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# Population Assessment, Ecology and Trophic Relationships of Steller Sea Lions in the Gulf of Alaska

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# Introduction

This project is a detailed study of the population dynamics, life history and some aspects of the ecology of the Steller sea lion (*Eumetopias jubatus*). In addition to the sea lion investigations, the work has been expanded to include an examination of the distribution and abundance of belukha whales (*Delphinapterus leucus*) in Cook Inlet and the distribution and abundance of sea otters (*Enhydra lutris*) near the south end of the Kodiak Archipelago. As in the past, the basic objectives of the sea lion work are to provide information on population status, seasonal distribution, movement patterns, population composition and segregation, use of critical habitats, food habits, reproductive biology and productivity. Other objectives include collection of information on growth, pathology and environmental contaminant loads. The basic objectives of the belukha work are to gather information on seasonal distribution, and abundance and use of critical habitats, and to test practicality of survey methods. Basic objectives of the sea otter work are to provide information on the distribution of sea otters in the area between Kodiak Island and Chirikof Island, to identify specific areas critical to these sea otters and to determine the extent of repopulation in this former sea otter habitat.

This study has been carefully designed to examine the potential impacts associated with exploration for, development of and transportation of crude oil and natural gas reserves in the Gulf of Alaska. All three species studied under this research project are vulnerable to Outer

Continental Shelf oil and gas development through direct contact and contamination, indirect contamination of food sources or habitat, and disturbance generated by activities associated with exploring for and recovering oil and gas.

For a detailed description of the study area, current state of knowledge and sources, methods and rationale of data collection, see Calkins and Pitcher (1977) and Schneider (1976a and 1976b).

# Steller Sea Lions in the Gulf of Alaska

Donald Calkins

## Breeding Rookeries and Hauling Areas

### I. Surveys

Sea lion surveys were conducted at selected rookeries and hauling areas on two different occasions this year. The first survey was a photo survey of the breeding rookeries in conjunction with pup counts made in June and July. Photo counts were limited to adults wherever possible. Table 1 shows the photo survey made in June and July, while Figure 1 shows the locaiton of those areas surveyed.

Table 1. counts of sea lions at selected locations in the Gulf of Alaska, June, July 1978.
a/ one roll of film did not expose est. 1500 more sea lions here
b/ count from ground

| Name | Lat. | Long. | Photo Count |
|---|---|---|---|
| Marmot I. | 58°12'10"N | 151°47'50"W | 8506 |
| Seal Rocks | 60°09'58"N | 146°50'30"W | 2463 |
| Outer Island | 59°30'50"N | 150°24'07"W | 3142 |
| Chiswell Island | 59°35'57"N | 149°33'59"W | 1477 |
| Puale Bay | 57°40'55"N | 155°24'05"W | 5109 |
| Castle Rock | 55°16'45"N | 159°29'45"W | 541 |
| Atkins I. | 55°03'05"N | 159°17'50"W | 2943a/ |
| Chernabura I. | 54°45'15"N | 159°33'00"W | 2758 |
| Sanak I. | 54°17'45"N | 162°42'30"W | 1320 |
| Clubbing Rocks | 54°42'50"N | 162°26'45"W | 2663 |
| Pinnacle Rock | 54°46'15"N | 161°45'45"W | 3692 |
| Lighthouse Rock | 55°46'30"N | 157°24'10"W | 928 |
| Chowiet I. | 56°00'40"N | 156°41'00"W | 4519 |
| Chirikof I. | 55°49'25"N | 155°44'20"W | 3699 |
| Sugarloaf I. | 58°53'29"N | 152°02'21"W | 4810b/ |

The second photo survey (Table 2) was accomplished in August and September. This survey, again, was at selected locations in conjunction with sea otter and harbor seal surveys.

Table 2. Sea lion surveys at selected locations August/September 1978.

| Location | Lat. | Long. | Photo Count |
|---|---|---|---|
| Twoheaded Island | 56°53'55"N | 153°33'30"W | 1955 |
| Chirikof Island | 55°49'25"N | 155°44'20"W | 2094 |
| Sugarloaf Island | 58°53'29"N | 152°02'21"W | 5504 |
| Marmot Island | 58°12'10"N | 151°47'50"W | 8383 |

## II. Pup Counts

Steller sea lion pupping takes place at pupping and breeding rookeries throughout the Gulf of Alaska. A pupping and breeding rookery can be defined as any area where a large percentage of the sea lions present from the period of late May to early July are taking part in breeding and pupping. Many of the areas that are used by sea lions as rookeries are used as hauling areas throughout the rest of the year while other areas are used only as rookeries and have few sea lions the rest of the year.

The composition of haulout areas prior to May can vary from a single age group and sex to both sexes and all age classes. Beginning near the first of May the composition of those areas which change to rookery areas shifts towards pregnant females and mature males. At about the same time pregnant females and mature males begin arriving at those rookeries which are not used the rest of the year. Males which arrive

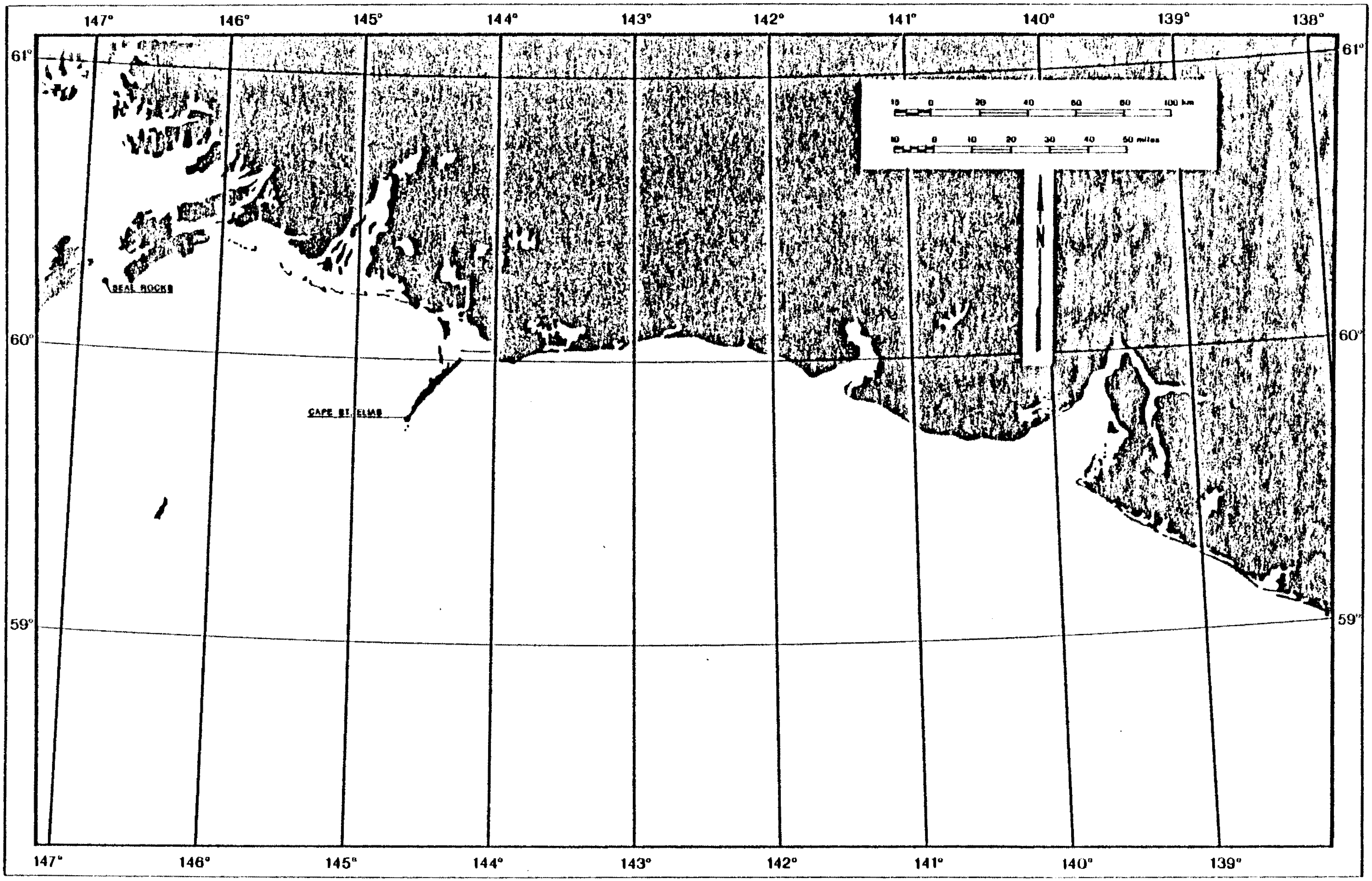


FIGURE 1A. LOCATIONS OF STELLER SEA LION HAULOUTS AND ROOKERIES SURVEYED IN 1978.

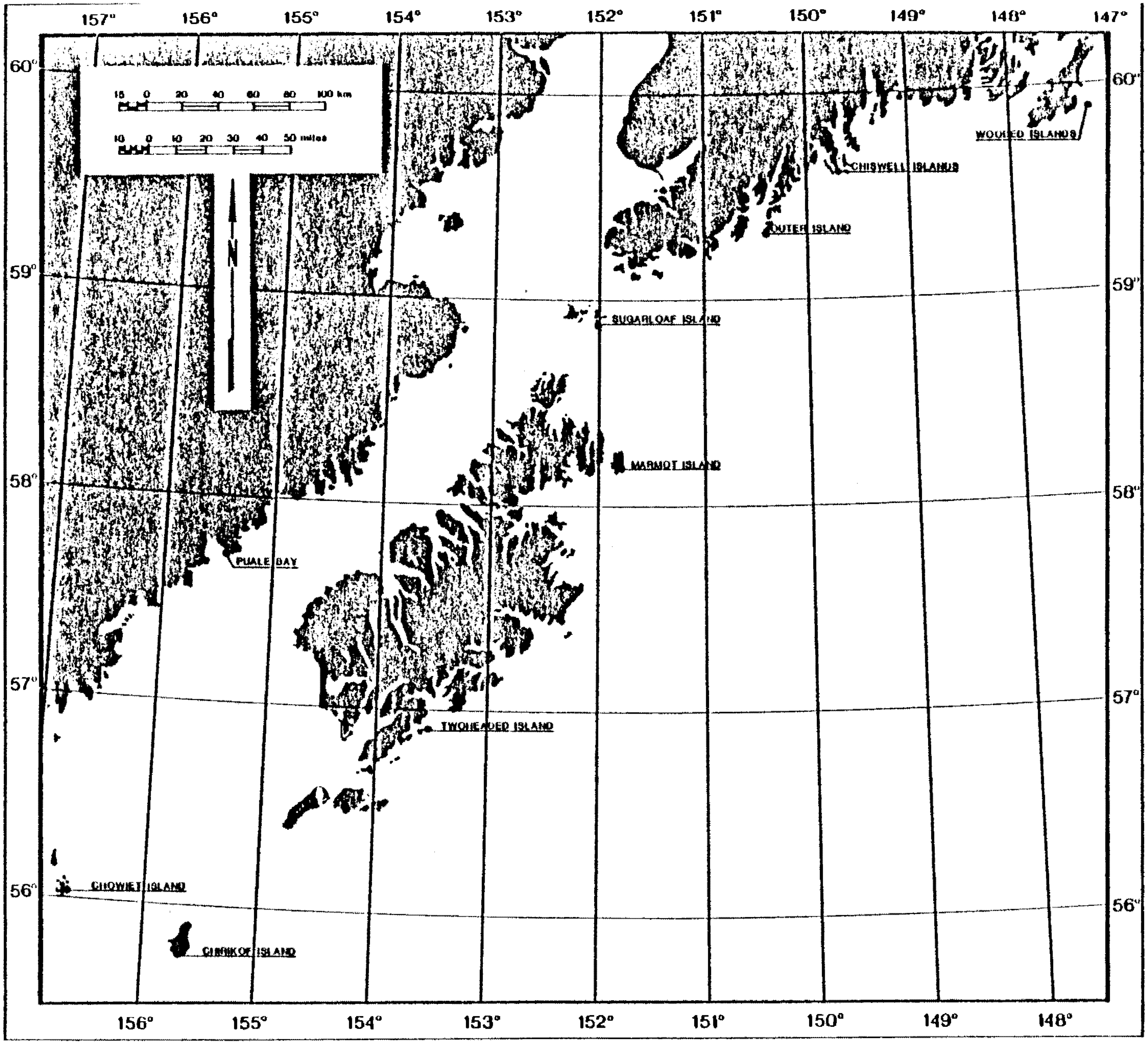
157° 156° 155° 154° 153° 152° 151° 150° 149° 148° 147°
60° 59° 58° 57° 56°
15 0 20 40 60 80 100 km
10 0 10 20 30 40 50 miles
N
WOODED ISLANDS
CHISWELL ISLANDS
OUTER ISLAND
SUGARLOAF ISLAND
MARMOT ISLAND
PUALE BAY
TWOHEADED ISLAND
CHOWIET ISLAND
CHIRIKOF ISLAND

FIGURE 1B.

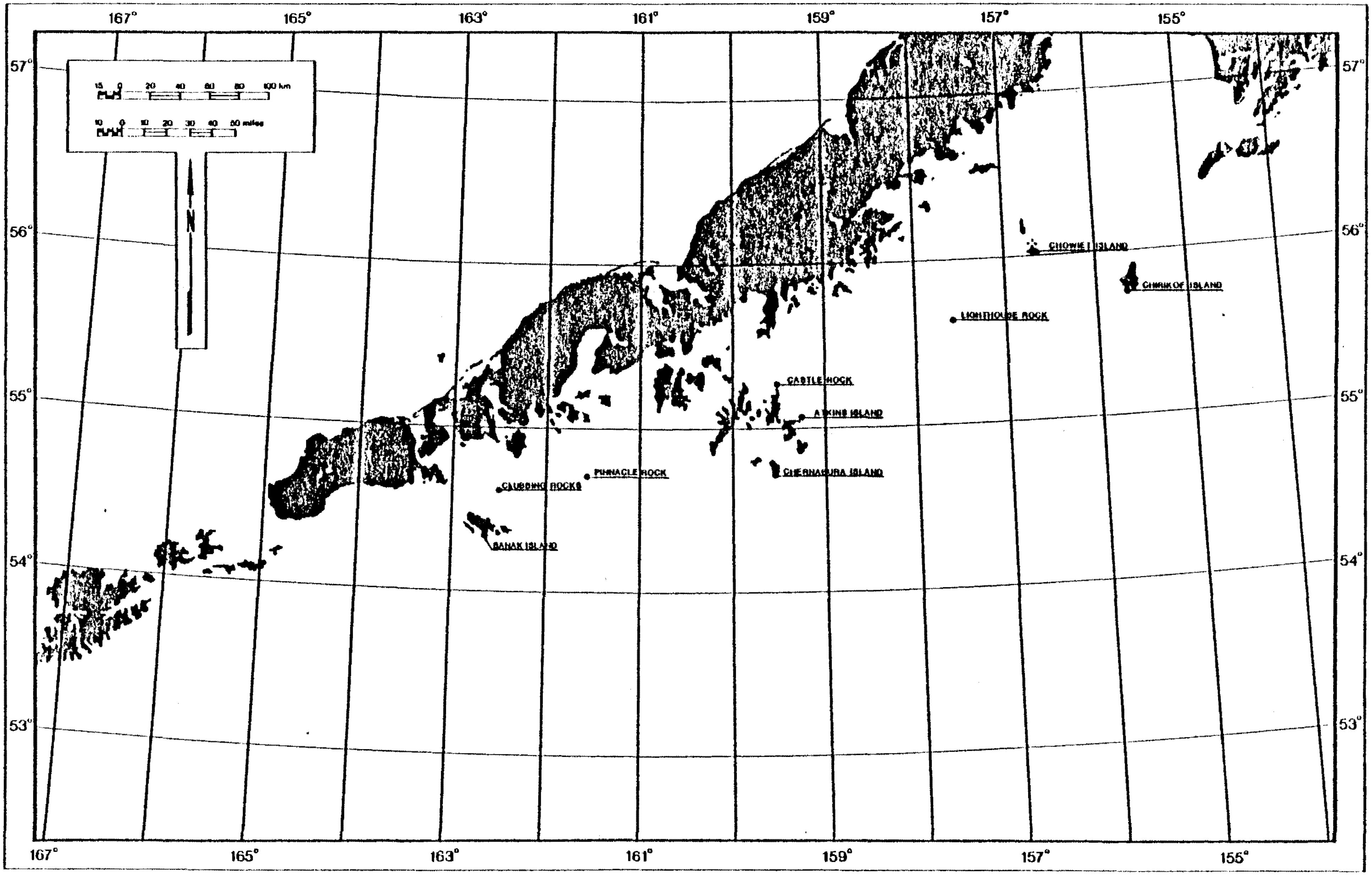
167°
165°
163°
161°
159°
157°
155°
57°
56°
55°
54°
53°
CHOWIET ISLAND
CHIRIKOF ISLAND
LIGHTHOUSE ROCK
CASTLE ROCK
ATKINS ISLAND
PINNACLE ROCK
CHERNABURA ISLAND
CLUBBING ROCKS
SANAK ISLAND

FIGURE 1C.

in early May often begin establishing territories even though there may be no females present on the areas where they establish themselves. It is not uncommon at areas like Sugarloaf Island, where the majority of animals are present only during pupping and breeding, to see several large males positioned along the shore at regular intervals with no other animals near them. These animals usually positioned themselves in areas which eventually became parts of the breeding and pupping rookery, but some apparently inexperienced males occasionally established and defended territories which never became a functioning part of the rookery. Gentry (1970) observed similar occurrences of males establishing territories without females by Steller sea lions in California, although he felt that these territories were not maintained as long as a normal territory with females.

