DISTRIBUTION AND ABUNDANCE OF MARINE MAMMALS IN THE GULF OF ALASKA

By
Donald G. Calkins
Kenneth W. Pitcher
Karl Schneider

Alaska Department of Fish and Game
Division of Game
July 31, 1975

Table of Contents

INTRODUCTION

This report has been prepared by the Alaska Department of Fish and Game under contract with the U.S. Department of Commerce, National Oceanic and Atmospheric Administration. The general purpose of this report is to delineate our present knowledge of the status of the Marine Mammal populations in the Gulf of Alaska. This has been accomplished through use of material on file in Alaska Department of Fish and Game offices from many previous surveys, from interviews with individuals who have observed marine mammals along the Gulf Coast and on the high seas and from information supplied by the National Marine Fisheries Marine Mammal Division. Scientific publications on Gulf of Alaska marine mammals have been consulted and pertinent information included in this report.

A list of marine mammals likely to be found in the Gulf of Alaska is shown in Table 1. We have attempted to include all marine mammals found in the area although this report is directed primarily towards the sea otter (Enhydra lutris), the Steller (Northern) sea lion (Eumetopias jubatus) and the harbor seal (Phoca vitulina richardi). Observations on cetaceans have been supplied by Cliff Fiscus of the National Marine Fisheries Marine Mammal Laboratory, Seattle.

The area covered by this report is shown in Figure 1, from Cape Spencer on the north side of Cross Sound in Southeastern Alaska to Scotch Cap on Unimak Island. Our best information on marine mammal populations between Cape St. Elias and Cape Puget is contained in "Distribution and Abundance of Sea Otter, Sea Lions and Harbor Seals in Prince William Sound" (Pitcher M.S.) (Appendix A).

Table 1. List of marine mammal species likely to occur in Northeastern Gulf of Alaska waters.

Species	Occurence Coastal and Inside Waters	Offshore
Sea otter (*Enhydra lutris*)	X	
Northern sea lion (*Eumetopias jubatus*)	X	
Northern fur seal (*Callorhinus ursinus*)		X
Harbor seal (*Phoca vitulina*)	X	
ıck right whale (*Balaena glacialis*)		X
Gray whale (*Eschrichtius robustus*)		X
Minke whale (*Balaenoptera acutorostrata*)	X	X
Sei whale (*Balaenoptera borealis*)	X	X
Fin whale (*Balaenoptera physalus*)		X
Blue whale (*Balaenoptera musculus*)		X
' pback whale (*Megaptera novaeangliae*)	X	X
North Pacific white-sided dolphin (*Lagenorhynchus obliquidens*)		X
Killer whale (*Orcinus orca*)	X	X
Harbor porpoise (*Phocoena phocoena*)	X	
Dall porpoise (*Phocoenoides dalli*)	X	X
Sperm whale (*Physeter catodon*)		X
ring Sea beaked whale (*Mesoplodon stejnegeri*)		X
Goosebeaked whale (*Ziphius cavirostris*)		X
Northern right whale dolphin (*Lissodelphis borealis*)		X
Short-finned pilot whale (*Globicephala macrorhyncha*)	X	X
Beluga (*Delphinapterus leucas*)	X	
Pacific giant bottlenose whale (*Berardius bairdi*)		X

SEA LION

The Northern sea lion is found throughout the Gulf of Alaska and is considered one of the more important marine mammal species. The single, most pronounced characteristic of the sea lion which distinguishes it from other marine mammals of the Gulf of Alaska is its affinity for specific, well defined locations along the coast used as breeding and pupping rookeries and hauling areas.

Adult sea lions gather on the breeding rookeries in late May. The large, dominant bulls gather harems of cows and defend territories. Pupping generally takes place within these defended territories and is closely followed by mating. As the breeding season progresses harem bulls become more tolerant of other male intruders until early July when they begin to desert their territories. Not all sea lions go to rookery areas during the breeding season. Large numbers of mature bulls occupy male hauling grounds, generally located adjacent to rookeries. Also males and females without pups may gather on hauling grounds where males also defend territories and engage in breeding activities. (Alaska Department of Fish and Game 1973).

Although pups are able to swim within hours of birth they rarely enter the water before one month of age (Sandegren 1970, Alaska Department of Fish and Game 1973). As many as 25 percent of adult females may fail to produce a pup each year. In addition, more than half the new pups die in their first year. Drowning, abandonment, malnutrition and predation are the major causes of death (Alaska Department of Fish and Game 1973).

Many sea lions leave the breeding and pupping rookeries in favor of more protected waters during the winter and have been known to follow predictable feeding patterns, such as concentrating on herring spawning schools in the spring (Alaska Department of Fish and Game 1973).

Sea lions are known to eat a wide variety of fishes and crustaceans although they are generally considered to be primarily piscivorous. (Fiscus and Baines 1966, Mathisen et al. 1962, Pike 1958, Brooks 1957.)

Sea lions from the Gulf of Alaska as well as other areas have long been considered an enemy of fishermen because of their dietary preference for fishes. (Mathisen et al. 1962, Brooks 1957, 1963, Fiscus and Baines 1966) but few actual quantative data are available concerning the extent of predation on commercially exploited fishes.

Populations of sea lions have been exploited by man throughout history. The earliest records of harvest of sea lions in the Gulf of Alaska come from middens near native village sites and show that sea lions were used extensively. In fact there are indications that sea lion populations were reduced prior to the early 1900's by subsistence hunting.

Commercial interest in sea lions brought about harvests of pups for their pelts and some experimental harvest of adults for meat. A total of 45,808 sea lion pups were recorded harvested from Alaskan rookeries from 1959 through 1972. A total of 31,070 of these came from Marmot and Sugarloaf Islands.

Previous surveys by Alaska Department of Fish and Game Biologists, information from other marine mammal biologists and our survey indicate there are a total of 91 different rookeries and hauling areas in the northeast Gulf of Alaska. Sea lion rookeries and haul out areas are found on a variety of different substrates ranging from sand beaches to beaches with boulders up to 10m in diameter to bedrock and are often found on exposed points or isolated small islands. These rookeries and hauling areas are shown on maps SL-1 through SL-6 of this report.

The following is a discussion of each rookery or haul out area, beginning in the southeastern part of the study area. Counts of animals are reported as the highest known counts.

Venisa Point and Sugarloaf Island

Located on the north side of Graves Harbor, Greg Strevelar (Pers. Comm.) reported sighting 11 sea lions hauled out on the south side of Sugarloaf Island in July 1974 and 3 at Venisa Point in June 1974.

Harbor Point

On the south entrance of Lituya Bay, Strevelar reported 40 sea lions in July 1970.

Cape Fairweather

Located 54 miles north of Cape Spencer, Strevelar reported about 200 animals here in April 1970.

Sitkagi Bluffs

An ice cliff 5 miles long on the open coast north of Yakutat had a population of about 1,000 animals. (Alaska Department of Fish and Game 1973).

Pinnacle Rock*

On the south end of Kayak Island.

Porpoise Rocks

Three main rocks on the north side of Port Etches, Hinchinbrook Island. As many as 50 sea lions have been sighted here but no recent sightings.

Seal Rocks*

Lying 6 to 7 miles southwest of Cape Hinchinbrook.

Fish Island* (Lewis Island)

Outermost of the Wooded Islands on the southeast side of Patton Bay on Montague Island.

* Population data presented in "distribution and Abundance of Sea Otters, Sea Lions and Harbor Seals in Prince William Sound", Pitcher (1975) (see Appendix A).

The Needle*

In Montague Strait 3.8 miles from the nearest point on Montague Island and 5.5 miles southeast of Point Helen, the southern extremity of Knight Island.

Glacier Island*

On the north side of Prince William Sound, west of the entrance to Valdez arm.

Point Eleanor*

The northernmost point of Eleanor Island.

Perry Island*

In the northwest corner of Prince William Sound.

Point Elrington*

The southwestern end of Elrington Island in Prince William Sound.

Knowles Head

The westernmost point between Port Gravina and Port Fidalgo in northeastern Prince William Sound. Population of 200 sea lions have been reported here but no recent sightings. May be winter hauling area.

Fox Point

Near the northeast end of Hawkins Island, is not shown on USCGS charts. Alaska Department of Fish and Game (1973) show 200 sea lions using this area but recent survey information suggests this may no longer be used as a sea lion hauling area.

Latouche Island

On the western side of Montague Strait, Prince William Sound, this sea lion haul out is reported to be on the southernmost tip of the island (Mathisen and Lopp 1963) with 86 animals sighted and Alaska Department of Fish and Game (1973) with 75. No animals sighted on recent surveys. This area could be used as an alternative to Danger Island or Point Elrington under certain conditions or may have changed enough during the earthquake in 1964 to cause abandonment.

Danger Island

One and four-tenths miles south of Latouche Island. Mathisen and Lopp (1963) sighted 298 sea lions here while Alaska Department of Game, (1973) showed 200. No sightings on recent surveys. This area, along with Latouche Island, could serve as an alternative to Point Elrington under certain conditions or may have changed sufficiently during the 1964 earthquake to cause abandonment.

Middleton Island

About 50 miles south of the entrance to Prince William Sound, the sea lions haul out on a small sand spit which arcs off the north end of the Island. Our survey in February 1975 showed 175 animals but reports by local residents indicate much higher usage, up to 1,000 animals, in the summer. Probably no pups are produced here because this haul out is composed of a sand bar which is completely exposed to storms and high tides.

Fountain Rocks

Four miles north of Middleton Island, reported to be awash at low water, breaking only in heavy weather although could have changed during the 1964 earthquake. Reported in Alaska Department of Fish and Game (1973) to have 300 sea lions. This haul out may have been mistaken for the one on Middleton Island.

Cape Puget

First prominent headland west of Prince William Sound, forms southwest side of the Sound. Alaska Department of Fish and Game (1973) listed 20 animals here and Mathisen and Lopp (1963) counted 20 animals. No sightings on recent surveys.

Cape Junken

Prominent headland about 17 miles southwest of Cape Puget, Alaska Department of Fish and Game (1973) showed 20 animals here.

Rugged Island

On the eastern side of the entrance to Resurrection Bay. Reported in Alaska Department of Fish and Game (1973) to be used by 50 sea lions.

Hive Island

North of Rugged Island on the eastern entrance to Resurrection Bay, Alaska Department of Fish and Game (1973) reported 100 sea lion here.

Barwell Island

Four-tenths mile southwest of Cape Resurrection, 100 animals recorded by Alaska Department of Fish and Game (1973).

Aialik Cape

On the southeastern entrance of Aialik Bay, Alaska Department of Fish and Game (1973) showed 50 sea lions.

Chiswell Island

On the west side of the approach to Resurrection Bay, surveyed by Mathisen and Lopp (1963) with a high of 4,759 and Alaska Department of Fish and Game (1973) with 4,715.

Seal Rocks

The southernmost land feature in the western approach to Resurrection Bay, Mathisen and Lopp (1963) gave a count of 499 animals and Alaska Department of Fish and Game (1973) showed 500.

Outer Island

The outermost and smallest of the Pye Islands on the eastern side of Nuka Bay. Mathisen and Lopp's (1963) survey showed a high of 6,073 animals and is listed in Alaska Department of Fish and Game (1973) as 6,000. This is the largest, most important rookery north of the Barren Islands.

Nuka Point

The southern end of Nuka Island, Mathisen and Lopp (1963) and Alaska Department of Fish and Game (1973) reported 160 animals here.

Gore Point

The southeastern end of a prominent headland on the east side of the entrance to Port Dick. Mathisen and Lopp (1963) and Alaska Department of Fish and Game (1973) reported 221 sea lions.

East Chugach Island, Perl Island, Elizabeth Island and Nagahut Rocks

These comprise the Chugach group and are located on the coast of the Kenai Peninsula near the entrance to Cook Inlet. Several small hauling

areas exist on these islands with the following numbers from either Alaska Department of Fish and Game (1973) or Mathisen and Lopp (1963): East Chugach Island - 20, Perl Island - 737, Nagahut Rocks - 80 and Cape Elizabeth on Elizabeth Island - 129.

Flat Island

One and four-tenths miles north of Magnet Rock, 300 sea lions reported here by Alaska Department of Fish and Game (1973).

West Amatuli Island

One of the Barren Islands in the middle of the entrance to Cook Inlet between the Chugach Islands and Shuyak Island. Alaska Department of Fish and Game (1973) gave a population of 1,600.

Sugarloaf Island

One and one tenth miles south of East Amatuli Island in the Barren Islands, Sugarloaf Island has one of the largest sea lion rookeries in the northeast Gulf of Alaska. Alaska Department of Fish and Game (1973) had the population at 10,000 while Mathisen and Lopp (1963) counted 11,998 sea lions. Pup production has always been very high here. Estimates made by Vania, (1967, 1968) showed 5200 pups in 1967 and 3000 in 1968.

Ushagat Island

The westernmost and largest of the Barren Islands. Population given by Alaska Department of Fish and Game (1973) as 100 and by Mathisen and Lopp (1963) as as high of 834.

Latax Rocks

The northernmost feature of the Kodiak-Shuyak-Afognak group, 3,300 sea lions have been counted here (Mathisen and Lopp 1963 and Alaska Department of Fish and Game 1973).

Sea Lion Rocks

Five and five-tenths miles eastward from Tonki Cape and 4 miles northward from Marmot Island. Five hundred sea lions listed by Alaska Department of Fish and Game (1973) and 1,600 by Mathisen and Lopp (1963).

Tonki Cape

The northeast end of Afognak Island shown by Alaska Department of Fish and Game (1973) with 100 sea lions.

Marmot Island

Parallels the eastern side of Afognak Island. This, along with Sugarloaf Island in the Barren Islands, is one of the two largest sea lion rookeries

in the northeastern Gulf of Alaska. Alaska Department of Fish and Game (1973) gave a total population of 10,000 animals while Mathisen and Lopp (1963) showed 5,790 for their highest count. This rookery produces a large number of pups with Vania reporting 5,900 pups in 1967 and over 5,000 in 1968 (Vania 1967, 1968).

Long Island

The easternmost island in the northern end of Chiniak Bay. Fifty to 75 sea lions have been sighted hauled out here (Alaska Department of Fish and Game 1973, Mathisen and Lopp 1963).

Cape Chiniak

The southeast point of Chiniak Bay, Mathisen and Lopp (1963) showed 772 while Alaska Department of Fish and Game (1973) showed 600 sea lions.

Ugak Island

Two and five tenths miles off Narrow Cape, 440 sea lions were reported by Mathisen and Lopp (1963) and Alaska Department of Fish and Game (1973).

Cape Barnabas

The eastern end of Sitkalidak Island, 2,487 sea lions were sighted here by Mathisen and Lopp (1963) and 1,000 by Alaska Department of Fish and Game (1973).

Twoheaded Island

Lying off the southern extremity of the western shore of Sitkalidak Strait, has a population of 3,608 to 4,261 sea lions (Alaska Department of Fish and Game 1973, Mathisen and Lopp 1963).

Cape Hepburn

At the southern tip of Hepburn Peninsula in Alitak Bay, no recent counts recorded.

Sitkinak Island

Northeasternmost island of the Trinity Islands off the south end of Kodiak Island had 470 sea lions (Mathisen and Lopp 1963, Alaska Department of Fish and Game 1973).

Chirikof Island

Sixty miles south-southwest of the Trinity Islands. Alaska Department of Fish and Game (1973) showed 500 sea lions here while Mathisen and Lopp (1963) counted 2,450.

Sundstrom Island

Off the southwest end of Aiaktalik Island between the south end of Kodiak Island and the Trinity Islands. Listed in Alaska Department of Fish and Game (1973) with 100 sea lions.

Outer Seal Rock

One and eight-tenths miles west of Cape Ikolik on the southwestern end of Kodiak Island Alaska Department of Fish and Game (1973) has shown this area to be used by 50 sea lions.

Tombstone Rocks

Eight tenths mile off Middle Cape on the western side of Kodiak Island, had 50 sea lions (Alaska Department of Fish and Game 1973).

Middle Cape

The westernmost promontory on Kodiak Island had 25 sea lions (Alaska Department of Fish and Game 1973).

Cape Ugat

On the eastern shore of Shelikof Strait 12 miles southwest of Cape Uganik, Alaska Department of Fish and Game (1973) listed 50 sea lions using this haul out.

Cape Paramanof

The northwest end of the peninsula between Paramanof and Malina Bays on the west side of Afognak Island. Fifty sea lions shown by Alaska Department of Fish and Game (1973).

Augustine Rocks

Nine miles south of the Peak of Augustine Island in Kamishak Bay on the southeast corner of Cook Inlet, Alaska Department of Fish and Game (1973) listed 500 sea lions here.

Cape Nukshak

Thirty-six miles south of Cape Douglas on the Alaska Peninsula, used by 500 sea lions (Alaska Department of Fish and Game 1973).

Cape Ugyak

Eight miles south of Cape Nukshak, used by 100 sea lions according to Alaska Department of Fish and Game (1973).

Cape Gull

Five miles south of Cape Ugyak, 100 sea lions (Alaska Department of Fish and Game 1973).

Takli Island

Between Cape Atushagvik and Cape Ilktugitak, north of Katmai Bay, no recent counts.

Puale Bay

Between Cape Kekwinoi and Cape Aklek on the Alaska Peninsula in the southern part of Shelikof Strait, Alaska Department of Fish and Game (1973) showed 2,800 animals.

Ugaiushak Island

Six miles south of Cape Kuyuyukak, 600 sea lions recorded by Alaska Department of Fish and Game (1973).

Foggy Cape (Sutwik Island)

About 7 miles off the Alaska Peninsula and 90 miles southwest of Kodiak Island. Alaska Department of Fish and Game (1973) reported 738 sea lions.

West End of Sutwik Island

Alaska Department of Fish and Game (1973) reported a haul out area here but no recent counts have been made.

Cape Kumlik

The promontory on the Alaska Peninsula nearest to Sutwik Island, 10 sea lions reported by Alaska Department of Fish and Game (1973).

Kak Island

One and three-tenths miles south of Nakchamik Island (in the mid-entrance to Chignik Bay), 100 sea lions (Alaska Department of Fish and Game 1973).

Alkulik Island

Three miles southeast of Nukchamik Island (in the mid-entrance to Chignik Bay), 10 sea lions (Alaska Department of Fish and Game 1973).

Chowiet Island

The large, southern island of the Semidi Islands, Alaska Department of Fish and Game (1973) showed 5,000 sea lions; Mathisen and Lopp (1963) showed a count of 6,323.

Seal Cape

Eight miles east of Cape Tolstoi on the Alaska Peninsula, Alaska Department of Fish and Game (1973) showed 10 sea lions here.

Mitrofania Island

About 25 miles southwest of Cape Ikti; and 5 miles off the Alaska Peninsula, Alaska Department of Fish and Game (1973) showed 216 sea lions here.

Spitz Island

One and two-tenths miles southward of the southwest tangent of Mitrofania Island, Alaska Department of Fish and Game (1973) showed 700 sea lions here.

Kupreanof Point

The southwestern end of the Kupreanof Peninsula, Alaska Department of Fish and Game (1973) gave a count of 35 sea lions.

Castle Rock

Lying about 1.5 miles north of Cape Thompson, the north point of Big Koniuji Island which is the northern and largest of the eastern group of the Shumagin Islands, a population of 400 sea lions was reported here by Alaska Department of Fish and Game (1973).

Atkins Island

On the northeast headland of Little Koniuji Island (connected by shoal) in the Shumagin Islands, Alaska Department of Fish and Game (1973) showed 3,100 sea lions here.

The Haystacks

Southerly from Andronica Island, forming western side of West Nagai Strait, used by 100 sea lions (Alaska Department of Fish and Game 1973).

The Whaleback

One mile west of the Haystacks, 600 sea lions shown by Alaska Department of Fish and Game (1973).

Unga Cape

The southeast point of Unga Island, used by 30 sea lions according to Alaska Department of Fish and Game (1973).

Sealion Rocks (Shumagin Islands)

One mile south-southeast of Unga Cape, Alaska Department of Fish and Game (1973) showed 400 sea lions here.

Jude Island

Thirteen miles northwest of Acheredin Point which forms the southwest end of Unga Island, a population of 3,000 sea lions shown by Alaska Department of Fish and Game (1973).

Wosnesesnki Island

The easternmost of the Pavlof group, approximately 15 miles from the Alaska Peninsula coast south of Pavlof Bay, shown by Alaska Department of Fish and Game (1973) as being used by 300 sea lions.

Simeonof Island

The most easterly of the Shumagin Islands, used by 150 sea lions, Alaska Department of Fish and Game (1973).

Chernabura Island

The most southerly of the Shumagins, a rookery of 2,000 sea lions here (Alaska Department of Fish and Game 1973).

Nagai Island

In the center of the Shumigan group, 15 sea lions counted here by Alaska Department of Fish and Game (1973).

Pinnacle Rock (Sandman Reefs)

The easternmost named point of the Sandman Reefs, high count of 980 sea lions by Alaska Department of Fish and Game (1973).

Clubbing Rocks

On the northwestern edge of the Sandman Reefs, 5,600 sea lions reported by Alaska Department of Fish and Game (1973). Kenyon and Rice (1962) estimated 200 sea lions.

Cherni Island

Five miles northward of Hague Rock light, used by 380 sea lions according to Alaska Department of Fish and Game (1973).

South Rock (Sanak Island)

The southernmost named point southeast of Sanak Island, used by 3,200 sea lions according to Alaska Department of Fish and Game (1973). Kenyon and Rice (1961) estimated 1,000 sea lions here.

Bird Island

The most prominent landmark between Capes Pankof and Aksit off the Ikatan Peninsula of Unimak Island, Alaska Department of Fish and Game (1973), showed 260 sea lions here. Most recent survey gave count of 250 sea lions.

Rock Island

Located 1.5 miles west of Cape Lazaref on Unimak Island, 25 sea lions sighted here on June 1975 survey.

Cape Lutke

The southwest headland of Unimak Bight, we counted 22 sea lions here in June 1975.

Off rookery or hauling ground activity of sea lions in the Gulf of Alaska is little known and poorly understood. Seasonal migration to inside waters is generally accepted although specific movements by individuals has not been observed. Movement of immature animals large distances away from breeding areas and subsequent return to ancestral breeding grounds after maturity is suggested by Vania (pers. comm.).

Our information on sea lions on the high seas comes from the files and memories of National Marine Fisheries Service special agents involved in monitoring high seas international fisheries off the coast of Alaska and from pelagic fur seal investigations by NMFS personnel. The special agents reported a number of sea lions remaining at sea with the ships and feeding on fish lost from the trawls or taking fish directly from long lines as they were brought to the surface. The trawl fleet in the Gulf, and therefore the sea lions, take primarily Pacific Ocean perch (*Sebastes alutus*) along the 250 fathom curve throughout the Gulf of Alaska and Atka mackeral (*Pleurogrammus monopterygius*) east of Kodiak Island in about 100 fathoms of water. This fishing and associated sea lion activity took place in water depths far exceeding those where sea lions are normally found. Pelagic fur seal investigators of the National Marine Fisheries Service Marine Mammal laboratory report sightings of sea lions in numerous locations throughout the Gulf of Alaska.

The National Marine Fisheries Service special agents reported that sea lions were found associated with the fleet throughout the year. It is common to find sea lions wherever the ships are fishing in the Gulf of Alaska.

At any given time an average of 20 ships might be working the Gulf of Alaska. NMFS special agents (pers. comm. Milstead Zahn) estimated sea lion numbers to average from 6-20 per ship. From this we can conclude that about 400, or more, sea lions are at sea with the fishing fleet in the Gulf of Alaska.

In estimating the total number of sea lions in the Gulf of Alaska from Cape Spencer to Scotch Cape on Unimak Island, the minimum number would be 95,825. It must be born in mind that this figure only takes into account those sea lions seen on rookeries and hauling areas plus the minimum of 400 assumed to be associated with high seas fisheries. Since at any given time a certain number of animals would be in the water and therefore not counted we can only assume this to be an absolute minimum number.

SEA OTTER

The sea otter is abundant in much of the Gulf of Alaska. The Gulf of Alaska as a whole is considered of primary importance to the continued recovery of this species. After nearly being hunted to extinction by the early 1900's, small, remnant populations remained in several areas. These populations are slowly recovering in large areas of the Gulf of Alaska and are expanding and reoccupying former habitat.

Sea otters are gregarious animals that may be found in groups of up to 1,000 animals although single animals are common. Sea otter habitat is generally inside the 50 fathom curve; areas with reefs and rocky shoals are preferred. Their diet consists of bottom dwelling invertebrates and fishes. Common invertebrates found in sea otter diets are crabs, clams, sea urchins, abalone, sea cucumbers, octopus and squid. Fishes known to be eaten by sea otters are globe fish (*Cyclopterichthys glaber*), red Irish lord (*Hemilepidotus hemilepidotus*), Atka mackerel (*Pleurogrammus monopterygius*) and the sablefish (*Anoplopoma fimbria*) (Kenyon 1969).

Pupping and breeding can occur throughout the year but probably reach a peak in the spring. Delayed implantation is known to occur. Pups remain with the females for about one year during which time they grow rapidly.

In the Aleutian Islands, sexual segregation is pronounced and probably occurs in most areas in some form. Territoriality during breeding has been observed but appears to be in response to specific environmental conditions. (Calkins and Lent 1975).

Sea otter censusing techniques have been discussed by Schneider (unpub. A.D.F. & G. report). Schneider concluded that the best survey technique is the shore count, then the skiff count, followed by the helicopter count with the poorest being the fixed-wing aircraft count. The majority of our information on sea otter populations is based upon aerial counts, both fixed-wing and helicopter.

