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SEASONAL DISTRIBUTION AND HABITAT USE BY SITKA BLACK-TAILED DEER IN SOUTHEASTERN ALASKA

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Volume I
Project Progress Report
Federal Aid in Wildlife Restoration
Project W-17-11, Job No. 2.6R

(Printed December 1979)

JOB PROGRESS REPORT (RESEARCH)

State: Alaska

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Project No.: W-17-11 Project Title: Big Game Investigations

Job No.: 2.6R Job Title: Seasonal Distribution and Habitat Use By Sitka Black-Tailed Deer in Southeastern Alaska

Period Covered: August 1, 1978 through June 30, 1979

SUMMARY

Spring pellet group sampling indicated lower overall deer use in clearcut-forest edge sites than in old-growth forest sites. These data, in combination with the results of spring 1979 beach mortality surveys, suggested higher mortality levels for deer wintering near beaches below clearcuts than in old growth. Sampling techniques were developed for evaluating deer-forest relationships. One hundred and thirty-one sites were sampled and data prepared for computer analysis.

Various deer capture techniques were evaluated. Shooting capture syringes loaded with powdered succinylcholine chloride from a skiff, when deer were concentrated on beaches by deep snow, proved most successful. Baiting and trapping were ineffective. Twenty-one deer were captured. The average successful drug dose for adult deer was 11.5 mg.

From November 1978 through September 1979, 484 locations of instrumented deer were recorded. Seasonal home range areas were calculated and habitat use described. During winter and spring, deer ranged as high as snow conditions permitted but were generally confined below 450 m. Throughout the summer period, use was widely distributed from sea level to alpine. Throughout the period monitored, forested habitat was used to a greater degree than any other habitat type. During summer, use of alpine and subalpine areas increased substantially. Although deer use of clearcuts increased from winter to summer, use was proportionately low.

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BACKGROUND

The natural distribution of Sitka black-tailed deer (*Odocoileus hemionus sitkensis*) is limited to a narrow band of land between high coastal mountains to the east and the ocean on the west, from northern British Columbia to Glacier Bay in Southeast Alaska. Western hemlock-Sitka spruce (*Tsuga heterophylla-Picea sitchensis*) forests dominate the lower elevations of deer range, while above 650 m (2132 ft) alpine and subalpine areas predominate. Although some deer utilize alpine areas during snow-free periods (3 to 5 months of the year), forest is used year-round, and throughout most of the year the entire population is confined to forested areas.

The western hemlock-Sitka spruce forests of Southeast Alaska are valued for their production of lumber and pulp. The timber industry is a dominant force in Southeast Alaska and plays a major role in land-use decision-making on the National Forest. Because of the potential influence timber management exerts on wildlife habitat, the Alaska Department of Fish and Game and the Juneau Forestry Sciences Lab of the Pacific Northwest Forest and Range Experiment Station (USFS) initiated a cooperative investigation of deer-forest relationships in 1977. The first phase of this research (Job 2.5R) was directed at comparative deer use of old-growth (silviculturally over-mature, uneven-aged forest) and even-aged second-growth forests. Data collected thus far indicate that deer use of regrowth stands (ranging from 1 to 147 years old) averaged about one-sixth that of adjacent old-growth forest. No areas or age classes (including early successional clearcuts) were observed where deer use actually increased following logging. Regrowth stands from 34 to 147 years old produced substantially less understory vegetation (deer forage) than did adjacent old-growth forest. Initial comparisons of snow depth revealed that even in a moderate winter a recent clearcut was relatively unusable for deer, while adjacent uneven-aged forest was usable. This work was reported by Schoen (1978), Schoen and Wallmo (1979), Wallmo and Schoen (in press).

Based on our current understanding of deer-habitat relationships in Southeast Alaska, optimal winter range appears to be uneven-aged, old-growth forests in excess of 200 to 300 years of age. The importance of climax forests to deer has also been described with reference to northern Vancouver Island (Jones 1974, Hebert 1979), as well as Southeast Alaska (Bloom 1978, Barrett 1979, Billings and Wheeler 1979).

Current timber management plans for Southeast Alaska call for clearcutting on a one hundred-year rotation (even-aged silviculture) basis. Currently, about 14,000 acres of climax forest are harvested annually (Harris and Farr 1979). The data we have acquired thus far reveal that the deer carrying capacity of logged areas is severely reduced, relative to old-growth forest, throughout the entire rotation period.

Climax forest is a highly heterogeneous community made up of a mosaic of forest types occurring on various topographic and soil situations. Deer utilize many of the forested and non-forested types to some degree in some seasons, but such distributions have not been adequately described or explained. To do so, it is first necessary to define the distribution of deer throughout the year in relation to general habitat and topographic features. The next step will be to obtain specific measurements of forest variables and hypothesize which of those have causal relationships with deer distribution. These steps are fundamental in determining the relative degree to which specific attributes can be used to describe the distribution of deer within the forest complex.

This cooperative investigation is designed to assess seasonal habitat use on two levels. Level one is the individual level whereby the distribution and movements of individual animals are monitored by telemetry. This is the primary responsibility of the Game Division, Alaska Department of Fish and Game. The second level deals with population distribution within the forest and the relationships between deer use and particular forest characteristics. This is being approached through pellet-group counts and forest measurements and is the primary responsibility of the Forestry Sciences Lab.

OBJECTIVES

To develop capture and telemetry techniques for Sitka black-tailed deer and evaluate seasonal distribution, and determine habitat utilization and preference within natural (unlogged) and modified (logged) habitats.

Study Area

The Alexander Archipelago is composed of the islands of Southeast Alaska. A general description of the northern Alexander Archipelago was provided previously (Schoen 1978). Within this region two sites were selected for instrumenting and monitoring seasonal movements of individual deer. These sites are the Hawk Inlet-Young Bay area on northern Admiralty Island and the central portion of the Glass Peninsula on east Admiralty Island (Fig. 1).

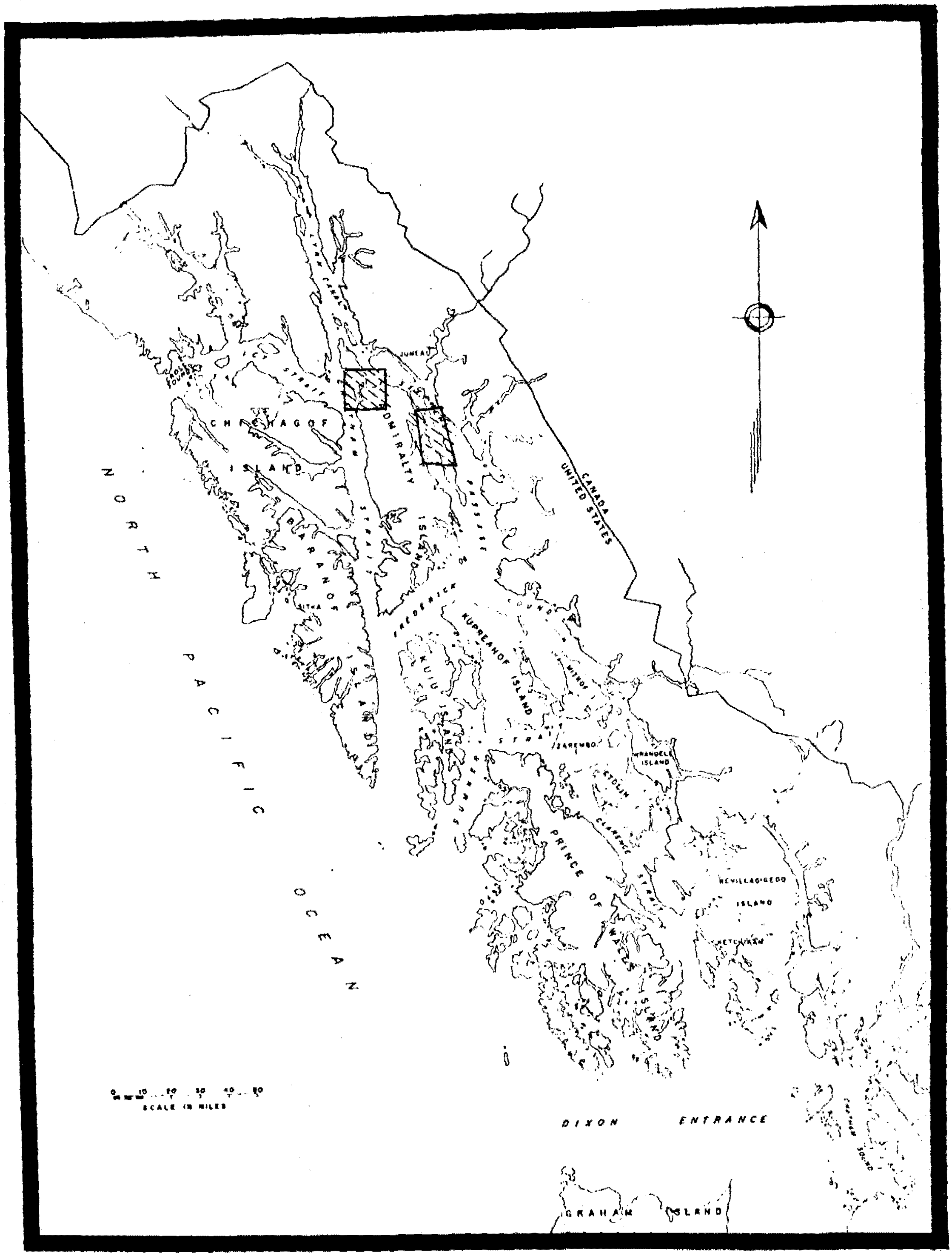


Fig. 1. Black-tailed deer study sites (stipled area) within the Alexander Archipelago.

The Hawk Inlet study site (Fig. 2) contains approximately 260 km^2 (100 mi^2) and is essentially undisturbed habitat. This site includes the areas to the east and west of Hawk Inlet as well as the southern and western shores of Young Bay. Topography is varied with elevations ranging from sea level to 1417 m (4650 ft). Timber harvest has been minimal in this area; however, an old cannery site is located on the east side of the inlet and the Noranda Corporation is currently involved in mining exploration in the Greens Creek drainage to the southeast. Moderate to high hunting pressure occurs in the Hawk Inlet area, primarily by Juneau residents.

The area is largely forested with western hemlock and Sitka spruce. Muskegs are scattered throughout the site, however, especially on the east side of the inlet, and alpine and subalpine areas occur above 610 m (2000 ft). There are approximately 64 km (40 mi) of marine shoreline with predominately easterly or westerly exposures and several large tidal flats. Numerous small lakes and an abundance of stream systems also occur within the site.

The Glass Peninsula study site (Fig. 3) contains approximately 142 km^2 (55 mi^2) and includes about 40 km (25 mi) of marine shoreline primarily facing southwest and northeast. This site consists of that portion of Glass Peninsula south of Fool Inlet on the north to Washburn Peak on the south. As with the Hawk Inlet site, topography is varied with elevations ranging from sea level to 1269 m (4165 ft). In general, the higher elevations are steeper and more broken than in the Hawk Inlet site.

The relative composition of vegetative communities at the Glass Peninsula site is similar to that of Hawk Inlet. It is important to note, however, that high-volume, uneven-aged old growth is not abundantly represented at either site and probably less so on Glass Peninsula.

The Glass Peninsula site was selected, in part, because of its past logging history. Although both sites have had extensive high-grading (selective logging) along their shorelines, several recent clearcuts and second-growth stands occur at Winning Cove on the southwest shore of Glass Peninsula. Approximately 6 km (4 mi) south of the southern end of Winning Cove lies a second-growth stand from a cut before 1920. About 1 km (0.6 mi) north are several stands from cuts made during the 1920's. Immediately north of these are several recent clearcuts from the late 1960's. Each of these stands is less than 40 ha (100 a) in extent. At the head of Winning Cove is a small second-growth stand from a cut probably made during the 1930's. The most recent and largest clearcut occurs immediately adjacent to the cove and extending about 5 km (3.1 mi) to the north. This cut is over 400 ha (988 a) and was logged by the Schnabel Lumber Company which began felling trees during fall 1970 and completed yarding during summer 1975. These sites are all located on the Seymour Canal side of the Glass Peninsula. We know of no areas which have been clearcut within the study area on the east side of Glass Peninsula. There are a few recreation cabins on the Peninsula, and hunting pressure is generally light to moderate.

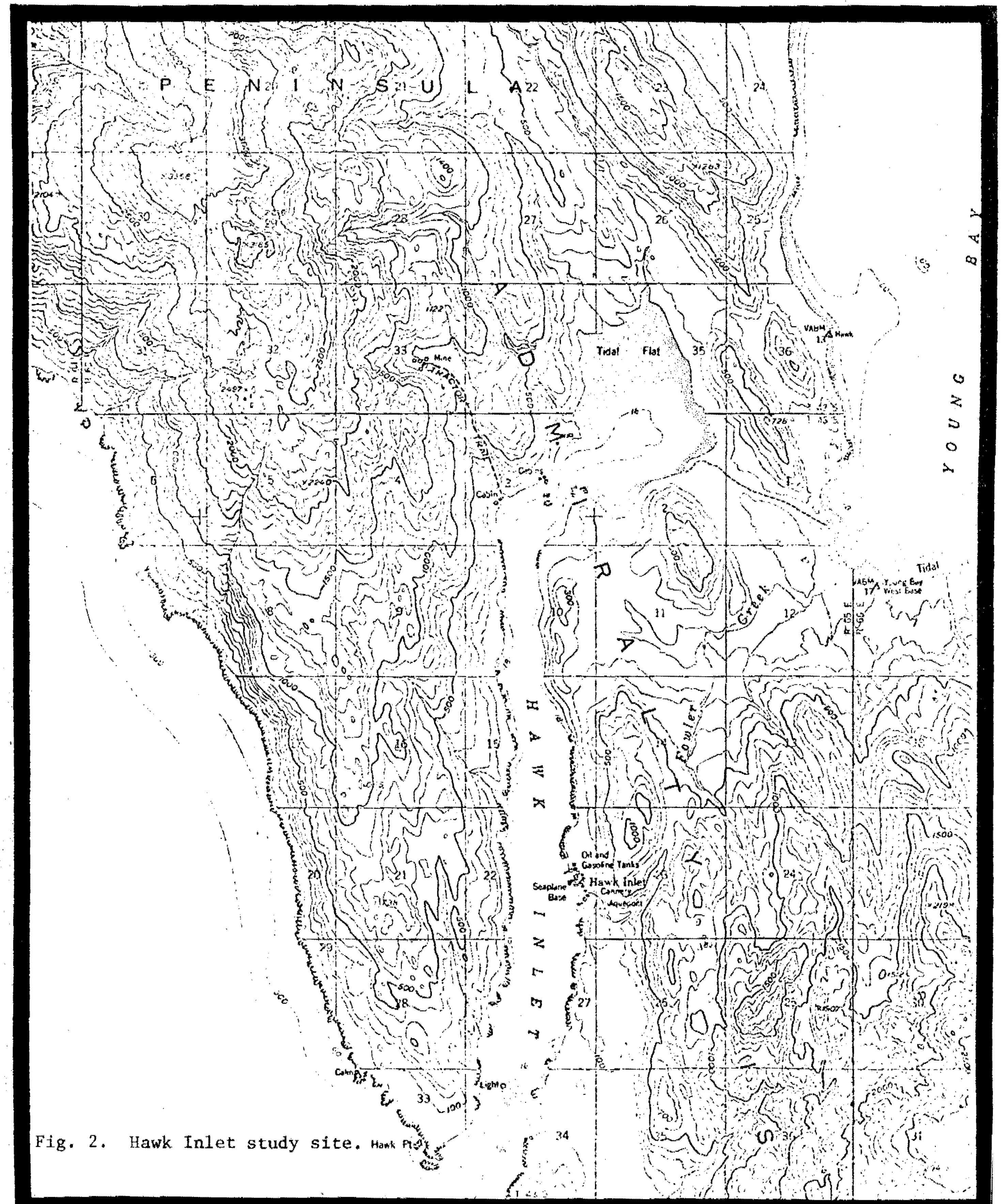


Fig. 2. Hawk Inlet study site.

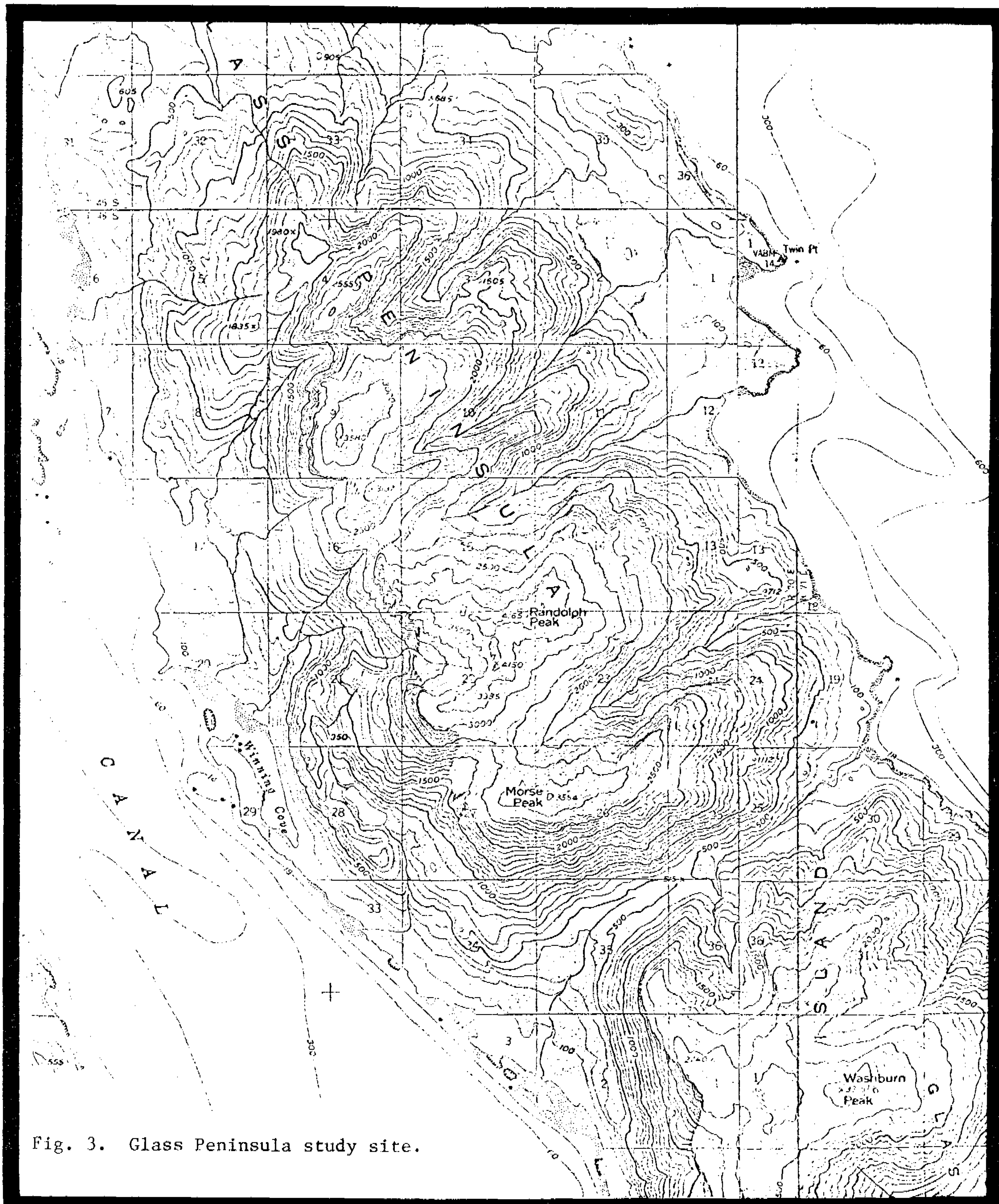


Fig. 3. Glass Peninsula study site.

PROCEDURES

Pellet Group Sampling of Clearcut and Old-Growth Forest Sites

This work entailed comparing relative deer use between a block of old-growth forest bordering the beach and a nearby, recent clearcut, including the adjacent forest edge above the cut, and the beach fringe forest below the cut. It was conducted jointly with the Forest Sciences Lab during May 1979 and was precipitated by the results of recent winter beach mortality surveys of deer (Appendix III). These surveys suggested differential mortality for deer inhabiting beach fringe forest backed by old growth versus those backed by clearcuts.

Two sample areas were established north of Winning Cove on Glass Peninsula, Admiralty Island. The first encompassed a 1-km (0.6 mi) section of beach fringe backed by a 6- to 9-year-old clearcut, and behind that a narrow strip of old-growth forest approximately 170 m (558 ft) in width. The elevation of this site ranged from sea level to about 152 m (500 ft). Ten transects were run, each made up of 100, 1 X 10 m (3 x 33 ft) contiguous plots. Pellet group densities were recorded as described by Schoen (1978).