Pupping begins in approximately mid-May. Gentry (1970) states that the first live young appear about mid-May in California, while Pike and Maxwell (1967) observed pupping to commence about the last week in May. The first surviving pup recorded in our study was born at Sugarloaf Island in the Barren Islands on May 15, 1978. Sandegren (1967) first observed the birth of a pup on May 29. Henceforth, we are using May 15 as the arbitrary birth date for all Steller sea lions born in the Gulf of Alaska. The occurrence of premature births in Steller sea lions in the Gulf of Alaska appears to be common as it is in California (Gentry 1970).

In late June and early July of 1978 we surveyed a total of 17 different sea lion haulouts for possible pupping activity. Of the 104 recorded locations where sea lions haulout in the Gulf, these 17 sites were selected as possible pupping rookeries on the basis of size, location and observed pupping activities in the past. It is highly unlikely that significant pupping takes place at any other location in the Gulf. Table 3 shows the sites selected and the pup counts made during the summer survey. Eleven of the sites selected proved to be areas where pups are produced in significant numbers (sites number 1 through 11, Table 3). At these 11 sites a minimum of 250 pups were counted at Lighthouse Rocks and a maximum of 6,140 were counted at Marmot Island. The total number of pups counted on these surveys was 23,288. Rookeries number 1 through 5 (Table 3) produced a total 20,154 pups. This accounts for 87 percent of all pups counted in the Gulf of Alaska.

Although we have counted the majority of pups born in 1978 in the Gulf of Alaska, we have by no means counted all of them. These pup counts consisted of driving the adults off the rookery and counting, viewing and counting from above with adults present, counting from a boat, and estimating numbers of pups from an airborne helicopter. These methods are given in ascending order of accuracy. Even with the most accurate method of counting pups after driving adults off, some pups are missed, while counting from the helicopter can only be considered an estimate. Beyond these problems associated with counting sea lions in the Gulf of Alaska, a problem also exists with timing of the counts. Timing of the counts had to be balanced between the time the majority of pups are born and the time when pups readily enter the water and swim. Scheffer 1946 observed the pupping season to last until June 20 for sea lions on the Pribilof Islands, with no marked peaks although the highest frequency was from June 10-12. Observations on Sugarloaf Island indicate pupping occurs there as late as July 14 with the highest rate from June 10 to June 20. Sandegren (1967) indicates that pups begin to enter the water on their own at approximately 14 days old. This means that in order to count the majority of pups, the counts should be initiated no earlier than June 20 and should be completed no later than July 15.

Breeding takes place shortly after pupping at the same locations where the pups are born, as well as any other locations a cow might be when estrus begins. Generally only those cows which are pregnant go to the rookeries while mature cows which are not pregnant may come into estrus at any other location. Pike and Maxwell (1958) thought that approximately 25 percent of the mature cows failed to breed each year in British Columbia while approximately 81 percent of all females we have collected are pregnant (Calkins and Pitcher 1978).

## Distribution and Movements

The investigation of distribution and movements of sea lions in the Gulf of Alaska was carried out through both intensive, long term, on site studies at one major rookery and one hauling area, and by short term visits at numerous other rookeries and hauling areas.

Sugarloaf Island was the site selected this year for the long term rookery study. Daily observations were made for branded sea lions. A total of 251 different branded animals were seen at Sugarloaf Island in 1978. Sea lions branded with X on both left and right shoulders were

Table 3. Sea lion pup counting sites and pup counts in the Gulf of Alaska, June 20 through July 4, 1978.

| Site Number | Location | Date Counted | Number Live Pups | Number Dead Pups | Comments |
|---|---|---|---|---|---|
| 1 | Marmot Island | July 4 | 6140 | 63+ | |
| 2 | Sugarloaf Island | July 4-5 | 5021 | 213 | |
| 3 | Chowiet Island | June 29 | 4670 | 80 | |
| 4 | Atkins Island | June 26 | 2750 | 107 | |
| 5 | Chirikof Island | June 30 | 1573 | 14 | |
| 6 | Clubbing Rocks | June 28 | 725 | No Count | estimated from helicopter |
| 7 | Pinnacle Rock | June 29 | 615 | No Count | estimated from helicopter |
| 8 | Seal Rocks (PWS) | June 20 | 545 | 46 | |
| 9 | Chernabura Island | June 26 | 486 | No Count | |
| 10 | Outer Island | June 21 | 431 | 4 | estimated from boat |
| 11 | Lighthouse Rock | June 29 | 250 | No Count | estimated from helicopter |
| 12 | Sanak Island | June 27 | 30 | 1 | |
| 13 | Wooded Islands | June 20 | 29 | 1 | |
| 14 | Chiswell Islands | June 21 | 11 | No Count | estimated from helicopter |
| 15 | Puale Bay Rocks | June 24 | 9 | 0 | part count from boat |
| 16 | Cape St. Elias | July 4 | 3 | 27 | |
| 17 | Castle Rock | July 25 | 0 | 0 | counted from helicopter |

Total Pups Counted in the Gulf of Alaska - 23,288

Table 4. Daily totals of branded animals seen in April - Sugarloaf Island (1978).

| | Left Shoulder | | | Right Shoulder | | | |
|---|---|---|---|---|---|---|---|
| Date | X | O | UN | X | T | UN | Daily Total |
| 16 | | 2 | | | | | 2 |
| 17 | | | | 1 | 1 | | 2 |
| 19 | 1 | 1 | 1 | | 2 | 1 | 9 |
| 20 | | | | | 2 | 3 | 5 |
| 21 | 1 | | 1 | 2 | 2 | 1 | 7 |
| 22 | | | | 1 | | 1 | 2 |
| 23 | | | | 2 | 1 | | 3 |
| 24 | 1 | | 4 | 2 | 1 | 2 | 10 |
| 25 | | 1 | 2 | 1 | | | 4 |
| 26 | | | | | | 1 | 1 |
| 27 | | 4 | 4 | | 4 | 1 | 13 |
| 28 | 2 | 3 | 3 | 3 | 5 | | 16 |
| 29 | | 2 | 4 | 1 | 2 | | 9 |
| 30 | | 3 | | | | 2 | 5 |
| | | | | | | | 88 |

Table 5. Daily totals of branded animals seen in May - Sugarloaf Island (1978).

| | Left Shoulder | | | Right Shoulder | | | |
|---|---|---|---|---|---|---|---|
| Date | X | O | UN | X | T | UN | Daily Total |
| 1 | | | 2 | 2 | 3 | 3 | 10 |
| 2 | | 1 | 4 | 1 | 2 | | 8 |
| 3 | 1 | 1 | 2 | 8 | 9 | 10 | 31 |
| 5 | | | 1 | | | | 1 |
| 7 | | 1 | | | | 1 | 2 |
| 8 | | 2 | | | 1 | 3 | 6 |
| 9 | | | | | 1 | 1 | 2 |
| 10 | | | 1 | | | | 1 |
| 11 | | 1 | | | 1 | | 2 |
| 12 | | 1 | 1 | 1 | | 3 | 6 |
| 13 | 1 | 1 | 2 | 5 | 1 | 2 | 12 |
| 14 | 1 | | 1 | 3 | | 1 | 6 |
| 15 | | 2 | | | | | 2 |
| 16 | 2 | 1 | 3 | 2 | 1 | 4 | 13 |
| 18 | 3 | | 2 | 2 | 1 | 4 | 12 |
| 20 | 2 | | | | 1 | 1 | 4 |
| 21 | | | 2 | 4 | | | 6 |
| 22 | | | | | 1 | | 1 |
| 24 | | | | 2 | 1 | | 3 |
| 25 | | | | | | | 1 |
| 26 | | | 1 | 6 | 1 | 1 | 9 |
| 27 | | | | 3 | | 1 | 4 |
| 28 | | | | 2 | 1 | 1 | 4 |
| 29 | | | | | | 1 | 1 |
| | | | | | | | 147 |

Table 6. Daily totals of branded animals seen in June - Sugarloaf Island (1978).

| | Left Shoulder | | | Right Shoulder | | | |
|---|---|---|---|---|---|---|---|
| Date | X | O | UN | X | T | UN | Daily Total |
| 1 | 1 | | | | | | 1 |
| 2 | 1 | | | | | | 1 |
| 4 | | | 1 | | | | 1 |
| 5 | | | | 1 | | | 1 |
| 10 | | | | 1 | 1 | | 2 |
| 12 | 1 | | | | | | 1 |
| 13 | 1 | | | | | | 1 |
| 15 | | | | 1 | 2 | | 3 |
| 19 | | | 1 | 1 | | | 2 |
| 21 | | | 1 | | | 1 | 2 |
| 23 | | | | 1 | | | 1 |
| 24 | | | | | | | 1 |
| 27 | 1 | | | | | 1 | 2 |
| 28 | | | | 1 | | 2 | 3 |
| 29 | | | | 1 | 1 | 1 | 3 |
| | | | | | | | 25 |

Table 7. Daily totals of branded animals seen in July - Sugarloaf Island (1978).

| | Left Shoulder | | | Right Shoulder | | | |
|---|---|---|---|---|---|---|---|
| Date | X | O | UN | X | T | UN | Daily Total |
| 1 | | | | 1 | | | 1 |
| 2 | | | 1 | | | | 1 |
| 3 | 1 | | 4 | | | | 5 |
| 4 | | | 4 | | | | 4 |
| 5 | 1 | | 3 | 1 | | | 5 |
| 6 | 1 | | 3 | 1 | 1 | 2 | 8 |
| 7 | 2 | | 2 | 1 | | 1 | 6 |
| 8 | | | 2 | | | | 2 |
| 12 | 1 | | | 1 | | 2 | 4 |
| 14 | | | 1 | | | | 1 |
| 15 | | | | 1 | | | 1 |
| | | | | | | | 38 |

ble 8. Monthly totals of branded animals seen, April - July - Sugarloaf Island (1978).

| | Left Shoulder | | | Right Shoulder | | | |
|---|---|---|---|---|---|---|---|
| nth | X | O | UN | X | T | UN | Total |
| ril | 5 | 16 | 19 | 16 | 20 | 12 | 88 |
| y | 10 | 11 | 22 | 42 | 25 | 37 | 147 |
| ne | 5 | | 3 | 8 | 4 | 5 | 25 |
| ly | 6 | | 20 | 6 | 1 | 5 | 38 |
| | 26 | 27 | 64 | 72 | 50 | 59 | 298 |

seen as well as with O's on the left shoulder and T's on the right shoulder. This indicates that sea lions were present at Sugarloaf Island in 1978 which were born at both Sugarloaf and Marmot Island in 1975 and 1976.

Tables 4 through 7 show the daily sightings of sea lions at Sugarloaf Island in 1978. Table 8 shows the monthly totals of brands sighted at Sugarloaf Island. Figure 2 depicts the distribution of sightings at Sugarloaf over the observation period.

A total of 6,429 sea lion pups were branded at Marmot Island and Sugarloaf Island in 1975 and 1976. Sixty-six percent of those were branded at Marmot Island while 34 percent were branded at Sugarloaf Island. Of the 2 and 3 year old branded sea lions re-sighted at Sugarloaf in 1978, 53 percent had been branded at Sugarloaf and 47 percent had been branded at Marmot. Three percent of all sea lions branded at Sugarloaf in 1975 were re-sighted in 1978, 4 percent of those branded at Sugarloaf in 1976 were re-sighted in 1978. Four percent of these sea lions branded at Marmot in 1975 were sighted at Sugarloaf in 1978, while only 1 percent of those branded at Marmot in 1976 were re-sighted at Sugarloaf in 1978.

Cape St. Elias was again used as the sea lion hauling area for intensive observations. The pattern of use by branded sea lions was substantially different here than at Sugarloaf Island. Table 9 shows the daily counts of branded sea lions at Cape St. Elias, while figure 3 illustrates the distribution over time of the total number of branded sea lions observed each day at Cape St. Elias.

