 Mean	1983 Max.	1984 Mean	1984 Max.	1988 Mean	1988 Max.
1	18.5	47.0	46.3	90.0	12.0	31.0
2	22.6	52.0	26.5	49.0	12.4	38.0
3	57.7	86.0	44.6	66.0	42.2	65.0
4	81.0	149.0	150.4	239.0	79.6	129.0
5	19.2	49.0	30.5	54.0	3.6	16.0
6	84.6	170.0	98.0	133.0	41.7	74.0
7	22.0	39.0	12.0	16.0	1.7	9.0
8	23.5	37.0	40.1	54.0	11.9	20.0
9	23.0	73.0	23.3	43.0	19.6	32.0
10	21.1	67.0	28.1	35.0	18.4	26.0
11	18.8	39.0	11.5	20.0	4.9	14.0
12	66.4	114.0	82.5	109.0	39.1	56.0
13	95.6	171.0	79.1	127.0	31.6	60.0
14	130.5	240.0	98.8	162.0	77.9	98.0
15	116.0	216.0	114.6	166.0	70.1	85.0
16	251.9	398.0	227.0	435.0	153.5	219.0
17	25.9	58.0	61.8	105.0	42.1	66.0
18	143.0	327.0	282.8	501.0	82.7	195.0
19	85.6	199.0	60.1	128.0	50.8	95.0
20	36.8	68.0	72.5	143.0	69.4	98.0
21	32.3	65.0	35.4	75.0	46.3	76.0
22	35.1	58.0	47.4	76.0	32.4	46.0
23	35.8	61.0	37.0	53.0	11.1	24.0
24	86.4	117.0	72.1	112.0	66.5	86.0
25	51.3	86.0	13.6	31.0	36.4	91.0
Totals	1,584.6	2,986.0	1,796.0	3,022.0	1,057.9	1,749.0

Counts of harbor seals on the southwestern Tugidak Island haul-out site were made from 25 August through 5 September (Table 5). Both mean and maximum counts showed a continuing trend of decreasing numbers (Table 6, Fig. 4) from 1976 through 1988 ($P < 0.0001$). Mean annual counts decreased by 85% during this period. The mean annual observed exponential rate of increase (r) was -0.17, based on mean counts.

The decline occurred primarily between 1976 and 1982 when mean counts decreased by 77%, a highly significant declining trend ($P = 0.0005$) (Fig. 5). Although the declining trend continued during the following 6 years ($P = 0.004$), mean counts decreased by only 36%. Between 1976 and 1982, r was -0.26, while from 1982 to 1988 r was -0.07 (Fig. 4); these slopes were significantly different ($P < 0.05$).

Figure 4. Observed changes in harbor seal numbers on Tugidak Island, Gulf of Alaska, during the molting period, 1976-1988.

