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AN EVALUATION OF PRODUCTIVITY AND MORTALITY FACTORS INFLUENCING GOOSE POPULATIONS

- a status report of the 1984 waterfowl monitoring effort at Manokinak River, Alaska

by

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INTRODUCTION

During spring and summer of 1984, six stationary field camps and two mobile or "roving" camps were established on the Yukon Delta National Wildlife Refuge (YDNWR). The primary purpose of the camps was to monitor the arrival, nesting chronology, general habitat use, and production of Pacific black brant (Branta bernicla nigricans), cackling Canada geese (B. canadensis minima), emperor geese (Chen canagica), and Pacific white-fronted geese (Anser albifrons frontalis). This monitoring effort was motivated in part by the recognition that breeding populations of these species (particularly of cackling Canada geese and of black brant) are presently much reduced from historic populations of the recent past (Jarvis and Bartonek 1979; Garrett et al. 1983). Additionally, the 1984 field program was conceived as a continuation of the refuge's annual waterfowl monitoring program, established in its present form during the previous (1983) field season (Wege 1983).

The Manokinak river field camp was first established in 1983. The study area was believed to support relatively high densities of nesting geese (particularly cackling Canada geese), although it was recognized the few brant nested so far inland. During 1983, a study area was established, nesting surveys were conducted, and much of the area was mapped according to basic vegetation types. The results of the 1983 Manokinak River field camp were summarized by Janik et al. (1983).

This report summarizes the methods used and the data obtained during 1984 at the Manokinak River field camp. Certain significant changes were made in the 1984 program even though it was seen as a continuation of the 1983 effort. Foremost among these changes was the addition of several new objectives, and a new data recording and coding prescription (R. L. Garrett, pers. comm.). To meet the objectives of the 1984 program, we expanded the study area, chose several new plots, and separated all plots to avoid undue disturbance between them.

In general terms, the objectives of the 1984 field effort at Manokinak River were:

1) To document the chronology and pattern of snow melt, and the chronology of migration arrival and nest initiation by geese.

2) To measure the production of geese by determining nesting success, and by observing the sources and rates of nest failure.

3) To examine the relationship between nesting success among geese and the level of disturbance induced by the monitoring effort, primarily through a study plot design incorporating different rates of nest visitation, and by recording handling times at nests, in subplots, and in plots.

4) To document the morphology of eggs, the vegetative composition of nest sites, and the general pattern of vegetation communities within study plots.

STUDY AREA

The Manokinak River field camp was located on the south bank of the lower Manokinak River, approximately 10 km east (upriver) from Hazen Bay (Fig. 1). The camp was established in early April, and manned by two people from 26 April to 17 July 1984 (Fig. 2).

The campsite used in 1984 was about 140 m east (upriver) of the campsite used the previous year. This location was slightly more elevated (and thus safer from potential storm tides) than the 1983 site.

METHODS

Preparation

Sampling design, field methods, report format, table formats, and calculations for table values were prescribed by R. L. Garrett, YDNWR biologist. To help insure consistency in the application of these methods by the different field camps, a 5 day training session for most field personnel was held just prior to the field season (16-21 April) at Oregon State University's Hatfield Marine Science Center, Newport, Oregon.

Daily Weather

Wind speed, wind direction, barometric pressure, cloud cover, and accumulated precipitation were recorded twice daily at approximately 0800 and 2200 hours, from a location about 10 m north of camp. Temperature was not recorded because no thermometer was supplied to the camp.

Snow Transects

The rate of snow melt on the study area was estimated along four, 1200 m transects and at two observation towers (Fig. 2). The four transects were measured with a 60 m fiberglass tape and marked with flagged, metal stakes. Transects were located adjacent to or near the main goose nesting areas identified during the previous year (YDNWR file reports). This was done to allow a reasonable estimation of the rate of snow melt in prime nesting areas while not unduly disturbing geese there as they searched for nest sites or engaged in the earliest stages of nest initiation.

Transects were walked every other day from 27 April through 20 May. Photos were taken in the 4 cardinal directions at 400 m intervals along each transect. At 200 m intervals the percent of bare ground, and of ground covered by snow, meltwater, or ponds, was visually estimated (to the nearest 5 percent) for a rectangle extending 100 forward and 100 m back along the transect, and 50 m to either side. Snow transect photographs are archived at YDNWR.

Chronology of Migration

The arrival of geese, shorebirds, and other bird species was documented in two ways:

1) Stationary migration counts were conducted during (usually) 2 hr observation periods from a point about 3 m west of camp. Birds present in or flying through the SW compass quadrant were identified and counted, and the flock size and distance from observer noted.

2) Birds were also identified, counted, flock size noted, and lateral distance from the transect line estimated, while walking along snow transects.

Subsistence Activity

No hunters or eggers were seen at Manokinak, and no evidence was found of egging or waterfowl harvest there during 1984.

Sample Plots

Eleven study plots were established comprising a total area of 680 ha. Individual plots (Fig. 3-13) ranged in size from 33.9 ha to 89.3 ha, and except for primary plots 3 and 4, were of a size that allowed two people to thoroughly search them in approximately 7-9 h. Each plot was divided into subplots which, as nearly as possible, were defined by natural boundaries and which took one person 50-70 min to search.

Three plot strategies were employed:

Calibration plots. Three calibration plots were established on the study area. The plots were located in areas of apparently superior habitat where relatively high numbers of geese were observed just prior to and during nest initiation. Additionally, high nest densities had been found in two of the areas during surveys in 1983, while the third area was chosen in part on the recommendation of Bill Butler (personal communication), who had consistently noted high numbers of nesting geese there during aerial surveys in previous years.

Beginning at the first signs of nest initiation, calibration plots were thoroughly searched on three (one plot) or four (two plots) successive visits timed at three day intervals (except a late snow storm forced a four day interval between the first and second searches in two of the plots). Thereafter, located nests were re-visited every three days until hatch. A special effort was made to visit all successful nests on the day of hatch (which increased the visitation rate for many nests as hatch neared).

Validation plots. Four validation plots were established. They were selected as the best of six "cackler plots" prescribed for the study area. (Cackler plots are historical plots which have been surveyed for nest densities and hatching success for several years.)

Validation plots were thoroughly searched twice; once just following peak initiation of incubation, and once shortly before

hatch. An additional, post-hatch visit was made to each located nest.

Primary plots. Four primary plots were established. Two were the remaining Cackler plots, and two were selected near calibration plots to expand the area sampled and to serve somewhat as control areas that did not receive the intense sampling effort of calibration plots. In general, however, primary plots exhibited the least attractive nesting habitat of all areas sampled, and thus may not be strictly comparable to other strategies.

Primary plots were thoroughly searched only once, near peak incubation. A second visit to check nests was made following hatch.

Nest sampling procedures

Nests were located by completely walking through the entire area of a subplot, including all islands, peninsulas, and pond or slough edges. Individuals worked independently in separate subplots, moving systematically from one subplot to the next as each was completed. Subplot searches resulted in some inefficiency, such as back-tracking over areas previously searched, or exposing nests to sequential disturbance as different field personnel simultaneously worked in adjacent subplots.

Once discovered, nests were marked with a lathe or flag place 5 m distant, and with a numbered tongue depressor at the edge of the nest bowl. Nest location was mapped, and the condition of the nest and of any eggs present was noted. Eggs were numbered to account for subsequent loss, and the clutch covered before leaving. The physiographic location of the nest site (e.g. island, peninsula, etc.), its distance to the water, and the vegetative community ("ecological formation") in which it was located were also recorded.

Nest initiation

Nest initiation dates were determined either directly from observation of the egg laying sequence, or were estimated by back-dating from the observed hatch day. Incubation periods used for determining incubation dates by back-dating were 22 days for brant, 26 days for cacklers, 23 days for emperors, and 26 days for white-fronts (Wege and Garrett 1983). It was also assumed that one egg was laid each day, with 1 day skipped between eggs 4 and 5, and that incubation began the day the last egg was laid (Wege and Garrett 1983).

Hatch Date

Expected hatch dates were calculated by adding the supposed incubation period (Wege and Garrett 1983) to the date the last egg was laid (as determined from direct observation of the laying sequence). Actual hatch dates were defined as the day when pipped eggs or goslings were first observed in the nest.

Clutch Size

"Complete clutches." A clutch was considered complete only if the nest was located in a calibration plot, and if the number of eggs in the nest increased on at least two successive visits and then remained the same for at least two consecutive visits. Dump nests were included with complete clutches when they met these criteria (R. L. Garrett, pers. comm.).

"Incomplete clutches." Any clutch not meeting the criteria for complete clutches was defined as incomplete, implying that the true maximum clutch size could not be determined with as great a degree of confidence as could be granted complete clutches. By definition, this included all nests located in validation or primary plots, as well as any calibration plot clutches not considered complete.

Nest status

Successful nests. Nests were considered successful if at least one egg was known to hatch. Hatch was determined either by direct observation of a pipped egg or gosling in the nest, or indirectly by the presence of a detached egg shell membrane following hatch.

Depredated nests. Depredation was determined either by direct observation of egg shell fragments typical of those resulting from animal predation, or by indirect means such as the disappearance of a numbered egg, or the presence of a disrupted nest bowl with scattered down.

Abandoned nests. Nests were considered abandoned when the clutch was found cold and unattended on two or more successive visits following the end of laying. In most cases, however, abandoned clutches were probably quickly scavenged. Scavenged clutches were usually indistinguishable from depredated clutches, and without evidence of prior abandonment were consequently classified as depredated.

Status Undetermined. This category included nests which were not re-located, or for which insufficient evidence existed to determine either hatch or depredation.

Egg photos

An attempt was made to photograph each egg in every goose nest. A standard frame was used which supported the camera (at a constant elevation), the egg being photographed, and an attached scale. Thus relative differences in egg sizes could be compared. Egg photos are archived at YDNWR.

Habitat sampling

Nest sampling. Following hatch, nest sites were re-visited to determine certain features of their vegetative composition. At each nest, 4 rectangular frames 20 cm x 50 cm were placed at the edge of the nest bowl with the long axis pointing in each of the cardinal directions. The areal percent cover of each species was visually estimated and classed into one of 6 cover categories. The elevation of the nest above the nearest pond was measured, as was the difference between the pond high water mark and the existing water level. Finally, a photograph including the area of each frame was taken. Nest habitat photos are archived at YDNWR.

Habitat mapping. Also following hatch, habitat maps were prepared for each plot by delineating on field maps the apparent extent of the various vegetative communities found there. Habitat maps are archived at YDNWR.

Habitat sampling was complicated by several factors. First, hatch occurred just prior to or during the time approximately corresponding to the period of maximum rate of vegetative growth in the study area. Thus, the sampling period was also the period of maximum rate of change in areal cover of most species. Nests measured at the extremes of the sampling period would a priori be expected to show differences in their vegetative composition, regardless of their true similarity, while nests measured at about the same time within the sampling period would not.

Brood counts

The time consuming nature of the prescribed habitat sampling precluded extensive brood observations. However, broods were always noted wherever they were incidentally observed, and several surveys were made of the mudflats west of camp. Also, one survey of the lower reaches of the Manokinak River, and of two of the major sloughs draining into it, was accomplished on 13 July.

RESULTS

Weather

Late April and much of May was cold, with snow occurring on 8 of 13 days when precipitation was recorded (Fig. 14). Inclement weather prevailed during both nest initiation and hatch. Snow and freezing rain fell from 23-29 May, when most species were initiating nests, while 53% of all measurable rain received occurred from 19-24 June (days 170-175), coinciding with hatch of all goose species.

Snow Transects

Upon arrival at the field camp on 26 April, the study area was nearly 100% covered with snow. Snow cover decreased after about 26-30 April, but temperatures dropped over the next 7 days, increasing snow cover and freezing standing meltwater. Snow cover again decreased after 7 May, and after 15 May meltwater also disappeared rapidly with dry ground (and hence nest sites) becoming proportionately more available (Fig. 15-17). River break-up began on 31 May, and the river was nearly ice-free by 4 June.

Chronology of Migration

Small numbers of white-fronted, Cackling Canada, and emperor geese were present fairly early on the study area. White-fronted geese were observed the day we arrived on the study area (26 April; day 116), while Cackling Canada geese were seen the next day, and emperors were first observed the day following that. However, the number of geese, swans, and cranes on the study area actually declined from 28 April - 5 May (days 118-125), a period of steady, northerly winds, cold temperatures, and occasional snow flurries. Small numbers of geese reappeared the following week, but peak arrival of white-fronts, cacklers, and emperors occurred from 11-15 May (days 131-135) (Fig. 18-19). Peak arrival of brant began several days later than did peak arrival of other geese, occurring from 13-20 May (days 133-140).

Study Area Search

Density: We located 8 brant, 95 cackler, 64 emperor, and 11 white-front nests within sample plots (Tables 1-4). An additional 2 cackler nests and 3 emperor nests were found incidentally outside sample plots. The density of nests in all sample plots combined averaged 0.14 nests/ha for cacklers, 0.09 nests/ha for emperors, and 0.02 nests/ha for white-fronts. Average nest density was not determined for brant, which nested in one small aggregation in only one small part of calibration plot III. Peak densities (per plot) of cackler, emperor, and white-front nests were, respectively, 0.33/ha, 0.18/ha, and 0.06/ha.

Nest Location: The majority of brant, cackler, and emperor nests were located on islands (Table 5). The apparent preference for islands was particularly strong among brant (86% of 8 nests) and cacklers (97% of 91 nests). Among emperors, about half the nests were on islands, while a third were on peninsulas and 15% were found in "other" locations. Although only a small sample of white-front nests was available (n=10), most (60%) were in "other" locations, and only 30% were found on islands.

Nest initiation

The date of nest initiation was estimated or determined for 2 brant nests, 19 cackler nests, 24 emperor nests, and 6 white-front nests (Table 6). Nest initiation by brant was not analyzed because of the extremely small sample of nests for which initiation dates were obtained (n=2).

There appeared to be no difference between nest initiation dates of cacklers, emperors, and white-fronts. The median nest initiation date for all three species was 22 May (day 142), while the mean date of nest initiation ranged from day 142.3 (22 May) for white-fronts, to day 143.3 (23 May) for emperors and day 143.8 (approximately 24 May) for cacklers.

White-fronted geese exhibited the narrowest range of nest initiation dates (17-27 May), but this is probably best attributed to the small sample obtained. Cacklers initiated nests from 17-31 May, while emperors exhibited the greatest range of nest initiation dates (and also the largest sample), with nests started from 17 May to (in one case) 7 June.

Most nests for which initiation dates were determined were located on islands (Tables 7-10), and there were no apparent or discernable differences in the dates of nest initiation in different nest locations.

Determination of the date of nest initiation allowed an estimate of the number of active nests in a plot not located during the initial, complete searches of the plot (Tables 11-13). Although it appeared that some active nests were missed during complete searches, the data are limited to only those nests for which nest initiation dates could be determined by back-dating from hatch. Thus, the large number of nests which were unsuccessful in calibration plots I and II resulted in a relatively poor data set.

Clutch Size

For all plots combined, the complete clutch size for cacklers, emperors, and white-fronts was, respectively, 5.0 ± 0.36 (n=6), 5.6 ± 0.68 (n=7), and 4.00 (n=1) (Table 14). Complete clutch size was not determined for brant. There was no difference between complete and incomplete clutch sizes for the three species, and incomplete clutch size for cacklers, emperors, and white-fronts was, respectively, 5.0 ± 0.31 (n=43), 4.95 ± 0.39 (n=42), and 4.25 ± 0.62 (n=8). Incomplete clutch size for brant was 3.75 ± 1.03 (n=4) (Tables 15-18).

An insufficient sample was obtained to compare the frequency of complete clutch size by nest location (Tables 19-24).

Although it appeared that larger clutches were initiated earliest (Tables 25-27), the sample size was too small to prove reliable.

Hatch Date

The period of observed hatch extended 7 days among cacklers, emperors, and white-fronts. Hatch was observed on only 1 day among brant, when two nests were seen hatching on 20 June (day 171) (Tables 28-29).

Emperor and white-front nests were first to hatch on 17 June (day 168). The first observed cackler hatch occurred 2 days later on 19 June (day 170).

Nest Success

General. Nest success was greatest for white-fronts (90%), less for emperors (61%), and least for cacklers (37%) and brant (38%) (Table 30).

Nest location. The only successful brant and cackler nests were located on islands. However, only 1 brant nest (12%) and 3 cackler nests (3%) were recorded from locations other than islands, so sample sizes were minimal for evaluating success rates at peninsulas or "other" locations for those species. Among emperors, nest success was similar between islands and "other" locations, and only slightly less on peninsulas. White-fronts exhibited similar success on islands and peninsulas, and slightly less success at "other" locations, but sample sizes were too small for valid comparisons (Table 30).

Number of revisits. Calibration plot nests that hatched without egg loss were visited an average of 8 times before hatch (n=23), while nests that hatched with egg loss were visited an average of 7.9 times before hatch (n=8) (Tables 31-40). Calibration plot nests that failed to hatch because they were abandoned or depredated were visited an average of 3 times (n=17).

Clutch size. Hatching success of complete cackler, emperor, and white-front clutches did not vary with clutch size; however, sample sizes were small (Tables 41-43).

Nest Depredation

Most nests depredation was caused by arctic fox (Vulpes lagopus) and glaucous gulls (Larus hyperboreus). Mew gulls (L. canus) and jaegers (Stercorarius spp.) were locally important nest predators, but appeared to have less overall impact on goose nests than did foxes or glaucous gulls. In general, it appeared that foxes were most important as nest predators early in the nesting season, whereas gulls increased in importance as the nesting season progressed.

Brant and cacklers suffered the highest rates of nest predation (62% each), while 36% of emperor nests and only 9% of white-front nests were depredated (Table 44). Nest predation was least on islands for all species, although similar rates were found for emperors on islands (30%) and "other" locations (33%).

No eggs found in nests were described as addled; however, abandoned eggs were not uncommon (Table 45). Abandoned eggs were usually eggs which had been "dumped" in the nest after onset of incubation (and so did not develop sufficiently before hatch of the host clutch), or were eggs abandoned as a result of disturbance on the day of hatch.

Subsistence Activities

No evidence was found of waterfowl harvest at Manokinak during the 1984 season.