Cape Spencer to Cape Suckling

Few sea otters are known to inhabit the waters between Cape Spencer and Cape Fairweather. Twenty-five otters were released southeast of Cape Spencer but none have been sighted north of there to Cape Fairweather.

In the area from Cape Fairweather to Point Manby, at least 15 sea otters are known to exist. Ten animals were released in Yakutat Bay in August 1966, and five were sighted in the area of the Akwe and Dangerous Rivers and 1 east of Dry Bay in 1970. Fifteen were sighted in Yakutat Bay in 1970.

From Point Manby to Icy Bay we had one sighting of five sea otters in June 1966. No reports of otters exist between Icy Bay and Cape Suckling.

Prince William Sound

Our best information on sea otter distribution and abundance between Cape Suckling and Cape Puget is contained in the report, "Distribution and Abundance of Sea Otters, Sea Lions and Harbor Seals in Prince William Sound," (Pitcher 1975), Appendix A.

Kenai Peninsula

Prior to 1967, only scattered observations of otters had been reported from Cape Puget to Port Graham on the Kenai Peninsula. In approximately 1967 large numbers of otters began to be regularly sighted on the southern tip of the Kenai Peninsula in the area from Koyoktaluk Bay to Chugach Bay (see map page SO-3). In a 1968 survey of this area 400 otters were seen. Lensink 1960 reported sighting 15 animals near Elizabeth Island in 1953, while Kenyon (1969) felt that no significant population of otters occupied the area. The apparent movement of large numbers of otters to the southern tip of the Kenai Peninsula, probably from the Barren Islands, and subsequent expansion up the southeast side of the Kenai, probably occurred in the years 1966 to 1968. At the same time otters from Prince William Sound probably moved into the eastern portion of the area.

Our most recent information from surveys conducted in 1970 confirms concentrations of otters on the tip of the Kenai Peninsula with scattered groups found along the coast up to Cape Puget (Table 1). It is important to realize that data presented in Table 1 originated from a series of surveys conducted by different observers under varying conditions from various fixed-wing aircraft. The large variability between surveys renders them useless for comparative purposes. The Kenai Peninsula information should only be used to indicate the presence of animals and can in no way be extrapolated to give total numbers. More work is required in this area to delineate the population. Reports from the public since 1970 indicate that up to 200 otters are regularly seen in Port Graham and that small numbers are straying into Kachemak Bay. Sightings from as far north of Kachemak Bay as Ninilchik are increasing.

Table 1. SEA OTTERS COUNTED ON AERIAL SURVEYS OF KENAI PENINSULA
June, 1970 - January, 1971

AREA	JUNE 5 & 9	JULY 15-20	AUG. 14	OCT. 12	NOV. 12	JAN. 12
C. Junken-C. Resurrection	5	30	42	27	10	30
Resurrection Bay	2	2	0	4	2	NS
Aialik Bay	1	20	5	8	0	21
Harris Bay	8	18	7	5	3	* 25
Nuka Bay	106	56	NS	31	28	27
Port Dick	0	11	NS	NS	3	23
Rocky Bay-Port Chatham	121	125	NS	NS	9	26
Koyuktolik Bay-Port Graham	0	0	NS	NS	0	NS
Total	243	262	54	75	55	152

* 38 Sea otters counted from shore and skiff 11/20/70.

Barren Islands

Sea otter sightings in the Barren Islands date back to 1931, when 2 otters were seen near Sud Island. Otters have been observed regularly in the Barren Islands since then. The highest count prior to 1970 was 325 animals seen in 1957 (Lensink 1960). Kenyon (1969) reported seeing 272 otters in the Barren Islands during 1959 survey and estimated a population of 363 animals.

In June 1970 Schneider flew as the only observer in a Grumman Goose during a survey of the Barren Islands. Offshore coverage was poor although conditions and visibility were good and a complete count of the Barren Islands was made with a total count of 307. (See map SO-3 for distribution on this survey).

Kamishak Bay

The Kamishak Bay area including Augustine Island, Shaw Island and Cape Douglas has been partially surveyed on numerous occasions. Lensink (1962) reported that approximately 50 otters were seen near Augustine Island in 1918 and that Spencer counted 40 at Augustine Island and one at Shaw Island in 1957. Lensink counted 52 on Augustine in 1959, but he considered it a poor count. In 1965 Kenyon counted 18 on Augustine Island and 101 in the Shaw Island-Cape Douglas area. In 1969 Alaska Department of Fish and Game biologists tallied 62 and 130 animals in the Augustine Island area on different counts. In 1971 Alaska Department of Fish and Game biologists counted 150 otters between Augustine Island and Tignagvik Point. Also in 1971 Prasil (1971) counted 60 otters between Augustine and Shaw Islands.

Cape Douglas to Unimak Island

Surveys along the Alaska Peninsula have been fragmentary and most made were done under less than ideal conditions. There are a number of reasons for this. Weather tends to be poor along the south shore where squalls form along the mountains. Areas where an aircraft can refuel are north of the mountains and there are relatively few passes, therefore range of the aircraft is a problem. Also there is much shallow water offshore in the area from the Shumagin Islands to Sanak Island. Coverage of this area is difficult and many animals are doubtless missed.

Reports from various individuals are available from the 1930's and 1940's. Major surveys by the Fish and Wildlife Service in 1951, 1961 and 1965 (Kenyon 1962, 1965) covered at least portions of the area. In 1969, the southern Shumagin Islands were counted by the Alaska Department of Fish and Game.

Aerial counts of sea otters were made in the southern Shumagins on April 16, 1969 and along the south side of the Alaska Peninsula from Shaw Island to Cape Lazaref on Unimak Island between March 16 and March 27, 1970, (Table 2). Sanak Island, the Sandman Reefs, the Pavlof Islands, northern Shumagin Islands and Sutwick Island were included. A BLM Aero Commander N6392U was used at an altitude averaging 150 feet and an airspeed of 100 mph. Observers were Karl Schneider next to the pilot and Jim Faro behind the pilot. The count on March 27, 1970 was made in a Gruman Goose with Robert Wolfe substituting for Faro. Pups with their mothers were not counted.

Because of poor visibility and scattered distribution of animals all these counts were considered low. Results of these surveys are presented in Table 2 and maps SO-5 through SO-9.

In general, the variability in factors influencing this type of count is so great that the results are not reliable for population estimates or for determining short-term fluctuations in dense populations. Nevertheless aerial counts should be useful for determining general distribution and abundance and for following major large changes in population size. Such changes are occurring where relatively dense populations are expanding into habitat that is either unoccupied or sparsely occupied. Aerial counts are also the quickest way to familiarize new personnel with large areas of habitat.

Basically there are four distinct population centers in the area. These are the Sanak Island-Sandman Reef area, the Shumagin Islands area, the Sutwick Island area and the Augustine Island-Cape Douglas area. The following discussion of the growth of these population centers is based on information from U. S. Fish and Wildlife Service reports and from Alaska Department of Fish and Game surveys.

Table 2. AERIAL COUNT OF SEA OTTERS - APRIL 1969 and MARCH 1970

Location	Count	Date	Partial or Complete Count	Visibility
Cape Lazaref-Cold Bay				
Cape Lazaref	1	3/20/70	Complete	Poor
Ikatan Peninsula	71	3/20/70	Complete	Poor
False Pass-Amagat I.	66	3/20/70	Complete	Poor
Cold Bay	1	3/21/70	Partial	Poor
TOTAL	141			
Sanak Islands	239	3/22/70	Complete	Fair to Poor
Sandman Reefs				
Clubbing Rocks	12	3/22/70	Complete	Fair to Poor
Cherni I. & Rocks	495+	3/22/70	Complete	Fair to Poor
Goose I.	7	3/22/70	Complete	Fair to Poor
Hay I.	18	3/22/70	Complete	Fair to Poor
Hunt I.	2	3/22/70	Complete	Fair to Poor
Deer I.	34	3/22/70	Partial	Fair to Poor
TOTAL	568+			
Pavlof Islands				
Inner Iliasik	2	3/21/70	Complete	Fair to Poor
Outer Iliasik	16	3/21/70	Complete	Fair to Poor
Goloi	2	3/21/70	Complete	Fair to Poor
Dolgoi	67	3/21/70	Complete	Fair to Poor
Poperechnoi	29	3/21/70	Complete	Fair to Poor
Ukolnoi	2	3/21/70	Complete	Fair to Poor
Wosnesenski	4	3/21/70	Complete	Fair to Poor
TOTAL	122			

Table 2 (cont.)

Location	Count	Date	Partial or Complete Count	Visibility
Northern Shumagin Islands				
Unga	184	3/21/70	Complete	Fair to Poor
Popof	52	3/21/70	Complete	Fair to Poor
Korovin	46	3/21/70	Complete	Fair to Poor
Karpa	4	3/21/70	Complete	Fair to Poor
TOTAL	286			
Southern Shumagin Islands				
Castle Rk.	0	4/16/69	Complete	Poor to Fair
Big Koniuji	296	4/16/69	Complete	Poor to Fair
Peninsula	15	4/16/69	Complete	Poor to Fair
Little Koniuji	232	4/16/69	Complete	Poor to Fair
Atkins	58	4/16/69	Complete	Poor to Fair
Simeonof	329	4/16/69	Complete	Poor to Fair
Nagai	232	4/16/69	Complete	Poor to Good
Near	150	4/16/69	Complete	Fair
Turner	6	4/16/69	Complete	Fair
Bendel	27	4/16/69	Complete	Fair
Spectacle	8	4/16/69	Complete	Fair
Bird	76	4/16/69	Complete	Poor
Chernabura	6	4/16/69	Complete	Poor
Andronica & The Haystacks	75	4/16/69	Complete	Poor to Fair
TOTAL	1,510			
Cold Bay to Beaver Bay	0	3/20-21/70	Partial	Poor

Table 2 (cont.)

Location	Count	Date	Partial or Complete Count	Visibility
Beaver Bay to Kupreanof Pen.				
Beaver Bay	2	3/21/70	Partial	Fair to Poor
Cape Aliaksin	4	3/2/70	Partial	Fair to Poor
Guillemot I.	16	3/21/70	Partial	Fair to Poor
Kupreanof Peninsula	1	3/21/70	Partial	Fair to Poor
TOTAL	23			
Kupreanof Pen. to Castle Cape	0	3/21/70	Partial	Fair to Poor
Castle Cape to Amber Bay				
Castle Cape-Castle Bay	16	3/21/70	Partial	Fair to Poor
Chignik Bay	118	3/20/70	Complete	Fair
Nakchamik I.	5	3/20/70	Complete	Fair
Hook Bay	13	3/20/70	Complete	Fair
Cape Kumliun	88	3/20/70	Complete	Fair
Kujulik Bay	1,199	3/20/70	Complete	Very Good
Univikshad I.	62	3/20/70	Complete	Fair
Cape Kumlik	54	3/20/70	Complete	Fair to Poor
Sutwick I.	14	3/20/70	Complete	Fair to Poor
Cape Agutka	197	3/23/70	Complete	Fair
TOTAL	1,766			

Table 2 (cont.)

Location	Count	Date	Partial or Complete Count	Visibility
Cape Kunmik to C. Kubugakli				
Cape Kunmik	13	3/23/70	Complete	Fair
Nakalikok Bay & offshore islands	16	3/23/70	Complete	Fair
Chiginagak Bay	5	3/23/70	Complete	Fair
Agripina & Imuya Bay	105	3/23/70	Complete	Good
Wide Bay to Puale Bay	N O T S U R V E Y E D			
Puale Bay to C. Kubugakli	7	3/27/70	Partial	Fair
TOTAL	146			
Kashvik Bay to C. Chiniak	0	3/27/70	Partial	Very Good to Excellent
Cape Chiniak to Shaw I.				
Shakun Is. & Rocks	71	3/27/70	Partial	Very Good to Excellent
Kiukpalik I. to Shaw I.	0	3/27/70	Partial	Very Good to Excellent
TOTAL	71			

Cape Douglas to Wide Bay

Small numbers of otters appear to have reached Cape Douglas from the Kamishak Bay population. Scattered individuals have been reported throughout the area but the main concentration occurs in the vicinity of Shakun Rock where 71 were recorded. Prasil (1971) recorded up to 443 on subsequent surveys of the area.

Sutwick Area

Reports of sea otters near Sutwick Island began to appear in 1936. This population is far removed from other populations and is probably a remnant left after hunting ceased. In 1951 Jones counted 388 between Cape Kumliun and Cape Kunmik (Lensink 1962). Most were near Sutwick Island. In 1957, 889 were counted by Lensink. Nineteen of these were between Cape Kunmik and Cape Providence indicating some northeastward expansion of range. In 1962, 949 were seen with individuals straying as far as Cape Igvak and one between there and Cape Kuliak. A major shift of the population from Sutwick into Kujulik Bay occurred. This may have been the result of time of year and weather. In 1965 a lone otter was seen at Kinak Bay (Kenyon 1965).

During the 1970 survey 1,766 were counted between Castle Cape and Cape Kunmik. Again, the majority were in Kujulik Bay. Large numbers had moved northeastward ranging as far as Cape Kubugakli. The area from Wide Bay to Puale Bay was not surveyed because of weather.

Total count for the population was 1,912 but conditions were less than ideal throughout the survey and we feel many were missed. It is possible that the increase in numbers is entirely due to reproduction assuming a 10 percent annual increase. However, it is difficult to compare surveys.

There is still room for expansion in both directions from this population. The greater movement to the northeast is probably the result of better habitat. The population around Kujulik Bay is very dense and a large movement of animals may occur if competition for food becomes serious. Otherwise we should expect to see continued steady expansion into adjacent areas for a number of years to come.

Shumagin Islands

This has been considered the largest of the four populations in the Alaska Peninsula area. The most recent counts have not been adequate to show any major increase in numbers in the last decade; however, major changes in distribution have occurred which are very similar to the pattern observed in the Sanak-Sandman population. There were occasional reports of sea otters in the Shumagins in the 1930's. By 1947 Victor Scheffer estimated 500 around Simeonof Island. In 1953 Hooper counted 633 around Simeonof and Little Koniuji Islands (Lensink 1962). Lensink's 1957 survey showed 1,829. Most of these were in the southern islands. Five individuals were scattered in the northern islands and one was on the mainland shore near Elephant Point. The 1962 survey totaled only 1,352. These animals were scattered well offshore and the count was low. However, the count on Nagai increased from 149 to 338 indicating a

continued northward expansion (Kenyon 1962).

In 1969, 1,510 otters were counted in the southern islands under relatively poor conditions. An additional 286 were counted in the northern islands in the 1970 survey and 23 were seen along the mainland north of the Shumagins, again survey conditions were not good.

There has clearly been an expansion of the population from a center near Simeonof. Substantial numbers now occur on all the islands and re-population of the mainland is occurring. The population in the northern islands should continue to increase and most of the habitat on the mainland is not occupied.

There is no evidence of an increase in total numbers since 1957. However, the last two surveys have been less than ideal and the large, shallow offshore areas have not been covered adequately. Also the survey techniques used are often insensitive to increases in numbers once the population reaches a certain point. Considering the survey conditions and the obvious extentions of range it is almost certain that the populations from Sanak Island to the Shumagins have continued to increase. In general, it appears that the southern islands and reefs have become fully populated and the northern areas are just developing significant populations. The entire area may be completely repopulated in the next 10 years. This will depend largely on the status and potential habitat in the offshore areas.

Sanak Island-Sandman Reefs

Small numbers of sea otters have been reported at Sanak Island since 1922. No reports came from the Sandman Reefs until 1942. In 1948, 27 were sighted at Cherni Island. The 1951 aerial survey showed 65 around Sanak and 97 in the Sandman Reefs. In 1957, 251 were seen around Sanak and 508 around the Sandman Reefs (Lensink 1962). In addition, two were seen in the Pavlof Islands, however, few were on the mainland. In 1962, 548 were counted in the Sanak area and 638 in the Sandman Reefs (Kenyon 1962). None were reported from the mainland or Pavlof Islands, however, much of the increase was in the northern area around Deer Island. The 1962 survey was probably the best, being made under excellent cond

itions.

On the 1970 survey, which was made under relatively poor conditions, 239 were seen in the Sanak area and 568+ in the Sandman Reefs. The latter count was incomplete and conditions were such that the number of otters observed was more a function of time spent counting rather than area covered. Obviously many were missed and as a result not much can be said about total numbers. The main change evident is that 141 were seen along the mainland and eastern portion of Unimak Island and 122 were seen in the Pavlof Islands indicating a fairly extensive movement northward and along the Peninsula is occurring. More recent surveys of the north side of the Alaska Peninsula indicate that at least part of the increase around the east end of Unimak Island and Morzhovoi Bay may have resulted from immigration through False Pass. Such immigration has been observed during periods of extreme sea ice conditions to the north (Schneider and Faro 1975).

A remnant population probably remained along the south side of Sanak Island in the early 1900's. While no sightings were recorded in the Sandman Reefs until the 1940's, this was one of the last hunting areas and small numbers may have survived there. Both groups have steadily increased and extended their range northward. There is still unoccupied or sparsely populated habitat along the mainland shore and in the Pavlof Islands. There should be continued expansion of this population for a number of years although the numbers around Sanak Island and the western Sandman Reefs may have already reached a peak.

With the arrival of substantial numbers in the Pavlof Islands, this population is probably on the verge of mixing with the Shumagin Island population. No doubt some individuals have moved back and forth in the past, but the two populations are almost continuous at the present time.

As in past surveys, few otters were seen around the north side of Sanak Island and Caton Island. This is probably poor habitat for otters. The main population is around the south and west sides. The higher count on the west end was probably more a result of intensive searching rather than a higher population.

During the 1970 survey only one sea otter was seen in the Cold Bay area while in a 1972 survey Schneider saw a total of 60 otters. The otters were expected to move into this area from the south but it is unlikely that such large numbers had done so yet. Schneider (unpub. report) attributed the rapid increase in the Cold Bay area to movements of otters from the Bering Sea in March 1971, both on their own and by being moved by local residents when Bering Sea ice formed south of the normal range.

Kodiak Archipelago

Portions of the Kodiak-Shuyak-Afognak area, including the Trinity Islands and Chirikof Island, have good sea otter habitat. Some of the area is undoubtedly of poor quality. Kodiak was an important hunting area during the period of Russian exploration, but the population was never completely extirpated.

Reports from the Kodiak area are fragmentary and incomplete; no complete surveys have been attempted. We know that a relatively large population exists at the north end of the group and a population of unknown size occurs at the south end.

In 1948 Refuge Manager Beals reported three otters off Shuyak Island and in 1951 Chapados and Spencer saw 15 on Sea Otter Island and 67 at Latax Rocks (Lensink 1960). In 1957 Lensink saw 14 in the Trinity Islands and 281 around Shuyak area. In 1964 Ed Klinkhart counted 63 sea otters at Latax rocks, 13 at Seal Island and one at Marmot Island. Most recently (July 1975) 15 were sighted off the south end of Marmot Strait.

Sightings at areas other than the north and south ends include five sighted by James Faro at Uyak Bay, three near the south end of Chirikof sighted by the crew of the "Teal" and, most recently, 10 otters sighted by Ben Ballenger in April 1975 just off Outlet Cape south of Raspberry Island.

The most recent survey information came from Schneider (1970, unpub. report) who saw 18 at Ban Island-Shuyak Strait, six in Pernosa Bay, three at Marmot Island, 121 in the area of Sea Otter Island, 33 on the west side of Shuyak Island and 26 in the area of Latax Rocks and Dark Island for a total of 207. A separate group of unknown size inhabits the shallow waters around the Trinity Islands and Chirikof Island. Lensink (1962) reported several sightings of up to 15 animals in the 1950's. Reports of small numbers and incidence of beach-dead animals on Tugidak Island indicate that at least moderate numbers occur there.

Lensink (1960) estimated the total sea otter population of the Kodiak Archipelago including the Barren Islands at 800-1,500, while Kenyon (1969) indicated that the Kodiak area had not been repopulated to a significant degree with a total estimate of 1,118 otters. Our most recent information suggests that this population should now be well over 2,000 animals and is probably slowly expanding to Kodiak Island.

Table 3. SUMMARY OF SEA OTTER SURVEYS

(Compiled by population from Lensink (1962), Kenyon (1962, 1965 and 1969) and Alaska Department of Fish and Game Data.)

Location	Pre. 1951	1951	1957	1959	1962	1965	1969	1970
ALASKA PENINSULA								
C. Kuliak-C. Igvak			0		1			71 *)
C. Igvak-C. Kunmik			19		22			139
Aniakchak Bay & Amber Bay		8	6		47			197
Sutwick Area	Misc. Reports	355	581		109			14
Kujulik Bay & C. Kumlik	Since 1936	12	103		684			1,253
C. Kumliun								101
Univikshak Island		13	180		86			62
Nakchamik Island					Not Surveyed			5
Chignik Bay			0					118
Castle Bay & Cape		—	—		—			16
TOTAL		388	889		949			1,912
SHUMAGIN	Few Reports Before 1940							
Mainland Shore Kupreanof Pen. to Pavlof Bay			1					23
Unga Island			2		4			184
Popof Island			2					52

Table 3 (cont.)

Location	Pre. 1951	1951	1957	1959	1962	1965	1969	1970
SHUMAGIN (Cont.)								
Korovin Island								46
Karpa Island								4
Andronica & the Haystacks			1				75	
Nagai			149		338		232	
Spectacle							8	
Bendel			268		105		27	
Turner							6	
Twins			7					
Near			3		14		150	
Peninsula			0		3		15	
Big Koniuji			220		222		296	
Little Koniuji & Atkins			430		255		290	
Simeonof	500 Estimate (1947)	633 (1953)	455		294		329	
Bird			160		38		76	
Chernabura			132		79		6	—
TOTAL			1,830		1,352		1,510	309

Table 3 (cont.)

Location	Pre. 1951	1951	1957	1959	1962	1965	1969	1970
SANAK - SANDMAN								
Mainland Shore Pavlof Bay to Unimak Bay								141
Pavlof Islands								
Wosnesenski Island			2					4
Ukolnoi Island								2
Poperechnoi Island								29
Dolgoi Island								67
Goloi Island								2
Outer Iliasik Island								16
Inner Iliasik Island								2
Sandman Reefs								
Cherni Island	27 (1948)		271		259			495+
Clubbing Rocks	No sightings before 1942	97	33		2			12
Goose Island			76		82			7
Deer Island & Other Reefs			123		295			(Incomplet
Sanak Island	Sightings since 1922	65	251		548			239
TOTAL		162	754		1,186			1,070

HARBOR SEAL

The land breeding harbor seal is the most abundant pinniped of coastal Alaska from Dixon Entrance to the Bering Sea (Alaska Department of Fish and Game 1973). It is a common resident of coastal waters throughout the area and is found at times in rivers and lakes some distance from salt water. Harbor seals usually occur in close proximity to the coast although sightings of animals a mile or two offshore are not unusual. Spalding (1964) did not consider the harbor seal a pelagic species and stated that they are seldom found more than five miles from shore. Bigg (1969) supported this as he states that "harbor seals live mainly along the coast." However, it is apparent from observations made by the National Marine Fisheries Service during pelagic fur seal investigations that individual animals occasionally do occur some distance offshore. They made a number of sightings, nearly all of single animals, up to 50 miles offshore. Spalding (1964) reported harbor seals 30-40 miles offshore on the Portlock Banks near Kodiak.

Haul out areas include offshore rocks, sandbars and beaches of remote islands. Floating ice pans calved from glaciers are used for hauling out when available. During winter, ice shelves, which form at the heads of bays, are frequently used as hauling platforms. The versatility of the harbor seal is further illustrated by its successful habitation of areas with varying bottom types, water clarity and salinity.

Sexual maturity is attained by female harbor seals at three to five years and by males at five to six (Bigg 1969, Bishop 1967). They

have a relatively long life-span, some attaining over 30 years of age. Large males in some areas may exceed 400 pounds but the average adult weighs about 200 pounds. Pupping occurs from late May to mid-July with the majority taking place during the first three weeks in June. Pups average 28 pounds at birth and are nearly double that weight at weaning three to four weeks later. Ovulation and breeding take place shortly after weaning. Delayed implantation occurs and embryonic development is retarded for about 2 months. The period of active fetal development is about 8.5 months. No significant amount of twinning is known to occur.

Harbor seals are mainly fish eaters and feed on a wide variety of species including herring, gadids, flounders, smelt, rockfish, sculpins, salmon, and greenling. Octopus, squid and shrimp have been found in large quantities in harbor seal stomachs (Imler and Sarber 1947 and Spalding 1964).

Reliable techniques have not been developed for censusing harbor seal populations. Aerial surveys are commonly used as a tool for determining distribution and relative abundance (Mathisen and Lopp 1963, Richardson 1973). However, these surveys are not adequate for estimating population size and are only marginally suited for determining distribution (Pitcher in prep.) Seals in the water are very difficult to see. When under water they can be seen only under the most favorable conditions i.e. clear, shallow, calm water with good lighting. Even on the surface seals are difficult to see and many are missed. Seals are most easily seen and accurately counted when hauled out. However, even when large numbers of seals are seen hauled out, we have no method to determine

what proportion of the total population represented. Aerial surveys are a vaulable tool as long as their limitations are realized and the resulting data interpreted accordingly.

