AN EVALUATION OF PRODUCTIVITY AND MORTALITY FACTORS INFLUENCING GOOSE POPULATIONS

- a status report of the 1984 waterfowl monitoring effort at Kokechik Bay, Alaska

by

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All data and conclusions presented in this report are preliminary and not for publication or citation.

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INTRODUCTION

During spring and summer of 1984, 6 stationary field camps and 2 mobile or "roving" camps were established on the Yukon Delta National Wildlife Refuge (YDNWR). The purpose of the camps was primarily 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 in part motivated by the recognition that breeding populations of these species, particularly of cackling Canada geese (cacklers) and of Pacific black brant (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 it present form during the previous (1983) field season (Wege 1983).

The Kokechik Bay field camp was established in 1982. The study area has historically supported relatively high densities of nesting brant, and lesser densities of cacklers and emperor geese (Garrett et al. 1983). Nesting productivity was monitored in 1982, and this effort was expanded in 1983 (Masteller et al. 1983).

This report summarizes the methods used and the data obtained during 1984 at the Kokechik Bay 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 a new data recording and coding procedure, and the addition of a number of new data collecting objectives. To meet the objectives of the 1984 program, we increased the number of sample plots from the 1983 procedure, and separated all plots to avoid disturbing nesting birds at one plot while sampling another.

In general terms, the objectives of the 1984 field effort at Kokechik Bay 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 study area was located on the south side of Kokechik Bay (Fig. 1), and extended from the west end of the Bay (on the Bering Sea) for approximately 16 km east along lowland tundra adjacent to the Bay (Fig. 2). The field camp was located about 3 km south of the Bay, and about 11 km east of the Bering Sea (Fig. 2), and was near snow machine trails which connected the villages of Hooper Bay (22 km southwest of camp), Scammon Bay (37 km northeast of camp), and Chevak (32 km southeast of camp) (Fig. 1).

The camp was established in early April, consisted of 2 weatherports and 2 tents, and was manned by 5 people from April 27 to July 9, 1984. The campsite used in 1984 was about 1 km northwest (closer to the Bay) of the campsite used the previous year. This location provided better access to a large slough used for boat transportation.

METHODS

Preparation

The sampling design, report format, table formats, and calculations for table values used in the goose monitoring program were prescribed by R. L. Garrett, biologist for the YDNWR.

A 5-day training session for most field personnel was held just prior to the field season (April 16-21) at Oregon State University's Hatfield Marine Science Center, Newport, Oregon.

Daily Weather

Minimum and maximum temperatures were recorded each day using a standard min/max thermometer which was re-set manually each morning. The thermometer was kept shaded inside a wooden box, and was located on the lee (west) side of the weatherports.

A plastic rain gauge was kept in a sheltered area between the 2 weatherports, and rainfall was checked each morning. A hand-held, directional wind gauge was used daily (usually morning and evening), and an estimate of visibility was recorded (to the nearest mile) each time the wind speed and direction was recorded.

Snow Transects

Four 1600-meter transects were established (April 29-May 1) at 90 degrees to each other, each beginning at camp (Fig. 2). Two transects ran toward Kokechik Bay (1 on a northwest line directly toward the Bay, the other northeast toward the origin of the Bay), and 2 moved away from the Bay, toward the long bluff which parallels the Bay. These locations provided a gradient for snow melt, from potential nesting areas near the Bay, to more inland areas near the bluff.

Initially, transects were run every other day. Freezing temperatures persisted until mid-May, and with no noticeable melt occurring, 3 and occasionally 4 days elapsed between visits to a particular transect. Rate of melt increased during the third week in May, and transects were run each day. As rate of melt decreased on subsequent days, transects were visited every second or third day.

Four photographs were taken at each of 9 points along the transects: the starting point, and each 400 m point, for a total of 36 photos. Photos were taken on black and white print film each time a transect was sampled. At each of the 9 points, the first of the 4 photos was taken forward, along the transect, the second at 90 degrees to the first (moving clockwise), the third at 90 degrees to the second (looking back along the transect), and the fourth at 90 degrees to the third.

At each point where photos were taken, 3 cover estimates were recorded: percent snow cover, percent meltwater cover, and percent bare ground. These 3 ocular estimates totaled to 100%, and considered and area 400 m along the transect (200 m in front of, and 200 m behind the observer), and 200 m on either side of the transect (100 m to the right, and 100 m to the left of the observer), totalling 8 ha.

Chronology of Migration

The arrival of geese and other bird species was monitored daily during a 4-hour migration watch. The watch was broken into two 2-hour segments, and was staggered from one day to the next in order to sample across all daylight hours. Migration watch began on April 28, with 2-hour segments from 0700-0900 and from 1100-1300. The following day, watch proceeded from 0900-1100 and from 1300-1500. On the third day, watch proceeded from 1100-1300 and from 1500-1700; this 3-day pattern was repeated until migration watch was abandoned on May 28.

A single observer conducted the watch, and observers alternated in 1/2-hour or 1-hour periods. Observations were made from camp at a fixed location in front of the 2 weatherports. Two flags were set at 90 degrees to each other, 10 m from the observation point. Only birds viewed between these two flags were recorded in the migration watch. The viewing area faced northwest, toward Kokechik Bay, which prevented the observer from facing the sun, and provided good opportunity to monitor birds moving along the bay.

The observer was equipped with 10x40 power binoculars and spotting scope. Birds were recorded by species and number in a flock. The direction of movement was also recorded; for example: 20 brant flying north, 4 glaucous gulls circling, 30 cacklers flying east and landing, 6 white-fronts rising, flying west, and landing. Descriptions of movements could help seperate observations between birds migrating through the area without stopping, those that were migrating to the Bay and landing (presumably to nest) and those that were already established in a local area on the Bay.

When species and/or number could not be determined, general groupings were recorded; for example: about 20 unidentified geese flying north, 50+ sandpipers flying east and landing. Weather conditions which might effect observations (fog, rain, blowing snow) were noted.

Subsistence Information

Natives from the villages of Hooper Bay, Scammon Bay, and Chevak visited the camp frequently while snow-machine travel was possible. They offered information on most of their hunting activities, but the subject of the current year's goose hunting was not pursued by camp members. We told all visitors that our camp had no law enforcement responsibilities, and that we were on the YDNWR only to observe nesting geese.

Natives offered information on previous years hunting, and also offered information on location of collared-goose shootings after we showed the visitors a collar and explained that there was nothing wrong with shooting a marked bird. Some native visitors seemed to feel that they had done something wrong if a goose they shot turned out to have a collar. Most of the visitors had little or no knowledge of the purpose or origins of collaring geese, but they readily understood the concept of using collars to mark nesting birds and to subsequently monitor their movements through collar returns, once the idea was explained to them. Camp members asked native visitors to spread the word among the villages that collar numbers and locations of collared-goose shootings would be helpful to the YDNWR, but it was stressed that the collar itself did not have to be returned, and since the name of the person who shot the goose was of no consequence, it did not have to be reported.

A daily estimate was recorded for the number of shots heard. Sightings of people collecting goose eggs were recorded, and the number of people involved, the areas where egging occurred, the duration of egging, and an estimate of the amount of eggs taken were noted. Eggers and hunters were never approached by camp members. All observations of subsistence activities were made from camp, or during the course of normal work activities (running snow transects, visiting sample plots, etc.).

Sample Plots: Location and Search

Three calibration plots, 3 validation plots, and 3 primary plots were established for brant, and 2 validation plots were established for cacklers (Figs. 3-13). A minimum of 50-100 active nests (nests with eggs) were desired for brant plots, and 25-50 active nests were desired for cackler plots. The physical bounds of all sample plots were established in units, or subplots. Subplots were established by choosing an identifiable landform (a particular point on a pond edge, or a bend in a slough), marking it on an aerial photo, and then searching for nests between natural landforms (ideally pond edges and sloughs) which were also identified on the photo. The area of a subplot was determined by search time. As search time approached 1 hour, an attempt was made to close off the subplot within natural bounds, but this was not always possible, and in some cases artificial bounds were established between subplots. The area covered within a 60±10 minute period on the first plot visit was searched as a unit on all subsequent visits to the sample plot, regardless of the amount of time required to find and sample all nests, including nests discovered after the initial visit.

Calibration plots were established during or just after the peak of nest initiation. One of the calibration plots was visited each day, which meant that each of the 3 calibration plots was visited every third day. The 3-day schedule was not disrupted between nest initiation and initiation of peak of hatch. At peak of hatch, calibration plots were visited daily in order to determine the exact day of hatch and the degree of success (full or partial hatch) for each nest. On the first 3 visits to each calibration plot, a complete search was made. On subsequent visits, only flagged nests were visited, but additional nests found incidentally during the plot visit were sampled. Validation plots were visited for the first time near the peak of incubation, a second time just prior to the peak of hatch, and one or more times after the peak of hatch. On the first 2 visits, a complete search was made. Validation plots were located so that repeated visits to calibration plots would not disturb birds in the validation areas. Primary plots were visited for the first time just before, or during the peak of hatch, and one or more times after hatch. The first visit was the only complete search. With one exception, primary plots were located so that visits to calibration and validaton areas would not be disruptive. Primary plot I had to be located at the edge of validation IV.

Calibration plots were established in the densest concentrations of nesting brant. Calibration plot I was established on May 29, 3.9 km inland from the Bay and 1.3 km southwest of camp, and included 4 islands and a large area of adjoining pond shoreline (Fig. 3). Another, but less extensive concentration of nesting brant was observed on 3 islands and adjoining shoreline to the west of calibration I, and was later established as validation plot I (Fig. 6). Calibration plot II was established on May 31, on the edge of Kokechik Bay, 8 km northwest of camp (Fig. 4). Less extensive concentrations of nesting brant were observed further east along the Bay (relative to calibration II), and were later used for validation II and primary II (Figs. 7 and 10, respectively). Calibration plot II was established on June 2 at the eastern edge of the study area, and was confined entirely to a large (0.7 ha) inland island 5 km south of the Bay (Fig. 5). Smaller concentrations of nesting brant were found on islands in this portion of the study area, and were later used for validation III, primary I, and primary III (Fig. 8, 9, and 11, respectively).

The 3 calibration plots were of distinctly different character (calibration I with small inland islands and adjoining shoreline, calibration II on a sedge-grass flat at the edge of the Bay, and calibration III on a single, 0.7 ha inland island). Locations for validation and primary plots I, II, and III were chosen to approximate conditions at calibration plots I, II, and III, respectively. The 2 cackler plots, validation IV and V, were established about 1.5 km south of the Bay in an area where nesting cacklers had been observed (Fig. 12-13).

Prior to sampling, camp members prepared "write-in-the-rain" field books so that data (see Appendix I, Dzinbal et al. (1984) could be entered across 2 facing pages, and took part in mock nest sampling.

Subplot Data: Static

The area of land and water in each subplot was determined from aerial photos using a planimeter and dot-grid. The number of islands in ponds within subplots was tallied, as were the number of nests for the various goose species encountered.

Subplot Data: Dynamic

On each visit to a subplot, the researcher responsible for all or most of the sampling recorded the time spent in the subplot, and the number of goose nests located by species.

Nest Data: Static

On the first visit to a nest, the location (island, peninsula, grass flat, etc.), distance to water (in meters), and dimensions of an island or peninsula were recorded. After the nesting season, summary variables were determined from dynamic nest data: julian day of first egg; occurrence of dump egg(s); total number of eggs laid; complete or incomplete clutch size; numbers of eggs hatched; number of eggs lost; number of eggs of undetermined status; expected and/or observed hatch day; number of visits pre-, during, and post-hatch; and handling time.

The status of eggs that could not be accounted for during a hatch or post-hatch visit (no evidence of shell fragments or detached membranes) was coded as undetermined. In calibration plots, eggs with an undetermined status likely hatched (they were known to be in the nest on the visit prior to the hatch or post-hatch visit, only 1, 2, or 3 days before), but in validation and primary plots, there may be an equal likelihood of hatch or predation for eggs of undetermined status (up to 7 days separated the last pre-hatch visit from the hatch or post-hatch visit).

Nest Data: Dynamic

On each nest visit, the presence or absence of the male and female goose was determined as the observer approached the nest. If the female flushed from the nest, the observer paced the distance to the nest, and recorded the flushing distance to the nearest meter. If the male was present at or near the nest, the observer estimated the distance of the male from the nest. When it was uncertain if the male and/or female were present as the observer approached, both presence and flushing distance were recorded as undetermined. If adult bird(s) were not observed, the species was determined from down feathers and/or eggs in the nest. If neither down, eggs, or adult birds were observed, the species was listed as undetermined.

On the first nest visit, a wooden tongue depressor (TD) was labelled with a unique, sequential nest number, and the TD was inserted under the north side of the nest bowl (toward the site of

Pimute fishing camp, which is an easily recognizable landmark on the north side of the Bay). The nest location was marked on an aerial photo, and the nest number was written with a permanant marker on a small (5x8 cm) red plastic flag. The flag was placed 3 m north of the nest (toward Pimute). Where brant nests were dense, a single flag was used to mark 2-5 nests. Any eggs present were labelled with the nest number, and with an egg number, using a permanant marker. The darkest (most heavily stained) egg was assigned egg number 1, with successively lighter colored eggs receiving sequentially higher numbers. On each egg, the nest number appeared first, followed by a dash, and then the egg number (100-1 meant the first egg in nest 100). On subsequent visits, eggs that were added to the clutch between visits were labeled. If an egg(s) had been depredated between visits, the egg numbers originally assigned to the depredated egg(s) were not reused; each egg received a unique, sequential number.

For each nest visit, the arrival and departure times were recorded from a stop or wrist watch. All activities at the nest (including the recording of static data and taking egg photographs) were included in the handling times. All remaining dynamic data was always recorded relative to conditions that existed at the nest on the previous visit.

Nest status was recorded as either undisturbed or depredated. Biological depredation was recorded when evidence of animal predation existed (broken egg shells from gulls or jaegars, or disappearance with no trace, which indicated fox predation), or when an egg(s) appeared to have been kicked out of the nest by the goose, and was left unattended. Environmental depredation was coded if a storm or a high tide had caused loss of egg(s).