Brood Size

Broods were observed infrequently in study plots, and were usually noticed feeding on mudflats along the Manokinak River or one of the larger sloughs. Emperor broods were observed frequently, but cackler and white-front broods were seen only rarely. No brant broods were observed. Two class I cackler broods observed on 27 June had 5 goslings each, while three class II cackler broods observed on 13 July each had 4 goslings. Thirteen class I emperor broods observed on 25 June had an average size of 4.62, while 52 class II emperor broods observed on 13 July had an average size of 3.92 (Fig. 20).

Habitat Description

Plant associations (ecological formations) were subjectively determined and mapped in all study plots. Seventeen different ecological formations were categorized on the basis of relative frequency and percent cover of plant species. The most common formations in study plots were sedge-grass meadow and grass-sedge meadow. Habitat maps of study plots are archived at YDNWR.

DISCUSSION

Nest Initiation

Peak nest initiation among cacklers, emperors, and white-fronts occurred approximately 10 days after their peak arrival. Cold weather and snow from about 24-27 May accompanied nest initiation, and may have interrupted nesting for at least cacklers (which exhibited two peaks of initiation (21-23 May and 27-29 May)).

Human Disturbance

The effect of human disturbance on geese at Manokinak was difficult to evaluate. Since neither egging nor spring hunting occurred there, any human disturbance to nesting geese can be attributed solely to the monitoring effort. Disturbance was greatest in calibration plots, which were entered every 3 days beginning shortly after the first indications of nest initiation. However, snow

transects, albeit deliberately located to avoid direct passage through any plots, contributed to some disruption of geese in the lower portion of the study area (particularly calibration plots I and II, validation plot A, and primary plot 1) even prior to nest initiation. Whether, or to what extent, geese are capable of habitualizing to such routine or periodic procedures is unknown.

The study plot design, employing three plot strategies (calibration, validation, and primary) having different visitation rates, was thought to provide comparisons of nest success and depredation in a way that would allow evaluation of the effect of human disturbance. Clearly, however, the type of disturbance and its timing was quite different between strategies. For example, complete searches (which were the most disrupting events of the monitoring program) were made in calibration plots during and shortly after nest initiation. This was a period when geese were probably least committed to individual nest sites, and when environmental stresses were often greatest. Further, it appeared that arctic foxes were most active as nest predators early in the nesting cycle at about the same time calibration plot searches were being conducted.

In contrast, complete searches were conducted only twice in validation plots, and just once in primary plots, but they were timed during late incubation or just prior to hatch. During this period, geese were probably strongly tied to their nests, and arctic foxes appeared much less active as predators (although gulls and jaegers may have become more active).

Habitat differences further complicated comparison between strategies. Calibration plots were generally selected on the basis of their presumably superior habitat, and almost certainly offered better habitat to nesting geese than did the primary plots surveyed. However, validation (cackler) plots displayed the highest average nest densities of any strategy.

Thus, the quality of habitat varied between strategies. The timing of complete searches (the major disturbance to study plots) varied between strategies, and (probably) the active predator complex was different between the time of complete searches in calibration plots and the time of complete searches in validation and primary plots.

Nest Distribution

On average, cackling Canada geese were the most numerous of the four species of geese nesting at Manokinak, followed (respectively) by emperor geese, Pacific white-fronted geese, and black brant. Cacklers also exhibited the peak nest density (per plot) of 33 nests/km, followed by emperors (18 nests/km), brant (9 nests/km), and white-fronts (6 nests/km).

Cacklers seemed slightly more aggregated in their distribution than did emperors, and to a weak extent it appeared that a somewhat negative relationship existed between the density of cackler nests and emperor nests in a given plot. Most likely, cacklers clustered in areas where an abundance of their prefered islands occurred, while

emperors were (possibly) less specifically tied to islands or to one particular type of habitat. White-fronts were widely scattered in a variety of habitats, but occurred in densities too low to detect patterns in their distribution. Brant, which did not nest in the study area surveyed during 1983, were found nesting in a small aggregation in calibration plot III, part of the expanded study area surveyed this year.

RECOMMENDATIONS

1. See recommendations contained in Dzinbal et al. (1984).

2. Discontinue calibration plots I and II, in which relatively few goose nests were located, or conduct them as validation plots. Minimize disturbance by employing only one calibration plot.

3. Re-locate tower 1 to a position adjacent to the large mudflat west of camp (i.e. the mudflat formed by the confluence of the Manokinak River and the slough running west and south of camp). This location would be reasonably close to camp, and would afford the best vantage point for migration counts and brood observations.

4. Concentrate greater effort on gathering meaningful brood data. At Manokinak, brood surveys along the river and along the large slough west and south of camp would be most productive.

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Table 1. Production data for Pacific black brant at Manokinak River, 1984.

	Plot										
	Calibration			Validation				Primary			
Category	I	II	III	I	II	III	IV	I	II	III	IV
Number of nests located	-	-	8	-	-	-	-	-	-	-	-
Number of nests which status was determined	-	-	8	-	-	-	-	-	-	-	-
Number of nests/km^2	-	-	9	-	-	-	-	-	-	-	-
Number of nests/mi^2	-	-	24	-	-	-	-	-	-	-	-
Average size of "complete" clutch	-	-	-	-	-	-	-	-	-	-	-
Average number of eggs per nest at the end of incubation[b]	-	-	1.8(5)[a]	-	-	-	-	-	-	-	-
Average egg loss from nests that lost eggs	-	-	2.5(4)	-	-	-	-	-	-	-	-
Average size of clutch that hatched[c]	-	-	3.0(3)	-	-	-	-	-	-	-	-
Average number of goslings hatched per nest[d]	-	-	1.1	-	-	-	-	-	-	-	-
Percent of successful nests	-	-	38	-	-	-	-	-	-	-	-

[a] Figures in parentheses are sample sizes.

[b] This = $B-C/N_b$, where B = total number of eggs observed in all nests, C = minimum number of eggs known to have been lost from all nests, and N_b = total number of nests in which eggs were observed. Nests depredated before the first nest visit are not included in this average; nests depredated during early, mid, or late incubation, are included in this average. This equation prescribed by R. Garrett (pers. comm.).

[c] This = $B-C/N_g$, where B and C are defined above, and N_g = total number of successfull nests. Eggs of undetermined fate (unknown if hatched or predated) are counted as hatched. This equation prescribed by R. Garrett (pers. comm.).

[d] This = $B-D/N_j$, where B and C are defined above, and N_j = total number of nests (includes nests which were observed with eggs (N_b) and nests which were never observed with eggs). Eggs of undetermined fate are assumed to have hatched. This equation presecribed by R. Garrett (pers. comm.).

Table 2. Production data for cackling Canada geese at Manokinak River, 1984.

	Plot										
	Calibration			Validation				Primary			
Catgory	I	II	III	I	II	III	IV	I	II	III	IV
Number of nests located	4	2	13	6	17	21	15	7	10	-	-
Number of nests which status was determined	4	2	13	6	17	21	15	7	10	-	-
Number of nests/km^2	5	3	15	11	31	33	22	9	19	-	-
Number of nests/mi^2	13	7	38	27	81	84	58	24	50	-	-
Average size of "complete" clutch	6.0(1)[a]	-	4.8(5) ±0.8[b]	-	-	-	-	-	-	-	-
Average number of eggs/nest at the end of incubation[c]	0(4)	0(4)	4.1(13)	0(2)	5.6(11)	3.8(10)	4.8(9)	-	1.0(1)	-	-
Average egg loss from nests that lost eggs	3.2(4)	3.5(2)	1.4(4)	-	2.0(1)	2.0(6)	3.5(2)	-	1.0(1)	-	-
Average size of clutch that hatched[d]	-	-	4.8(11)	-	5.6(11)	6.3(6)	6.1(7)	-	-	-	-
Average number of goslings hatched per nest[e]	-	-	4.1	-	3.6	1.8	2.9	-	0.1	-	-
Percent of successful nests	0	0	85	0	65	29	47	0	0	-	-

[a] Figures in parentheses are sample sizes.

[b] Standard deviation.

[c] This = $B-C/N_b$, where B = total number of eggs observed in all nests, C = known to have been lost from all nests, and N_b = total number of nests in which eggs were observed. Nests depredated before the first nest visit are not included in this average; nests depredated during early, mid, or late incubation, are included in this average. This equation prescribed by R. Garrett (pers. comm.).

[d] This = $B-C/N_g$, where B and C are defined above, and N_g = total number of successfull nests. Eggs of undetermined fate (unknown if hatched or predated) are counted as hatched. This equation prescribed by R. Garrett (pers. comm.).

[e] This = $B-D/N_j$, where B and C are defined above, and N_j = total number of nests (includes nests which were observed with eggs (N_b) and nests which were never observed with eggs). Eggs of undetermined fate are assumed to have hatched. This equation presecribed by R. Garrett (pers. comm.).

Table 3. Production data for emperor geese at Manokinak River, 1984.

	Plot										
	Calibration			Validation				Primary			
Catgory	I	II	III	I	II	III	IV	I	II	III	IV
Number of nests located	6	15	10	10	3	1	9	5	4	-	1
Number of nests which status was determined	6	14	10	10	3	1	9	5	4	-	1
Number of nests/km^2	8	18	11	18	5	2	13	7	8	-	3
Number of nests/mi^2	20	48	29	45	14	4	35	17	20	-	8
Average size of "complete" clutch	6.0(1)[a]	7.6(5) ±3.0	5.0(1)	-	-	-	-	-	-	-	-
Average number o eggs/nest at the end of incubation[c]	3.2(5)	3.9(11)	6.2(6)	3.8(6)	0(1)	3.0(1)	6.2(8)	4.2(4)	3.5(2)	-	-
Average egg loss from nests that lost eggs	3.0(2)	1.5(6)	1.0(1)	-	14(1)	1.0(1)	2.0(2)	1.0(1)	-	-	-
Average size of clutch that hatched[d]	4.0(4)	5.9(7)	6.2(6)	3.8(6)	-	3.0(1)	6.2(8)	4.2(4)	3.5(2)	-	-
Average number of goslings hatched per nest[e]	2.7	2.9	3.7	2.3	-	3.0	5.6	3.4	1.8	-	3.1
Percent of successful nests	67	50	60	60	0	100	89	80	50	-	0

[a] Figures in parentheses are sample sizes.

[b] Standard deviation.

[c] This = $B-C/N_b$, where B = total number of eggs observed in all nests, C = minimum number of eggs known to have been lost from all nests, and N_b = total number of nests in which eggs were observed. Nests depredated before the first nest visit are not included in this average; nests depredated during early, mid, or late incubation, are included in this average. This equation prescribed by R. Garrett (pers. comm.).

[d] This = $B-C/N_g$, where B and C are defined above, and N_g = total number of successfull nests. Eggs of undetermined fate (unknown if hatched or predated) are counted as hatched. This equation prescribed by R. Garrett (pers. comm.).

[e] This = $B-D/N_J$, where B and C are defined above, and N_J = total number of nests (includes nests which were observed with eggs (N_b) and nests which were never observed with eggs). Eggs of undetermined fate are assumed to have hatched. This equation presecribed by R. Garrett (pers. comm.).

Table 4. Production data for Pacific white-fronted geese at Manokinak River, 1984.

	Plot										
	Calibration			Validation				Primary			
Catgory	I	II	III	I	II	III	IV	I	II	III	IV
Number of nests located	2	1	2	-	-	-	4	1	1	-	-
Number of nests which status was determined	2	1	2	-	-	-	4	1	1	-	-
Number of nests/km^2	3	1	2	-	-	-	6	1	2	-	-
Number of nests/mi^2	7	3	6	-	-	-	23	3	5	-	-
Average size of "complete" clutch	4.0(1)[a]	-	-	-	-	-	-	-	-	-	-
Average number of eggs/nest at the end of incubation[b]	5.5(2)	5.0(1)	3.5(2)	-	-	-	3.5(4)	3.0(1)	-	-	-
Average egg loss from nests that lost eggs	-	-	1.0(1)	-	-	-	-	-	-	-	-
Average size of clutch that hatched[c]	5.5(2)	5.0(1)	3.5(1)	-	-	-	3.5(4)	5.0(1)	-	-	-
Average number of goslings hatched per nest[d]	5.5	5.0	3.5	-	-	-	3.5	5.0	-	-	-
Percent of successful nests	100	100	100	-	-	-	100	100	0	-	-

[a] Figures in parentheses are sample sizes.

[b] This = $B-C/N_b$, where B = total number of eggs observed in all nests, C = minimum number of eggs known to have been lost from all nests, and N_b = total number of nests in which eggs were observed. Nests depredated before the first nest visit are not included in this average; nests depredated during early, mid, or late incubation, are included in this average. This equation prescribed by R. Garrett (pers. comm.).

[c] This = $B-C/N_g$, where B and C are defined above, and N_g = total number of successfull nests. Eggs of undetermined fate (unknown if hatched or predated) are counted as hatched. This equation prescribed by R. Garrett (pers. comm.).

[d] This = $B-D/N_j$, where B and C are defined above, and N_j = total number of nests (includes nests which were observed with eggs (N_b) and nests which were never observed with eggs). Eggs of undetermined fate are assumed to have hatched. This equation presecribed by R. Garrett (pers. comm.).

Table 5. Nest site locations for Pacific black brant, cackling Canada geese, emperor geese, and Pacific white-fronted geese at Manokinak River, 1984.

Species / Plot	Nest Location: Island	Peninsula	Other[a]	Total
BRANT:				
Calibration III	7 (88)[b]	1 (14)	0	8
Subtotal	7 (88)	1 (14)	0	8
CACKLERS:				
Calibration I	3 (100)	0	0	3
Calibration II	2 (100)	0	0	2
Calibration III	13 (100)	0	0	13
Validation I	6 (100)	0	0	6
Validation II	17 (100)	0	0	17
Validation III	20 (95)	1 (5)	0	21
Validation IV	14 (93)	1 (7)	0	15
Primary I	7 (100)	0	0	7
Primary II	9 (90)	1 (10)	0	10
Subtotal	91 (97)	3 (3)	0	94
EMPERORS:				
Calibration I	2 (40)	1 (20)	2 (40)	5
Calibration II	6 (43)	4 (29)	4 (29)	14
Calibration III	9 (91)	1 (9)	0	11
Validation I	4 (44)	4 (44)	1 (11)	9
Validation II	0	3 (100)	0	3
Validation III	0	0	1 (100)	1
Validation IV	6 (67)	3 (33)	0	9
Primary I	3 (60)	1 (20)	1 (20)	5
Primary II	3 (75)	1 (25)	0	4
Primary IV	0	1 (100)	0	1
Subtotal	34 (55)	19 (31)	9 (15)	62
WHITE-FRONTS:				
Calibration I	1 (50)	0	1 (50)	2
Calibration II	0	0	1 100	1
Calibration III	2 (100)	0	0	2
Validation IV	0	1 (33)	2 (67)	3
Primary I	0	0	1 (100)	1
Primary II	0	0	1 (100)	1
Subtotal	3 (30)	1 (10)	6 (60)	10
Total	134 (77)	24 (14)	15 (9)	173

[a] Includes: pond-shoreline; slough-shoreline; pingo top; grass flat; displaced island; and mudflat.

[b] Number in parentheses are percentages.

Table 6. Nest initiation dates for Pacific black brant, cackling Canada geese, and Pacific white-fronted geese at Manokinak River, 1984.

Species	Julian day																												
Plot	133	134	135	136	137	138	139	140	141	142	143	144	145	146	147	148	149	150	151	152	153	154	155	156	157	158	159	160	Total
BRANT:																													
Calibration III	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	2
Subtotal	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	2
CACKLERS:																													
Calibration I	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
Calibration III	0	0	0	0	0	0	1	0	1	2	1	0	0	0	2	1	2	0	1	0	0	0	0	0	0	0	0	0	11
Validation b	0	0	0	0	1	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
Validation d	0	0	0	0	0	0	0	0	2	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
Subtotal	0	0	0	0	1	0	1	0	5	2	2	0	0	0	2	2	2	0	1	0	0	0	0	0	0	0	0	0	18
EMPERORS:																													
Calibration I	0	0	0	0	0	0	0	0	1	1	0	0	1	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	5
Calibration II	0	0	0	0	0	1	2	0	1	0	0	0	1	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	7
Calibration III	0	0	0	0	1	0	0	0	0	2	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	5
Validation a	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Validation d	0	0	0	0	1	0	1	0	0	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5
Primary I	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	2
Subtotal	0	0	0	0	2	1	3	1	2	5	1	0	3	0	2	1	1	1	0	0	0	0	0	0	0	2	0	0	25
WHITE-FRONTS:																													
Calibration I	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	2
Calibration II	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Calibration III	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
Validation d	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Subtotal	0	0	0	0	1	0	0	1	1	0	1	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	6
TOTAL	0	0	0	0	4	1	4	2	8	8	4	0	3	1	6	3	3	1	1	0	0	0	0	0	0	2	0	0	51

Table 7. Nest initiation dates by nest location for Pacific black brant, cackling Canada geese, emperor geese, and Pacific white-fronted geese in calibration plot I at Manokinak River, 1984.[a]

Species	Julian day																													
Plot	132	133	134	135	136	137	138	139	140	141	142	143	144	145	146	147	148	149	150	151	152	153	154	155	156	157	158	159	160	Total
CACKLERS:																														
Island	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	2
Peninsula	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Subtotal	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	2
EMPERORS:																														
Island	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	2
Peninsula	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1
Other	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
Subtotal	0	0	0	0	0	0	0	0	0	1	1	0	0	1	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	5
WHITE-FRONTS:																														
Island	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Peninsula	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Subtotal	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	2
TOTAL	0	0	0	0	0	1	0	0	0	1	2	0	0	1	0	1	2	0	1	0	0	0	0	0	0	0	0	0	0	9

[a] No brant nests were located in calibration plot I.

Table 8. Neat initiation dates by nest location for Pacific black brant[a], cackling Canada geese[b], emperor geese, and Pacific white-fronted geese in calibration plot II at Manokinak River, 1984.

Species	Julian day																													
Plot	132	133	134	135	136	137	138	139	140	141	142	143	144	145	146	147	148	149	150	151	152	153	154	155	156	157	158	159	160	Total
EMPERORS:																														
Island	0	0	0	0	0	0	1	2	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4
Peninsula	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1
Other	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	2
Subtotal	0	0	0	0	0	0	1	2	0	1	0	0	0	1	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	7
WHITE-FRONTS:																														
Island	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Peninsula	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Subtotal	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
TOTAL	0	0	0	0	0	0	1	2	1	1	0	0	0	1	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	8

[a] No brant nests were located in calibration plot II.

[b] No initiation dates were determined for cackling Canada geese in calibration plot II.

