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SURVEY OF NORTHERN SEA LIONS (EUMETOPIAS JUBATUS) IN THE GULF OF ALASKA AND ALEUTIAN ISLANDS DURING JUNE 1989

by

Thomas R. Loughlin[1], Adolf S. Perlov[2], and Valery A. Vladimirov[3]

[1]National Marine Mammal Laboratory
Alaska Fisheries Science Center
National Marine Fisheries Service
7600 Sand Point Way NE
Seattle, WA 98115

[2]Pinnipeds Section
Pacific Research Institute
of Marine Fisheries and Oceanography
Shevchenko Alleye, 4
Vladivostok, U.S.S.R. 690600

[3]Marine Mammal Laboratory
All-Union Research Institute
of Marine Fisheries and Oceanography
V. Krasnoselskaya, 17
Moscow, U.S.S.R. 107140

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INTRODUCTION

The abundance of northern sea lions, Eumetopias jubatus, has declined about 52% in most of Alaska, from a high of 140,000 in 1956-60 to about 68,000 in 1985, an annual rate of decline of about 2.7% (Merrick et al. 1987). The decline in northern sea lion abundance was first detected in the eastern Aleutian Islands (Fig. 1) in the mid 1970s (Braham et al. 1980). The decline appeared to spread eastward to the Kodiak Island area during the late 1970s and early 1980s and westward to the central and western Aleutian Islands during the early and mid-1980s (Merrick et al. 1987; Byrd 1989[1]). Factors related to the decline have not been identified, but the synergistic effects of fisheries, and perhaps environmental perturbations or disease, are considered to be the most likely causes (Calkins and Goodwin 1988; Loughlin and Merrick 1989; Lowry et al. 1989).

This report summarizes the results of a 1989 aerial survey conducted to determine if the abundance decline is continuing in Alaska. Counts of adult and juvenile northern sea lions from the Kenai Peninsula to Kiska Island in the central Aleutian Islands and sea lion pups at Kiska and Seguam Islands in the central Aleutian Islands, Bogoslof Island in the eastern Aleutian Islands, and Chirikof and Marmot Islands in the Gulf of Alaska are presented. The survey is a repeat of a National Marine Mammal Laboratory (NMML) 1985 survey (Merrick et al. 1987) and is

part of a range-wide survey of the species conducted during 1989 coordinated by the senior author. This work is part of a joint U.S.-U.S.S.R. project covered under the auspices of the U.S.-U.S.S.R. Environmental Agreement, Area V, Marine Mammals. Results of the range-wide survey will be published at a later date.

METHODS

Our counts of adults, juveniles, and pups followed the procedures and rationales of earlier studies (Braham et al. 1980; Merrick et al. 1987; Withrow 1982). We assumed that the dates and times of seasonal and daily abundance were unchanged from earlier surveys and that the proportion of the population on shore during the survey period has not changed significantly among survey years (Merrick et al. 1987). Although the last assumption would not be valid if adult female reproductive rates have declined (resulting in nonparturiant females spending more time at sea), available data support this assumption (Calkins and Goodwin 1988).

The reader should keep in mind that the counts of adults and juveniles presented here are for one day and that the number of animals on land may vary from day to day depending on weather, disturbance, and other factors. Thus, the counts are indices of abundance, important for trend analysis but not intended to be estimates of total population abundance. The number of animals missed, however, is unlikely to account for the observed declines

in abundance. Pup counts are more reliable because they are obtained before pups enter the water or leave the island; most pups remain on land from birth (late May-early July) to mid-July facilitating accurate counts.