Transects were laid out horizontally along contour lines (Fig. 4). The first transect was run along the forest-beach edge just inside the forest. The second was run equidistant between the first and third transect, which was run along the forest-clearcut edge within the forest. The fourth transect was run along this same edge but within the clearcut about 30 m (33 ft) from the third transect. The fifth through seventh transects were established equal distances apart between the upper and lower edges of the clearcut. Transects eight and nine were established along the clearcut-forest edge similar to three and four. Transect 10 was run about 100 m (328 ft) into the upper forest. Edge transects were assumed to sample a 30-m wide area, while other transects were assumed to sample the remaining area in each habitat (beach fringe or clearcut) equally.

The second sample site was established just north of the clearcut and the same number of transects (10) and plots (1,000) were run. Transects were established roughly equidistant to each other (Fig. 4). Slope steepness and exposure (southwest) were similar for both sites.

Forest Sampling

Topographic distribution of deer was investigated by establishing pellet-group transects run along contours in each of two sites south of Winning Cove. The exposure of one site was northwest and the other southeast. Transects were run at 30 m (100 ft) intervals. The northwest exposure was sampled from 152 to 335 m (500-1100 ft) while the southeast exposure was sampled from 122 to 610 m (400-2000 ft). Both sites were sampled to snowline. Each transect was composed of 50, 1 X 10 m belt plots and sampled as described by Schoen (1978).

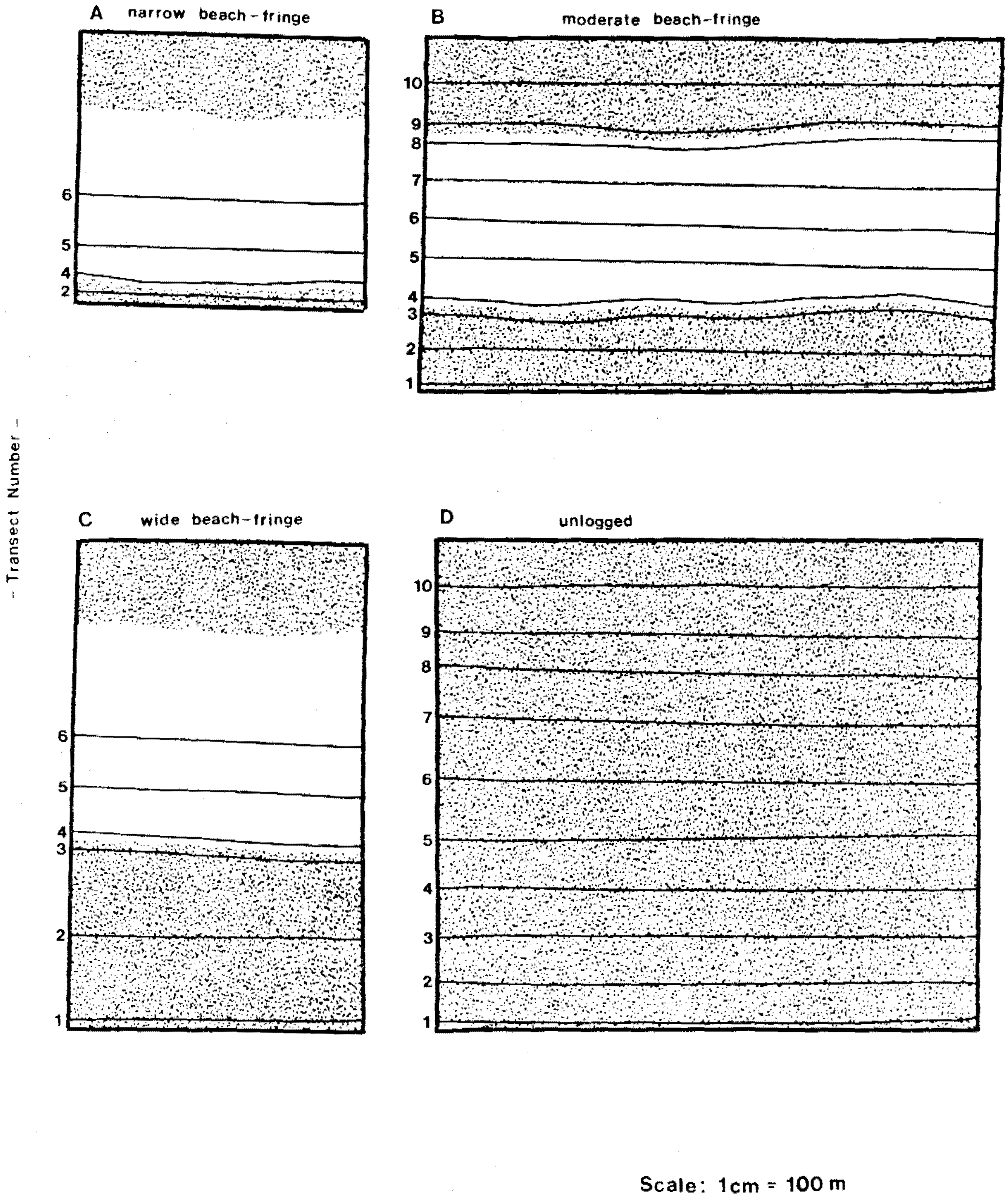


Fig. 4. Sampling design for clearcut-forest use by deer.

Deer response to forest site characteristics was investigated on 131, 0.4 ha (1 a) homogeneous forest plots. Nine sample points were established in each stand, spaced about 20 m (66 ft) apart in a grid pattern of three parallel rows (Fig. 5). Pellet-groups were recorded in four 1 X 10 m belt plots radiating out from each point. In the middle of each belt plot an estimate of over-story canopy cover was made on a scale of zero to nine. At each sample point, presence or absence of understory species was recorded in a circular 0.5 m^2 plot. An estimate of the degree of deer browsing at each sample point, rated from one through three (light, moderate or heavy), was also recorded. Over-story measurements, other than canopy, included tree species, diameter at breast height for trees greater than three in DBH, and distance from the sample point. These were sampled by the point quarter method (Cottam and Curtis 1956, MacLeod and Chaudhry 1979). Elevation, slope, and aspect were also recorded at each sample stand. Sampling was conducted by two-person teams. During the latter half of June the canopy measurements were dropped and understory species present in 2 by 5 dm plots 15 dm high and centered on each sample point were clipped and frozen. These samples were later dried and weighed for biomass estimates. Basal area measurements were also recorded using standard timber cruising prisms at sample points one, five, and nine.

Capture Techniques

Several capture techniques were considered including trapping, snaring, drop-netting, and immobilizing free-ranging deer. Two basic techniques were tried, trapping and immobilization of free-ranging animals. The Forestry Sciences Lab built six portable Clover traps (Clover 1954) which were assembled at several locations in the Winning Cove area along game trails within 50 m (164 ft) of the beach. Baits used included alfalfa and molasses, apples, pelleted rabbit feed, and lettuce. Traps were checked one to two times per day from December through February when we were in the field. During February, several circular drop-nets were also set up in trees above deer trails.

Stalking free-ranging deer with an immobilizing gun proved most successful. Merriam (1962) reported using a crossbow with darts containing succinylcholine chloride and approaching deer on the beach using a skiff. We used Pneu Dart (Williamsport, Pennsylvania) capture equipment which fires a small plastic dart with preloaded dosages of powdered succinylcholine chloride. This equipment worked well in the coldest weather encountered (-18°C) and was accurate to about 70 m (77 yd).

Deer were stalked on foot throughout the year with the most intensive effort occurring from November through February. Throughout most of November, during the rut, a deer call was used. When deep snow forced deer to the beaches they were approached and shot from a skiff.

Most shots were taken at ranges from 15 to 45 m (16-49 yd). Following a successful hit, the shooter would wait for 5 to 7 minutes before pursuing the deer. When the animal was captured it was placed in a sternal position and its eyes were covered.

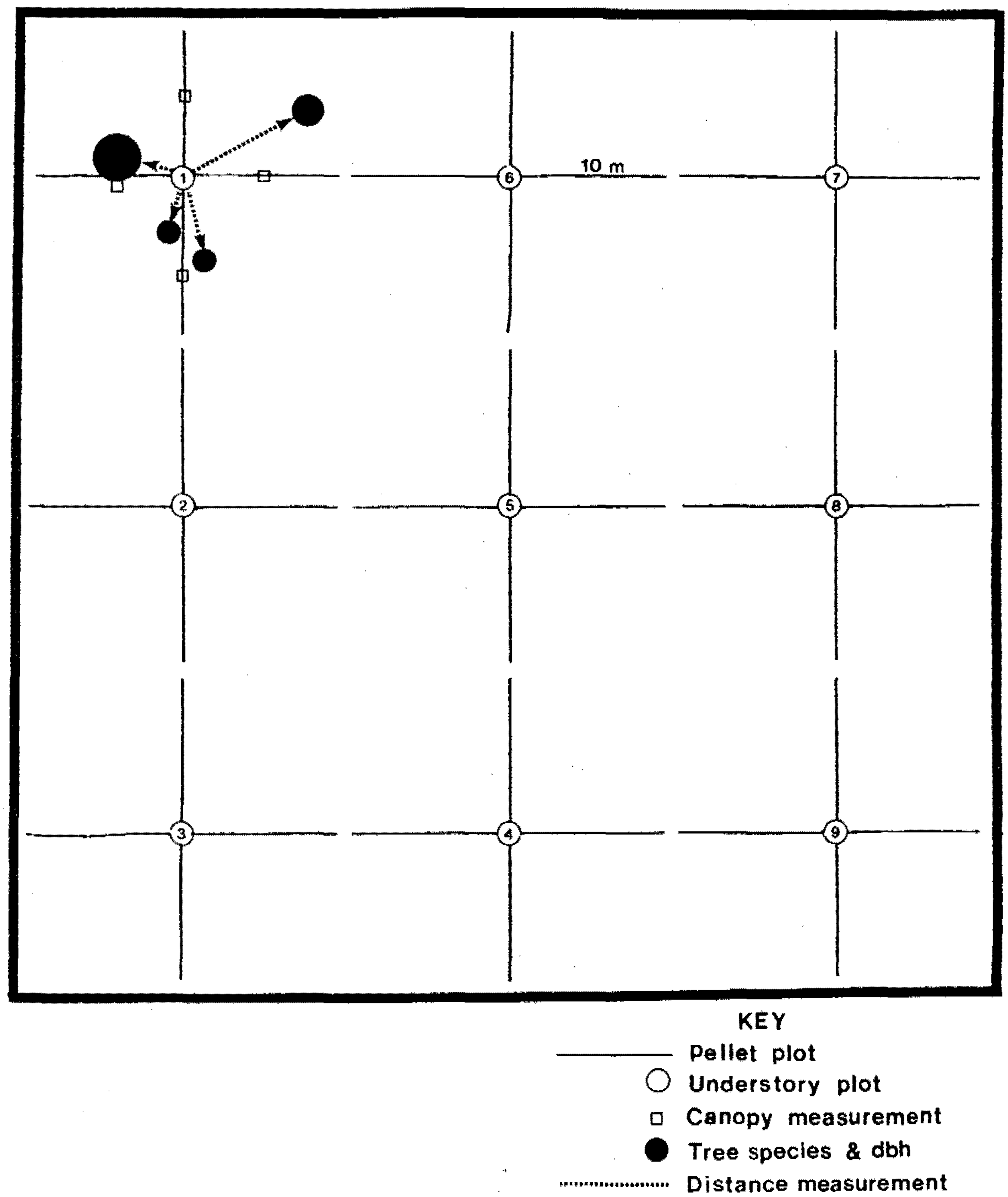


Fig. 5. Sampling design for forest characteristics.

Animals were marked with colored plastic ear tags (Y-Tex Corp., Cody, Wyoming); females in the left ear and males in the right. They were then instrumented with radio collars. Sex, age, estimated weight, and standard body measurements were recorded. Females were checked for lactation and all animals were assessed for general condition and presence of external parasites. Hair samples were collected for potential future laboratory analyses. A sample data form is presented in Appendix I.

Telemetry Techniques

Telemetry equipment, purchased from Telonics Company (Mesa, Arizona), consisted of a TR-2 telemetry receiver and scanner operating in the 150.0 to 152.0 MHz range and capable of monitoring 200 separate frequencies. Transmitters, also purchased from Telonics, operated in the 151.150 to 151.590 MHz range. Thirty transmitters were initially acquired in anticipation of instrumenting 15 animals in each of the two sites. Location and habitat data were obtained using fixed-wing aircraft. Our antenna system consisted of two twin-element yagi antennas, one mounted on each wing perpendicular to the aircraft fuselage and connected to a right/left switchbox located in the cockpit. Pilot and observer wore boom mike headsets connected to the receiver through a Sigtronic intercom system enabling a free exchange of communication while monitoring the transmitter's signal. Most aerial telemetry work was done in a 250-hp Helio Courier on wheels, although occasionally a 290-hp Helio Courier on amphibious floats was used.

Telemetry flights were generally conducted once per week in each study site, usually between 0800 and 1800 hours depending on light and weather conditions. After reaching the study site the operating frequencies were scanned until one was picked up and a pattern was flown to isolate the general direction of the transmitter. Once isolated, diminishing circles were flown over the site until a fix was obtained. During field trials in forested habitat, location accuracy was determined to be generally within a 46 m (50 yd) radius. After an animal was located, its position was plotted on 1:63,360 scale topographic maps, and specific landscape attributes such as elevation, habitat type, canopy, terrain, and snow cover were recorded. Each location also included the deer number, date, time, weather, and an assessment of the accuracy of that particular fix. Following completion of the flight, steepness of slope, slope exposure, and location coordinates for each deer were recorded from topographic maps. A sample field data form and data code are presented in Appendix II.

Seasonal Distribution, Habitat Utilization, and Home Range

A map of the two study sites was overlayed by an X,Y-grid coordinate system. Grid size was 10.4 ha (25.6 a). This coincided with the accuracy with which the instrumented animals could be located considering both the accuracy of the antenna system and accuracy of determining the location on 1:63,360 scale maps. Thus, for each individual animal we have a record of all locations which can be broken down by any given time period (season) and plotted on a map according to its X,Y coordinates. Landscape attributes were determined at each location.

Elevation was recorded to the nearest 30 m (100 ft) from the aircraft altimeter. Slope and aspect were determined from the map. Slope was recorded to the nearest five degrees and aspect was recorded as flat, north, northeast, east, southeast, south, southwest, west, northwest, or ridge top.

Fifteen general habitat types were defined. These were beach, beach-fringe forest (old-growth forest less than 91 m [100 yd] from beach), old-growth spruce-hemlock forest (uneven-aged and silviculturally overmature), early successional clearcut (0-15 years), mid-successional clearcut with deciduous or conifer species dominating (16-30 years), even-aged second growth with deciduous or conifer species dominating (31-200 years), deciduous brush (e.g., slides and avalanche chutes), muskeg, subalpine, alpine, rocky outcrop-cliff, permanent ice-snowfield, and frozen lake or river.

Over-story canopy coverage was estimated from the air and recorded to the nearest 5 percent. The character of the terrain was recorded as either smooth or broken. Percent snow cover and depth of snowpack in the general vicinity of the animal were estimated from the air. Snow type was described as soft, hardpacked, or crusted.

Location accuracy was estimated as follows: position accurate to within 10.4 ha (25.6 a) and landscape attributes accurate; position accurate but landscape attributes uncertain; and position accurate only to within 40 ha (100 a) and all landscape attributes uncertain.

Telemetry data were entered into the University of Alaska computer network's Honeywell computer and stored for immediate retrieval. The computer was accessed through the time-sharing system with a Teletype Model 43 terminal located in the Juneau office. Telemetry data were collected in a format acceptable for entering immediately on the terminal and then stored in a permanent file called DEERDATA. A plotting routine and packaged retrieval system utilized this data file.

The plotting program, adapted from Koepple et al. (1975), used a Tektronix desk-top plotter to produce two-dimensional plots of deer movements. It plotted for each animal any combination of the following: points of location, location points successionally connected by lines, an elliptical home range plot around these points, including an area calculation, or a home range ellipse alone. This ellipse, originally proposed by Jennrich and Turner (1969), represented a 95 percent confidence ellipse, corrected for orientation on a two-dimensional grid. The elliptical home range model is based on the assumption of a bivariate normal distribution. Ford and Krumme (1979) pointed out that it has not been conclusively demonstrated that any home ranges conform to this assumption and it probably represents an oversimplification in the majority of cases. For our purposes, however, the ellipse represents a reasonable and systematic technique for portraying the seasonal home ranges of deer in a general manner, and for providing a relative area figure from which to compare individuals and seasons.

The Statistical Package for the Social Sciences, SPSS, (Nie et al. 1975) was used to analyze the data on deer habitat use. The primary SPSS Procedures utilized were Frequencies and Crosstabs. Frequencies calculated means, ranges, standard deviations, and variances and generated tabular frequency distributions and histogram plots. Crosstabs produced two-way cross tabulations of variables and computed a chi-square statistic which tested whether a systematic relationship existed between the habitat variables and season.

RESULTS

Pellet Group Sampling of Clearcut and Old-Growth Forest Sites

Ten 100-plot transects were sampled by the pellet-group technique to determine relative deer use in two sites at Winning Cove; a clearcut including beach fringe forest and upper forest (Fig. 4), and a nearby uncut forest with similar site characteristics. These data are presented by transect as pellet groups per plot (Table 1). The width of the strip sampled by each transect and the mean number of pellet groups per hectare for each site are presented in Table 2.

The relative density of groups in the first three transects below the clearcut was about 1.5 times higher than in the first three transects of the old growth site. However, the density of groups in the five transects within the cut was less than one-half of those in the old growth. The mean density for both sites was 1170 and 1547 pellet groups/ha for the clearcut and old-growth sites, respectively. Thus, the level of use in the uncut site averaged 1.3 times higher than the managed site.

As a followup to this work two additional clearcut sites were sampled at Winning Cove. These sites differed from the first in that one had a smaller, and one a greater, beach-fringe forest below the cut. These data have not yet been fully analyzed and will be reported later.

Results of the spring beach mortality transect surveys were reported by Kirchhoff and Johnson and are included in Appendix III.

Forest Sampling

Results of sampling topographic distributions of deer are summarized in Table 3. Significant between-site differences in slope and forest quality made results from this preliminary work inconclusive. Because of time and manpower limitations this aspect of our sampling was discontinued.

Deer response to forest site characteristics was investigated at both Winning Cove and Hood Bay. One hundred and thirty-one, 0.4 ha (1 a) forest sites were intensively sampled in these areas. These data will be analyzed during the coming winter.

Capture and Immobilization

Twenty-one deer were successfully captured during this report

Table 1. Relative winter-spring deer density in a paired clearcut and old-growth forest site at Winning Cove (see Fig. 4 for distribution of transects).

Transect #	Pellet-groups/plot: Clearcut-forest edge site	Pellet-groups/plot: Old-growth forest site
1	1.58	1.07
2	1.57	1.12
3	2.72	1.94
4	1.35	1.11
5	0.86	1.09
6	0.51	1.57
7	0.60	1.17
8	0.75	1.65
9	1.41	1.91
10	1.32	2.57
Mean pellet-groups/plot	1.25	1.44

Table 2. Width of areas sampled by each transect in clearcut and old growth sites and mean pellet groups per hectare in those sites (see Fig. 4 for distribution of transects).

Transect #	Width of strip sampled (m): Clearcut-forest edge site	Width of strip sampled (m): Old-growth forest site
1	30	30
2	90	93
3	30	93
4	30	93
5	80	93
6	80	93
7	80	93
8	30	93
9	30	93
10	140	93
Mean pellet groups/ha	1170	1547

Table 3. Deer distribution relative to topographic features.

Transect[1] #	Elev.(m)	Mean Pellet Groups/Plot SE Exposure	NW Exposure
1	122	1.040	
2	152	0.700	1.180
3	183	0.800	1.200
4	213	1.000	1.100
5	244	0.740	0.860
6	274	0.580	0.640
7	305	0.680	0.580
8	335	0.240	0.540 (snowline)
9	366	0.340	
10	396	0.560	
11	427	0.440	
12	457	0.380	
13	488	0.140	
14	518	0.140	
15	549	0.160	
16	579	0.220	
17	610	0.080 (snowline)	
Grand Mean =		0.485	0.871
Standard Deviation =		0.936	1.208

[1]each transect contained 50 1x10 m plots

period, 12 on Glass Peninsula and 9 at Hawk Inlet. Capture date, sex, age, and status of these animals as of September 1979 are presented in Table 4. Of this sample, 12 were males and 9 females. Fawns, yearlings, and adults made up 14, 29, and 57 percent of the sample, respectively. To date, 14 of the 21 animals originally captured are being monitored by radio telemetry, 6 on Glass Peninsula and 8 at Hawk Inlet. One yearling buck was not instrumented following capture because of a preponderance of males in the sample, two animals disappeared, or their radios failed shortly after capture and four animals were later recovered dead.