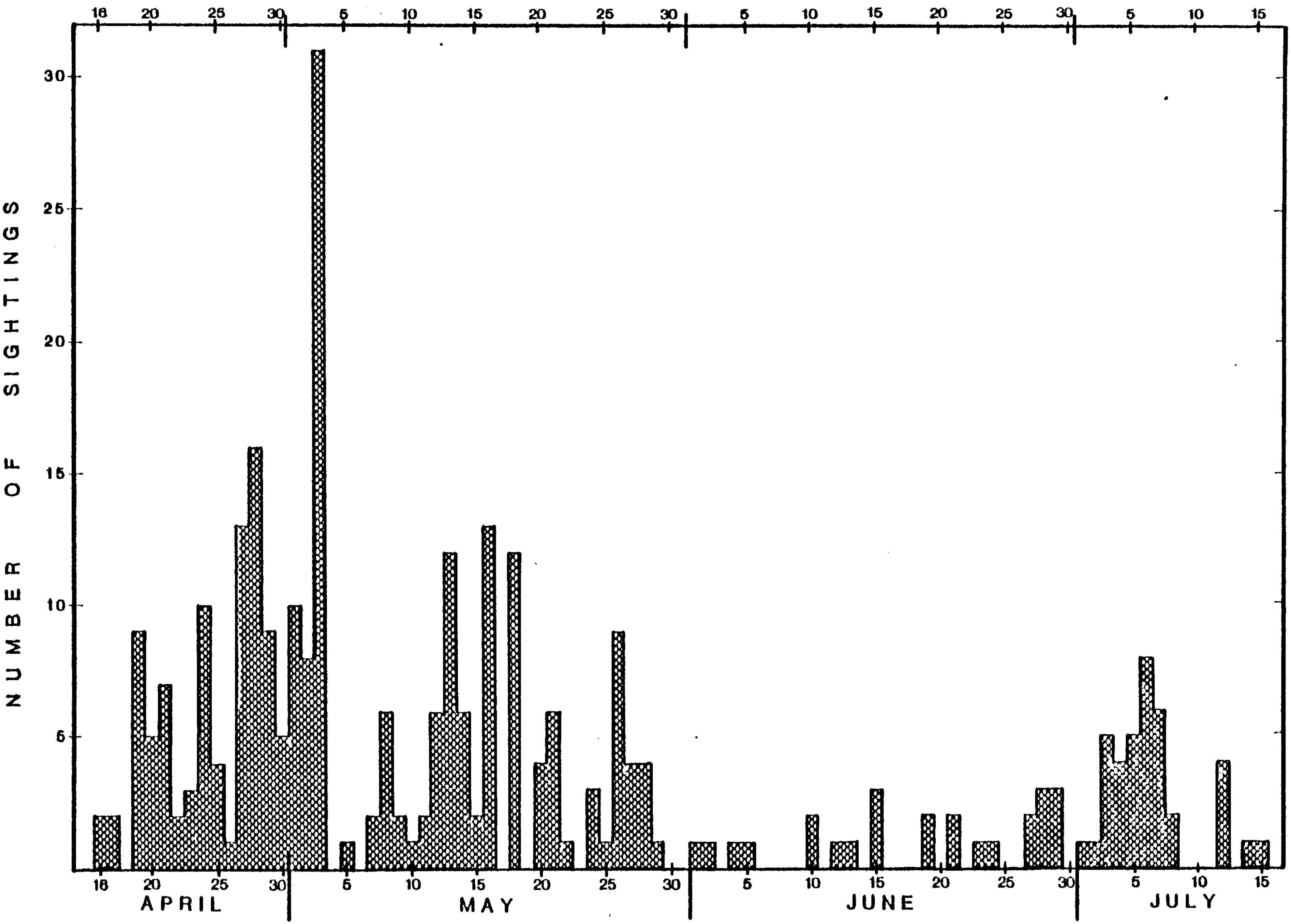


FIGURE 2. DISTRIBUTION OF DAILY TOTALS OF BRANDED SEA LION SIGHTINGS - SUGARLOAF ISLAND (1978).
(DATES BETWEEN 16 APRIL AND 15 JULY WITH NO SIGHTINGS SHOWN INDICATE DAYS NO ONSITE CHECKS WERE TAKEN.)

Table 9. Complete counts of branded sea lions observed on Cape St. Elias, March through June, 1978.

| | Right Shoulder | | | | | | | Left Shoulder | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Date | X | T | J | E | L | V | Unknown | X | O | Unknown | Day Totals |
| 22 March | 1 | 3 | | | | | | 2 | | | 6 |
| 23 March | 5 | 5 | 5 | | | 1 | | 1 | | | 17 |
| 24 March | 1 | 1 | 1 | | | | | | | | 3 |
| 25 March | 6 | 2 | 1 | | | 1 | 2 | | | 4 | 16 |
| 26 March | 3 | 7 | 4 | 1 | | | 1 | 3 | | 2 | 21 |
| 27 March | 2 | 5 | 1 | | | | 1 | 2 | | 1 | 12 |
| 28 March | 2 | 2 | 1 | | | | | 1 | | 1 | 7 |
| 29 March | 17 | 10 | 7 | | 1 | | 6 | 3 | | 4 | 48 |
| 30 March | 15 | 10 | 7 | 1 | | | 3 | 2 | | 3 | 41 |
| 31 March | 4 | 8 | 2 | | | | 2 | 1 | | 2 | 19 |
| 1 April | 3 | 7 | 1 | | | 1 | 3 | | | 4 | 19 |
| 2 April | 7 | 8 | 3 | | | | 7 | 4 | | 4 | 33 |
| 3 April | 14 | 8 | 4 | | | | 2 | 3 | | 6 | 37 |
| 4 April | 6 | 10 | 3 | 1 | | | 6 | 2 | | 1 | 29 |
| 5 April | 3 | 2 | 1 | | | | | 1 | | 2 | 9 |
| 10 April | 10 | 8 | 6 | 1 | | 1 | 3 | 1 | | 2 | 32 |
| 11 April | 8 | 4 | 2 | | | | 5 | 1 | | 3 | 23 |
| 12 April | | | | | | | | | | 2 | 2 |
| 13 April | 1 | | | | | | | | | 1 | 2 |
| 14 April | | 2 | 1 | | | | | 1 | | 1 | 5 |
| Totals | 108 | 102 | 50 | 4 | 1 | 4 | 41 | 28 | | 43 | 381 |

Table 9 (cont.).

| Date | Right Shoulder X | T | J | E | L | V | Unknown | Left Shoulder X | O | Unknown | Daily Totals |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 14 April | 3 | 1 | 1 | | | | 2 | 1 | | 2 | 10 |
| 16 April | 6 | 1 | 2 | 1 | | | 3 | 1 | | 1 | 15 |
| 17 April | | 3 | 2 | | | | 2 | | | | 7 |
| 18 April | 3 | 2 | 1 | | | | | | | | 6 |
| 19 April | 2 | 1 | 2 | | | | | | | | 5 |
| 20 April | 3 | 2 | | | | 1 | | | | | 6 |
| 21 April | 2 | 1 | 2 | | | | 3 | | | 2 | 10 |
| 22 April | 3 | 1 | 1 | | | | 4 | | | 1 | 10 |
| 23 April | 4 | 3 | | | | | 5 | 2 | | 1 | 15 |
| 25 April | 6 | 6 | 2 | | | | 5 | 1 | | 1 | 21 |
| 28 April | 4 | 1 | 2 | | | | 2 | | | 2 | 11 |
| 29 April | 1 | 1 | 1 | | | | 1 | | 1 | | 5 |
| 2 May | 3 | 2 | 1 | | | | | 1 | 1 | 1 | 9 |
| 3 May | 4 | | 5 | | | | | | | | 9 |
| 4 May | 5 | 8 | 2 | | | | 3 | 1 | | | 19 |
| 5 May | 4 | 4 | 2 | | | 1 | 1 | | | 1 | 13 |
| 8 May | 3 | 5 | 2 | | | | 5 | | | 4 | 19 |
| 10 May | 6 | 4 | 1 | | | | | 2 | | | 13 |
| 12 May | 2 | 2 | | | | | | | | | 4 |
| 13 May | 9 | 7 | 5 | 1 | 1 | | 8 | 1 | | 6 | 38 |
| 15 May | 10 | 4 | 5 | | 1 | | 2 | 2 | 2 | 2 | 28 |
| 16 May | 1 | | | | | | | | | | 1 |
| 19 May | 6 | 9 | 3 | | | | | 3 | 1 | 5 | 27 |
| 20 May | 7 | 4 | 3 | | | | 4 | | | | 18 |

continued

Table 9. (Cont.)

| Date | Right Shoulder X | T | J | E | L | V | Unknown | Left Shoulder X | O | Unknown | Daily Totals |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 21 May | 5 | 6 | 2 | | | | 3 | 1 | 1 | 2 | 20 |
| 22 May | 7 | 6 | 4 | | | | 5 | 2 | 1 | 2 | 27 |
| 26 May | 2 | 4 | | 1 | | 1 | 5 | 1 | 1 | | 15 |
| 29 May | 5 | 5 | 1 | | | | 5 | | | 1 | 17 |
| 31 May | 15 | 14 | 3 | | | 1 | 6 | 2 | 1 | 5 | 47 |
| 1 June | 7 | 8 | 5 | | | 1 | 6 | 2 | 1 | 4 | 34 |
| 2 June | 9 | 9 | 1 | | | | 3 | 1 | | 2 | 25 |
| 3 June | 12 | 8 | 1 | | 1 | | 4 | 2 | 1 | 5 | 34 |
| 5 June | 5 | 7 | 2 | | 1 | | 10 | 1 | 1 | 2 | 29 |
| 6 June | 8 | 9 | 1 | | | | 6 | 1 | | | 25 |
| 7 June | 11 | 8 | 5 | | | | 5 | 2 | | 2 | 33 |
| 8 June | 5 | 8 | 2 | | | | 5 | | 1 | 1 | 22 |
| 9 June | 20 | 12 | 2 | | 1 | 1 | 5 | 3 | 1 | 1 | 46 |
| 10 June | 11 | 3 | 1 | | | | 2 | | 1 | | 18 |
| 12 June | 9 | 3 | 3 | | | | 7 | 1 | | 1 | 24 |
| 17 June | 6 | 3 | 2 | 2 | 1 | | 1 | | | 4 | 19 |
| 18 June | | | | | | | 1 | | | | 1 |
| 19 June | 13 | 4 | 3 | 2 | | | 4 | 3 | | 1 | 30 |
| 20 June | 12 | 7 | 1 | 1 | 1 | | 3 | 1 | | | 26 |
| 21 June | 8 | 1 | | | | | 1 | | 1 | | 11 |
| 23 June | 9 | 9 | 1 | 1 | 1 | | 2 | | | 2 | 25 |
| 24 June | 5 | 2 | 1 | | | 1 | 3 | | | 1 | 13 |
| 26 June | | 4 | | | | | 1 | | | 1 | 6 |
| 27 June | 5 | 5 | 4 | | | | 6 | | | 1 | 21 |
| Totals | 286 | 217 | 90 | 9 | 8 | 7 | 149 | 38 | 16 | 67 | 887 |

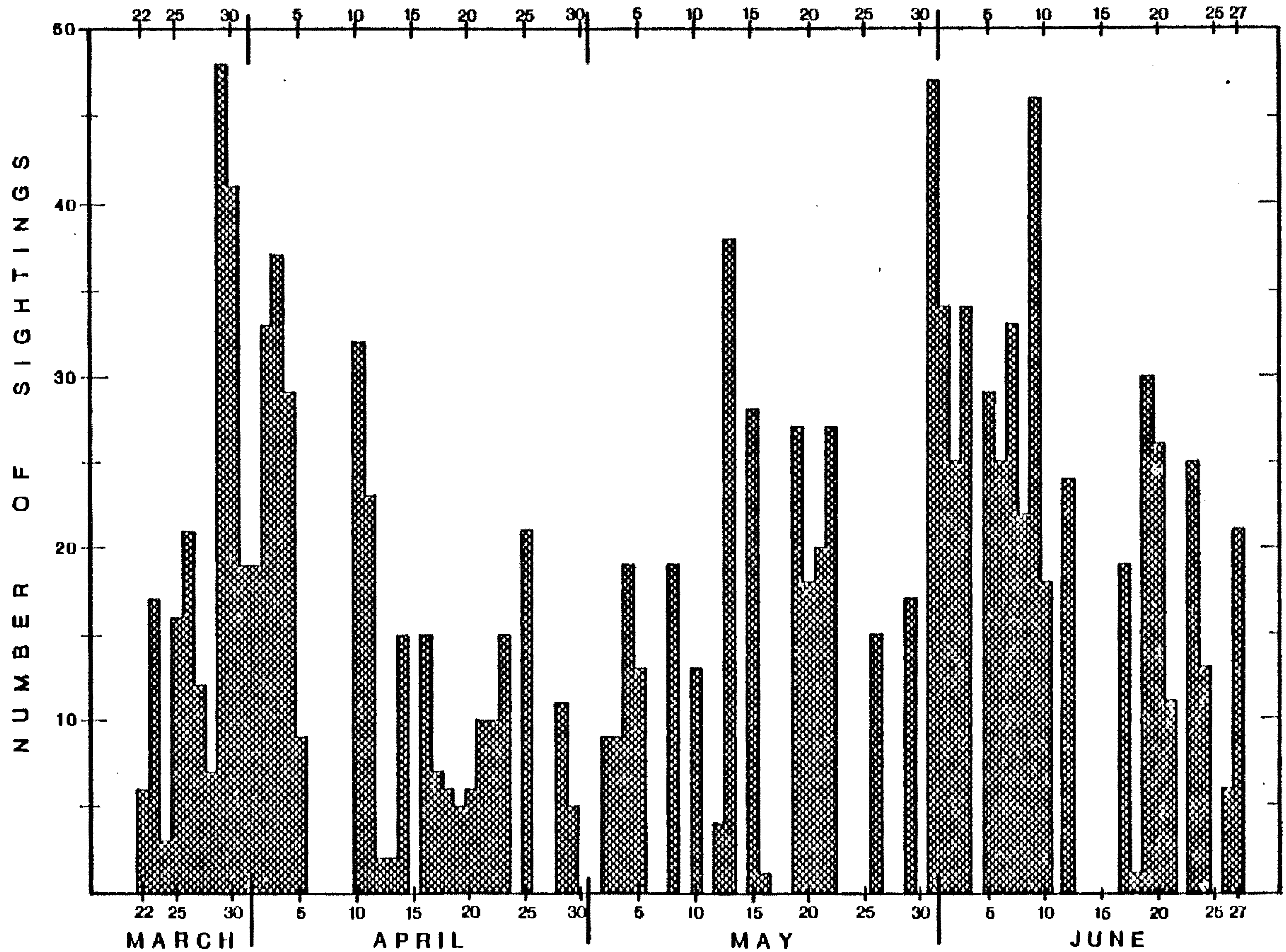


FIGURE 3. DISTRIBUTION OF DAILY TOTALS OF BRANDED SEA LION SIGHTINGS - CAPE ST. ELIAS (1978).
(DATES BETWEEN 22 MARCH AND 27 JUNE WITH NO SIGHTINGS SHOWN INDICATE DAYS NO ONSITE CHECKS WERE TAKEN.)

In general sea lions have moved away from their rookeries of birth in large numbers and have been sighted at haulouts from Chirikof and the Semidi Islands in the southwest to Cape St. Elias in the northeast. Nearly all animals leave Sugarloaf Island in the winter while many sea lions remain at Marmot Island in winter. Figure 4 illustrates the hypothetical movement patterns away from Marmot Island with the destinations shown as those locations where sea lions branded at Marmot have been sighted. Figure 5 illustrates movements of sea lions away from Sugarloaf Island.

Sea lions branded at Sugarloaf Island as pups in 1975 and 1976 were 2 and 3 years old during the summer of 1978. Few of these 2 and 3 year old animals returned to Sugarloaf Island in 1978. Large numbers were sighted at several other locations throughout the Gulf of Alaska, particularly Cape St. Elias.

Information on sea lion reproductive parameters, food habits, and growth and body condition will be presented in the final report.