Adult and juvenile northern sea lions were counted from airplanes at rookeries and haul-out locations from Outer Island (Kenai Peninsula) to Kiska Island (central Aleutian Islands) during 13-29 June 1989 (Fig. 1). Our surveys were designed to visit traditional sea lion rookeries and haul-out areas (cf. Calkins and Pitcher 1983; Fiscus et al. 1981; Loughlin et al. 1984; Merrick et al. 1987), but other areas along the flight path were examined en route to the primary sites. Under ideal conditions flights were conducted at approximately 200 m altitude, air speed at 90 knots, and approximately 500 m offshore. High winds required flights to be higher and farther offshore, and fog required flights to be somewhat lower, depending on human safety and terrain. A Grumann Widgeon[2] airplane was used for surveys between Outer Island and the Islands of Four Mountains; a Piper Navajo airplane was used for flights to the areas west of the Islands of Four Mountains. Initial counts of animals were visually estimated and immediately recorded on daily log sheets. Next animals were photographed using a 35 mm camera with a motor drive and 70-210 mm zoom lens. Later, the processed transparencies were projected onto a white background in the laboratory and the animals counted. In the few cases when the projected transparencies were too blurred or

distant for us to be able to make accurate counts, we used our visual estimates. Visual estimates were generally lower than photographic counts, but our experience has been that the estimates represent the overall trend in the population. We missed some locations due to inclement weather, such as Semispochnoi Island and Column Rocks at Amchitka Island, but we estimate that these missed sites represent only 3-4% of the expected total count.

Pup counts were obtained at Marmot, Chirikof, Bogoslof, Seguam, and Kiska Islands by walking through the rookery and forcing all sea lions other than pups into or near the water. Counts at Kiska, Seguam and Bogoslof Islands were obtained on 8, 12, and 15 July, respectively, by U.S. and Soviet scientists on board the Soviet research vessel Rubezhnoe (Merrick et al. in press); we conducted the pup counts at Chirikof and Marmot Islands on 28 and 29 June, respectively. We recorded dead pups as well, but did not report them here since the number of dead pups on the beach at one moment in time has no relationship to the overall number of pups that may have died. Dead pups are washed off the beaches during tidal cycles or are consumed by bald eagles, foxes, and other scavengers.

To determine trends in relative abundance, area counts were regressed as a linear function of time (Merrick et al. 1987). Wilcoxon's signed rank test was used for between-year comparisons of paired site counts within an area (Hollander and Wolfe 1973).

RESULTS

A total of 24,953 adult and juvenile northern sea lions were counted in the study area (Tables 1 and 2). This represents a decline of 63% from the 67,617 counted in the same area during 1985 (8.5% average decline per year) and 86% decline from the 180,000 counted in 1960 (4.5% average decline per year; Fig. 2; Merrick et al. 1987). Of the total counted in 1989, 9,614 (38%) were from the central Gulf of Alaska versus 24,389 (36%) counted in 1985; 4,435 (18%) were from the western Gulf of Alaska versus 6,667 (10%) in 1985; 3,145 (13%) were from the eastern Aleutian Islands versus 10,802 (16%) in 1985; and 7,759 (31%) were from the central Aleutian Islands versus 25,759 (39%) in 1985 (Merrick et al. 1987). Declines were noted in all areas and at all rookeries and haul-out locations except at Chernabura Island, which had an increase of 57 animals from 487 in 1985 to 544 in 1989.

The largest decline occurred in the eastern Aleutian Islands. The six major rookeries in this area totaled 41,220 adult northern sea lions in 1960 (Table 3). In 29 years, sea lion numbers declined 93% to 2,813 in 1989 (8.6% per year). Analysis indicates that the negative slope of the regression is significantly different from zero ($P = 0.01$; $sd = 1.66$) and the estimated regression line is approaching zero (Fig. 3). From 1956 to 1989, sea lion numbers in the western Gulf of Alaska declined at an annual rate of 4.8%. The negative slope of the regression for these years is significantly different from zero

(P = 0.03; sd = 1.22; Fig. 3). The slopes of the regressions for the central Gulf of Alaska and central Aleutian Islands also show annual declines of 3.1 and 2.6%, respectively, which were not significantly different from zero.