All animals were captured free-ranging by shooting with an immobilizing gun. Other capture techniques such as baiting and trapping proved unsuccessful. Eighty-one man-days were spent attempting to take free-ranging deer with a capture gun. A summary of this effort is presented in Table 5. We attempted 68 shots of which 41 (60%) were successful hits. Of those animals hit, 51 percent were captured. Thirty-one percent of all shots taken resulted in a successful capture.

The most successful method for immobilizing free-ranging deer was shooting from a skiff when deer were concentrated on the beaches by deep snow. By dividing the number of hits by man-days in the field we found this method to be roughly twice as efficient as calling during the rut, and four times as efficient as hunting from the ground. Seventy-nine percent of the shots attempted from a skiff resulted in a hit while shots taken during the rut and stalking during other periods resulted in 56 percent and 52 percent hit rates, respectively. Capture success during the rut was lower compared to hunting on foot due to under dosing animals at the beginning of the study.

Immobilization results, including dosages and times, are presented in Table 6. Forty-one animals were hit, resulting in 21 successful captures (51%), 14 animals were not affected (34%), and 6 died (15%). The average dosage of succinylcholine chloride for all animals was 9.9 mg with a range of 5-13 mg. The average successful dosage for adults (1 year and older) was 11.5 mg and for fawns 9.3 mg. The average estimated response time from injection to immobilization for all animals was 8 minutes with a range of 5 to 17 minutes. Average duration of paralysis was not calculated since many animals were left before they fully recovered. The range for duration of paralysis was estimated to be between 30 and 90 minutes. Mortality appeared related to individual variability in tolerance to the drug. Those most susceptable to overdosing were fawns and animals in poor condition.

Telemetry

Since November 1978 we have accumulated 484 relocations of instrumented deer. The proportions of relocations by season were as follows: fall 2 percent, winter 29.5 percent, spring 39 percent, and summer 29.5 percent. Ninety-six percent of these relocations were considered accurate to within 10 ha (25 a) and were used in our analysis of habitat use. The total number of relocations for individual animals ranged from 1 to 44 and averaged 24. Nine percent of our telemetry locations of instrumented deer actually resulted in a visual observation of the animal. Animals

Table 4. Summary and status of captured deer as of September 1979.

Capture Date	Study Site	Deer #	Age	Sex	Status
11-2-78	Winning Cove	6	Yearling	F	Radio functional
11-7-78	Winning Cove	20	Adult	M	Radio functional
11-8-78	Winning Cove	80	Yearling	M	Radio functional
1-3-79	Winning Cove	33	Fawn	M	Winter mortality
1-3-79	Winning Cove	90	Adult	M	Radio functional
1-4-79	Winning Cove	70	Fawn	F	Radio functional
1-18-79	Winning Cove	89	Fawn	M	Winter mortality
2-14-79	Winning Cove	13	Adult	M	Not located since May
2-14-79	Winning Cove	51	Adult	M	Never located
2-14-79	Winning Cove	46	Adult	F	Winter mortality
2-16-79	Winning Cove	29	Yearling	M	Not instrumented
2-21-79	Hawk Inlet	24	Yearling	M	Found dead 2 wks later
2-22-79	Hawk Inlet	5	Adult	M	Radio functional
2-22-79	Hawk Inlet	74	Adult	F	Radio functional
2-22-79	Hawk Inlet	25	Adult	F	Radio functional
2-23-79	Hawk Inlet	17	Adult	M	Radio functional
2-23-79	Hawk Inlet	3	Adult	M	Radio functional
2-23-79	Hawk Inlet	18	Yearling	F	Radio functional
2-24-79	Hawk Inlet	43	Adult	F	Radio functional
2-24-79	Hawk Inlet	16	Yearling	F	Radio functional
3-6-79	Winning Cove	61	Adult	F	Radio functional

Table 5. Summary of capture success immobilizing free ranging deer.

Method	Man days	Shots	Hits	Misses	Captures
Calling during the rut	16	18	10	8	3
Shooting from skiff	13	19	15	4	10
Hunting on foot	52	31	16	15	8
Total	81	68	41	27	21

Table 6. Immobilization results using succinylcholine chloride on Sitka black-tailed deer.

Date	Sex	Age	Dosage (mg)	Time from Injection[1] to Immobilization (min)	Duration of[1] Paralysis (min)
9-21	?	Fawn	5	No effect	
11-2	F	Yearling	5	5	40
11-2	M	Adult	6	No effect	
11-2	M	Adult	6	No effect	
11-3	M	Adult	8	No effect	
11-3	M	Adult	8	No effect	
11-7	M	Adult	10	10	70
11-8	M	Yearling	8	6	60
11-8	M	Adult	8	No effect	
11-8	M	Adult	10	No effect	
11-9	F	Adult	8	No effect	
12-12	F	Adult	8	No effect	
12-13	?	Fawn	5	No effect	
12-13	?	Fawn	10	No effect	
1-3	M	Fawn	9	5	75
1-3	M	Adult	12	6	45
1-4	?	Fawn	8	No effect	
1-4	F	Fawn	9	11	45
1-4	M	Fawn	10	10	Mortality
1-18	M	Fawn	10	15	60
2-14	M	Adult	12	10	45
2-14	M	Adult	12	6	30
2-14	F	Adult	12	5	30
2-16	M	Yearling	12	5	45
2-21	?	Adult	12	No effect	
2-21	M	Yearling	11	4	20
2-22	M	Adult	12	14	30
2-22	F	Adult	12	5	30
2-22	F	Adult	12	17	30
2-22	M	Fawn	8	6	Mortality
2-22	M	Adult	11	4	Mortality
2-23	M	Yearling	12	7	64
2-23	M	Adult	12	9	32
2-23	F	Yearling	12	7	30
2-24	F	Yearling	11	10	30
2-24	F	Adult	11	5	30
2-24	F	Adult	11	7	Mortality
3-6	F	Adult	12	No effect	
3-6	F	Adult	12	5	33
7-19	F	Adult	12	6	Mortality
7-19	F	Yearling	13	4	Mortality

[1]Times are estimated because of difficulty of observation under field conditions.

with operable transmitters have been monitored three to four times each month if flying conditions permit. Average flight time per animal, including ferry time to the site, was approximately 15 to 20 minutes.

Home Range and Habitat Use

Home ranges were calculated for each animal during winter, spring, and summer. A summary of these data is presented in Table 7. Average home range size during the winter and summer seasons was relatively similar, 201 and 179 ha (497-442 a), respectively. During spring, however, the mean "home range" area increased over four times to 818 ha (2021 a). During this period, most individuals moved the greatest distance, some from winter to summer range. The greatest airline distance moved from point of capture was 19 km (12 mi), while the shortest distance moved was less than 1.6 km (1 mi). Two-dimensional plots of movements from capture to-date, by deer with nine or more relocations are presented in Appendix IV.

Although marked deer appeared highly individualistic in their home range patterns, several general patterns were apparent. Some deer used distinctly different summer and winter ranges (Figs. 6, 7, 8, and 9). Since deer in the Hawk Inlet site were not captured until after 15 February 1979, we utilized the relocations between February 15 and April 15 to describe their winter range. Winning Cove ranges were calculated following calendar seasons. Deer numbers 16 and 25 were adult females while numbers 17 and 20 were adult males. These examples demonstrate distinct shifts in location as well as an increase in elevation during the summer period. Many of the summer relocations and much of the summer home range area of these particular animals occurred below tree line.

Another general pattern was an overlapping of winter and summer ranges with little or no distinct seasonal shift (Figs. 10, 11, and 12).

Deer number 70 was a yearling female while numbers 43 and 74 were adult females. Although number 74 used slightly higher country during the summer, overlap between summer and winter ranges in all these examples was substantial.

Two animals (numbers 6 and 18), moved a significant distance between summer and winter ranges. Both were 2-year-old females. This pattern is exemplified in Fig. 13 where the airline distance between home range centers for deer number 6 was greater than 14 km (9 mi). By 7 October 1979 deer number 18 had moved back to her original winter range while deer number 6 was still on her summer range.

Seasonal habitat use by instrumented deer was evaluated with respect to the following attributes: elevation, slope, aspect, terrain, habitat type, percent canopy cover, and percent snow cover. A summary of instrumented deer use of elevation by season is presented in Table 8. During winter, spring, and summer the mean elevation by season of radio-located deer was 57, 150, and 439 m (188, 493, and 1440 ft), respectively (Table 9). During winter, spring, and summer 99, 83, and 36 percent of

Table 7. Summary of seasonal home ranges of radio-instrumented deer.

Season	Home Range In Hectares (acres) Mean area	Range	Standard Deviation	η
Winter	201 (497)	68-648	221	6
Spring	818 (2021)	19-3831	1139	15
Summer	179 (442)	16-507	124	14

Table 8. Seasonal summary of locations of radio-instrumented deer relative to elevation.

* * * * * * * * * * * * * * * * * * C R O S S T A B U L A T I O N O F * * * * * * * * *
ELEV ELEVATION FT. BY SEASON CALENDAR SEASON

ELEV	COUNT[1/] COL PCT	SPRING, 1.	SUMMER, 2.	FALL, 3.	WINTER 4.	ROW TOTAL
0-500	1.	103 58.5	31 21.8	2 33.3	125 88.0	261 56.0
501-1000	2.	43 24.4	20 14.1	4 66.7	16 11.3	83 17.8
1001-1500	3.	23 13.1	23 16.2	0 0.	1 0.7	47 10.1
1501-2000	4.	6 3.4	25 17.6	0 0.	0 0.	31 6.7
2001-2500	5.	1 0.6	22 15.5	0 0.	0 0.	23 4.9
2501-3000	6.	0 0.	16 11.3	0 0.	0 0.	16 3.4
3001-3500	7.	0 0.	5 3.5	0 0.	0 0.	5 1.1
COLUMN TOTAL		176 37.8	142 30.5	6 1.3	142 30.5	466 100.0

CHI SQUARE = 225.38510 WITH 18 DEGREES OF FREEDOM SIGNIFICANCE = 0.

[1/] The upper and lower figure in each col. of the table represents the number and percentage, respectively, for that variable during a given season.

Table 9. Mean, range, and standard deviation of elevation and slope of deer locations during winter, spring, and summer.

Season	Elevation (m)			Slope (degrees)		
	Mean	Range	s.d.	m	Range	s.d.
Winter	57	366	78	8	39	9
Spring	150	671	146	10	45	8
Summer	439	1036	280	12	50	10