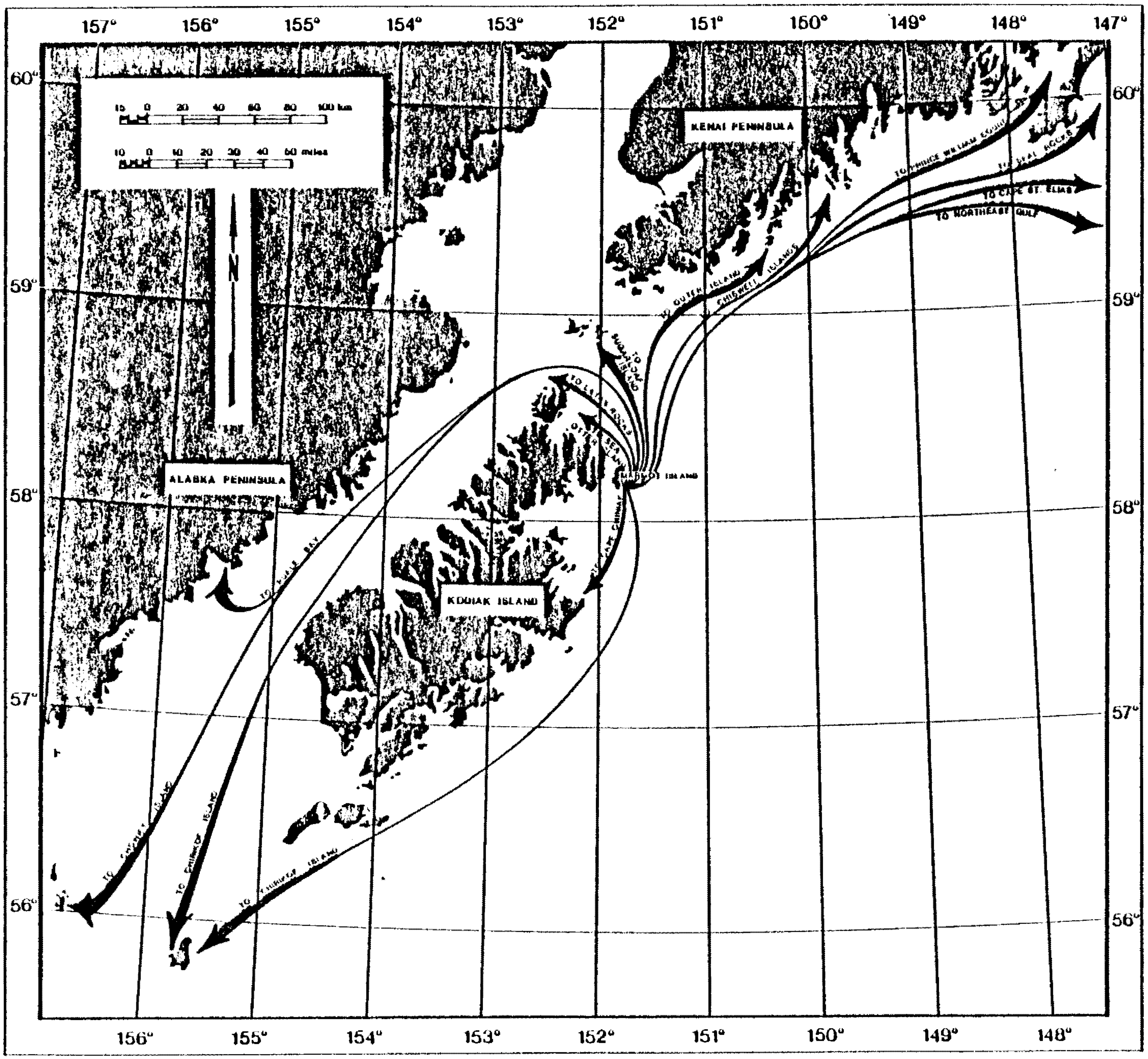


FIGURE 4. MOVEMENTS OF STELLER SEA LIONS AWAY FROM MARMOT ISLAND.

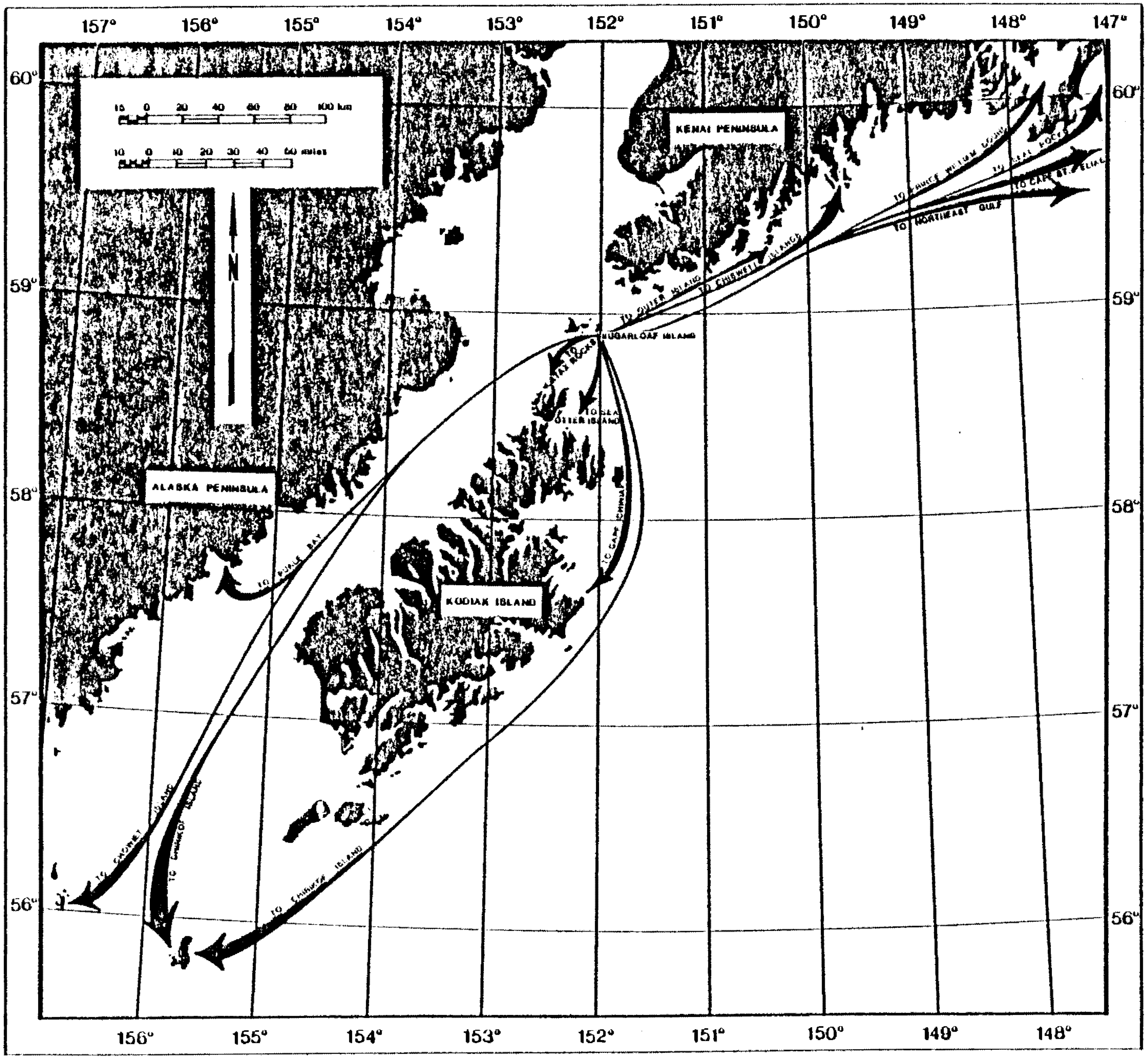


FIGURE 5. MOVEMENTS OF STELLER SEA LIONS AWAY FROM SUGARLOAF ISLAND.

# SEA OTTER DISTRIBUTION AND ABUNDANCE

# SOUTHERN KODIAK ARCHIPELAGO AND THE SEMIDI ISLANDS

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## SUMMARY

The distribution and abundance of sea otters in the waters between Kodiak Island and Chirikof Island and around the Semidi Islands were assessed through aerial surveys, incidental sightings and location of beach dead animals.

Sea otters have been sighted throughout the shallow waters southeast of Kodiak Island but established breeding groups occupy only two areas. The largest colony inhabits the waters south of the Trinity Islands and is roughly estimated to number between 400 and 700 sea otters. A second concentration of less than 100 sea otters exists around Chirikof Island. Sea otter densities in these areas are believed to be well below the capacity of the habitat but numbers are increasing. Both colonies are vulnerable to oil spills because of their small size, limited distribution and proximity to proposed OCS lease tracts.

Sea otters have been present in the Semidi Islands at least since 1957. The present population is small (30 to 50 animals) and not occupying all available habitat.

## INTRODUCTION

Changes in sea otter distribution and abundance have been monitored since the 1930's when it first became apparent that the species was repopulating portions of its former range. Studies intensified during the 1950's (Lensink 1960, Kenyon 1969) but were concentrated in the Aleutian Islands. During the 1970's the threat of oil and gas development created a need for information on the status of sea otters in other parts of Alaska. While the distribution of sea otters in these areas was generally known there was a lack of detailed, current information.

Pitcher (1975) conducted two surveys of Prince William Sound filling major data gaps in an area likely to be impacted by the Trans-Alaska Pipeline and associated tanker traffic. The proposed Outer Continental Shelf leasing program created a need for similar information from several other areas. Schneider (1976a and b) upgraded information from the Kenai Peninsula, lower Cook Inlet, the northern portion of the Kodiak Archipelago and southwestern Bristol Bay.

Major gaps remained in the northeast Gulf of Alaska, southern Kodiak Archipelago, south side of the Alaska Peninsula, eastern Aleutian Islands and Pribilof Islands. However direct funding from OCSEAP for sea otter studies was terminated before these gaps could be filled. This has made it necessary to gather information opportunistically in conjunction with activities directed at other species. This report summarizes information which helps fill some of these data gaps and is intended as a supplement to Pitcher (1975) and Schneider (1976a and b).

## KODIAK ARCHIPELAGO

### Background

Schneider (1976a) summarized available information on sea otter distribution and abundance around the Kodiak Archipelago. At that time the status of sea otters around the northern half of the archipelago was well known. A remnant population had apparently survived north of Shuyak Island and by 1976 had grown and expanded its range southward to Marmot Strait on the east and Raspberry Island on the west side of the archipelago. The rate of range expansion in recent years had been rapid and it appeared likely that substantial numbers would move into Marmot Bay in the near future.

Another group of sea otters was known to inhabit portions of the 10,00 $km^2$ shallow area between Kodiak Island and Chirikof Island. That area had never been adequately surveyed and knowledge of the distribution and abundance of sea otters there was based on isolated sightings, a few fragmented surveys and speculation. Small numbers were present in the Trinity Island area in the 1950's although no significant population could be found (Lensink 1962). This group probably represented a remnant population but could have formed from animals straying from Shuyak Island. During the 1960's sightings around the Trinity Islands and Chirikof Island increased. Beach dead animals were found on Tugidak Island each year by seal biologists but live otters were rarely seen from shore. In 1971 a survey of the area between Tugidak Island and Chirikof Island was attempted but poor conditions and fog interfered. Six sea otters were seen midway between Tugidak and Chirikof Islands.

This suggested that the range of the population was extensive and that the population was larger than suspected.

Schneider (1976a) surveyed portions of the area in 1976 and located two concentrations. One was distributed around Chirikof Island and the other appeared centered south of the Trinity Islands. Scattered sea otters were seen along the southern shore of Kodiak Island but these appeared to be stray animals.

Potential sea otter habitat extends over 20 km from shore in this area and includes proposed oil and gas lease tracts. As sea otters are the most vulnerable of all marine mammals to the effects of oil more detailed information on their distribution and abundance in this area was needed. Consequently systematic aerial surveys of suspected sea otter concentration areas were conducted.

Methods

Aerial systematic strip transect surveys were made over suspected sea otter concentration areas. A Bell 206 helicopter based on the NOAA ship Surveyor was flown along predetermined tracklines at an altitude of 200 feet and an airspeed of approximately 80 mph. An electronic navigation system was used to maintain tracklines and determine positions. Two observers counted sea otters within 0.1 nm wide strips to either side of the aircraft. Width of the strips was determined by maintaining a constant altitude and using an inclinometer. Sea otters sighted outside of the strips were recorded separately.

Substantial portions of the Kodiak Island coastline were visited by small boat during seal and sea lion studies. Significant sightings of sea otters were recorded. These observations served primarily to confirm the absence of sea otters in areas not surveyed and to monitor the rate of range expansion of the northern Kodiak population.

In past years the incidence of beach dead sea otters found by biologists studying seals along the northwest side of Tugidak Island has been used as a crude indicator of the status of sea otters in the Trinity Islands. This information collected between 1965 and 1978 was summarized. A transect for locating beach dead sea otters was established on the southeast side of Tugidak Island and surveyed from foot twice during 1978.

## Results and Discussion

Sea otter sightings available prior to the surveys (Fig. 6) indicated that at least scattered individuals occurred throughout the area and established groups inhabited the waters surrounding Chirikof Island and south of Tugidak Island. The primary questions were 1) What was the distribution of these groups? Specifically how far offshore did they range and did the Tugidak Island group's range extend south of Sitkinak Island and north of Tugidak Island. 2) What was the approximate size of each colony? Consequently the survey transects were positioned over the two known concentrations and extended beyond the maximum suspected limits of their distribution (Fig. 7).

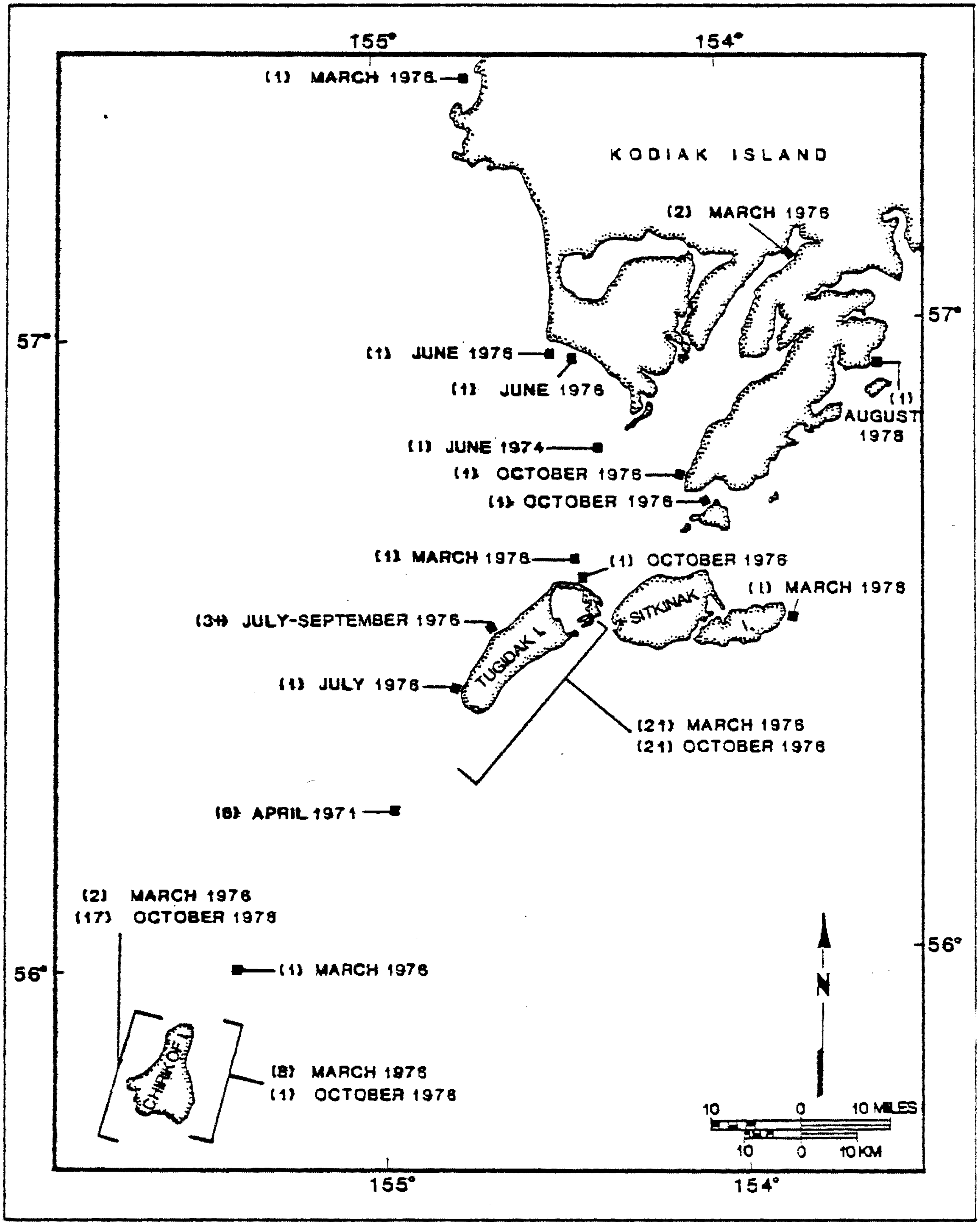


FIGURE 6. SIGHTINGS OF SEA OTTERS, SOUTHERN KODIAK/CHIRIKOF REGION. 1971-1976.