In the early and mid-1960's Alaskan phocid seals were introduced and became established in the European fur market. High prices were paid for harbor seal skins, which stimulated intensive hunting efforts in many areas of the state. High harvests of seals occurred in Southeastern, along the Gulf Coast, along the Kenai Peninsula, in the Kodiak area and in several locations on the Alaska Peninsula. Through a combination of bounty records, fur export permits, interviews with fur buyers and field observations the Department of Fish and Game was able to calculate the magnitude of harvest. These harvest data provide valuable insight into population size. It was not unusual for an area to sustain, over several years, an annual harvest in excess of what was thought to occur in the area and to end up with a population that was apparently not greatly reduced. It was then possible, by using basic biological information on the reproductive potential of harbor seals, to calculate in a general way the sizes of populations required to support harvests of these magnitudes. This information, while admitedly not precise, provides in many instances the best indication of population size. Crude population estimates of harbor seals for selected areas of the Gulf of Alaska are presented in this report. These estimates were calculated using known harvest levels and their apparent effect on the population combined with information on reproductive rates. Bigg (1969), in a study of harbor seals in British Columbia found that 53 percent of the population older than pups consisted of females, of which 55 percent were sexually

mature. The annual fecundity rate for mature females was 88 percent. Using these data, the annual production of a harbor seal population will amount to about 20 percent of the post whelping population. Boulva (1971) working on Sable Island in Novia Scotia, found the pups represented about 18 percent of the population after whelping. There are indications from current investigations that reproductive rates vary in different populations, possibly as a result of varying habitat productivity and population density. Regardless, the figures provided by Bigg and Boulva are sufficient for the purpose of making broad population estimates. Estimates by this method tend to be low because of several factors. They do not include natural mortality which may be somewhat compensated by high harvests but is not eliminated. Mortality of pups may be particularly significant. Harvest data do not include sinking loss (which can range from 0-50 %) or animals which are wounded and later die. When prices for seal skins were very high unknown numbers of seals were not bountied and may not be included in the harvest data.

In some areas hunting was never intensive and little insight into population size can be gained from harvest data. The only bases for population estimates in these areas are observation of relative abundance and knowledge of available habitat.

In the following discussions we will attempt to describe in a general way the distribution of harbor seals along the Gulf Coast. Particular emphasis will be placed on areas where harbor seals concentrate and which are apparently important to the well-being of seal populations.

Harbor seals are found all along the Coast from Cape Spencer to Yakutat Bay with concentrations found in certain bays and at the mouths of rivers. The area near Cape Spencer where numerous, small offshore islands and rocks occur appears to be excellent seal habitat. On May 16, 1975 a skiff survey for sea otter was conducted in the area and more than 100 seals were observed. Up to 165 seals have been counted in Lituya Bay hauled on icebergs discharged from glaciers. Pupping occurs here but the magnitude is unknown (Gregory Streveler, N.P.S., Gustavus, pers. comm.). Seal concentrations are found in Dry Bay, and at the mouths of the East Alsek, Akwe, Italio, Dangerous and Situk Rivers, particularly during summer months (Wayne Fleek, Fish and Wildlife Protection Officer, Anchorage pers. comm.).

Seals are found throughout Yakutat Bay and are particularly abundant on the floating ice calved from Hubbard Glacier. Limited commercial hunting occurred in the Yakutat area; 300 seals were reported harvested in 1969.

Icy Bay contains one of the most spectacular concentrations of harbor seals in Alaska. During summer months tremendous amounts of ice are calved from the active glaciers and harbor seals use the floating ice for pupping and haul out platforms. Pitcher surveyed the Icy Bay area from an aircraft on July 26, 1973. He was unable to obtain a satisfactory count but estimated that several thousand seals were hauled on ice floes.

Icy Bay was the site of a commercial seal hunting operation during the late 1960's. Two Yakutat residents harvested in excess of 1000 seals each summer for several consecutive years. Little if any decline in numbers was noted in the area. To support a harvest of this level the population of the Icy Bay area must exceed 5000 animals and may be considerably higher.

The coast from Icy Bay to Cape Suckling is similar to that south of Yakutat. Seals occur along the entire coast with concentrations of up to several hundred animals seen at river mouths, notably the White, Tsiu and Seal Rivers.

Most of our data on harbor seals along the coast from Cape Suckling to Cape Puget are presented in the report "Distribution and Abundance of Sea Otters, Sea Lions and Harbor Seals in Prince William Sound" (Appendix A).

The Copper River Delta which contains impressive numbers of seals during summer months was the site of a dynamite bombing control program from 1951 to 1958 during which a reported 30,250 seals were killed (A.D.F.&G. 1958). The control activities were initiated because of severe depredation problems on the drift net fishery for salmon at the mouth of the Copper River. The population was apparently significantly reduced as seal-fishery conflicts were at a minimum when the control program ceased. Now, 17 years after cessation of control activities, the population has apparently recovered to a relatively high level as reports from fishermen

indicate depredation problems have again become serious. While no solid data are available on population numbers, if the numbers reported killed are at all accurate, there were probably in excess of 15,000 seals present before control activities took place.

The Copper River freezes during winter and except for a few seals along the outer bars this population apparently disperses to other areas. No data are available on seal movements or population discreteness in the area but it is probable that seals gather on the delta from distant areas for pupping, breeding, molting and feeding activities during summer.

Prince William Sound apparently did not receive continuous, intensive commercial hunting pressure during the mid-1960's unlike some areas of the state. Hunting activities were related to fishing activities. Some fishermen turned to seal hunting as an alternate source of income during closed fishing seasons. From an examination of bounty and fur buyer records, it appears that the peak harvest occurred in 1963-64 with an estimated take of 2,500 seals. Removal of these animals had no obvious effect on seal population density, indicating a population probably well in excess of 13,000 seals.

Middleton Island is an offshore island in the Gulf about 75 miles south of Cordova. We visited the island on February 10, 1975. The weather was bad and it was impossible to count harbor seals, however, they were obviously abundant around the entire island. Few seals were ever

harvested on Middleton Island probably because of its remoteness and the difficulty of hunting along the exposed shoreline.

Wessels Reef, 19 miles north of Middleton Island, is reported to have numbers of harbor seals (Pete Islieb, commercial fisherman, Cordova, pers. comm.).

The coast of the Kenai Peninsula from Cape Puget to Dangerous Cape is generally rocky and precipitous with numerous deep water fiords. Active glaciers which calve icebergs are found at the head of several bays and fiords. Harbor seals are abundant along the entire coast with concentrations found near certain points and capes, in some bays and most glacial fiords.

Johnstone Bay is reported as a high density area by Alaska Department of Fish and Game (1973). The area just west of Cape Fairfield is a major concentration area. A series of aerial surveys conducted by A.D.F.&G. in 1970 always found numerous seals in the area. The maximum seen was about 400 on August 14, 1970. During the same surveys up to about 50 seals were routinely observed in Whidbey Bay and around Cape Mansfield. Although quantitative data are lacking, Day Harbor is known to contain numbers of seals. Resurrection Bay, while not containing spectacular concentrations at any one location, has numerous seals. While collecting seals for a research project, we observed several hundred animals scattered throughout the bay in October 1973.

Aialik Bay, a glacial fiord with floating ice, is inhabited by numerous harbor seals. Bishop (1967) reported 490-500 seals hauled on ice floes in August 1963. During 1970 and 1971 A.D.F.&G. flew several surveys of the area and observed up the 400 animals. 1964 bounty records indicated a harvest of 639 seals for Aialik Bay area.

Harris Bay, another deep glacial fiord with floating ice, also contains numerous seals. Bishop (1967) felt the population approached 500 in October 1963. Carl Divinyi, former A.D.F.& G. biologist, counted 200-300 seals during a boat survey of Harris Bay in November 1970. Bounty records indicated harvests of 946 in 1964 and 596 in 1965.

Harvest data from Nuka Bay indicate large numbers of harbor seals. Over the three-year period, 1964 through 1966, 3,420 seals were reported taken from the area. Seals are apparently abundant throughout much of Nuka Bay, however, the largest visible concentration is consistently found at the head of East Arm where ice was calved from McCarty Glacier. High density areas were also reported in Moonlight Bay, Beauty Bay and along the western side of Nuka Island (Alaska Department of Fish & Game 1973).

Seals are abundant on the Chugach Islands, particularly along the outside coast. They are distributed all along the Kenai Peninsula coast from Nuka Bay to Dangerous Cape with concentrations of over 25 animals reported from Port Dick, Windy Bay and Rocky Bay (Alaska Department of Fish & Game 1973 and unpublished data).

The Barren Islands, well known for the large numbers of sea lions which utilize the area, also have a substantial number of harbor seals. Alaska Department of Fish and Game (1973) reported high density harbor seal numbers on Sud Island, the south side of Ushagat Island and part of West Amatuli. Bounty records show a harvest of 1,001 seals in 1964 and about 500 in 1965.

The Afognak, Shuyak, Kodiak and Trinity Islands area contains large numbers of seals. According to bounty records nearly 26,000 seals were harvested during the peak hunting years of 1964-1966. To support a harvest of this magnitude the total population in the area probably exceeded 35,000 animals.

Much of the coast of Shuyak Island is excellent seal habitat, particularly the western portion. In 1966, 926 seals were reported taken from the Shuyak area. High density seal areas on Afognak Island include Seal Bay and Perenosa Bay. Nearly 800 seals were bountied from these areas in 1965. Seals are found along the entire coastline of Kodiak Island. Concentration areas include Cape Chiniak, where 931 seals were counted and Ugak Island where 2,796 were seen (Mathisen and Lopp 1963). Fish and Wildlife Service biologists reported seeing 200 seals at Ayakulik Island during January 1973. Sitkalidak Island, particularly its southeastern shore, is reported as a concentration area (Alaska Department of Fish and Game 1973). Ben Ballenger, A.D.F.& G. reported seeing 500 seals here on August 27, 1970. In March 1968 a hunter reportedly took 250 seals from Sitkalidak in a single week. On the southern end of Kodiak, Geese Islands, Aiaktalik Island and Alitak Bay are all reported as high density harbor seal areas (Alaska Department of Fish & Game 1973).

The Trinity Islands south of Kodiak host one of the largest known harbor seal concentrations. While seals are present all year in the area, large numbers concentrate during June and July for pupping and breeding. The western and northern shorelines of Tugidak Island contain the largest numbers of seals. In 1968 a Department biologist counted nearly 9,000 seals on Tugidak. Bishop (1967) estimated the Tugidak population at 12,000-17,000 including up the 5500 pups. In 1964 and 1965 about 5,000 seals were harvested from Tugidak each year. Sitkinak Island also has large numbers of seal; 1,000 to 1,500 animals were seen on an aerial survey on June 21, 1972.

We have little information from Chirikof Island but it appears to be good seal habitat. Several hundred seals were bountied from Chirikof in 1966. During sea otter surveys of the area, Calvin Lensink reported seeing harbor seals (Alaska Department of Fish & Game unpublished data).

Very little information is available about harbor seals along the Alaska Peninsula coast and Aleutian Islands from Kamishak Bay to Scotch Cap. Much of the area appears to be excellent seal habitat. Little hunting pressure has been exerted on these seals and it is assumed that the populations are at or near maximum levels. The Kamishak Bay-Augustine Island area received some hunting pressure in the mid-1960's and a reported 500 seals were taken from the area in 1964. Department biologists saw 50-60 seals hauled out on ice along the south side of Augustine Island on April 9, 1971. During a series of surveys along the coastline of Katmai National Monument, concentrations of harbor seals were seen at

Cape Douglas Reefs, Shakun Rocks, the point off Kukak Bay and the offshore islands in Hallo Bay (Prasil 1971). Incidental observations during a sea otter survey showed concentrations at Kumlik Island, Unavikshak Island and Nakehamik Island (unpublished data).

Harbor seals are known to occur around the Semidi Islands. Several hundred were bountied from there in 1966.

CETACEANS

Miscellaneous observations on cetaceans are included in this section only to indicate the presence and possible relative abundance of the species. In most cases we have no more information than a collection of sightings; no population estimates can be made, nor in most cases can distribution be defined.

Pacific Right Whale or Black Right Whale *(Balaena glacialis)*

This large whale was hunted to near extinction in the North Pacific and was most frequently found in the Gulf of Alaska in the summer months. Little is known about their present distribution and abundance except they are considered rare. (Leatherwood et al. 1972) We have no sightings recorded in our files.

Gray Whale *(Eschrichtins robustus)*

Gray whales are known to migrate through the Gulf of Alaska in the spring from May through November to feed in the waters of the Bering and Chukchi Seas. In December and January they return to breed in shallow waters of California and Mexico (Leatherwood et al. 1972). The National Marine Fisheries Service reported sightings of gray whales between the Fairweather Grounds and Yakutat Bay in April 1958, made while on pelagic fur seal cruises.

Minke Whale *(Balaenoptera acutorostrata)*

Minke whales are relatively common throughout the Gulf of Alaska and are known to concentrate in areas of abundant food such as the Kodiak Island area and Prince William Sound. They are migratory, moving into the Gulf of Alaska in spring and returning south in the fall. The minke is the most common small whale in the Gulf of Alaska with pelagic fur seal investigators reporting a total of 43 minkes at 33 locations.

Sei Whale *(Balaenoptera borealis)*

The range of the Sei whale extends into Gulf of Alaska waters although the specific distribution is poorly known (Leatherwood et al. 1972) Sei whales have been reported during pelagic fur seal investigations by National Marine Fisheries Service, although sightings are not common.

Blue Whale *(Balaenoptera musculus)*

Blue whales are found in the Gulf of Alaska from May through September according to Leatherwood et al. 1972. Pelagic fur seal investigators of the National Marine Fisheries Service recorded a total of 7 blue whales sighted from 1958 through 1968. Blue whales are considered endangered and near extinction.

Humpback Whale *(Megaptera novaeangliae)*

Humpback whales are the most common of the large whales with dorsal fins in the Gulf of Alaska and according to Leatherwood et al. (1972) can be

seen in virtually any part of their range in the summer which includes all of the Gulf of Alaska. National Marine Fisheries Service pelagic fur seal investigators have sighted 132 humpbacks on 64 different occasions in the Gulf of Alaska.

North Pacific White-sided Dolphin *(Lagenorhynchus obliquidens)*

North Pacific White Sided Doplhins or Lags are found from Alaska to Baja California according to Leatherwood et al. (1972) but sightings are not common in the Gulf of Alaska. One sighting of 2,000+ Lags was recorded by National Marine Fisheries Service pelagic fur seal investigators at latitude 57° 34', Longitude 140° 33' and a sighting of 12 Lags was recorded during the cruise of the OCEANOGRAPHER. These Lags were recorded as being near the 1,000 fathom curve off Yakutat Bay.

Killer Whale *(Orcinus orca)*

Killer whales are found throughout the Gulf of Alaska during the summer months and may shift to the south in the winter (Leatherwood et al. 1972). A total of 36 Killer whales were sighted by National Marine Fisheries pelagic fur seal investigators on nine different occasions in the Gulf of Alaska. National Marine Fisheries Service special agent Jim Branson reported seeing 500+ Killer whales near Middleton Island on April 24, 1973.

Harbor Porpoise *(Phocoena phocoena)*

The Harbor Porpoise is the smallest cetacean in the Gulf of Alaska and can often be seen in bays and harbors throughout the Gulf according to

Leatherwood et al. (1972). Pelagic fur seal investigators report a total of 176 animals sighted at 17 locations between 1958 and 1968.

Dall Porpoise *(Phocoena dalli)*

The Dall Porpoise is probably the most common cetacean seen in Gulf of Alaska waters with sightings common both near shore and offshore. A total of 1,912 Dalls were sighted on 289 occasions during pelagic fur seal investigations between 1958 and 1968 by National Marine Fisheries personnel.

Sperm Whale *(Physeter catodon)*

Leatherwood et al. (1972) considered the sperm whale migratory, being found in the Gulf of Alaska in the summer months. National Marine Fisheries pelagic fur seal investigators list sightings of 19 sperm whales on nine occasions.

Pelagic catches of whales in the Gulf of Alaska by Japan and Russia have been recorded by the National Marine Fisheries Service and are shown in Table 4. This reflects the total catch of whales by these two nations in all Gulf of Alaska waters, including areas south of Cape Spencer.

Table 4. Pelagic catches of whales in the Gulf of Alaska by the USSR and Japan 1965-1974

Year	Blue	Humpback	Fin	Sei	Sperm
1965	68	106	1118	816	1344
1966	1/	1/	833	1174	1009
1967	1/	1/	101	145	1137
1968	1/	1/	35	239	356
1969	1/	1/	11	49	538
1970	1/	1/	115	119	180
1971	1/	1/	59	100	138
1972	1/	1/	4	15	311
1973	1/	1/	4	8	171
1974	1/	1/	88	10	307

1/ Completely protected from 1966 on.

Miscellaneous Marine Mammal Observations

Occasionally Marine Mammals not common to Gulf of Alaska waters have been sighted. Our files contain reports of walrus (*Odohens rosmarus*) sightings both in Prince William Sound and Cook Inlet, a sighting of a ringed seal (*Pusa hispida*) in Prince William Sound and most recently the carcass of Northern Elephant Seal (*Mirounga angustirastris*) was reported to have washed up on the beach of Middleton Island.

LITERATURE CITED

Alaska Department of Fish and Game. 1973. Alaska's Wildlife and Habitat. Anchorage, Alaska. 143 pp. +563 maps.

Bigg, M. A. 1969. The harbor seal in British Columbia. Fish Res. Bd. Can. Bull. 172. 33 pp.

Bishop. R. H. 1967. Reproduction, age determination, and behavior of the harbor seal, *Phoca vitulina* L., in the Gulf of Alaska. MSc. Thesis. Univ. of Alaska, College, Alaska 120 pp.

Boulva, J. 1971. Observations on a colony of whelping harbour seals, *Phoca vitulina concolor*, on Sable Island, Nova Scotia. Fish Res. Bd. Can. 28: 755-759.

Brooks, J. W. 1957. Paper presented at the Eighth Alaskan Science Conf., Anchorage, Ak. Sept. 10-13. 6 pp.

_____. 1963. The Management and status of marine mammals in Alaska. Transactions of the Twenty Eighth N. Amer. Wildlife and Nat. Resources, March 4, 5, 6 pp. 314-326.

Calkins, D., and P. C. Tent. 1975. Territoriality and mating behavior in Prince William Sound sea otters Jour. Mamm. 56: 528-529.

Fiscus, C. H. and G. A. Baines. 1966. Food and feeding behavior of Steller and California sea lions. Jour. Mamm. 47: 196-200.

Imler, R. H. and H. R. Sarber. 1947. Harbor seals and sea lions in Alaska. U. S. Fish and Wild. Serv. Spec. Sci. Rept. 28. 22 pp.

Kenyon, K. W. 1962. Aerial survey of sea otters and other marine mammals, Alaska Peninsula and Aleutian Islands, 19 April to 9 May 1965. Bur. Sport Fish and Wildl. Unpub. report. Sand Point Naval Air Sta. Seattle 24 pp. +24 maps.

_____. 1965. Sea otter studies, population and distribution. Unpub. report, Branch of Wildlife Research, Fish and Wildlife Service Bldg. 192, Sand Point Naval Air Sta. Seattle. 47 pp.

_____. 1969. The sea otter in the eastern Pacific Ocean. N. Amer. Fauna No. 68: U. S. Government printing office, Washington D. C., 352 pp.

_____. and D. W. Rice. 1961. Abundance and distribution of the Steller sea lion. Jour. Mamm. 42: 223-234.

Leatherwood, S., W. E. Evans and D. W. Rice. 1972. The whales, dolphins and porpoises of the eastern North Pacific, a guide to their identification in the water. NUC TP 282, 175 p. Not for sale. Can be obtained through MMD.

Lensink, C. J. 1960. Status and distribution of sea otters in Alaska. Jour. Mamm. 41: 172-182.

_____. 1962. The history and status of sea otters in Alaska. Phd. Thesis. Purdue Univ. Lafayette, Ind. 188 pp.

Mathisen, O. A., R. T. Baade and R. J. Lopp. 1962. Breeding habits, growth and stomach contents of the Steller sea lion in Alaska. Jour. Mamm. 43: 469-477.

_____ and R. J. Lopp. 1963. Photographic census of the Steller sea lion herds in Alaska, 1956-1958. U. S. Fish and Wild. Serv. Spec. Sci. Bull. #424. 17 pp.

Pike, G. C. 1958. Food of the northern sea lion. Progress reports of the Pacific coast stations of the Fish. Res. Bd. Can. 112: 18-20.

Prasil, R. G. 1971. Distribution of sea mammals and associated land mammals found along the Katmai Natl. Monument. Proceedings 22nd Ak. Sci. Conf. College, Ak.

Richardson, D. T. 1973. Feeding habits and population studies of Maine's harbor and gray seals. Contract Report between the Natl. Geographic Society and the Maine Dept. of Sea and Shore Fisheries. 43 pp.

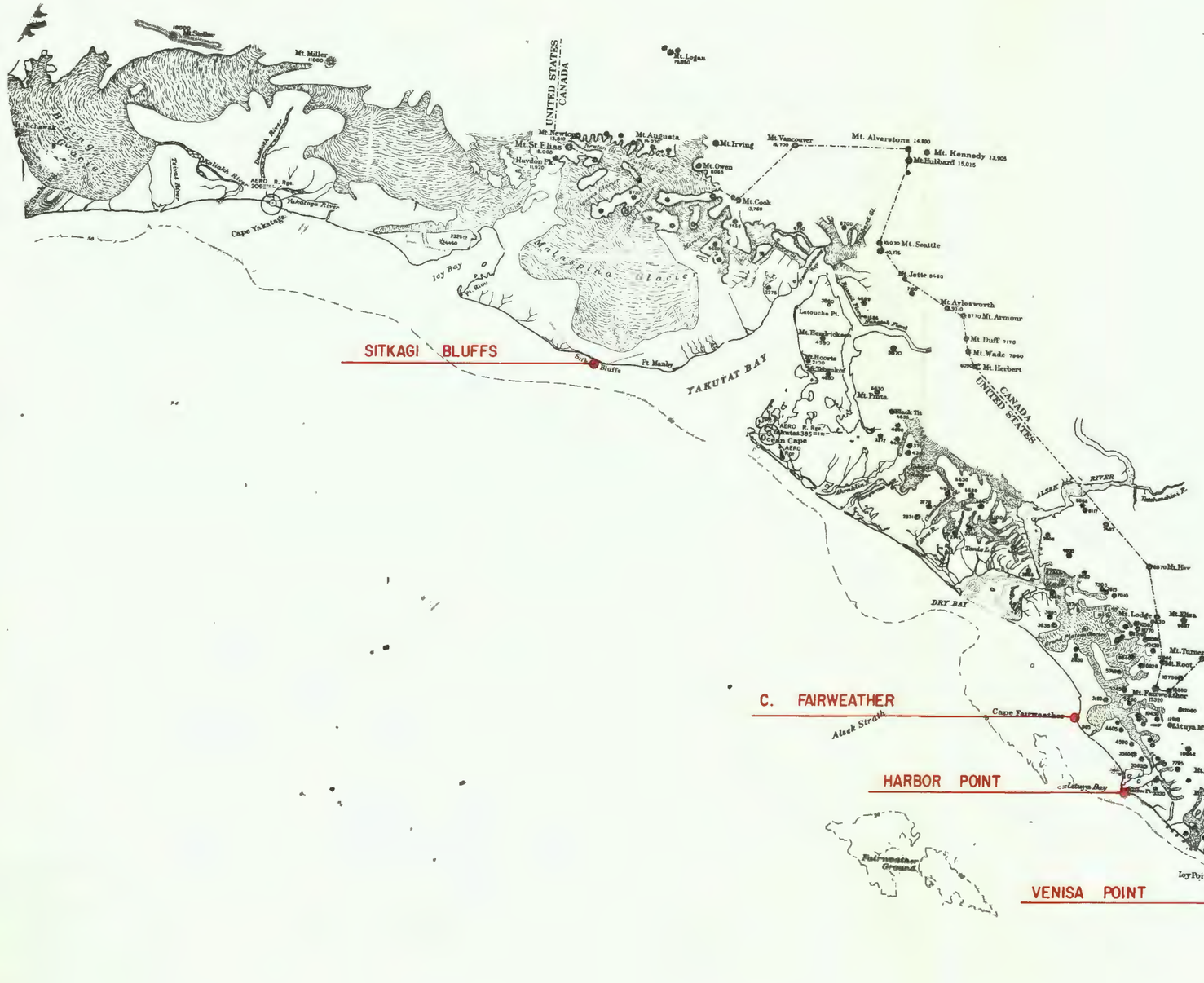
Sandegren, F. E. 1970. Breeding and maternal behavior of the Steller sea lion (*Eumetopias jubatus*) in Alaska. MSc. Thesis. Univ. of Ak., College, Ak. 138 pp.

Schneider, K. B. and J. B. Faro. 1975. Effects of sea ice on sea otters (*Enhydra lutris*). Jour. Mamm. 56: 91-101.

Spalding, D. J. 1964. Comparative feeding habits of the fur seal, sea lion and harbour seal on the British Columbia coast. Fish. Res. Bd. Can. Bull. 146. 52 p.

Vania, J. 1967. Sea lion. In Marine mammal investigations. Alaska Dept. of Fish and Game Vol. IX Annual Project Segment Rept., Fed. Aid in Wildl. Restoration, Project W-14-R-2 and 3, work plan G.

_____ 1968. Sea lion. In Marine mammal investigations. Alaska Dept. of Fish and Game Vol. X Annual Project Segment Rept., Fed. Aid in Wildl. Restoration, Project W-14-R-3 and W-17-1 work plan G.