We compared the numbers of animals at rookeries versus haul-out sites to assess whether the decreases observed at rookeries could be explained by the movement of animals to haul-out sites. However, we found no increases at haul-out sites which could account for the large decreases observed at rookeries. In fact, most haul-out sites showed declines of a greater magnitude than rookeries when comparing 1989 counts to 1985 counts. During 1985, haul-out sites accounted for 40% of the animals surveyed (Merrick et al. 1987); in 1989 they accounted for 25%.

Particularly alarming is the magnitude of decline at major rookeries within the study area from 1985 to 1989. For instance, Sugarloaf Island declined 38% (by 1,130 animals), Marmot Island (the largest northern sea lion rookery) declined 53% (by 2,652 animals), Ugamak Island (once the largest rookery in the Aleutian Islands) declined 69% (by 979 animals), and Seguam Island declined 80% (by 2,340 animals; Table 4). The smallest decline occurred at Pinnacle Rocks, which declined by 222 animals (14%).

Pup numbers also declined. The pup count at Marmot Island in 1989 was 2,199 live pups, down 49% from 4,266 in 1986 (Table 5). The magnitude of the drop in pup production at Marmot was surprising. At Beach 3 of the island, zero pups were born in 1989; 832 pups were born there in 1988. At Chirikof Island the

count was 709 live pups, down 52% from 1,476 in 1985; at Bogoslof Island the count was 358 live pups, down 62% from 1,120 in 1985; at Seguam Island the count was 529 pups, down 80% from 2,635 in 1985; and at Lief Cove, Kiska Island, the count was 293 live pups, down 67% from 885 in 1985 (Table 5; Merrick et al. 1987).

DISCUSSION

Results from our survey confirmed that northern sea lion abundance continues to decline throughout Alaska. The magnitude of the decline is apparent when the surveys are compared. Just 29 years ago 140,000 animals were counted from Sugarloaf Island to Kiska Island (Loughlin et al. 1984); in 1985, about 68,000 northern sea lions were counted in this area (Merrick et al. 1987); and in 1989 only about 25,000 were counted. A total of 25,000 is approximately the same number of sea lions counted in the eastern Aleutian Islands alone in 1979 (Braham et al. 1980). Over the past 29 years (1960-89) the sea lion population in our study area has declined at about 4.5% per year; in the eastern Aleutian Islands the rate of decline has been about 8.6% per year.

An alarming aspect of the decline is that it continues to spread. The 1985 survey showed that the decline had stopped at Marmot Island, near Kodiak, and that areas to the east, such as Sugarloaf Island, had remained stable. Our 1989 survey shows that Sugarloaf and Outer Island populations to the east have now declined. Unpublished data collected by the Alaska Department of

Game suggest that sea lion numbers in areas east and south of Outer Island have remained stable[3]. These data for the two areas will be discussed in depth in the report being prepared on the range-wide survey of northern sea lions.

Also of concern is the magnitude of the decline in the central Aleutian Islands. Sea lions in this area declined by only 8% from the mid-1950s to 1985 (Merrick et al. 1987). Since 1985, the population has declined by 70% from 25,759 animals to only 7,759. The most significant declines were at Seguam Island and Kiska Island (Table 4); pup production at Seguam declined 80% over the 4 years, 1985-89 (Table 5).

Clearly, the northern sea lion population in our study area is at reduced levels. We recommend continued studies to monitor the status of northern sea lions in Alaska and research to determine the cause(s) of observed declines.

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research was coordinated through the U.S.-U.S.S.R. Environmental Agreement, Area V, Marine Mammals, coordinated by R. V. Miller (U.S.) and L. Popov (U.S.S.R.). The manuscript was improved by comments from H. Braham, G. Duker and his staff, M. Goebel, and R. Merrick.

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[2]Reference to trade names does not imply endorsement by the National Marine Fisheries Service, NOAA.

[3]D. G. Calkins, Alaska Department of Fish and Game, 333 Raspberry Road, Anchorage, AK, 99518. Pers. commun., August 1989.