DEER 16 JUN 20 78-SEP 20 78 114.4 HECTARES
DEER 16 FEB 15 78-APR 15 78 181.7 HECTARES
1 KILOMETER

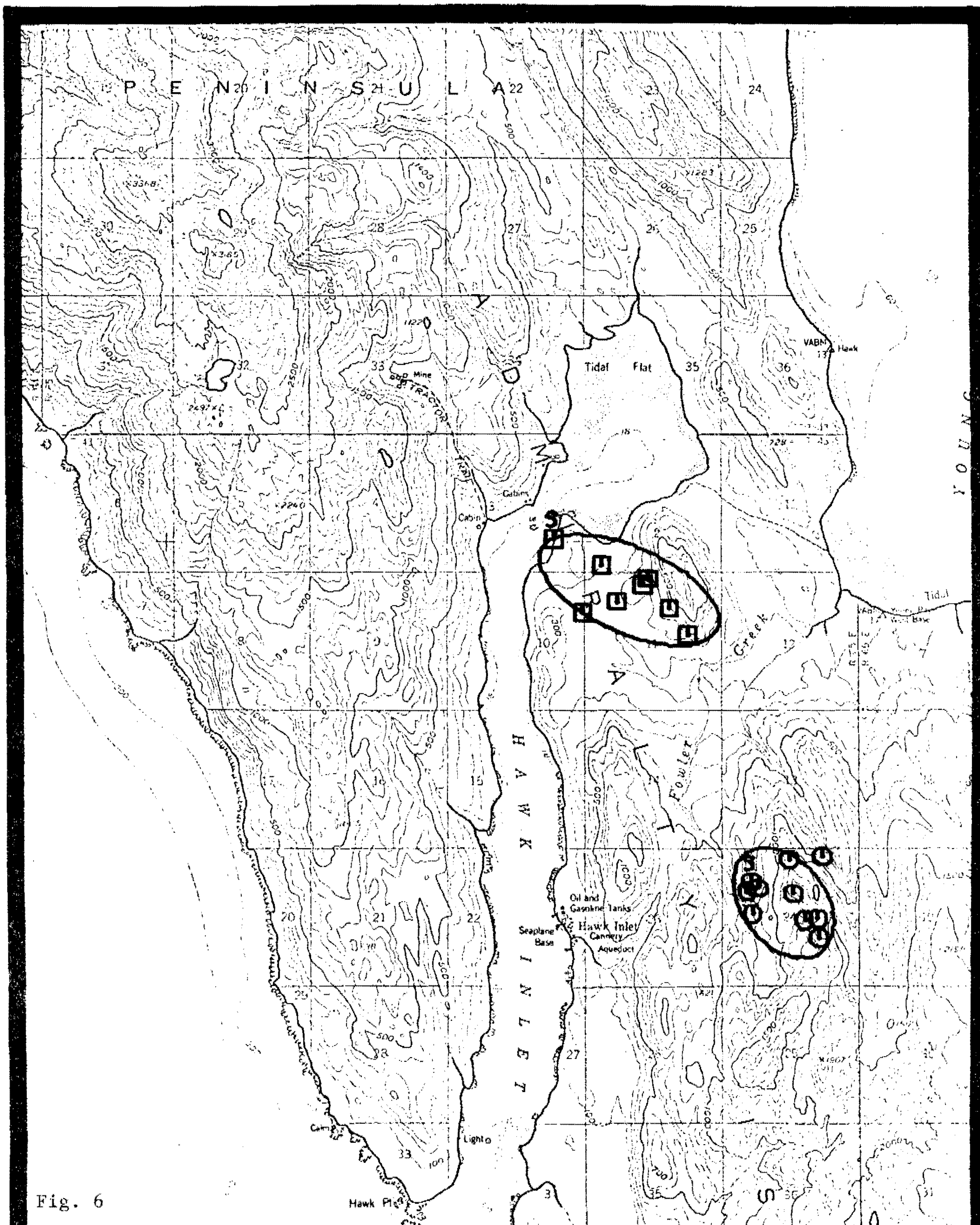


Fig. 6

DEER 25 JUN 21 78-SEP 20 78 68.2 HECTARES
DEER 25 FEB 15 78-APR 15 78 88.2 HECTARES
1 KILOMETER

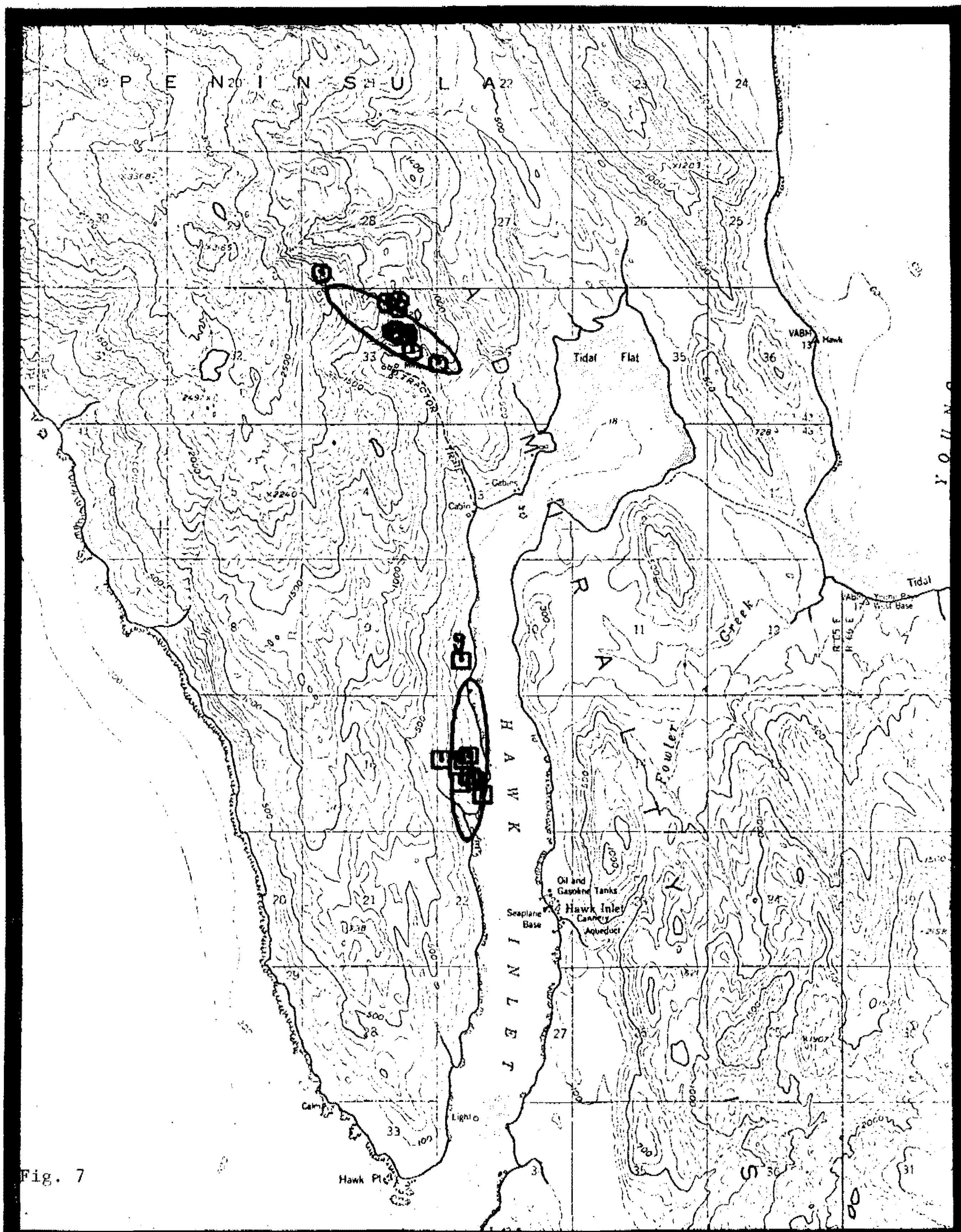


Fig. 7

◎ DEER 17 JUN 21 79-SEP 20 79 280.8 HECTARES
▣ DEER 17 FEB 15 79-APR 15 79 28.2 HECTARES
├──────┤ 1 KILOMETER

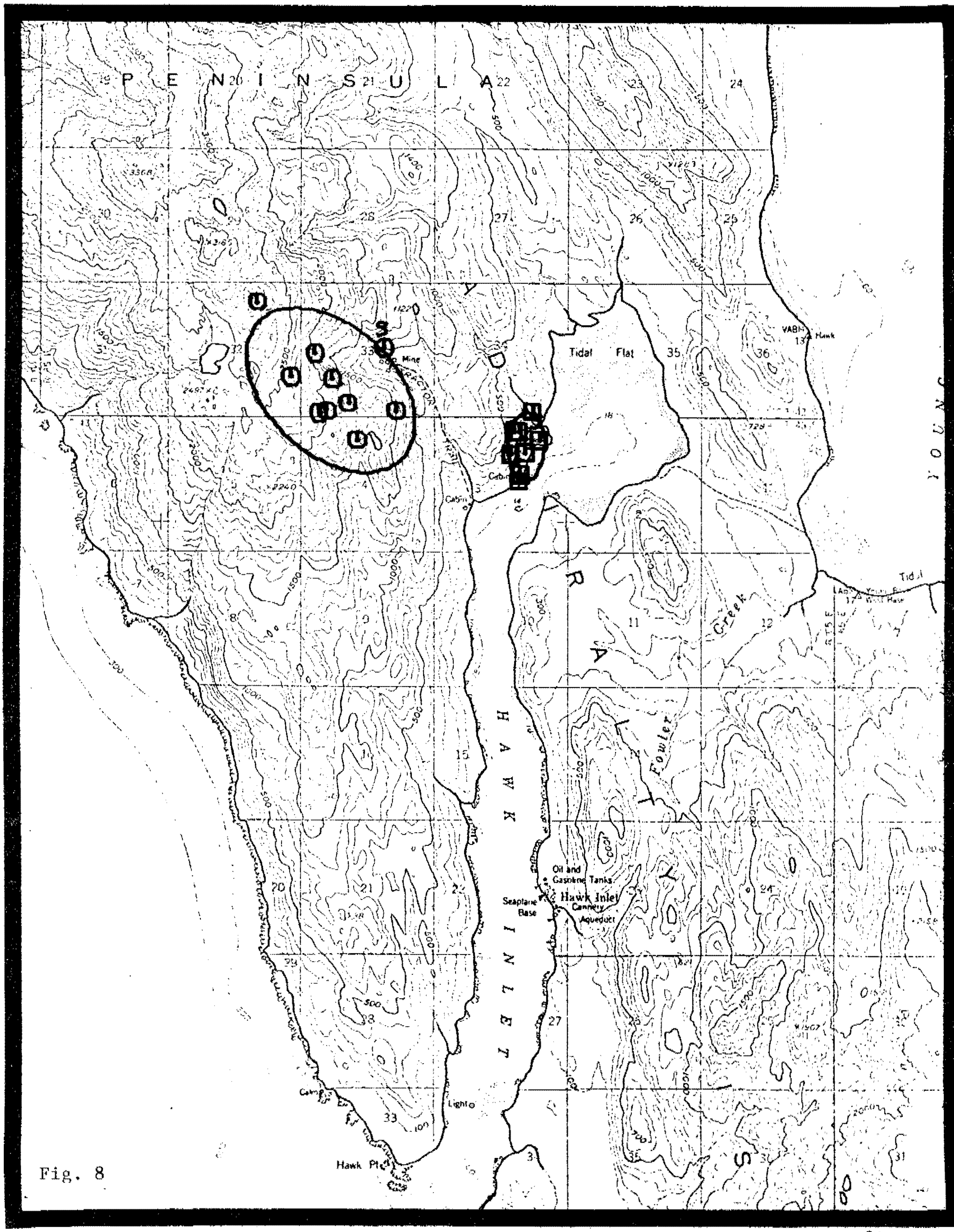


Fig. 8

⦶ DEER 20 JUN 21 79-SEP 15 79 228.0 HECTARES

⊡ DEER 20 DEC 21 78-MAR 20 79 131.4 HECTARES

├──┤ 1 KILOMETER

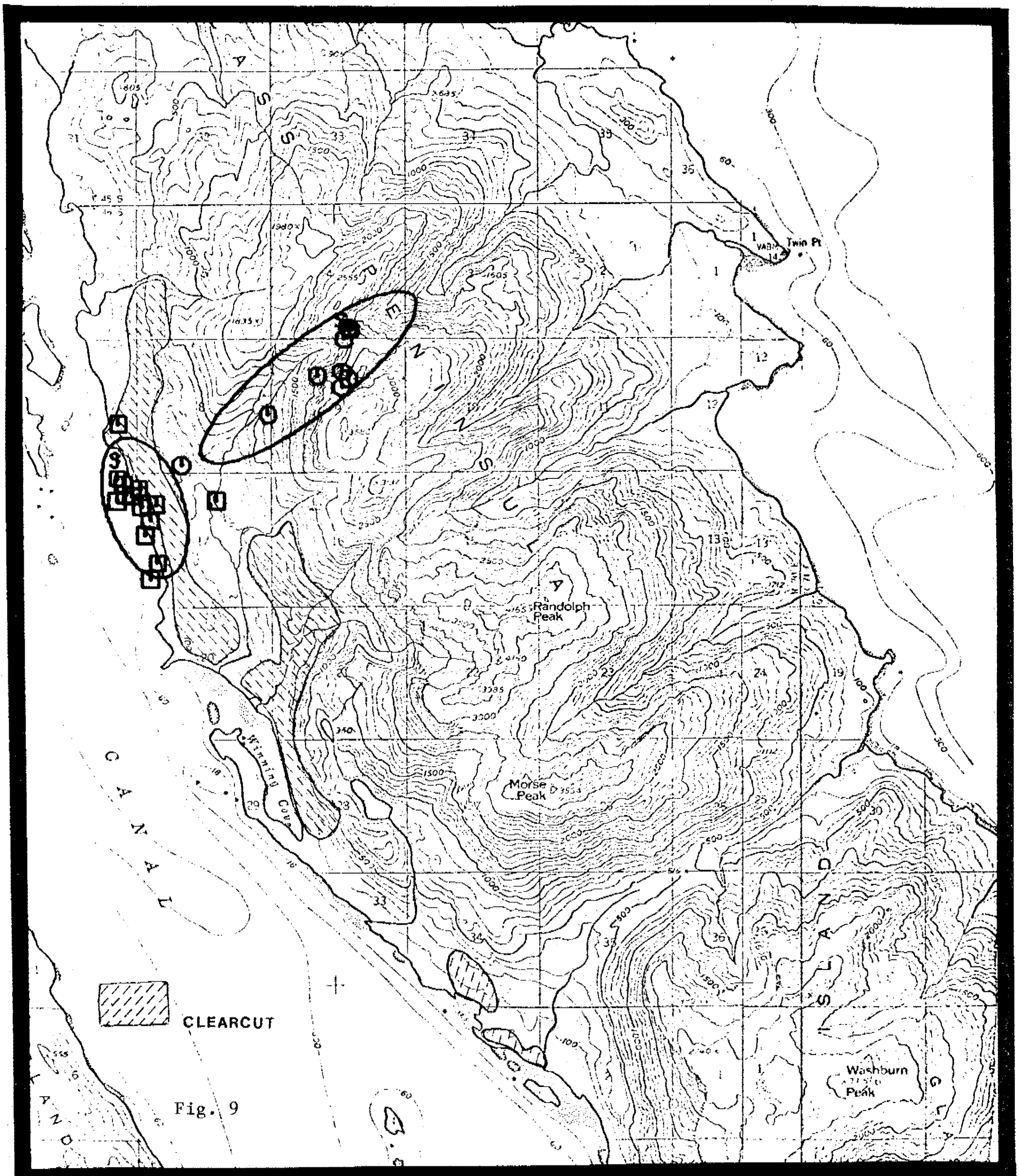


Fig. 9

⊙ DEER 70 JUN 21 78-SEP 15 79 172.8 HECTARES
⊡ DEER 70 DEC 21 78-MAR 20 79 130.4 HECTARES
|———| 1 KILOMETER

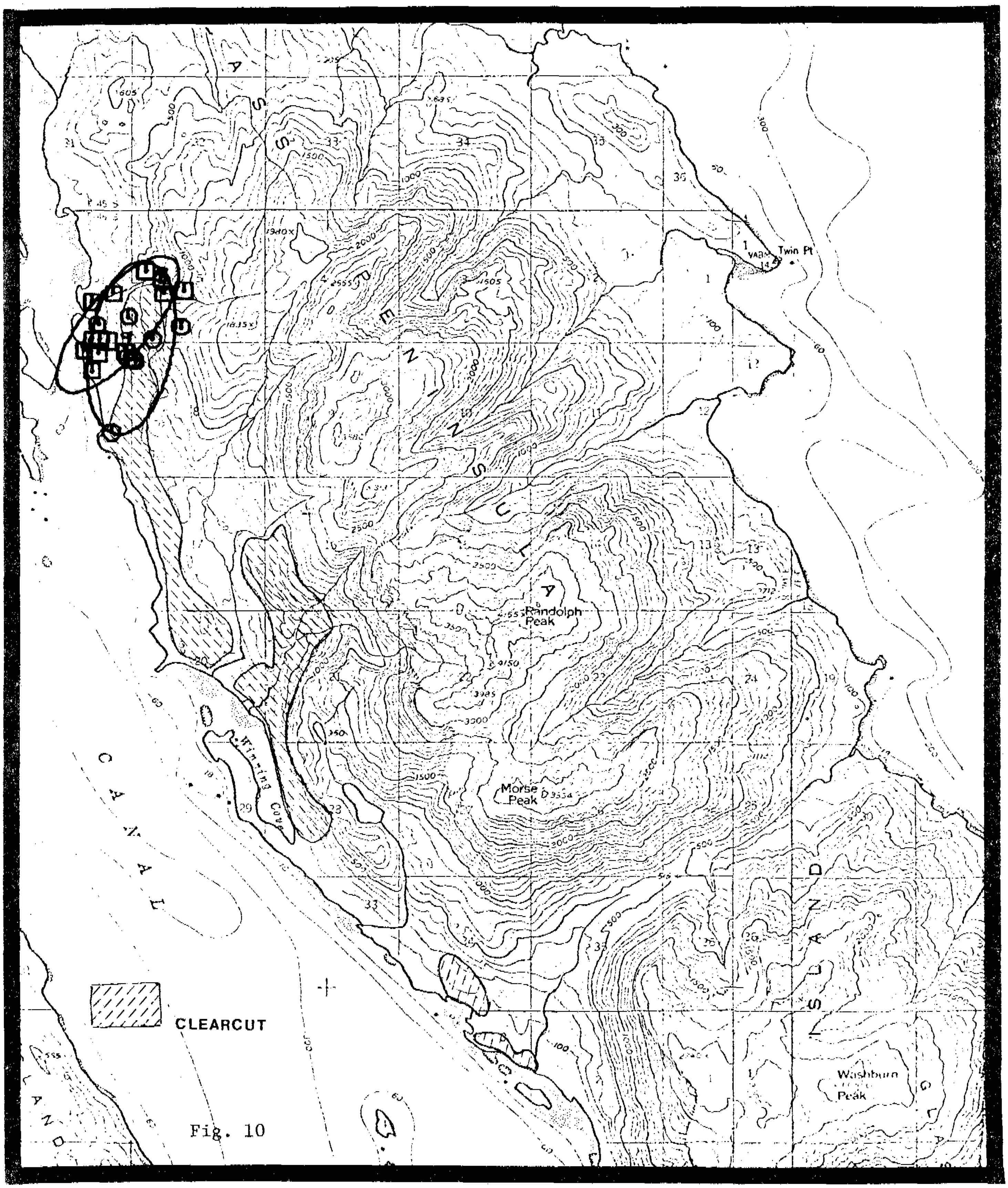


Fig. 10

DEER 43 JUN 21 78-SEP 20 78 15.1 HECTARES

DEER 43 FEB 15 78-APR 15 78 15.5 HECTARES

1 KILOMETER

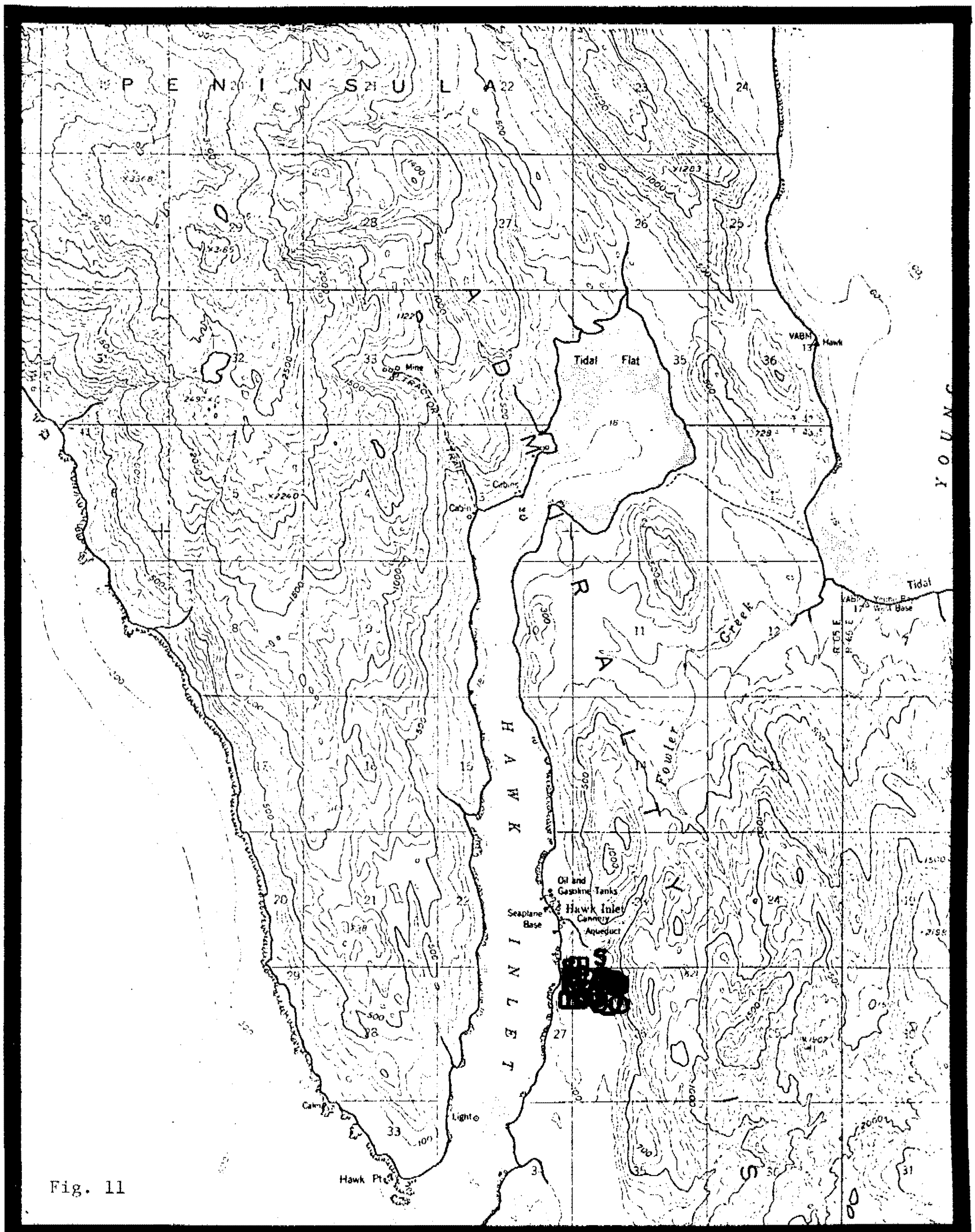


Fig. 11

DEER 74 JUN 21 79-SEP 20 79 85.7 HECTARES
DEER 74 FEB 15 79-APR 15 79 52.1 HECTARES

1 KILOMETER

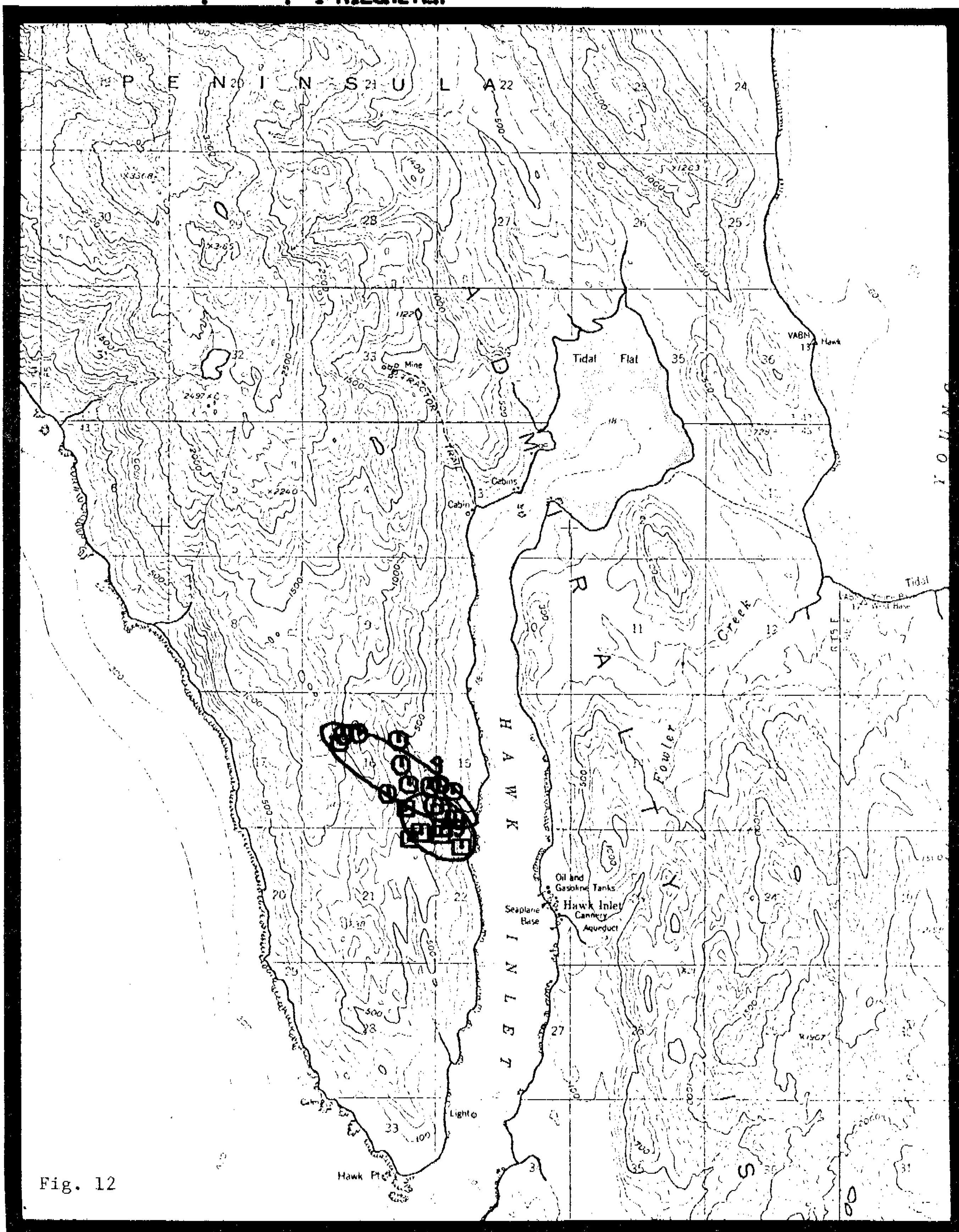


Fig. 12

DEER 6 JUN 21 78-SEP 15 78 88.4 HECTARES
DEER 6 DEC 21 78-MAR 20 79 67.8 HECTARES
1 KILOMETER

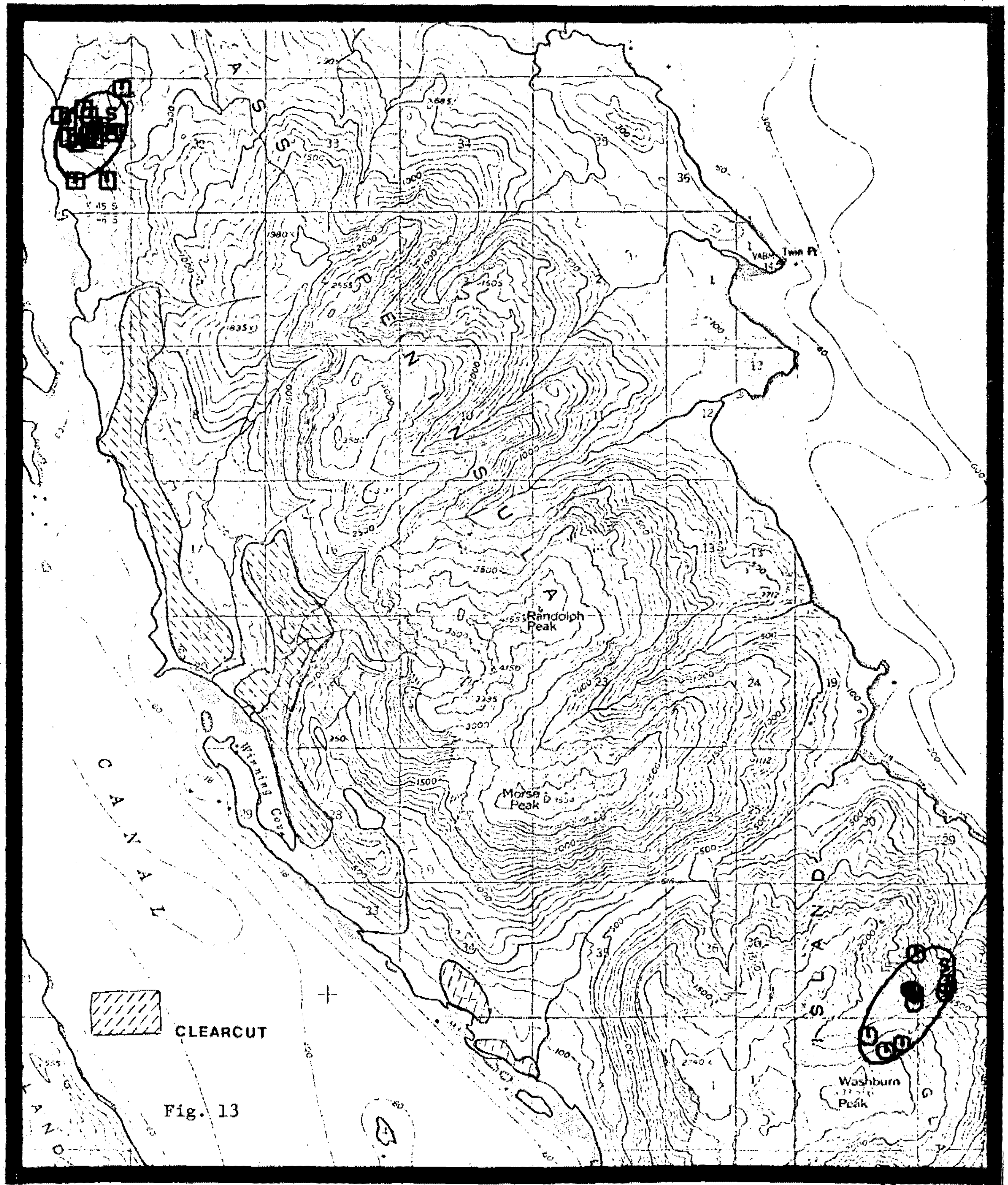


Fig. 13

instrumented deer relocations, respectively, occurred between sea level and 305 m (1000 ft). Approximately 30 percent of the summer locations occurred above 610 m (2000 ft) while only 1 percent of the spring locations and no winter locations occurred above this level. Deer use of elevation varied significantly ($P < .01$) between seasons.