LEGEND

50 Fathom Curve

Sea Lion Rookeries and Hauling Areas

N

SCALE - 1: 1,338,270

CAPE SUCKLING TO CAPE SPENCER

SL-1

LEGEND

50 Fathom Curve

Sea Lion Rookeries and Hauling Areas

N

SCALE - 1: 1,338,270

PRINCE WILLIAM SOUND
COPPER RIVER DELTA

SL - 2

C. JUNKIN
BARWELL IS.
RUGGED IS.
HIVE IS.
CHAT IS.
CHISWELL IS.
SEAL ROCKS
OUTER IS.
NUKA POINT
GORE POINT
E. CHUGACH IS.
PERL IS.
AMATULI IS.
SUGARLOAF IS.
SUD IS.
ROCKS SW OF SUD IS.
O FLAT IS.
AUGUSTINE ROCKS
C. ELIZABETH
NAGAHUT ROCKS
USHAGAT IS.

LEGEND

50 Fathom Curve

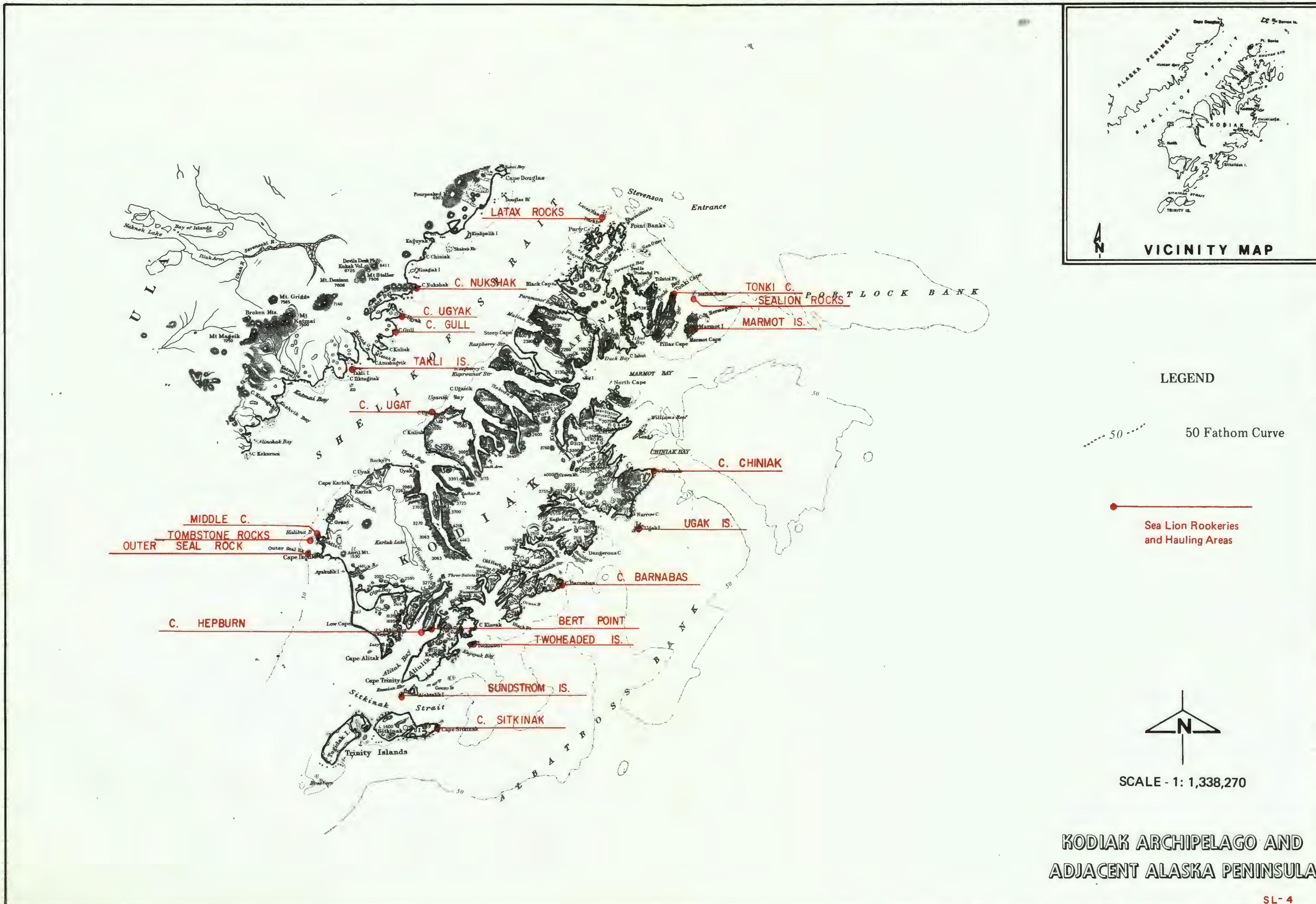
Sea Lion Rookeries and Hauling Areas

N

SCALE - 1: 1,338,270

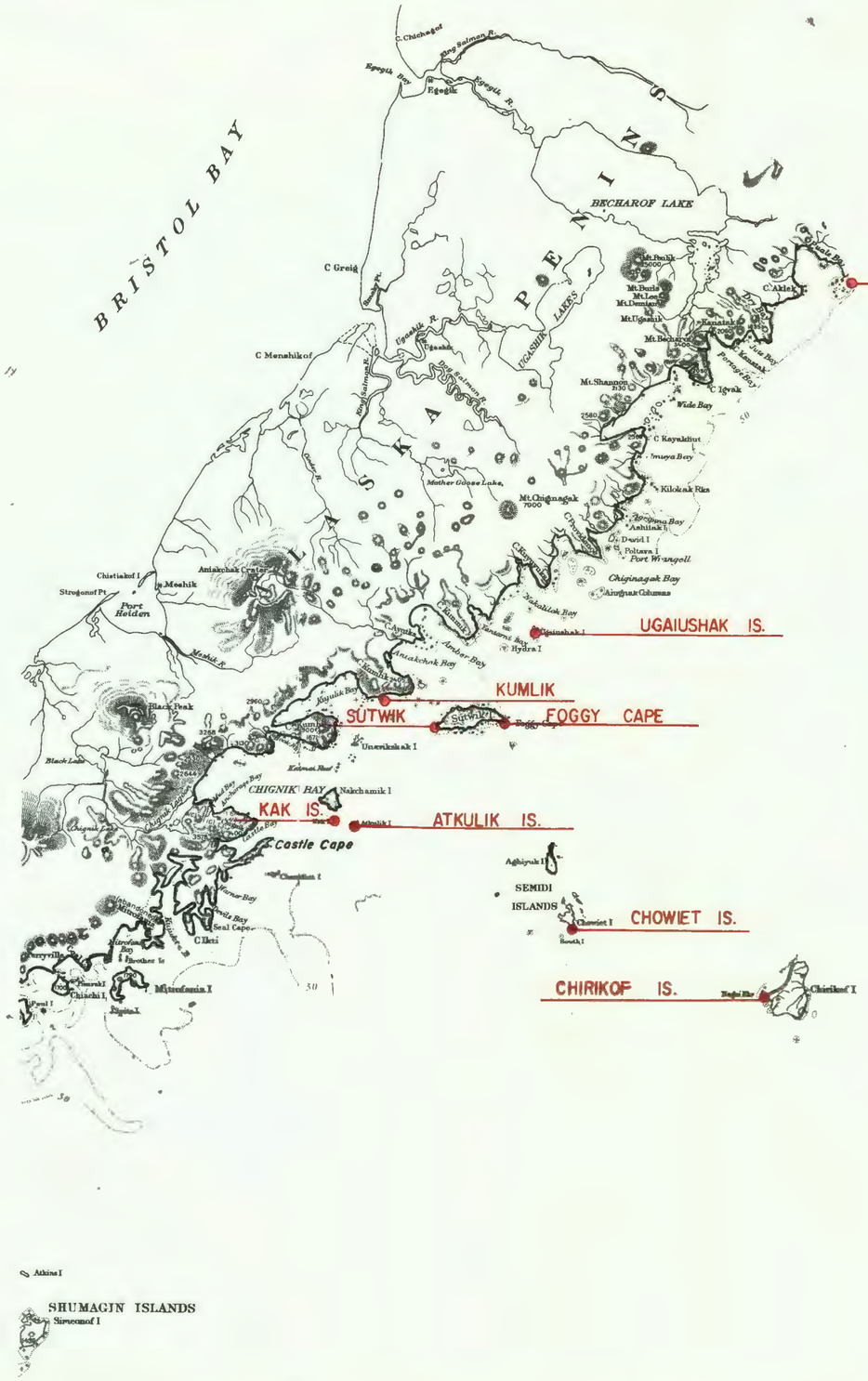
LOWER COOK INLET BAREN ISLANDS AND KENAI PENINSULA

SL-3



KODIAK ARCHIPELAGO AND ADJACENT ALASKA PENINSULA

SL- 4



LEGEND

50 Fathom Curve

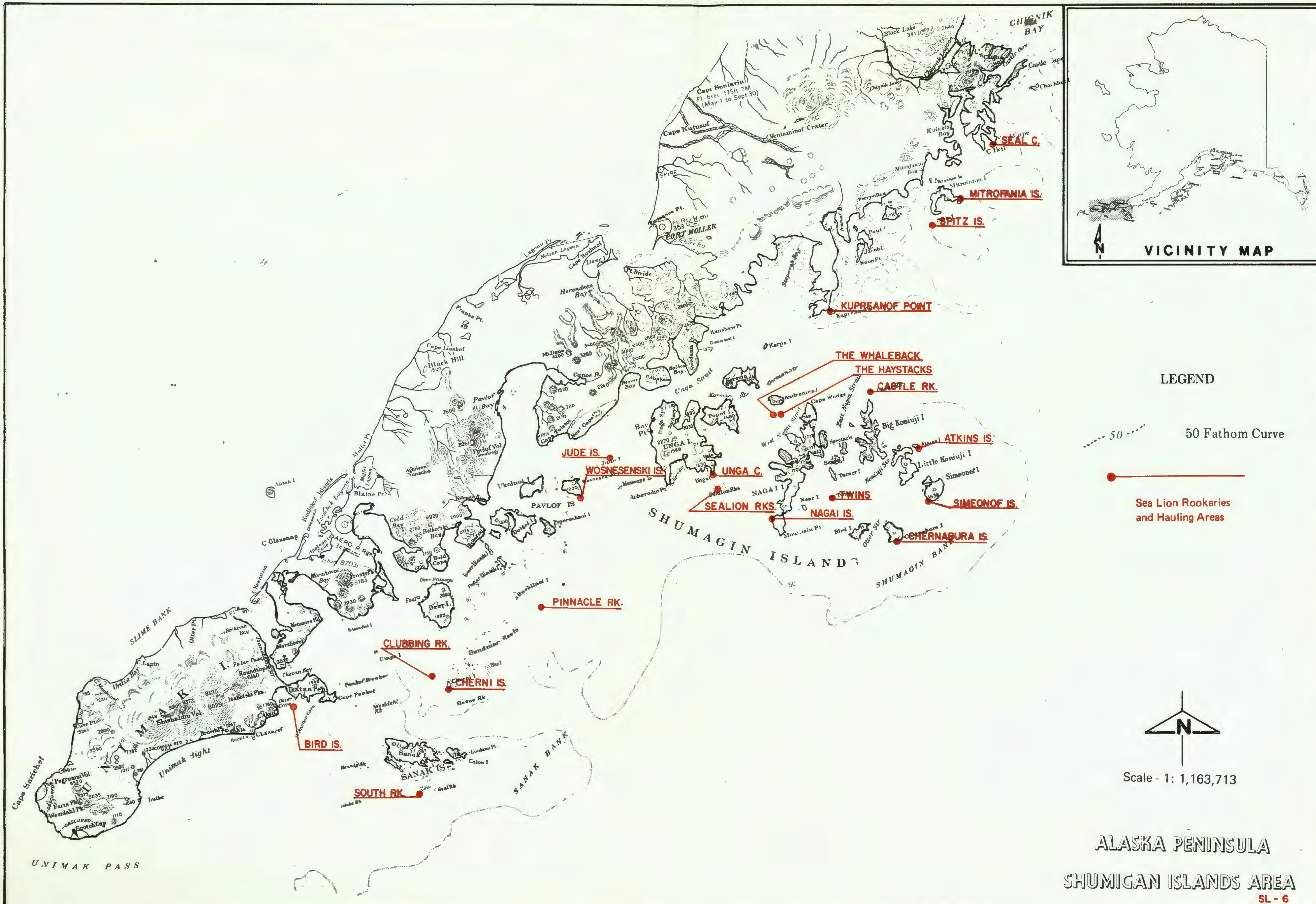
Sea Lion Rookeries and Hauling Areas

N

SCALE - 1: 1,338,270

ALASKA PENINSULA
PUALE BAY TO CASTLE CAPE

SL - 5



SEAL C.
MITROFANIA IS.
SPITZ IS.
KUPREANOF POINT
THE WHALEBACK
THE HAYSTACKS
CASTLE RK.
ATKINS IS.
JUDE IS.
WOSNESENSKI IS.
UNGA C.
TWINS
SEALION RKS.
NAGAI IS.
SIMEONOF IS.
CHERNABURA IS.
PINNACLE RK.
CLUBBING RK.
CHERNI IS.
BIRD IS.
SOUTH RK.
SHUMAGIN ISLANDS
SHUMAGIN BANK
SANAK BANK
SLIME BANK
UNIMAK PASS
CHIGNIK BAY
PAVLOF IS
VICINITY MAP
LEGEND
50 Fathom Curve
Sea Lion Rookeries and Hauling Areas
N
Scale - 1: 1,163,713
ALASKA PENINSULA
SHUMIGAN ISLANDS AREA
SL - 6