Table 1.--Counts of adult and juvenile northern sea lions by area in the Gulf of Alaska and Aleutian Islands during 1985-89.

Area	1985[a] Count	1989 Count	Percent change
Central Gulf (Outer I. to Chirikof I.)	24,389[b]	9,614	-61
Western Gulf (Atkins I. to Clubbing Rock)	6,667	4,435	-34
Eastern Aleutians (Ugamak I. to Samalga)	10,802	3,145	-71
Central Aleutians (Is. Four Mnts. to Kiska)	25,759	7,759	-70
Total	67,617	24,953	-63

[a]Merrick et al. 1987.

[b]Does not include Outer Island.

Table 2.--Counts of adult and juvenile northern sea lions at rookeries (*) and haul-out locations in the Gulf of Alaska and Aleutian Islands during 1989.

Location	Time	Estimate	Count
	13 June		
Central Gulf of Alaska			
Puale Bay	0955	80	309
Takli Island	1014	200	66
Sud Rocks	1105	2	2
Sugarloaf*	1120	1300	1861
Ushagat south	1125	2	2
Ushagat north	1130	120	168
Cape Elizabeth	1308	250	249
Nagahut Rocks	1311	20	20
Perl Island	1313	50	50
Gore Point	1330	25	25
Outer Island*	1343	350	350
	14 June		
Marmot Island*	1010	1400	2331
Sea Lion Rocks	1030	30	46
Sea Otter Rocks	1035	200	450
Latex Rocks	1055	270	354
Tonki Point	1110	22	22
Long Island		30	30
Twoheaded Island	1250	120	479
Cape Sitkinak	1307	210	204

Table 2.--Continued.

Location	Time	Estimate	Count
Ugaiushak Island	1418	90	138
Sutwik Island	1433	120	210
Chowiet Island*	1612	600	737
Nagai Rocks	1637	170	233
Chirikof Island*	1640	870	1278
Western Gulf of Alaska			
Lighthouse Rocks	1716	40	172
Spitz Island	1745	180	156
	15 June		
Whaleback	1020	350	355
Haystack		0	0
Castle Rock	1035	60	79
Atkins Island *	1045	650	755
Chernabura Island*	1059	650	544
Nagai Island	1125	20	22
Sea Lion Rocks	1130	60	96
Pinnacle Rock*	1157	1490	1366
Clubbing Rocks*	1216	470	856
South Rock	missed due to fog		
Jude Island	missed due to fog		
Bird Island	1237	25	34
Rock Island		0	0

Table 2.--Continued.

Location	Time	Estimate	Count
Amak Island	0910	70	98
Eastern Aleutian Islands			
Sea Lion Rock*	0912	180	344
Cape Sarichef		50	50
Ugamak Island*	1315	450	450
Akun, Billingshead Bight*	1335	150	150
Rootok	1352	28	28
Akutan, Cape Morgan*	1410	550	578
	16 June		
Bogoslof Island*	0930	450	682
Adugak Island*	1015	500	392
Samalga Island	1025	3	3
Uliaga Island	1050	0	0
Vsevidof Island	1150	20	23
Ogchul Island*	1152	150	217
Pillars	1200	0	0
Cape Aslik	1225	60	98
Cape Winslow	1300	45	60
Central Aleutian Islands			
Kagamil Island	1045	15	17
Carlisle Island	1100	17	20
Herbert Island	1105	40	40

Table 2.--Continued.

Location	Time	Estimate	Count
Chuginadak, Concord Point	1128	100	248
	17 June		
Yunaska Island*	1345	350	466
Chugalak Island	1400	40	40
Amukta Island	1410	30	30
Seguam Is., Saddleridge*	1430	500	602
rest of island		107	107
Agligadak Island*	1442	150	132
Tanadak Island	1445	75	84
Sagigik Island	1455	80	116
Amlia	1500	50	50
Atka-north Cape	1515	250	333
Cape Korovin		0	0
Salt Island	1530	25	25
Koniuji Island	1545	0	0
Kasatochi Island*	1550	700	659
Anagagsik Island	1610	0	0
Great Sitkin missed due to high winds			
	18 June		
Little Tanaga	1130	150	150
	20 June		
Adak Island, Cape Yakak*	0930	350	424

Table 2.--Continued.