Results of the two surveys are presented in Tables 10 and 11. Several factors combined to make these surveys relatively inefficient. Visibility conditions were generally fair to poor because of wind and lighting conditions. This was a particular problem on the Trinity Island survey where the only sea otter seen outside of the strips was directly in the path of the helicopter during transit between transects and none of the sea otters within the strips were near the outer edges of the strips. A substantial portion of the sea otters especially those farther from the path of the helicopter may have been missed. The right observer had poor forward visibility making him less efficient than the left observer. Even under ideal conditions some sea otters are missed during such surveys either because they were under water or were simply not recognized by the observer.

Therefore the quality of the surveys was marginal but when viewed with other data they provided enough information to satisfy the gross objectives of delineating the distribution of sea otters in the area and at least establishing an order of magnitude of abundance.

1. Distribution - Specific locations of sea otters sighted on the surveys are presented in Table 13 and Figs. 8 and 9.

   Sea otters regularly occur on all sides of Chirikof Island but densities appear greatest north of Nagai Rocks along the west side of the island and along the rocky shores north of South Cape on the east side. While the number of otters seen on the systematic survey was low the distribution was similar to that observed on previous occasions (Fig. 10). It is unlikely that any major concentrations were missed.

le 10. Results of sea otter aerial strip transect survey. Chirikof Island, 30 June 1978.

| nsect ber | Latitude | Longitude Start | Longitude End | Length (nm) | Sea otters sighted: Left strip | Right strip | Outside strips |
|---|---|---|---|---|---|---|---|
| [illegible] | 55° 44' | 155° 45' | 155° 15' | 14 | 0 | 0 | 0 |
| [illegible] | 55° 46' | 155° 15' | 155° 33' | 11 | 0 | 0 | 1 |
| [illegible] | 55° 48' | 155° 33' | 155° 15' | 10 | 0 | 0 | 2 |
| [illegible] | 55° 50' | 155° 15' | 155° 32' | 10 | 0 | 0 | 3 |
| [illegible] | 55° 52' | 155° 32' | 155° 15' | 10 | 0 | 0 | 0 |
| 10 | 55° 54' | 155° 15' | 155° 32' | 10 | 0 | 0 | 1 |
| 12 | 55° 56' | 155° 15' | 155° 50' | 20 | 0 | 0 | 0 |
| 13 | 55° 58' | 155° 14' | 155° 50' | 20 | 0 | 0 | 0 |
| 11 | 55° 54' | 155° 50' | 155° 37' | 6 | 0 | 0 | 0 |
| [illegible] | 55° 52' | 155° 39' | 155° 50' | 6 | 1 | 0 | 3 |
| [illegible] | 55° 50' | 155° 50' | 155° 43' | 4 | 1 | 0 | 0 |
| [illegible] | 55° 48' | 155° 43' | 155° 50' | 4 | 0 | 0 | 0 |
| [illegible] | 55° 46' | 155° 50' | 155° 43' | 4 | 0 | 0 | 0 |
| | | | Total | 129 | 2 | 0 | 10 |

le 11. Results of sea otter aerial strip transect survey. Trinity Islands, 28 August 1978.

| nsect ber | Longitude | Latitude South end | Latitude North end | Length (nm) | Sea otters sighted Left strip | Sea otters sighted Right strip | Sea otters sighted Outside strips |
|---|---|---|---|---|---|---|---|
| th of Trinity Islands | | | | | | | |
| -2S | 153° 55' | 56° 25' | Sitkinak I. | 5.5 | 0 | 0 | 1 |
| -3S | 154° 00' | 56° 25' | Sitkinak I. | 5.9 | 1 | 0 | 0 |
| -4S | 154° 05' | 56° 25' | Sitkinak I. | 5.3 | 0 | 0 | 0 |
| -5S | 154° 10' | 56° 25' | Sitkinak I. | 6.1 | 0 | 1 | 0 |
| -6S | 154° 15' | 56° 25' | Sitkinak I. | 5.7 | 0 | 0 | 0 |
| -7S | 154° 20' | 56° 23' | Sitkinak I. | 8.4 | 0 | 0 | 0 |
| -8S | 154° 25' | 56° 23' | Tugidak I. | 10.2 | 0 | 0 | 0 |
| -9S | 154° 30' | 56° 23' | Tugidak I. | 8.0 | 1 | 2 | 0 |
| -10S | 154° 35' | 56° 20' | Tugidak I. | 9.6 | 1 | 0 | 0 |
| -11S | 154° 40' | 56° 15' | Tugidak I. | 11.8 | 3 | 0 | 0 |
| -12S | 154° 45' | 56° 15' | Tugidak I. | 9.9 | 0 | 0 | 0 |
| -13S | 154° 50' | 56° 15' | 56° 26' | 11.0 | 2 | 0 | 0 |
| -14S | 154° 55' | 56° 15' | 56° 26' | 11.0 | 1 | 1 | 0 |
| -15S | 155° 00' | 56° 15' | 56° 26' | 11.0 | 0 | 0 | 0 |
| al | | | | 119.4 | 9 | 4 | 1 |
| th of Trinity Islands | | | | | | | |
| -15N | 155° 00' | 56° 26' | 56° 45' | 19.0 | 0 | 0 | 0 |
| -14N | 154° 55' | 56° 26' | 56° 45' | 19.0 | 0 | 0 | 0 |
| -13N | 154° 40' | 56° 26' | 56° 45' | 19.1 | 0 | 0 | 0 |
| -12N | 154° 45' | Tugidak I. | 56° 45' | 14.8 | 0 | 0 | 0 |
| -11N | 154° 40' | Tugidak I. | 56° 45' | 12.1 | 0 | 0 | 0 |
| -10N | 154° 35' | Tugidak I. | 56° 45' | 11.2 | 0 | 0 | 0 |
| -9N | 154° 30' | Tugidak I. | 56° 45' | 9.1 | 0 | 0 | 0 |
| -8N | 154° 25' | Tugidak I. | 56° 45' | 9.1 | 0 | 0 | 0 |
| -7N | 154° 20' | Sitkinak I. | 56° 45' | 12.8 | 0 | 0 | 0 |
| -6N | 154° 15' | Sitkinak I. | 56° 45' | 9.3 | 0 | 0 | 0 |
| -5N | 154° 10' | Sitkinak I. | 56° 45' | 9.2 | 0 | 0 | 0 |
| al | | | | 144.7 | 0 | 0 | 0 |

le 12. Locations of sea otters sighted on aerial systematic strip transect surveys.

rikof Island - 30 June 1978

| up e | Latitude | Longitude | Distance offshore | Water depth (fathoms) |
|---|---|---|---|---|
| | 55° 46' | 155° 33' | <1 nm | <10 fm |
| | 55° 47.5' | 155° 33' | <1 nm | <10 fm |
| | 55° 50.1' | 155° 30' | 2 nm | 10 fm |
| | 55° 51' | 155° 33' | <1 nm | <10 fm |
| | 55° 54' | 155° 28' | 5 nm | 20 fm |
| | 55° 51.8' | 155° 39.8' | near shore | <10 fm |
| | 55° 52' | 155° 42' | <2 nm | 10 fm |
| (w/pup?) | 55° 50' | 155° 43' | near shore | <10 fm |

nity Island - 26 August 1978

| up e | Latitude | Longitude | Distance offshore | Water depth (fathoms) |
|---|---|---|---|---|
| | 56° 30.3' | 154° 01.3' | 50 yd | < 5 fm |
| | 56° 27.0' | 154° 02' | 2.8 nm | 20 fm |
| | 56° 26.1' | 154° 12' | 3.5 nm | 20 fm |
| | 56° 24.4' | 154° 31.7' | 5.3 nm | 15 fm |
| | 56° 25.4' | 154° 31.6' | 4.2 nm | 12 fm |
| | 56° 27.9' | 154° 37' | 0.5 nm | < 5 fm |
| (♀ w/pup) | 56° 23.4' | 154° 42.1' | 1.0 nm | <10 fm |
| | 56° 22.5' | 154° 42' | 1.6 nm | <10 fm |
| | 56° 23.3' | 154° 51.2' | 2.7 nm | 10 fm |
| | 56° 23.3' | 154° 51.2' | 2.7 nm | 10 fm |
| (♀ w/pup) | 56° 23.3' | 154° 52.3' | 3.2 nm | 10 fm |
| | 56° 19.4' | 154° 56.8' | 7.5 nm | 12 fm |
| | 56° 20.5' | 154° 56.8' | 6.9 nm | 12 fm |

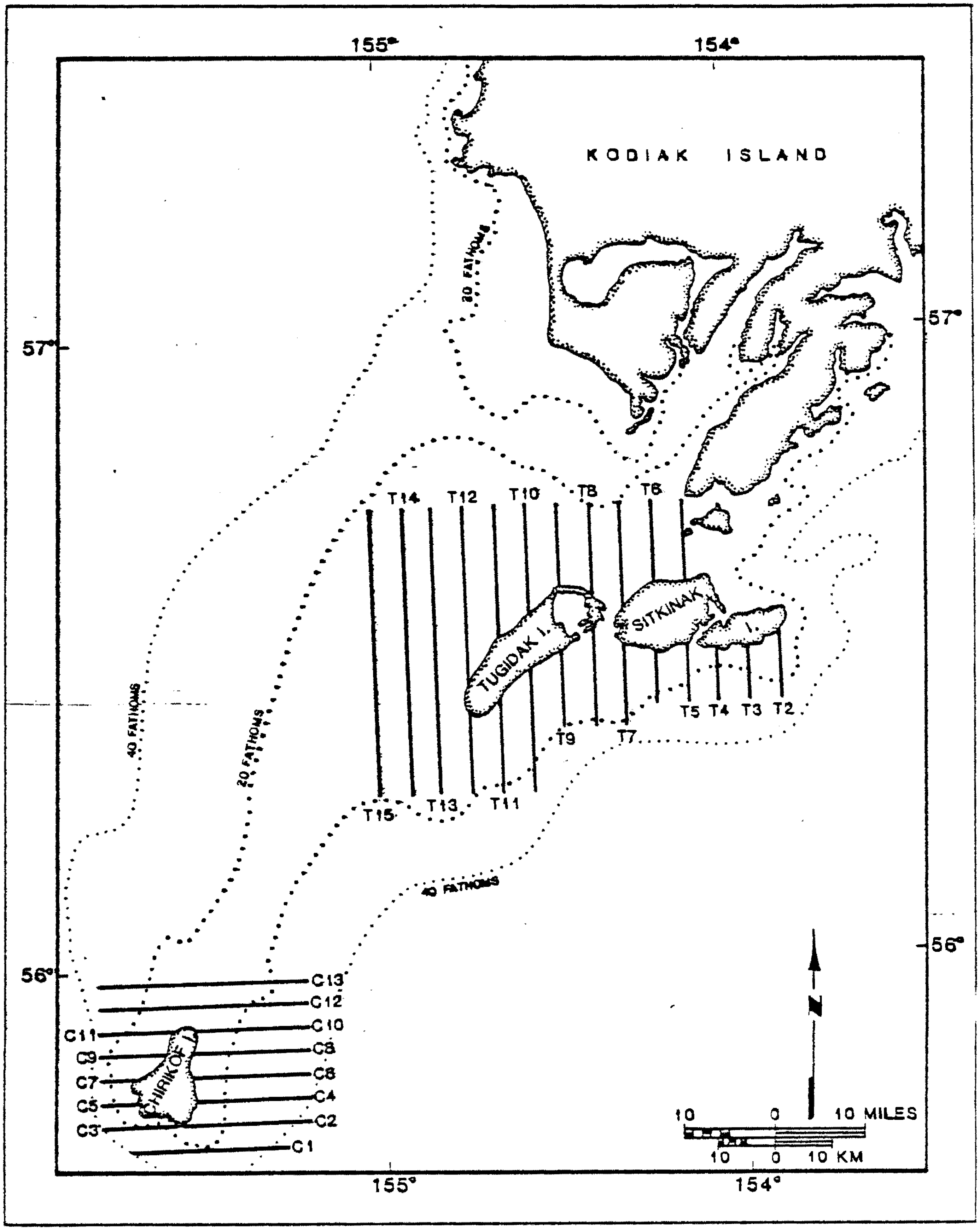


FIGURE 7. SEA OTTER SURVEY TRANSECTS.

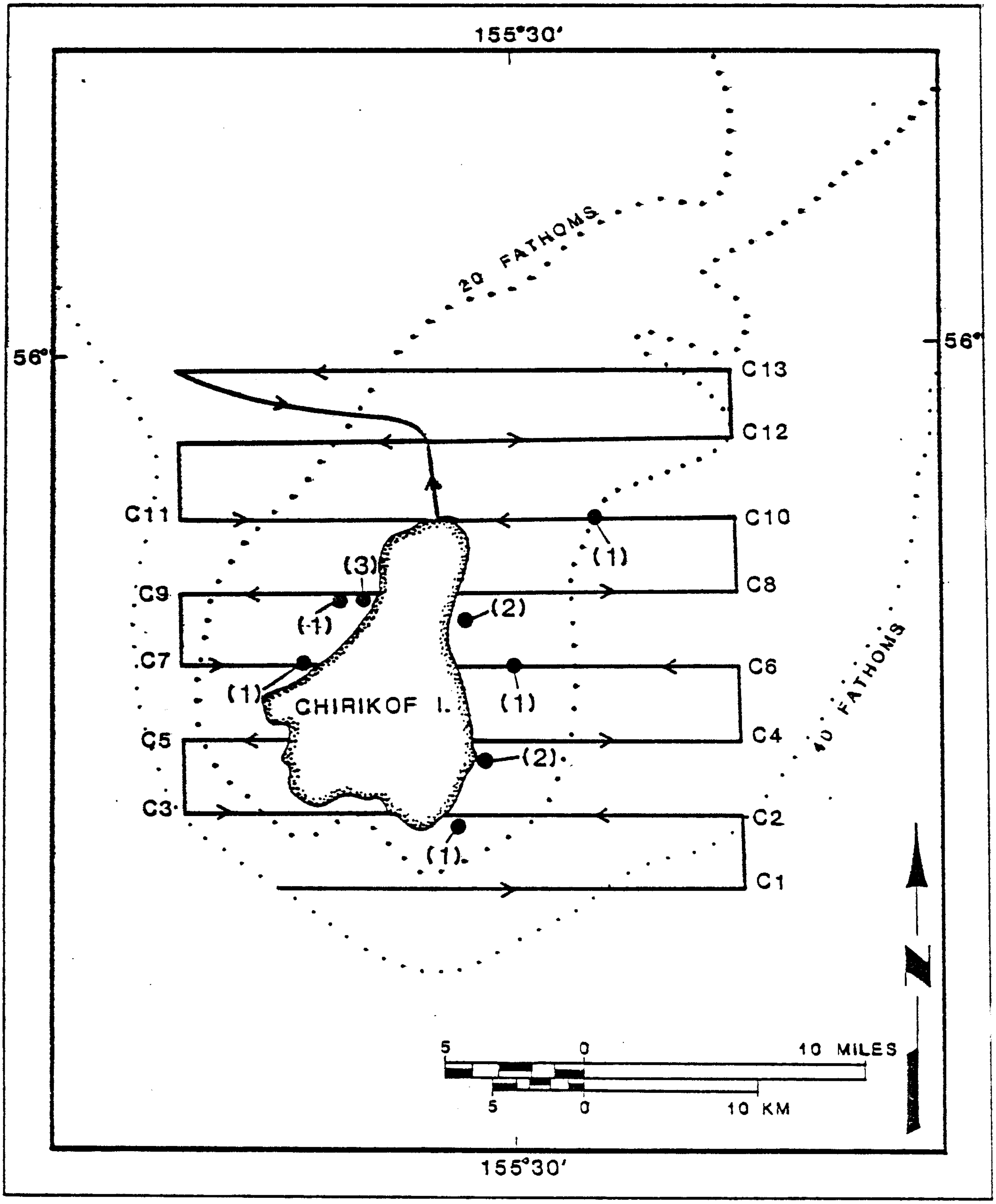


FIGURE 8. LOCATIONS OF SEA OTTERS SIGHTED ON SYSTEMATIC STRIP TRANSECT SURVEY, 30 JUNE 1978.