Table 9. Nest initiation dates by nest location for Pacific black brant[a], cackling Canada geese, emperor geese, and Pacific white-fronted geese in calibration plot III at Manokinak River, 1984.

Species	Julian day																														
Plot	132	133	134	135	136	137	138	139	140	141	142	143	144	145	146	147	148	149	150	151	152	153	154	155	156	157	158	159	160	Total
BRANTS:																														
Island	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	2
Peninsula	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Subtotal	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	2
CACKLER:																														
Island	0	0	0	0	0	0	0	1	0	1	2	1	0	0	0	2	1	2	0	1	0	0	0	0	0	0	0	0	0	11
Peninsula	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Subtotal	0	0	0	0	0	0	0	1	0	1	2	1	0	0	0	2	1	2	0	1	0	0	0	0	0	0	0	0	0	11
EMPEROR:																														
Island	0	0	0	0	0	1	0	0	0	0	2	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	5
Peninsula	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Subtotal	0	0	0	0	0	1	0	0	0	0	2	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	5
WHITE-FRONT:																														
Island	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
Peninsula	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Subtotal	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
TOTAL	0	0	0	0	0	1	0	1	0	2	6	2	0	1	0	5	1	2	0	1	0	0	0	0	0	0	0	0	0	18

Table 10. Nest initiation dates by nest location for Pacific black brant[a], cackling Canada geese, emperor geese, and Pacific white-fronted geese in validation plots (a-d)[b] at Manokinak River, 1984.

Species	Julian day																													
Plot	132	133	134	135	136	137	138	139	140	141	142	143	144	145	146	147	148	149	150	151	152	153	154	155	156	157	158	159	160	Total
CACKLERS:																														
Island	0	0	0	0	0	1	0	0	0	4	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6
Peninsula	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Subtotal	0	0	0	0	0	1	0	0	0	4	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6
EMPERORS:																														
Island	0	0	0	0	0	1	0	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5
Peninsula	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Other	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Subtotal	0	0	0	0	0	1	0	1	1	0	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6
WHITE-FRONTS:																														
Island	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Peninsula	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Other	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Subtotal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
TOTAL	0	0	0	0	0	2	0	1	1	4	2	2	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	13

[a] No brant nests were located in validation plots.

[b] All validation plots combined.

Table 11. The number of goose nests located[a] during successive searches of calibration plot I at Manokinak River, 1984.

Species	Successive Search		Number of nests initiated since last search		
	Number	Julian	Located	Not Located	Total
Cackling Canada geese	1	144	1	-	1
	2	148	1	-	1
	3	151	-	-	-
	4	154	-	-	-
	Total		2	-	2
Emperor geese	1	144	2	-	2
	2	148	1	2	3
	3	151	-	-	-
	4	154	-	-	-
	Total		3	2	5
Pacific white-fronted geese	1	144	-	1	1
	2	148	1	-	1
	3	151	-	-	-
	4	154	-	-	-
	Total		1	1	2

[a] Includes only nests for which initiation date was determined.

Table 12. The number of goose nests located[a] during successive searches of calibration plot II at Manokinak River, 1984.

Species	Successive Search		Number of nests initiated since last search		
	Number	Julian	Located	Not Located	Total
Cackling Canada geese	1	145	-	-	-
	2	149	-	-	-
	3	152	-	-	-
	4	155	-	-	-
	Total		-	-	-
Emperor geese	1	145	5	-	5
	2	149	1	1	2
	3	152	-	-	-
	4	155	-	-	-
	Total		6	1	7
Pacific white-fronted geese	1	145	-	1	1
	2	149	-	-	-
	3	152	-	-	-
	4	155	-	-	-
	Total		-	1	1

[a] Includes only nests for which initiation date was determined.

Table 13. The number of goose nests located[a] during successive searches of calibration plot III at Manokinak River, 1984.

Species	Successive Search		Number of nests initiated since last search		
	Number	Julian	Located	Not Located	Total
Pacific black brant	1	150	2	-	2
	2	153	-	-	-
	3	156	-	-	-
	Total		2	-	2
Cackling Canada geese	1	150	11	-	11
	2	153	-	-	-
	3	156	-	-	-
	Total		11	-	11
Emperor geese	1	150	5	-	5
	2	153	-	-	-
	3	156	-	-	-
Total			5	-	5
Pacific white-fronted geese	1	150	2	-	2
	2	153	-	-	-
	3	156	-	-	-
	Total		2	-	2

[a] Includes only nests for which initiation date was determined.

Table 14. Frequency of clutch size from "complete" clutches for cackling Canada geese, emperor geese, and Pacific white-fronted geese in calibration plots at Manokinak River, 1984.

	Clutch									
Plot	1	2	3	4	5	6	7	8	9	Total
CACKLERS:										
Calibration I	0	0	0	0	0	1	0	0	0	1
Calibration II	-	-	-	-	-	-	-	-	-	-
Calibration III	0	0	0	2	2	1	0	0	0	5
Subtotal	0	0	0	2	2	2	0	0	0	6
EMPERORS:										
Calibration I	0	0	0	0	0	1	0	0	0	1
Calibration II	0	0	0	1	1	0	0	1	0	3
Calibration III	0	0	0	0	1	0	0	0	0	1
Subtotal	0	0	0	1	2	1	0	1	0	5
WHITE-FRONTS:										
Calibration I	0	0	0	1	0	0	0	0	0	1
Calibration II	-	-	-	-	-	-	-	-	-	-
Calibration III	-	-	-	-	-	-	-	-	-	-
Subtotal	0	0	0	1	0	0	0	0	0	1
TOTAL	0	0	0	4	4	3	0	1	0	12

[a] Does not include dump nests (i.e. nests with clutches > 9 eggs).

Table 15. Frequency of clutch size from "incomplete" clutches for Pacific black brant at Manokinak River, 1984.

	Clutch										
Plot	U	1	2	3	4	5	6	7	8	9	Total
Calibration I	-	-	-	-	-	-	-	-	-	-	-
Calibration II	-	-	-	-	-	-	-	-	-	-	-
Calibration III	0	1	0	0	3	0	1	0	0	0	5
Subtotal	0	1	0	0	3	0	1	0	0	0	5
Validation a	-	-	-	-	-	-	-	-	-	-	-
Validation b	-	-	-	-	-	-	-	-	-	-	-
Validation c	-	-	-	-	-	-	-	-	-	-	-
Validation d	-	-	-	-	-	-	-	-	-	-	-
Subtotal	-	-	-	-	-	-	-	-	-	-	-
Primary 1	-	-	-	-	-	-	-	-	-	-	-
Primary 2	-	-	-	-	-	-	-	-	-	-	-
Primary 3	-	-	-	-	-	-	-	-	-	-	-
Primary 4	-	-	-	-	-	-	-	-	-	-	-
Subtotal	-	-	-	-	-	-	-	-	-	-	-
Total	0	1	0	0	3	0	1	0	0	0	5

[a] "Incomplete" indicates that the number of eggs present during nest revists did not meet the criteria for defining a complete clutch.

Table 16. Frequency of clutch size from "incomplete" clutches for cackling Canada geese at Manokinak River, 1984.

	Clutch										
Plot	U	1	2	3	4	5	6	7	8	9	Total
Calibration I	0	2	0	0	0	1	0	0	0	0	3
Calibration II	0	0	0	1	1	0	0	0	0	0	2
Calibration III	0	1	1	0	1	2	2	1	0	0	8
Subtotal	0	3	1	1	2	3	2	1	0	0	13
Validation a	0	0	0	0	0	0	0	0	0	0	0
Validation b	0	0	0	1	1	2	3	3	1	0	11
Validation c	0	1	1	1	1	0	2	4	0	0	10
Validation d	0	1	0	0	0	3	2	2	1	0	9
Subtotal	0	2	1	2	2	5	7	9	2	0	30
Primary 1	0	0	0	0	0	0	0	0	0	0	
Primary 2	0	0	1	0	0	0	0	0	0	0	1
Primary 3	0	0	0	0	0	0	0	0	0	0	0
Primary 4	0	0	0	0	0	0	0	0	0	0	0
Subtotal	0	0	1	0	0	0	0	0	0	0	1
Total	0	5	3	3	4	8	9	10	2	0	44

[a] "Incomplete" indicates that the number of eggs present during nest revists did not meet the criteria for defining a complete clutch.

Table 17. Frequency of clutch size from "incomplete" clutches for emperor geese at Manokinak River, 1984.

	Clutch										
Plot	U	1	2	3	4	5	6	7	8	9	Total
Calibration I	0	0	1	1	0	1	1	0	0	0	4
Calibration II	0	2	2	1	0	1	0	0	0	0	6
Calibration III	0	0	0	0	0	2	0	2	0	1	5
Subtotal	0	2	3	2	0	4	1	2	0	1	15
Validation a	0	0	0	3	1	2	0	0	0	0	6
Validation b	0	0	0	0	0	0	0	0	0	0	0
Validation c	0	0	0	0	1	0	0	0	0	0	1
Validation d	0	0	0	0	1	2	2	0	1	1	7
Subtotal	0	0	0	3	3	4	2	0	1	1	14
Primary 1	0	0	0	1	1	1	1	0	0	0	4
Primary 2	0	0	0	1	1	0	0	0	0	0	2
Primary 3	0	0	0	0	0	0	0	0	0	0	0
Primary 4	0	0	0	0	0	0	0	0	0	0	0
Subtotal	0	0	0	2	2	1	1	0	0	0	6
Total	0	2	3	7	5	9	4	2	1	2	35

[a] "Incomplete" indicates that the number of eggs present during nest revists did not meet the criteria for defining a complete clutch.

Table 18. Frequency of clutch size from "incomplete" clutches for Pacific white-fronted geese at Manokinak River, 1984.

	Clutch										
Plot	U	1	2	3	4	5	6	7	8	9	Total
Calibration I	0	0	0	0	0	0	0	1	0	0	1
Calibration II	0	0	0	0	0	1	0	0	0	0	1
Calibration III	0	0	0	1	0	1	0	0	0	0	2
Subtotal	0	0	0	1	0	2	0	1	0	0	4
Validation a	0	0	0	0	0	0	0	0	0	0	0
Validation b	0	0	0	0	0	0	0	0	0	0	0
Validation c	0	0	0	0	0	0	0	0	0	0	0
Validation d	0	0	1	2	0	0	1	0	0	0	4
Subtotal	0	0	1	2	0	0	1	0	0	0	4
Primary 1	0	0	0	1	0	0	0	0	0	0	1
Primary 2	0	0	0	0	0	0	0	0	0	0	0
Primary 3	0	0	0	0	0	0	0	0	0	0	0
Primary 4	0	0	0	0	0	0	0	0	0	0	0
Subtotal	0	0	0	1	0	0	0	0	0	0	1
Total	0	0	1	4	0	2	0	1	0	0	9

[a] "Incomplete" indicates that the number of eggs present during nest revists did not meet the criteria for defining a complete clutch.

Table 19. Frequency of clutch size from "complete" clutches by nest location for cackling Canada geese in calibration plot I at Manokinak River, 1984.

	Nest Location			
Clutch Size	Island	Peninsula	Other[a]	Total
1	0	0	0	0
2	0	0	0	0
3	0	0	0	0
4	0	0	0	0
5	0	0	0	0
6	1	0	0	1
7	0	0	0	0
8	0	0	0	0
9	0	0	0	0
Mean ± S.E.	-	-	-	-

[a] Nest site locations designated as "other" contain six categories: pond-shoreline, slough-shoreline, pingo top, "grass flat", displaced island, and mudflat.

Table 20. Frequency of clutch size from "complete" clutches by nest location for emperor geese in calibration plot I at Manokinak River, 1984.

	Nest Location			
Clutch Size	Island	Peninsula	Other[a]	Total
1	0	0	0	0
2	0	0	0	0
3	0	0	0	0
4	0	0	0	0
5	0	0	0	0
6	1	0	0	1
7	0	0	0	0
8	0	0	0	0
9	0	0	0	0
Mean ± S.E.	-	-	-	-

[a] Nest site locations designated as "other" contain six categories: pond-shoreline, slough-shoreline, pingo top, "grass flat", displaced island, and mudflat.

Table 21. Frequency of clutch size from "complete" clutches by nest location for Pacific white-fronted geese in calibration plot I at Manokinak River, 1984.

	Nest Location			
Clutch Size	Island	Peninsula	Other[a]	Total
1	0	0	0	0
2	0	0	0	0
3	0	0	0	0
4	1	0	0	1
5	0	0	0	0
6	0	0	0	0
7	0	0	0	0
8	0	0	0	0
9	0	0	0	0
Mean ± S.E.	-	-	-	-

[a] Nest site locations designated as "other" contain six categories: pond-shoreline, slough-shoreline, pingo top, "grass flat", displaced island, and mudflat.

Table 22. Frequency of clutch size from "complete" clutches by nest location for emperor geese in calibration plot II at Manokinak River, 1984.

	Nest Location			
Clutch Size	Island	Peninsula	Other[a]	Total
1	0	0	0	0
2	0	0	0	0
3	0	0	0	0
4	0	0	1	1
5	1	0	0	1
6	0	0	0	0
7	0	0	0	0
8	1	0	0	1
9	0	0	0	0
10	1	0	0	1
11	1	0	0	1
Mean ± S.E.	8.5±1.3 (4)[b]	1	1	7.6±1.4 (5)

[a] Nest site locations designated as "other" contain six categories: pond-shoreline, slough-shoreline, pingo top, "grass flat", displaced island, and mudflat.

[b] Number in parentheses are sample sizes.

Table 23. Frequency of clutch size from "complete" clutches by nest location for cackling Canada geese in calibration plot III at Manokinak River, 1984.

	Nest Location			
Clutch Size	Island	Peninsula	Other[a]	Total
1	0	0	0	0
2	0	0	0	0
3	0	0	0	0
4	2	0	0	2
5	2	0	0	2
6	1	0	0	1
7	0	0	0	0
8	0	0	0	0
9	0	0	0	0
Mean ± S.E.	4.8±0.5 (5)b	-	-	4.8±0.4 (5)

[a] Nest site locations designated as "other" contain six categories: pond-shoreline, slough-shoreline, pingo top, "grass flat", displaced island, and mudflat.

[b] Number in parentheses are sample sizes.

Table 24. Frequency of clutch size from "complete" clutches by nest location for emperor geese in calibration plot III at Manokinak River, 1984.

	Nest Location			
Clutch Size	Island	Peninsula	Other[a]	Total
1	0	0	0	0
2	0	0	0	0
3	0	0	0	0
4	0	0	0	0
5	1	0	0	1
6	0	0	0	0
7	0	0	0	0
8	0	0	0	0
9	0	0	0	0
10	0	0	0	0
11	0	0	0	0
Mean ± S.E.	-	-	-	-

[a] Nest site locations designated as "other" contain six categories: pond-shoreline, slough-shoreline, pingo top, "grass flat", displaced island, and mudflat.

Table 25. Nest initiation dates by clutch size from "complete" clutches for cackling Canada geese at Manokinak River, 1984.

Clutch Size	Julian day																															
	123	133	134	135	136	137	138	139	140	141	142	143	144	145	146	147	148	149	150	151	152	153	154	155	156	157	158	159	160	Total
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	2
5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	2
6	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	2
7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	2	1	2	0	0	0	0	0	0	0	0	0	0	0	6

Table 26. Nest initiation dates by clutch size from "complete" clutches for emperor geese at Manokinak River, 1984.

Clutch Size	Julian day																															
	123	133	134	135	136	137	138	139	140	141	142	143	144	145	146	147	148	149	150	151	152	153	154	155	156	157	158	159	160	Total
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
5	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
6	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	1	0	0	1	0	0	1	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5

Table 27. Nest initiation dates by clutch size from "complete" clutches for Pacific white-fronted geese at Manokinak River, 1984.

Clutch Size	Julian day																													Total
	123	133	134	135	136	137	138	139	140	141	142	143	144	145	146	147	148	149	150	151	152	153	154	155	156	157	158	159	160	
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1

Table 28. Observed hatch dates for Pacific black brant, cackling Canada geese, emperor geese, and Pacific white-fronted geese in calibration plots at Manokinak River, 1984.

	Julian day																													
Species - Plot	158	159	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175	176	177	178	179	180	181	182	183	184	185	Total
BRANT:																														
Calibration III	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
Subtotal	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
CACKLERS:																														
Calibration III	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	2	0	4	0	0	0	0	0	0	0	0	0	7
Subtotal	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	2	0	4	0	0	0	0	0	0	0	0	0	7
EMPERORS:																														
Calibration I	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	3	0	0	0	0	0	0	0	0	0	0	0	4
Calibration II	0	0	0	0	0	0	0	0	0	0	0	0	2	2	0	0	1	0	0	0	0	0	0	0	0	0	0	0	5
Calibration III	0	0	0	0	0	0	0	0	0	0	1	0	0	3	0	0	2	0	0	0	0	0	0	0	0	0	0	0	6
Subtotal	0	0	0	0	0	0	0	0	0	0	1	0	2	6	0	0	6	0	0	0	0	0	0	0	0	0	0	0	15
WHITE-FRONTS:																														
Calibration I	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	2
Calibration II	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Calibration III	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
Subtotal	0	0	0	0	0	0	0	0	0	0	1	1	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	5
TOTAL	0	0	0	0	0	0	0	0	0	0	2	1	3	10	0	0	9	0	4	0	0	0	0	0	0	0	0	0	29

Table 29. Observed hatch dates for Pacific black brant[a], cackling Canada geese, and Pacific white-fronted geese in validation and primary plots at Manokinak River, 1984.

	Julian day																													
Species - Plot	158	159	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175	176	177	178	179	180	181	182	183	184	185	Total
CACKLERS:																														
Validation B	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
Validation D	0	0	0	0	0	0	0	0	0	0	0	0	0	1	3	0	0	0	0	0	0	0	0	0	0	0	0	0	4
Subtotal	0	0	0	0	0	0	0	0	0	0	0	0	3	1	3	0	0	0	0	0	0	0	0	0	0	0	0	0	7
EMPERORS:																														
Valication A	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Validation D	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	3
Primary I	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Subtotal	0	0	0	0	0	0	0	0	0	0	0	1	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	1	5
WHITE-FRONTS:																														
Validation D	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Subtotal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
TOTAL	0	0	0	0	0	0	0	0	0	0	0	1	3	1	7	0	0	0	0	0	0	0	0	0	0	0	0	1	13

[a] No brant nests were located in validation plots.