Location	Time	Estimate	Count
Gramp Rock*	0950	500	747
Tag Island*	1000	450	590
Unalga Island	1000	150	178
Ulak Island*	1010	700	1123
Dinkum Rocks	1010	4	4
Semisopochnoi Island	missed due to high winds		
Amchitka east cape	1050	20	20
Column Rocks*	1110	missed due to high winds	
Ayugadak Island*	1115	350	389
Sea Lion Rock	1125	3	3
Tanadak Island	1130	100	136
Kiska Island- Sobaka Rock	1140	2	2
Vega Point	1140	50	50
Cape St. Stephen*	1142	300	464
Lief Cove*	1150	400	510

Table 3.--Counts of adult and juvenile northern sea lions at rookeries in the eastern Aleutian Islands, 1960-89. (Unlike Table 1, this table does not include counts at haul-out sites).

Rookery	Northern sea lion counts			
	1960[a]	1977[a]	1985[b]	1989[c]
Sea Lion Rock	2,000	2,227	538	344
Ugamak	19,400	5,408	1,429	450
Akutan-Akun	15,720	3,269	2,145	728
Bogoslof	1,100	2,328	1,287	682
Ogchul	2,000	1,130	547	217
Adugak	1,000	1,842	955	392
Totals	41,220	16,204	6,901	2,813

Decline from 1960 to 1989 = 93%

Decline from 1977 to 1989 = 83%

Decline from 1985 to 1989 = 59%

[a]Braham et al. 1980.

[b]Merrick et al. 1987.

[c]This study.

Table 4.--Counts of northern sea lions at principle rookeries in the Aleutian Islands and Gulf of Alaska during 1985 and 1989. (Outer Island not included).

Island	1985[a]	1989	Percent decline
Sugarloaf	2991	1861	38
Marmot	4983	2331	53
Chowiet	2059	737	65
Chirikof	2346	1278[b]	46
Atkins	1562	755	52
Chernabura	487	544	--
Pinnacle Rock	1588	1366	14
Clubbing Rocks	1251	856	32
Sea Lion Rock	538	344	36
Ugamak	1429	450[b]	69
Akun	435	150[b]	66
Akutan	1710	578[b]	66
Bogoslof	1287	682	47
Ogchul	547	217	60
Adugak	955	392	59
Yunaska	1071	466	56
Seguam	2942	602	80
Agligadak	514	132	74
Kasatochi	1170	659	44
Adak	964	424	56
Gramp	1290	747	42

Table 4.--Continued.

Island	1985	1989	Percent decline
Tag	944	590	38
Ulak	2729	1123	59
Semisopochnoi	nc	nc	--
Amchitka	728	nc	--
Ayugadak	702	389	45
Kiska (2 rookeries)	3066	974	68
Total	39,560[c]	18,647	53

[a]Merrick et al. 1987.

[b]Poor quality photographs.

[c]Does not include Amchitka Island.

nc = no count

Table 5.--Counts of live northern sea lion pups at selected rookeries in the Aleutian Islands and Gulf of Alaska, 1979 to 1989.

Rookery	1979[a]	1985-86[a]	1989	Percent change[b]
Marmot Island	6,658	4,266	2,199	-67 (-48)
Chirikof Island	1,649	1,476	709	-57 (-52)
Bogoslof Island	914	1,120	358	-61 (-68)
Seguam Island	2,500	2,635	529	-79 (-80)
Kiska Island (Lief Cove)	476	882	293	-38 (-67)

[a]Merrick et al. 1987.

[b]1989/1979 (1989/1985-86).