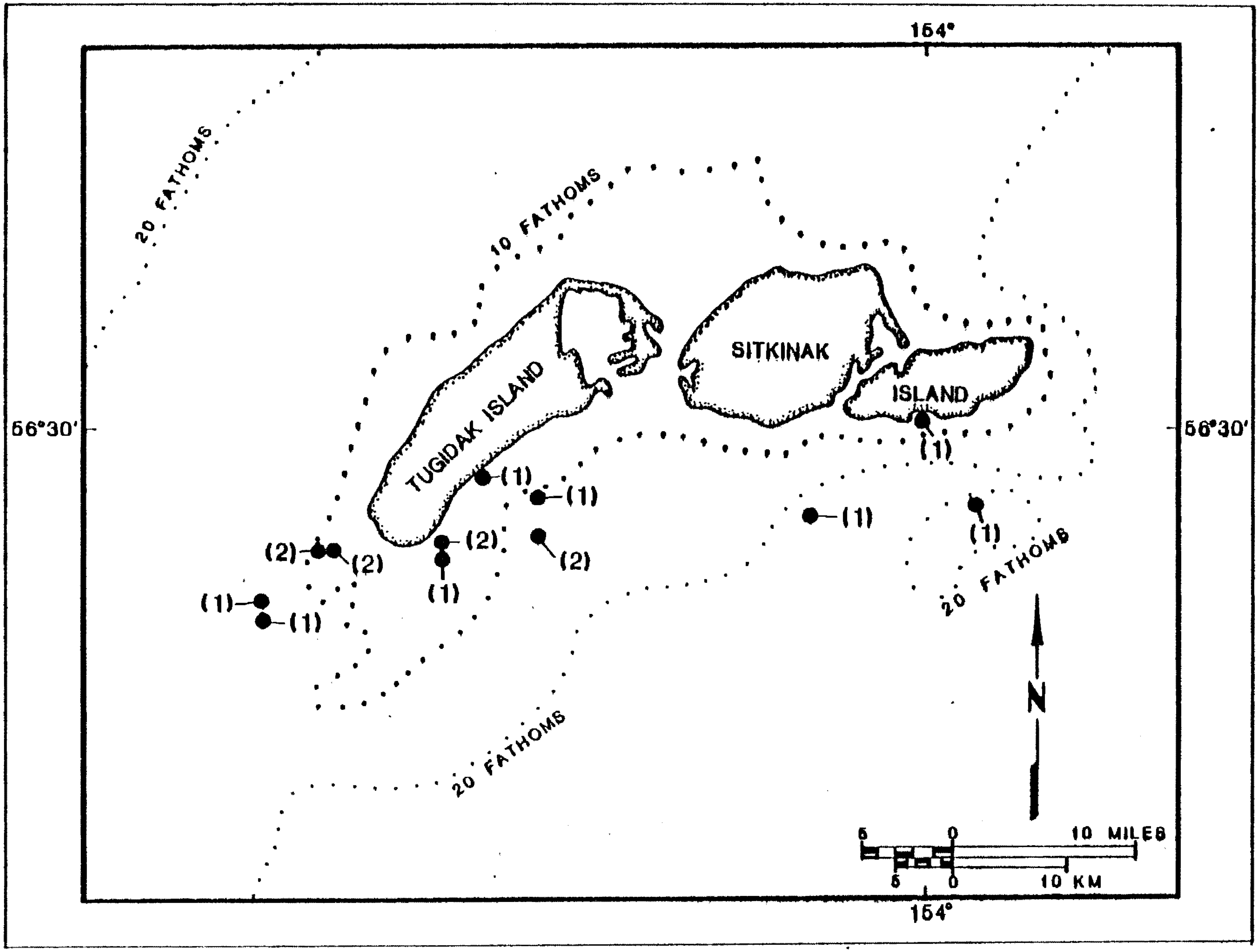


FIGURE 9. LOCATIONS OF SEA OTTERS SIGHTED ON SYSTEMATIC STRIP TRANSECT SURVEY, 26 AUGUST 1976.

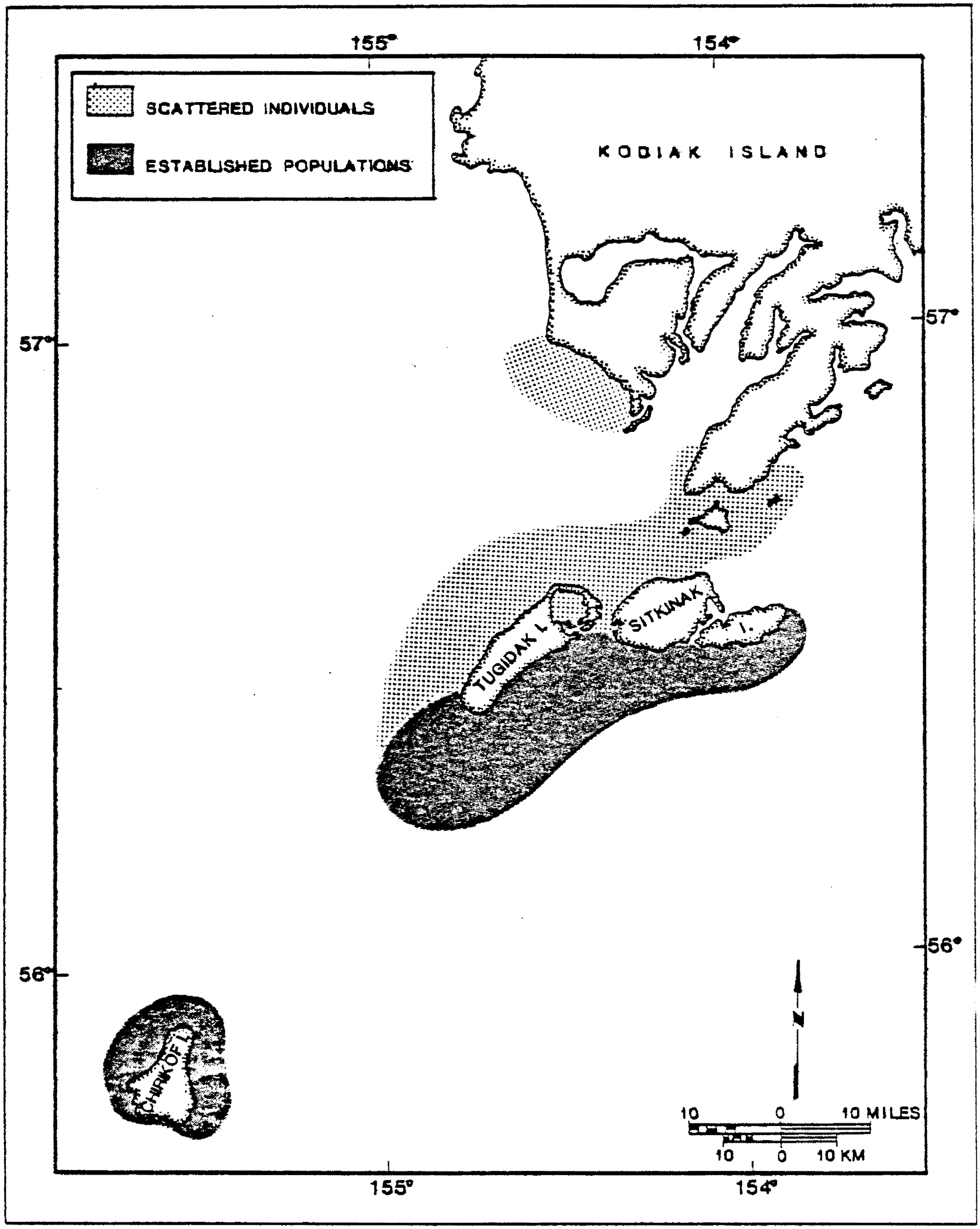


FIGURE 10. DISTRIBUTION OF SEA OTTER COLONIES, SOUTHERN KODIAK ARCHIPELAGO.

Sea otters have been sighted far from shore between Chirikof and Tugidak Islands but the lack of observations made on numerous trips by boat and aircraft between these islands indicates that no established concentration exists there at present. Therefore the Chirikof and Trinity Island colonies appear relatively distinct even though some interchange of individuals may occasionally occur.

As indicated by earlier observations, the Trinity Island concentration is centered south of Tugidak Island. The established range of this concentration appears to extend from the shallow area southwest of Tugidak Island to the vicinity of Cape Sitkinak. Most of the sea otters sighted in this area have been in waters less than 15 fathoms deep and the 15 fathom depth contour can probably be used to delineate the areas of highest sea otter use. Several sea otters were near the 20 fathom contour and it is possible that individuals may occasionally range offshore to waters up to 40 fathoms deep.

No sea otters were sighted north of the Trinity Islands. Biologists conducting seal studies along the northwest side of Tugidak Island have regularly found beach dead sea otters but few sightings of live sea otters have been reported except in 1976. At present it appears that the regular range of the population does not include the area north of the islands but that small numbers of otters move into the area periodically. This suggests that the population will extend its range in that direction in the near future.

The southern shore of Kodiak Island including Alitak and associated bays was surveyed by small boat and aircraft repeatedly between 1976 and 1978. Only stray individual sea otters were sighted and it is clear that no established concentrations presently exist east of Cape Alitak. The shallow area northwest of Cape Alitak has not been adequately covered. There is no evidence that more than stray individuals presently use this area but groups offshore may have been missed on the few flights made through the area.

2. Population Size - Available data are inadequate for development of a reliable population estimate. They do allow some guesses of the approximate magnitude of each colony however.

Approximately 10 percent of the potential sea otter habitat around Chirikof Island lay within the survey strips. Only two sea otters were seen inside these strips. A minimum of 18 different sea otters was seen during the survey and a seal survey conducted later the same day. Similarly a minimum of 18 were seen in October 1976. Experience with sea otter surveys in other areas indicates that such counts are usually biased low. The number of sea otters around Chirikof may be several times higher than these counts. However it is unlikely that any major concentrations have been missed and the total number of otters in the area probably does not exceed 100.

The Trinity Island colony is clearly larger than the Chirikof colony. Approximately 7 percent of the survey area fell within the survey strips. A simple expansion of the counts produced an estimate of·182 sea otters. If the left strip is excluded because of the poor viewing angle for the observer the estimate is increased to 252. Survey conditions were poor, the mean group size was small and a substantial portion of the population is likely to be underwater at any moment. Therefore these estimates are consistantly quite low. A subjective assessment based on comparative counts of other sea otter populations suggests that there may be two or three times the number estimated. A range of 400 to 700 would appear reasonable. The actual population may fall outside of this range but the incidence of beach dead animals is higher than would be expected in a smaller population. If the actual number exceeds that range one or more major concentrations must have been missed.

3. <u>Status</u> - Available information indicates that the southern Kodiak sea otter colonies are growing steadily but are far below carrying capacity. It is not possible to estimate the rate of population growth but sea otters probably numbered in the tens in the late 1950's and in the hundreds now.

There is no reliable basis for estimating carrying capacity directly so we must rely on comparisons with other areas. Southwestern Bristol Bay is the only area previously studied which appears outwardly similar to southern Kodiak. An estimate of 400 to 700 sea otters south of the Trinity Islands represents densities of 0.35 to 0.61 sea otters/$km^2$ in the area surveyed. Densities in southwestern Bristol Bay were estimated at over 3.0 sea otters/$km^2$

and up to 20 sea otters/km$^2$ may occur in other types of habitat. Therefore densities in the primary range of the present colonies are relatively low.

Extensive areas of evidently excellent sea otter habitat adjacent to the present colonies are essentially vacant. This indicates little population stress within the primary range.

The status of sea otter populations tends to be reflected in the age structure of beach dead animals. Natural mortality of young animals tends to be low in colonies well below carrying capacity and the majority of beach dead animals are old adults. As the population approaches carrying capacity, competition for food increases and juvenile mortality increases sharply resulting in a shift in the age structure of beach dead sea otters. Numbers of beach dead sea otters found on Tugidak Island have increased in recent years. As a result two areas have been selected as beach-dead sea otter transects (Fig. 11). Specific ages of dead otters found have not been analyzed, but all except two newborn pups (possibly stillborn twins) were adults fitting the typical pattern of a population well below carrying capacity.

4. Future - Both the Chirikof and Trinity Island colonies are well established and of sufficient size to survive any likely natural calamities. An unnatural event such as an oil spill could endanger either colony however.

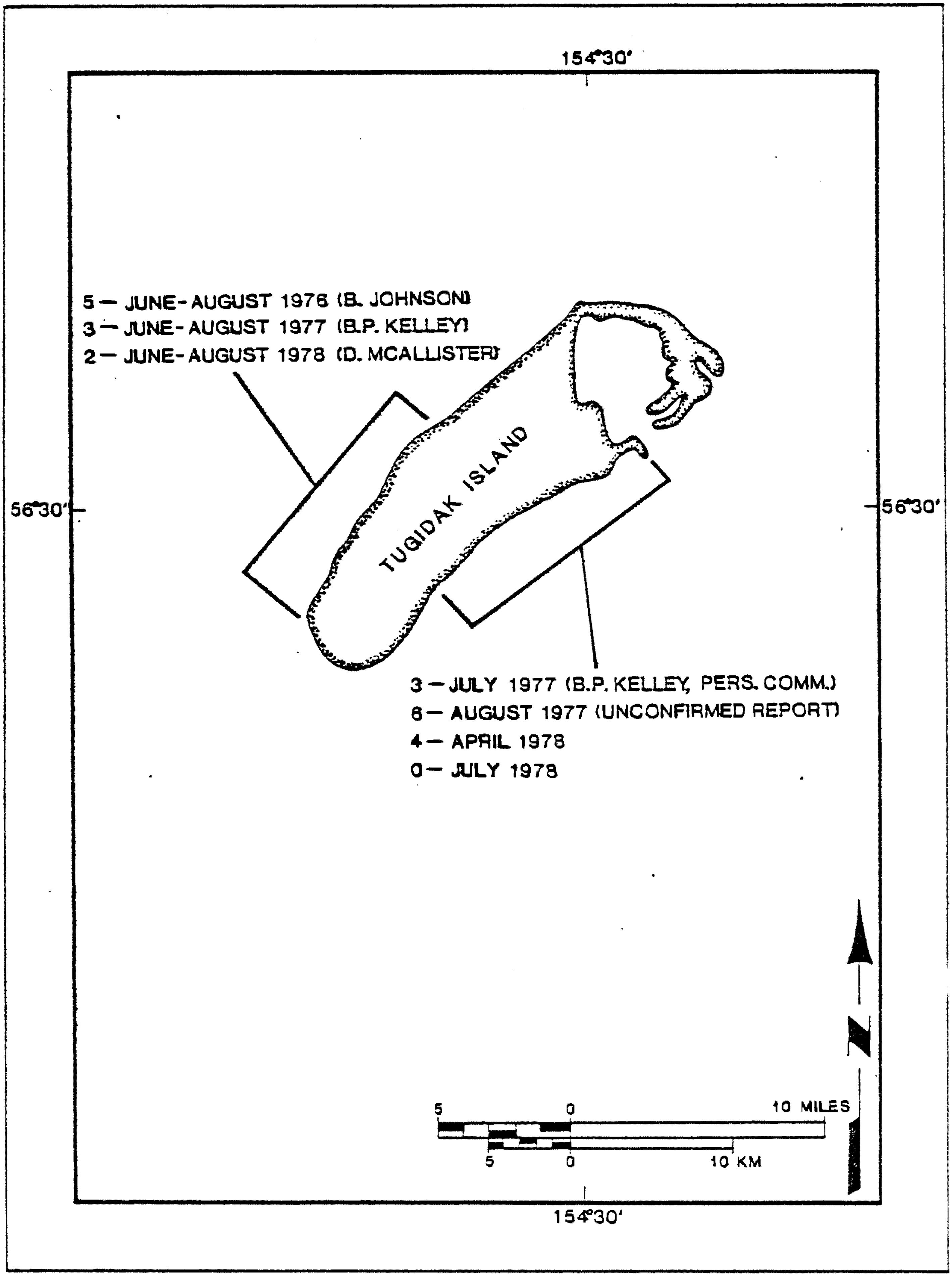


FIGURE 11. BEACH-DEAD SEA OTTER TRANSECTS. TUGIDAK ISLAND.