Table 30. Percent nesting success for Pacific black brant, cackling Canada geese, emperor geese, and Pacific white-fronted geese at different nest locations at Manokinak River, 1984.

	Brant				Cacklers			
Plot	Island	Peninsula	Other[a]	Total	Island	Peninsula	Other	Total
Calibration I	-	-	-	-	0 (3)	-	-	0 (3)
Calibration II	-	-	-	-	0 (2)	-	-	0 (2)
Calibration III	43 (7)[b]	0 (1)	-	38 (8)	85 (13)	-	-	85(13)
Subtotal	43 (7)	0 (1)	-	38 (8)	58 (19)	-	-	58(19)
Validation I	-	-	-	-	0 (6)	-	-	0 (6)
Validation II	-	-	-	-	65 (17)	-	-	65(17)
Validation III	-	-	-	-	30 (20)	0 (1)	-	29(21)
Validation IV	-	-	-	-	50 (14)	0 (1)	-	47(15)
Subtotal	-	-	-	-	42 (57)	0 (2)	-	41(59)
Primary I	-	-	-	-	0 (7)	-	-	0 (7)
Primary II	-	-	-	-	0 (9)	0 (2)	-	0(11)
Primary III	-	-	-	-	-	-	-	-
Subtotal	-	-	-	-	0 (16)	0 (2)	-	0(18)
Total	43 (7)	0 (1)	-	38 (8)	38 (91)	0 (4)	-	37(95)

Table 30. Continued

Plot	Emperors				White-fronts			
	Island	Peninsula	Other	Total	Island	Peninsula	Other	Total
Calibration I	100 (2)	100 (1)	50 (2)	80 (5)	100(1)	-	100(1)	100 (2)
Calibration II	67 (6)	33 (3)	50 (7)	54(13)	-	-	100(1)	100 (1)
Calibration III	67 (9)	0 (1)	-	60(10)	100(2)	-	-	100 (2)
Subtotal	71(17)	40 (5)	50 (6)	57(30)	100(3)	-	100(2)	100 (5)
Validation I	25 (4)	75 (4)	100 (1)	60 (9)	-	-	-	-
Validation II	-	0 (3)	-	0 (3)	-	-	-	-
Validation III	-	-	100 (1)	100 (1)	-	-	-	-
Validation IV	83 (6)	100 (3)	-	89 (9)	-	100(2)	100(2)	100 (3)
Subtotal	60(10)	60(10)	100 (2)	65(23)	-	100(1)	100(2)	100 (3)
Primary I	67 (3)	100 (1)	100 (1)	80 (5)	-	-	100(1)	100 (1)
Primary II	67 (3)	-	-	67 (3)	-	-	0(1)	0 (1)
Primary III	-	-	-	-	-	-	-	-
Primary IV	-	0 (1)	-	0 (1)	-	-	-	-
Subtotal	67 (6)	50 (2)	100 (1)	67 (9)	-	-	50(2)	50 (2)
Total	67(33)	53(17)	67 (9)	61(62)	100(3)	100(1)	83(6)	90(10)

[a] Nest locations designated as "other" contain six categories: pond-shoreline, slough-shoreline, pingo top, "grass flat", displaced island and mudflat.

[b] Numbers in parentheses are the number of nests for which status was determined.

Table 31. Status of cackling Canada goose clutches in relation to the number of prehatch visits in calibration plot I at Manokinak River, 1984.

Clutch status[a]	Number of visits															Total
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
Hatched:																
Without egg loss	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
With egg loss	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Partial hatch:																
Without egg loss	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
With egg loss	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Unhatched:																
Abandoned -																
at initiation	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	1
prehatch	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Predation -																
(avian & mammalian)	-	-	1	1	1	-	-	-	-	-	-	-	-	-	-	3
Harvest (egged)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fail to develop	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Continued (post-predation):																
Hatched	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Unhatched	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Continued (post-harvest):																
Hatched	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Unhatched	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Undetermined:	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	-	-	1	2	1	-	-	-	-	-	-	-	-	-	-	4

Table 32. Status of emperor goose clutches in relation to the number of prehatch visits in calibration plot I at Manokinak River, 1984.

Clutch status[a]	Number of visits															Total
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
Hatched:																
Without egg loss	-	-	-	-	-	-	-	1	2	-	-	-	-	-	-	3
With egg loss	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	1
Partial hatch:																
Without egg loss	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
With egg loss	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Unhatched:																
Abandoned -																
at initiation	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
prehatch	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Predation -																
(avian & mammalian)	-	-	1	1	-	-	-	-	-	-	-	-	-	-	-	2
Harvest (egged)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fail to develop	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Continued (post-predation):																
Hatched	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Unhatched	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Continued (post-harvest):																
Hatched	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Unhatched	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Undetermined:	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	-	-	1	1	-	-	1	1	2	-	-	-	-	-	-	6

Table 33. Status of Pacific white-fronted goose clutches in relation to the number of prehatch visits in calibration plot I at Manokinak River, 1984.

Clutch status[a]	Number of visits															Total
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
Hatched:																
Without egg loss	–	–	–	–	–	–	1	–	1	–	–	–	–	–	–	2
With egg loss	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Partial hatch:																
Without egg loss	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
With egg loss	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Unhatched:																
Abandoned -																
at initiation	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
prehatch	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Predation -																
(avian & mammalian)	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Harvest (egged)	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Fail to develop	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Continued (post-predation):																
Hatched	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Unhatched	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Continued (post-harvest):																
Hatched	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Unhatched	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Undetermined:	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Total	–	–	–	–	–	–	1	–	1	–	–	–	–	–	–	2

Table 34. Status of cackling Canada goose clutches in relation to the number of prehatch visits in calibration plot II at Manokinak River, 1984.

Clutch status[a]	Number of visits															Total
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
Hatched:																
Without egg loss	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
With egg loss	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Partial hatch:																
Without egg loss	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
With egg loss	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Unhatched:																
Abandoned -																
at initiation	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
prehatch	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Predation -																
(avian & mammalian)	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	2
Harvest (egged)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fail to develop	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Continued (post-predation):																
Hatched	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Unhatched	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Continued (post-harvest):																
Hatched	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Unhatched	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Undetermined:	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	2

Table 35. Status of emperor goose clutches in relation to the number of prehatch visits in calibration plot II at Manokinak River, 1984.

Clutch status[a]	Number of visits															Total
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
Hatched:																
Without egg loss	–	–	–	–	–	–	–	2	2	–	–	–	–	–	–	4
With egg loss	–	–	–	–	–	–	–	2	1	–	–	–	–	–	–	3
Partial hatch:																
Without egg loss	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
With egg loss	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Unhatched:																
Abandoned –																
at initiation	–	–	1	–	–	–	–	–	–	–	–	–	–	–	–	1
prehatch	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Predation –																
(avian & mammalian)	–	2	3	1	–	–	–	–	–	–	–	–	–	–	–	6
Harvest (egged)	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Fail to develop	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Continued (post-predation):																
Hatched	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Unhatched	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Continued (post-harvest):																
Hatched	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Unhatched	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Undetermined:	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	1
Total	–	2	4	1	–	–	–	4	3	1	–	–	–	–	–	15

Table 36. Status of Pacific white-fronted goose clutches in relation to the number of prehatch visits in calibration plot II at Manokinak River, 1984.

Clutch status[a]	Number of visits															Total
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
Hatched:																
Without egg loss	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	1
With egg loss	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Partial hatch:																
Without egg loss	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
With egg loss	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Unhatched:																
Abandoned -																
at initiation	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
prehatch	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Predation -																
(avian & mammalian)	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Harvest (egged)	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Fail to develop	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Continued (post-predation):																
Hatched	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Unhatched	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Continued (post-harvest):																
Hatched	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Unhatched	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Undetermined:	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Total	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	1

Table 37. Status of Pacific black brant clutches in relation to the number of prehatch visits in calibration plot III at Manokinak River, 1984.

Clutch status[a]	Number of visits															Total
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
Hatched:																
Without egg loss	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	1
With egg loss	–	–	–	–	–	–	1	1	–	–	–	–	–	–	–	2
Partial hatch:																
Without egg loss	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
With egg loss	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Unhatched:																
Abandoned –																
at initiation	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
prehatch	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Predation –																
(avian & mammalian)	–	–	5	–	–	–	–	–	–	–	–	–	–	–	–	5
Harvest (egged)	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Fail to develop	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Continued (post-predation):																
Hatched	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Unhatched	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Continued (post-harvest):																
Hatched	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Unhatched	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Undetermined:	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Total	–	–	5	–	–	–	2	1	–	–	–	–	–	–	–	8

Table 38. Status of cackling Canada goose clutches in relation to the number of prehatch visits in calibration plot III at Manokinak River, 1984.

Clutch status[a]	Number of visits															Total
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
Hatched:																
Without egg loss	–	–	–	–	–	–	2	3	3	–	–	–	–	–	–	8
With egg loss	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	1
Partial hatch:																
Without egg loss	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	1
With egg loss	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Unhatched:																
Abandoned –																
at initiation	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
prehatch	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Predation –																
(avian & mammalian)	–	–	1	1	–	–	–	–	–	–	–	–	–	–	–	2
Harvest (egged)	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Fail to develop	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Continued (post-predation):																
Hatched	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	1
Unhatched	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Continued (post-harvest):																
Hatched	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Unhatched	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Undetermined:	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Total	–	–	1	1	–	–	2	3	4	2	–	–	–	–	–	13

Table 39. Status of emperor goose clutches in relation to the number of prehatch visits in calibration plot III at Manokinak River, 1984.

Clutch status[a]	Number of visits															Total
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
Hatched:																
Without egg loss	–	–	–	–	–	–	1	1	–	–	–	–	–	–	–	2
With egg loss	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	1
Partial hatch:																
Without egg loss	–	–	–	–	–	1	1	1	–	–	–	–	–	–	–	3
With egg loss	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Unhatched:																
Abandoned –																
at initiation	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
prehatch	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Predation –																
(avian & mammalian)	–	2	2	–	–	–	–	–	–	–	–	–	–	–	–	4
Harvest (egged)	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Fail to develop	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Continued (post-predation):																
Hatched	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Unhatched	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Continued (post-harvest):																
Hatched	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Unhatched	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Undetermined:	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Total	–	2	2	–	–	1	3	2	–	–	–	–	–	–	–	10

Table 40. Status of Pacific white-fronted goose clutches in relation to the number of prehatch visits in calibration plot III at Manokinak River, 1984.

Clutch status[a]	Number of visits															Total
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
Hatched:																
Without egg loss	–	–	–	–	–	1	1	–	–	–	–	–	–	–	–	2
With egg loss	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Partial hatch:																
Without egg loss	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
With egg loss	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Unhatched:																
Abandoned –																
at initiation	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
prehatch	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Predation –																
(avian & mammalian)	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Harvest (egged)	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Fail to develop	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Continued (post-predation):																
Hatched	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Unhatched	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Continued (post-harvest):																
Hatched	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Unhatched	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Undetermined:	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Total	–	–	–	–	–	1	1	–	–	–	–	–	–	–	–	2

Table 41. Hatching success of "complete" clutches for cackling Canada geese at Manokinak River, 1984.

	Clutch size									
Plot	1	2	3	4	5	6	7	8	9	Total
Calibration I	-	-	-	-	-	0[a](1)[b]	-	-	-	0 (1)
Calibration II	-	-	-	-	-	-	-	-	-	-
Calibration III	-	-	-	100 (2)	100 (2)	100 (1)	-	-	-	100 (5)
Total	-	-	-	100 (2)	100 (2)	50 (2)	-	-	-	53 (6)

[a] Numbers are percentages.

[b] Numbers in parentheses are sample sizes.

Table 42. Hatching success of "complete" clutches for emperor geese at Manokinak River, 1984.

	Clutch size									
Plot	1	2	3	4	5	6	7	8	9	Total
Calibration I	-	-	-	-	-	100[a](1)[b]	-	-	-	100 (1)
Calibration II	-	-	-	100 (1)	100 (1)	-	-	100 1	-	100 (3)
Calibration III	-	-	-	-	100 (1)	-	-	-		
Total	-	-	-	100 (1)	100 (2)	100 (1)	-	100 (1)	-	100 (5)

[a] Numbers are percentages.

[b] Numbers in parentheses are sample sizes.

Table 43. Hatching success of "complete" clutches for Pacific white-fronted geese at Manokinak River, 1984.

	Clutch size									
Plot	1	2	3	4	5	6	7	8	9	Total
Calibration I	-	-	-	100[a](1)[b]	-	-	-	-	-	100 (1)
Calibration II	-	-	-	-	-	-	-	-	-	-
Calibration III	-	-	-	-	-	-	-	-	-	-
Total	-	-	-	100 (1)	-	-	-	-	-	100 (1)

[a] Numbers are percentages.

[b] Numbers in parentheses are sample sizes.

Table 44. Percentage of Pacific black brant, cackling Canada goose, and emperor goose nests suffering "animal predation"[a] at different nest locations at Manokinak River, 1984.

	Brant				Cacklers			
Plot	Island	Peninsula	Other[b]	Total	Island	Peninsula	Other	Total
Calibration I	-	-	-	-	75 (4)[c]	-	-	75 (4)
Calibration II	-	-	-	-	100 (2)	-	-	100 (2)
Calibration III	57 (7)	100 (1)	-	62(8)	15(13)	-	-	15(13)
Subtotal	57 (7)	100 (1)	-	62(8)	37(19)	-	-	37(19)
Validation I	-	-	-	-	100 (6)	-	-	100 (6)
Validation II	-	-	-	-	35(17)	-	-	35(17)
Validation III	-	-	-	-	70(20)	100(1)	-	71(21)
Validation IV	-	-	-	-	50(14)	100(1)	-	53(15)
Subtotal	-	-	-	-	58(57)	100(2)	-	59(59)
Primary I	-	-	-	-	100 (7)	-	-	100 (7)
Primary II	-	-	-	-	100 (9)	100(2)	-	100(11)
Primary III	-	-	-	-	-	-	-	-
Subtotal	-	-	-	-	100(16)	100(2)	100(18)	
Total	57 (7)	100 (1)	-	62(8)	61(92)	100(4)	-	62(96)

Table 44. Continued

	Emperors				White-fronts				
Plot	Island	Peninsula	Other	Total	Island	Peninsula	Other	Total	Total
Calibration I	0 (2)	0 (1)	50(2)	20 (5)	0 (1)	-	0(1)	0 (2)	18 (11)
Calibration II		67 (3)	50(4)	38(13)	-	-	0(1)	0 (1)	44 (16)
Calibration III	33 (9)	100 (1)	-	40(10)	0 (2)	-	-	0 (2)	33 (33)
Subtotal	24(17)	60 (5)	50(6)	36(28)	0 (3)	-	0(2)	0 (5)	37 (60)
Validation I	75 (4)	25 (4)	0(1)	44 (9)	-	-	-	-	67 (15)
Validation II	-	100 (3)	-	100 (3)	-	-	-	-	45 (20)
Validation III	-	-	0(1)	0 (1)	-	-	-	-	68 (22)
Validation IV	17 (6)	0 (3)	-	11 (9)	-	0(2)	0(2)	0 (4)	32 (28)
Subtotal	40(10)	40(10)	0(2)	636(22)	-	0(2)	0(2)	0 (4)	51 (85)
Primary I	33 (3)	0 (1)	0(1)	20 (5)	-	-	0(1)	0 (1)	62 (13)
Primary II	33 (3)	-	-	33 (3)	-	-	100(1)	100 (1)	87 (15)
Primary III	-	-	-	-	-	-	-	-	-
Subtotal	33 (6)	50 (2)	0(1)	33 (9)	-	-	50(2)	50 (2)	76 (29)
Total	30(33)	47(17)	33(9)	36(59)	0 (3)	0(2)	17(6)	9(11)	50(174)

[a] Does not include eggs (nests) taken by natives during spring harvest activity.

[b] Nest locations designated as "other" contain six categories: pond-shoreline, slough-shoreline, pingo top, "grass flat", displaced island and mudflat.

[b] Numbers in parentheses are sample sizes.

Table 45. Frequency of nests which were abandoned or contained unhatched eggs for Pacific black brant, cackling Canada geese, emperor geese, and Pacific white-fronted geese at Manokinak River, 1984.

	Species												
	Brant			Cacklers			Emperors			White-fronts			
Plot	Abandoned	Addled	Total	Abandoned	Addled	Total	Abandoned	Addled	Total	Abandoned	Addled	Total	Total
Calibration I	-	-	-	25 (4)	0 (4)	25 (4)	50 (6)	0 (6)	60 (6)	100 (2)	0 (2)	100 (2)	54 (12)
Calibration II	-	-	-	0 (2)	0 (2)	0 (2)	36 (14)	0 (14)	38 (14)	100 (1)	0 (1)	100 (1)	38 (16)
Calibration III	12 (8)	0 (8)	12 (8)	69(13)	0(13)	69(13)	50 (10)	0 (10)	50 (10)	100 (2)	0 (2)	100 (2)	52 (33)
Total	12 (8)	0 (8)	12 (8)	53(19)	0(19)	53(19)	43 (30)	0 (30)	46 (30)	100 (5)	0 (5)	100 (5)	48 (60)

[a] Percentages of total number of nests for which status was determined within a plot.

[b] Number in parentheses equal the number of nests for which status was determined within a plot.