Nest stage was coded with higher values representing more advanced combinations of nest bowl, grass, down, eggs, goslings, detached membranes, and predated eggs. When more than 1 code was applicable, the highest numbered of these was used. Total number of eggs was recorded and partitioned between numbers of unhatched, addled, and pipping eggs. Incubation stage and method of staging was recorded next. Only laying sequence and direct observation of hatch were used to stage eggs. When one of these methods was not available, incubation stage was recorded as undetermined, and method of staging was none employed. Egg karma was recorded was undisturbed when there was no evidence of depredation at the nest. Occurrence of addled eggs, embryonic mortality, predated eggs, pipping eggs, or detached membranes resulted in higher codes. When more than 1 code applied, the highest code was recorded.

On any visit where depredaton had occurred, the number of eggs lost and the source of mortality was recorded. All missing eggs were assummed to have been predated (except during hatch and post-hatch visits, when eggs lost was coded as undetermined). If predation was evident on the first visit to a nest, the minimum number of eggs known to have been lost (based on broken egg shells or shell fragments) was recorded. If on the first visit there was no trace of eggs, but the nest contained abundant down (indicating that egg(s) had been present), the number of eggs lost was entered as undetermined. For these cases, source of mortality was entered as unknown fox, provided that fox tracks had been observed in or near the sample plot, and/or that fox cached eggs had been found in or near the plot. If neither tracks nor cached eggs were found, source of mortality was entered as undetermined.

For predated eggs which were nearly or actually broken in two, the source of mortality was entered as gull. Predated eggs with a single hole or hole had source of mortality coded as jaegar, and shells from bird predated eggs which had been broken into fragments (likely by subsequent activity of geese around the nest) had source of mortality coded as avian.

The last dynamic data recorded was for the number of goslings and detached membranes present. If a gosling was observed in the nest, one of the detached membrane present (if any) was not tallied; a membrane was recorded only when there was not a gosling present to account for it (M. L. Wege, pers. comm.).

Nest Initiation

Initiation dates were determined in calibration plots for nest where the laying sequence was observed, and in all sample plots by back-dating for observed hatch days. Incubation periods were assumed to be 22 days for brant, 23 days for emperors, and 26 days for cacklers and white-fronts. For all species, it was assumed that 1 egg was laid per day, up to 4 days, with 1 day skipped for clutches of 5 or more (M. L. Wege, pers. comm.). Nest initiation dates were compared between sample plots and between nest locations.

Clutch Size Determination

Nests in calibration plots for which the laying sequence was observed were used to calculate complete clutch size. For these nests, the number of eggs observed increased between at least 2 consecutive visits. All other nests in calibration plots, and all nests in validation and primary plots were used to calculate incomplete clutch size.

Hatch Date Determination

Expected hatch dates were calculated for nests in calibration plots for which the laying sequence was observed. Incubation was assumed to begin on the day the last egg was laid. Incubation periods stated above were used to calculate expected hatch day.

Observed hatch day was recorded for every nest that hatched in calibration plots, and was recorded incidentially in validation and primary plots (when the scheduled search happened to coincide with hatch for a particular nest).

Nest Success

Nest success was expressed as the percentage of all nests of known fate that hatched at least one egg. Nests which were not relocated, and where the condition of the nest did not allow determination of success, were defined with an undetermined status. Nest success was expressed by species, nest location, clutch size, and the number of pre-hatch visits.

Nest Depredation

Nest depredation was expressed by estimating the average number of eggs remaining in the nest at the end of incubation, and comparing it with clutch size. This estimate is B-C/Bn, where B = the total number of eggs observed in all nest, C = the minimum number of eggs known to have been lost from all nests, and Bn = the total number of nests that eggs were observed in. (R. L. Garrett, pers. comm.). Nests that had eggs, but were predated before the first nest visit, are not included in the denominator, and this inflates the overall average. Nests which lost eggs during early, mid or late incubation all contribute equally to this average. This equation assumes that all eggs of undetermined status hatched, and this further inflates the average because eggs of undetermined status in validation and primary plots had a greater chance of being predated, as opposed to hatching, relative to eggs in calibration plots. This equation is further complicated by the fact that eggs known to have been predated (based on presence of shell fragments) prior to the first nest visit are included in C, but if no whole eggs were observed in any of these same nests (i.e. if they were predated before the first visit), they were not included in Bn.

Brood Size

Brood counts were made incidentially during the first week of July when habitat sampling was in progress. Broods were encountered in the large slough east of validation II, along the Bay edge near validation II, and along the old inter-tidal grass flat north of validation IV, and V (Fig. 2).

Habitat Sampling

Percent cover estimates by plant species were made at nests, using a 20 x 50 cm wooden frame. Four sets of estimates were recorded at each nest. The frame was placed first on the north side of the nest bowl, with 1 of the 20 cm edges abutting the bowl. Estimates were recorded for plants within the frame, a label was attached to the frame with the nest number and direction, and a photograph was taken of the frame, label, and plants. This procedure was repeated on the east, west, and south sides of the nest.

RESULTS

Weather

Sub-freezing temperatures were recorded each day between April 28, day 118, and May 14, day 134 (Fig. 14). Temperatures remained above freezing at all times of day between May 14 and May 19, day 139. Sub-freezing temperatures returned on May 20, and were recorded each day up to May 30, day 150. Beginning May 31 warm daytime temperatures (54-74 degrees Farenheit) prevailed (Fig. 14). The warm weather period of May 14-19 resulted in appreciable snow melt, but water and ice remained on the study area until May 24, day 144, and ice did not move out of Kokechik Bay until May 26, day 146.

Clear weather occurred between May 17-22, days 137-142, but cloudy days with occasional blowing rain or snow prevailed from May 23-29, days 143-149 (Fig. 15). Many brant that nested on the study area arrived on May 27-29, during the poor weather period. However, clear weather returned on May 30, continued uninterrupted through June 6, day 157 (Figs. 14-15), and may have provided a favorable start for the nesting season.

Snow Cover Transects

By May 22, day 142, there was greater than 50% dry land, less than 50% meltwater, and less than 10% snow cover on all transects (Fig. 16). The first potential waterfowl nest sites were available inland from Kokechik Bay about May 22-24. The Bay was filled with ice at this time (and remained so until may 26), and traditionally high density nesting sites along the edge of the Bay remained cold and partly frozen until May 27.

Chronology of Migration

Consistent (daily) sightings of cacklers and white-fronts began on May 10, day 130 (Fig. 17). A single cackler was sighted on April 30, day 120, and 2 white-fronts were seen on May 6, day 126. Daily sightings for emperors began on May 11, day 131, and for brant on May 13, day 133 (Fig. 17). Peak arrival for cacklers, white-fronts, and emperors occurred between May 11-14, days 131-134, May 11-16, days 131-134, and May 14-17, days 134-137, respectively (Fig. 17). Three distinct influxs of brant were observed: May 13-16 (days 133-136), 19-24 (days 139-144), and 27-29 (days 147-149) (Fig. 18). Few if any brant landed along Kokechik Bay from May 13-16, some birds landed in the study area between May 19-24, and many brant landed along the edge of Kokechik Bay between May 27-29.

Study Area Search

Density: A total of 1,217 nests were sampled: 1,105 brant (897 in sample plots, 208 incidentals),, 79 cacklers (76 in sample plots, 3 incidentals), 32 emperors (27 in sample plots, 5 incidentals), and 1 white-front (an incidental). Production data for brant, cacklers, and emperors are presented in Tables 1-3, respectively. Nest density varied greatly for brant throughout the study area. High densities occurred only around inland ponds containing islands, and specific areas along the edge of Kokechik Bay. The remainder of the study area supported a relatively low density of brant. Nesting densities expressed on a km^2 basis (Table 1) do not reflect general conditions for brant on the study area. Cacklers and emperors were more evenly distributed, relative to brant, and exclusive of land adjacent to the edge of the Bay, nested throughout the study area.

Nest Location: Preference for nest location cannot be evaluated for brant, because sample plots were intentionally established in the densest nesting areas. The majority of brant nests on the study area occurred on sedge-grass flats along Kokechik Bay, and on pond shorelines within 2 mile of the Bay. Highest nesting densities occurred on particular inland islands and associated pond edges, and in particular areas of sedge-grass flat. As a result, the percentage of nest locations for brant on islands (42%) in Table 4, should not be taken to represent conditions over the entire study area. Sample pots for cacklers and emperors (validation plots IV and V) were large, relative to sample plots for brant (Figs. 12-13), and probably reflect a legitimate preference for nest locations on islands and peninsulas for cacklers, and pond edges and grass flats for emperors (Table 4).

Nest Initiation: The date of nest initiation was determined for 156 nests: 131 brant, 13 cacklers, and 12 emperors (Table 5), primarily by backdating from the observed hatch day. For some nests (30 brant and 1 cackler) the laying sequence and nest initiation were observed. The beginning and peak of nest initiation appeared similar for all 3 species (Table 5). For brant and cacklers, there is an indication that nests were initiated first on islands (Table 6), which is likely because nesting sites were available on inland islands earlier than along the Bay. Nest initiation for cacklers appears to have extended slightly longer than for brant (20 vs. 16 days, respectively), and longer for both of these species than for emperors (10 days) (Tables 6 and 10).

Nest initiation dates for brant occurred 4-5 days later in calibration plot II (on Kokechik Bay, Table 8) than in calibration plots I and III (which occurred inland from the Bay, Tables 7 and 9). Initiation dates in calibration II ranged from May 27 to June 3, days 147-154 (except for a single nest on day 144) and peaked on May 30, day 150. This generally coincided with the breakup of ice in Kokechik Bay (May 26), and with the last influx of migrating brant (May 27-29) (Fig. 18). Calibration plots I and III occurred 1-2 miles inland from the Bay, where nesting habitat was available earlier than on the Bay.

For nests where the initiation date was determined, the number of nests not located during the first plot search after initiation are displayed in Tables 11-13. Most nests were found during the first search after initiation.

Clutch Size Determination

Modal complete clutch size for brant was 3 or 4 eggs (Table 14), while modal incomplete clutch size was 3 eggs (Table 15). Incomplete clutches of 4 or more eggs were common in calibration I, less common in calibration III, and relatively few in calibration II (Table 15). Modal incomplete clutch sizes in validation and primary plots were less than in calibration plots (2 vs. 3 eggs, respectively) (Table 15), and this likely resulted from a greater length of time for depredation to occur in validation and primary plots (first visit at or after mid-incubation) relative to calibration plots (first visit at initiation of incubation).

Modal incomplete clutch sizes were equal for cacklers and emperors (6 eggs), but clutches tended to be larger for emperors (range of 3-11 eggs) relative to cacklers (range 1-8 eggs) (Tables 16-17). This likely resulted from dump nesting, which was observed more frequently for emperors than for cacklers.

Most complete clutches for brant were observed on islands (Tables 18-20). Only a single complete clutch was observed for cacklers (Table 21). Nest initiation dates for complete brant clutches occurred primarily between May 26-June 1 (Table 22).

Hatch Date Determination

The period of hatch in calibration plots was 11 days for brant (June 16-26, days 167-177) and the peak of hatch occurred over 5 days (June 19-23, days 170-174), when over 70% of observed hatches occurred (Table 23). The range of hatch dates for brant in validation and primary plots was longer (18 days, June 16-July 4, days 168-185), than in calibration plots (11 days), but this was due primarily to a single nest in validation II which hatched on July 4, day 185 (Table 24).

Peak of hatch for cacklers and emperors was around June 21, day 172, but range of hatch dates appeared to be later and longer for cacklers (June 20-July 4, days 171-185, 15 days) than for emperors (June 17-21, days 168-172, 5 days) (Table 24). However, sample sizes are small (10 cacklers and 9 for emperors) and firm conclusions should not be made from these data.

Nest Success

Nest success varied greatly for brant depending on nest location. Island nests were most successful for brant: 41% of all island nests sampled were successful, while less than 10% of nests at all other locations hatched (Table 25). Islands in calibration plots I and II, and in validation plot II did not afford the same protection from fox predation as did islands in calibration III, validation plots I and III, and primary plot III. Islands in calibration I and II and in validation II occurred in ponds which totally or partially dried up during the nesting season, and were exposed to fox predation at hatch (calibration I), or throughout the nesting season (calibration and validation II). These islands had lower nest success (10-30%) than islands in calibration III, validation I and III, and primary III (43-58%) (Table 25).

The total nesting success for brant (22%) in Table 25 is inflated because of sample plots on inland islands: over 40% (345 of 809) of all brant nests in sample plots were located on islands, but of all brant nests occurring on the study area, it is estimated that less than 10% occurred on inland islands. Nesting success on peninsulas and "other" nest locations (8% and 7% respectively) is more representitive for the study area as a whole than is the value of 22% (Table 25).

Nesting success was highest for cacklers and emperors on islands (81% and 100%) respectively). Nests on peninsulas had lower success (52% for cacklers and 50% for emperors) than nests on pond edges and grass flats (63% for cacklers and 88% for emperors). Overall, emperors had the highest nesting success (86%), followed by cacklers (65%), and brant (22% or less) (Table 25).

Nest Depredation

The majority of egg loss in sample plots was caused by animal predation (Table 26). Arctic and red fox (*Vulpes lagopus* and *V. vulpes*) were responsible for more than half of the animal predation, with gull and then jaegar predation accounting for the remaining egg loss.

Egging by natives did not occur in sample plots, nor did storm tides or other environmental forces cause any apparent egg loss. Occurrence of addled eggs was minimal (Table 27), as was nest abandonment prior to hatch. All but 1 nest listed as abandoned in Table 27 had 1 or more eggs left in the nest after hatch; only 1 nest with eggs was abandoned prior to hatch in calibration plots.

In calibration II, over 90% of all nests had been totally predated by June 12, day 163. In calibration I, 88% of all nests had been totally predated by June 18, day 169. Mammalian and avian predators were active in calibration I and II, but in calibration III all predation was avian, and occurred at a relatively constant rate throughout the nesting season (Scanlon, unpubl. data).