Most sea otter populations that have reached the size of the Trinity Island colony have continued to increase rapidly and expanded their range into adjacent vacant habitat when available. There is no reason to believe that this pattern will not be repeated here. As the population gets larger and less concentrated its vulnerability to oil spills will decrease.

## SEMIDI ISLANDS

### Background

The Semidi Islands have been virtually ignored by authors decribing the distribution of sea otters. Lensink (1962: 36) indicated that sea otters were present in a figure but made no mention of the islands in his text. Kenyon (1969) referred to a survey made by Lensink in 1957 when five sea otters were sighted. Apparently no other surveys have been made in this island group although W. Troyer (pers. comm.) confirmed that sea otters were present in small numbers in the late 1960's.

### Methods

No special effort to survey the Semidi Islands has been made but sufficient information to provide a general picture of distribution and abundance has been collected incidental to other activities. The islands have been visited several times in the course of sea lion surveys. The waters around Anowik, Kiliktagik, Suklik, Aliksemit and the southeast portion of Chowiet Islands have been searched repeatedly from boat, helicopter and shore. On October 7, 1976 the shoreline of the entire island group was covered by helicopter although visibility conditions were considered unacceptable for sea otter surveying. S. Hatch (pers. comm.) conducted studies of Fulmars in the southern half of the island group for several years. He recorded sea otter observations in the vicinity of Chowiet Island.

Results and Discussion

All recent recorded sightings of sea otters in the Semidi Islands are presented in Fig. 12.

Coverage of the southern half of the island group has been sufficiently thorough that we can be confident of the distribution of sea otters there. A small concentration is centered around Kateekuk Island and the adjacent northern tip of Chowiet Island. The occasional individuals sighted away from this group are probably transient strays. At least 20 sea otters inhabited this area in 1977. Since Kateekuk Island wasn't covered when S. Hatch sighted the largest number this colony could be somewhat larger. Most likely this colony does not exceed 25 to 30 sea otters.

Information from Aghiyuk Island in the northern half of the group is less reliable. Sea otters sighted there on October 7, 1976 probably were not at Chowiet on May 11, 1977 but this possibility can not be ruled out. Regardless, a second concentration area and probably a relatively distinct group of individuals occurs along the northeast side

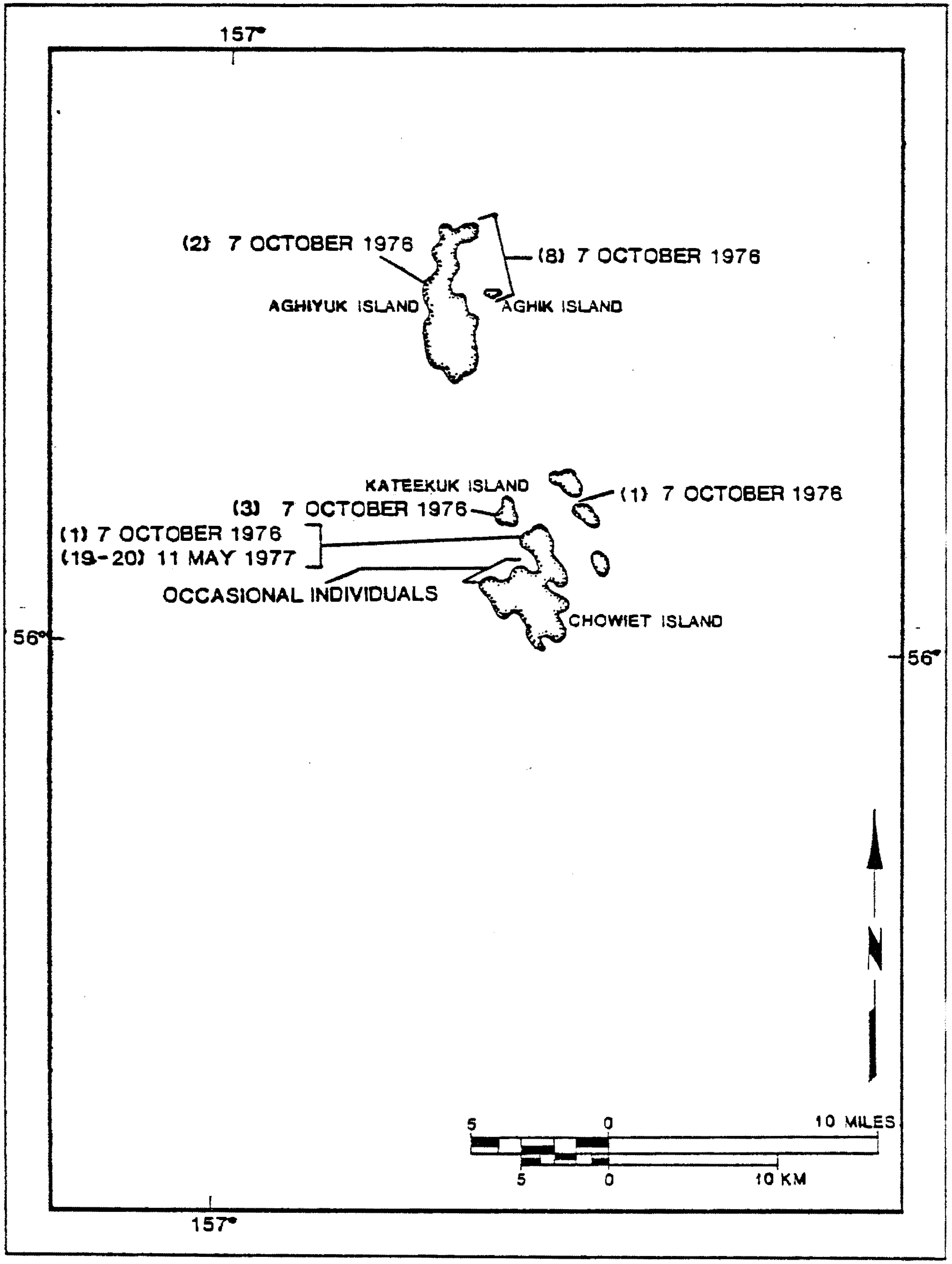


FIGURE 12. RECENT SIGHTINGS OF SEA OTTERS IN THE SEMIDI ISLANDS.

of Aghiyuk Island. Since survey conditions on October 7, 1976 were extremely poor a number of sea otters probably were missed.

Therefore the total sea otter population of the Semidi Islands is probably between 30 and 50. Portions of the available sea otter habitat are not currently inhabited. The population probably is growing through reproduction, immigration from Sutwick Island or both. It is impossible to predict the final population size but potential habitat is limited. A rough comparison with other areas indicates that the long term carrying capacity of the Semidi Islands is less than 200.

The population is obviously in a tenuous position because of its small size, limited distribution and relative remoteness from more securely established colonies.

# BELUKHA WHALES IN LOWER COOK INLET

Nancy Murray

## Distribution and Abundance

The Cook Inlet belukha population has been estimated by Klinkhart (1966) at 300 to 400. Recent survey conducted in the Inlet to determine distribution and abundance have not changed this estimate. Most surveys have involved shoreline observations and have not been intensive surveys of the open water areas of the Inlet. Accurate counting methods need to be developed so that a better population estimate will become available.

Fay (pers. comm.) feels the Cook Inlet belukha population could be a separate stock. A preliminary investigation of comparative crainial morphology indicates that the Cook Inlet belukhas may be taxonomically distinct from all other populations, perhaps as a consequence of long-term isolation in this area.

The Cook Inlet belukha population is thought to be resident in the Inlet year-round (Fay 1971; Klinkhart 1966; Scheffer 1973). Sighting data from 1976-1979 confirm that belukhas are present in all seasons in the Inlet.

Belukhas are seasonally distributed in the different regions of the Inlet. They have been sighted in the Upper Inlet primarily in late spring and summer. Belukhas are seen throughout the year in the central and lower areas, with heaviest use occurring in the central Inlet area (Fig. 13).

Within the Inlet, numbers appear to fluctuate seasonally, with the greatest number seen in mid to late summer and the fewest in winter. Ice conditions may have a strong correlation with winter abundance. In a winter of warm temperatures (1978) with little ice cover, belukhas were found in the central and lower Inlet. Whereas, in a winter of normally colder temperatures (1979) and extensive ice conditions, few belukhas were observed. The location to which the belukhas go when and if they leave the Inlet in winter has not been determined. No belukhas were sighted on an aerial survey in March, 1979 in the neritic waters from Chignik Bay on the Alaska Peninsula to the mouth of Cook Inlet to the eastern extremity of Prince William Sound. Belukhas have been sighted in Yakutat Bay which are presumably from Cook Inlet.

There is a paucity of information on breeding, calving and feeding concentrations of belukhas in Cook Inlet. Breeding whales have not been observed in the Inlet. Calving areas are not known; however, on aerial surveys in 1978 calves were observed at the Beluga River and in Trading and Redoubt Bays in mid-July. No calves were seen on the mid-June survey. Consequently, it appears that calving begins between mid-June and mid-July and may occur at the large river estuaries in the western upper Inlet. Calves were also observed in mid-August in the central Inlet between Kalgin Island and the Kasilof River and in mid-October in Tuxedni Bay.

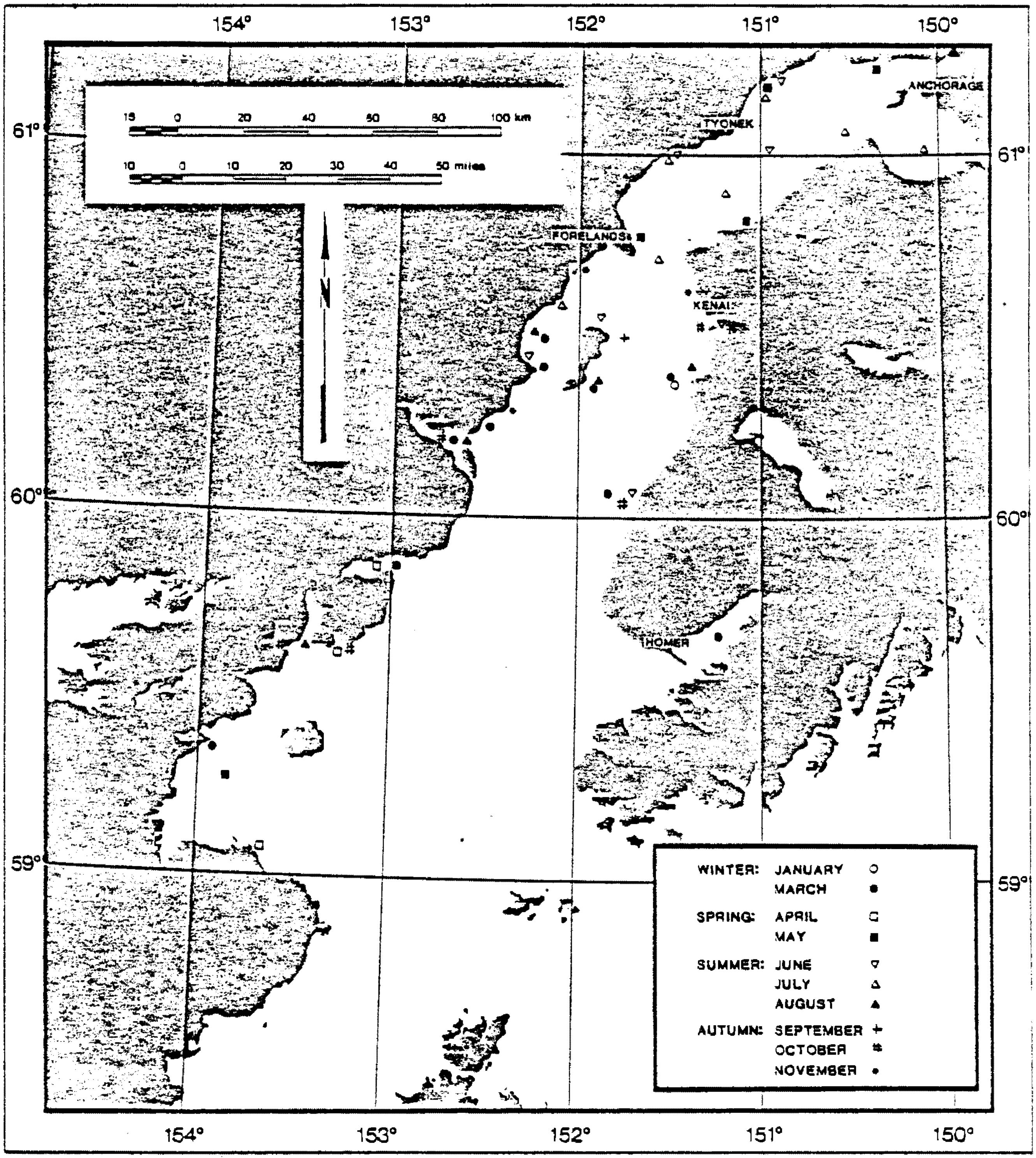


FIGURE 13. SEASONAL SIGHTINGS OF BELUKHA WHALES IN COOK INLET, 1976, 1977 AND 1978.

Concentrations were observed in mid-July at the mouth of the Beluga River and along the shoreline in Trading Bay, apparently feeding. The belukhas appeared to be eating fish caught close in to shore. These belukhas were in groups ranging from two to 25 animals. In mid-August a group of at least 150 whales was observed on three different days in the waters between Kalgin Island and the Kasilof River. The whales remained in this general area over at least a 4 day period. The whales were all aligned on the same directional heading with lead animals observed to break off from the front of the group. This behavior did not result in the remainder of the group changing its heading. Consequently, this type of large group formation most likely represents a feeding aggregation, although no feeding behavior (such as darting after a fish, etc.) or food source was directly observed.

## Habitat

Studies have been conducted on various aspects of the biology of belukha whales in several major arctic and subarctic concentration areas, but no study directly addressing the problem of habitat requirements has been undertaken. The habitat types used by belukhas appear to fall into four categories: 1) migration routes, 2) feeding grounds, 3) breeding grounds, and 4) calving/ nursery grounds. Food resources may be the critical element determining the interrelationship of habitat requirements. The habitat requirements vary seasonally and with the age and sex of the whale. The seasonal variations are dynamic and introduce difficulties in determining simple habitat requirements.