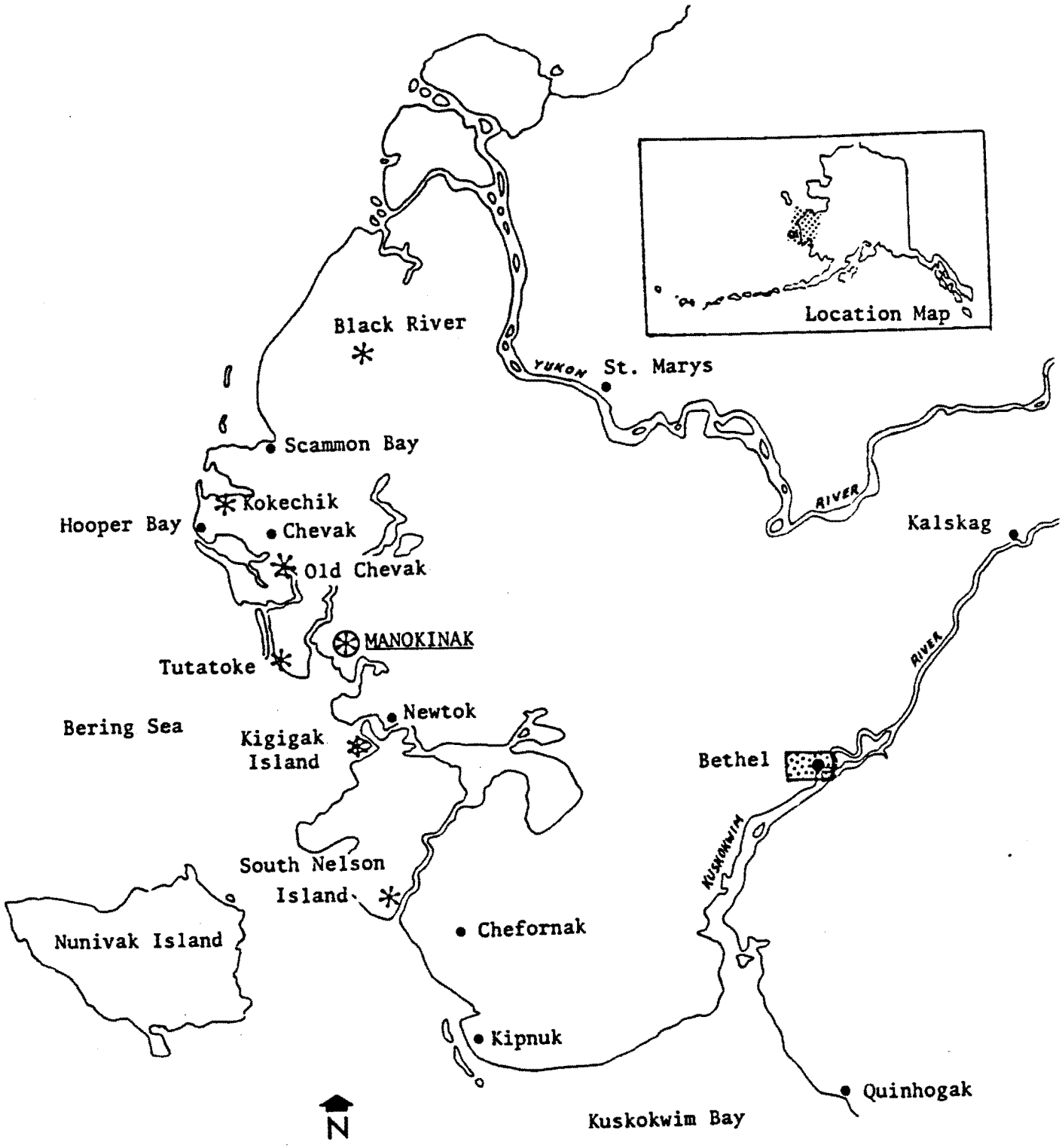


Fig. 1. Location of Manokinak River field camp in relation to location of other field camps and villages on the Yukon Delta National Wildlife Refuge.

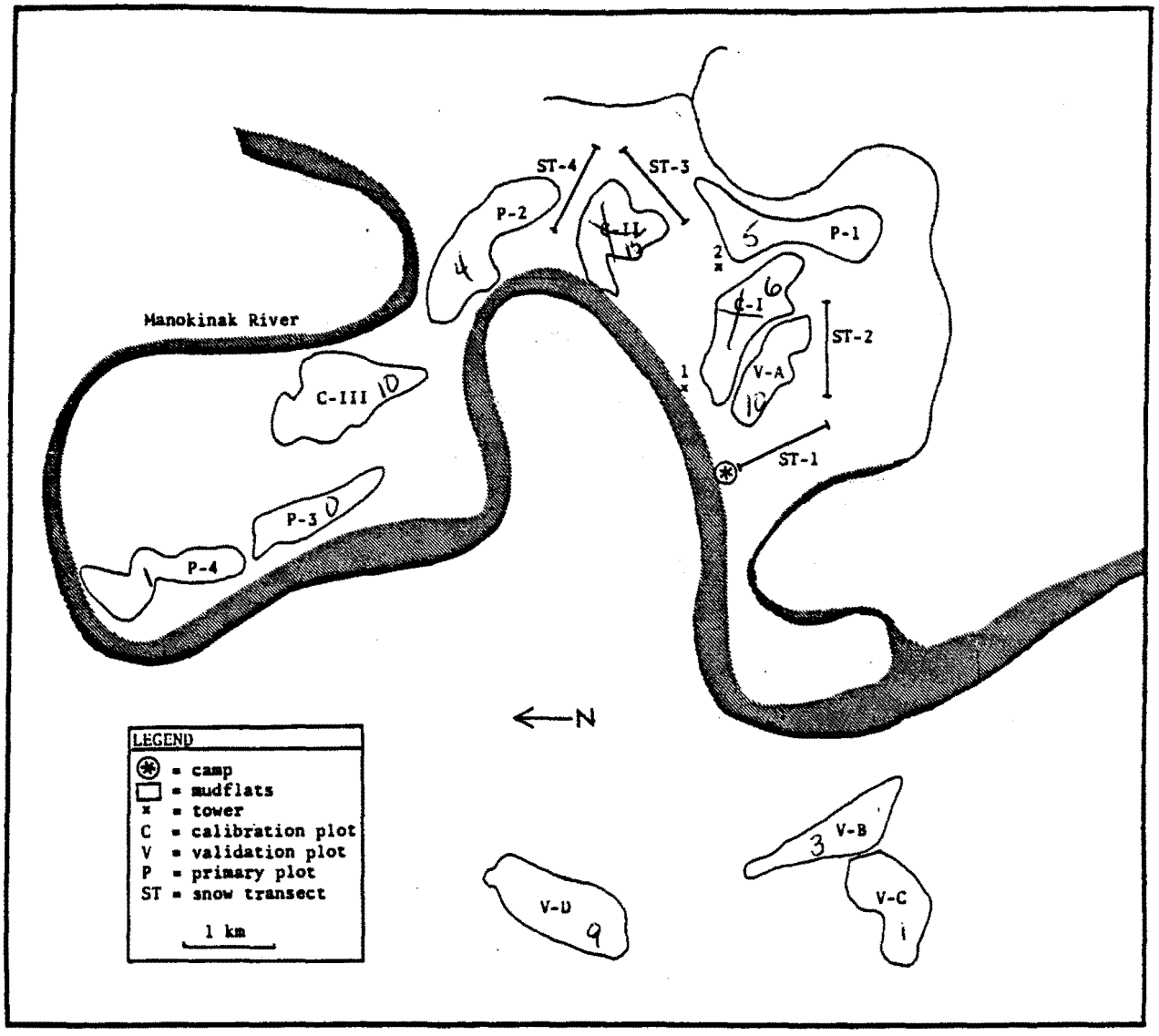


Fig. 2. Manokinak River field camp, 1984.

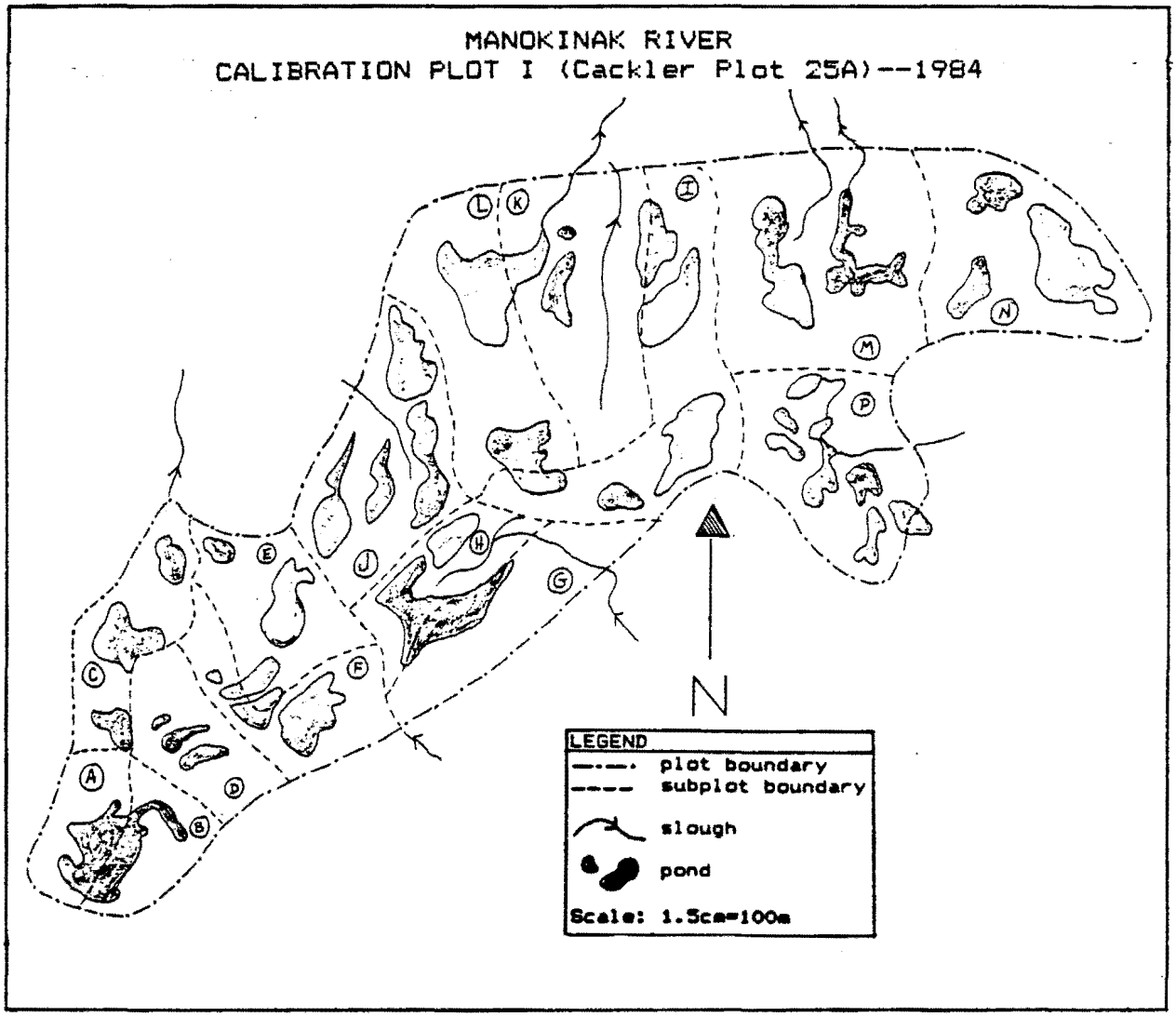


Fig. 3 Calibration Plot I, Manokinak River field camp, 1984.

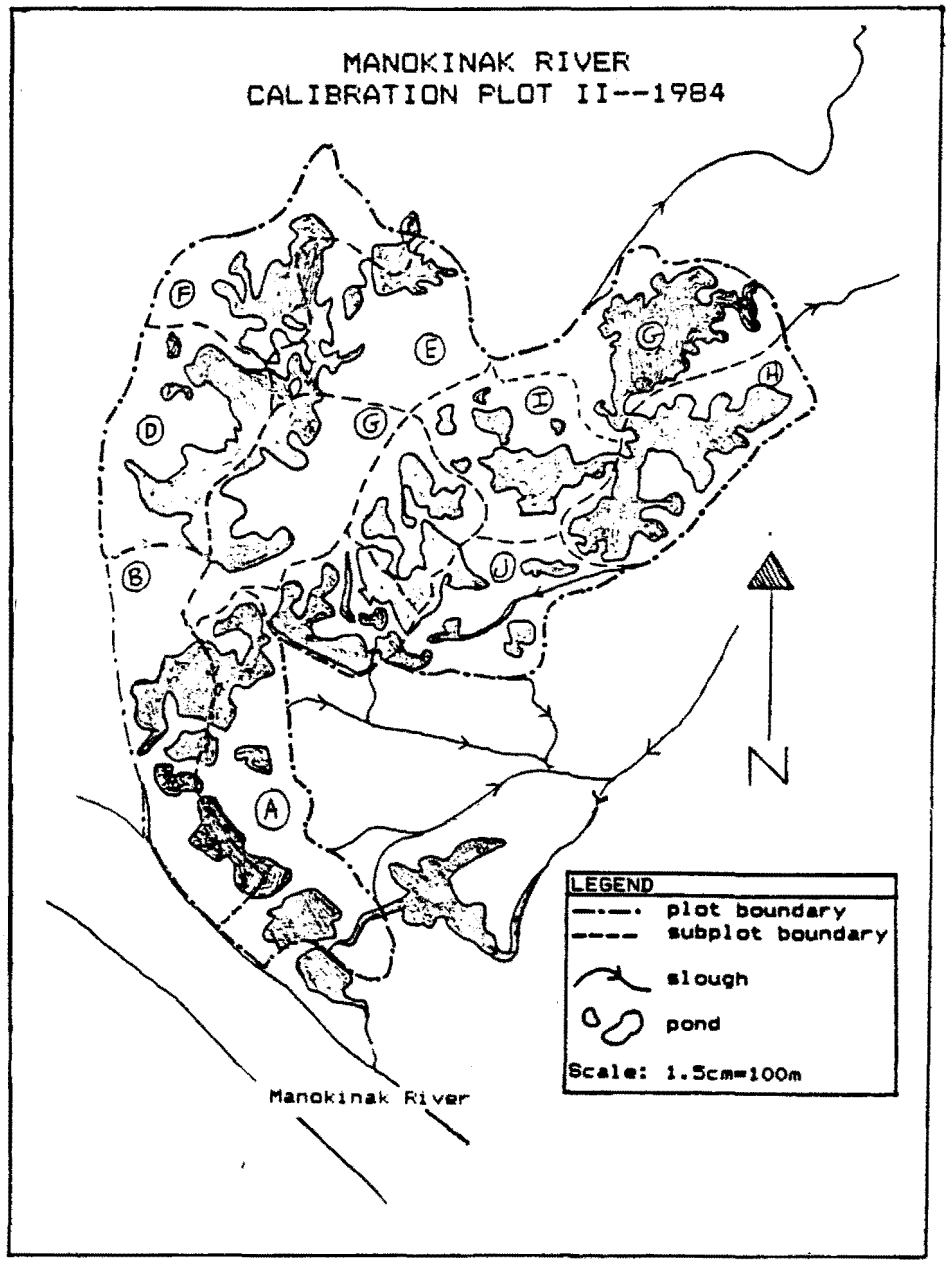


Fig. 4 Calibration Plot II, Manokinak River field camp, 1984.

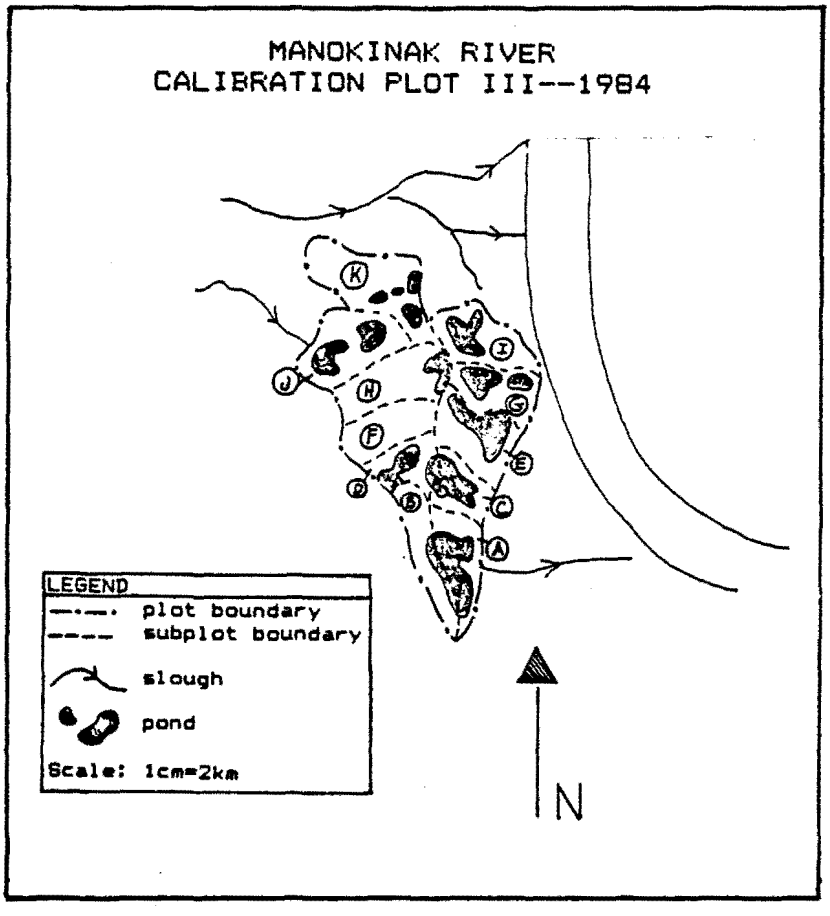


Fig. 5 Calibration Plot III, Manokinak River field camp, 1984.