It was unclear if animal predation increased with increasing numbers of pre-hatch visits (Tables 28-32). It was also unclear if complete clutches had any relationship to hatching success (Tables 33-34).

Subsistence Activities

Between May 1-12, days 121-132, 23 parties of natives visited the camp (a total of 42 people in groups of 1, 2, or 3), and all but one of these parties were hunting. Most had their guns with them when they came into camp, but a few left their guns outside of camp. Natives were hunting willow ptarmigan (*Lagopus lagopus*) during the first week of May, then turned to hunting sandhill cranes (*Grus canadensis*).

The number of shots heard per day increased from less than 10 (May 5-11) to 10-133 (May 12-22), then dropped to 0 (May 23-29) when snow machine travel was no longer possible. The fish camp at Pimute was in operation from May 30-June 5, and 30-80 shots were heard on each of these days. From June 6 until the end of the sampling season (July 9), few or no shots were heard on any given day.

Two incidents of egging were observed, on June 3 and 4. On June 3, 8 people, each with a single bucket, were taking eggs from nests to the west of validation IV (Fig. 2). Egging went on for 45 minutes, between 2300-2345 hours. At this same time, egging also occurred 10 km to the east, near Camp Lake (M. R. Petersen, pers. comm.). On June 4, 3 people were egging for 1 hour, at the same time and in the same place as the previous day. The eggers were likely from the Pimute fish camp.

Brood Size

For 48 broods observed between June 22, day 173, and July 4, day 185, emperors had the largest number of goslings per brood ($\bar{x} = 3.8 \pm 0.5$, n = 18), followed by cacklers $\bar{x} = 3.6 \pm 0.4$, n = 9), and brant ($\bar{x} = 3.0 \pm 0.4$, n = 20) (Fig. 19). Adult birds of all three species appeared to move from nesting areas to the sloughs, and then down the sloughs to the mudflats along the edge of Kokechik Bay.

Habitat Sampling

Percent cover estimates by species, and photographs were collected at 100 brant nests (50 along Kokechik Bay, and 50 on an inland island), 50 cackler nests, and 32 emperor nests. There was no analysis planned or accomplished for these data.

General habitat descriptions for sample plots are as follows: calibration, validation, and primary I, mostly grass-sedge meadow with some small pingos; calibration, validation, and primary II, exclusively sedge-grass meadow; calibration, validation, and primary III, exclusively grass-sedge meadow; validation IV and V, a mixture of grass-sedge and sedge-grass meadow, small and large pingos, and hippirus marsh.

DISCUSSION

Nest Initiation

The presence of ice in Kokechik Bay delayed nest initiation there (at calibration II) for brant by 4-5 days, relative to inland areas (calibration I and III) (Tables 7-9). A few brant nests with 0, 1, or 2 eggs each were found along the Bay on May 25, day 145 (a total of 5 nests in about 2 ha), but these nests were solitary; peak of nest initiation did not occur along the Bay until after the ice went out (May 26, day 146) and until after the largest arrival of migrating brant (May 27-29). It appeared that brant arrived along the Bay and initiated nests 1-3 days later, based on arrival dates of May 27-29, and back-calculated initiation dates which peaked on May 30 in calibration II (Table 8). The solitary, early nesting brant observed along the Bay are represented in calibration II by a single nest which was initiated on May 24, day 144 (Table 8).

Nest initiation at calibration I (inland from the Bay) began by May 20, day 140, and peaked on May 25, day 145 (Table 7); these brant likely arrived on the study area during the influx of May 19-24 (Fig. 18). On the inland island at calibration III, nest initiation began by May 22, day 142, and peaked on May 26-27, days 146-147, just 2 days later than in calibration I. It seems likely that birds nesting at calibration III (which was the most productive spot for brant on the study area) also arrived during the influx of May 19-24 (Fig. 18). These birds may have selected the inland island nesting sites over all other locations, or they may have selected the islands as an alternative nesting site after finding frozen conditions along the edge of Kokechik Bay upon their arrival.

The islands used for nesting by brant in calibration I (Brant Island, and subplots c and j, Fig. 3), which contained a total of 93 nests in a total of about 0.3 ha, were not used by brant in 1983 (William Tinker, pers. comm.). The 0.7 ha island at calibration III (Fig. 5), has historically been used by nesting glaucous gulls (*Larus hyperoreus*), and in 1972 had 29 gull nests, only 26 brant nests, and 4 common eider (*Somateria mollissima*) nests (Strang 1976). In 1984 there were 34 gull nests, about 200 brant nests (95 of which were included in calibration III), and 8 eider nests on the island. In 1982 and 1983, brant nests were not counted on the island, but nesting birds were observed, and density appeared high (M. R. Petersen, pers. comm.). It seems possible that, as brant populations declined, the birds were unable to maintain sufficiently dense colonies for self-protection in the traditional nesting areas along Kokechik Bay, and certain birds established smaller colonies on inland islands, which afforded better protection.

Human Disturbance

The impact of human disturbance (from nest sampling) on depredation from brant nests cannot be determined from available data. The field crew witnessed predation by jaegars and gulls during visits to calibration plots, but the degree of predation beyond that occurring in an undisturbed area is unknown. Depredation in validation and primary plots cannot be directly compared with calibration plots because numbers of nests and area sampled were progressively less for calibration, validation, and primary plots, respectively (Table 1).

Calibration plots occurred among the most extensive concentrations of nesting brant, and because brant rely on a colonial nesting habit to discourage predators, it is possible that brant in these sample plots would not be as subject to predation coinciding with human disturbance as would brant in validation and primary plots.

It did not appear that human activity during nest sampling caused nest abandonment; only a single brant nest (a grass lined bowl with 1 egg and no down) was abandoned prior to hatch in calibration plots. The greatest impact of human disturbance appeared to be opportunistic gull and jaegar predation. Gulls would circle overhead constantly during sampling, and while the presence of humans was enough to deter them from predating eggs while sampling was in progress, predation subsequent of field personnel's departure from the sample plots was not determined. Once hatch was initiated, gulls would take goslings which had left nests disturbed by sampling. Jaegars appeared more aggressive than gulls when nests had eggs, and would occasionally predate eggs at nests within the plot during sampling.

Whole eggs, pipping eggs, or goslings that were left at a nests when adults and dry goslings deserted during sampling were placed in nearby brant nests which did not yet have dry goslings. Adults usually did not return to nests if 1 or more goslings had not left the nest with them. All whole eggs, piping eggs, and goslings moved were adapted successfully.

The excessive amount of fox predation complicates any attempt to evaluate human impact on predation. Many brant nests (exclusive of islands) in calibration I and II had abundant down in an undisturbed bowl, but contained no eggs on the first, and on all subsequent visits (41 and 45 nests, respectively). There were no shell fragments at these nests, and they were assumed to have been fox-predated based on their undisturbed appearance, the presence of fox prints and fox cached eggs in or near the plots, and an occasional egg shell with tooth punctures which suggested fox.

As of the first plot visit, there were 41 fox-predated nests in calibration I and 45 fox-predated nests in calibration II. As of the second plot visit, an additional 60 nests had been fox predated in calibration I (for a total of 101), and an additional 20 nests had been fox predated in calibration II (for a total of 65). After the third plot visit, 7 additional nests were fox-predated in calibration I (a total of 108), and an additional 28 nests were fox-predated in calibration II (a total of 93). Prior to the initiation of hatch, 100% of non-island nests in calibration I, and 94% of all nests in calibration II had been totally predated (a combination of fox, avian, and undetermined predators) (Scanlon, unpubl. data). It is unknown if human scent at nests in sample plots is correlated with fox predation.

While these data indicate that predation by foxes was devastating to brant populations at Kokechik Bay, the authors feel that studies addressing fox predation on geese should not take priority over studies addressing human impacts on goose populations. Additionally, management actions directed at reducing fox populations should not be undertaken without quantifying human predation and taking steps to eliminate it.

Nest Distribution

Within the study area, brant nested along the entire 16 km edge of Kokechik Bay, and up to 3.5 km inland from the Bay. Nests were not dense throughout most of this area (occassionally 2-3 m between nests, but more often 10-20 m or more), and very few nests occurred toward the west end of the Bay. The only exceptions to this general trend were at particular inland islands. Most brant nested on sedge-grass flats, pond edges, and peninsulas within 2-3 km of the Bay. Only a small percentage of brant on the study area used inland islands like those in calibration plots I and III, yet these were by far the most successful nesters.

Average nest density for brant throughout the study area is probably slightly more than the 1,200 and 1,531 nests/km2 observed in calibration II and validation II (Table 1). The concentration of nesting brant at primary II (5,426/km^2) did not extend far beyond the bounds of the sample plot, and was an exception to the generally less dense pattern of nest distribution along the Bay. The high densities associated with islands in calibration, validation, and primary III (23,750/km^2, 11,008/km^2, and 7,056/km^2, respectively) were very much the exception rather than the rule (Table 1).

Average nests densities for cacklers and emperors are probably slightly less than the values of 121/km^2 and 106/km^2 for cacklers, and 44/km^2 and 20/km^2 for emperors in validation IV and V, respectively (Tables 2 and 3). These densities are probably slightly inflated because the locations of validation IV and V (the 2 cackler plots were selected after we observed that cacklers appeared more abundant in this region than in other parts of the study area. Even though cacklers seemed to prefer island nesting sites (Table 4), there were islands within validation plots IV and V without nests of any species. The declining numbers of geese on the YDNWR may have reduced competition for nest sites.

MANAGEMENT RECOMMENDATIONS

Data Gathering

1) Continue pre-season training workshops. Require that all field people (specially natives) attend the training session, and place major emphasis on mock nest sampling, and plot location selection. A concise written summary of techniques should be distributed to all camps.

2) Discontinue calibration and primary plots, and use only validation plots. Establish 3 validation plots in high density nesting areas for brant, 3 in medium density nesting areas, and 3 in low density nesting areas, for a total of 9 brant sample plots (the same as this year : 3 calibration, 3 validation, and 3 primary). This will allow comparison of nest success and depredation between all plots, and will avoid disturbing nests at hatch, which results in predation, and should be avoided for goose species such as brant and cacklers with tenious population levels.

3) Continue the 2 cackler plots (validation IV and V) at the same locations.

4) Discontinue collecting flushing distances, nest handling time, and egg karmas. These data are unnecessary and divert attention from nest success and depredation.

5) Discontinue subplot establishment. Establishing easily repeated sub-units within plots was difficult, and detracted from the basic goal of locating a minimum number of nests with eggs.

6) Discontinue habitat sampling in its present form.

7) Do not collect any data for which a method of analysis has not been outlined.

8) Move the campsite to the next large pingo to the south of this year's campsite. This will allow access to the camp by float plan (which was sadly lacking this year), and maintain access by boat to the large slough near this years campsite.

9) Devote additional time to a standardized sampling of broods. This is the most important data to be monitored. Knowledge of nest success will be provided by recommendation 2 above, and supplimenting this with knowledge of brood size will provide a more complete picture of goose production on the YDNWR than is obtained under the present sampling scheme.

Data Recording

1) Standardize field books between camps.

2) Re-design coding sheets for transcribing field data; use one continuous line on a coding sheet for data at a particular nest. As many as 4 seperate coding sheets had to be used this year to enter a single line of data, which led to errors and frustration.

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Table 1. Production data for Pacific black brant at Kokechik Bay, 1984.

Category	Plot								
	Calibration			Validation			Primary		
	I	II	III	I	II	III	I	II	III
Number of nests located	222	223	95	52	132	43	39	76	24
Number of nests for which status was determined	213	210	89	48	102	37	34	52	24
Number of nests/km^2	1,554	1,200	23,750	3,250	1,531	11,008	2,168	5,426	7,056
Number of nests/mi^2	4,018	3,100	61,540	8,387	3,973	28,466	5,616	14,060	15,360
Average size of "complete" clutch	4.4(18)[a] ±1.8[b]	2.9(7) ±0.9	4.6(5) ±2.0	--	--	--	--	--	--
Average number of eggs/nest at the end of incubation[c]	0.7(115)	0.2(124)	1.5(89)	2.1(18)	1.5(69)	1.7(36)	2.9(25)	2.0(57)	2.1(17)
Average egg loss from nests that lost eggs	3.4(105)	2.1(120)	2.0(59)	2.5(6)	1.8(35)	1.8(20)	2.5(2)	2.8(16)	1.2(5)
Average size of clutch that hatched[d]	2.7(26)	2.7(6)	2.5(50)	2.9(13)	2.1(17)	2.9(16)	3.3(18)	2.8(18)	2.7(13)
Average number of goslings hatched per nest[e]	0.4	0.1	1.4	0.7	0.8	1.4	1.9	1.5	1.5
Percent of successful nests	12.1	2.9	56.2	27.1	16.7	43.2	52.9	34.6	54.2

[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.L. 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.L. 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 prescribed by R.L. Garrett (pers. comm.).

Table 2. Production data for cackling Canada geese at Kokechik Bay, 1984.

	Plot								
	Calibration			Validation			Primary		
Category	I	II	III	I-III	IV	V	I	II	III
Number of nests located	4	0	0	0	25	47	0	0	2
Number of nests for which status was determined	4				25	47			2
Number of nests/km^2	28				121	106			522
Number of nests/mi^2	72				315	275			1280
Average size of "complete" clutch	7.0(1)[a]				—[b]	--			—
Average number of eggs/nest at the end of incubation[b]	4.5(4)				3.8(21)	3.7(34)			5.0(2)
Average egg loss from nests that lost eggs	1.0(2)				3.3(8)	2.1(10)			—(0)
Average size of clutch that hatched[c]	6.0(4)				4.7(17)	4.3(29)			5.0(2)
Average number of goslings hatched per nest[d]	4.5				3.2	2.7			5.0
Percent of successful nests	75.0				68.0	61.7			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.L. 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.L. 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 prescribed by R.L. Garrett (pers. comm.).

Table 3. Production data for emperor geese at Kokechik Bay, 1984.