A summary, by season, of use of slope is presented in Table 10. During winter, spring, and summer the mean slope used by deer was 8, 10, and 12 degrees, respectively (Table 9). Deer use of aspect is summarized in Table 11, while terrain use is summarized in Table 12. Progressively greater use was made of steeper slopes from winter through summer. Use of southerly exposures remained relatively constant throughout the year at about 40 percent. Northerly exposures, however, received increasing use from winter through spring and summer with 2.1, 11.4, and 26.8 percent use, respectively. During winter and spring, most deer relocations occurred in smooth terrain, while use of broken terrain increased during the summer. Deer use of slope, aspect, and terrain varied significantly ($P < .01$) between seasons.

Use of habitat type by instrumented deer in each season is presented in Table 13. The most used habitat during any season was old-growth forest. During winter, the greatest use occurred in old-growth forest (52.8%), beach-fringe forest (36.6%), and beach (8.5%) types. During spring this use shifted primarily to old-growth (86.9%) and beach fringe forest (10.8%). The greatest shift, however, occurred during summer with relocations distributed throughout the old-growth (54.9%), subalpine (31.7%), alpine (7.7%), muskeg (4.2%), and clearcuts (1.4%). Habitat types used less than 1 percent during other seasons included clearcuts, muskeg, alpine, second-growth forest, and brush. Deer use of habitat types varied significantly ($P < .01$) between seasons.

Table 14 describes the use of canopy cover by instrumented deer. This habitat attribute was not recorded until approximately mid-winter; therefore, our sample size during winter was less than for spring and summer. During winter and spring most relocations occurred in areas with canopy coverage between 61 and 80 percent. Through summer, however, use of more open canopies prevailed with 47.9 percent of the relocations occurring in areas with canopy coverage less than 41 percent. It is significant that the higher canopy densities (>80%) represent mostly dense, even-aged stands.

Table 15 describes deer use relative to percentage snow cover. Sample sizes during fall and winter were too small to evaluate. During the spring, deer were distributed in areas with varying amounts of snow cover with most relocations occurring in areas with less than 25 percent cover. Throughout the summer most relocations (93%) occurred in areas bare of snow.

Clearcut habitats were not represented equally throughout the study areas. To better evaluate the relative value of habitat attributes that are not widely distributed, it is necessary to restrict the analysis to areas where deer have an opportunity to select those specific attributes. In order to realistically evaluate seasonal clearcut use by deer, we selected four deer whose home ranges substantially overlapped clearcuts (Fig. 14, 15, 16, and 17). A summary of this analysis is presented in

Table 10. Seasonal summary of locations of radio-instrumented deer relative to slope.

* * * * * * * * * * * * * * * * * * C R O S S T A B U L A T I O N O F * * * * * * * * * *
SLOPE BY SEASON CALENDAR SEASON
* *

SLOPE	COUNT 1/ COL PCT	SEASON SPRING, 1.	SUMMER, 2.	FALL, 3.	WINTER 4.	ROW TOTAL
FLAT	1.	18	16	2	59	95
		10.2	11.3	33.3	41.5	20.4
1-10	2.	98	63	1	52	214
		55.7	44.4	16.7	36.6	45.9
11-20	3.	46	49	0	0	95
		26.1	34.5	0.	0.	20.4
21-30	4.	11	7	3	28	49
		6.3	4.9	50.0	19.7	10.5
31-40	5.	2	4	0	3	9
		1.1	2.8	0.	2.1	1.9
41-50	6.	1	3	0	0	4
		0.6	2.1	0.	0.	0.9
	COLUMN TOTAL	176	142	6	142	466
		37.8	30.5	1.3	30.5	100.0

CHI SQUARE = 133.75673 WITH 15 DEGREES OF FREEDOM SIGNIFICANCE = 0.

1/ The upper and lower figure in each col. of the table represents the number and percentage, respectively, for that variable during a given season.

Table 11. Seasonal summary of location of radio-instrumented deer relative to aspect.

* * * * * * * * * * * * * * * * * * C R O S S T A B U L A T I O N O F * * * * * * *
ASPECT BY SEASON CALENDAR SEASON

SEASON

COUNT[1]/ COL PCT

ASPECT		SPRING, 1.	SUMMER, 2.	FALL, 3.	WINTER 4.	ROW TOTAL
FLAT	1.	24	16	1	58	99
		13.6	11.3	16.7	41.1	21.3
N	2.	1	5	0	0	6
		0.6	3.5	0.	0.	1.3
NE	3.	12	19	0	3	34
		6.8	13.4	0.	2.1	7.3
E	4.	34	15	0	11	60
		19.3	10.6	0.	7.8	12.9
SE	5.	14	29	0	4	47
		8.0	20.4	0.	2.8	10.1
S	6.	12	12	0	3	27
		6.8	8.5	0.	2.1	5.8
SW	7.	48	15	4	49	116
		27.3	10.6	66.7	34.8	24.9
W	8.	24	16	0	13	53
		13.6	11.3	0.	9.2	11.4
NW	9.	7	14	0	0	21
		4.0	9.9	0.	0.	4.5
RIDGETOP	10.	0	1	1	0	2
		0.	0.7	16.7	0.	0.4
COLUMN TOTAL		176	142	6	141	465
		37.8	30.5	1.3	30.3	100.0

CHI SQUARE = 175.76517 WITH 27 DEGREES OF FREEDOM SIGNIFICANCE = 0.

NUMBER OF MISSING OBSERVATIONS = 1

[1]/The upper and lower figure in each col. of the table represents the number and percentage, respectively, for that variable during a given season.

Table 12. Seasonal summary of locations of radio-instrumented deer relative to terrain.

* C R O S S T A B U L A T I O N   O F   * * * * * * * * *
TERRAIN   BY SEASON   CALENDAR SEASON
* *

TERRAIN	SEASON COUNT[1] COL PCT	SPRING, 1.	SUMMER, 2.	FALL, 3.	WINTER 4.	ROW TOTAL
SMOOTH	1.	175 99.4	122 85.9	5 83.3	141 99.3	443 95.1
BROKEN	2.	0 0.	20 14.1	1 16.7	1 0.7	22 4.7
	5.	1 0.6	0 0.	0 0.	0 0.	1 0.2
	COLUMN TOTAL	176 37.8	142 30.5	6 1.3	142 30.5	466 100.0

CHI SQUARE = 44.95202 WITH 6 DEGREES OF FREEDOM SIGNIFICANCE = 0.0000

[1] The upper and lower figure in each col. of the table represents the number and percentage, respectively, for that variable during a given season.

Table 13. Seasonal summary of locations of radio-instrumented deer relative to habitat type.

* * * * * * * * * * * * * * * * * * C R O S S T A B U L A T I O N O F * * * * * * * * * * *
HABITAT BY SEASON CALENDAR SEASON
* *

HABITAT	COUNT[1/] COL PCT	SPRING, 1.	SUMMER, 2.	FALL, 3.	WINTER 4.	ROW TOTAL
BEACH	1.	0	0	0	12	12
		0.	0.	0.	8.5	2.6
BEACH FRINGE	2.	19	0	0	52	71
		10.8	0.	0.	36.6	15.2
OLDGROWTH	3.	153	78	6	75	312
		86.9	54.9	100.0	52.8	67.0
RECENT CLEARCUT	4.	2	2	0	1	5
		1.1	1.4	0.	0.7	1.1
SECONDGROWTH CON	8.	0	0	0	1	1
		0.	0.	0.	0.7	0.2
BRUSH	9.	1	0	0	0	1
		0.6	0.	0.	0.	0.2
MUSKEG	10.	1	6	0	0	7
		0.6	4.2	0.	0.	1.5
SUBALPINE	11.	0	45	0	0	45
		0.	31.7	0.	0.	9.7
ALPINE	12.	0	11	0	1	12
		0.	7.7	0.	0.7	2.6
COLUMN TOTAL		176	142	6	142	466
		37.8	30.5	1.3	30.5	100.0

CHI SQUARE = 252.22443 WITH 24 DEGREES OF FREEDOM SIGNIFICANCE = 0.

[1/] The upper and lower figure in each col. of the table represents the number and percentage, respectively, for that variable during a given season.

Table 14. Seasonal summary of locations of radio-instrumented deer relative to percent canopy cover.

* * * * * * * * * * * * * * * * * * * C R O S S T A B U L A T I O N O F * * * * * * * * *
CANOPY % CANOPY COVER BY SEASON CALENDAR SEASON
* *

CANOPY	COUNT[1] / COL PCT	SEASON SPRING, 1.	SUMMER, 2.	WINTER 4.	ROW TOTAL
0-10,	1.	5 2.8	28 19.7	12 20.3	45 11.9
11-20,	2.	0 0.	8 5.6	1 1.7	9 2.4
21-30,	3.	1 0.6	16 11.3	4 6.8	21 5.6
31-40,	4.	8 4.5	16 11.3	0 0.	24 6.4
41-50,	5.	23 13.1	15 10.6	0 0.	38 10.1
51-60,	6.	43 24.4	33 23.2	1 1.7	77 20.4
61-70,	7.	59 33.5	24 16.9	0 0.	83 22.0
71-80,	8.	34 19.3	2 1.4	37 62.7	73 19.4
81-90,	9.	3 1.7	0 0.	0 0.	3 0.8
91-100	10.	0 0.	0 0.	4 6.8	4 1.1
	COLUMN TOTAL	176 46.7	142 37.7	59 15.6	377 100.0

CHI SQUARE = 210.60029 WITH 18 DEGREES OF FREEDOM SIGNIFICANCE = 0.

NUMBER OF MISSING OBSERVATIONS = 89

[1]The upper and lower figure in each col. of the table represents the number and percentage, respectively, for that variable during a given season.

Table 15. Seasonal locations of summary of radio-instrumented deer relative to percent snow cover.

* * * * * * * * * * * * * * * * * * C R O S S T A B U L A T I O N O F * * * * * * * * * * *

SNOCOVER % SNOW COVER BY SEASON CALENDAR SEASON

SNOCOVER	COUNT[1/] COL PCT	SEASON SPRING, 1.	SUMMER, 2.	FALL, 3.	WINTER 4.	ROW TOTAL
0	1.	91	132	4	21	248
		51.7	93.0	100.0	91.3	71.9
1-25	2.	33	9	0	2	44
		18.8	6.3	0.	8.7	12.8
26-50	3.	12	1	0	0	13
		6.8	0.7	0.	0.	3.8
51-75	4.	12	0	0	0	12
		6.8	0.	0.	0.	3.5
76-100	5.	28	0	0	0	28
		15.9	0.	0.	0.	8.1
	COLUMN TOTAL	176	142	4	23	345
		51.0	41.2	1.2	6.7	100.0

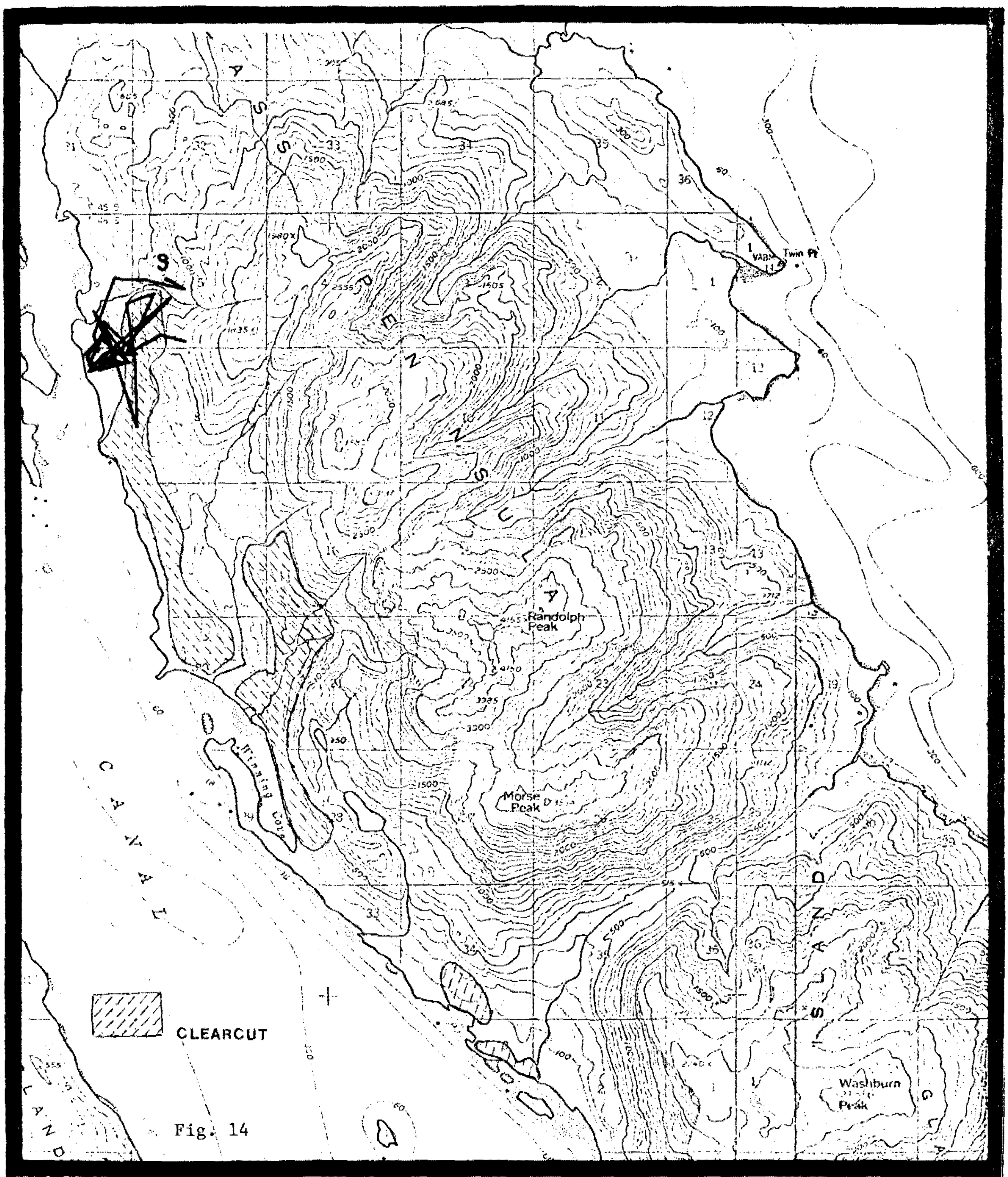
CHI SQUARE = 78.05068 WITH 12 DEGREES OF FREEDOM SIGNIFICANCE = 0.0000

NUMBER OF MISSING OBSERVATIONS = 121

[1/] The upper and lower figure in each col. of the table represents the number and percentage, respectively, for that variable during a given season.