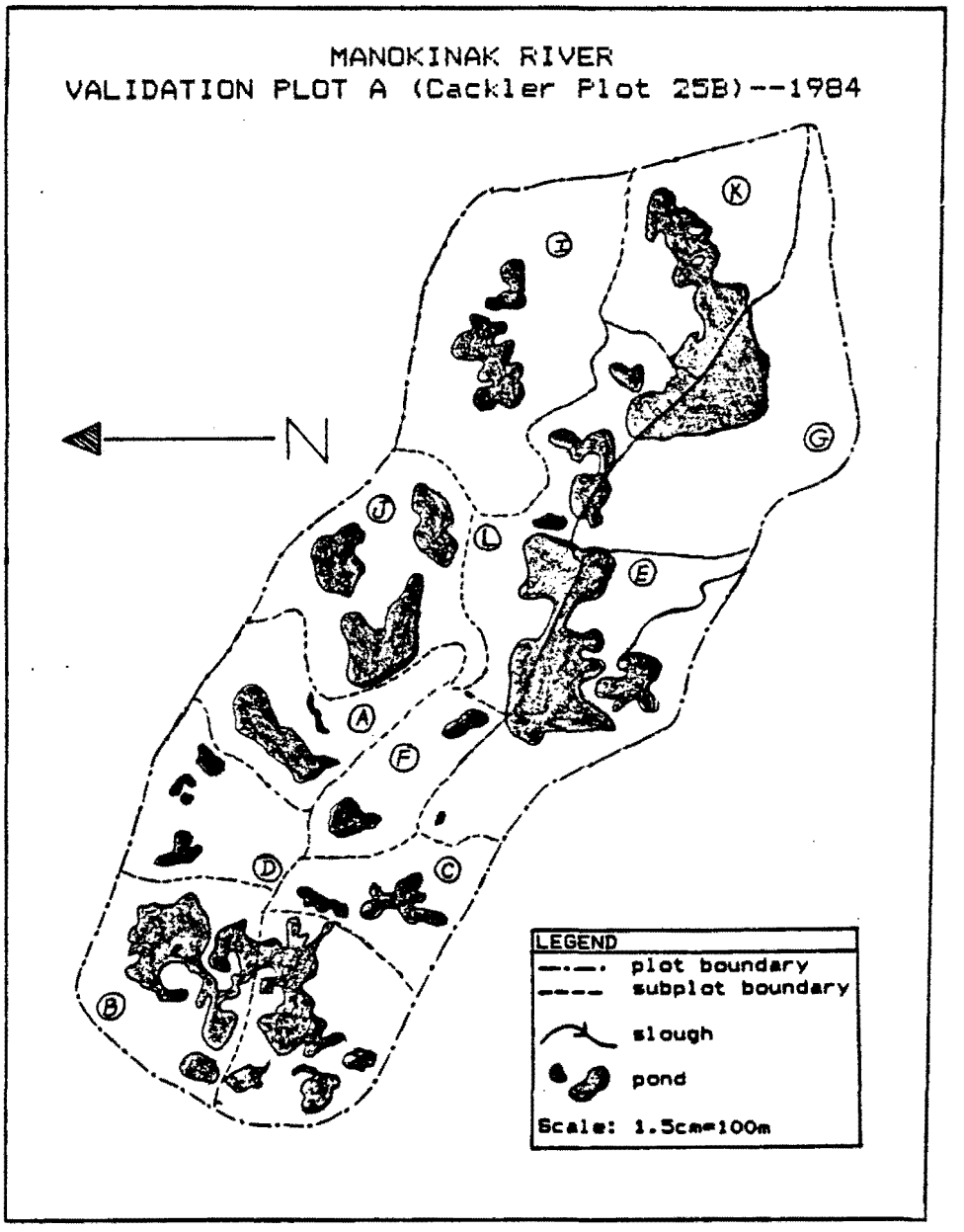


Fig. 6 Validation Plot A, Manokinak River field camp, 1984.

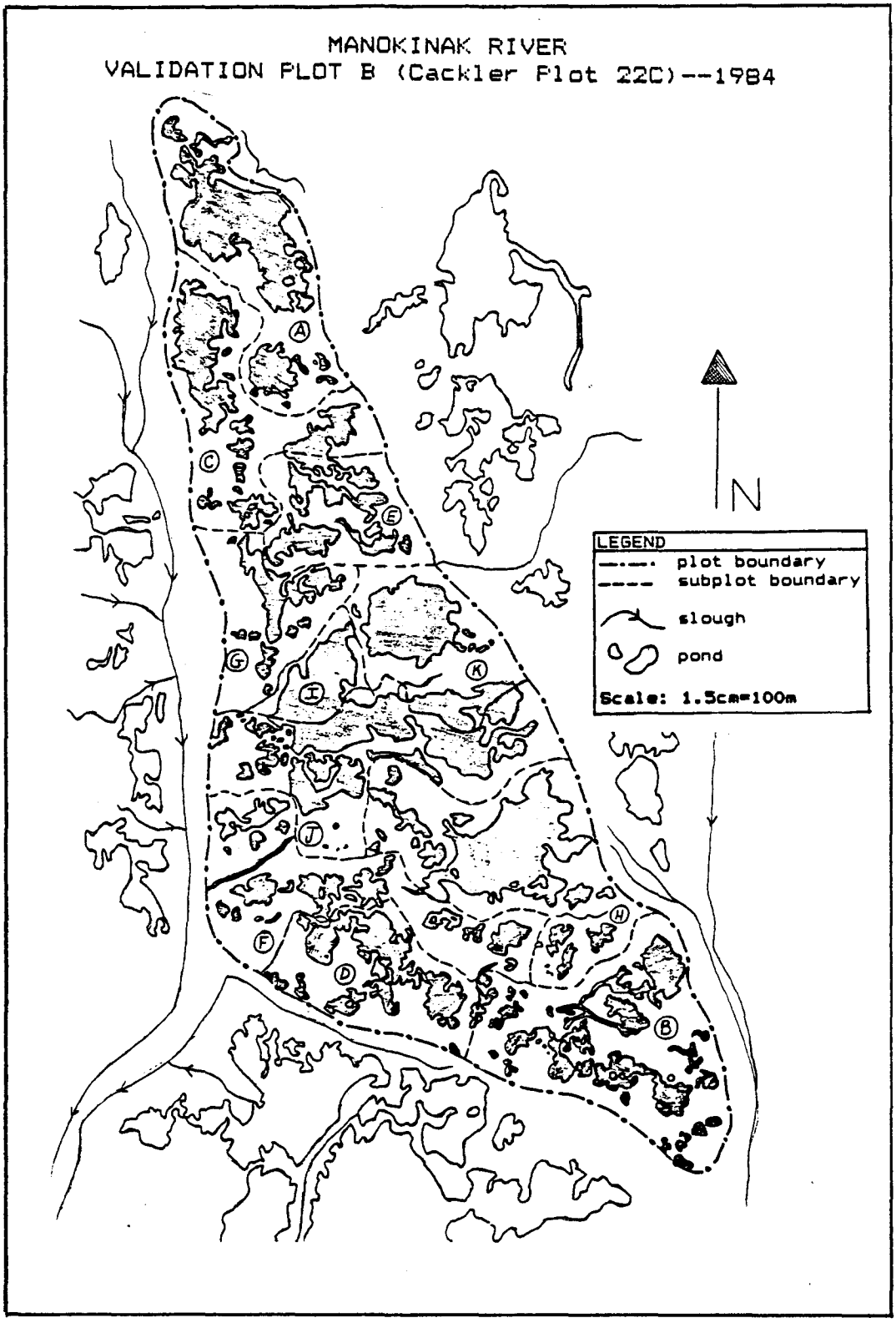


Fig. 7 Validation Plot B, Manokinak River field camp, 1984.

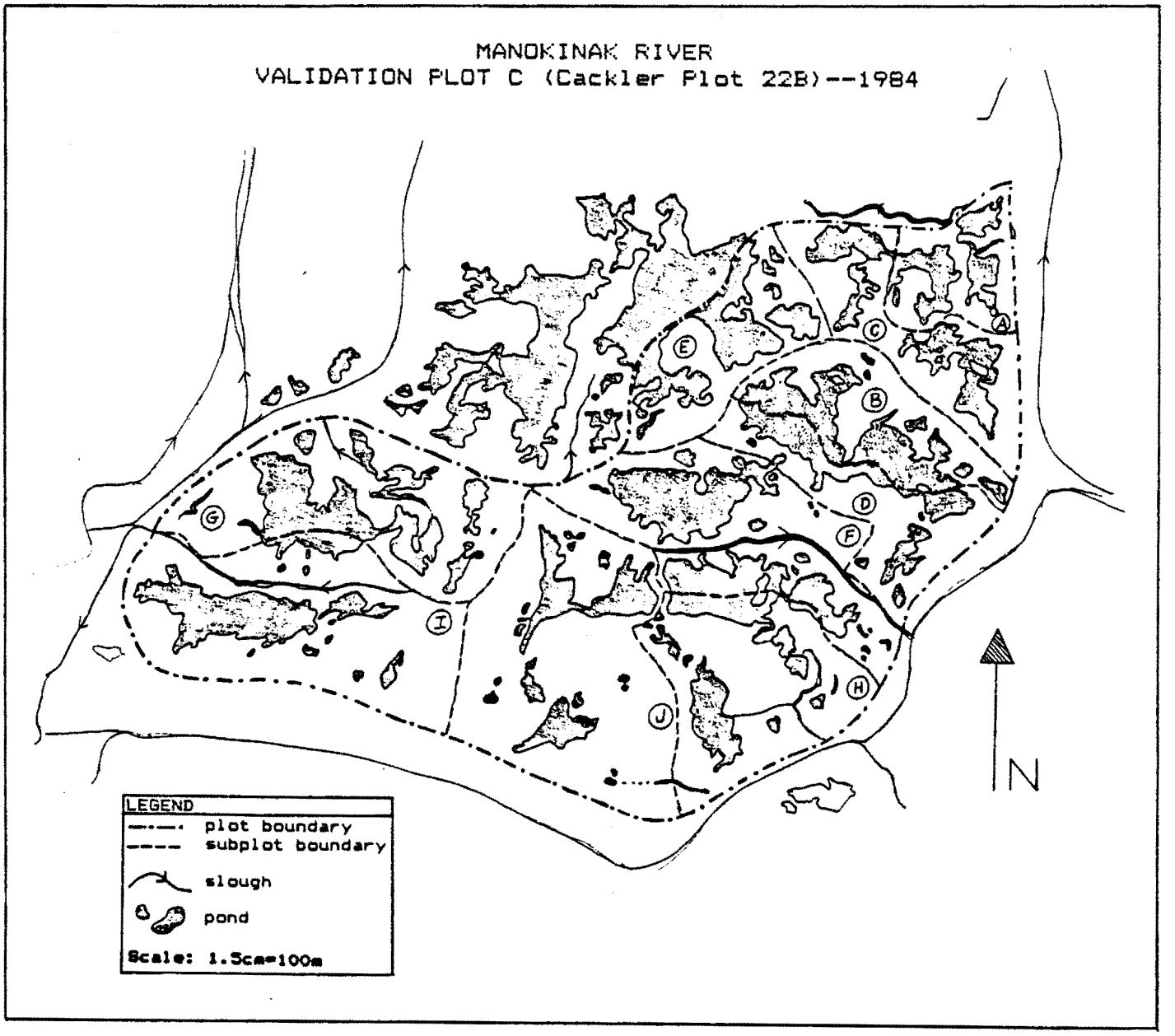


Fig. 8 Validation Plot C, Manokinak River field camp, 1984.

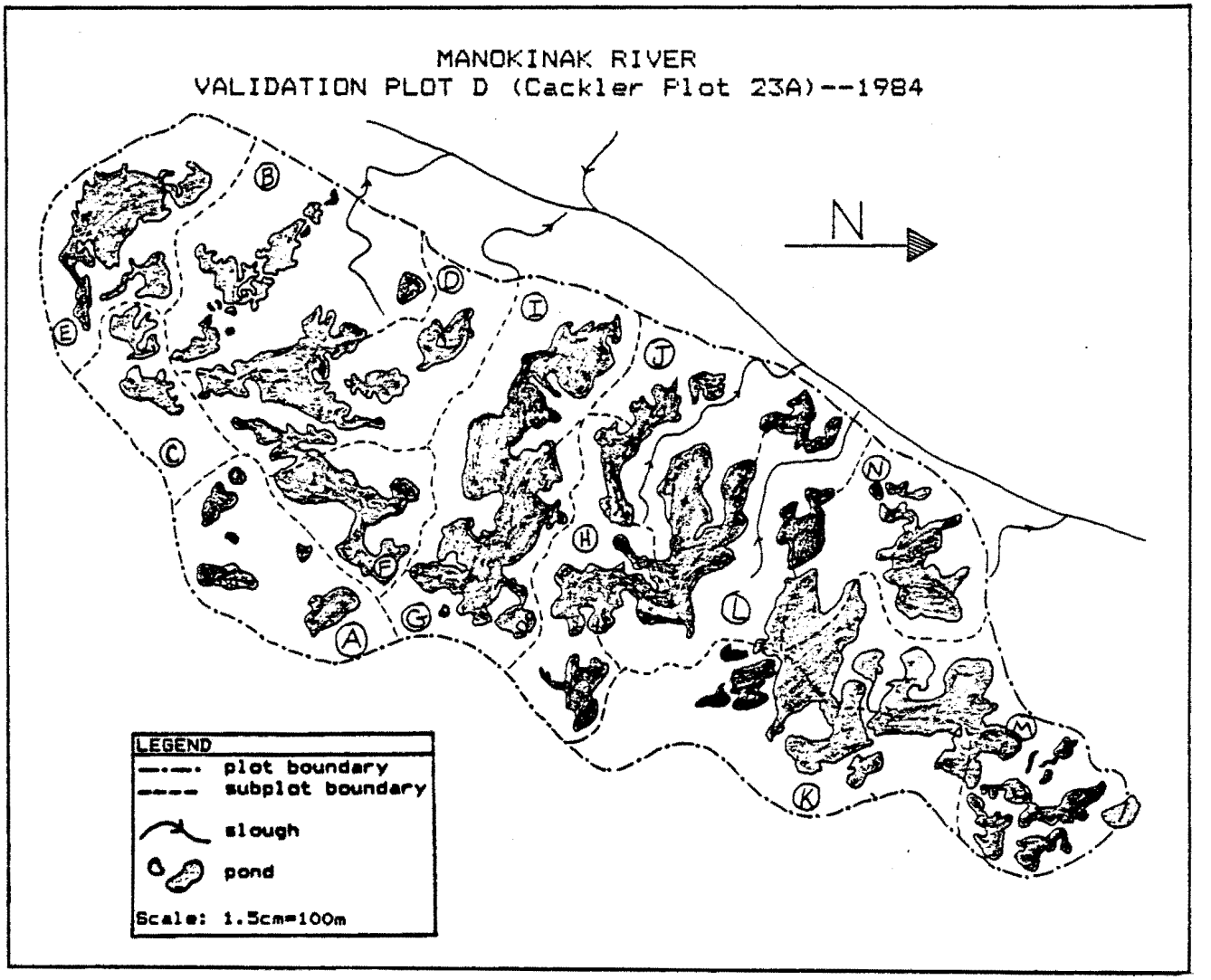


Fig. 9 Validation Plot D, Manokinak River field camp, 1984.

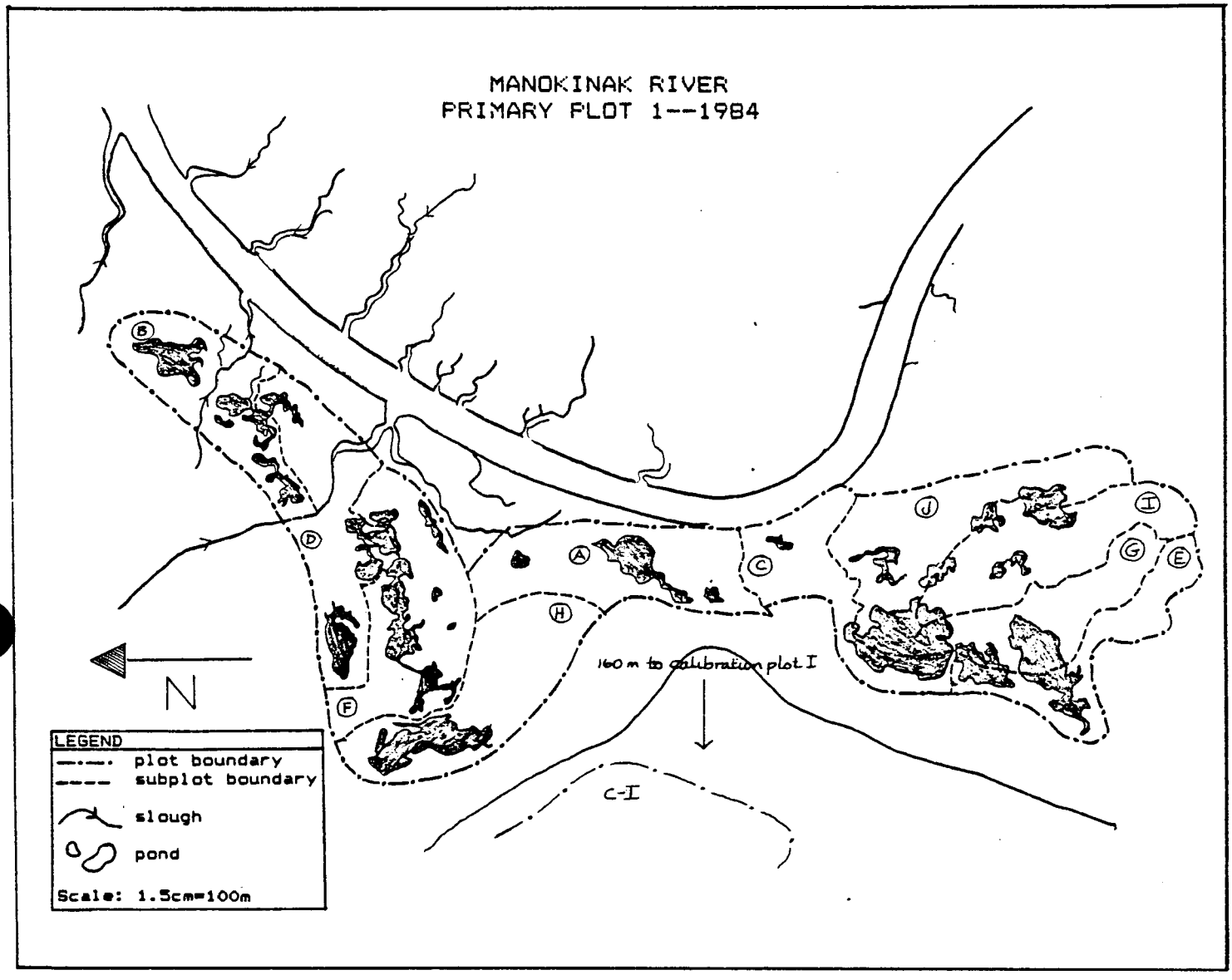


Fig. 10 Primary Plot 1, Manokinak River field camp, 1984.