Category	Plot								
	Calibration			Validation			Primary		
	I	II	III	I	IV	V	I	II	III
Number of nests located	4	0	0	4	9	9	2	0	0
Number of nests for which status was determined	4			4	9	9	2		
Number of nests/km^2	28			250	44	20	111		
Number of nests/mi^2	72			645	113	53	288		
Average size of "complete" clutch	NA[a]			—	—	—	—		
Average number of eggs/nest at the end of incubation[c]	3.3(4)[b]			7.5(2)	5.4(9)	5.8(9)	5.5(2)		
Average egg loss from nests that lost eggs	3.5(2)			1.0(1)	2.5(2)	3.0(2)	—(0)		
Average size of clutch that hatched[d]	4.3(3)			7.5(2)	6.1(8)	5.8(9)	5.5(2)		
Average number of goslings hatched per nest[e]	3.25			3.8	5.4	5.8	5.5		
Percent of successful nests	75.0			50.0	88.9	100.0	100.0		

[a] NA = not applicable, no complete clutches sampled.

[b] Figures in parentheses are sample sizes.

[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.L. 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.L. 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 prescribed by R.L. Garrett (pers. comm.).

Table 4. Nest site locations for geese in sample plots at Kokechik Bay, 1984.

Species Plot	Nest Location: Island		Peninsula		Other[a]		Total	
BRANT:								
Calibration I	93	(42)[b]	44	(20)	85	(38)	222	(100)
Calibration II	45	(20)	17	(8)	160	(72)	222	(100)
Calibration III	95	(100)	0	(0)	0	(0)	95	(100)
Validation I	28	(54)	18	(35)	6	(16)	52	(100)
Validation II	15	(12)	16	(13)	93	(75)	124	(100)
Validation III	43	(100)	0	(0)	0	(0)	43	(100)
Primary I	36	(92)	2	(5)	1	(3)	39	(100)
Primary II	1	(1)	10	(13)	65	(86)	76	(100)
Primary III	24	(100)	0	(0)	0	(0)	24	(100)
Subtotal	380	(42)	107	(12)	410	(46)	897	(100)
CACKLER:								
Calibration I	2	(50)	2	(50)	0	(0)	4	(100)
Validation IV	13	(52)	6	(24)	6	(24)	25	(100)
Validation V	9	(19)	17	(36)	21	(45)	47	(100)
Primary III	2	(100)	0	(0)	0	(0)	2	(100)
Subtotal	26	(33)	25	(32)	27	(35)	78	(100)
EMPEROR:								
Calibration I	0	(0)	0	(0)	4	(100)	46	(100)
Validation I	1	(33)	1	(33)	1	(33)	3	(100)
Validation IV	1	(11)	0	(0)	8	(89)	9	(100)
Validation V	1	(11)	0	(0)	8	(89)	9	(100)
Primary I	0	(0)	0	(0)	2	(100)	2	(100)
Subtotal	3	(11)	1	(7)	23	(82)	27	(100)
Total	409	(41)	133	(13)	460	(46)	1002	(100)

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

[b] Number in parentheses are percentages.

Table 5. Nest initiation dates for Pacific black brant, cackling Canada geese, and emperor geese at Kokechik Bay, 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 I	0	0	0	0	0	0	0	1	1	2	4	4	9	3	4	6	1	1	1	1	0	1	0	0	0	0	0	0	39
Calibration I	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1	3	10	1	2	1	2	0	0	0	0	0	0	22
Calibration III	0	0	0	0	0	0	0	0	0	1	0	2	5	12	11	6	7	3	4	1	0	0	0	0	0	0	0	0	52
Validation I	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	3
Validation II	0	0	0	0	0	0	0	0	0	0	0	0	1	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	4
Validation III	0	0	0	0	0	0	0	0	1	0	1	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	4
Primary I	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	4
Primary 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
Primary III	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	0	2
Subtotal	0	0	0	0	0	0	0	1	2	3	5	7	18	17	24	13	11	14	6	4	2	4	0	0	0	0	0	0	131
CACKLERS:																													
Calibration I	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	3
Validation IV	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
Validation V	0	0	0	0	0	0	1	1	1	0	0	3	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	8
Primary III	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
Subtotal	0	0	0	0	0	0	1	1	1	0	1	4	0	1	0	0	2	0	0	0	0	0	0	1	0	1	0	0	13
EMPERORS:																													
Calibration I	0	0	0	0	0	0	0	0	1	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
Validation I	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	1
Validation V	0	0	0	0	0	0	1	1	0	1	0	1	0	0	2	1	0	0	0	0	0	0	0	0	0	0	0	0	7
Primary I	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	1
Subtotal	0	0	0	0	0	0	1	1	2	1	1	1	1	1	2	1	0	0	0	0	0	0	0	0	0	0	0	0	12
TOTAL	0	0	0	0	0	0	2	3	5	4	7	12	19	19	26	14	13	14	6	4	2	4	0	1	0	1	0	0	156

Table 6. Initiation dates by nest location for Pacific black brant, cackling Canada geese, emperor geese and Pacific white-fronted geese at Kokechik Bay, 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
BRANT:																														
Island	0	0	0	0	0	0	0	0	1	2	3	6	7	16	17	13	13	9	5	6	2	1	4	1	0	0	0	0	0	109
Peninsula	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	4
Other	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	2	0	2	9	0	1	1	0	0	0	0	0	0	0	16[a]
Subtotal	0	0	0	0	0	0	0	0	1	2	3	7	7	18	17	19	13	11	14	6	4	2	4	1	0	0	0	0	0	129
CACKLERS:																														
Island	0	0	0	0	0	0	0	1	1	0	0	1	1	0	1	0	0	1	0	0	0	0	0	0	1	0	0	0	0	7
Peninsula	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	3
Other	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	1	0	0	3
Subtotal	0	0	0	0	0	0	0	1	1	1	0	1	4	0	1	0	0	2	0	0	0	0	0	0	1	0	1	0	0	13
EMPEROR:																														
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	1	1	2	1	1	1	1	1	2	1	0	0	0	0	0	0	0	0	0	0	0	0	12
Subtotal	0	0	0	0	0	0	0	1	1	2	1	1	1	1	1	2	1	0	0	0	0	0	0	0	0	0	0	0	0	12
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	0	0	0	0	1	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	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
TOTAL	0	0	0	0	0	0	0	2	3	5	4	9	13	19	19	21	14	13	14	6	4	2	4	1	1	0	1	0	0	154

[a] One nest was initiated on Julian Day 162.

Table 7. Initiation dates by nest location for Pacific black brant, cackling Canada geese, and emperor geese in calibration plot I at Kokechik Bay, 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
BRANT:																														
Island	0	0	0	0	0	0	0	0	1	1	2	4	4	9	3	4	6	1	1	1	1	0	1	0	0	0	0	0	0	39
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	1	1	2	4	4	9	3	4	6	1	1	1	1	0	1	0	0	0	0	0	0	39
CACKLERS:																														
Island	0	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
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	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	1	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	3
EMPEROR:																														
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	0	1	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
Subtotal	0	0	0	0	0	0	0	0	0	1	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
TOTAL	0	0	0	0	0	0	0	0	1	2	2	5	4	10	5	4	6	2	1	1	1	0	1	0	0	0	0	0	0	45

Table 8. Initiation dates by nest location for Pacific black brant geese in calibration plot II at Kokechik Bay, 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
BRANT:																														
Island	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	1	1	1	0	0	2	0	0	0	0	0	0	7
Peninsula	0	0	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	1
Other	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	2	9	0	1	1	1	0	0	0	0	0	0	14
TOTAL	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1	3	10	1	2	1	2	0	0	0	0	0	0	22

Table 9. Initiation dates by nest location for Pacific black brant geese in calibration plot III at Kokechik Bay, 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
BRANT:																														
Island	0	0	0	0	0	0	0	0	0	0	1	0	2	5	12	11	6	7	3	4	1	0	0	0	0	0	0	0	0	52
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
TOTAL	0	0	0	0	0	0	0	0	0	0	1	0	2	5	12	11	6	7	3	4	1	0	0	0	0	0	0	0	0	52

Table 10. Initiation dates by nest location for Pacific black brant, cackling Canada geese, and emperor geese in validation plots I-V at Kokechik Bay, 1984.

Species Nest Location	Julian day																													
	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	161	162	Total
BRANT:																														
Island	0	0	0	0	0	0	0	1	0	1	0	2	1	0	0	0	0	0	0	1	1	1	0	0	0	0	0	0	0	8
Peninsula	0	0	0	0	0	0	0	0	0	1	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
Other	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	2
Subtotal	0	0	0	0	0	0	0	1	0	2	0	2	1	3	0	0	0	0	0	1	1	1	0	0	0	0	0	0	1	13
CACKLERS:																														
Island	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	3
Peninsula	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	0	0	0	0	2
Other	0	0	0	0	0	0	1	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	5
Subtotal	0	0	0	0	0	1	1	1	0	0	4	0	0	0	0	1	0	0	0	0	0	0	1	0	1	0	0	0	0	10
EMPERORS:																														
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	1	1	1	1	0	1	0	0	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8
Subtotal	0	0	0	0	0	1	1	1	1	0	1	0	0	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8
TOTAL	0	0	0	0	0	2	2	3	1	2	5	2	1	5	1	1	0	0	0	1	1	1	1	0	1	0	0	0	1	31

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

	Successive Search		Number of nests initiated since last search		
Species	Number	Julian Day	Located	Not Located	Total
Brant	1	149	36	0	36
	2	152	2	0	2
	3	155	1	0	1
	Total		39	0	39
Cackler	1	149	1	1	2
	2	152	0	1	1
	3	155	0	0	0
	Total		1	2	3
Emperor	1	149	1	2	3
	2	152	0	0	0
	3	155	0	0	0
	Total		1	2	3

[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 Kokechik Bay, 1984.

Species	Successive Search Number	Successive Search Julian Day	Number of nests initiated since last search: Located	Not Located	Total
Brant	1	151	16	1	17
	2	154	5	0	5
	Total		21	1	22

[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 Kokechik Bay, 1984.

Species	Successive Search Number	Successive Search Julian Day	Number of nests initiated since last search: Located	Not Located	Total
Brant	1	153	48	4	52
	2	156	0	0	0
	3	159	0	0	0
	Total		48	4	52

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

Table 14. Frequency of clutch size from "complete" clutches for Pacific black brant and cackling Canada geese, in calibration plots at Kokechik Bay, 1984.

	Clutch Size									
Plot	1	2	3	4	5	6	7	8	9	Total
BRANT:										
Calibration I	0	1	6	4	3	0	3	1	0	18
Calibration II	0	3	2	2	0	0	0	0	0	7
Calibration III	0	1	0	2	0	1	1	0	0	5
Subtotal	0	5	8	8	3	1	4	1	0	30
CACKLERS:										
Calibration I	0	0	0	0	0	0	1	0	0	1
Subtotal	0	0	0	0	0	0	1	0	0	1
TOTAL	0	5	8	8	3	1	5	1	0	31

Table 15. Frequency of clutch size from "incomplete" clutches for Pacific black brant in sample plots at Kokechik Bay, 1984.

Plot	Clutch Size U	1	2	3	4	5	6	7	8	9	10	11	Total
Calibration I	0	12	15	22	22	12	3	4	3	1	1	1	96
Calibration II	0	34	40	34	3	3	1	0	0	0	0	0	115
Calibration III	0	20	16	29	11	3	2	2	1	0	0	0	84
Subtotal	0	66	71	85	36	18	6	6	4	1	1	1	295
Validation I	0	3	4	4	6	1	0	0	0	0	0	0	18
Validation II	0	14	27	13	9	3	1	0	0	0	0	0	67
Validation III	0	3	6	13	6	2	0	0	0	0	0	0	30
Subtotal	0	20	37	30	21	6	1	0	0	0	0	0	115
Primary 1	0	3	5	5	7	4	0	0	0	0	0	0	24
Primary 2	0	5	19	18	12	2	1	0	0	0	0	0	57
Primary 3	0	1	6	4	2	1	0	0	0	0	0	0	14
Subtotal	0	9	30	27	21	7	1	0	0	0	0	0	95
Total	0	95	138	142	78	31	8	6	4	1	1	1	505

[a] "Incomplete" indicates that the nuber 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 in sample plots at Kokechik Bay, 1984.

Plot	Clutch Size U	1	2	3	4	5	6	7	8	9	Total
Calibration I	0	1	0	0	0	0	2	0	0	0	3
Subtotal	0	1	0	0	0	0	2	0	0	0	3
Validation IV	0	1	2	1	0	6	10	1	0	0	21
Validation V	0	2	4	5	7	8	6	1	1	0	34
Subtotal	0	3	6	6	7	14	16	2	1	0	55
Primary III	0	0	0	0	0	2	0	0	0	0	2
Subtotal	0	0	0	0	0	2	0	0	0	0	2
Total	0	4	6	6	7	16	18	2	1	0	60

[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 in sample plots at Kokechik Bay, 1984.

	Clutch Size												
Plot	U	1	2	3	4	5	6	7	8	9	10	11	Total
Calibration I	0	0	0	0	2	0	2	0	0	0	0	0	4
Subtotal	0	0	0	0	2	0	2	0	0	0	0	0	4
Validation I	0	0	0	0	0	0	1	0	0	0	1	0	2
Validation IV	0	0	0	3	1	0	1	0	2	1	1	0	9
Validation V	0	0	0	1	2	1	1	1	1	0	1	1	9
Subtotal	0	0	0	4	3	1	3	1	3	1	3	1	20
Primary I	0	0	0	0	1	0	0	1	0	0	0	0	2
Subtotal	0	0	0	0	1	0	0	1	0	0	0	0	2
Total	0	0	0	4	6	1	5	2	3	1	3	1	26

[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 "complete" clutches by nest location for Pacific black brant in calibration plot I at Kokechik Bay, 1984.