DEER 70 JAN 1 79-SEP 15 79

1 KILOMETER



DEER 20 DEC 1 78-SEP 15 79

1 KILOMETER

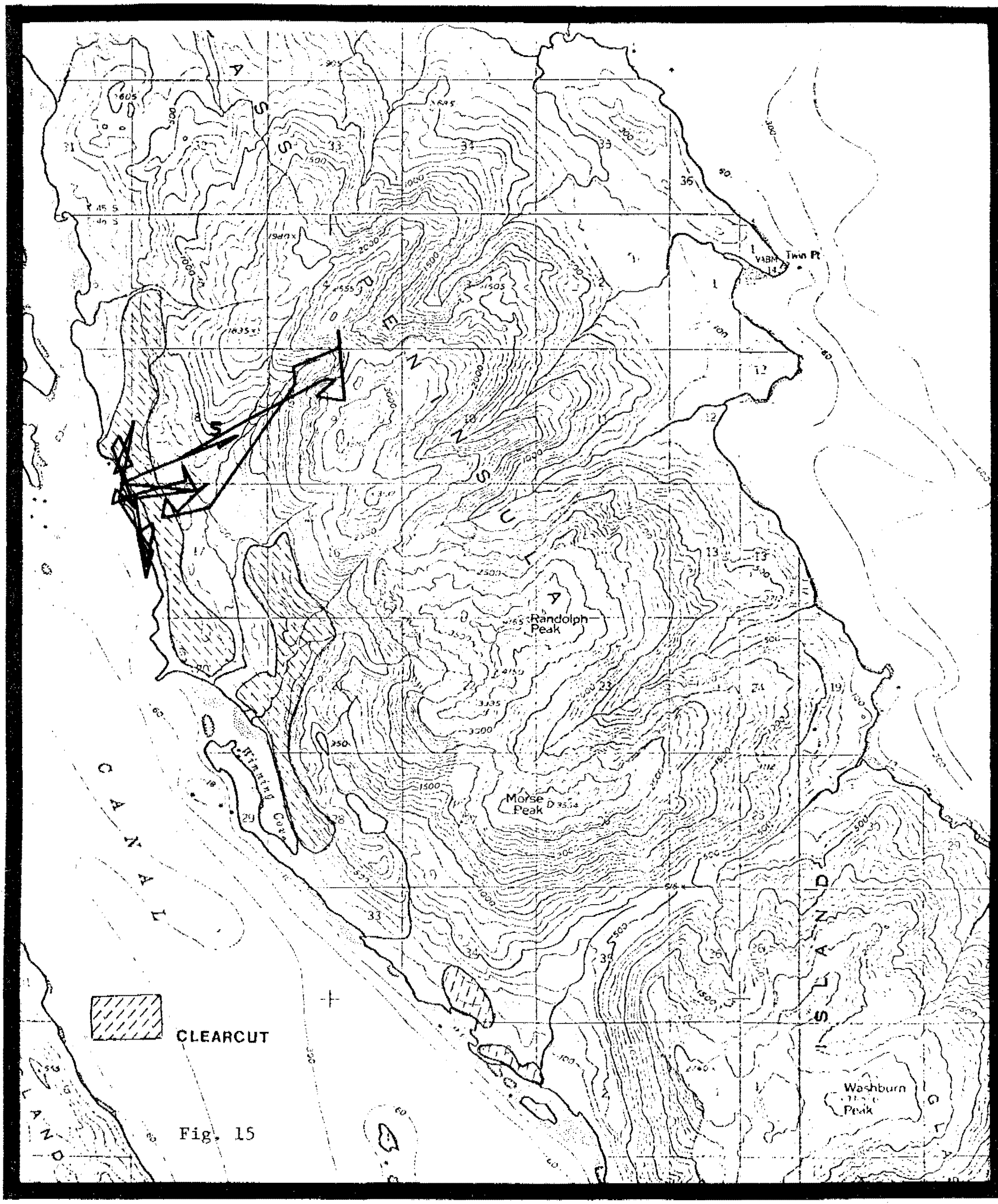


Fig. 15

DEER 80 DEC 21 78-SEP 15 79

1 KILOMETER

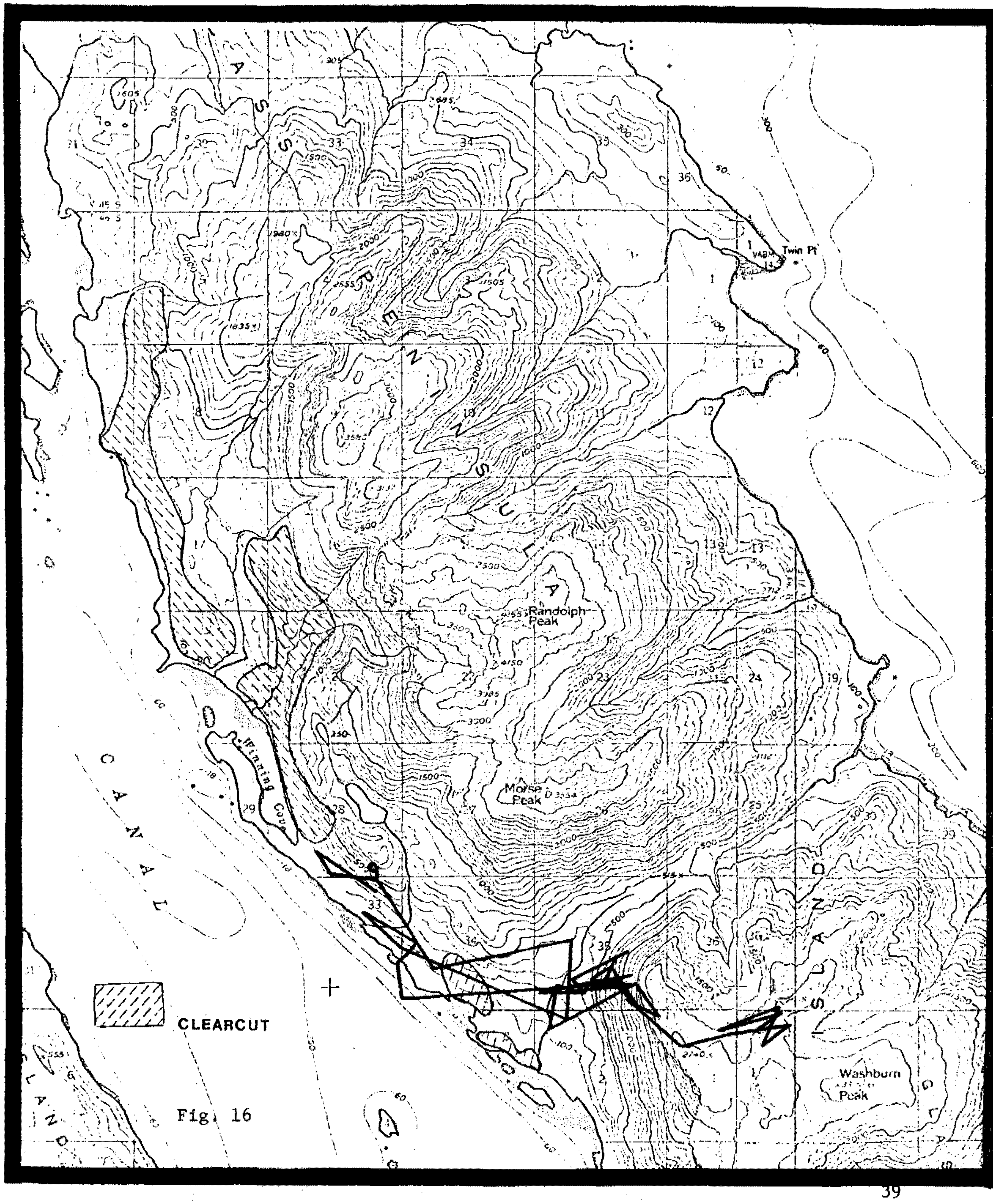


Fig. 16

DEER 90 DEC 21 78-SEP 15 79

1 KILOMETER

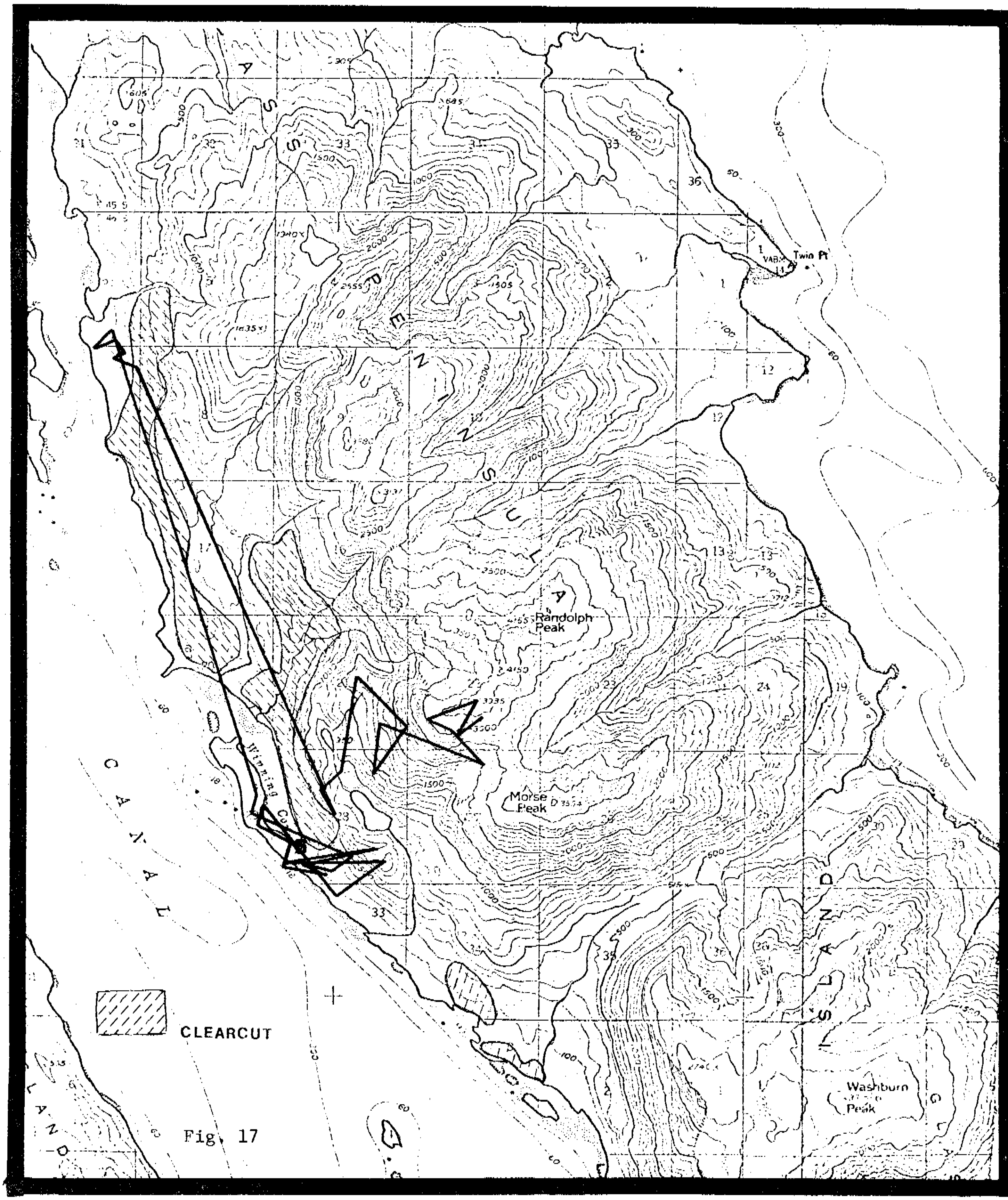


Fig. 17

Table 16. The proportions of relocations occurring in clearcuts during winter, spring, and summer were 1.8, 3.8, and 5.6 percent, respectively. During winter and spring, use of forested habitat (96.3%) greatly exceeded use of clearcuts. During the summer, use of forest habitat fell to 33.3 percent and deer use of subalpine and alpine habitat rose to 61.1 percent, while use of clearcuts remained comparatively low.

DISCUSSION

Preliminary data from spring 1979 beach mortality transects (Appendix III) indicated a higher proportion of winter beach mortalities adjacent to recently clearcut areas than to uncut forests. We also found a higher density of deer use in the clearcut-backed beach fringe than in the uncut fringe. However, when the two areas were evaluated as a whole, deer use was 1.3 times higher in the uncut area. As winter snow accumulated and deer moved to lower elevations, it appeared that they were forced out of the clearcut by deep snow and concentrated in the beach-fringe forest in numbers probably in excess of its carrying capacity. In the uncut area, deer use was distributed to higher elevations than in the cut area. Thus the pressure on limited forage resources was more dispersed even though the overall population level was higher. These preliminary data suggest that: 1) deer densities in cut areas, including forest edge and adjacent beach-fringe forest, are lower than in comparable uncut areas and 2) mortality levels, as determined by beach mortality surveys, are proportionately higher below beach-fringe areas backed by clearcuts than in areas backed by old-growth forest.

Although it is well documented that deer use levels in Southeast Alaska are lower in cut than in old-growth sites (Schoen 1978), it was interesting to evaluate this relationship with respect to "edge effect." The limited data presented here indicate that the benefits derived from edge do not compensate for the loss incurred by clearcutting. It is also important to recognize that any benefits derived from "edge effect" are short-lived, decreasing as the new conifer canopy becomes established. We consider these data to be preliminary and recognize the need to further investigate these relationships in additional sites, both with respect to beach-fringe sites of various conditions as well as interior sites.

Sampling was undertaken in order to assess the relationships of topography to deer distribution. This work was discontinued after we determined a major weakness in our approach. Because of high within-site variability of a number of landscape components, we were unable to isolate the effects of slope exposure on deer use patterns. Rather than evaluating several sites while trying to control for a variety of landscape influences, it would be preferable to sample many sites and evaluate the relationship complex by a multivariate analysis. This is the approach being taken with our forest sampling data which will be prepared for the next report.

In this region, capture programs should be planned to take advantage of periods when deer are concentrated on beaches. Two-man crews are most efficient, with one person running the skiff and the other shooting.

Table 16. Seasonal summary of use of habitat type for four instrumented deer whose home ranges included clearcuts.

* * * * * * * * * * * * * * * * * * * C R O S S T A B U L A T I O N O F * * * * * * *
HABITAT BY SEASON CALENDAR SEASON
* *

HABITAT	SEASON COUNT 1/ COL PCT	SPRING, 1.	SUMMER, 2.	WINTER 4.	ROW TOTAL
BEACH	1.	0 0.	0 0.	1 1.8	1 0.7
BEACH FRINGE	2.	10 18.9	0 0.	29 52.7	39 27.1
OLDGROWTH	3.	41 77.4	12 33.3	24 43.6	77 53.5
RECENT CLEARCUT	4.	2 3.8	2 5.6	1 1.8	5 3.5
SUBALPINE	11.	0 0.	14 38.9	0 0.	14 9.7
ALPINE	12.	0 0.	8 22.2	0 0.	8 5.6
	COLUMN TOTAL	53 36.8	36 25.0	55 38.2	144 100.0

CHI SQUARE = 102.32152 WITH 10 DEGREES OF FREEDOM SIGNIFICANCE = 0.0000

1/ The upper and lower figure in each col. of the table represents the number and percentage, respectively, for that variable during a given season.

Once observed, deer can be approached from the water and shot close to shore from the skiff. Without suitable weather conditions, however, capturing deer, except perhaps during the November rut can be very costly in terms of man-days in the field, and meet with limited success.

The range and accuracy of the Pneu Dart gun were far better than the Cap Chur system, although we had some problems with variability of the power charges used to fire the gun. We determined that most adult deer were effectively immobilized with dosages of 11 to 12 mg. Harestad and Jones used 6 to 8 and 7 to 11 mg, respectively, for adult black-tailed deer (*Odocoileus hemionus columbianus*) on Vancouver Island (Hebert and McFetridge 1979) and Hill used 7 to 8 mg for black-tails on the Olympic Peninsula, Washington (Waldeisen, Pres. Pneu Dart Inc., pers. comm.). Waldeisen (pers. comm.) indicated substantial variability between areas of effective dosages for deer. Merriam (pers. comm.) found dosages of 10 to 12 mg to be effective for deer on southern Admiralty Island during March. Five fawns were captured during this work, however, two died during immobilization and two died later during the winter. In terms of cost effectiveness, we will, in the future, concentrate our capture efforts on adults unless we have a particular question relative to young-of-the-year.

In general, the home ranges of most instrumented deer were confined to relatively small areas, usually 5 to 10 km^2 (2-4 mi^2). The movements of some individuals greatly exceeded this range, while others inhabited a much smaller area. This variation is probably due, in part, to differences in the quality of habitat each animal inhabits, but individual behavior patterns may play an important role as well.

Deer were distributed from sea level to above timberline during snow-free periods. However, some deer remained at low elevations exclusively while others utilized higher ranges and still others used a variety of elevations throughout snow-free periods. Even after snow forced deer off alpine ranges, some continued ranging as high as conditions allowed, often up to 300 m (985 ft), even during winter.

Deer use of all habitat attributes measured varied significantly ($P<.01$), from one season to another. Patterns of use of some attributes, such as slope and exposure, were less distinct than others and require more data before generalities can be developed. Deer were generally located in areas of smooth terrain, except during the summer season when some animals used broken terrain to a small degree. These sites generally consisted of broken alpine or subalpine regions.

Throughout the year uneven-aged, old-growth forest was the single most important habitat type used by our sample of instrumented deer. During winter and spring, respectively, this forest community, including beach-fringe old growth, represented almost 90 to 98 percent of the total relocations. Even during summer when higher alpine areas were available, 55 percent of our relocations of instrumented deer occurred in old-growth habitat. While many locations (32%) occurred in subalpine habitat, only 8 percent were in open alpine, and an even smaller proportion occurred in muskegs and clearcuts. Thus, most deer appeared to be closely associated with forested habitat throughout the seasons for which we have an adequate sample. There was a trend from winter through summer, however, for deer to use areas of decreasing canopy cover. This is probably related to snow-canopy relationships, a subject we hope to pursue in more detail in the future.

We undertook a closer examination of forest-clearcut use by selecting only deer whose home ranges substantially overlapped clearcut habitat. By doing this we assumed that clearcut habitat represented one of a number of choices available to these deer. Based on their observed use of habitat types we should be able to infer some degree of preference or avoidance of those types. Although use of clearcuts increased from winter to spring, the proportion of use deer made of forested habitat greatly exceeded the use of clearcuts. This seems reasonable during periods when deep snow renders the open clearcuts essentially unusable for deer, but during snow-free periods the comparatively limited use deer made of clearcuts suggests other areas are still more attractive.

These data represent the results of the first year of this study and are considered preliminary in nature. We have avoided generalizations about differences in habitat use related to age and sex because our sample size was small. We have few data from the fall season; thus, a pattern of year-round use is still incomplete. We anticipate doubling our sample size of instrumented deer during the coming field season and maintaining our intensity of data collection. We are confident that these data and those collected over the next year will greatly increase our knowledge of the habitat requirements of the Sitka black-tailed deer and contribute to better management for this species and its habitat in the coming years.

ACKNOWLEDGEMENTS

Numerous individuals contributed time and effort to this investigation. Appreciation is extended to all our field crew especially Dave Beaudin, Gordon Fisch, Kevin Johnson, Tom Spoth, George Reifenstein, Ron Bressette, Barry Roderick, Sarah Watson, Tom Paul, Mike Balint, Tim Thomas, and Vern Beier.

Thanks to Jack Lentfer, Nate Johnson, and Don McKnight for their support, advice, field assistance, and editorial suggestions.

Lynn Bennett of L.A.B. Flying Service, Inc. performed our telemetry flying with keen interest, understanding, safety, and much skill.

Thanks to the vessels staff, especially the crew of the Auklet, for their logistic support under adverse conditions.

Appreciation is expressed to Fritz Funk and Larry Tally for their fine programming skills. And to Mickey Lesley, thanks for typing of the manuscript and handling a variety of other details involved with this project.

Charlie Wallmo and Matt Kirchhoff cooperated in all phases of this investigation. They contributed greatly to the successful completion of this stage of the project.

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APPENDIX I. Deer capture data form.

Personnel ____________

____

____

DEER - CAPTURE DATA

Specimen # ____________ Date ____________ Time ____________

Location ____________

Weather: Temp ________ Sky ________ Precip ________ Wind ________

Elevation ________ Slope ________ Aspect ________ Habitat ________

____

Sex ____________ Age Estimate ____________

Antler points ____________ Teeth ____________

Measurements: (cm)

Body L. ________ Tail L. ________ Total L. ________

Hock L. ________ Heart Girth ________

Weight Estimate ________ Neck Circumference ________

Female Lactating ________ Antler L. ________ Spread at tips ________

Hair Sample ________ Blood Sample ________ Pellet Sample ________

Ectoparasites ____________

General Condition ____________

____

Marking:

Roto-Tag # ________ Ear ________ Color Flag ________

Metal Tag # ________ Ear ________ Color Flag ________

Radio-Collar # ________ Frequency ________

Color of Collar ________ Other Marks ________

____

Capture Technique ____________

Drug ________ Dose ________ Time:Inject ________,Down ________,Up ________

Other deer present ____________

____

Remarks: ____________

____

APPENDIX II. Location data form and data codes. loaded ________________

Mountain Goat and Black-tailed Deer Location Data

Header Information

Animal Survey Type Observer Date (yr.,mo.,day) Julian Date

Weather Data

Air Temp. Wind Dir.(deg.) Wind Speed(mph) Clouds(%) Precip.

F

+-

Location Data

Number Elev.(ft) Habitat Canopy(%) Terrain Slope(°) Time(hr)

Cover(%) Snow Depth(in) Type Group Size #M #F #Ad. #Juv.

Accuracy Animal Location Aspect

Black-Tailed Deer Mountain Goat Telemetry

DATA CODES

Animal	Survey Type	Observer	Clouds	Precipitation
1=goat	1=aerial	1=John 4=Jack	% Cover	1=no rain
2=deer	2=ground	2=Matt 5=Charlie		2=intermittant rain
		3=Nate 6=Gordon		3=steady rain
		7=Dave		4=snow

Wind Direction	Wind Velocity
° Magnetic	MPH
0, Variable=111	

Habitat
01=Beach
02=Beach fringe (old growth forest less than 100 yards from beach)
03=Old growth conifer forest
04=Early successional clearcut (0-15 years)
05=Mid successional clearcut (16-30 years); deciduous dominating
06=Mid successional clearcut (16-30 years); conifers dominating
07=Even aged regrowth (31-200 years); deciduous dominating
08=Even aged regrowth (31-200 years); conifers dominating
09=Deciduous brush (slide or avalanche chute)
10=Muskeg
11=Subalpine
12=Alpine tundra
13=Rocky outcrop; cliff face
14=Permanent ice-snowfield
15=Frozen lake-river

Canopy	Terrain	Snow Cover (%) and Depth (in)	Snow Type
% cover	1=smooth	(in general vicinity of animal	0=no snow
	2=broken		1=soft
			2=hardpack
			3=crust

Accuracy
1=accurate location within 25 acres-habitat accurate
2=accurate location within 25 acres-habitat uncertain
3=accurate location within 100 acres-habitat uncertain

Animal Location (from map)
First 3 values are the X (EW) coordinate
Last 3 values are the Y (NS) coordinate

Aspect (from map)

01=Flat	04=E	07=SW	10=Ridgetip
02=N	05=SE	08=W	
03=NE	06=S	09=NW	

Slope
degrees-#contour lines/grid
1-15 = 1-2
16-30 = 3-5
31-45 = 6-9
46+ = 10+

Group Size
# of individuals observed in each class within group

APPENDIX III. 1979 winter beach mortality data for black-tailed deer.

WINNING COVE BEACH SURVEY
29-30 March 1979

Objectives

1. To compare deer mortality along beaches backed by recent clearcuts with that along beaches backed by old-growth forest.

2. To determine the relative efficiency of 1 and 3-man crews in conducting such beach surveys.

3. To evaluate problems associated with sampling design in such a survey.

Methods

Observers walked along the beaches at, or slightly above, the high tide mark looking for deer carcasses. Special care was taken to examine the ground around, and beneath, the fringe of alders (*Alnus crispa*) which characteristically grow along the beach. For each carcass found, the following data were collected: 1) location (as recorded on a topo map); 2) distance to carcass when first spotted; 3) description of surrounding vegetation and topography; 4) evidence and extent of deer browse in the area; 5) distance from carcass to high tide line and, if applicable, to clearcut; 6) general condition of carcass; and 7) estimated nutritional condition of deer at time of death. In addition, the femur (or humerus) and lower jaw of each dead deer were collected for later analysis of nutritional condition and age. Finally, a 1-mile section of coastline was surveyed simultaneously by three observers: one walking on the beach, one walking on the forest side of the alder fringe, and the third walking game trails within the old-growth forest.

Results

Approximately 7.75 miles of coastline were surveyed. Four miles were backed by recent (1968) clearcuts, and 3.75 adjacent miles were backed by old-growth forest. A total of 8 deer carcasses were found, 5 on clearcut backed beach, and 3 on old-growth backed beach (see map). Data collected at each carcass location are presented below.

Data summary (carcass locations)

Deer #1
- a) first spotted from 20 feet
- b) in spruce and alder; 10 foot cliff 20 yards in from beach
- c) no evidence of browse
- d) 25 feet from high tide mark
- e) only hair and scattered bones remaining
- f) marrow not checked; bones not collected

Deer #2
- a) first spotted from 20 feet
- b) at base of 10 foot high cliff (overhung by some conifer and alder), lots of duff

c) no evidence of browse
d) 10 feet from high tide mark; 150+ yards from clearcut
e) only hair and scattered bones remaining
f) nutritional condition at time of death poor, but appeared to be somewhat more fat content in marrow that in previous deer. Condition of teeth indicate an older deer.