LEGEND

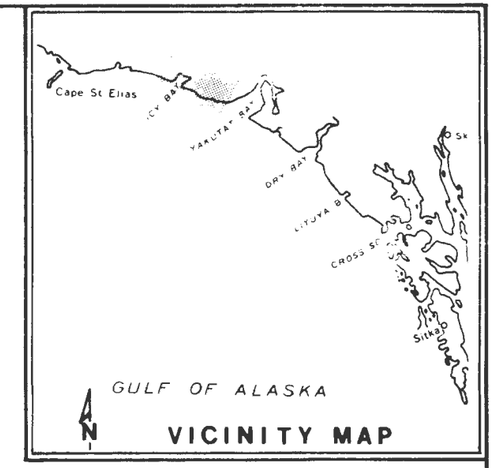
50 Fathom Curve

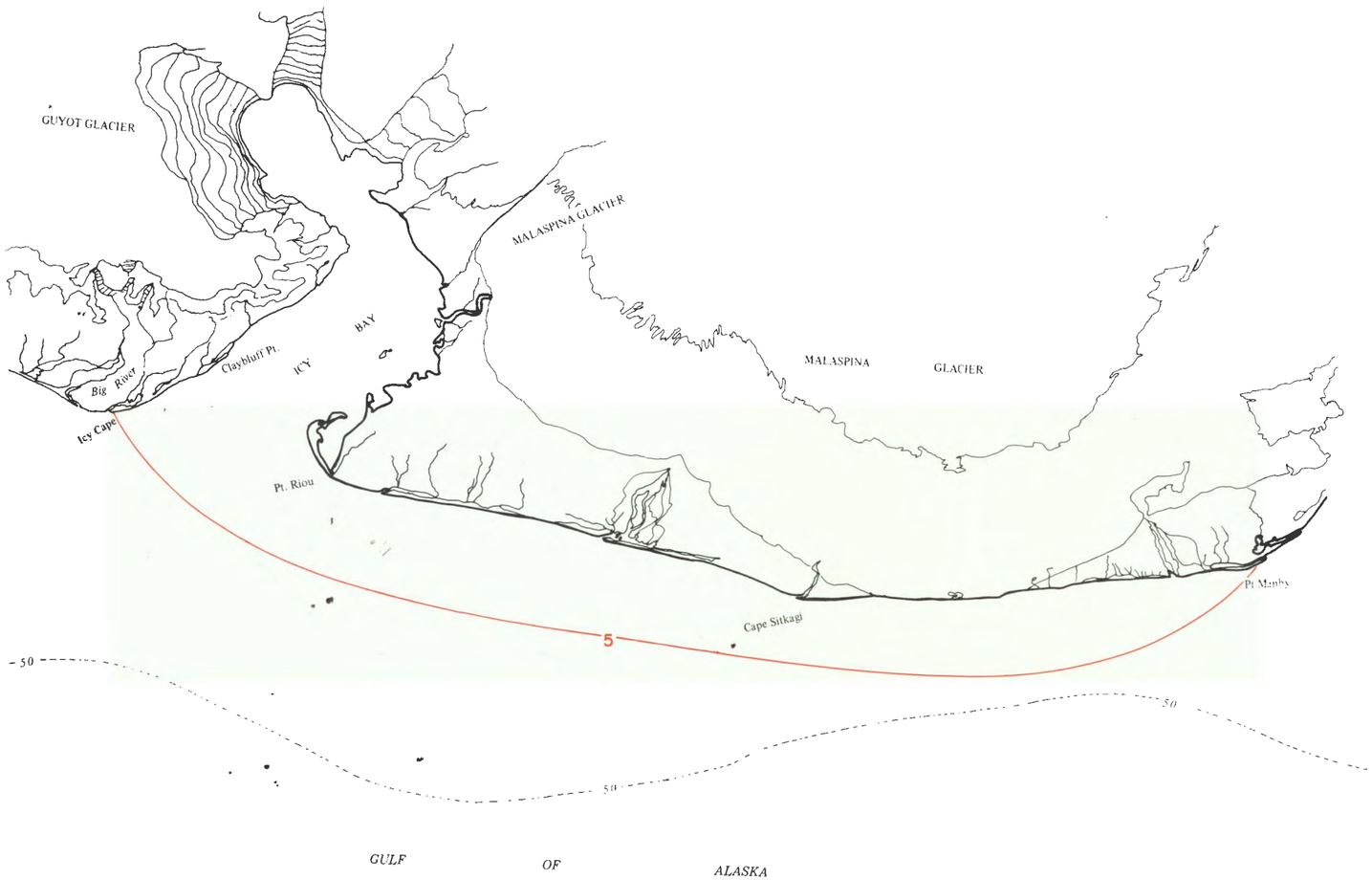
N

SCALE - 1: 420,000

YAKUTAT BAY AREA

SO-1





LEGEND

50 Fathom Curve

N

SCALE - 1: 350,000

ICY BAY AREA

SO-2

LEGEND

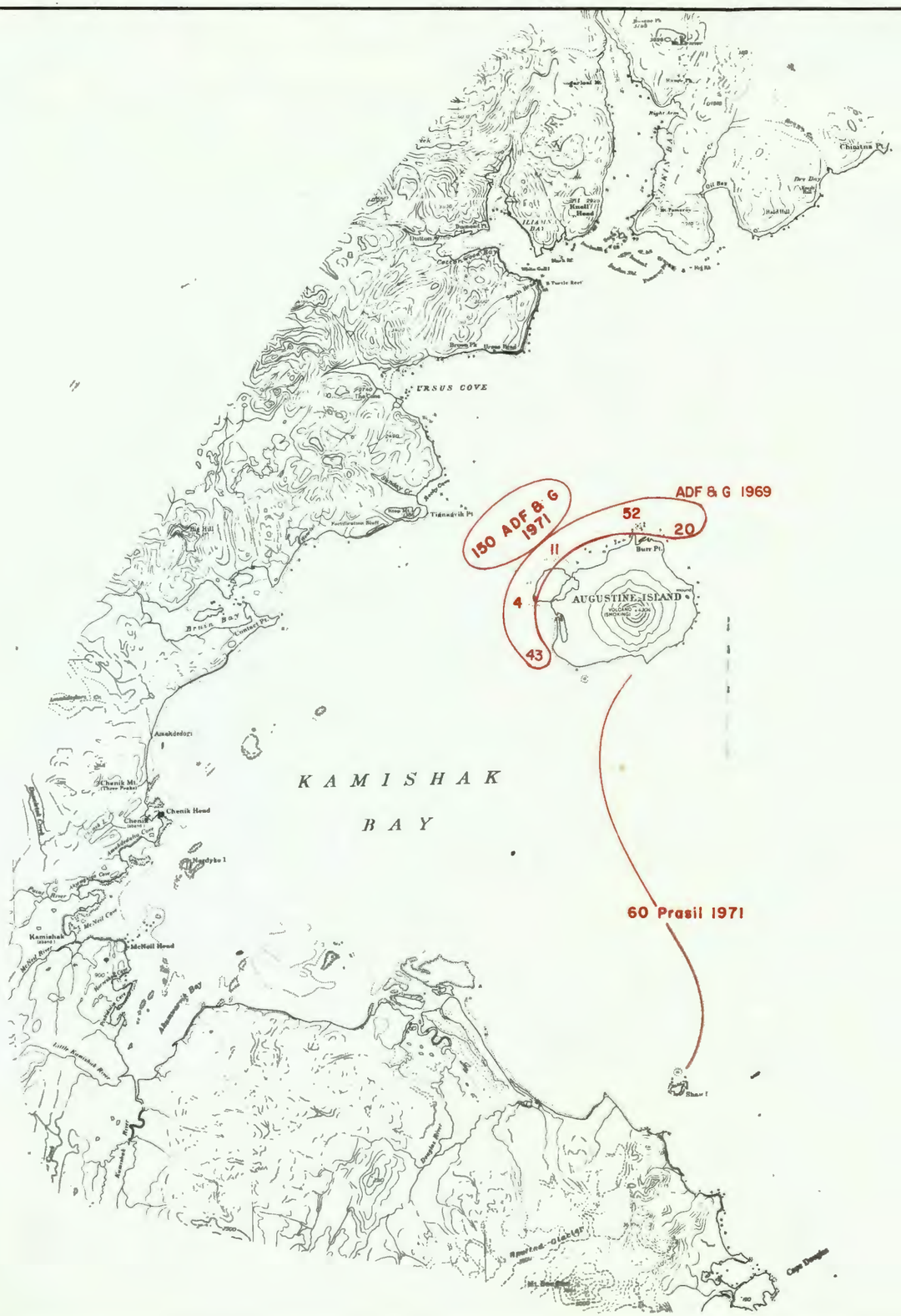
50 — 50 Fathom Curve

N

SCALE - 1: 270,000

CHUGACH
BARREN ISLANDS AREA

SO-3



LEGEND

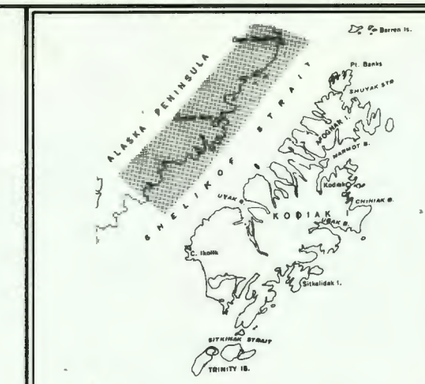
----- 50 ----- 50 Fathom Curve

N

Scale - 1:300,000

KAMISHAK BAY AREA

SO-4



LEGEND

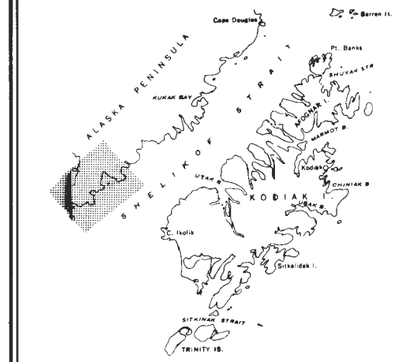
50 Fathom Curve

N

SCALE - 1: 560,000

CAPE DOUGLAS
KATMAI BAY AREA

SO- 5



VICINITY MAP

LEGEND

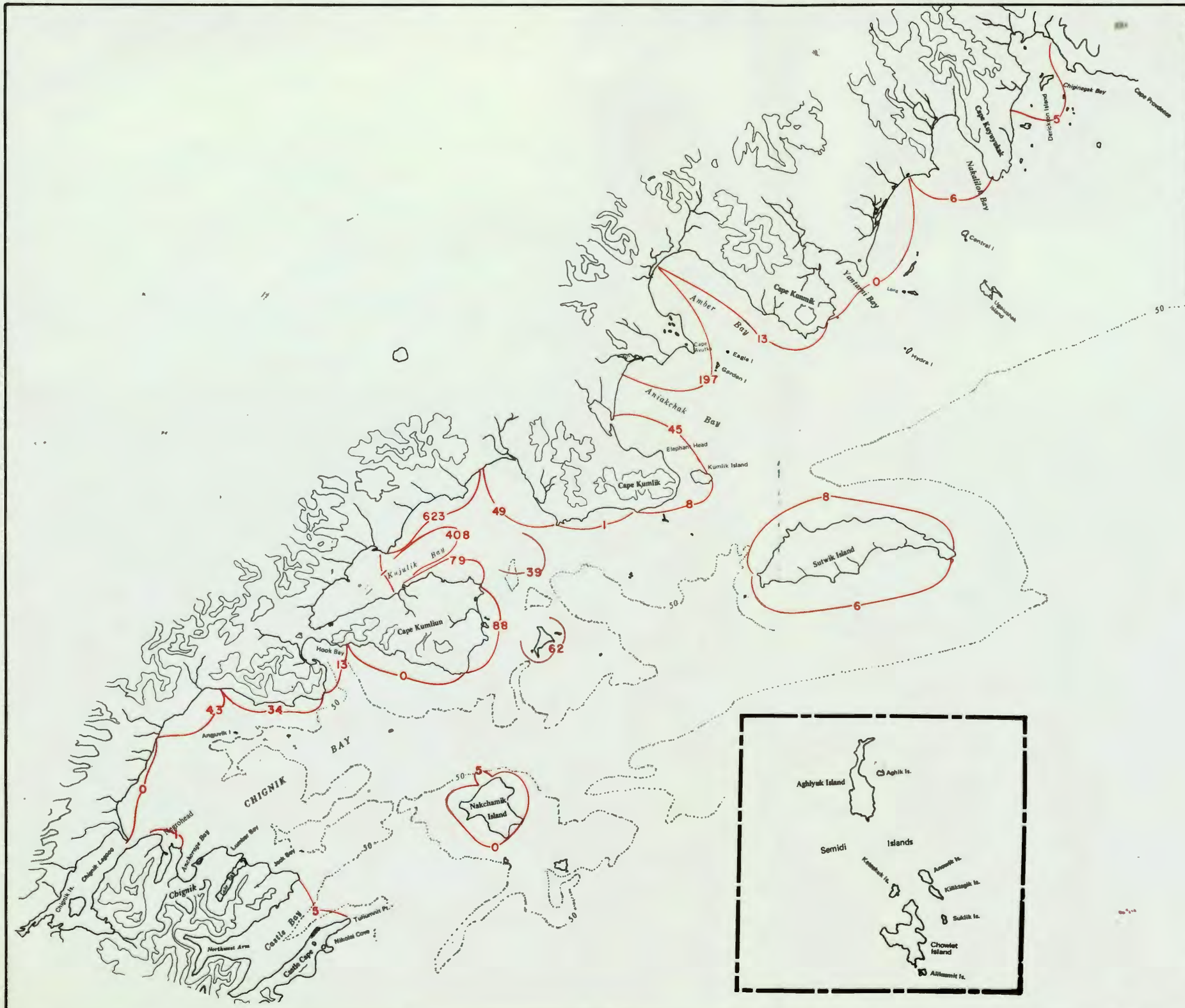
50 Fathom Curve

N

SCALE - 1: 350,000

PAULE BAY TO PORT WRANGELL

SO-6



LEGEND

50 Fathom Curve

N

SCALE - 1: 350,000

SUTWIK ISLAND AREA

SO-7

LEGEND

50 Fathom Curve

N

Scale - 1: 415,000

STEPOVAK BAY AREA

SO-8

LEGEND

50 Fathom Curve

Scale - 1: 427,500

UNIMAK ISLAND

VICINITY MAP

LEGEND

50 Fathom Curve

Harbor Seal Density

High

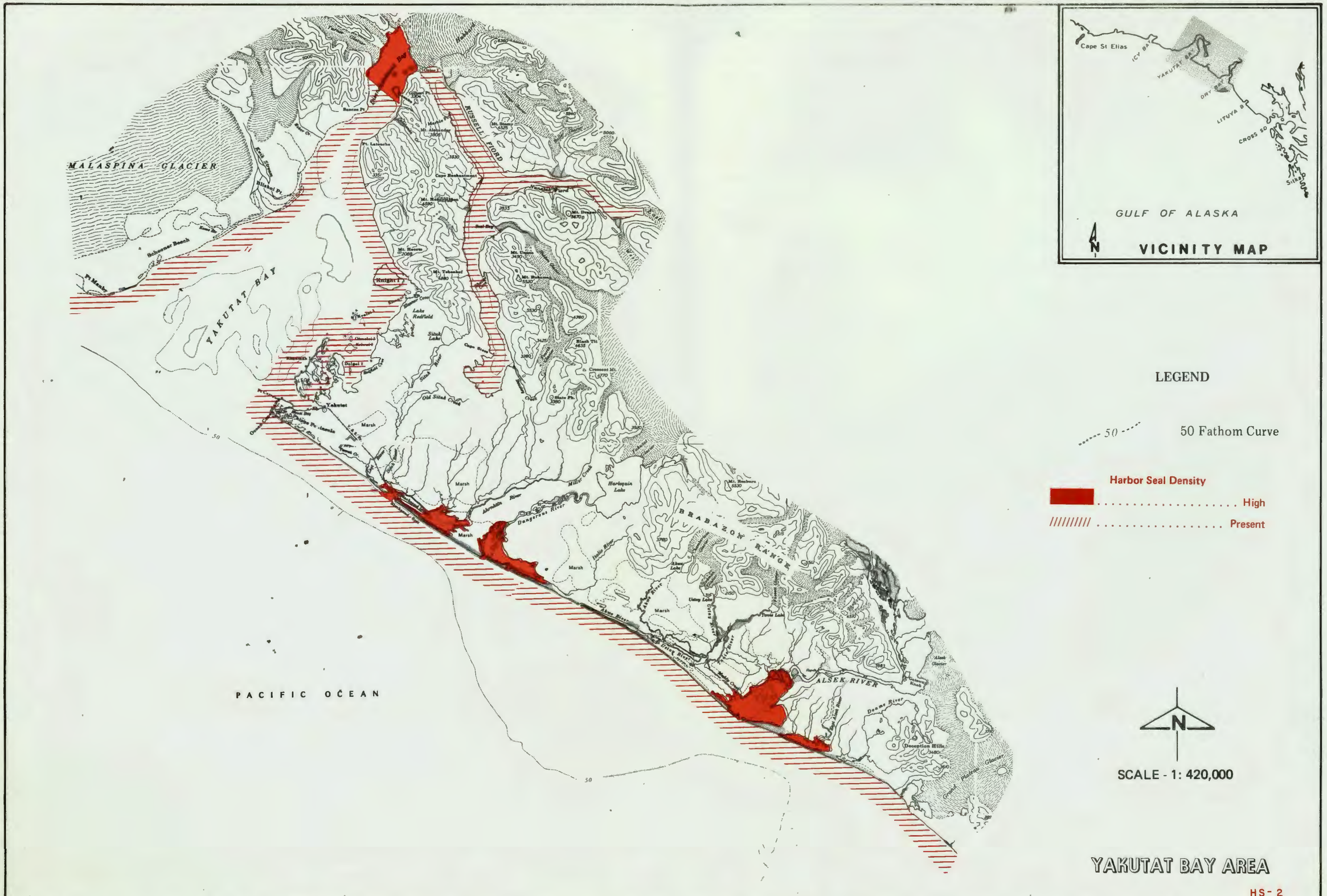
Present

N

SCALE - 1: 420,000

CAPE SPENCER
CAPE FAIRWEATHER AREA

HS - I


MALASPINA GLACIER
YAKUTAT BAY
RUSSELL FIORD
PACIFIC OCEAN
BARANOF RANGE
ALSEK RIVER
Cape St Elias
ICY BAY
YAKUTAT BAY
DRY BAY
LITUYA B
CROSS SD
SITKA
GULF OF ALASKA
N
VICINITY MAP
LEGEND
50
50 Fathom Curve
Harbor Seal Density
High
Present
N
SCALE - 1: 420,000
YAKUTAT BAY AREA
HS - 2

LEGEND

50 Fathom Curve

Harbor Seal Density

High

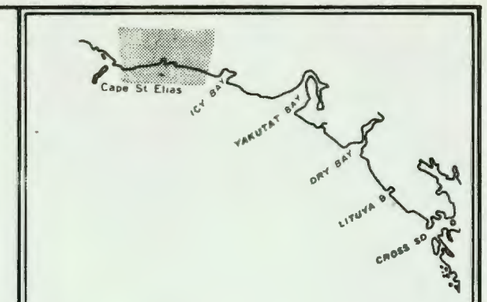
Present

N

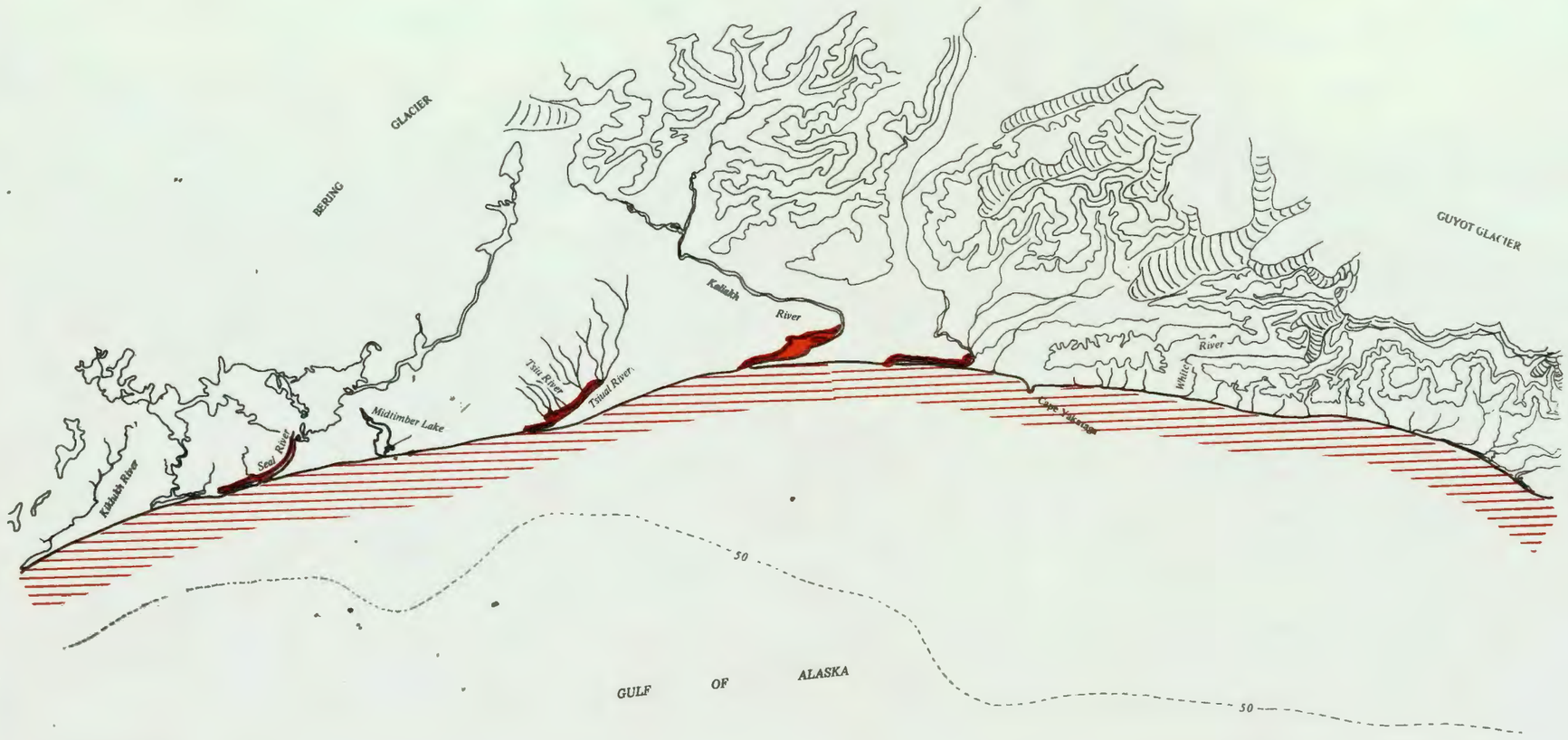
SCALE - 1: 350,000

ICY BAY AREA

HS - 3



VICINITY MAP



LEGEND

50 Fathom Curve

Harbor Seal Density

High

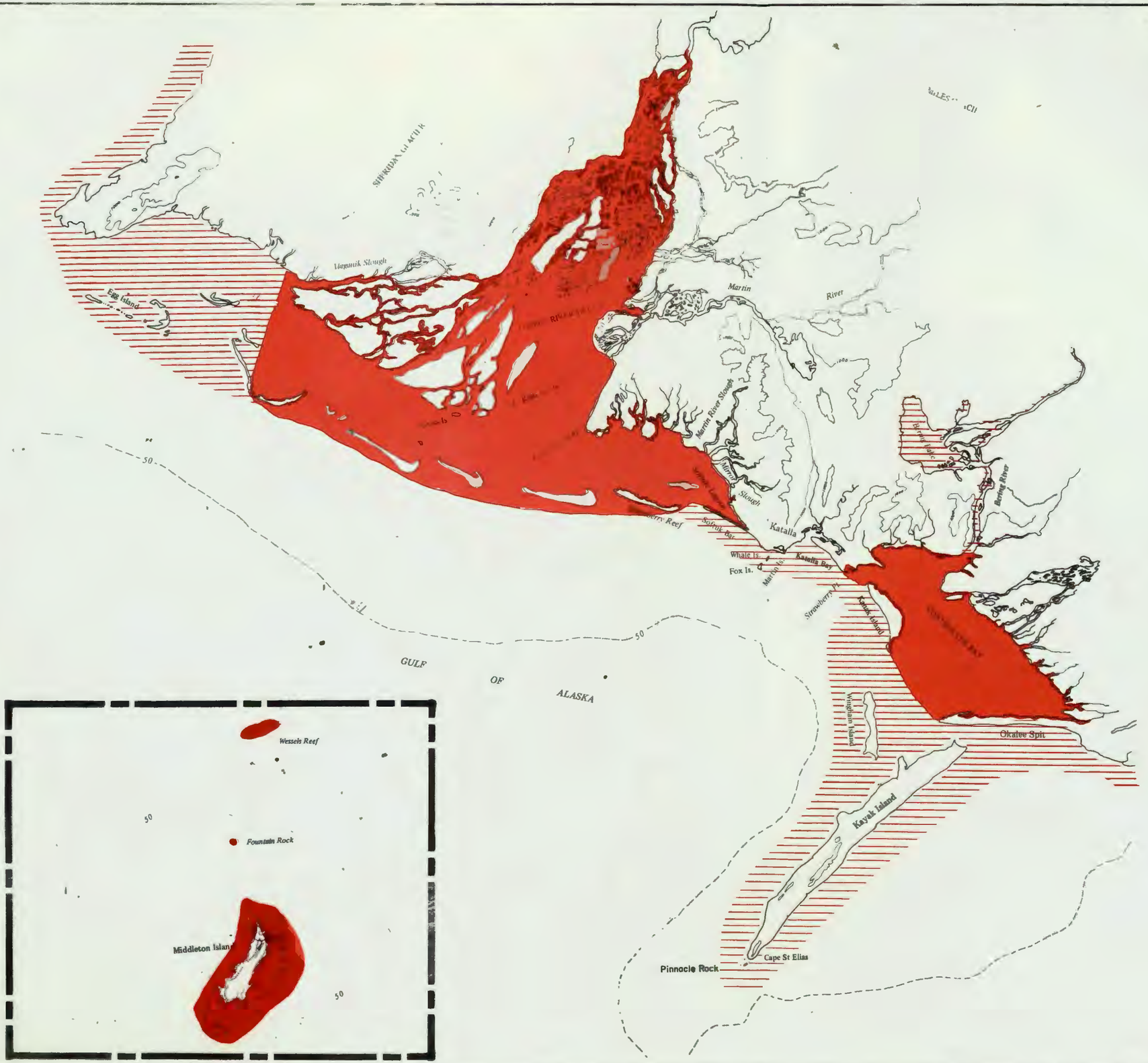
Present

N

SCALE - 1: 350,000

CAPE YAKATAGA AREA

HS-4



VICINITY MAP

LEGEND

50 Fathom Curve

Harbor Seal Density

High

Present

N

SCALE - 1: 350,000

KAYAK ISLAND
COPPER RIVER AREA

HS - 5

VICINITY MAP

RESURRECTION PENINSULA

AIALIK PENINSULA

HARRIS PENINSULA

BLYING SOUND

HARDING GATEWAY

SEWARD

CAPE RESURRECTION

AIALIK CAPE

GRANITE CAPE

CAPE JUNKEN

CAPE FAIRFIELD

Bear Glacier

Aialik Glacier

Pederson Glacier

Holgate Glacier

Godwin Glacier

Bloomfield Glacier

Excelsior Glacier

Mt Fairfield

Pilot Rk

Seal Rks.

LEGEND

50 Fathom Curve

Harbor Seal Density

High

Present

N

SCALE - 1: 270,000

KENAI COAST
RESURRECTION BAY AREA

HS - 6

LEGEND

50 Fathom Curve

Harbor Seal Density

High

Present

N

SCALE - 1: 270,000

KENAI COAST
NUKA BAY AREA

HS - 7

LEGEND

50 Fathom Curve

Harbor Seal Density

High

Present

N

SCALE - 1: 270,000

CHUGACH
BARREN ISLANDS AREA

HS-8

LEGEND

50 Fathom Curve

Harbor Seal Density

High

Present

N

Scale - 1:300,000

KAMISHAK BAY AREA

HS - 9

VICINITY MAP

LEGEND

50 Fathom Curve

Harbor Seal Density

High

Present

N

SCALE - 1: 560,000

CAPE DOUGLAS
KATMAI BAY AREA

HS-10

LEGEND

50 Fathom Curve

Harbor Seal Density

High

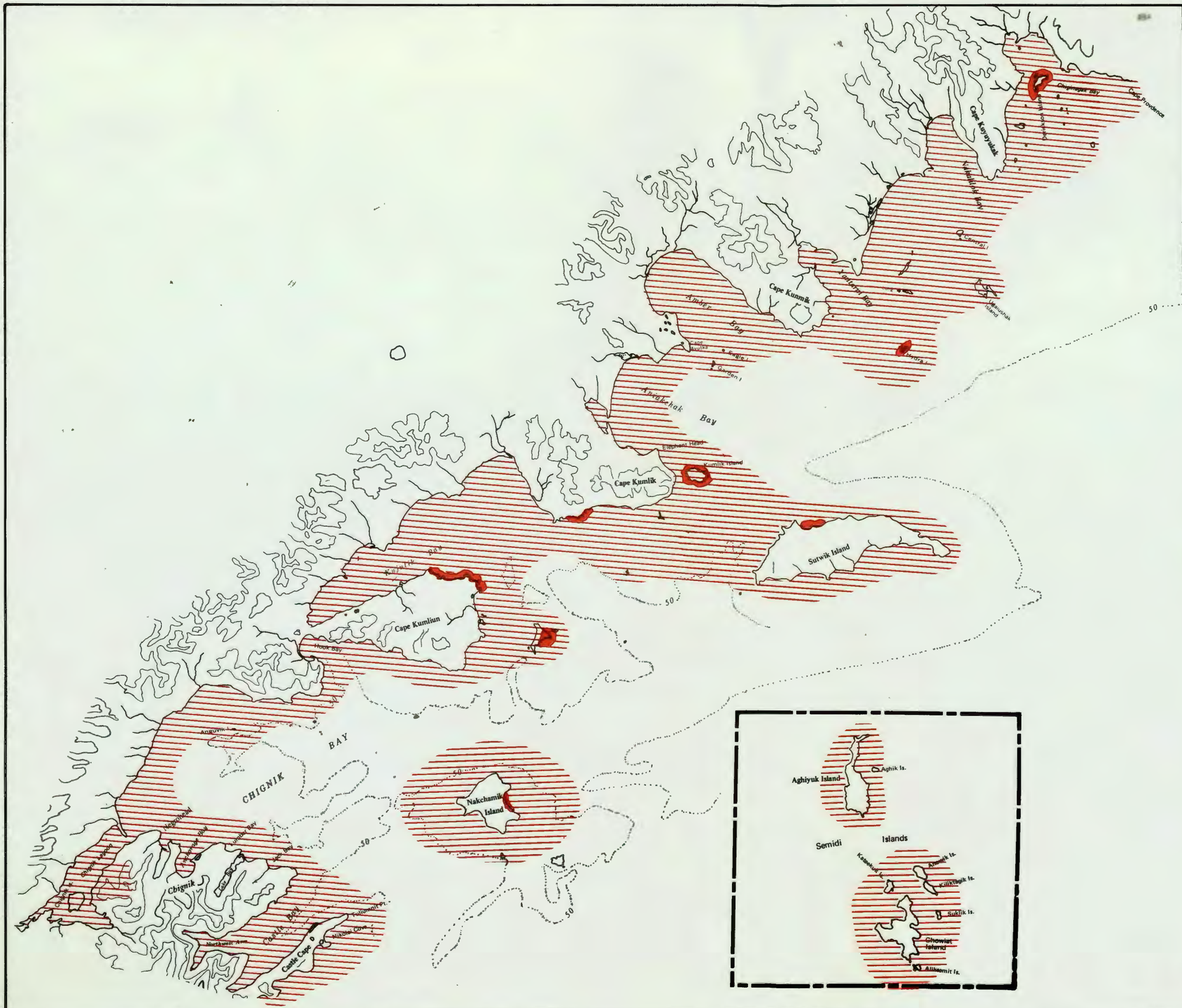
Present

N

SCALE - 1: 350,000

PAULE BAY TO PORT WRANGELL

HS-11



LEGEND

50 — 50 Fathom Curve

Harbor Seal Density

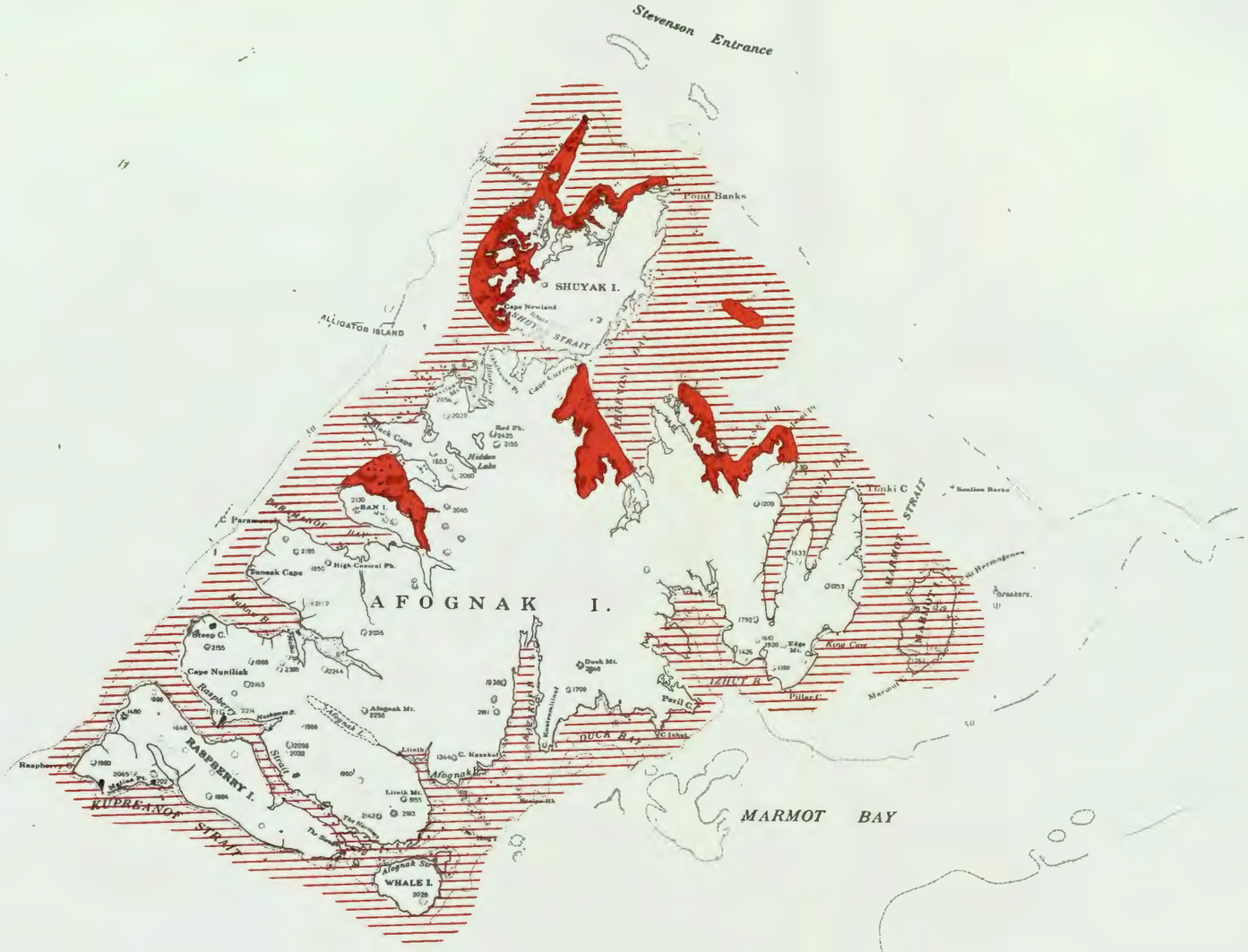
- High
- Present

N

SCALE - 1: 350,000

SUTWIK ISLAND AREA

HS - 12



LEGEND

50 Fathom Curve

Harbor Seal Density

High

Present

N

SCALE - 1: 490,000

AFOGNAK ISLAND AREA

HS-13

KODIAK ISLAND - EAST SIDE

HS-14

LEGEND

50 Fathom Curve

Harbor Seal Density

High

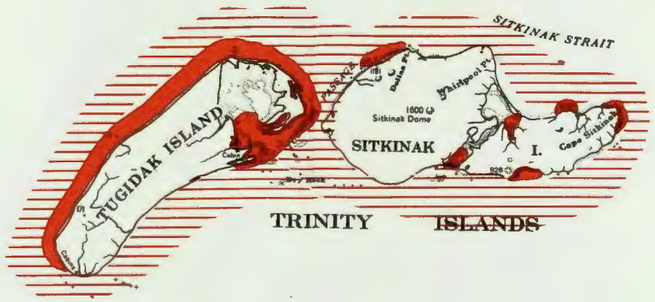
Present

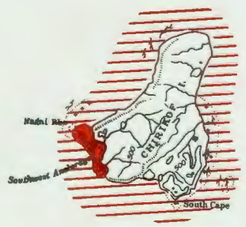
N

SCALE - 1: 490,000

KODIAK ISLAND - WEST SIDE

HS - 15





LEGEND

50 Fathom Curve

Harbor Seal Density

High

Present

N

SCALE - 1: 490,000

TRINITY - CHIRIKOF ISLANDS

HS - 16

APPENDIX A

DISTRIBUTION AND ABUNDANCE OF SEA OTTERS, STELLER SEA LIONS, AND HARBOR SEALS IN PRINCE WILLIAM SOUND, ALASKA

Kenneth W. Pitcher

State of Alaska

Jay S. Hammond

Governor

Department of Fish and Game

James W. Brooks

Commissioner

Division of Game

Robert A. Rausch, Director

Alaska Department of Fish and Game

September 1975

ABSTRACT

Helicopter surveys of marine mammals were conducted along the coastline of the Prince William Sound area in June 1973 and March 1974. These surveys, designed to provide general information on abundance and more specific information on distribution, were directed towards sea otters, Steller sea lions and harbor seals. Observations of other marine mammals were recorded incidentally.