Clutch Size	Nest Location: Island	Peninsula	Other[a]	Total
1	0	0	0	0
2	1	0	0	1
3	6	0	0	6
4	4	0	0	4
5	3	0	0	3
6	–	0	0	0
7	3	0	0	3
8	1	0	0	1
9	0	0	0	0
Mean ± S.E.	4.4±0.4 (18)[b]	0	0	4.4±0.4 (18)

[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 19. Frequency of clutch size from "complete" clutches by nest location for Pacific black brant in calibration plot II at Kokechik Bay, 1984.

	Nest Location			
Clutch Size	Island	Peninsula	Other[a]	Total
1	0	0	0	0
2	1	0	2	3
3	0	1	1	2
4	1	0	1	2
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.	3.0±1.5 (2)[b]	3.0 (1)	2.8±0.5 (4)	2.9±0.3 (7)

[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 20. Frequency of clutch size from "complete" clutches by nest location for Pacific black brant in calibration plot III at Kokechik Bay, 1984.

	Nest Location			
Clutch Size	Island	Peninsula	Other[a]	Total
1	0	0	0	0
2	1	0	0	1
3	0	0	0	0
4	2	0	0	2
5	0	0	0	0
6	1	0	0	1
7	1	0	0	1
8	0	0	0	0
9	0	0	0	0
Mean ± S.E.	4.6±0.9 (5)[b]	0	0	4.6±0.9 (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 21. Frequency of clutch size from "complete" clutches by nest location for cackling Canada geese in calibration plot I at Kokechik Bay, 1984.

Clutch Size	Nest Location			Total
	Island	Peninsula	Other[a]	
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	0	0	0	0
7	1	0	0	1
8	0	0	0	0
9	0	0	0	0
Mean ± S.E.	7.0 (1)	0	0	7.0 (1)

[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 22. Nest initiation dates by clutch size from "complete" clutches for Pacific black brant at Kokechik Bay, 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	2	0	2	0	1	0	0	0	0	0	0	5
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	0	1	2	1	1	0	0	0	0	0	0	8
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	1	1	1	1	0	0	0	0	0	0	0	0	0	8
5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	2	0	0	0	0	0	0	0	0	0	0	0	0	3
6	0	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	1
7	0	0	0	0	0	0	0	0	0	0	1	1	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	4
8	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	0	1
Total	0	0	0	0	0	0	0	0	0	0	1	1	0	1	2	5	5	2	3	3	4	1	2	0	0	0	0	0	0	30

Table 23. Observed hatch dates for Pacific black brant, cackling Canada geese, and emperor geese in calibration plots at Kokechik Bay, 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 I	0	0	0	0	0	0	0	0	0	6	0	7	7	2	4	0	0	0	0	0	0	0	0	0	0	0	0	0	26
Calibration II	0	0	0	0	0	0	0	0	0	0	0	0	0	2	3	1	0	0	0	0	0	0	0	0	0	0	0	0	6
Calibration III	0	0	0	0	0	0	0	0	0	0	4	0	14	7	13	0	10	0	1	1	0	0	0	0	0	0	0	0	50
Subtotal	0	0	0	0	0	0	0	0	0	6	4	7	21	11	20	1	10	0	1	1	0	0	0	0	0	0	0	0	82
CACKLERS:																													
Calibration I	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	2	0	0	0	0	0	0	0	3
Subtotal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	2	0	0	0	0	0	0	0	3
EMPEROR:																													
Calibration I	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	3
Subtotal	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	3
TOTAL	0	0	0	0	0	0	0	0	0	6	4	7	22	12	21	1	11	0	1	1	2	0	0	0	0	0	0	0	88

Table 24. Observed hatch dates for Pacific black brant, cackling Canada geese, and emperor geese in validation and primary plots at Kokechik Bay, 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:																													
Validation I	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	3
Validation II	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	6
Validation III	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	4
Primary I	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	4
Primary II	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	3
Primary III	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	3
Subtotal	0	0	0	0	0	0	0	0	0	0	4	1	9	3	0	0	0	0	0	3	1	1	0	0	0	0	0	1	23
CACKLERS:																													
Validation IV	0	0	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	1
Validation V	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	2	8
Primary III	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	0	0	0	0	0	0	0	0	0	1	6	0	0	0	0	0	1	0	0	0	0	0	0	2	10
EMPERORS:																													
Validation I	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
Validation V	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	7
Primary I	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	1
Subtotal	0	0	0	0	0	0	0	0	0	0	1	0	1	0	7	0	0	0	0	0	0	0	0	0	0	0	0	0	9
TOTAL	0	0	0	0	0	0	0	0	0	0	5	1	10	4	13	0	0	0	0	3	2	1	0	0	0	0	0	3	42

Table 25. Percent nesting success for Pacific black brant, cackling Canada geese, and emperor geese at different nest locations at Kokechik Bay, 1984.

	Brant				Cacklers				Emperors				
Plot	Island	Peninsula	Other[a]	Total	Island	Peninsula	Other[a]	Total	Island	Peninsula	Other[a]	Total	Total
Calibration I	29 (90)[b]	0(40)	0 (83)	12(213)	100 (2)	50 (2)	–	75 (4)	–	–	75 (4)	75 (4)	14(221)
Calibration II	10 (40)	0(14)	1(156)	3(210)	–	–	–	–	–	–	–	–	3(210)
Calibration III	56 (89)	–	–	56 (89)	–	–	–	–	–	–	–	–	56 (89)
Subtotal	37(219)	0(54)	1(239)	16(512)	100 (2)	50 (2)	–	75 (4)	–	–	75 (4)	75 (4)	17(520)
Validation I	54 (24)	0(17)	0 (7)	27 (48)	–	–	–	–	100 (1)	0 (1)	50 (2)	50 (4)	29 (52)
Validation II	30 (10)	62 (8)	11 (84)	17(102)	–	–	–	–	–	–	–	–	17(102)
Validation III	43 (37)	–	–	43 (37)	–	–	–	–	–	–	–	–	43 (37)
Validation IV	–	–	–	–	77(13)	33 (6)	83 (6)	68(25)	100 (1)	–	88 (8)	89 (9)	74 (34)
Validation V	–	–	–	–	78 (9)	59(17)	57(21)	62(47)	–	100 (1)	100 (8)	100 (9)	68 (56)
Subtotal	45 (71)	20(25)	10 (91)	25(187)	77(22)	52(23)	63(27)	64(72)	100 (2)	50 (2)	89(18)	86(22)	40(281)
Primary I	58 (31)	0 (2)	0 (1)	53 (34)	–	–	–	–	–	–	100 (2)	100 (2)	56 (36)
Primary II	–	33 (6)	35 (46)	35 (52)	–	–	–	–	–	–	–	–	35 (52)
Primary III	54 (24)	–	–	54 (24)	100 (2)	–	–	100 (2)	–	–	–	–	58 (26)
Subtotal	56 (55)	25 (8)	34 (47)	44(110)	100 (2)	–	–	100 (2)	–	–	100 (2)	100 (2)	46(114)
Total	41(345)	8(87)	7(377)	22(809)	81(26)	52(25)	63(27)	65(78)	100 (2)	50 (2)	88(24)	86(28)	27(915)

[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 sample sizes.

Table 26. Percentage of Pacific black brant, cackling Canada goose, and emperor goose nests suffering "animal" predation[a] at different nest locations at Kokechik Bay, 1984.

	Brant				Cacklers				Emperors				
Plot	Island	Peninsula	Other[b]	Total	Island	Peninsula	Other[b]	Total	Island	Peninsula	Other[b]	Total	Total
Calibration I	71 (90)[c]	100(40)	100 (83)	88(213)	0 (2)	50 (2)	-	25 (4)	-	-	25 (4)	25 (4)	83(221)
Calibration II	88 (40)	100(14)	99(156)	97(210)	-	-	-	-	-	-	-	-	97(210)
Calibration III	42 (89)	-	-	42 (89)	-	-	-	-	-	-	-	-	42 (89)
Subtotal	62(219)	100(54)	99(239)	83(512)	0 (2)	50 (2)	-	25 (4)	-	-	25 (4)	25 (4)	83(520)
Validation I	46 (24)	100(17)	100 (7)	73 (48)	-	-	-	-	0(1)	100(1)	50 (2)	50 (4)	71 (52)
Validation II	70 (10)	38 (8)	89 (84)	83(102)	-	-	-	-	-	-	-	-	83(102)
Validation III	57 (37)	-	-	57 (37)	-	-	-	-	-	-	-	-	57 (37)
Validation IV	-	-	-	-	23(13)	67 (6)	17 (6)	32(25)	0(1)	-	13 (8)	11 (9)	26 (34)
Validation V	-	-	-	-	22 (9)	41(17)	43(21)	38(47)	-	0(1)	0 (8)	0 (9)	32 (56)
Subtotal	55 (71)	80(25)	90 (91)	75(187)	23(22)	48(23)	37(27)	36(72)	0(2)	50(2)	11 18	14(22)	60(281)
Primary I	42 (31)	100 (2)	100 (1)	47 (34)	-	-	-	-	-	-	0 (2)	0 (2)	44 (36)
Primary II	-	67 (6)	65 (46)	65 (52)	-	-	-	-	-	-	-	-	65 (52)
Primary III	46 (24)	-	-	46 (24)	0 (2)	-	-	0 (2)	-	-	-	-	42 (26)
Subtotal	44 (55)	75 (8)	66 (47)	55(110)	0 (2)	-	-	0 (2)	-	-	0 (2)	0 (2)	54(114)
Total	58(345)	92(87)	93(377)	78(809)	19(26)	48(25)	37(27)	35(78)	0(2)	50(2)	13(24)	14(28)	72(915)

[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.

[c] Numbers in parentheses are sample sizes.

Table 27. Frequency of nests which were abandoned or contained unhatched eggs for Pacific black brant, cackling Canada geese, and emperor geese, at Kokechik Bay, 1984.

	Species									
	Brant			Cacklers			Emperors			
Plot	Abandoned	Addled	Total	Abandoned	Addled	Total	Abandoned	Addled	Total	Total
Calibration I	7[a] (213)[b]	0 (213)	7 (213)	25 (4)	0 (4)	25 (4)	0 (4)	0 (4)	0 (4)	7 (221)
Calibration II	3 (210)	0 (210)	3 (210)	-	-	-	-	-	-	3 (210)
Calibration III	30 (89)	2 (89)	33 (89)	-	-	-	-	-	-	33 (89)
Subtotal	9 (512)	1 (512)	10 (512)	25 (4)	0 (4)	25 (4)	0 (4)	0 (4)	0 (4)	10 (520)
Validation I	17 (48)	0 (48)	17 (48)	-	-	-	0 (4)	0 (4)	0 (4)	15 (52)
Validation II	8 (102)	0 (102)	8 (102)	-	-	-	-	-	-	8 (102)
Validation III	8 (37)	0 (37)	8 (37)	-	-	-	-	-	-	8 (37)
Validation IV	-	-	-	16 (25)	0 (25)	16 (25)	11 (9)	0 (9)	11 (9)	15 (34)
Validation V	-	-	-	15 (47)	0 (47)	15 (47)	22 (9)	0 (9)	22 (9)	16 (56)
Subtotal	10 (187)	0 (187)	15 (187)	15 (72)	0 (72)	15 (72)	14 (22)	0 (22)	14 (22)	12 (281)
Primary I	12 (34)	0 (34)	12 (34)	-	-	-	50 (2)	0 (2)	50 (2)	14 (36)
Primary II	19 (52)	0 (52)	19 (52)	-	-	-	-	-	-	19 (52)
Primary III	38 (24)	0 (24)	358 (24)	50 (2)	0 (2)	50 (2)	-	-	-	38 (26)
Subtotal	21 (110)	0 (110)	21 (110)	50 (2)	0 (2)	50 (2)	50 (2)	0 (2)	50 (2)	22 (114)
Total	11 (809)	0 (809)	11 (809)	17 (78)	0 (78)	17 (78)	14 (28)	0 (28)	14 (28)	12 (915)

[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 wihtin a plot.

Table 28. Status of Pacific black brant clutches in relation to the number of prehatch visits in calibration plot I at Kokechik Bay, 1984.

	Number of visits															
Clutch status	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Total
Hatched:																
Without egg loss	0	0	0	1	1	0	1	0	0	0	0	0	0	0	0	3
With egg loss	0	0	0	0	2	1	0	1	0	0	0	0	0	0	0	4
Partial hatch:																
Without egg loss	0	0	1	1	0	0	7	1	1	0	0	0	0	0	0	11
With egg loss	0	0	0	0	1	1	2	3	1	0	0	0	0	0	0	8
Unhatched:																
Abandoned –																
at initiation	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
prehatch	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Predation –																
(avian & mammalian)	18	41	65	12	7	10	8	11	8	3	4	0	0	0	0	187
Harvest (egged)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fail to develop	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Continued (post-predation):																
Hatched	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Unhatched	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Continued (post-harvest):																
Hatched	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Unhatched	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Undetermined:	4	2	1	0	0	0	1	0	1	0	0	0	0	0	0	9
Total	22	43	67	14	11	12	19	16	11	3	4	0	0	0	0	222

Table 29. Status of Pacific black brant clutches in relation to the number of prehatch visits in calibration plot II at Kokechik Bay, 1984.

	Number of visits															
Clutch status	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Total
Hatched:																
Without egg loss	0	0	0	0	1	0	3	0	0	0	0	0	0	0	0	4
With egg loss	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	2
Partial hatch:																
Without egg loss	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1
With egg loss	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Unhatched:																
Abandoned –																
at initiation	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
prehatch	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1
Predation –																
(avian & mammalian)	31	27	65	62	12	1	0	3	1	1	0	0	0	0	0	203
Harvest (egged)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fail to develop	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Continued (post-predation):																
Hatched	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Unhatched	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Continued (post-harvest):																
Hatched	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Unhatched	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Undetermined:	1	0	8	2	0	0	0	1	1	0	0	0	0	0	0	13
Total	32	27	73	64	13	1	4	7	2	1	0	0	0	0	0	224

Table 30. Status of Pacific black brant clutches in relation to the number of prehatch visits in calibration plot III at Kokechik Bay, 1984.