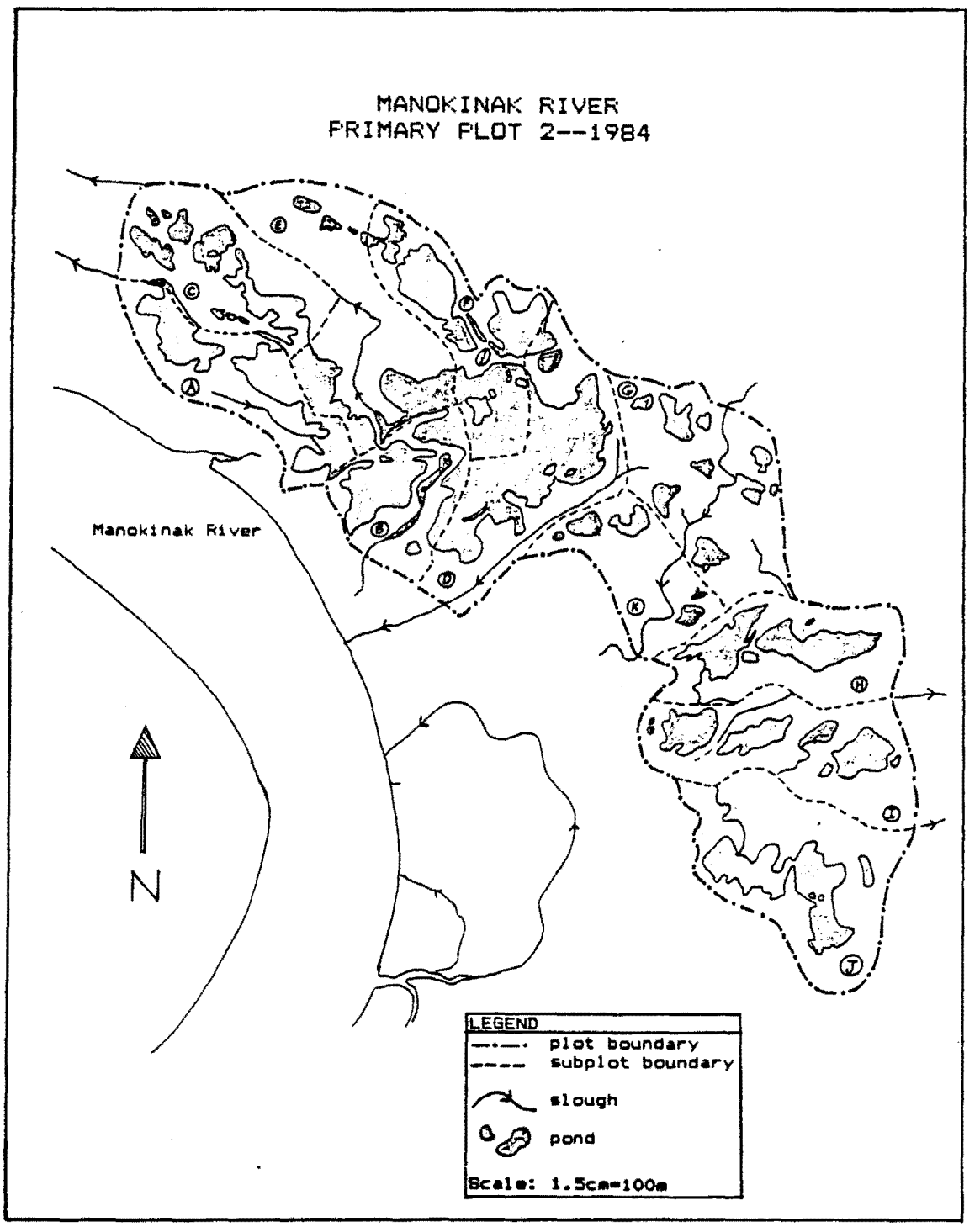


Fig. 11 Primary Plot 2, Manokinak River field camp, 1984.

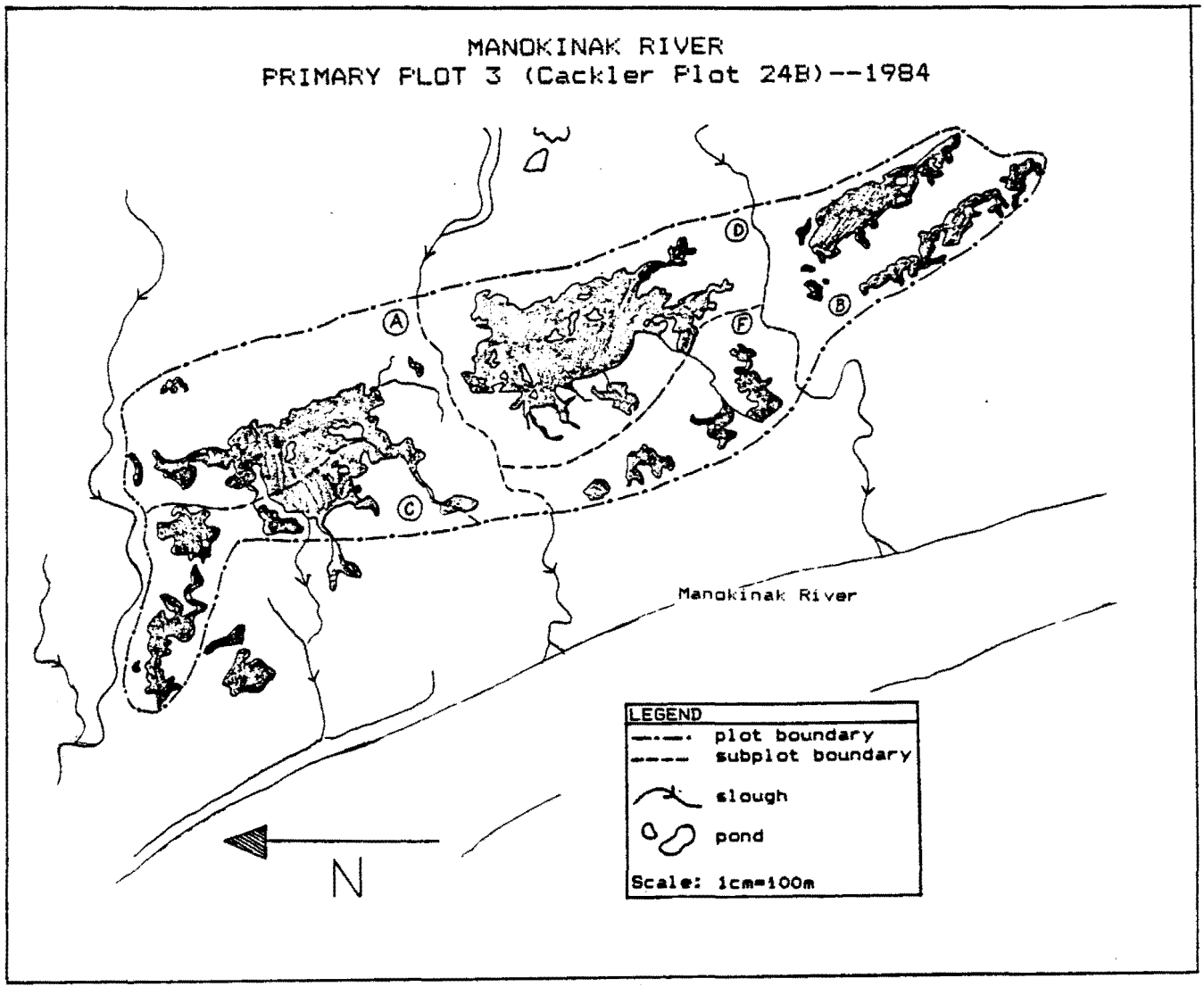


Fig. 12 Primary Plot 3, Manokinak River field camp, 1984.

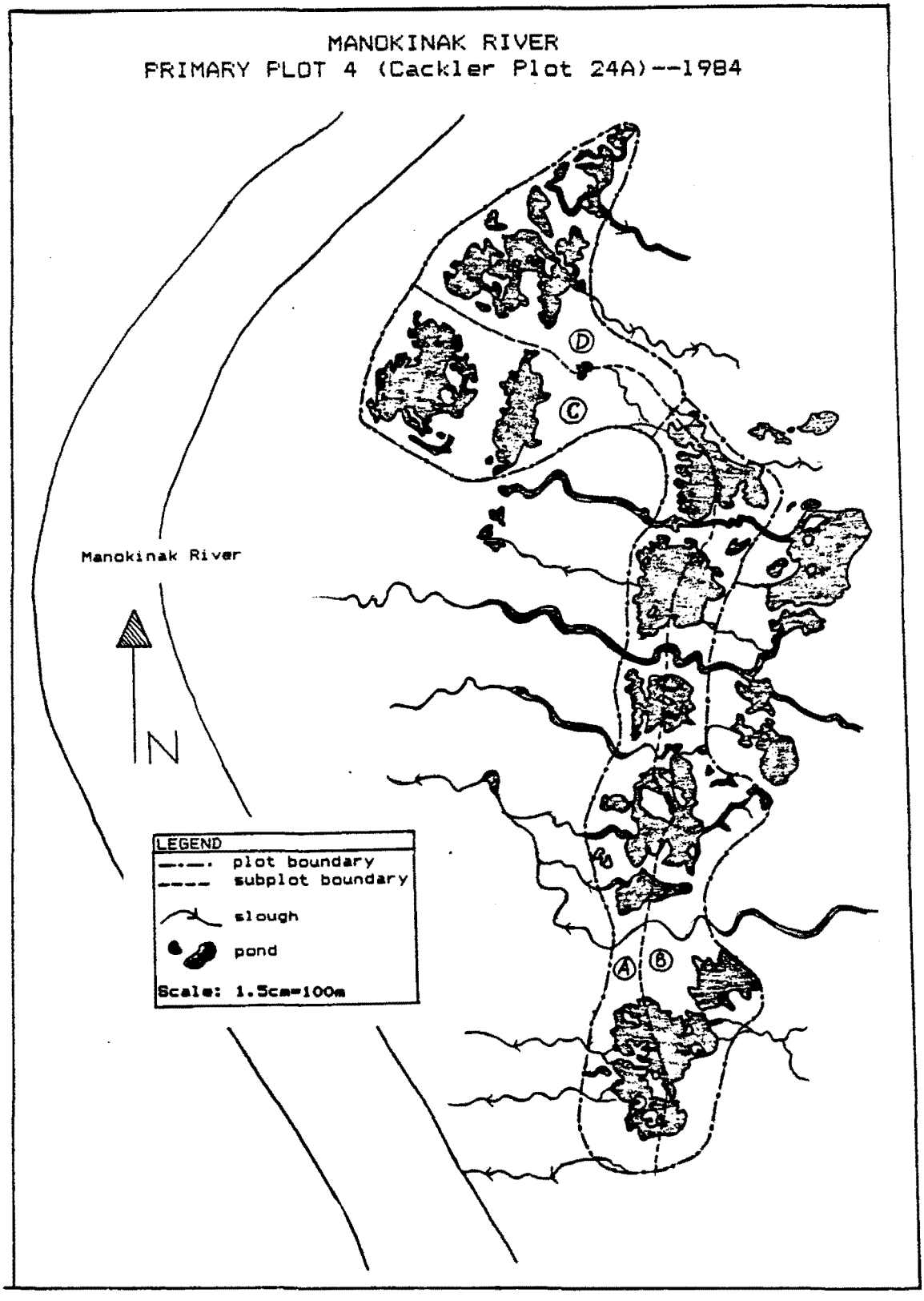


Fig. 13 Primary Plot 4, Manokinak River field camp, 1984.

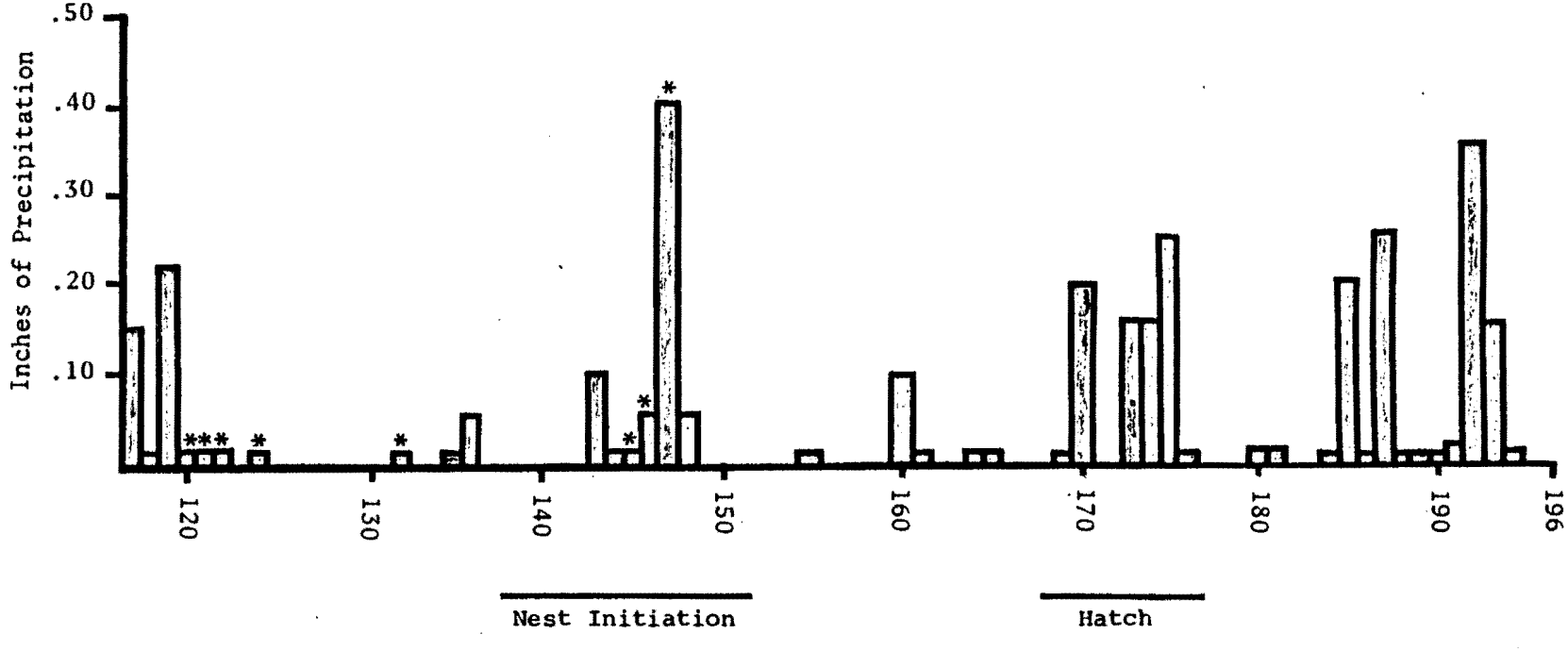


Fig. 14. Precipitation received at Manokinak River, 1984, in relation to nest initiation and hatch among black brant, cackling Canada geese, emperor geese, and Pacific white-fronted geese. Asteriks (*) indicate snow. Bars represent inches of precipitation as water received.

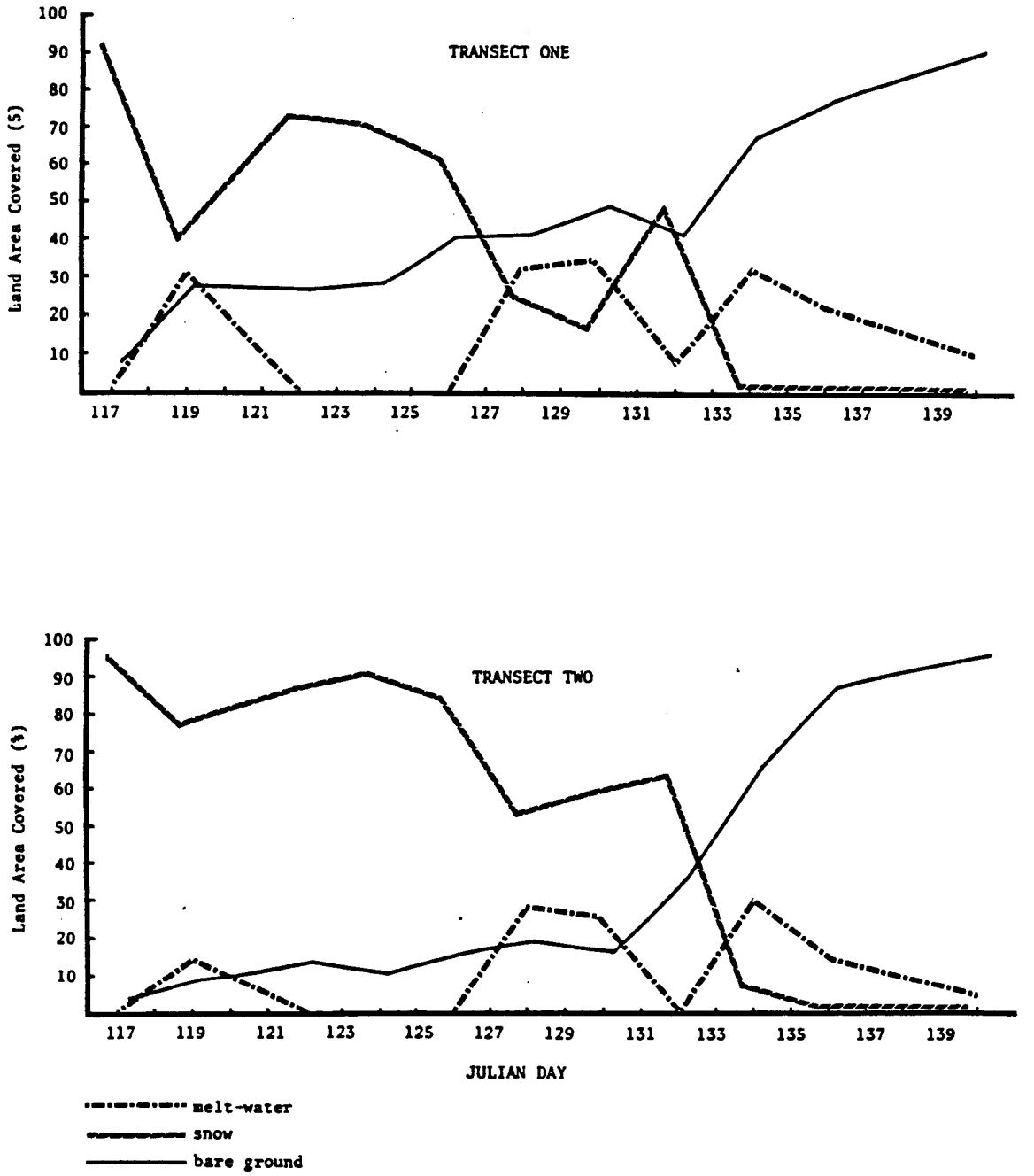


Fig. 15. Percent of land area covered by melt-water, snow, and bare ground along snow transects one and two at Manokinak River, 1984.