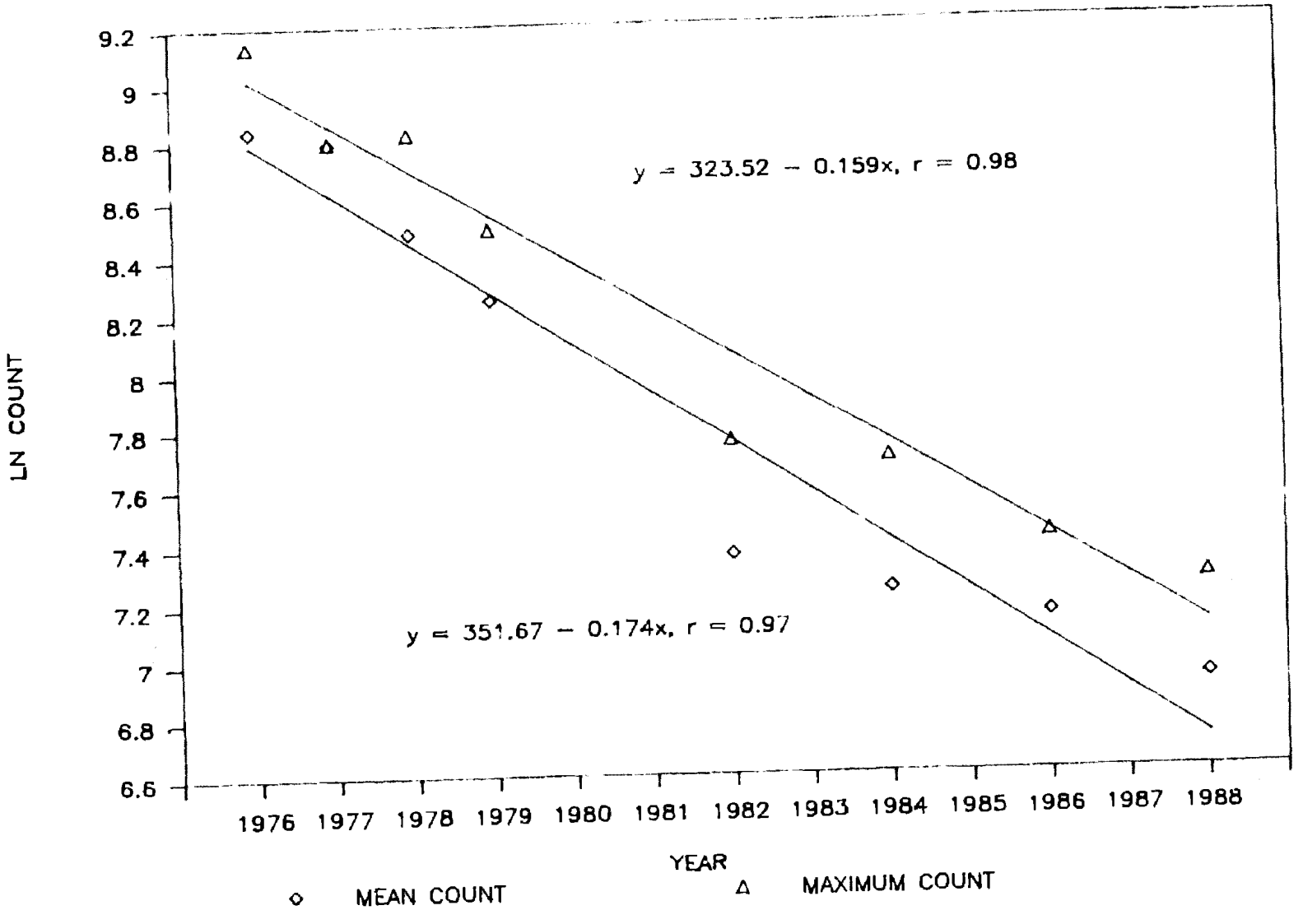

Figure 5. Observed changes in harbor seal numbers on Tugidak Island, Gulf of Alaska, during the molting period, 1976-82 and 1982-88.