Deer #3
a) first spotted from 15 feet
b) near deadfall along conifer edge (no alder fringe), lots of duff
c) moderate browse on alder buds; several pellet groups
d) 15 feet to high tide mark; 200+ yards to clearcut
e) hide relatively intact; dead perhaps 10 days or less
f) nutritional condition at time of death very poor; bones collected

Deer #4
a) first spotted from 10 feet
b) on grassy flat, some small alder, lots of duff (alder leaves and spruce needles), smooth terrain; low slope
c) no evidence of extensive browse; several nearby pellet groups
d) 20 feet from high tide mark; 180+ yards to clearcut
e) only found one foreleg. May have been dragged by scavengers to beach and lost to the tides
f) nutritional condition at death very poor; one bone collected

Deer #5
a) first spotted from 4 feet
b) on beach gravel near rocky outcrop, 10 foot cliff; high conifers overhanging
c) no evidence of browse
d) 5 feet to high tide mark, 150+ yards to clearcut
e) no hide; few bones; much loose hair
f) nutritional condition at death very poor; bones collected

Deer #6
a) first spotted from 10 feet
b) in grassy area with numerous small alder shoots; adjacent to fine gravel beach; smooth terrain; low slope
c) moderate deer browse on alder buds; numerous pellet groups
d) 30 feet to high tide mark, 40 yards to clearcut
e) hide relatively intact
f) marrow not examined; bones collected

Deer #7
a) first spotted from 4 feet
b) in flat area covered with duff; smooth terrain; low slope
c) no evidence of browse
d) found at high tide line, obviously washed daily by high tide
e) only the scapula and a handful of hair was found
f) no bones collected

Deer #8
a) first spotted from 2 feet
b) found on flat, green, mossy area

c) scattered evidence of browse
d) 30 feet from high tide mark
e) scattered bones and hair remain
f) in poor nutritional condition at time of death; bones collected

In general, carcasses were found on flat, alder-fringed beaches, especially in sheltered areas where an abundance of alder leaves, spruce needles, and other organic matter accumulated.

Although evidence of browse along the beach was minimal, in all areas surveyed, *Vaccinium* growing in the forest was heavily browsed.

It was easy to locate carcasses from the beach and we were fairly confident that all deer within 30 feet of the high tide mark were found. In the mile-long survey conducted by three observers (see map, sec. D), the observer on the beach found two deer while the observers walking in the forest and on the inside of the alder fringe found no deer.

The marrow of all bones examined in the field was red, thin, and gelatinous indicating the deer were in poor nutritional condition at the time of death.

Conclusions and Recommendations

It seems apparent from these limited data that deer mortality is substantially greater in forest habitat backed by clearcuts than it is in similar habitat backed by old-growth forest. The difference we observed in mortality between the two habitats in this study (1.25 deer/mi. vs. 0.8 deer/mi.) is probably less than might be expected on more typical sections of beach. This is because the northern portion of section B and most of section C consisted of forest fringe varying in width from 0-50 feet. It is unlikely that this minimal habitat supported many (if any) deer during winter. Thus, we can logically expect not to find many dead deer along these sections of beach in spring.

The problem of how to interpret results can be illustrated with another example. If one assumes there are more deer in old-growth forests than in clearcuts, and these deer move down to the beach in late winter, then in the spring following a particularly long, severe winter we can probably expect to find more carcasses on old-growth backed beaches than on clearcut backed beaches.

For the results of this survey to be interpreted, we must assume that 1) the numbers of deer using old-growth backed and clearcut backed beach prior to winter are nearly the same, and 2) that the quality of habitat (e.g., width of fringe, type and slope of beach) is fairly consistent along the selected beach. Furthermore, it would not be valid to lump the results of surveys conducted in widely separated areas since varying population levels, clearcut acreage, forest fringe width, beach type, food availability, and snow conditions, might obscure the true relationships.

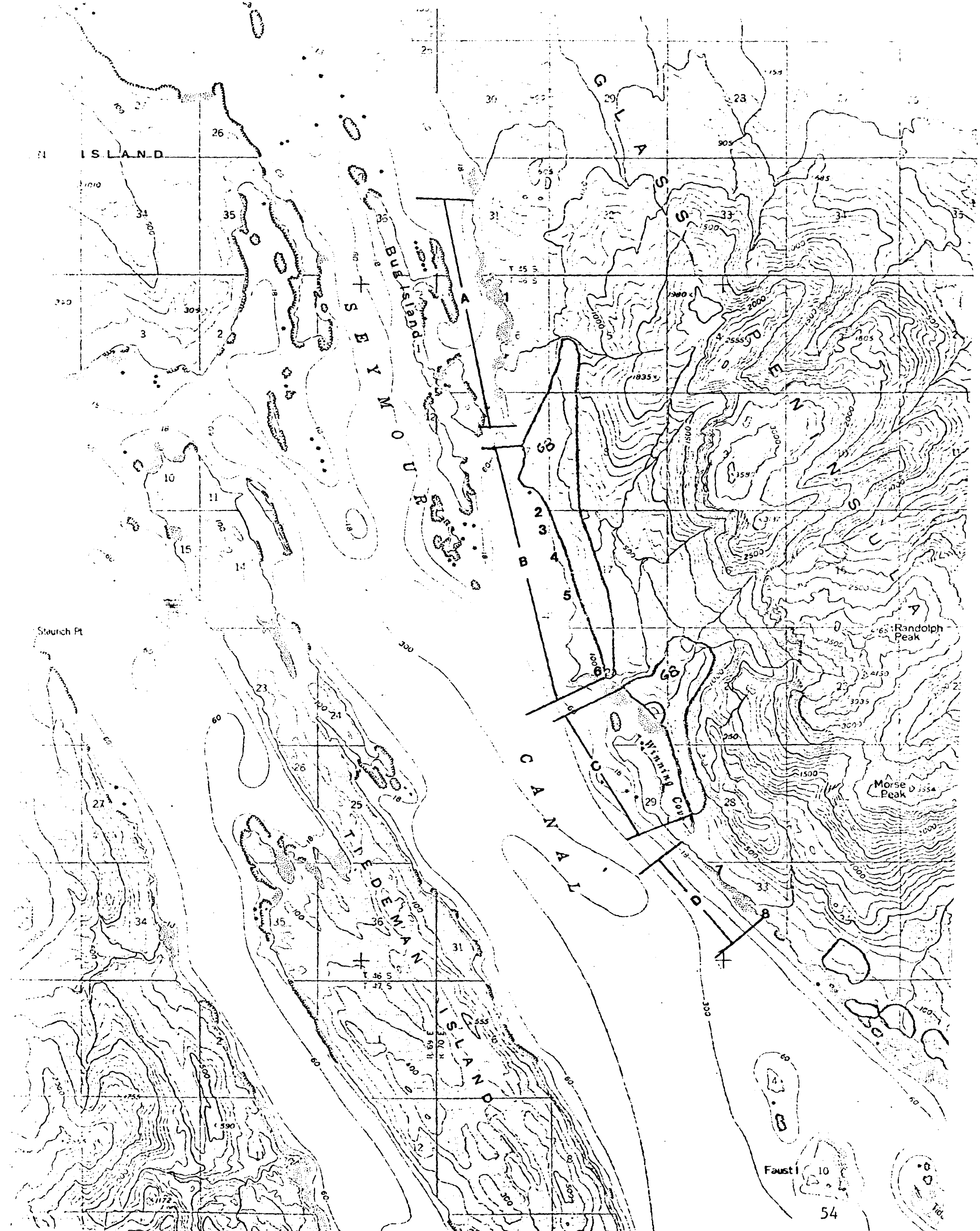
An alternate approach which would minimize these problems is outlined below.

1. Select clearcut backed beaches where the clearcut is between 200 and 500 yards from the beach. This will provide sufficient habitat to guarantee some deer use.

2. In early spring, conduct pellet group transects through these forest fringes. Conduct similar transects in adjacent areas backed by old-growth forest. This will provide a relative index of winter deer use in each area.

3. In spring, conduct surveys for carcasses along the beach. Express mortality as a relative percent of winter populations on the two habitats.

4. The percent mortality differences between these two habitat types can then be averaged among different study areas and over successive years to build a suitable sample size.


ISLAND
SEYMOUR
Bug Island
CANAL
GLASS PENINSULA
TIEDEMAN
ISLAND
Staunch Pt
Randolph Peak
Morse Peak
Winning Co
Faust I
A
B
C
D
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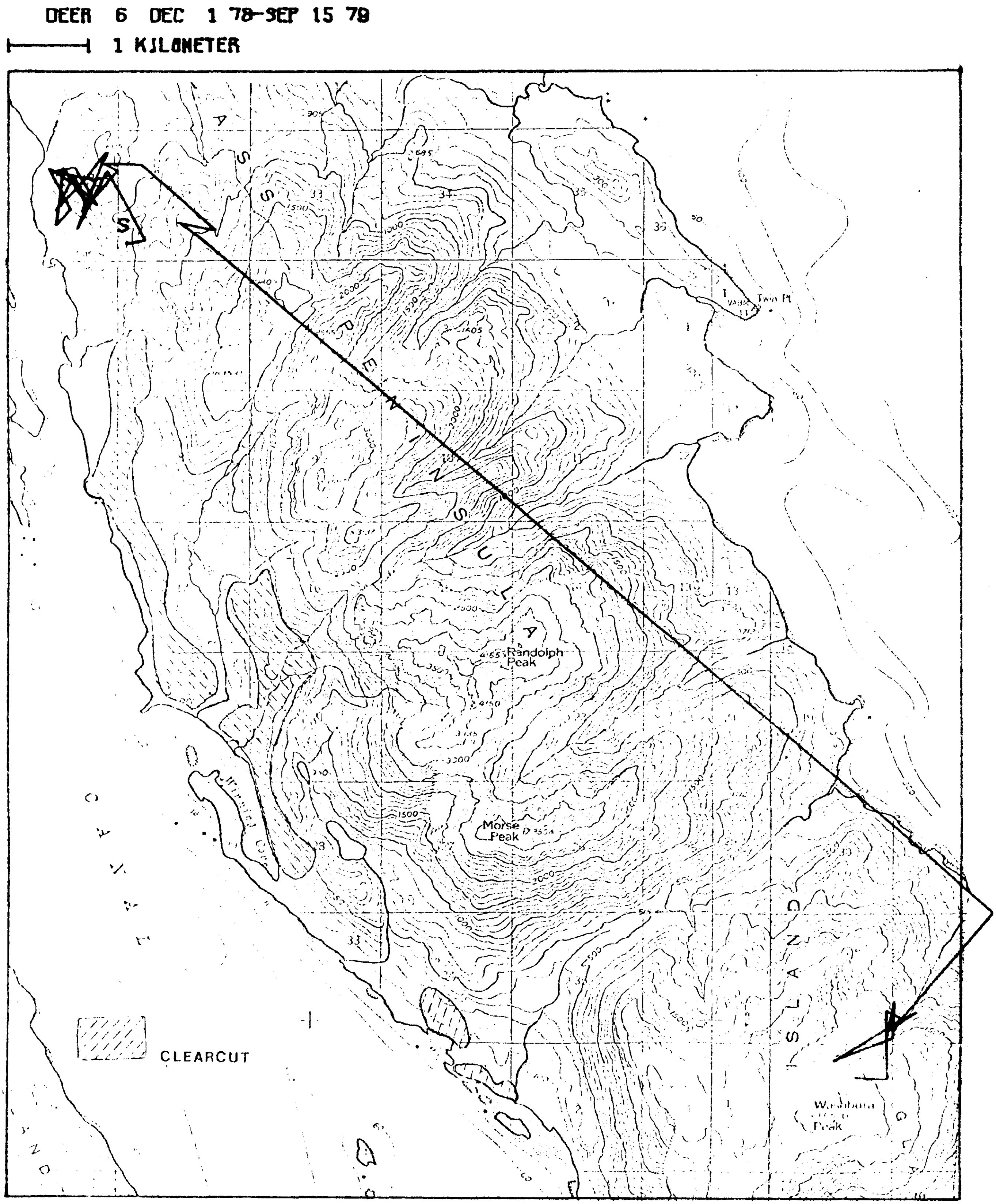
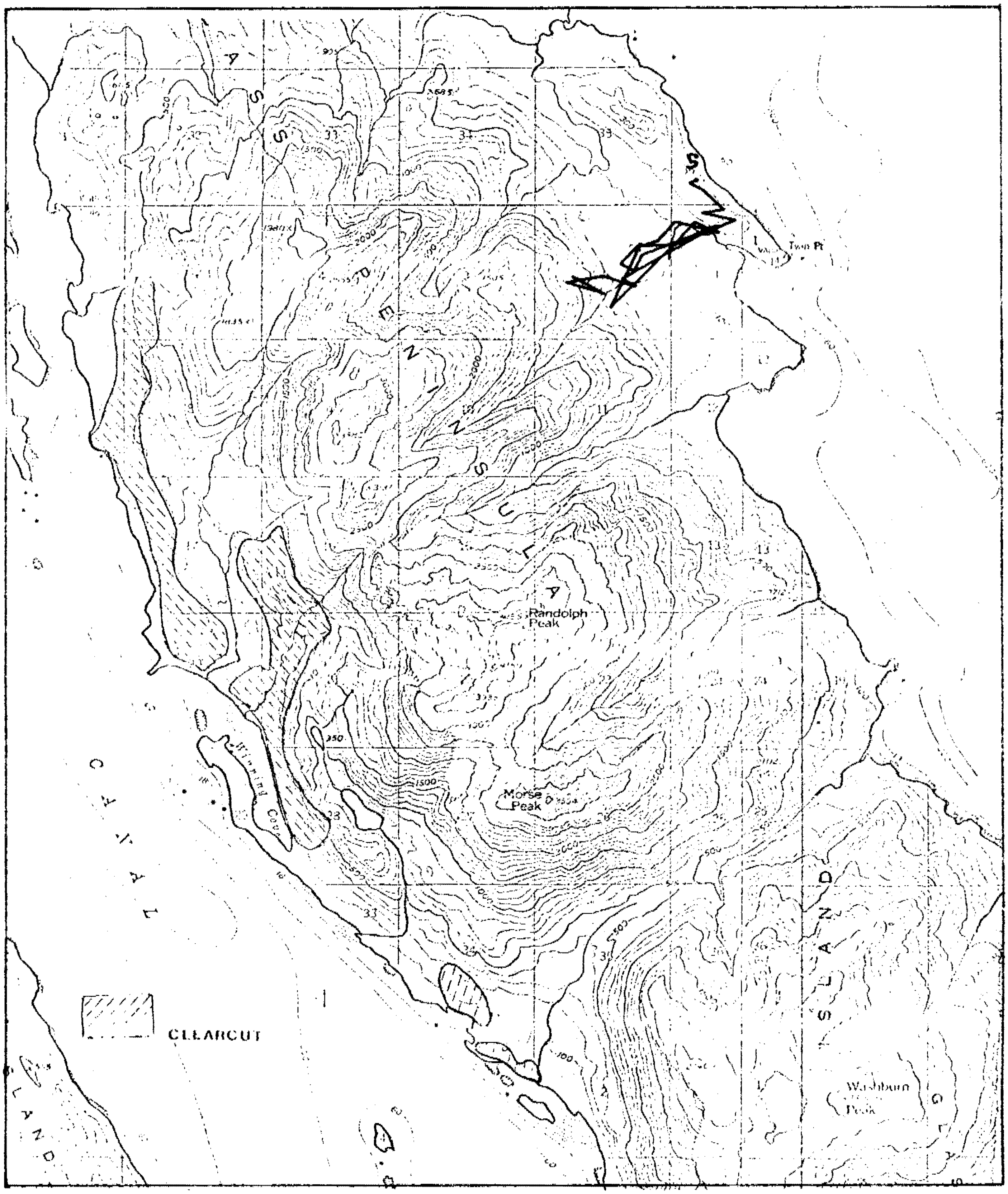
T 45 S
T 46 S
T 47 S

APPENDIX IV. Two dimensional plots of movements from capture to date by deer with nine or more locations.