Clutch status	Number of visits															
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Total
Hatched:																
Without egg loss	0	0	0	1	2	15	2	3	0	0	0	0	0	0	0	23
With egg loss	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1
Partial hatch:																
Without egg loss	0	0	0	1	2	11	2	5	2	0	0	0	0	0	0	23
With egg loss	0	0	0	0	0	1	2	0	0	0	0	0	0	0	0	3
Unhatched:																
Abandoned -																
at initiation	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
prehatch	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Predation -																
(avian & mammalian)	1	2	1	5	3	8	6	6	4	1	0	0	0	0	0	37
Harvest (egged)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fail to develop	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	2
Continued (post-predation):																
Hatched	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Unhatched	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Continued (post-harvest):																
Hatched	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Unhatched	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Undetermined:	0	1	0	1	0	1	1	0	0	2	0	0	0	0	0	6
Total	1	3	1	8	8	36	13	14	8	3	0	0	0	0	0	95

Table 31. Status of cackling Canada geese clutches in relation to the number of prehatch visits in calibration plot I at Kokechik Bay, 1984.

Clutch status	Number of visits															
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Total
Hatched:																
Without egg loss	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
With egg loss	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Partial hatch:																
Without egg loss	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	2
With egg loss	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1
Unhatched:																
Abandoned -																
at initiation	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
prehatch	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Predation -																
(avian & mammalian)	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1
Harvest (egged)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fail to develop	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Continued (post-predation):																
Hatched	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Unhatched	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Continued (post-harvest):																
Hatched	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Unhatched	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Undetermined:	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	1	0	0	1	1	0	0	1	0	0	0	0	4

Table 32. Status of emperor geese clutches in relation to the number of prehatch visits in calibration plot I at Kokechik Bay, 1984.

	Number of visits															
Clutch status	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Total
Hatched:																
Without egg loss	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
With egg loss	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Partial hatch:																
Without egg loss	0	0	0	0	1	1	1	0	0	0	0	0	0	0	0	3
With egg loss	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Unhatched:																
Abandoned –																
at initiation	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
prehatch	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Predation –																
(avian & mammalian)	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1
Harvest (egged)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fail to develop	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Continued (post-predation):																
Hatched	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Unhatched	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Continued (post-harvest):																
Hatched	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Unhatched	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Undetermined:	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	1	2	1	0	0	0	0	0	0	0	0	4

Table 33. Hatching success of "complete" clutches for Pacific black brant geese at Kokechik Bay, 1984.

Plot	Clutch size 1	2	3	4	5	6	7	8	9	Total
Calibration I	0	0[a] (1)[b]	0 (6)	50 (4)	33 (3)	0	33 (3)	0 (1)	0	22 (18)
Calibration II	0	33 (3)	0 (2)	0 (2)	0	0	0	0	0	14 (7)
Calibration III	0	0 (1)	0	100 (2)	0	0 (1)	100 (1)	0	0	60 (5)
Total	0	20 (5)	0 (8)	50 (8)	33 (3)	0 (1)	50 (4)	0 (1)	0	27 (30)

[a] Numbers are percentages.

[b] Numbers in parentheses are sample sizes.

Table 34. Hatching success of "complete" clutches for cackling Canada geese at Kokechik Bay, 1984.

Plot	Clutch size 1	2	3	4	5	6	7	8	9	Total
Calibration I	0	0	0	0	0	0	100 (1)	0	0	100 (1)
Total	0	0	0	0	0	0	100 (1)	0	0	100 (1)

[a] Numbers are percentages.

[b] Numbers in parentheses are sample sizes.

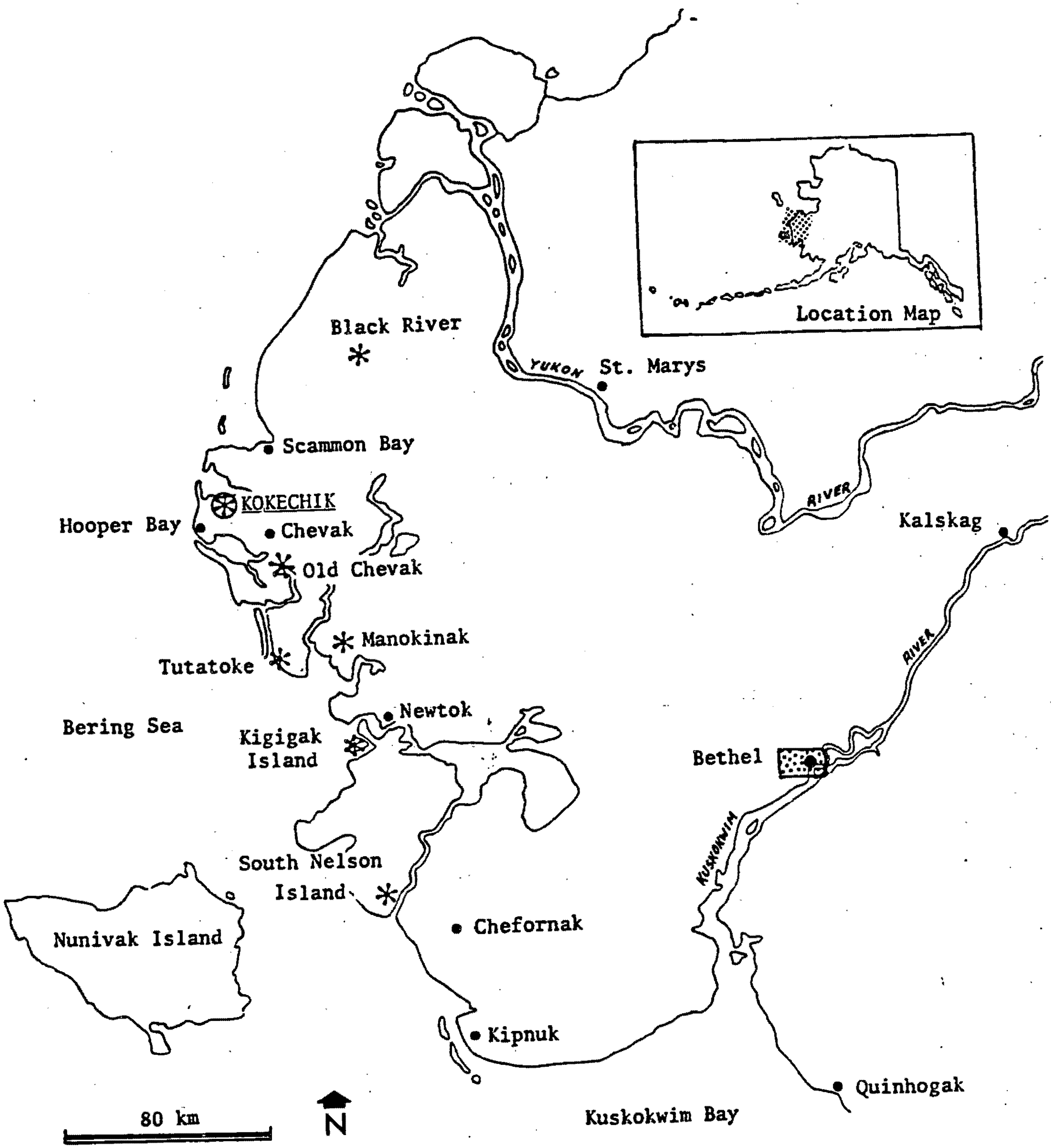


Figure 1. Location of Kokechik Bay field camp in relation to other field camps (✱) and to native villages (●) on the Yukon Delta National Wildlife Refuge, 1984.

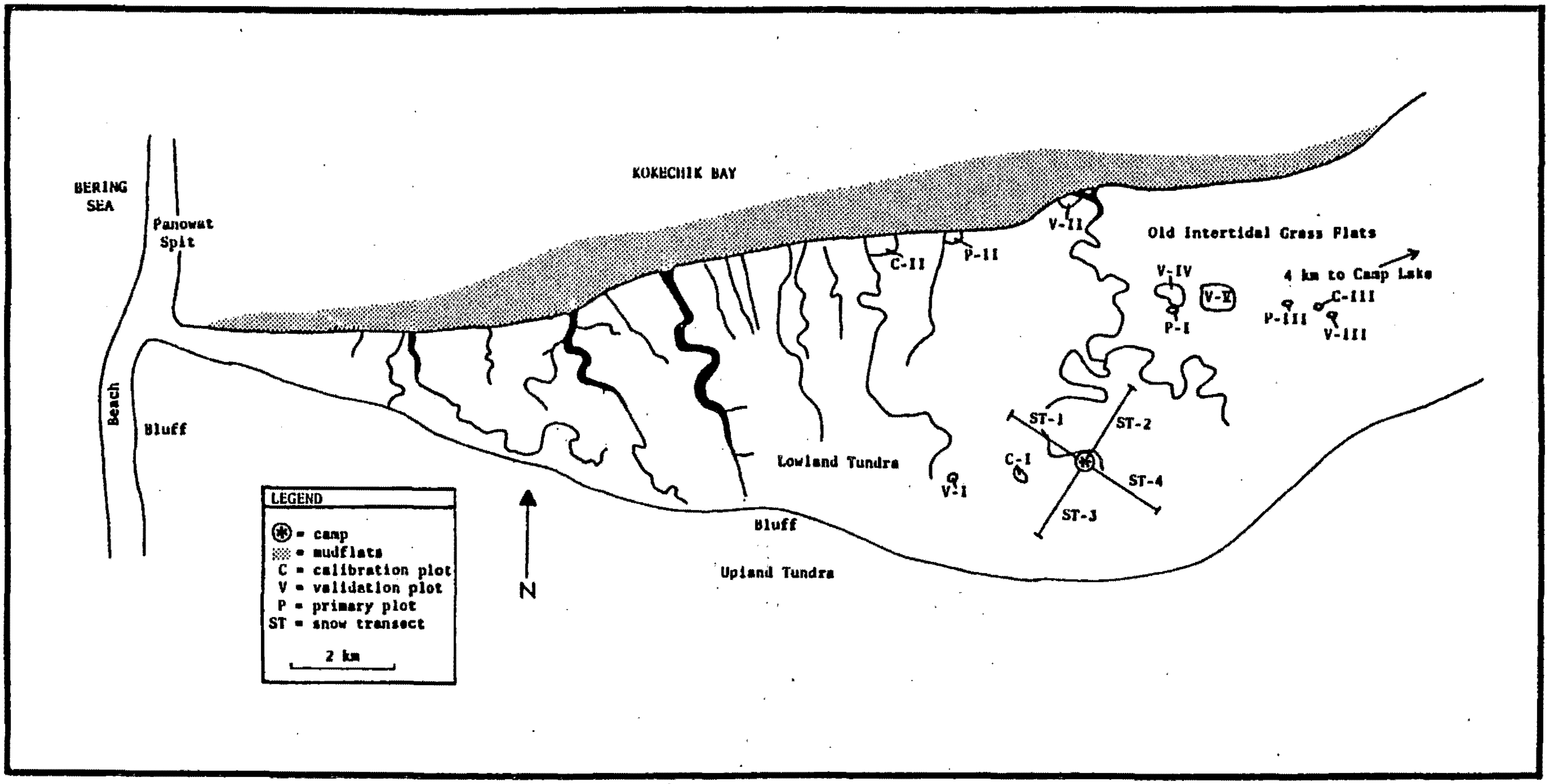
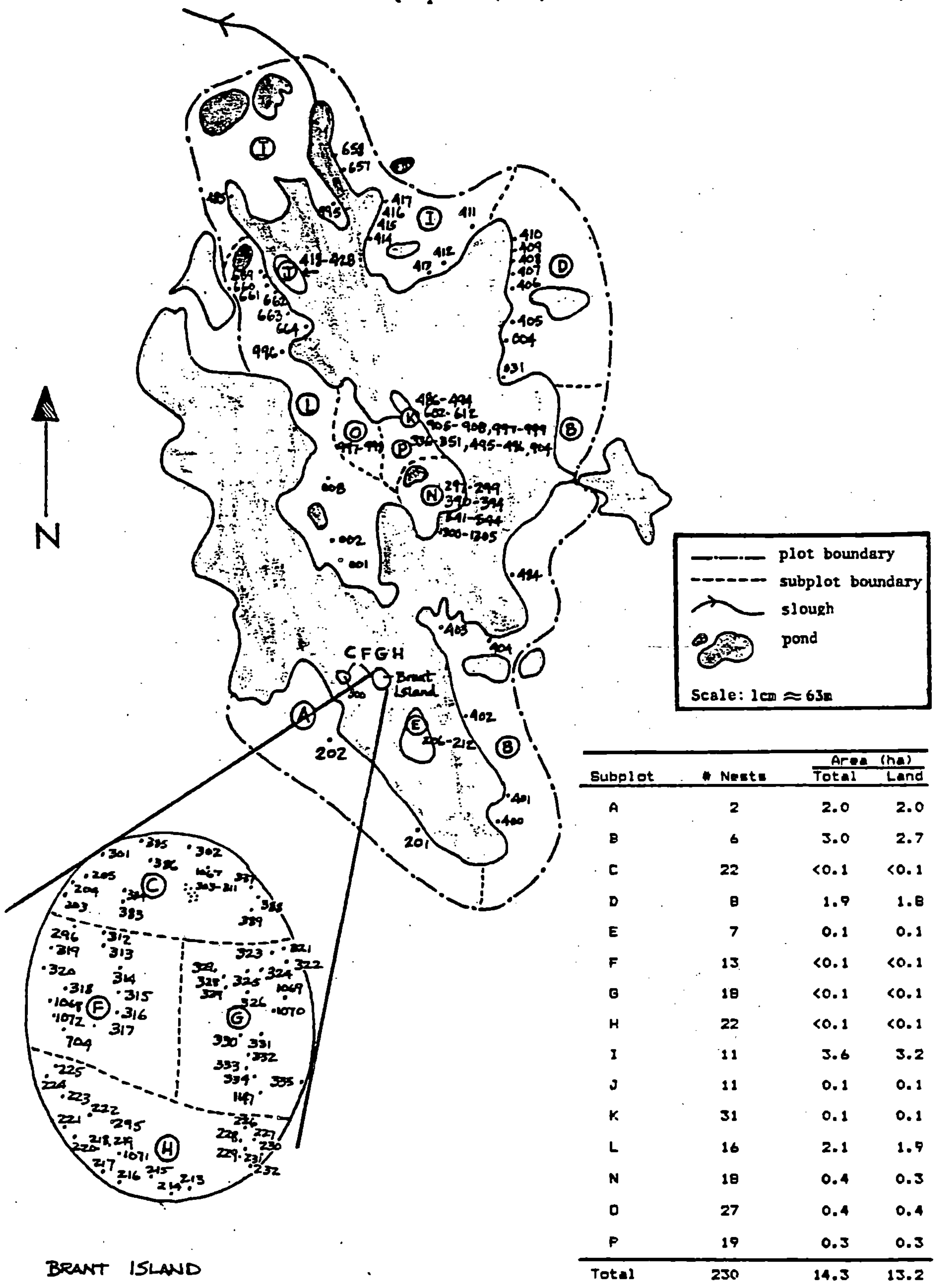