In June 1973, 2,015 sea otters were counted and 1,441 were observed in March 1974. The total population was estimated to be about 5,000. Current distribution patterns were determined. It appears the population is still expanding and animals are becoming established in areas of previously unoccupied habitat.

Based on observations of 5,134 animals in June and 4,614 in March numbers of sea lions occupying the area were estimated at 6,500 to 7,500. During June, sea lions were almost exclusively limited to outside waters. Most of the animals were found near the following five rookeries and summer hauling grounds; Cape St. Elias, Seal Rocks, Fish Island, The Needle and Pt. Elrington. Use of these areas continued in March, but limited movement into inside waters also occurred. Three winter hauling grounds, Glacier Island, Perry Island and Point Eleanor, were located in inside waters. Total numbers of sea lions in the Prince William Sound area appeared to be about the same as those observed in 1956-57, but a considerable increase at Seal Rocks and decrease at Fish Island were noted.

CONTENTS

INTRODUCTION

Current and proposed petrochemical developments in Prince William Sound necessitate increased knowledge of the ecology, distribution and abundance of the area's marine mammal populations. Location of the Trans-Alaska oil pipeline terminus in Valdez will result in construction of oil storage and loading facilities in Port Valdez and heavy oil tanker traffic in the Sound. El Paso Natural Gas Co. has recently announced tentative plans for a trans-Alaska natural gas pipeline with a terminus in Sheep Bay. This would require construction of liquification, storage and loading facilities and tanker traffic would increase. In addition, the Gulf of Alaska is highly regarded as a potential oil and gas source and a lease sale is scheduled for December 1975.

Petrochemical related developments in the area will inevitably result in the contamination of its marine ecosystem. Degradation of marine habitats, whether resulting from chronic low-level contamination or massive spills, may impact marine mammal populations by lowering ecological productivity as well as by direct injury to animals. Baseline abundance data are needed in order to detect and evaluate changes which might occur. Seasonal distribution data are basic to sound recommendations on development in the area, since contingency plans must be based on knowledge of areas important to marine mammal populations.

During the June survey 5,630 harbor seals were counted and 2,965 were seen in March. Although survey techniques were inadequate for estimating population size it is believed the seal population greatly exceeds the number of animals actually observed. A number of seal haul-outs and concentration areas were located. Some changes in seasonal distribution were noted.

ACKNOWLEDGEMENTS

Financial support for this study was provided by Federal Aid in Wildlife Restoration, Project W-17-R and the United States Department of Commerce. The Gulf of Alaska Operators Committee made a major financial contribution which made possible completion of the March survey.

Department biologists who participated in the surveys were: Paul Arneson, Donald Calkins, Albert Franzmann, Charles Irvine, Loyal Johnson, Edward Klinkhart, Julius Reynolds, Karl Schneider, Ronald Somerville and John Vania.

The project was conducted under the direction and supervision of John Vania.

Pilots who flew the helicopters during the surveys were: Gary Center, Jack Farwell, Vern Lofstedt, Don Ward and Glenn Wheeler.

Ansel Johnson, research biologist with the USFWS, participated in the March survey and provided data from a boat survey of part of Prince William Sound.

To all of these I express my thanks.

Depredations of and competition with commercially valuable fisheries by marine mammals in Prince William Sound are problems that can be expected to continue and probably increase in magnitude. Solutions to these problems are incumbent upon a thorough knowledge of the biology of the animals involved.

Widespread public concern for the welfare of marine mammal populations has been demonstrated during recent years. The Marine Mammals Protection Act of 1972 is a misguided manifestation of this concern. The need for accurate and complete information on marine mammal populations became evident during hearings before this Act became law.

This report presents data reflecting our current knowledge of marine mammal distribution and abundance in the Prince William Sound area. Emphasis is placed on sea otters (*Enhydra lutris*), Steller sea lions (*Eumetopias jubata*) and harbor seals (*Phoca vitulina*), but other marine mammal observations are also reported. Much of this information is general in nature, but in many instances sufficient detail is presented to provide direction for the decision making process. Should large-scale oil spills or other environmental contamination occur, the detailed information on marine mammal distribution and concentration areas will indicate priorities for containment and cleanup operations. Major changes in marine mammal use patterns or population numbers should be detectable by repetition of all or parts of the survey and comparison of the results obtained with the baseline data provided in this report.

METHODS

Most of the data presented were collected during two shoreline surveys of the Prince William Sound area from Cape Puget to Cape St. Elias. These surveys, designed to collect information on distribution and abundance of sea otters, sea lions and harbor seals, were conducted from June 24-29, 1973 and from March 5-20, 1974. Surveys were flown with five-place jet turbine helicopters, Jet Rangers (Bell 206A) and Fairchild-Hiller 1100's. Supplemental surveys, using a Cessna 180 and Piper Super Cub (PA-18), were conducted on the Copper River Delta, Controller Bay and Bering River on July 25 and 26, 1973. Port Wells, Passage Canal, Blackstone Bay, Cochrane Bay and Esther Island were surveyed using a 17' Boston Whaler skiff between May 17 and June 8 1973. Portions of Elrington, Evans, LaTouche, Knight, Green, Montague and Hinchinbrook Islands plus Port Gravina, Sheep Bay and Simpson Bay were surveyed from the "M/V Aleutian Tern" between March 15 and 21, 1974.

Helicopter surveys were flown at altitudes of 200-400 feet about 200 yards offshore. The contour of the shoreline was followed and offshore rocks and islets were circled. Airspeed was usually about 70 knots but when concentrations of animals were found, speed was reduced. Two observers and one recorder-observer were in each helicopter. One observer was seated in the front, and the helicopter was always flown so he was on the shoreward side. A recorder-observer was seated directly behind the front seat observer and helped with observations when not recording. The third observer, in the back on the offshore side of the

aircraft, and the pilot also assisted in making observations. All observations were called out to the recorder who was equipped with large-scale nautical charts and notebooks in which all data were recorded. In some instances visual counts were supplemented with photographs to provide a more precise estimate of numbers. A 35mm camera with 50 or 105mm lens and a medium-speed, black and white film (Kodak Plus - X) were used. Such photographs were useful when concentrations of animals, such as sea lion rookeries, large pods of sea otters and large seal hauling areas, were found.

Locations of sea lion rookeries and most hauling grounds were known prior to our surveys. When these areas were approached in the helicopter, the observers prepared themselves to photograph and estimate numbers of sea lions. An initial pass was made approximately 75 yards offshore at an altitude of about 500 feet. Airspeed was reduced to allow photographs to be taken and visual estimates of numbers to be made. The front seat observer estimated numbers while the backseat observer-recorder photographed the animals. After the initial pass, most of the adults had entered the water and the pups were counted. Approach and method of coverage were modified slightly from area to area because of varying topography. Sea lion numbers were later counted from 8 x 10 inch black and white prints.

Fixed-wing aircraft surveys were flown with a single observer-recorder seated directly behind the pilot in the PA-18 or alongside the pilot in the Cessna 180. Airspeed was 70-100 knots and the altitude was

300-700 feet. Data were recorded in a similar fashion to the helicopter surveys. Photographs were used to supplement visual counts.

Boat surveys were conducted at slow speeds (5-7 knots) and followed the contour of the shoreline. Binoculars were used as an aid in sighting and identifying the animals. Data were recorded in a similar manner to the aerial surveys.

SEA OTTER

Historical records indicate that sea otters were fairly abundant in Prince William Sound prior to intensive Russian hunting which began about 1795 (Lensink 1962). It appears that by 1800, however, populations of sea otters in the area had been reduced to very low levels. Continued Russian hunting through 1867 and American exploitation until 1911 prevented their recovery.

Small, remnant groups of animals apparently survived in isolated areas as indicated by Kenyon's (1969) report of two, illegally taken sea otter skins seized by the government at Seward in 1924. Repopulation to current levels undoubtedly was the result of buildup and dispersal of these remnant groups. The general pattern of population recovery and dispersal is fairly evident when Lensink's data derived from historical sources and surveys during 1959 and 1960 are examined along with Department records and results of our surveys (Table 1). Fig. 1 illustrates this

Table 1 Summary of sea otter surveys and sightings, Prince William Sound - Kayak

Area	Pre-1959[a]	1959[b]	1960[b]	1964[c]	1970[c]	1973[d]	1974[d]
Kayak I.	N.S.*	163	122	39	5	7	10
Hawkins I.	1 (1951)	N.S.	N.S.	N.S.	1	4	123
Bench. I.	150 (1951)	58	48	167	101	367	86
Montague I.	78 (1957)	349	100	42	259	514	206
Green I. area	N.S.	42	101	116	103	135	152
Galena Bay to Fish Bay	N.S.	N.S.	N.S.	N.S.	1	6	2
Fish Bay to Cordova	N.S.	0	N.S.	N.S.	104	199	311
Esther Pass. to Valdez Arm	N.S.	0	N.S.	N.S.	N.S.	24	132
Naked, Storey, Peak I.	N.S.	1 (1959)	0	0	N.S.	159	40
Knight, Eleanor I.	2 (1956)	N.S.	1	3	145	241	77
Int. Wells, College, Harr. Fiords, Esther I.	N.S.	N.S.	N.S.	N.S.	N.S.	35	47
Nellie Juan to Passage Canal	N.S.	0	N.S.	N.S.	1	15	51
P. Bainbridge, Latouche area	64 (1949)	96	149	41	133	309	206

Other Sightings of Interest

1.	Montague I.	Present	1936
2.	Whittier	6	winter 1969-70
3.	Perry I.	5	1968
4.	Falls Bay	4	1968
5.	Dangerous Pass	5	1968
6.	Kayak I.	85-100	1965
		35	1968

N.S. = not surveyed

a. Lensink (1962) - summary of miscellaneous observation.
b. Lensink (1962) - fixed wing aerial survey.
c. ADF&G - fixed wing aerial survey.
d. ADF&G - helicopter survey.

continuing process of repopulation in the Prince William Sound area. Sizable groups of otters were reported during the late 1940's and early 1950's from the Montague, Hinchinbrook, Latouche, Elrington, and Kayak Island areas. In addition, occassional sightings of one or two animals were made in other areas (Lensink 1962). In the early 1960's distribution remained about the same but numbers appeared to have increased (ADF&G unpublished data). By 1970, Knight and Naked Islands and Port Gravina were well populated and since then otters have moved into Sheep Bay and Orca Inlet. College and Harriman Fiords, the north end of Culross Island, Glacier Island and the Fairmount - Olsen Island area all appear to be newly populated. Additional small groups and single individuals are occasionally seen almost anywhere in Prince William Sound. Sightings are becoming increasingly frequent in the formerly barren, northwestern portion of the Sound.

The process of dispersal appears to be following the two patterns outlined by Kenyon (1969). Movement of large numbers of otters from densely populated areas to adjacent unpopulated habitat appear to have occurred around Knight Island, Naked Island, and the Port Gravina - Sheep Bay area. The second type of dispersal, in which wandering individuals accumulate to form colonies in good habitat a considerable distance from dense populations, has apparently taken place in the Harriman - College Fiord area and around the north end of Culross Island.

Kenyon (1969) presented data indicating that body weight of sea otters decreased considerably when food was a limiting factor. If this holds true Prince William Sound otters are not generally food-limited. Weights from animals captured during transplant operations are some of the highest recorded (ADF&G unpublished data). The severe, periodic "die-offs" which occur at Amchitka Island when populations outstrip food resources (Kenyon 1969) apparently have not yet occurred in Prince William Sound. There are some indications, however, that subadult mortality has steadily increased around Montague Island although all information indicates that population is still growing and new areas are being populated. Areas which appear to be acceptable habitat but are not presently supporting significant sea otter populations include Perry Island, Bligh Island and Galena Bay.

Helicopter surveys are useful in determining and monitoring changes in sea otter distribution. They are of only limited value in determining magnitude and changes in population size however (Schneider 1971). Because numerous factors influence the number of animals seen survey results vary greatly. Distribution of sea otters will affect the number seen. When animals are scattered offshore, many are missed during a shoreline survey. Higher counts will be obtained when otters are found in large pods close to shore as they are less likely to be missed. Kenyon and Spencer (1960) assumed that nearly 25 percent of the otters in the flight path will be submerged and missed during a survey. Estes and Smith (1973) stated that during periods of minimum feeding

activity approximately 30 percent of a population will be underwater at a given instant. In addition, weather conditions, time of day, observer experience and ability and pilot ability all affect survey results.

Survey conditions were superior during the June survey. In March, sun glare and wind were a continual problem reducing the effectiveness of the observers. Otter distribution was also different during the two surveys. Animals were usually found in the same general areas but during March they were much more scattered with some animals far offshore. Few large groups were seen during March in contrast to June when a number of sizable pods were noted. Differences in survey conditions and animal distribution probably account, to a great extent, for the difference in numbers of otters observed on the two surveys. During the June survey 2,015 otters were seen compared to 1,441 in March.

Lensink (1962) estimated the 1960 Prince William Sound - Kayak Island populations at 1,000 - 1,500 based on actual observations of 702 otters during a fixed-wing aircraft survey. Considering recent information on the accuracy of various types of sea otter surveys (Schneider 1971), his estimate was probably ultraconservative, possibly erring by 100 percent. The Alaska Department of Fish and Game (1973) estimated the population at 5,000. This figure seems reasonable in light of the numbers of otters counted on the past two surveys. Comparative shore - helicopter counts on Amchitka Island showed that two to four times as many animals could be counted from shore and even then some are missed (Schneider 1971).

Sea otter numbers around Kayak Island appear to have dropped in recent years. Aerial surveys in 1959 and 1960 accounted for 138 and 122 animals, respectively (Lensink 1962). Six Department surveys between 1964 and 1974 failed to find more than 39 otters although a commercial pilot reported seeing 85-100 in 1965 (Table 1). Reasons for the apparent decline are not known but several possibilities have been advanced. Changes in habitat resulting from the 1964 earthquake might have reduced carrying capacity although some areas in Prince William Sound appeared to experience more severe disturbance without corresponding reductions in numbers. Reports of otters down the coast toward Yakutat have caused speculation of emigration.

Several possible shifts in distribution were detected during the March survey. It is difficult to determine with only two surveys whether these represent; (1) changes in seasonal distribution, (2) range extensions, (3) normal variations within the distribution of groups of otters, or (4) variation resulting from differences in survey conditions, observers, pilots, etc. representing no actual change in distribution.

During the March survey, 115 otters were counted in Orca Inlet where none were seen during the June survey. This is not a recent range extension as we have received reports from the public on this group of otters for several years. The animals were probably present but not seen in June. Because shallow water extends far offshore in this area sea otters could easily be missed in a shoreline survey.

A major shift in distribution appeared to have occurred in the Sheep Bay area where 202 otters were counted in March compared to 5 in June. This is probably a range extension of the group of otters that has been located in the Knowles Head - Port Gravina area for the past 4-5 years.

The Glacier Island - Unakwik Inlet area appeared to have more sea otters in March, when 126 were seen, than during June when only 16 were counted. At the same time nearby Naked Island showed a marked reduction from 159 otters in June to 40 in March. This possibly represents a shift of otters from one area to the other.

The western side of the Sound, from Chenega Island north seemed to have more otters in March than in June. During the winter survey 173 sea otters were counted as compared to 66 in June. Whether this represents a true increase or is the result of variation inherent to the survey technique is not known.

March counts of sea otters at Hinchinbrook, Montague, Green, Knight, Latouche and Bainbridge Islands were down considerably. In June, 1,550 were seen in these areas, compared to only 652 in March. These are all areas with well-established otter populations and it is unlikely that there was an actual reduction in numbers. As previously mentioned, survey conditions and animal distribution during the March survey were not conducive to seeing large numbers of otters. Repetitive

helicopter counts of otters on Amchitka Island, which range from 1,545 to 4,042 (ADF&G unpublished data), illustrate the variations which occur on this type of survey.

Kenyon (1969) reported that in the Aleutian and Shumigans Islands otters regularly haul out on land. They favor rocky points but also utilize sand beaches, spits and islets. Reports of sea otters hauling out in the Prince William Sound area are relatively rare. Edward Klinkhart (ADF&G, Anchorage, AK., pers. comm.) stated that otters were routinely hauling out on Okalee Spit in March 1964. He saw a group of about 51 animals hauled out on the tip of the spit on March 1, 1964. On the same date he reported seeing 52 sea otters hauled out on the spit at the mouth of Boswell Bay. The Department has received a number of other reports of otters hauled out at Boswell Bay so it is apparently not uncommon.

During the June survey only one instance of hauling out was noted. A female and pup were seen hauled out on a floating glacial ice pan in Icy Bay. During March a number of otters were seen hauled out. Ice shelves which formed at the heads of many bays were commonly utilized. Three otters were seen hauled out on snow banks just above the high tide line and one had hauled out on a tidal rock. Sea otter tracks and beds were noted in the snow on several small islets and points.

It appears from these reports and observations that sea otters in the Prince William Sound area do not haul out with nearly the frequency

or regularity they do in the Aleutian Islands. "This behavior is apparently quite rare in summer but increases in winter months; with ice the favored hauling substrate.

Selected portions of Prince William Sound were surveyed from the 65 foot "M.V. Aleutian Tern" between March 15-20, 1974. The emphasis was on sea otters but notes on seals and sea lions were made. Areas covered included portions of Evans, Elrington and Latouche Islands, Knight and Green Islands, Applegate Rocks, Sheep Bay, Simpson Bay and Port Gravina. The survey technique was described by Schneider (1974).

This repetitive count, using a different counting platform, gives considerable insight into the shortcomings and variability of survey techniques for estimating population size. Data in table 2, a comparative summary of otter sightings in areas surveyed both by boat and helicopter, add support to Schneider's (1971) contention that boat surveys are considerably more efficient than aerial surveys. Schneider stated further that shore counts are higher than boat counts and even then obviously not all animals are counted.

In the Aleutian Islands, sea otters form sexual aggregations which have been studied by several observers; Lensink (1962), Kenyon (1969) and Schneider (1972, 1973). These workers found discrete "female areas" composed of females, pups and some mature males and "male areas" in which numerous subadult males and some older males were found. Numbers

Table 2. Comparison of numbers of sea otters counted in areas surveyed by both helicopter and boat.

	Boat	Helicopter	% Difference
gton I.	16	14	+ 14%
[illegible]	55	33	+ 66%
[illegible]e I.	51	12	+325%
[illegible]t I.	180	59	+205%
[illegible] area	201	152	+ 32%
Gravina-Sheep Bay	480	299	+ 61%
son Bay	0	0	0%
l	983	569	+ 73%

of males in the female areas varies directly with the number of estrous females. In the Aleutians, male areas are usually found where shallow water extends further offshore than normal, often near an exposed point of land or a pass between islands. Female areas are often points with water sheltered by rocks and islets (Schneider 1973).

If sexual segregation exists in Prince William Sound, it doesn't appear to take the same form as in the Aleutians (Calkins 1972). Some areas seem to have characteristics of female areas but no discrete male areas have been found (Schneider 1973). Habitat is considerably different from the Aleutians and sexual segregation could possibly be expressed in a different way.

Accurate knowledge of segregation and identification of specific areas would be important in event of localized kills of sea otters. It would be impossible to adequately evaluate effects on the population without knowing which segments were involved.

SEA LION

Information available on sea lion populations in the Prince William Sound area prior to our surveys was limited to that derived from census work in 1956 and 1957 by Mathisen and Lopp (1963), population studies on Fish Island (Lewis Island) (Brooks 1956), a behavioral study of sea lions on Fish Island (Sandegren 1970) and incidental observations by Department personnel. These provided fairly good background information for rookeries and summer hauling grounds but were incomplete, particularly during winter months.

Apparently a large proportion of sea lion populations haul out on traditional rookeries and hauling grounds. Rookeries and summer hauling areas are almost exclusively located along the outside coast. Generally, these areas are also used in winter, but in some instances by reduced numbers of animals. In winter, some movement of sea lions into more sheltered, inside waters occurs.

Although breeding females and mature territorial bulls are strongly tied to rookeries, Sandegren (1970) observed considerable movement to and from a rookery. Some territorial bulls went to sea occasionally while others remained on the rookery for over 60 continuous days. Females tended to make periodic trips to sea, probably for feeding purposes, but cows about to give birth, who have just given birth, or are estrous were reluctant to leave the rookery. Peak numbers of animals are usually ashore about midday (Mathisen and Lopp 1963 and Sandegren 1970). Stormy weather, high surf, high tides, disturbance and high solar radiation all appear to cause animals to return to the water. Numbers of animals found hauled out are usually greatest during summer (Mathisen and Lopp 1963). Population estimates based on rookery and hauling ground counts must be considered minimal as some animals will almost certainly be in the water at any given time. The various factors which influence haul out behavior must be considered when planning a rookery count or when interpreting the results.

Locations of rookeries and hauling grounds and number of sea lions seen during the two surveys are shown in fig. 2.

Sea lions utilize the Cape St. Elias area both summer and winter (Table 3). Mathisen and Lopp (1963) photographed these animals on October 2, 1957 and counted 1,253 adults and 90 pups. During our June 1973 survey we found 1,548 adults and 18 pups, mostly located on the exposed rocks, just south of Pinnacle Rock. The winter survey, on March 6, 1974, was hampered by gusty winds and turbulence resulting in poor quality photos. A minimum of 505 sea lions were present mostly located on a rocky beach on the southwest end of Pinnacle Rock.

Seal Rocks, located in Hinchinbrook Entrance, appear to be the largest breeding rookery and winter hauling ground in the Prince William Sound area at present. In 1956-1957 Mathisen and Lopp (1963) censused the area three times, counting a maximum of 183 sea lions. The Bureau of Land Management took aerial photos in 1966 which showed 864 sea lions. Our June 1973 survey indicated there were 1,733 animals, including 200 pups, while the March 1974 survey revealed 1,750 sea lions. There was a local change of distribution on Seal Rocks from summer to winter. During the summer the central rock-gravel beach served as the rookery area. In March no sea lions were using this area but 200 harbor seals were hauled out on the beach. Numbers of sea lions using the area appear to have increased considerably since the late 1950's.

Sea lion population numbers of Fish Island (also known as Lewis Island), the outermost of the Wooded Islands, are the most extensively documented of any group of sea lions in Prince William Sound (Table 3).

Table 3. Summary of sea lion rookery and hauling ground counts.

Area	Date		Number of sea lions
Cape St. Elias	2 Oct. 1957[a]		= 1,343
	26 June 1973[b]	1,584 ad. +18 pups	= 1,566
	6 March 1974[b]		= 505
Seal Rocks	22 July 1956[a]	162 ad. + 21 pups	= 183
	24 March 1957[a]		= 0
	2 Oct. 1957[a]		= 95
	4 Sept. 1966[c]		= 846
	26 June 1973[b]	1,533 ad. + 200 pups	= 1,733
	5 March 1974[b]		= 1,750
Fish I. (Lewis I.)	22 July 1956[a]	466 ad. + 213 pups	= 679
	Summer 1956[d]	2,400 ad. + 100 pups	= 2,500
	1 Sept. 1956[a]		= 2,556
	14 Dec. 1956[a]		= 1,694
	24 March 1957[a]		= 810
	27 June 1957[a]		= 3,000
	2 Oct. 1957[a]		= 3,762
	27 May 1968[e]	1,500 ad. + 49 pups	= 1,549
	26 June 1973[b]	1,243 ad. + 26 pups	= 1,269
	6 March 1974[b]		= 1,114
The Needle	21 July 1956[a]	179 ad. + 16 pups	= 195
	1 Sept. 1956[a]		= 150
	14 Dec. 1956[a]		= 165
	24 March 1957[a]		= 190
	27 June 1957[a]	179 ad. + 0 pups	= 179
	2 Oct. 1957[a]		= 130
	26 June 1973[b]	234 ad. + 2 pups	= 236
	6 March 1974[b]		= 568
Glacier I.	12 March 1974[b]		= 55
Pt. Eleanor	15 March 1974[b]		= 91
Perry I.	24 March 1957[a]		= 80
	16 March 1974[b]		= 153
Pt. Elrington	21 July 1956[a]	25 ad. + 6 pups	= 31
	1 Sept. 1956[a]		= 0
	14 Dec. 1956[a]		= 550
	24 March 1957[a]		= 200
	29 May 1957[a]		= 300
	27 June 1957[a]		= 250
	2 Oct. 1957[a]		= 353
	27 June 1973[b]	250 ad. + 0 pups	= 250
	15 March 1974[b]		= 339

a. Mathisen and Lopp, 1963
b. Alaska Department of Fish and Game surveys
c. Bureau of Land Management aerial photo - pups not distinguishable
d. Alaska Fisheries Board and Alaska Department of Fisheries, 1956

It appears that present numbers are considerably less than 1957 levels, possibly by as much as 50 percent, and sea lion distribution has also changed greatly. Sandergren (1970) described extensive changes in the topography of Fish Island resulting from the 1964 earthquake. The rookery area was previously on the north side of the island and is now on the south side. The former rookery is now covered with fallen rock, and the present rookery was formerly free-standing rocks in the ocean. There is a distinct possibility that the change in population size is the result of these tectonic changes in rookery and hauling areas.