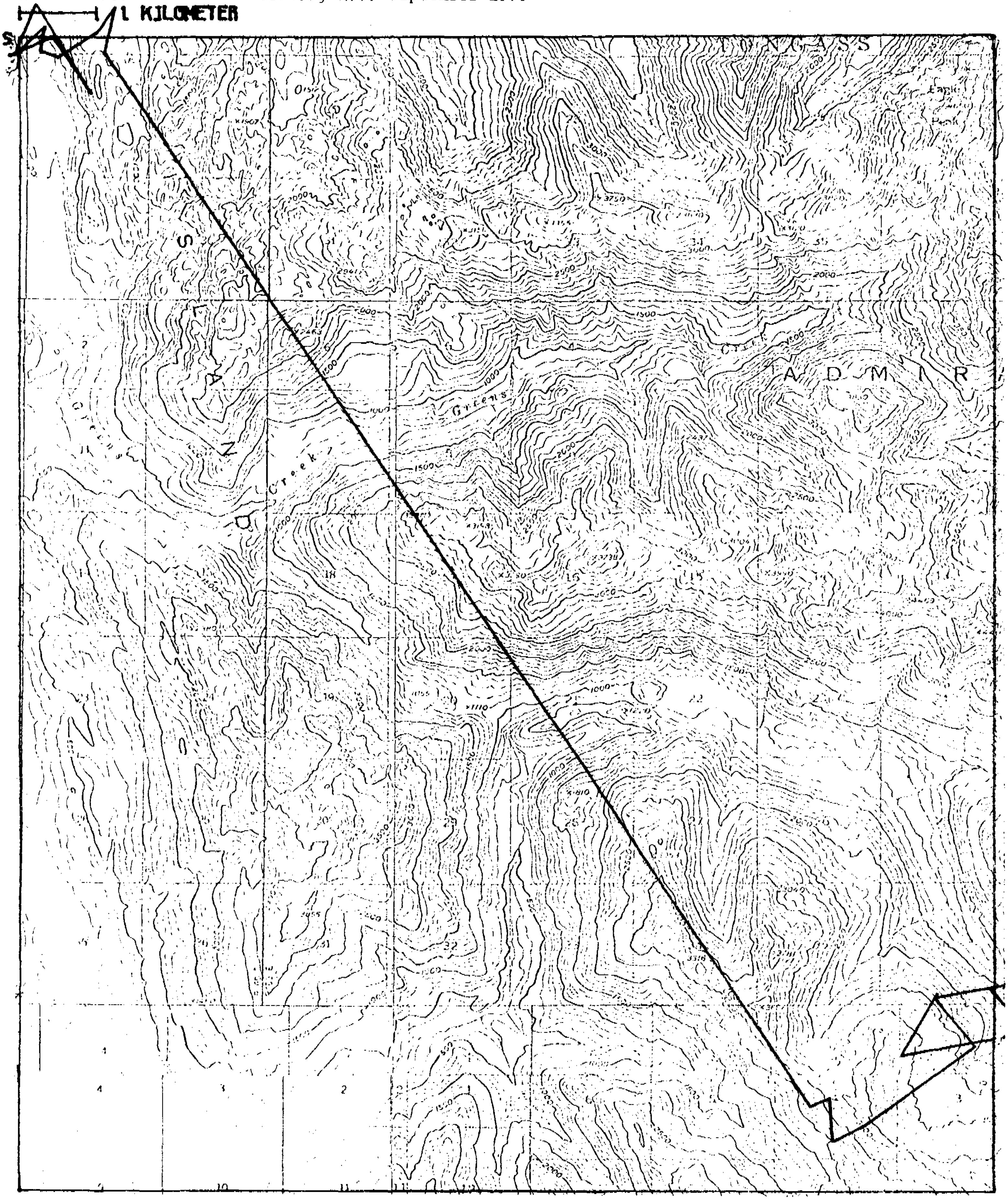


DEER 61 MAR 1 78-SEP 15 78

1 KILOMETER

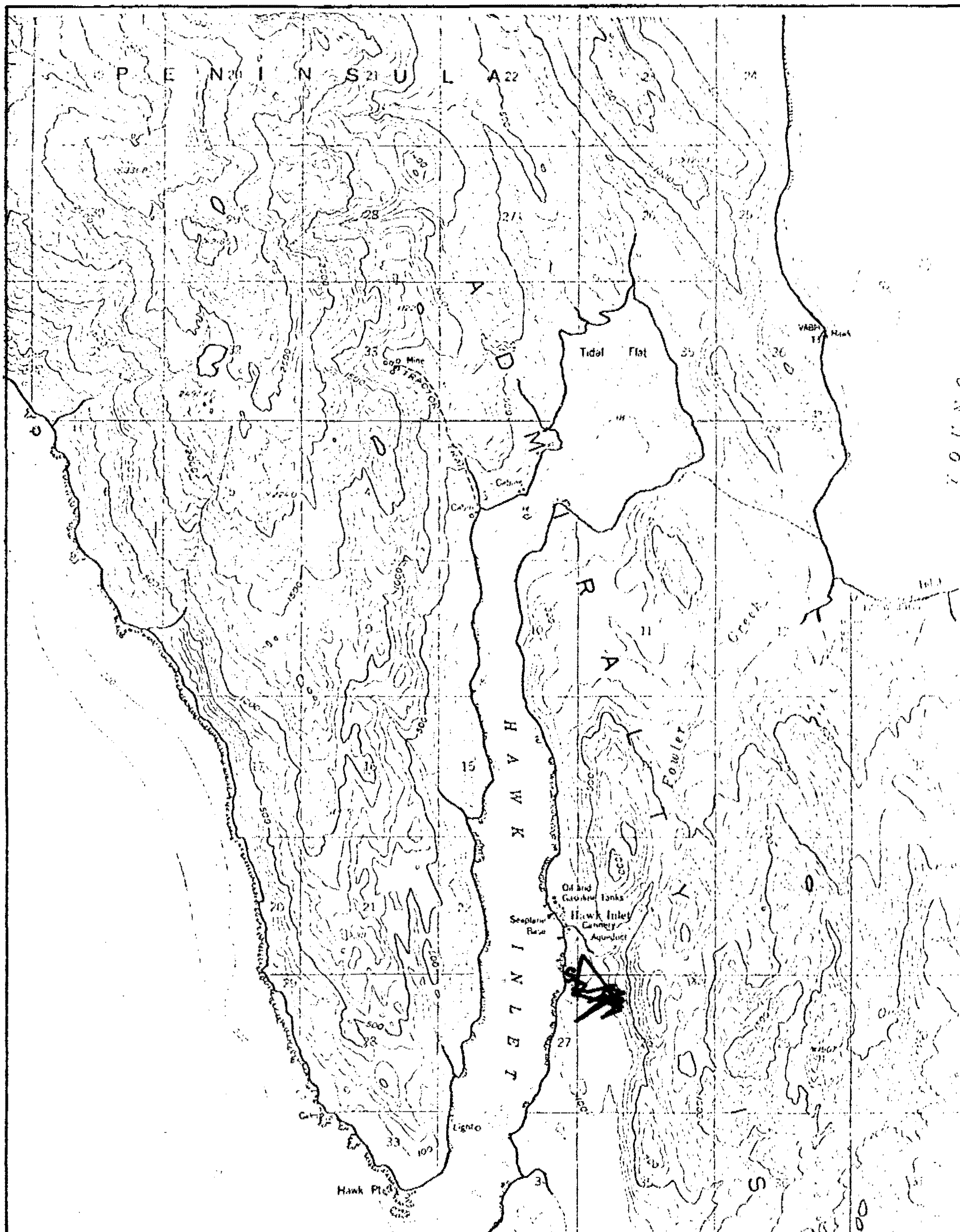


Hawk Inlet. Deer 18. February 1979-September 1979



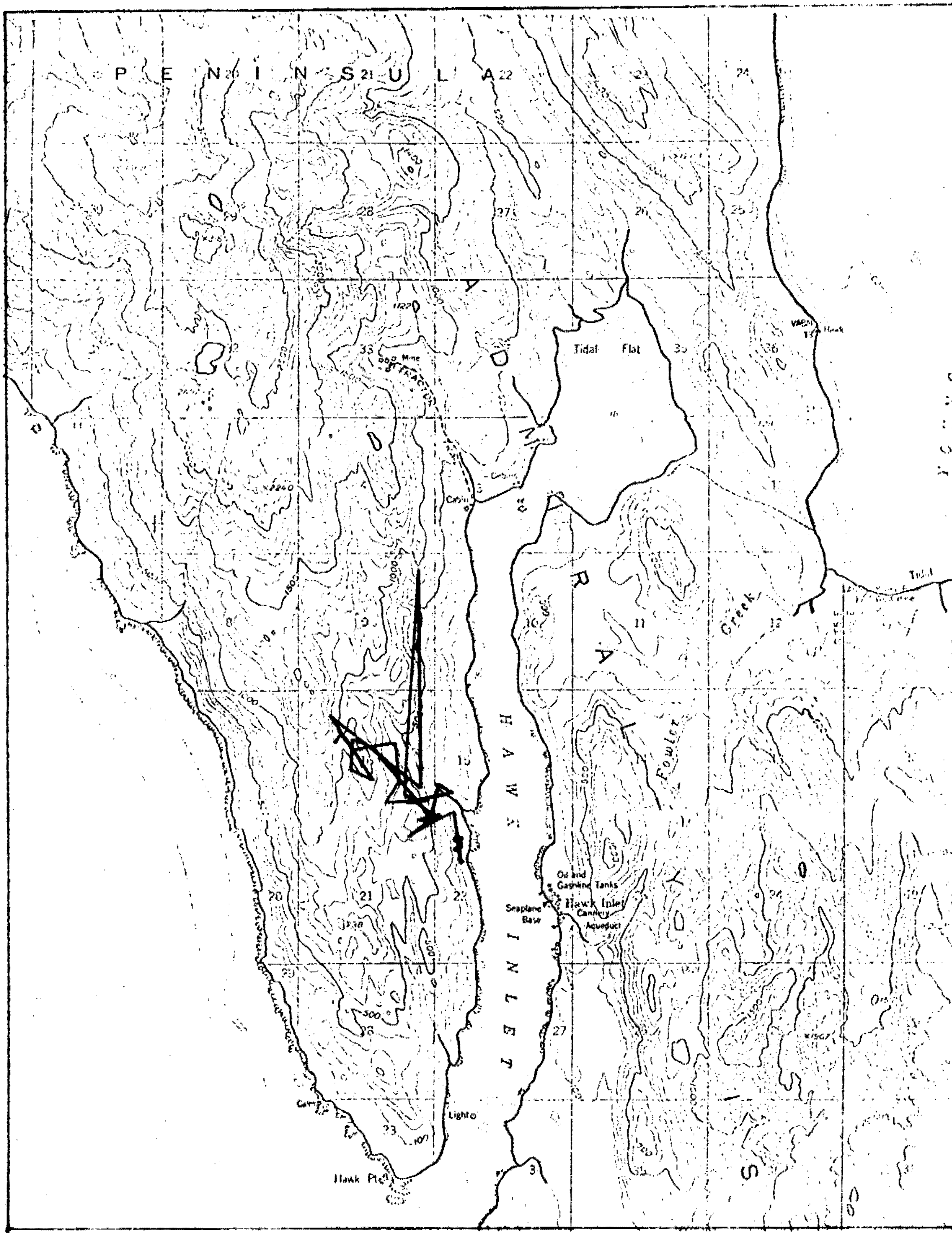
DEER 43 FEB 15 79-SEP 15 79

1 KILOMETER



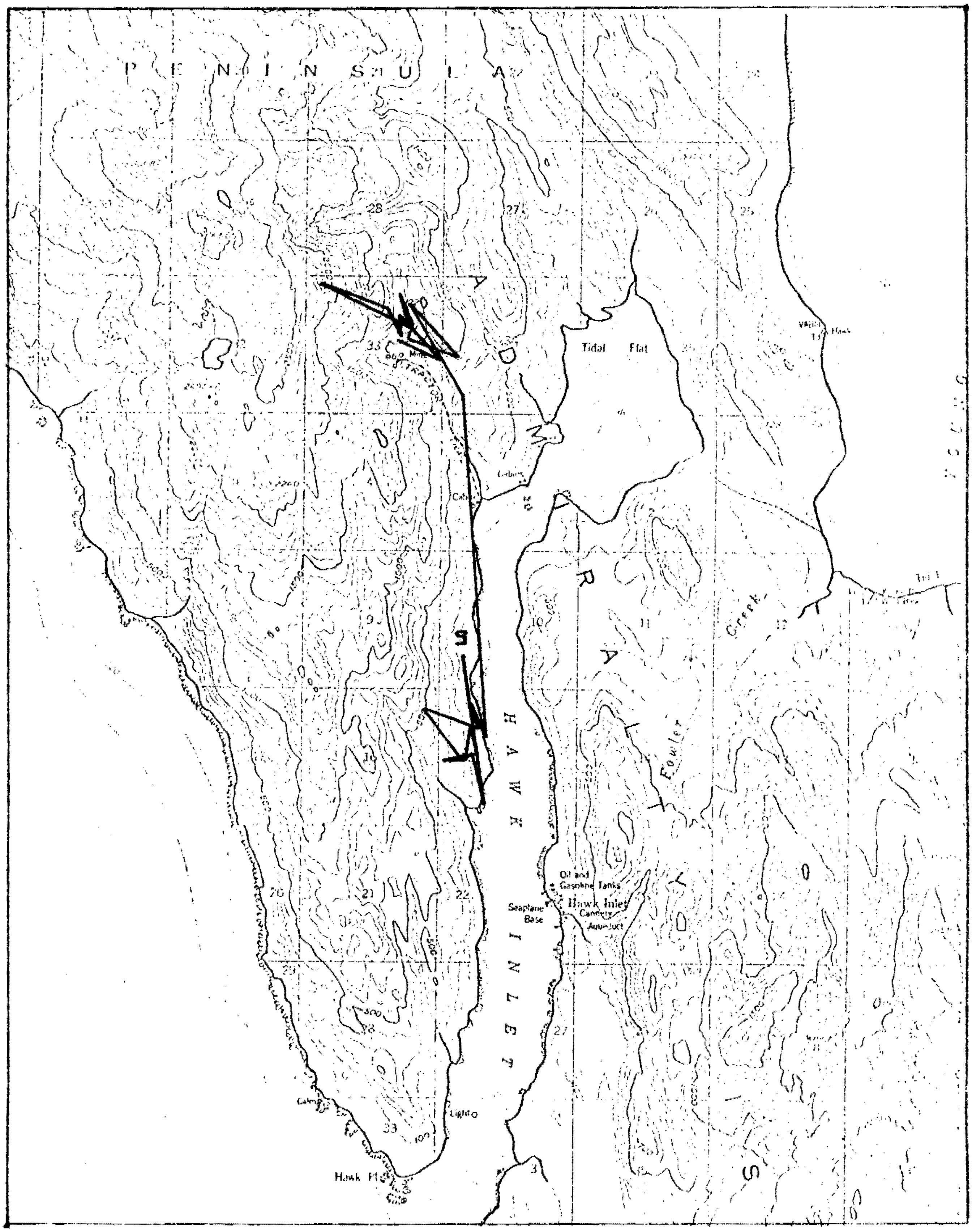
DEER 74 FEB 15 79-SEP 15 79

1 KILOMETER



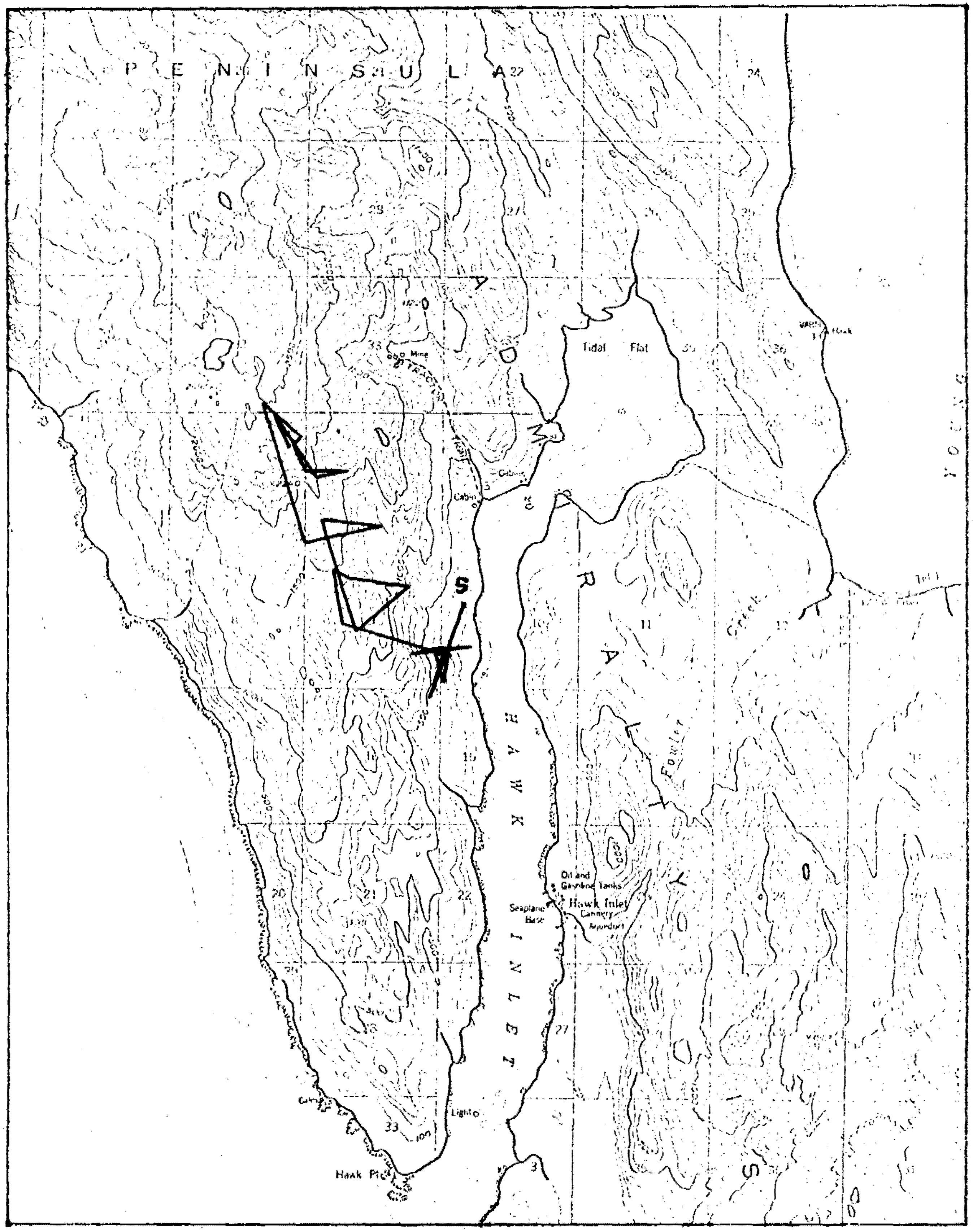
DEER 25 FEB 15 78-SEP 15 78

1 KILOMETER



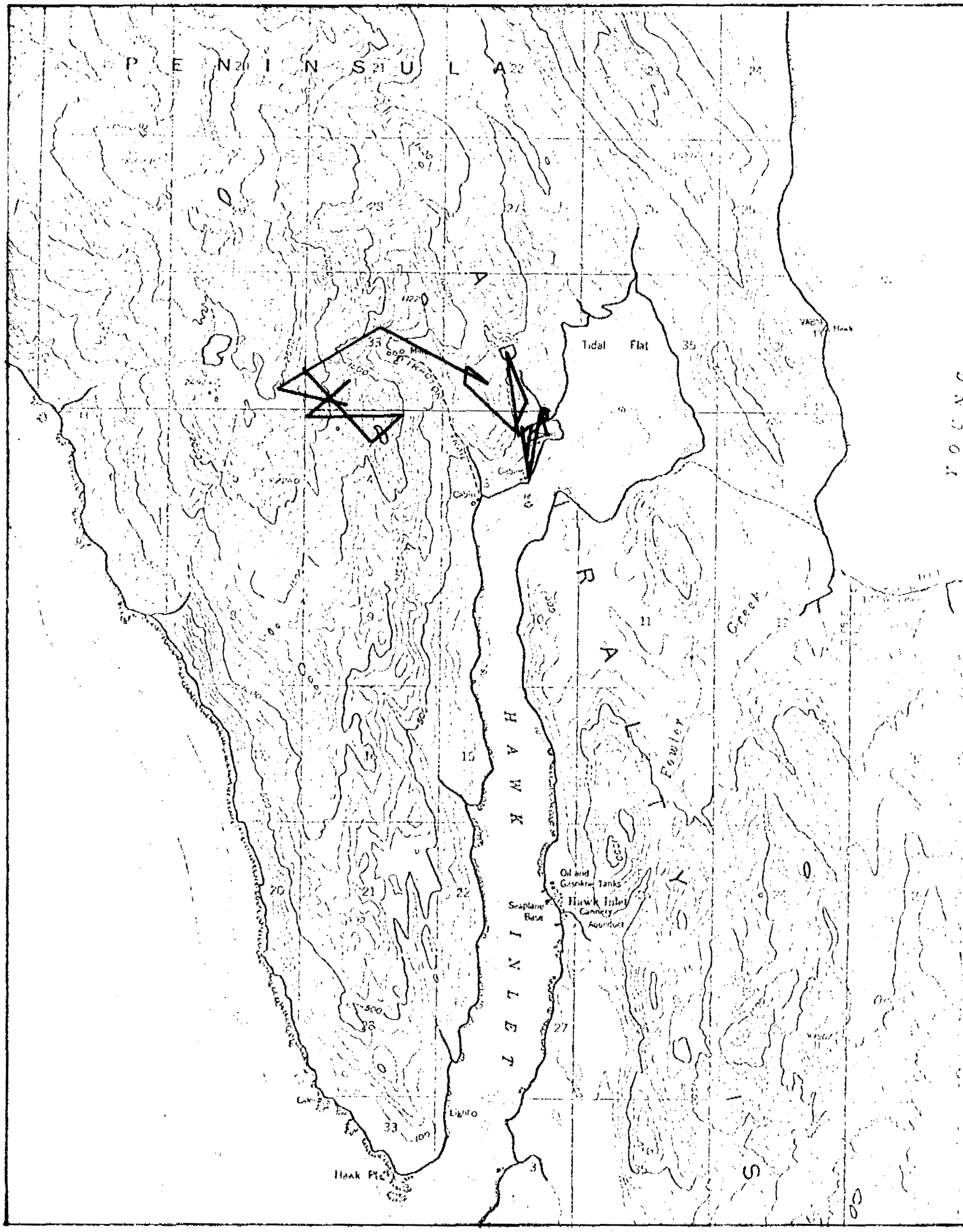
DEER 9 FEB 15 78-SEP 15 78

1 KILOMETER



DEER 17 FEB 15 79-SEP 15 79

1 KILOMETER



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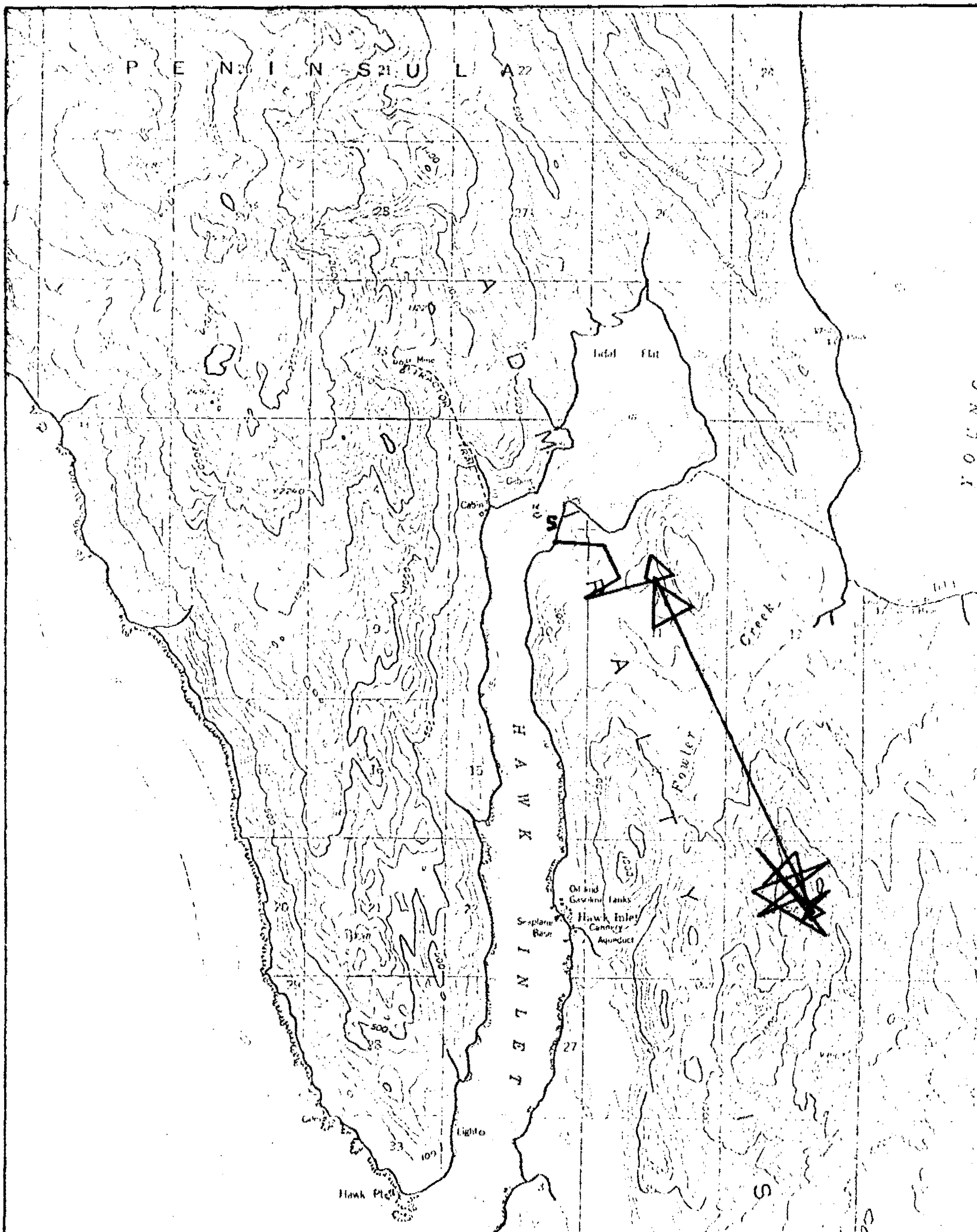

DEER 5 FEB 15 79-SEP 15 79

1 KILOMETER