Migrations, whether extensive or localized, can be influenced by abiotic and biotic factors. Some authors consider ice dynamics to be of primary importance, while others contend that availability of food resources dominates. Kleinenberg et al. (1964) held that these factors act in combination. Ice conditions have a definite impact on the direction and timing of movements. Both the pattern of distribution and the abundance of whales are dominated by ice (Fay 1974; Fraker 1977). Although migratory patterns along the Alaska coast are poorly known, the movements of belukhas appear to be related to the movements of smelt, salmon smolts, and Arctic cod (Fiscus et al. 1976). Major surface current patterns in Cook Inlet would suggest that the most energetically efficient route to the upper Inlet would be along the eastern coast, while the route from the upper Inlet to the lower would be on the western coast. Seasonal distribution in the Inlet suggest that localized movements, most likely related to food resources and possibly calving ground areas, are critical to sustaining this population.

Feeding grounds are determined and influenced by both biotic and abiotic factors. Concentration of food organisms is probably of major importance in determining where belukhas will feed. The biology and behavior of the food organisms play a key role in their accessibility to the belukha. Ice dynamics affect the presence of food organisms in certain areas as well as limit the movements of belukhas. Other abiotic factors, including temperature, salinity, depth, sediment characteristics, and tides and currents not only affect the distribution of the belukha but the distribution of the belukhas' food resources as well.

The belukhas' characteristic summer movement inshore to river estuaries appears to be associated with concentrations of fish in these areas (Klinkhart 1966; Sergeant 1962; Tarasevich 1960). These whales also leave the estuarine areas to feed on pelagic fishes and invertebrates in the open sea and among the broken ice (Hay and McClung 1976). Belukhas also feed along the migration routes on patchy plankton and fish concentrations (Kleinenberg et al. 1964), indicating an overlap between migration route and feeding ground categories. Large herd formation is associated with heavy concentrations of food organisms in small feeding areas (Bel'kovich 1960). Fluctuations in food organism numbers, periodicity of occurrence, and seasonal inaccessibility cause irregularity of food resources for the belukha. This variability has likely resulted in selection for the broad feeding spectrum exhibited by these whales.

There is a lack of information on the belukha's breeding biology. Breeding grounds are unknown in Cook Inlet. Due to the apparent timing of reproductive events, it is assumed here that breeding may occur along the migration route (overlap between categories) as the whales are approaching their summer feeding and calving grounds. It is also not known whether these whales feed while engaged in breeding activities.

While river estuaries are thought to be calving grounds, no births have been witnessed in these or any other areas. Recent evidence indicates that calves may be born outside the estuaries (Fraker 1977) and then move into these areas with their mothers (Hay and McClung 1976). Therefore, these areas might be considered more appropriately as nursery grounds.

Estuarine areas are important to newborn calves due to the higher temperatures which "may lessen the shock of birth and reduce heat loss in the first few days until the young animal has acquired some subcutaneous fat" (Sergeant 1973). Fraker (1977) also emphasized water temperature as the key factor in selection of these areas. He found that at the time of their use by large numbers of whales, these river estuaries had high temperatures, high turbidities, low salinities and shallow depths. All age classes congregate in the estuaries during the calving period. Fraker (1977) hypothesized that all age classes benefit from the thermal advantages, but that newborn calves would benefit the most from this advantage due to their small surface-to-volume ratio and limited fat deposits. Food resources have not been investigated in these areas, so it is possible that juvenile and adult whales may be feeding while in the calving/nursery grounds.

There is little information available at present on the seasonal use of specific habitat categories for the Cook Inlet population. Localized migrations occur throughout the Inlet during the year and may extend outside the Inlet into Shelikof Strait or possibly as far away as Yakutat Bay in the winter. Since food resources are likely the primary influence on localized migrations, the Cook Inlet belukhas are probably feeding in most areas where they are found. There are likely to be shifts in food items correlated with season and location. If Cook Inlet belukhas are breeding in May and or June, this activity is most likely occurring in the Upper Inlet. Calving/nursery grounds would be occupied in early to mid summer. Based on information from the literature as well as aerial survey data, the large river estuaries in the northwest Inlet (from

Susitna River to Trading Bay) are probably the primary location for these activities. In summary, the Cook Inlet belukhas range widely throughout the Inlet making seasonal use of specific habitat areas and food resources.

## Population Dynamics

Mating behavior has not been observed in belukhas. Sexual maturity is reached in the female at an age of five years and in the male at about eight years (Brodie 1971). Strong pair bonding between any one male and female is unlikely, since trios of two adults and a calf are not observed (Fraker 1977). This also appears to be the case for the Cook Inlet belukhas. Although Vladykov (1946) states that breeding occurs from April to June and Doan and Douglas (1953) state that breeding can occur later in the summer, the general concensus is that a breeding peak occurs in May (Brodie 1971; Doan and Douglas 1953; Vladykov 1946). Klinkhart (1966) states that all adult males taken from the Bristol Bay population from May to September were in reproductive condition. However, a short peak of calving for this population suggested that breeding was confined to a relatively short period in May or June. This timing may also be found for the Cook Inlet population.

Belukhas have a three year reproductive cycle (Brodie 1971). The gestation period is about 14 months (Sergeant 1962 and 1973). The breeding period occurs approximately 2 months prior to the calving period. Assuming that breeding occurs in May, Brodie (1971) found that females gave birth approximately 14 months later, in late July and early August. Lactation lasted for the next 21 months, indicating an almost 2 year period of nursing. Reproductive rates have not been calculated for any population. However, assuming an average life span of 32 years (Kleinenberg et al. 1964) with the onset of maturity in the female at 5 years and a 3 year period between calving, a female would have an average of nine calves over her life span.

The sex and age structure has not been determined for the Cook Inlet population. Males cannot be easily differentiated from females. However, color differentiation can be made between juveniles and adults, since attainment of white coloration corresponds to sexual maturity. In the large concentration observed in August 1978, approximately one of seven whales was a juvenile.

Mortality factors include predation, parasites, diseases, and hunting. The only natural predator of the belukha known to occur in Cook Inlet is the killer whale, *Orcinus orca*. Killer whales are seen only in the lower Inlet in summer. Since the belukhas are generally in the central and upper Inlet areas during this time, there is probably little loss of belukhas to killer whale predation.

Endoparasites found in the belukha include acanthocephalans, trematodes, cestodes and nematodes (Kleinenberg et al. 1964; Klinkhart 1966). Their effects on the belukha are unknown. The occurrence of these parasites in Cook Inlet belukhas has not been studied. Other diseases are unknown in belukha populations.

Only limited hunting of the Cook Inlet belukhas has taken place since the 1950's. Belukhas found near fishing nets and vessels are occasionally shot and killed. There are no concrete data on the frequency of occurrence of whales killed in this manner, but it is unlikely more than two per year.

Food Habits

The belukha has a broad feeding spectrum. Their food resources include a variety of fishes and various kinds of octopus, squid, crab, shrimp, clams, snails, and sand worms (Fay 1971). The maximum size of food organisms is limited by the capacity of the esophagus, since food items are swallowed whole (Fay 1971; Fraker 1977). Kleinenberg et al. (1964) state that belukhas do not feed on deep water organisms.

Important food organisms of the belukha in Cook Inlet in the summer appear to be the osmerids and salmonids. Belukhas caught in Bristol Bay and Cook Inlet during the summer were found to contain salmon, smelt, flounder, sole, sculpin, shrimp and mussels. Data for the upper Inlet are not available. Possible foods for the belukha in the Kachemak Bay area are shrimp, crab, halibut, sole, herring and octopus.

The food of the belukha can be expected to vary seasonally and with location. During the spring and summer, the Cook Inlet belukhas probably feed on salmon smolts migrating from river estuaries as well as heavy concentrations of adult salmon schooling off the river mouths. Throughout the summer, belukhas may switch from one salmon species to the next.

King salmon run earliest in the Inlet with reds, pinks, chum and silvers following in that order. In the fall-winter season belukhas may eat smelt, bottom fishes and invertebrates. In the spring belukhas are found near concentrations of smelt.

Sergeant and Brodie (1969) suggest that productivity of the winter environment is critical in determining the adult size of belukhas in different regions. They suggest that "Selection has reduced the biomass of an individual white whale to that enabling it to maintain its metabolic activity on the available food." Further, "there appears to be no gross difference in numbers of white whales between trophically suboptimal and more suitable environments; the difference is expressed in individual biomass."

The food of the belukha also varies with age and sex. Lactation lasts about 2 years in belukha (Brodie 1971; Sergeant 1973). Young of the year feed only on milk, while yearlings supplement the milk by feeding on capelin, sandlance, shrimp, and small bottom dwelling crustacea (Brodie 1971; Kleinenberg et al. 1964; Sergeant 1962). The food of subadults is similar to the diet of adult animals. Adult males feed primarily on large fish while females prefer food items such as sandlance, octopus and particularly *Nereis* (Kleinberg et al 1964). Fluctuations in food organism numbers, periodicity of occurrence, and seasonal inaccessibility cause irregularity of food resources for the belukha. This may have caused the belukha not only to widen its feeding spectrum but to differentiate food habits by age and sex. This differentiation enables the belukha to successfully utilize the available food (Kleinenberg et al. 1964).

## Behavior

Possible feeding behavior of belukhas has only been observed on two occassions during aerial surveys in Cook Inlet. Near shore feeding groups appear to consists of small aggregations of belukhas randomly aligned with respect to one another. Whales were seen lying at the surface facing the shore; individuals pitched forward in the water such that only the flukes were visible at the surface and then pitched back to the original position. The whales appeared to be operating individually in their efforts to catch food.

Groups of migrating belukhas vary in number and composition. Most groups contain a predominance of adults with a few juveniles. Generally the animals are closely spaced, although a widely scattered group in which all individuals had the same directional heading was observed in March 1979. In groups of 10 to 30 animals, all whales do not surface simultaneously. Instead, there is usually a wave of three groups: the first group surfaces; as it is beginning to submerge, the second group surfaces; as this group is beginning to submerge, the third group surfaces; this is closely followed by the first group surfacing while the third is still at the surface. Calves closely follow their mother's movements and on all occassions were seen to the left rear side of the adult.

## LITERATURE CITED

Bel'kovich, V. M. 1960. Some biological observations on the white whale from the aircraft. Zool. Zur. 30:1414-1422.

Brodie, P. F. 1971. A reconsideration of aspects of growth, reproduction and behavior of the white whale (*Delphinapterus leucas*), with reference to the Cumberland Sound, Baffin Island, population. J. Fish. Res. Bd. Can. 28:1309-1318.

Calkins, D. G. and K. W. Pitcher. 1977. Population Assessment, Ecology and Trophic Relationships of Steller Sea Lions in the Gulf of Alaska. In Environmental Assessment of the Alaskan Continental Shelf, Annual Reports of Principal Investigators for the year ending March 1977, Vol. I. Receptors - Mammals.

__________. 1978. Population Assessment, Ecology and Trophic Relationships of Steller Sea Lions in the Gulf of Alaska. In Environmental Assessment of the Alaskan Continental Shelf, Annual Reports of Principal Investigators for the year ending March 1978, Vol. I. Receptors - Mammals.

Doan, K. H., and C. W. Douglas. 1953. Beluga of the Churchill region of Hudson Bay. Fish. Res. Bd. Can. Bull. 98:27 pp.

Fay, F. H. 1971. Belukha, arctic white whales. In A. Seed (ed.), Toothed Whales in the Eastern North Pacific and Arctic Waters, Pacific Search, Seattle, Wash., pp. 23-27.

__________. 1974. The role of ice in the ecology of marine mammals in the Bering Sea. In D. W. Hood and E. J. Kelley (eds.), Oceanography of the Bering Sea, Univ. of Alaska, Inst. of Mar. Sci., Occas. Publ. No. 2, pp. 383-399.

Fiscus, C. H., H. W. Braham, R. W. Mercer, R. D. Everitt, B. D. Krogman, P. D. McGuire, C. E. Peterson, R. M. Sonntag, and D. E. Withrow. 1976. Seasonal distribution and relative abundance of marine mammals in the Gulf of Alaska. Seattle: NOAA, NWAFC, Marine Mammal Division.

Fraker, M. A. 1977. The 1977 whale monitoring program, Mackenzie estuary, N.W.T. IOL: F. F. Slaney and Co. Lts., Vancouver, Can. :53 pp.

Gentry, R. 1970. Social Behavior of the Steller Sea Lion. PhD Thesis. U.C. Santa Cruz. Santa Cruz, Calif. 113 pp.

Hay, K., and R. McClung. 1976. Observations on beluga and narwal in the Canadian high arctic, summer 1974. Fish. Res. Bd. Can., MRS No. 1358:44 pp.

Kenyon, K. 1969. The sea otter in the eastern Pacific Ocean. U.S. Fish Wildl. Serv. N. A. Fauna No. 68. 352 pp.

Kleinenberg, S. E., A. V. Yablokov, V. M. Bel'kovich, and M. N. Tarasevich. 1964. Belukha (*Delphinapterus leucas*): Monographic investigation of the species. Moscow: Science Publisher (Isreal Prog. Sci. Transl. 1969).

Klinkhart, E. G. 1966. The beluga whale in Alaska. Alaska Dept. Fish and Game, Juneau. 11 pp.

Lensink, C. 1960. Status and distribution of sea otters in Alaska. J. Mammal. 41(2):172-182.

__________. 1962. The history and status of sea otters in Alaska. Unpubl. PhD. Thesis Purdue Univ. 188 pp.

Pike, G. C., and B. E. Maxwell. 1958. The abundance and distribution of the northern sea lion (*Eumetopias jubata*) on the coast of British Columbia. J. Fish. Res. Bd. Canada. 15:5-17.

Pitcher, K. W. 1975. Distribution and abundance of sea otters, Steller sea lions, and harbor seals in Prince William Sound, Alaska. Alaska Dept. Fish & Game. 56 pp. Proc. Rep.

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

Scheffer, V. B. 1946. Growth and behavior of young sea lions. J. Mamm. 26:390-392.

__________. 1973. Marine mammals in the Gulf of Alaska. In D. H. Rosenburg (ed.), A Review of the Northern Gulf of Alaska, Univ. of Alaska. pp. 1975-207.

Schneider, K. B. 1976a. Distribution and abundance of Sea otters in Southwestern Bristol Bay, Final Report. In Environmental Assessment of the Alaskan Continental Shelf, Principal Investigators Reports October - December 1976. Vol. I. Receptors (Biota): Marine Mammals; Marine Birds; Microbiology, Pa 469-526. U.S. Dept. of Commerce, NOAA.

Schneider, K. B. 1976b. Assessment of the Distribution and Abundance of Sea Otters Along the Kenai Peninsula, Kamishak Bay and the Kodiak Archipelago. In Environmental Assessment of the Alaskan Continental Shelf, Principal Investigators Reports October - December 1976. Vol. I. Receptors (Biota): Marine Mammals; Marine Birds; Microbiology. pp. 376-468. U.S. Dept. of Commerce, NOAA.

Sergeant, D. E. 1962. The biology and hunting of beluga or white whales in the Canadian arctic. Fish. Res. Bd. Can., Arctic Unit, Circ. No. 8, 13 pp.

__________, and P. F. Brodie. 1969. Body size in white whales (*Delphinapterus leucas*). J. Fish. Res. Bd. Can. 26:2561-2580.

__________, and P. F. Brodie. 1975. Identity, abundance, and present status of populations of white whales, *Delphinapterus leucas*, in North America. J. Fish. Res. Bd. Can. 32:1047-1054.

Tarasevich, M. N. 1960. Characteristics of white whale migration toward the coast. NTIS, 1974. pp. 145-153.

Vladykov, V. D. 1946. Etudes sur les Mammiferes aquatiques IV. Nourriture du Marsouin Blanc ou Beluga...du Flueve St.-Laurent. Dept. Pecheries Prov. Quebec, Contrib. No. 17, 123 pp.