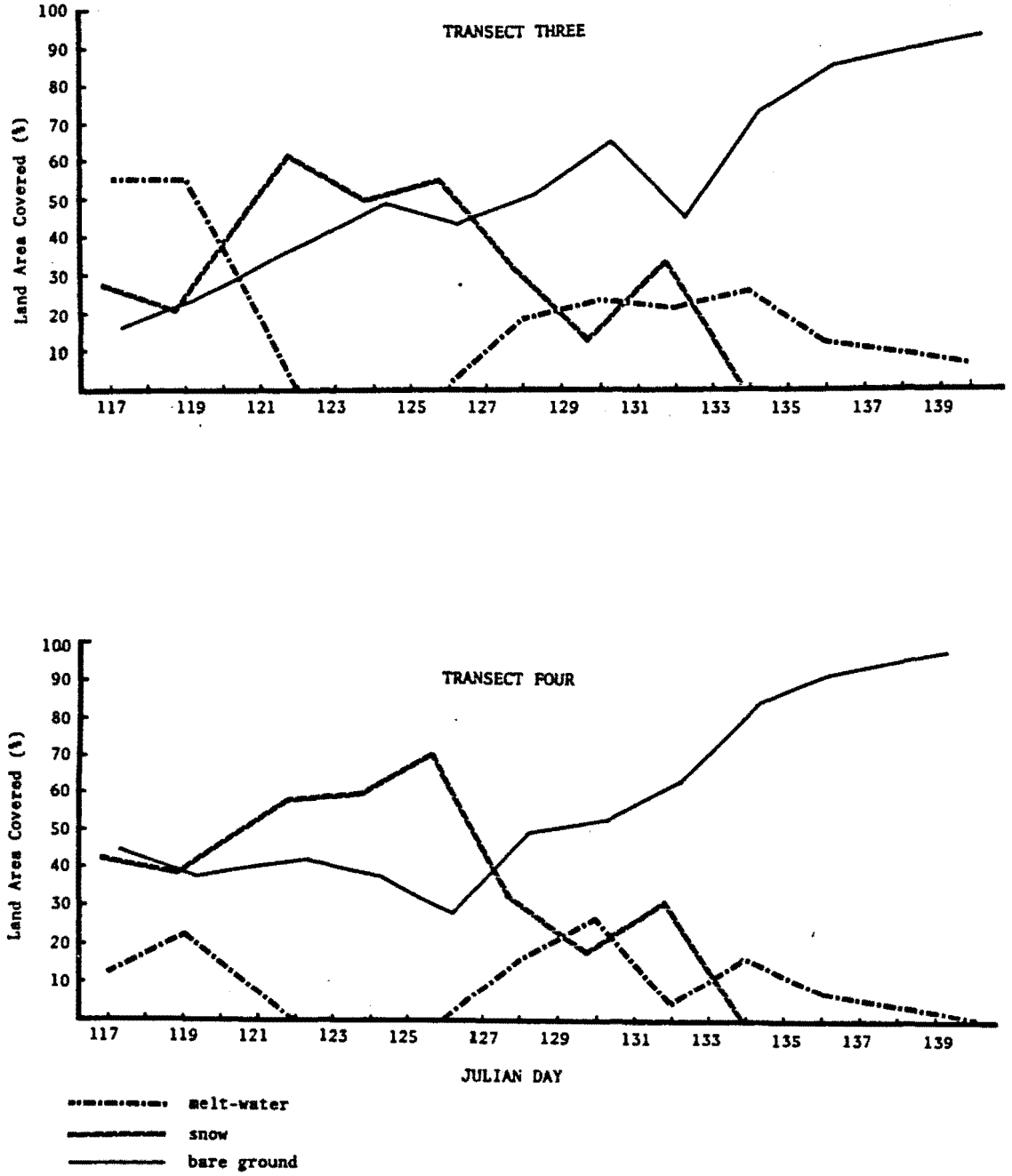


Fig. 16. Percent of land area covered by melt-water, snow, and bare ground along snow transects three and four at Manokinak River, 1984.

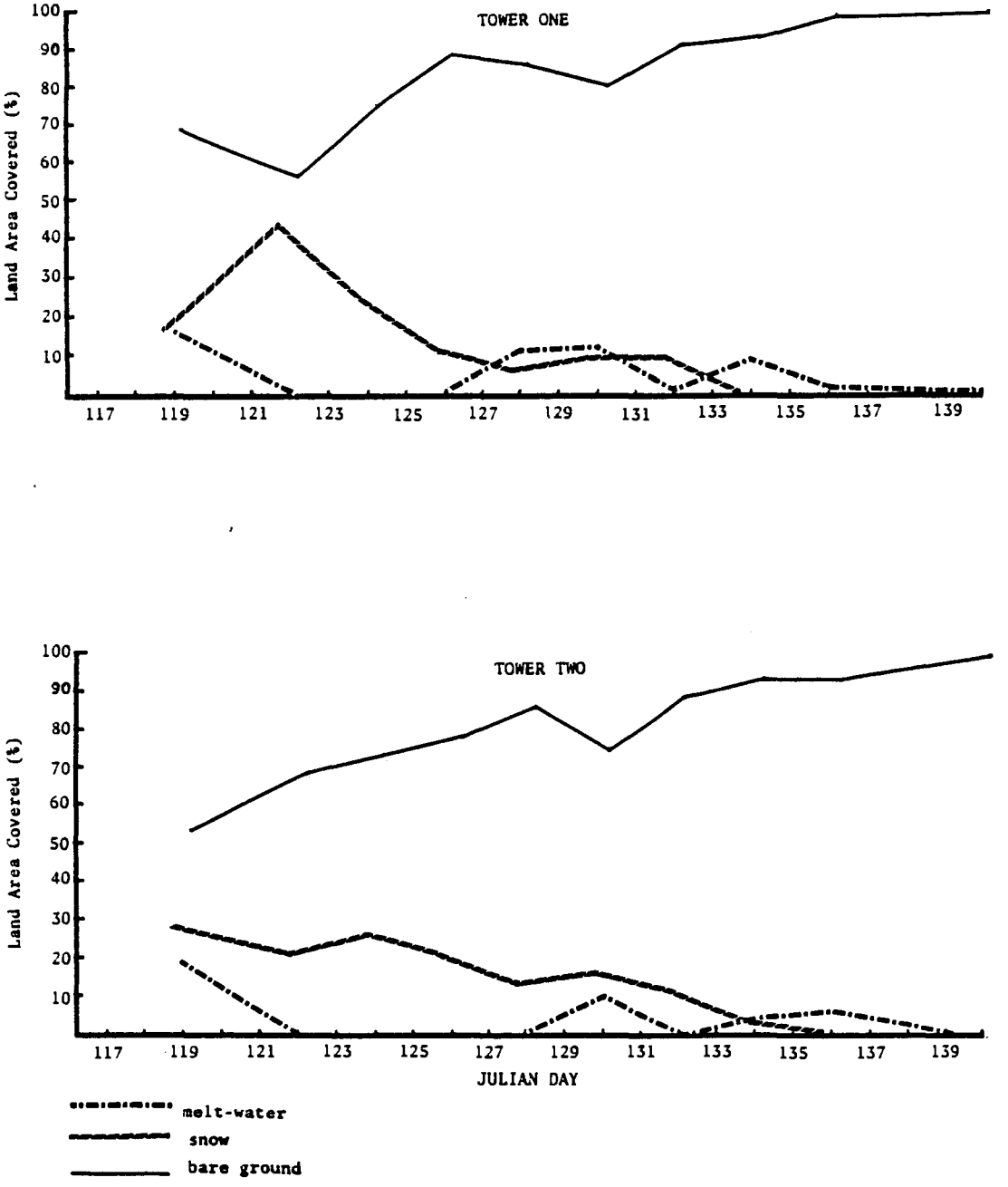


Fig. 17. Percent of land area covered by melt-water, snow, and bare ground at towers one and two at Manokinak River, 1984.

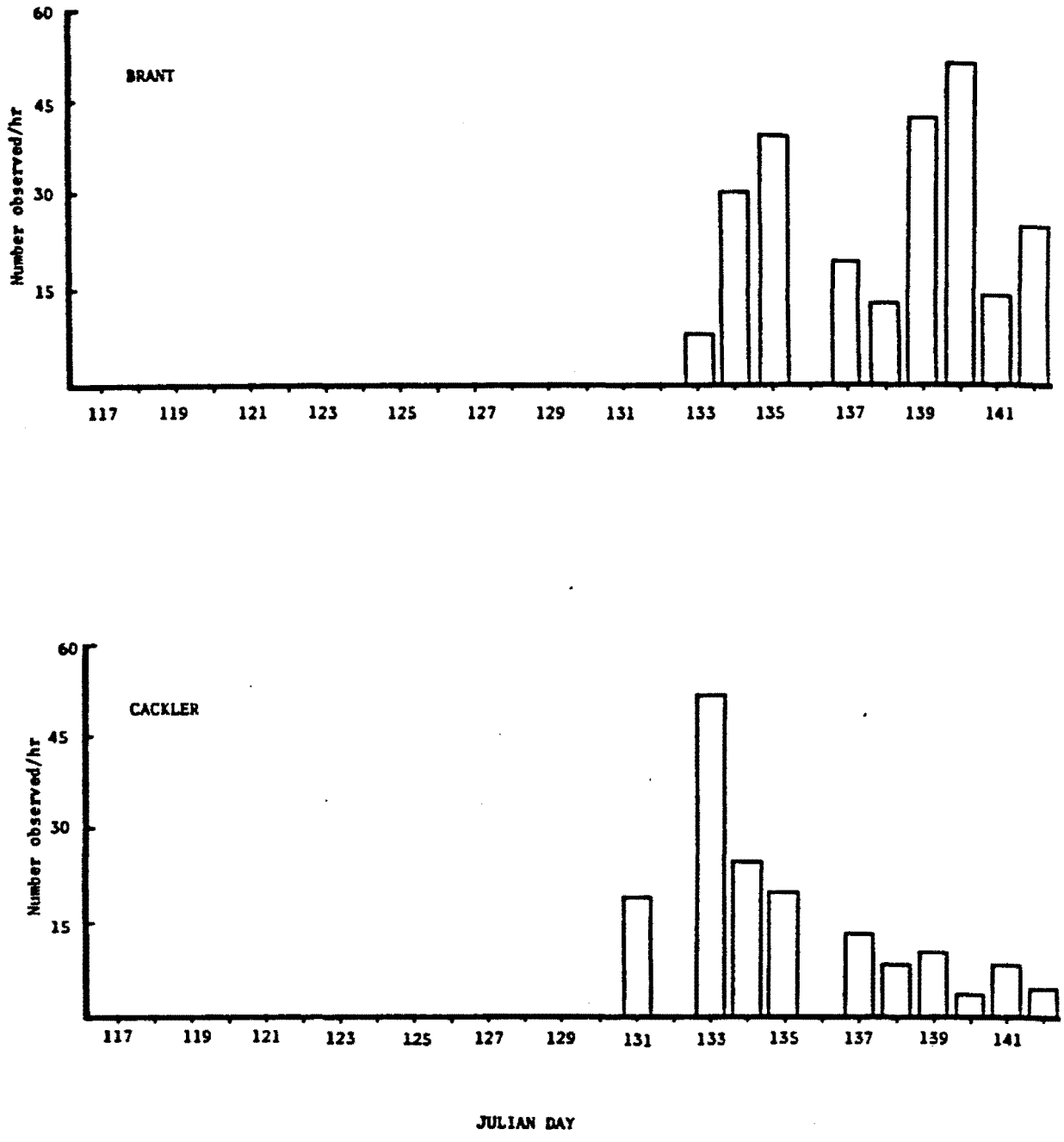


Fig. 18. Number of black brant and cackling Canada geese observed per hour during stationary migration counts at Manokinak River, 1984.

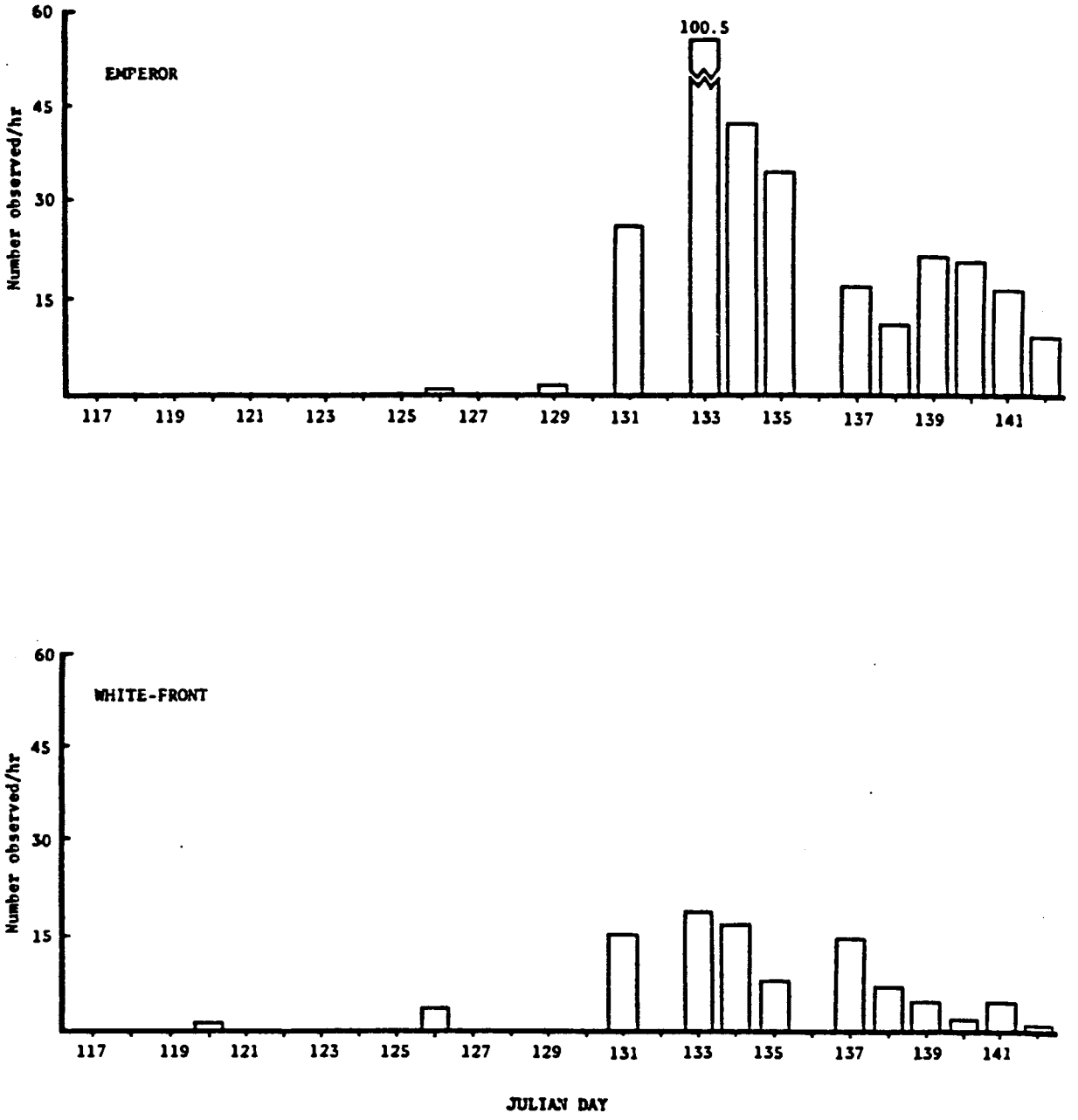
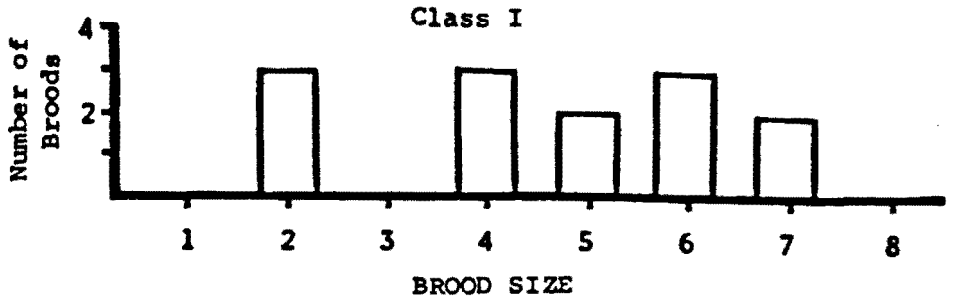


Fig. 19. Number of emperor and Pacific white-fronted geese observed per hour during stationary migration counts at Manokinak River, 1984.



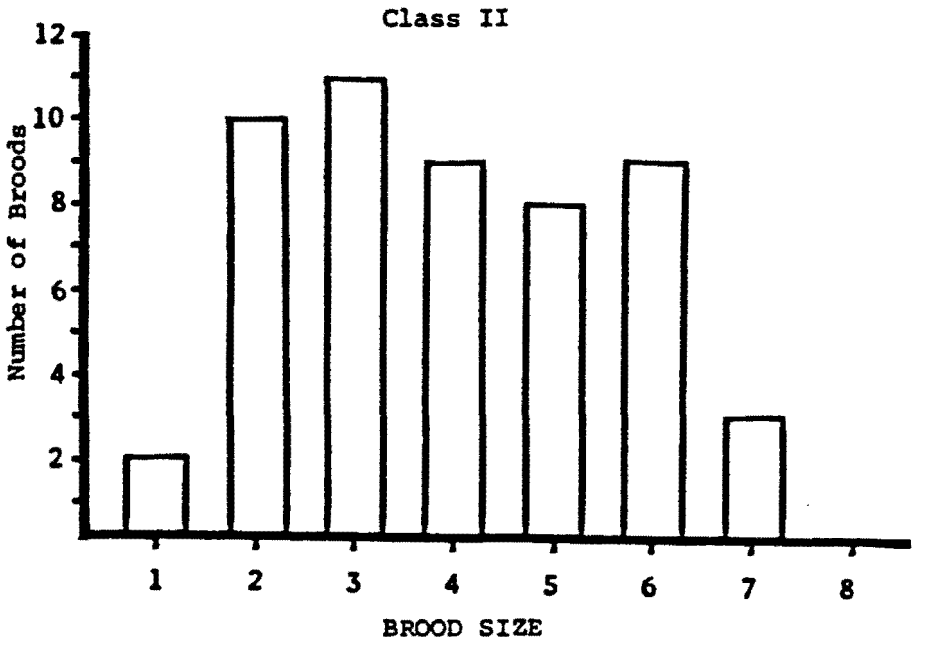


Fig. 20. The number of class I and class II emperor goose broods observed on (respectively) 25 June and 13 July at Manokinak River, 1984.