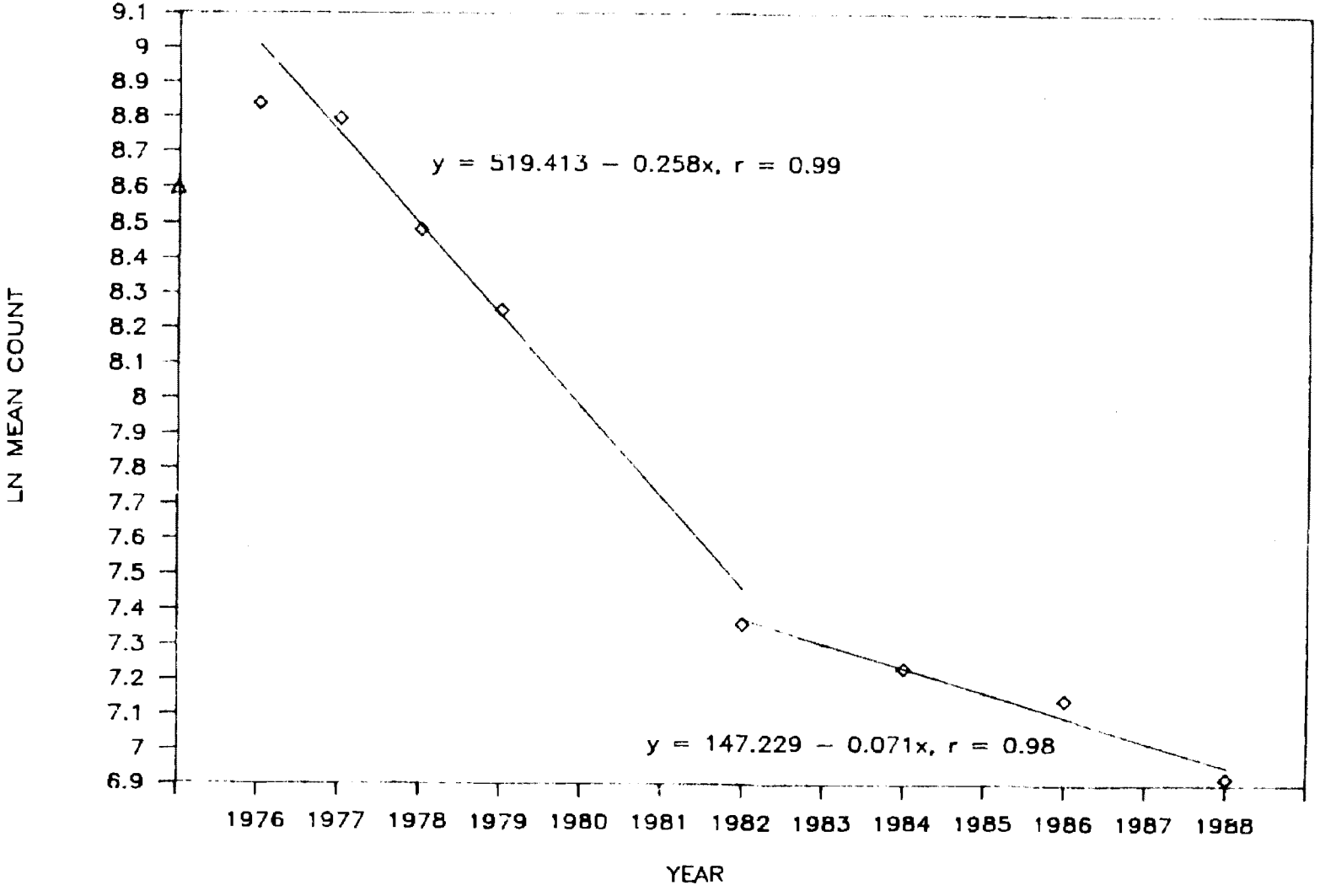

Table 5. Repetitive counts of harbor seals on the southwestern Tugidak Island, Alaska haul-out site, 1988.

Date	Count	Date	Count
25 August	1,437	30 August	1,089
26 August	788	31 August	980
27 August	605	1 September	806
28 August	1,008	2 September	1,171
29 August	1,219	5 September	1,033

Mean Count = 1,013.6
Coefficient of Variation = 0.24
N = 10

Table 6. Summary of repetitive counts of harbor seals on the southwestern Tugidak Island, Alaska hauling area during the molting period, 1976-88.

Year	Mean Count	Coefficient Of Variation	Minimum	Maximum	N
1976	6,919	0.280	2,800	9,300	12
1977	6,617	0.005	6,595	6,640	2
1978	4,839	0.270	2,532	6,817	12
1979	3,836	0.200	2,572	4,886	21
1982	1,575	0.390	660	2,325	10
1984	1,390	0.380	789	2,187	9
1986	1,270	0.230	639	1,673	10
1988	1,014	0.240	605	1,437	10

I assumed that the counts of harbor seals on the selected haul-out sites were valid linear indicies of local abundance. I have no reason to suspect that declines observed in Prince William Sound and Tugidak Island can be explained by changes in haul-out behavior or by emigration to other areas. Observations made during field activities and reports from the public also suggested reduced abundance in both areas.

Results of surveys conducted along the Bering Sea coast of the Alaska Peninsula in 1985, while not conclusive, indicated reduced abundance of harbor seals on major haul-out sites (Pitcher 1986b). This information, along with the results of the surveys reported here, suggests that harbor seal populations have declined over much of their range in the southeastern Bering Sea, central Gulf of Alaska, and

Prince William Sound. Numbers appeared stable in southeastern Alaska. There are large areas of southern Alaska for which no data are available regarding harbor seal population trend including the Aleutian Islands and the Pacific coastline of the Alaska Peninsula.

A somewhat similar decline in abundance of Steller sea lions in Alaska has occurred. Braham et al. (1980) and Merrick et al. (1987) documented declines beginning in the eastern Aleutian Islands and progressing to the northeast through the western and central Gulf of Alaska. As with harbor seals, sea lion numbers in southeastern Alaska appear stable (Calkins and Pitcher unpubl. data). A recent decline (1975-81) in numbers of northern fur seal pups born on St. Paul Island in the Bering Sea was also reported by York and Kozloff (1987).

Causes for declines in abundance of these Alaskan pinniped populations have not been identified with certainty. Factors that have been suggested include increased mortality of fur seals due to entanglement in marine debris (Fowler 1985), reduced carrying capacity for Steller sea lions in the Gulf of Alaska (Calkins and Goodwin 1988), incidental and directed take of sea lions by fishermen (Merrick et al. 1987), disease in Steller sea lions (Merrick et al. 1987, Calkins and Goodwin 1988), and harvest of sea lions (Braham et al. 1980, Merrick et al. 1987). Although no common causative factors are apparent, the general geographic proximity and timing of the declines suggest that they are more than coincidental and may be related.