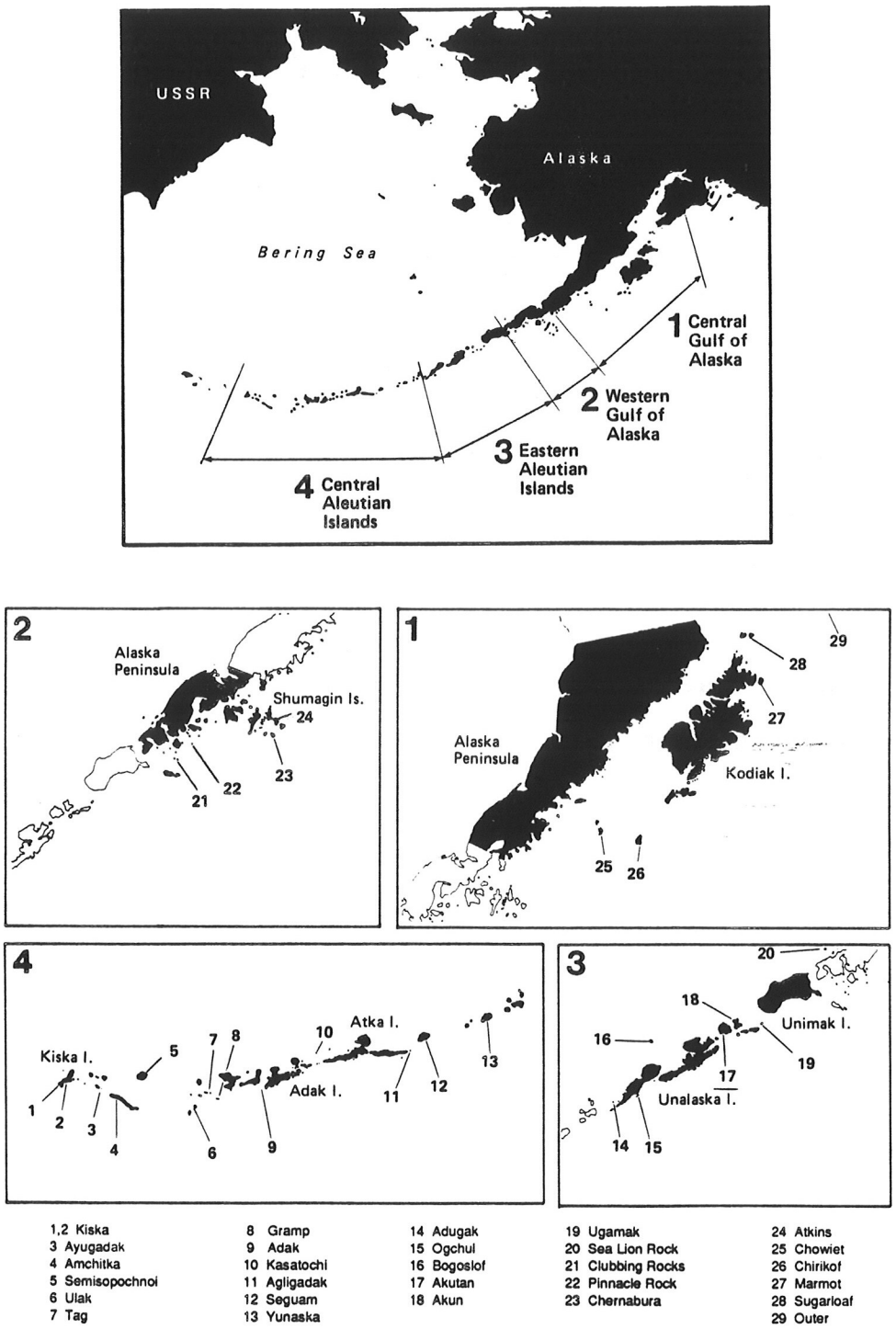

Figure 1.--The four Alaskan study areas and 29 northern sea lion rookeries counted during 1989 (modified from Merrick et al. 1987).