The Needle, although utilized by sea lions throughout the year, appears to receive more use during the winter (Table 3). This haul out area is in semi-protected waters and, as our surveys indicate, probably experiences an influx of animals during the winter. The area does not produce significant numbers of pups and during the summer has mostly nonbreeding animals.

No documented records of sea lions hauling out on Glacier I. were available before the March survey. On March 12, 1974, 55 sea lions were photographed on the southeast side of Glacier Island. As no sea lions were seen at this location during the June survey and because it is located in fairly protected waters we concluded that it serves only as a winter hauling ground.

Point Eleanor was documented for the first time as a hauling ground on March 15, 1974 when 91 sea lions were seen hauled out. Local fishermen

and boat operators have been aware of this hauling ground for some time. Use is probably limited to the winter due to its inside waters location.

Perry Island, located on inside waters, appears to be another winter hauling ground. Mathisen and Lopp (1963) found 80 sea lions on March 24, 1957 and we counted 153 lions on March 16, 1974.

Point Elrington, appears to serve as a year-round hauling ground for several hundred animals, but no pupping of significance is known to occur there. Counts vary between 31 and 550 sea lions but are usually between 250 and 350 (Table 3). It appears that more animals use the area in winter than summer.

Danger Island, Knowles Head, Porpoise Rocks and Fox Point have all been reported as minor hauling areas (Mathisen and Lopp 1963 and Alaska Department of Fish and Game 1973). No animals were seen in these areas on either survey and their present use status is unknown.

Total numbers of sea lions counted during the two surveys were similar, 5,134 during the June survey and 4,614 during March, and no difference in winter and summer population size could be detected. Differences in photograph quality and coverage and animal distribution combined with unknown numbers of sea lions at sea prohibit precise estimates of numbers. However, it appears that winter and summer population levels are similar in the Prince William Sound area, a minimal estimate being 6,500-7,500 sea lions.

Distribution of sea lions changed somewhat between the summer and winter surveys. At Cape St. Elias, only 505 sea lions were counted in March compared to 1,566 during June. If this is a true reflection of population size it indicates a winter movement away from Cape St. Elias. Seal Rocks and Lewis Island had similar numbers of sea lions during the two surveys. The Needle and Point Elrington had moderate increases from June to March. Point Eleanor, Perry Island and Glacier Island all inside water areas, were used during the winter only. During the June survey, only 0:07 percent of the sea lions were seen in inside waters compared to 7.3 percent during the March survey. This, plus the fact that the three inside hauling areas were used only during the winter, indicate a small but significant change in seasonal distribution.

Only 246 pups were counted during the June survey. Even though pups are difficult to see and some were undoubtedly overlooked this is very low pup production in relation to the total number of sea lions seen. All of the hauling areas appeared to have a very high proportion of immature animals. Sandegren's (1970) data show a high proportion of nursing subadults in relation to pups produced. These data all suggest that sea lions in the Prince William Sound - Kayak Island area may not be a discrete population but that there may be considerable interchange with other areas, possibly from the larger rookeries of the Kenai Peninsula and Kodiak area.

Total numbers of sea lions counted in the Prince William Sound - Kayak Island area during our surveys are comparable with population data

gathered by Mathisen and Lopp (1963) in 1956 and 1957. There have been two major changes; Seal Rocks has shown a dramatic increase in numbers and Fish Island appears to have declined considerably. Tectonic changes in hauling grounds and rookeries are the apparent cause of these changes in numbers. Both areas uplifted considerably, Fish Island about 11 feet and Seal Rocks about 8 feet (U.S. Geological Survey 1969). The effects, however, were quite different; at Fish Island there was an apparent loss of hauling and breeding areas (for description of changes see Sandegren 1970) while the uplift at Seal Rocks appears to have increased hauling habitat.

The relative stability of the total population over the past 18 years in light of the lack of human exploitation suggests a population at about carrying capacity for the area.

HARBOR SEAL

Detailed information on abundance and distribution of harbor seals in Prince William Sound is not available. Distribution and areas of concentration have been shown in a very general way (ADF&G 1973). Biologists have long noted areas with highly visible concentrations of seals such as Columbia Glacier, the Copper River Delta and Channel Island.

Available survey techniques for harbor seals are not adequate for estimating population size and are marginal for determining distribution.

When seals are underwater they can be seen only under the most favorable conditions i.e. clear, shallow, calm water with good lighting, and even when on the surface, they are difficult to see and most are missed. Seals are most easily seen and accurately counted when hauled out. Various environmental factors apparently affect haul out behavior, with tide probably being most important. It has been our experience that in tidal haul out areas many more seals can be counted at low tide than at high tide. Usually in glacier-fed bays, where seals haul on floating ice pans, the greatest numbers of animals are seen on higher stages of the tide when the floating ice is concentrated near the glaciers (Bishop 1967). There is also some indication that fewer seals haul out during periods of stormy weather than during fair weather. Unfortunately, even when large numbers of seals are hauled out, we have no idea what proportion of the total population we are seeing.

Ideally, a seal survey would only be conducted under optimum conditions; when surface conditions were calm, lighting was good and stage of tide was suitable for the type of haul out area. During these surveys, financial and time constraints prevented restricting the survey to times of optimum conditions. Weather was considered to some degree but stage of tide was disregarded and the results should be considered in this light. Survey conditions during the winter survey were generally poorer than during the June survey. Because of the lower observability of seals under these conditions, winter survey figures were undoubtedly more conservative than summer results.

No estimate of population size can be made from our survey data. Population numbers are undoubtedly far in excess of the 5,630 seen during the June survey and the 2,965 counted during March. Although over 2,600 more seals were counted during the summer survey it would be incorrect to assume that more seals were present. Poorer survey conditions and different distributional patterns make it difficult to compare numbers seen during the two surveys.

The most valuable harbor seal information obtained from the surveys was in regard to distribution, especially locations of concentration areas. The distribution patterns are not complete because of the impreciseness of the survey technique and some concentrations and haul out areas were inevitably missed.

During the summer, the largest concentration of seals was found on the Copper River Delta where 1,349 were counted hauled on sand bars. Controller Bay and the Bering River were other areas where seals used sand bars as a hauling substrate. The Copper River, Miles Lake and Bering River were the only areas where seals were found in fresh water although they have been reported from both Coghill and Miners Lakes (Wallace H. Noerenberg, Fisheries Consultant, Cordova, pers. comm.). Glacial ice pans served as haul outs in Columbia Bay, Unakwik Inlet, College Fiord, Harriman Fiord, Blackstone Bay, Derickson Bay and Nassau Fiord. Offshore rocks and islets served as hauling grounds throughout the area. Concentrations were found at; the Port Chalmers - Stockdale

Harbor area, Seal Island, Applegate Rocks, Channel Island, Little Green Island, Olsen - Fairmount Islands, Naked, Knight, Danger and Evans Islands and Port Bainbridge.

Detectable changes in winter distribution were apparent in several instances. The Copper River Delta, Miles Lake and Bering River, which all had concentrations of seals during the summer, were frozen and devoid of seals during the March survey. The Copper River Delta had the largest single concentration of seals seen during the summer survey. It is unknown where these seals spend the winter months.

Floating ice pans, calved from glaciers, are utilized by seals as haul out platforms. These areas may be especially important for pupping, mainly during the month of June, as large numbers of females with young pups are present. Glaciers are less active in the winter and much less floating ice is present. This probably was the reason for the reduction in numbers of seals seen in these areas during the March survey. During June 499 seals were seen hauled out on glacial ice pans compared to only 93 in March.

The heads of many bays, particularly those with sizable fresh water streams, freeze over during the winter and seals often use these ice shelves as haul outs. Most hauling out is along the ice edge but occasionally holes up to a half mile back from the ice edge are used.

During March considerably fewer seals were counted at some of the rock haul out areas than were seen during the June survey. Notable reductions were seen in the Port Chalmers - Stockdale Harbor area, at Danger, Channel, Little Green and Seal Islands, Bay of Isles and Prince of Wales Passage. Conversely, considerably more seals were seen at Seal Rocks, Montague Point, Jeannie Cove and Port Nellie Juan during the March survey. It is impossible to determine, from the data now available, whether these represented changes in distribution or were a result of timing and conditions during the two surveys.

OTHER MARINE MAMMALS

Dall porpoises (*Phocoenoides dalli*) and harbor porpoises (*Phocoena phocoena*) are common year-round residents of Prince William Sound and numerous sightings were made on both surveys.

Six minke whales (*Balaenoptera acutorostrata*) were seen during the June survey; two near Green Island, one at Bainbridge Island and three just east of Seal Island. In the past, Department biologists have reported this whale as common around the northwestern portion of Montague Island and Passage Canal during summer.

Eight observations of humpback whales (*Megaptera novaeangliae*) were made during the June survey, all in the southwestern portion of the Sound. Three were seen outside of Shelter Bay on Evans Island and five were found around Bainbridge Island. One humpback was seen from a boat near Point Pigot on August 1, 1973.

On June 27, 1973, a group of at least 40 and possibly as many as 100 killer whales (*Orcinus orca*) was seen between Evans and Knight Islands. Three were seen in Bass Harbor at Naked Island, three were observed off the east side of Perry Island and one at Busby Island, all during June. We did not see killer whales during the March survey but have received reliable reports of winter sightings. Larry Haddock (Wildlife Biologist, USFWS, Anch. pers. comm.) reported seeing an estimated 50 killer whales in Knight Island Passage during March 1973. Rick Rosenthal (Biological Consultant, Dames and Moore, Anch., pers. comm.) saw 4 killer whales near Porpoise Rocks about May 8, 1974.

A single adult male northern fur seal (*Callorhinus ursinus*) was seen with 17 immature male sea lions on a rock off the southwest end of Elrington Island on June 27, 1973.

SUMMARY AND CONCLUSIONS

Sea otter distribution was determined for the Prince William Sound area. All areas previously known to support otters continue to do so although numbers appear to be reduced in the Kayak Island area. The population appears to still be expanding and new areas are being populated. Between the two surveys, one major shift appeared to have occurred. Over 200 otters were seen in Sheep Bay in March compared to 5 in June. This appears to be a range extension of the group of sea otters which have been found in the Point Gravina area for the past 4-5 years. More sightings were made in the northwestern portion of the Sound in March than in June. Whether this represents movement of animals into the area

or is the result of a higher proportion of animals being seen in March is unknown. Indications are that the population will continue to expand and disperse, probably at a fairly rapid rate. A gross total population estimate is 5,000 based on results of the two surveys plus information from comparative shore-helicopter counts on Amchitka Island.

Summer distribution of sea lions was found to be almost exclusively limited to five rookeries and hauling grounds located in outside waters. During the winter these same areas were used as hauling grounds but some animals moved into inside waters and used several hauling grounds there. Counts of sea lions totaled 5,134 during June and 4,614 during March. Population size is estimated at 6,500-7,500. Total numbers appear to be about the same as during 1956-57 but an increase was detected at Seal Rocks and a decrease at Fish Island. Pup production was low, only 246 were recorded during the June survey. Large numbers of immature animals were seen. It appears that sea lions in Prince William Sound may not be a discrete population but that animals are moving to the Sound from other areas. A marking and recovery program on rookeries in Prince William Sound, the Kenai Peninsula and Kodiak area should provide needed information on degree of interchange and population discreteness. The 1964 earthquake appears to have changed hauling habitat on both Fish Island and Seal Rocks and there seems to be a corresponding increase of numbers at Seal Rocks and a decrease at Fish Island.

Useful information on harbor seal distribution, concentrations and hauling areas was obtained but cannot be considered complete due to shortcomings of the survey technique. Major summer concentration and haul out areas include: Controller Bay, Copper River Delta, Columbia Bay, Seal Island, Applegate Rocks, Channel Island, Little Green Island, Knight Island, College Fiord, Blackstone Bay, Danger Island and Evans Island. During winter seals were not found on the Copper River Delta or up the Bering River as they were ice covered. There was less use of glacial ice pans as hauling areas (probably because glaciers are less active and much less ice is calved). Seals hauled on ice shelves at the heads of many bays. Other possible changes in seasonal distribution were noted but due to difficulties in surveying seals they may not be valid. No population estimate can be made but it undoubtedly is far in excess of the 5,630 seen in June and the 2,965 counted in March. More precise information on numbers and distribution could be obtained by using skiff surveys under optimum tide and weather conditions. This technique is probably too time-consuming for the entire area but may be worthwhile in areas of special interest.

LITERATURE CITED

Alaska Department of Fish and Game. 1973. Alaska's Wildlife and Habitat. Anchorage, Alaska. 143pp. + 563 maps.

Bishop, R.H. 1967. Reproduction, age determination and behavior of the harbor seal, (*Phoca vitulina*) L., in the Gulf of Alaska. MSc. Thesis Univ. Alaska, College, Alaska. 121pp.

Brooks, J. W. 1956. In Alaska Fisheries Board and Alaska Department of Fisheries. Annual Report No. 8. Juneau, Alaska 118pp.

Calkins, D.G. 1972. Some aspects of the behavior and ecology of the sea otter, (*Enhydra lutris*), in Montague Strait, Prince William Sound, Alaska. MSc. Thesis Univ. Alaska. College, Alaska. 55pp.

Estes, J.A. and N.S. Smith. 1973. Research on the sea otter, Amchitka Island, Alaska. Final Rept. USAEC. NVO-520-1. 85pp.

Kenyon, K.W. 1969. The sea otter in the eastern Pacific Ocean. USFWS. North American Fauna No. 68. 352pp.

_____ and D.L. Spencer. 1960. Sea otter population and transplant studies in Alaska, 1959. USFWS, Spec. Sci. Rept. Wildl. No. 48:1-29pp.

Lensink, C.J. 1962. The history and status of sea otters in Alaska. PhD. Thesis. Purdue Univ. Lafayette, Ind. 188pp.

Mathisen, O.A. and R.J. Lopp. 1963. Photographic census of the Steller sea lion herds in Alaska, 1956-58. USFWS, Spec. Sci. Rept. Fish. No. 424: 20pp.

Sandegren, F.E. 1970. Breeding and maternal behavior of the Steller sea lion (*Eumetopias jubata*) in Alaska. MSc. Thesis. Univ. Alaska, College, Alaska. 138pp.

Schneider, K.B. 1971. An evaluation of sea otter survey techniques. Alaska Department of Fish and Game. Unpubl. report. Anchorage, Alaska. 18pp.

_____. 1972. Sea otter report. Alaska Fed. Aid Wildl. Rest. Rpt. Proj. W-17-4. 15pp.

_____. 1973. Sea otter report. Alaska Fed. Aid Wildl. Rest. Rpt. Proj. W-17-5. 15pp.

_____. 1974. Sea otter report. Alaska Fed. Aid. Wildl. Rest. Rpt. Proj. W-17-5. 18pp.

U.S. Geological Survey. 1969. The Alaskan earthquake, 27 March 1964, regional effects - tectonic. USGS Geo. Sur. Prof. Paper.

U.S. Dept. of Commerce. 1964. U.S. Coast Pilot, Pacific and Arctic Coasts, Alaska, Cape Spencer to Beaufort Sea. United States Government Printing Office.

LEGEND

50 Fathom Curve

N

Scale - 1:1,338,270

SEA OTTER
DISTRIBUTION MAPS

PRINCE WILLIAM SOUND
COPPER RIVER DELTA

APPENDIX I

Sea Otters Present

Figure 1 **Historical Sea Otter Distribution Prince William Sound Area 1950 to 1974**

VICINITY MAP

LEGEND

50 — 50 Fathom Curve

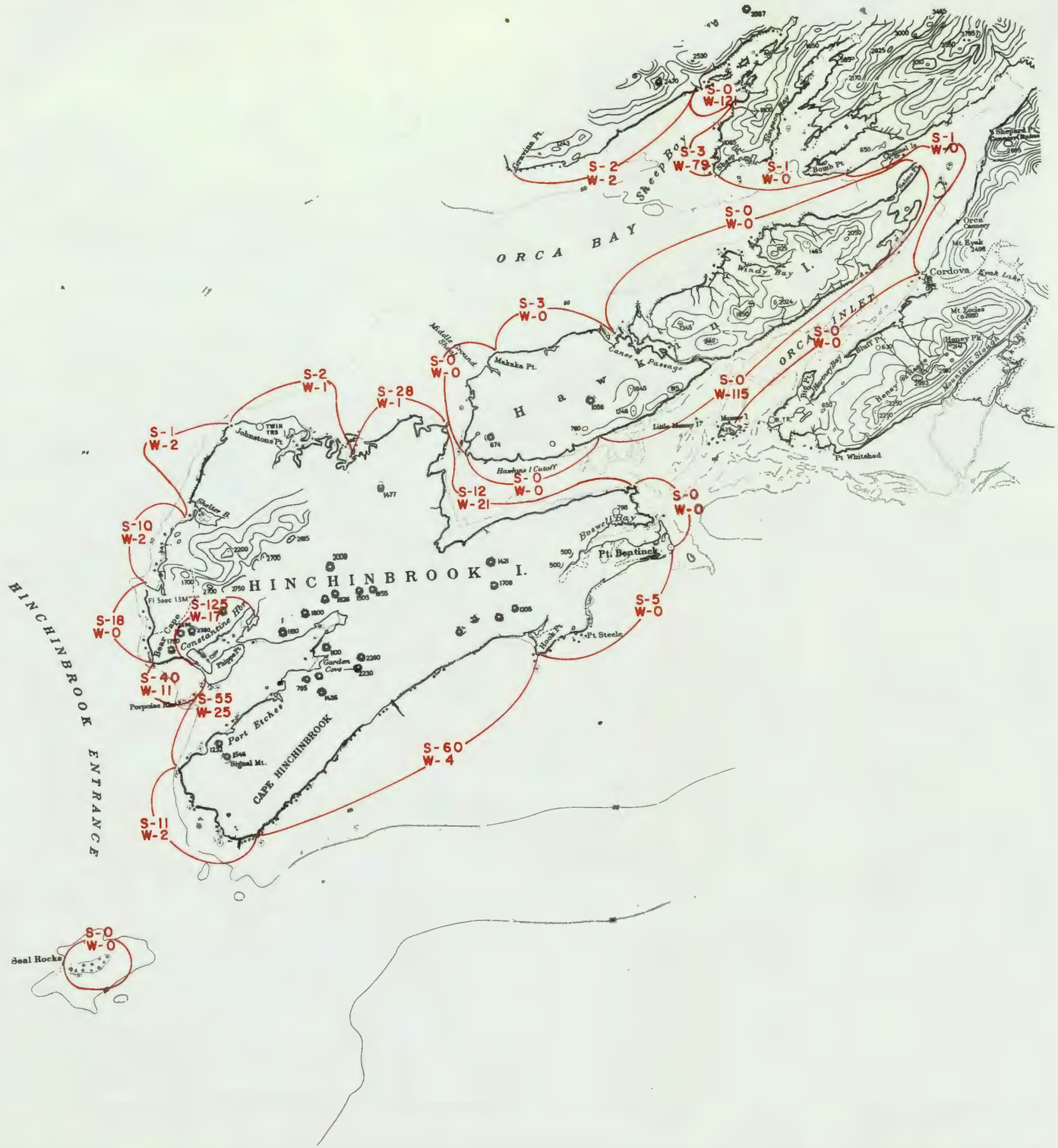
Sea Otter Surveys
S = June 1973
W = March 1974
Number Counted
S = 7
W = 18

N

SCALE - 1: 350,000

KAYAK ISLAND
COPPER RIVER AREA

SO-1



LEGEND

50 Fathom Curve

Sea Otter Surveys
S = June 1973
W = March 1974

Number Counted
S = 377
W = 403

N

SCALE - 1: 270,000

HINCHINBROOK
HAWKINS ISLANDS AREA

SO-2

LEGEND

50 Fathom Curve

Sea Otter Surveys
S = June 1973
W = March 1974
Number Counted
S = 677
W = 358

N

SCALE - 1: 270,000

MONTAGUE ISLAND AREA

SO-3

LEGEND

50 Fathom Curve

Sea Otter Surveys
S = June 1973
W = March 1974
Number Counted

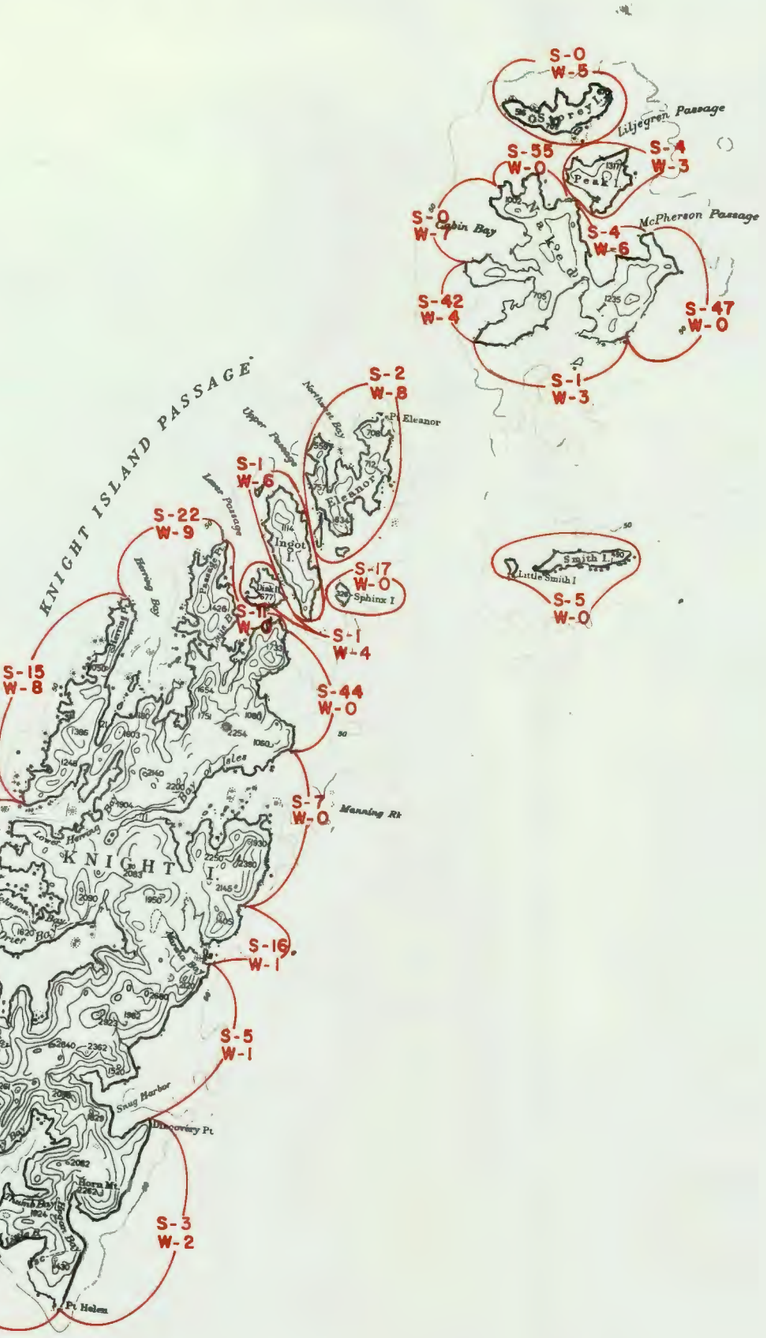
S = 214
W = 144
* Offshore Flightline

N

SCALE - 1: 270,000

VALDEZ ARM
PORT GRAVINA AREA

SO-4



LEGEND

50 Fathom Curve

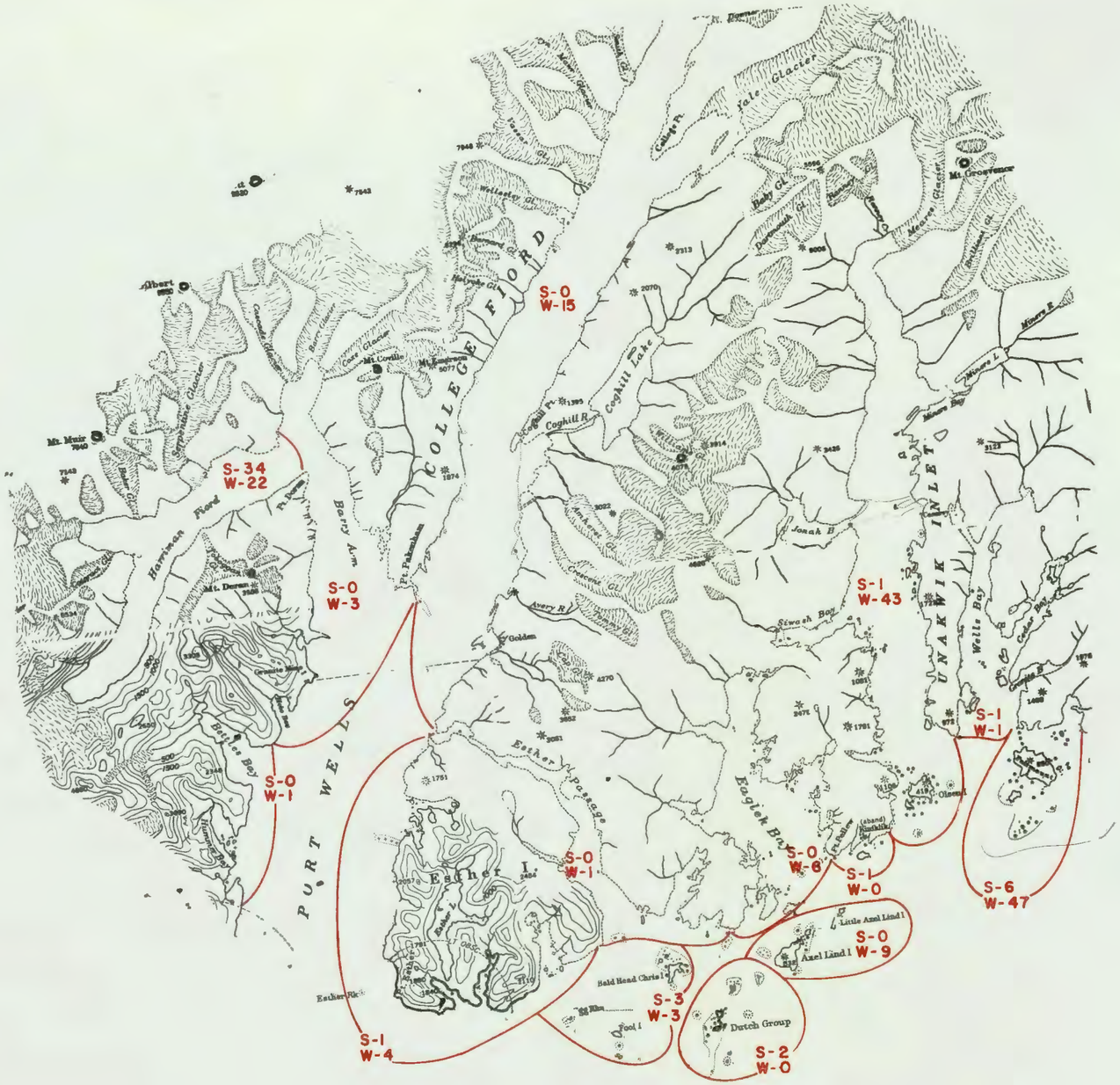
Sea Otter Surveys
S = June 1973
W = March 1974
Number Counted
S = 366
W = 105