Trend monitoring of harbor seals should be continued throughout Alaska to determine if established declines continue and if declines begin in other areas. It is important to document the magnitude and causes of the declines and evaluate whether these populations can rebound to their former levels, or if changes in their environments have occurred which will prevent full recovery. Consideration should be given to conducting biological studies to measure condition, growth, reproductive parameters, and food habits in order to gain insights into possible causes of the declines.

ACKNOWLEDGEMENTS

Dennis McAllister conducted the surveys in Prince William Sound and Lori Quakenbush counted seals on Tugidak Island. Dave Doyon and Steve Ranney flew survey aircraft. The U. S. Coast Guard provided helicopter transportation to and from Tugidak Island. The Marine Mammal Commission provided funding for these surveys. Lloyd Lowry, Sid Morgan, Steve Peterson, and Karl Schneider reviewed a draft of this report. Earl Becker offered advice on statistical procedures. I appreciate their contributions.

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APPENDIX I

10 March 1988

John R. Twiss, Jr.
Executive Director
Marine Mammal Commission
1625 Eye St., N.W., Rm. 307
Washington, DC 20006

Dear John:

This letter is to serve as the required plan for harbor seal trend surveys proposed to be conducted in 1988 and suggestions for a long-term monitoring schedule of selected "index" haulout sites as required by Contract MM4465853-2 AMENDED.

ADF&G has established harbor seal trend count survey routes at selected haulout sites in southeastern Alaska, Prince William Sound, the Tugidak Island-Kodiak Island area, and along the Bering Sea coast of the Alaska Peninsula. The purpose of these surveys is to provide an index of abundance in order that population trends may be tracked. With the exception of Tugidak Island, which consists of ground counts, these are aerial photographic surveys of a selected series of haulout sites in which the surveys are repeated on a daily basis, weather permitting, throughout a 10 day period. Mean numbers of seals present on the haulout sites, along with associated variances, are calculated allowing for statistical comparisons over time. The surveys are conducted during the molt or pupping periods, near low tide, when maximum numbers of animals are usually hauled out. Table 1 summarizes trend count survey route locations, survey years, and proposed survey schedules.

Table 1. Southern Alaska harbor seal trend count survey routes, including years when surveys have been conducted and proposed survey schedule.

Survey Route	Years Surveyed	Years Proposed
Ketchikan	1983, 84	1988, 91, 94
Sitka	1983, 84	1989, 91, 94
Pr. William Sd.	1983, 84	1988, 90, 93
Tugidak Is.	1976, 78, 79,82, 84, 86	1988, 90, 93
AK Peninsula	1966-73, 1975-77, 1985	1989, 92, 95

Based on the sensitivity of the technique to detect change, the realistic magnitude of potential changes, and the level of need of information for management purposes a monitoring frequency of triennial surveys is suggested. For 1988 it is proposed to survey one area in southeastern Alaska (Ketchikan route), the Prince William Sound route, and if logistic support can be obtained from the U.S. Coast Guard, Tugidak Island. Ground counts are conducted on Tugidak and costs are modest other than transportation. This would provide information from a wide range of areas with the limited funding available. In 1989 it is proposed to survey the Sitka route in southeastern Alaska and the Bering Sea coast of the Alaska Peninsula which would require operating expenses of about $16,000. Thereafter the schedule would be adjusted to a triennial base with Ketchikan and Sitka routes one year, Prince William Sound and Tugidak Island the next year, followed by the Alaska Peninsula. Annual operating expenses would be approximately $13,000.

Data bases are available from studies conducted by other agencies at other sites in southern Alaska which may also be suitable for evaluating population trends of harbor seals. These areas are Glacier Bay National Park, Kenai Fjords National Park, and Togiak National Wildlife Refuge. Agencies responsible for management of these areas should be encouraged to collect appropriate data.

The survey schedule proposed here would comprise a important component of a management program for harbor seals in Alaska. Funding sources should be developed through National Marine Fisheries Service, the agency responsible for harbor seal management in Alaska, to ensure that the surveys are conducted on a timely basis.

Sincerely,

Ken Pitcher

Kenneth W. Pitcher
Marine Mammals B ologis

cc: Robert Hofman
Marian Graham