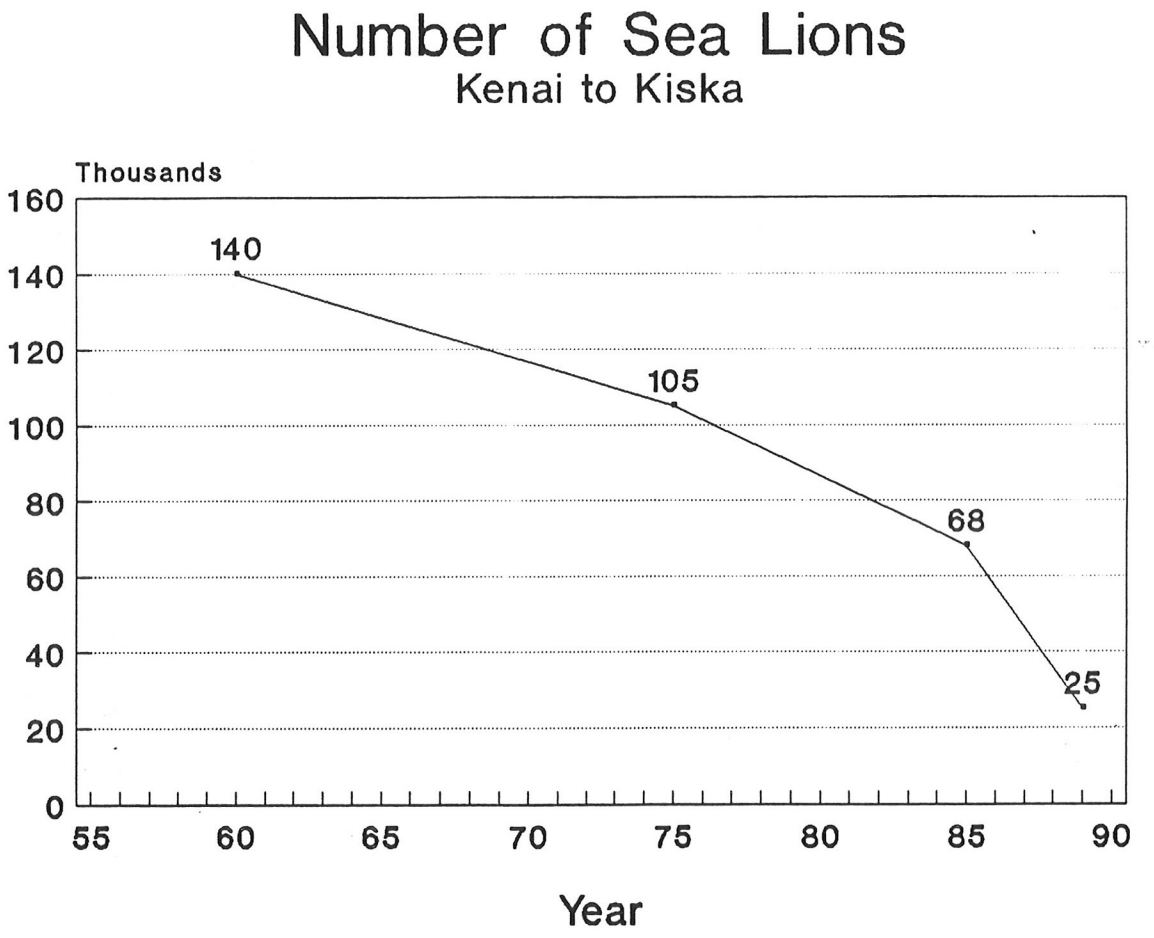

Figure 2.--Overall trend in northern sea lion abundance from the Kenai Peninsula to Kiska Island, 1960-89 (Braham et al. 1980; Fiscus et al. 1981; Merrick et al. 1987).