N

SCALE - 1: 270,000

KNIGHT ISLAND AREA

SO-5



LEGEND

50 Fathom Curve

Sea Otter Surveys
S = June 1973
W = March 1974

Number Counted
S = 49
W = 155

N

SCALE - 1: 270,000

PORT WELLS
UNAKWIK AREA BAY PASSAGE

SO-6

LEGEND

50 Fathom Curve

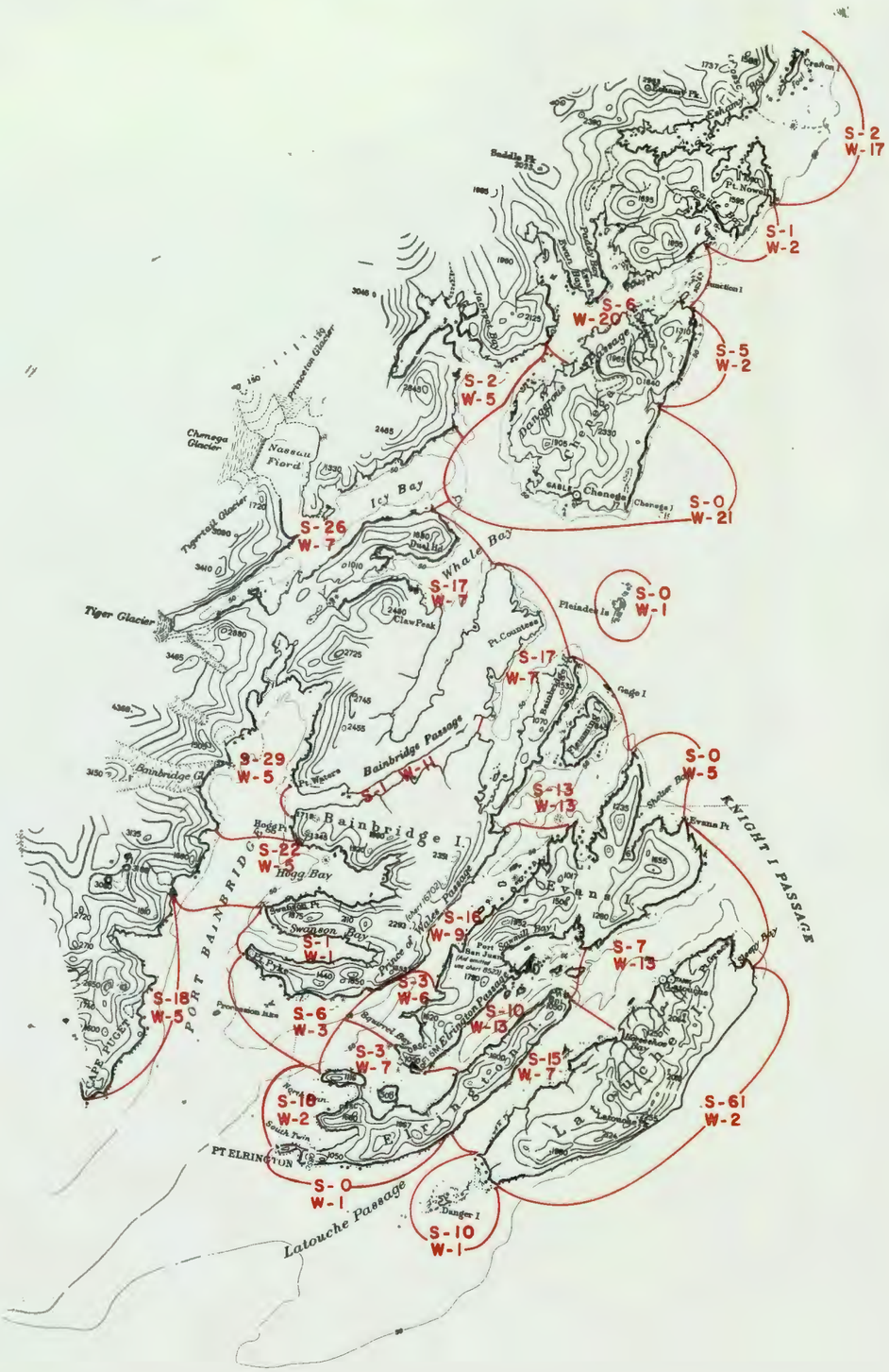
Sea Otter Surveys
S = June 1973
W = March 1974
Number Counted
S = 16
W = 60

N

SCALE - 1: 270,000

WELLS PASSAGE
PORT NELLIE JUAN AREA

SO-7



LEGEND

50 Fathom Curve

Sea Otter Surveys
S = June 1973
W = March 1974

Number Counted
S = 309
W = 198

N

SCALE - 1: 270,000

LATOUCHE - BAINBRIDGE AREA

SO-8

LEGEND

50 Fathom Curve

Steller Sea Lion Rookery and Hauling Ground Surveys:
S= June 1973
W= March 1974

N

Scale - 1:1,338,270

FIGURE 2 — Sea Lion rookeries and hauling grounds, Prince William Sound Area, 1973-1974

PRINCE WILLIAM SOUND
COPPER RIVER DELTA

LEGEND

50 Fathom Curve

N

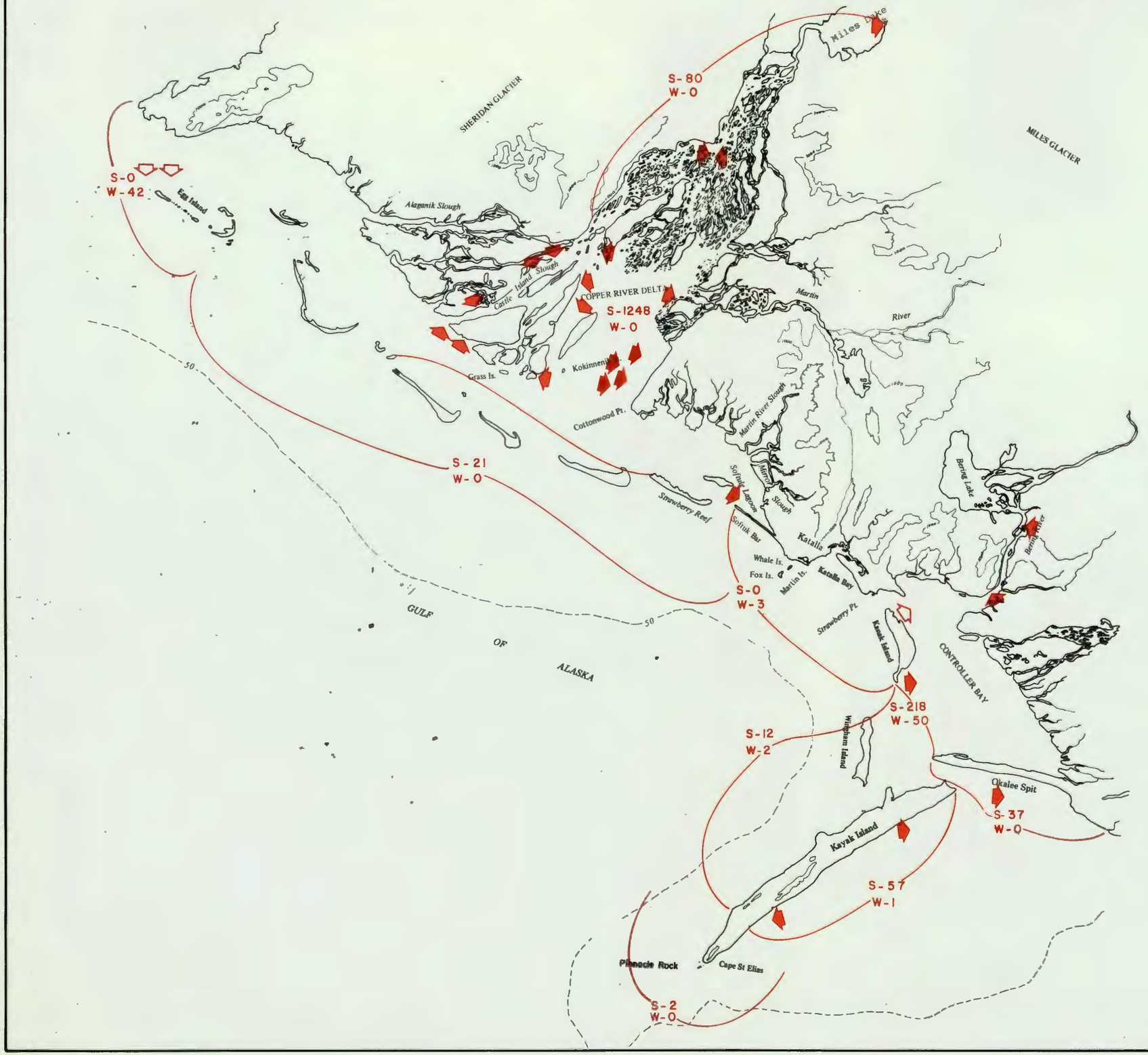
Scale - 1:1,338,270

HARBOR SEAL
DISTRIBUTION MAPS

PRINCE WILLIAM SOUND
COPPER RIVER DELTA

APPENDIX II

VICINITY MAP



LEGEND

50 — 50 Fathom Curve

Harbor Seal Surveys

S = June 1973

W = March 1974

= Land haul out area - Five or more seals observed

= Ice haul out area - Five or more seals observed

Number Counted

S = 1675

W = 98

N

SCALE - 1: 350,000

KAYAK ISLAND
COPPER RIVER AREA

HS - 1

LEGEND

50 — 50 Fathom Curve

Harbor Seal Surveys

S = June 1973
W = March 1974
= Land haul out area - Five or more seals observed
= Ice haul out area - Five or more seals observed

Number Counted

S = 66
W = 217

N

SCALE - 1: 270,000

HINCHINBROOK HAWKINS ISLANDS AREA

HS-2

LEGEND

50 Fathom Curve

Harbor Seal Surveys

S = June 1973
W = March 1974
= Land haul out area - Five or more seals observed
= Ice haul out area - Five or more seals observed

Number Counted

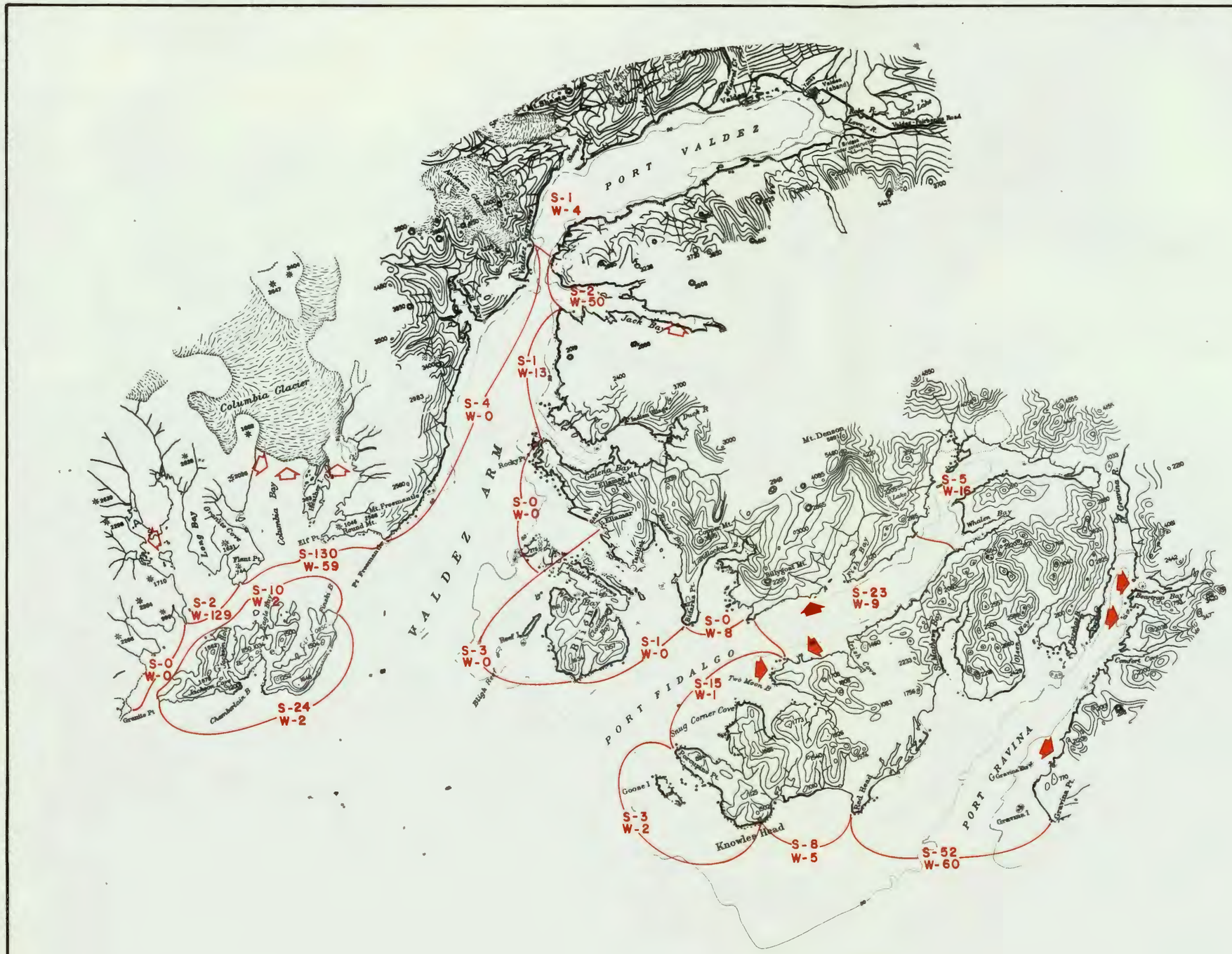
S = 1038
W = 717

N

SCALE - 1: 270,000

MONTAGUE ISLAND AREA

HS-3



LEGEND

50 ..... 50 Fathom Curve

Harbor Seal Surveys

S = June 1973

W = March 1974

= Land haul out area - Five or more seals observed

= Ice haul out area - Five or more seals observed

Number Counted

S = 284

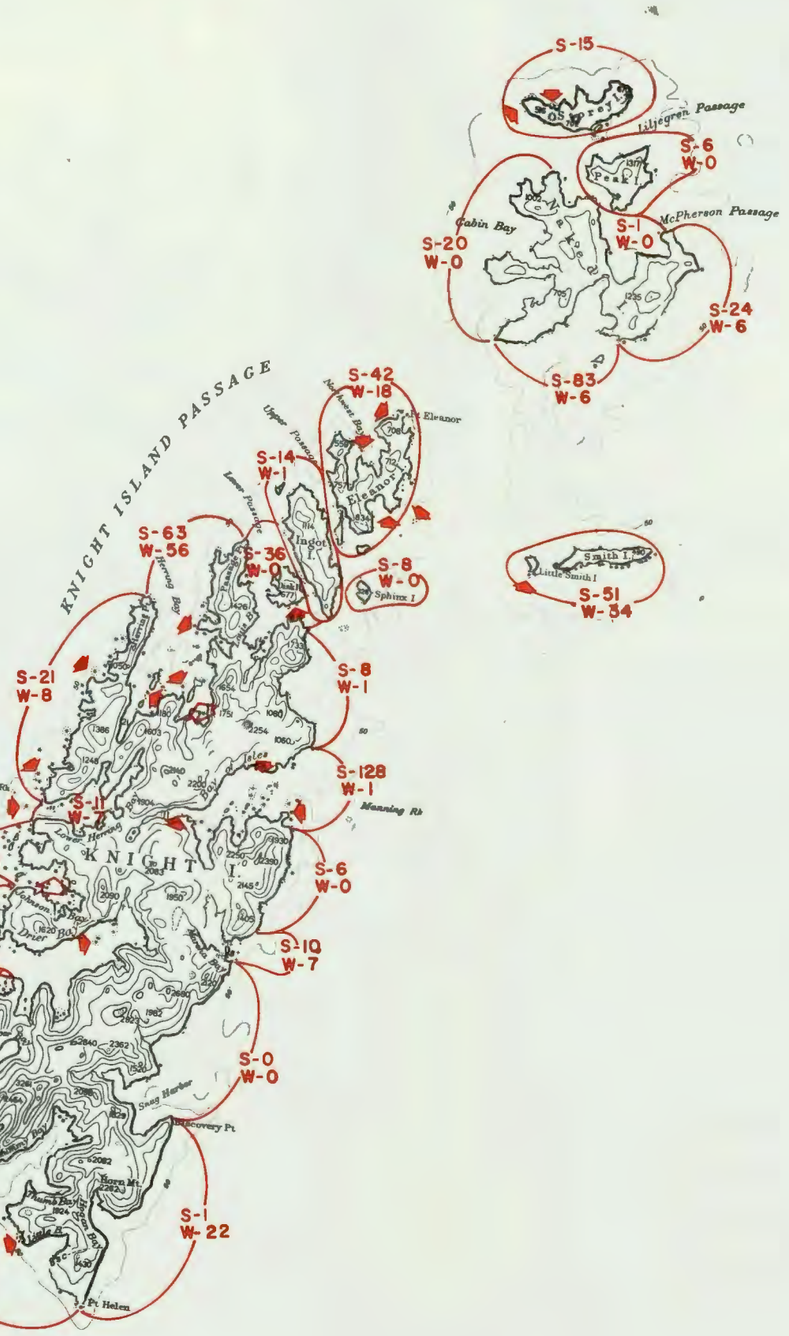
W = 360

N

SCALE - 1: 270,000

VALDEZ ARM
PORT GRAVINA AREA

HS-4



LEGEND

50 Fathom Curve

Harbor Seal Surveys

S = June 1973

W = March 1974

= Land haul out area - Five or more seals observed

= Ice haul out area - Five or more seals observed

Number Counted

S = 653

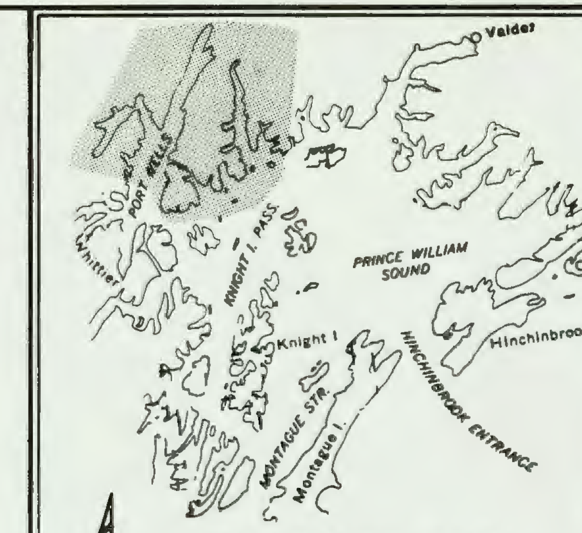
W = 282

N

SCALE - 1: 270,000

KNIGHT ISLAND AREA

HS-5



VICINITY MAP

LEGEND

50 50 Fathom Curve

Harbor Seal Surveys

S = June 1973

W = March 1974

= Land haul out area - Five or more seals observed

= Ice haul out area - Five or more seals observed

Number Counted

S = 581

W = 536

N

SCALE - 1: 270,000

PORT WELLS
UNAKWIK AREA BAY PASSAGE

HS- 6

LEGEND

..... 50 ..... 50 Fathom Curve

Harbor Seal Surveys

S = June 1973

W = March 1974

▰ = Land haul out area - Five or more seals observed

▱ = Ice haul out area - Five or more seals observed

Number Counted

S = 257

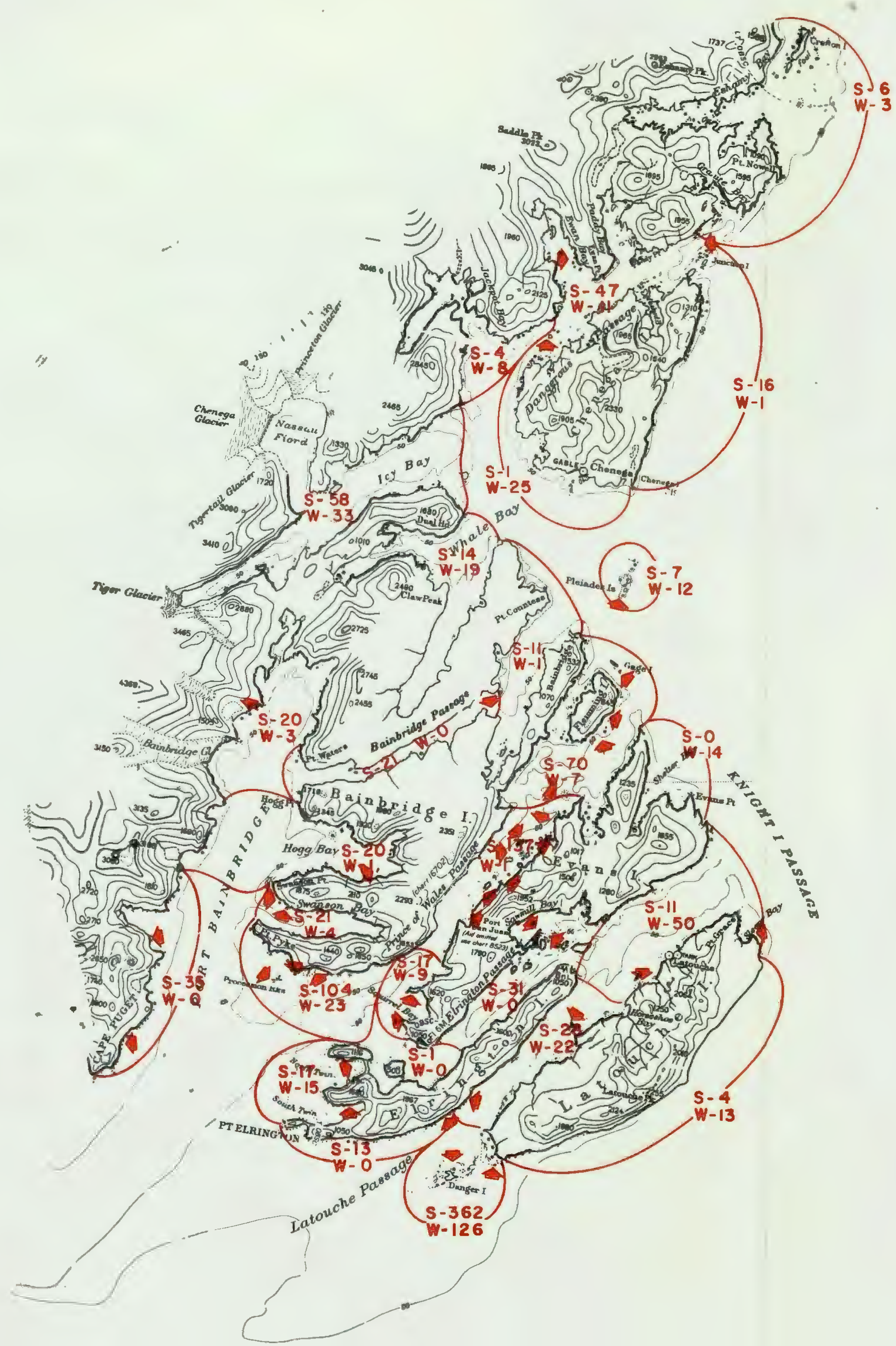
W = 354

N

SCALE - 1: 270,000

WELLS PASSAGE
PORT NELLIE JUAN AREA

HS-7



LEGEND

50 — 50 Fathom Curve

Harbor Seal Surveys

S = June 1973

W = March 1974

= Land haul out area - Five or more seals observed

= Ice haul out area - Five or more seals observed

Number Counted

S = 1076

W = 401

N

SCALE - 1: 270,000

LATOUCHE - BAINBRIDGE AREA

HS-8