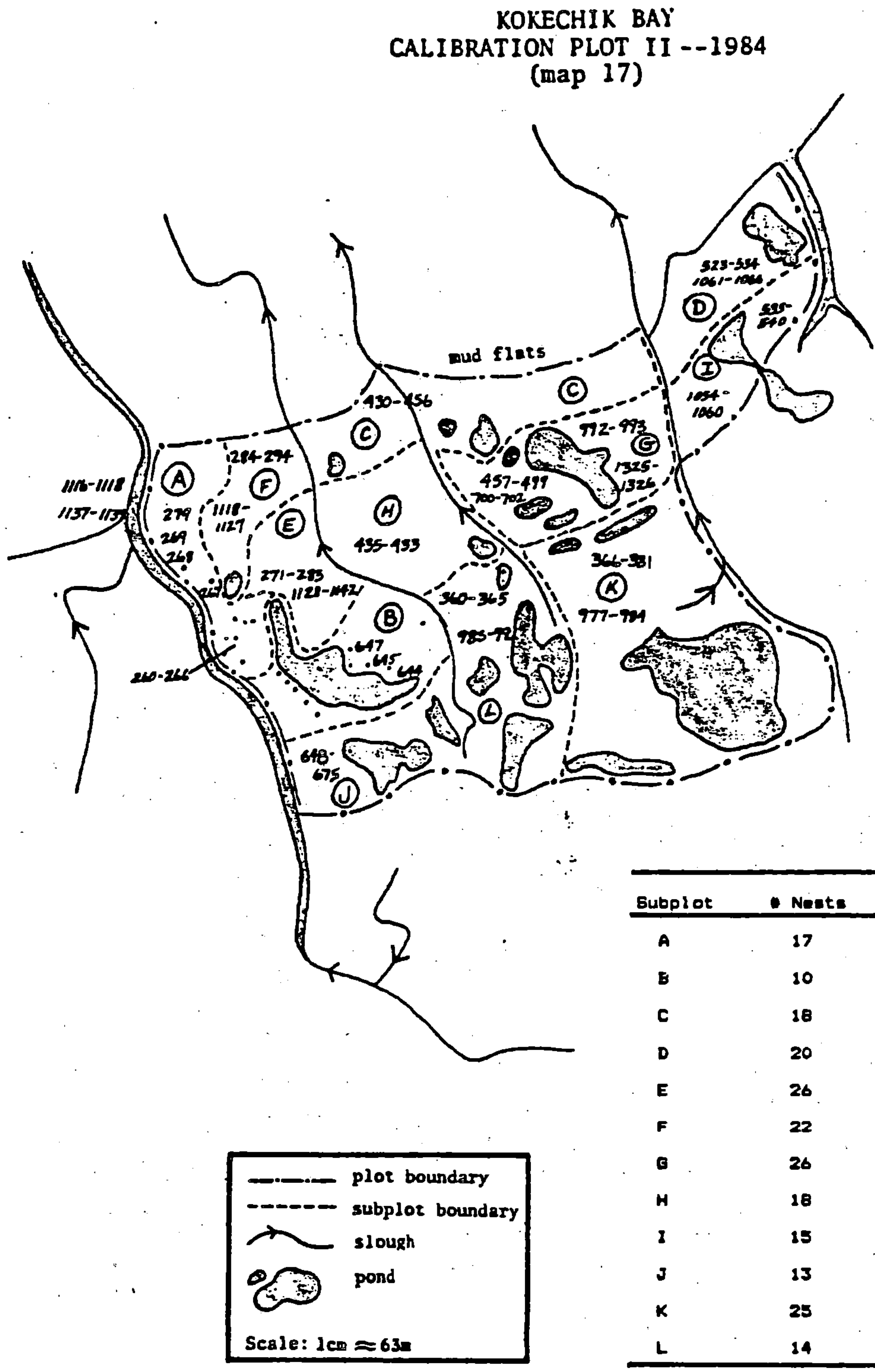
Figure 2. Kokechik Bay Study Area

KOKECHIK BAY
CALIBRATION PLOT I--1984
(maps 9 & 15)



Subplot	# Nests	Area (ha) Total	Area (ha) Land
A	2	2.0	2.0
B	6	3.0	2.7
C	22	<0.1	<0.1
D	8	1.9	1.8
E	7	0.1	0.1
F	13	<0.1	<0.1
G	18	<0.1	<0.1
H	22	<0.1	<0.1
I	11	3.6	3.2
J	11	0.1	0.1
K	31	0.1	0.1
L	16	2.1	1.9
N	18	0.4	0.3
O	27	0.4	0.4
P	19	0.3	0.3
Total	230	14.3	13.2

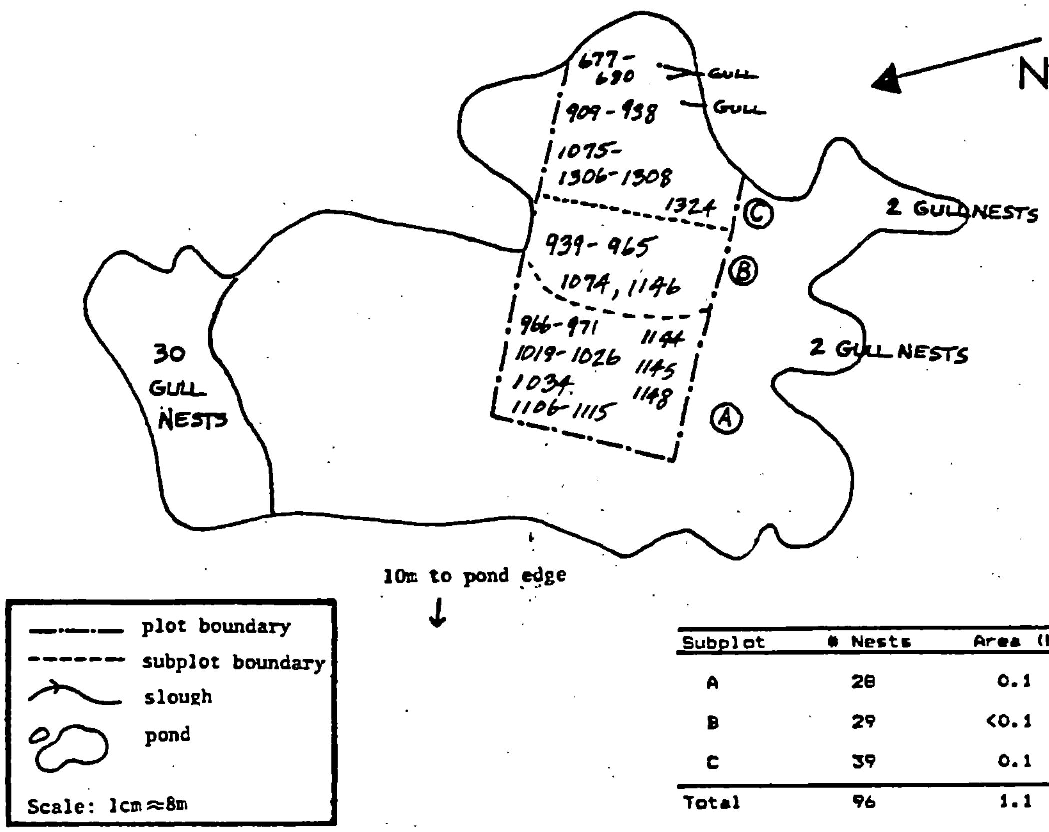
Figure 3. Calibration plot I, Kokechik Bay, 1984.



Subplot	# Nests	Area (ha) Total	Land
A	17	1.1	1.0
B	10	1.5	1.1
C	18	1.9	1.6
D	20	1.1	0.9
E	26	1.0	0.9
F	22	0.7	0.6
G	26	1.7	1.2
H	18	1.4	1.3
I	15	0.9	0.8
J	13	1.1	0.8
K	25	4.3	2.9
L	14	1.9	1.2
Total	224	18.6	14.4

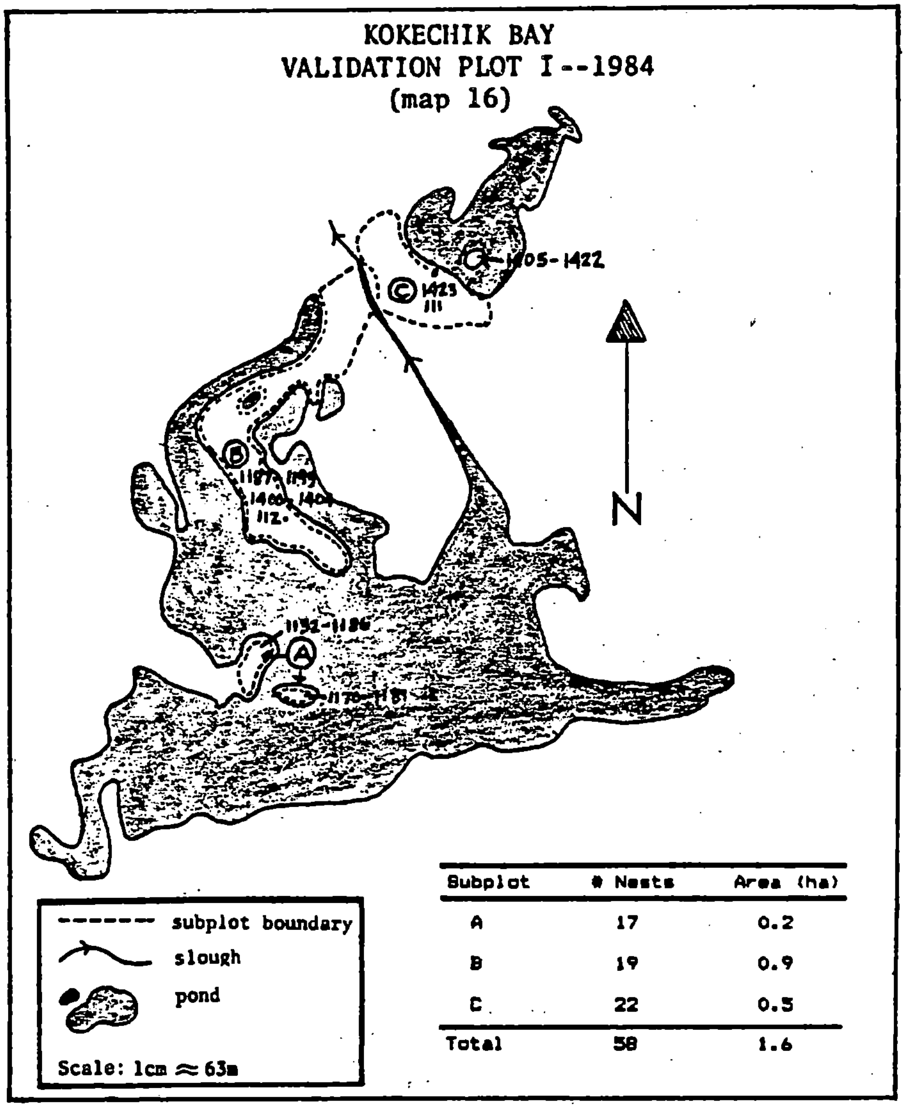
Figure 4. Calibration plot II, Kokechik Bay, 1984.

KOKECHIK BAY
CALIBRATION PLOT III--1984
(no photo coverage)



Subplot	# Nests	Area (ha)
A	28	0.1
B	29	<0.1
C	39	0.1
Total	96	1.1

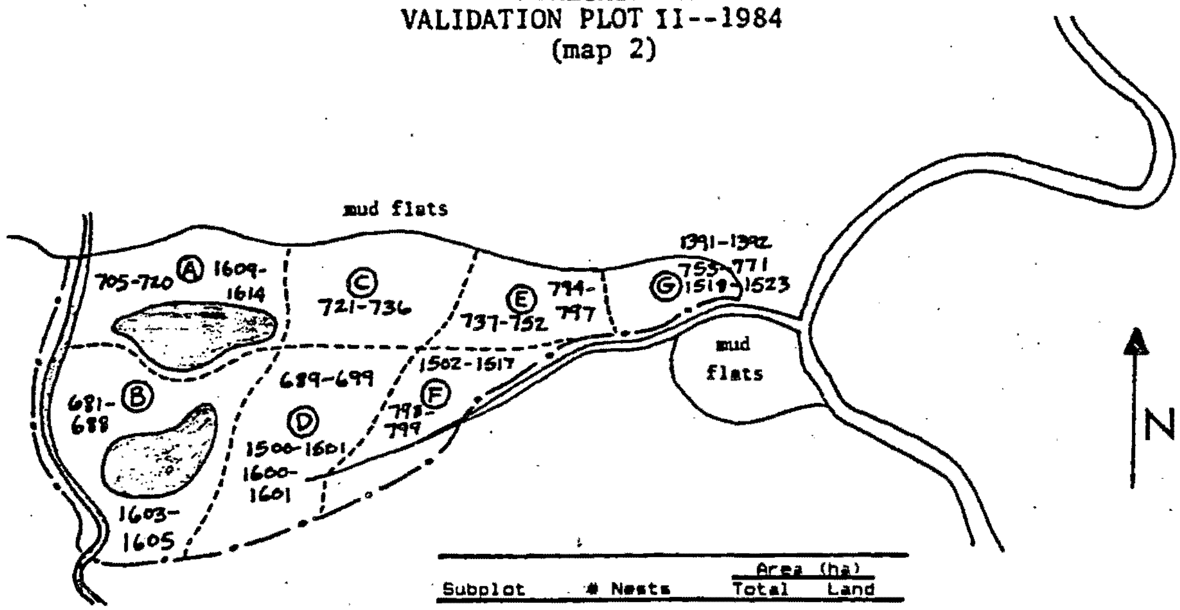
Figure 5. Calibration plot III, Kokechik Bay, 1984.