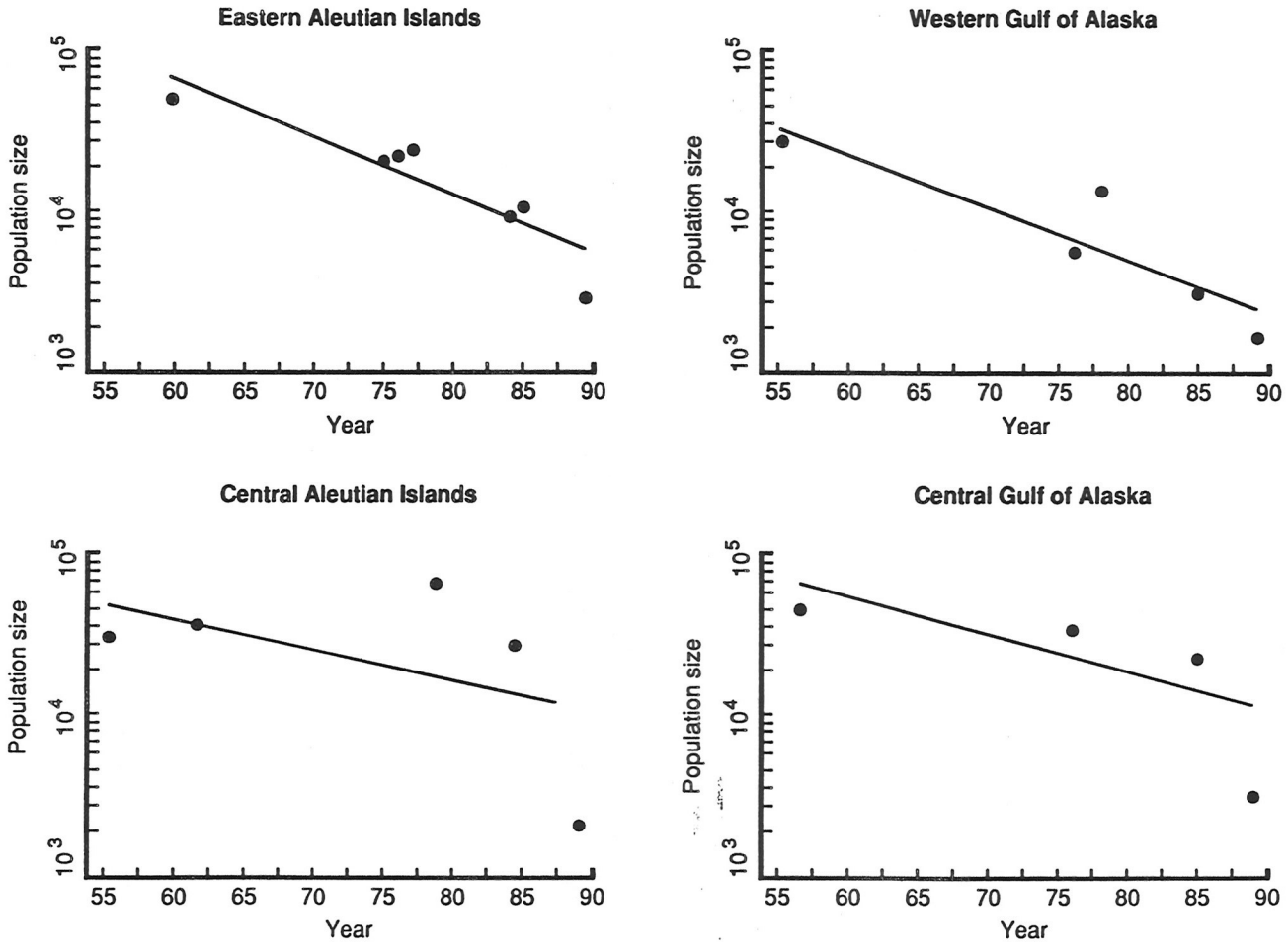

Figure 3.--Regression of the logarithm of the number of adult and juvenile sea lions by area by year from about 1955 to 1989 (Braham et al. 1980; Fiscus et al. 1981; Merrick et al. 1987).