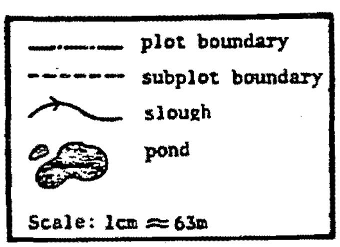


Subplot	# Nests	Area (ha)
A	17	0.2
B	19	0.9
C	22	0.5
Total	58	1.6

Figure 6. Validation plot I, Kokechik Bay, 1984.

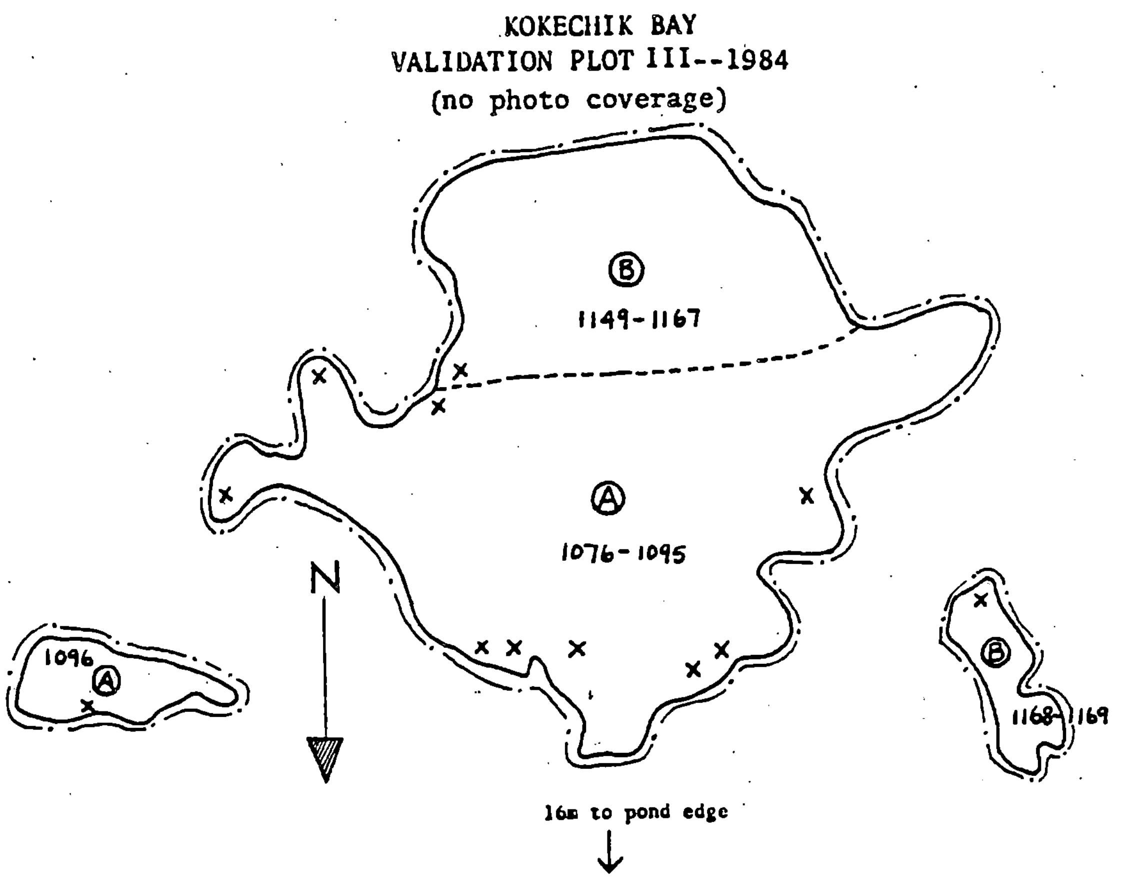
KOKECHIK BAY
VALIDATION PLOT II--1984
(map 2)





Subplot	# Nests	Area (ha) Total	Area (ha) Land
A	22	1.5	1.0
B	14	2.1	1.7
C	16	1.1	1.0
D	15	1.7	1.5
E	20	0.8	0.7
F	18	0.8	0.7
G	27	0.6	0.5
Total	132	8.6	7.1

Figure 7. Validation plot II, Kokechik Bay, 1984.

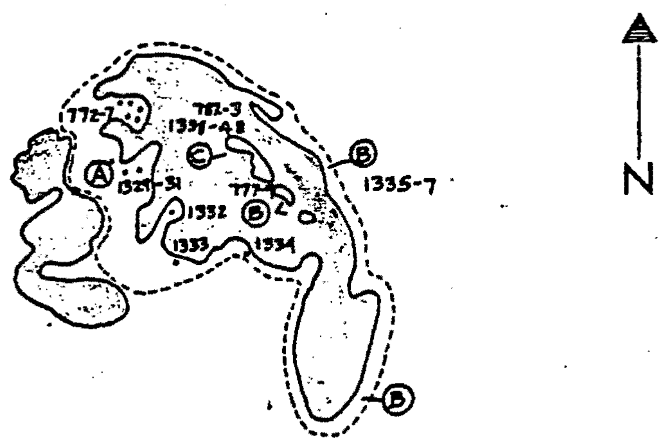


Subplot	# Nests	Land Area (ha)
A	21	0.25
B	22	0.14
Total	43	0.39

—·—·— plot boundary
------- subplot boundary
X gull nest
Scale: 1cm≈3m

Figure 8. Validation plot III, Kokechik Bay, 1984.

KOKECHIK BAY
PRIMARY PLOT I --1984
(map 2)



------ subplot boundary

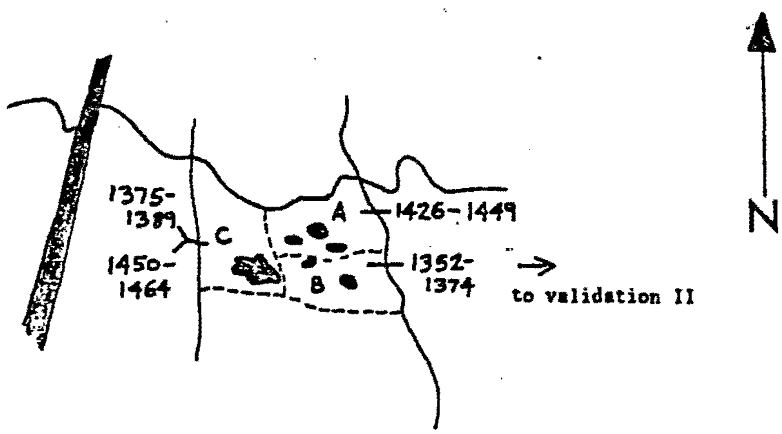
pond

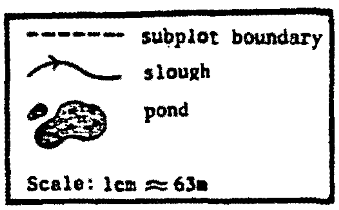
Scale: 1cm ≈ 63m

Subplot	# Nests	Land Area (ha)
A	12	1.2
B	6	0.5
C	23	0.1
Total	41	1.8

Figure 9. Primary plot I, Kokechik Bay, 1984.

KOKECHIK BAY
PRIMARY PLOT II --1984
(map 3)

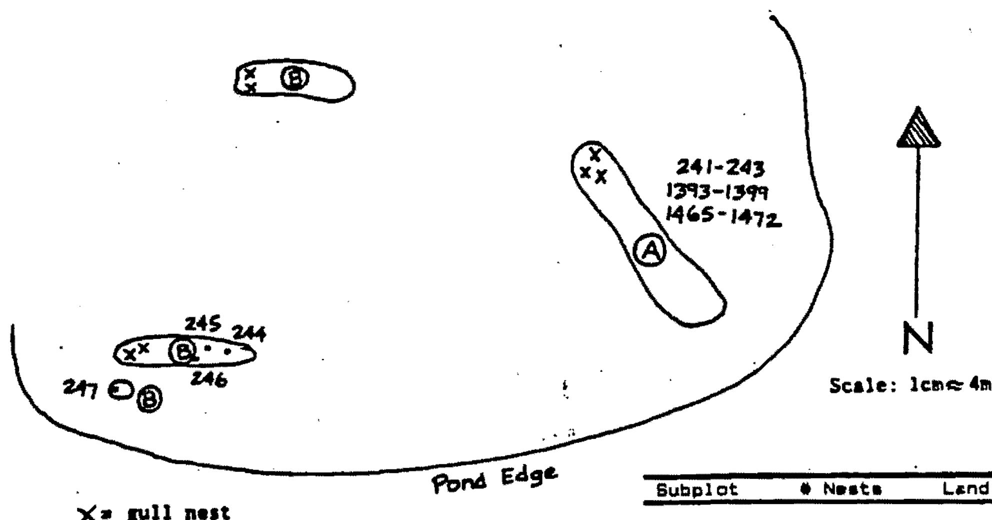




Subplot	# Nests	Area (ha) Total	Area (ha) Land
A	25	0.5	0.4
B	24	0.4	0.3
C	30	0.5	0.3
Total	79	1.4	1.0

Figure 10. Primary plot II, Kokechik Bay, 1984.

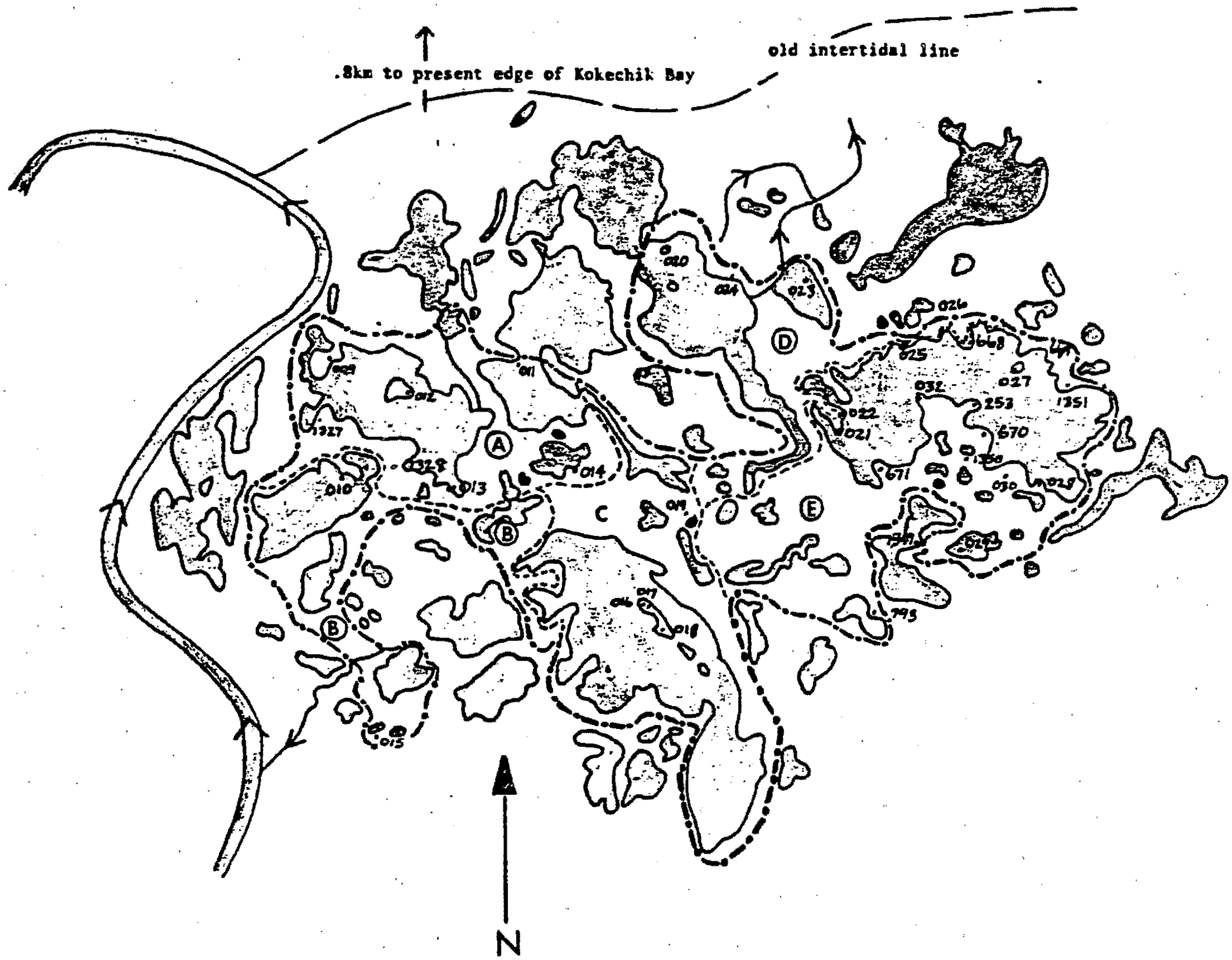
KOKECHIK BAY
PRIMARY PLOT III --1984
(no photo coverage)



Subplot	# Nests	Land Area (ha)
A	18	0.3
B	8	0.04
Total	26	0.34

Figure 11. Primary plot III, Kokechik Bay, 1984.

KOKECHIK BAY
VALIDATION PLOT IV (Cackler)--1984
(map 2)



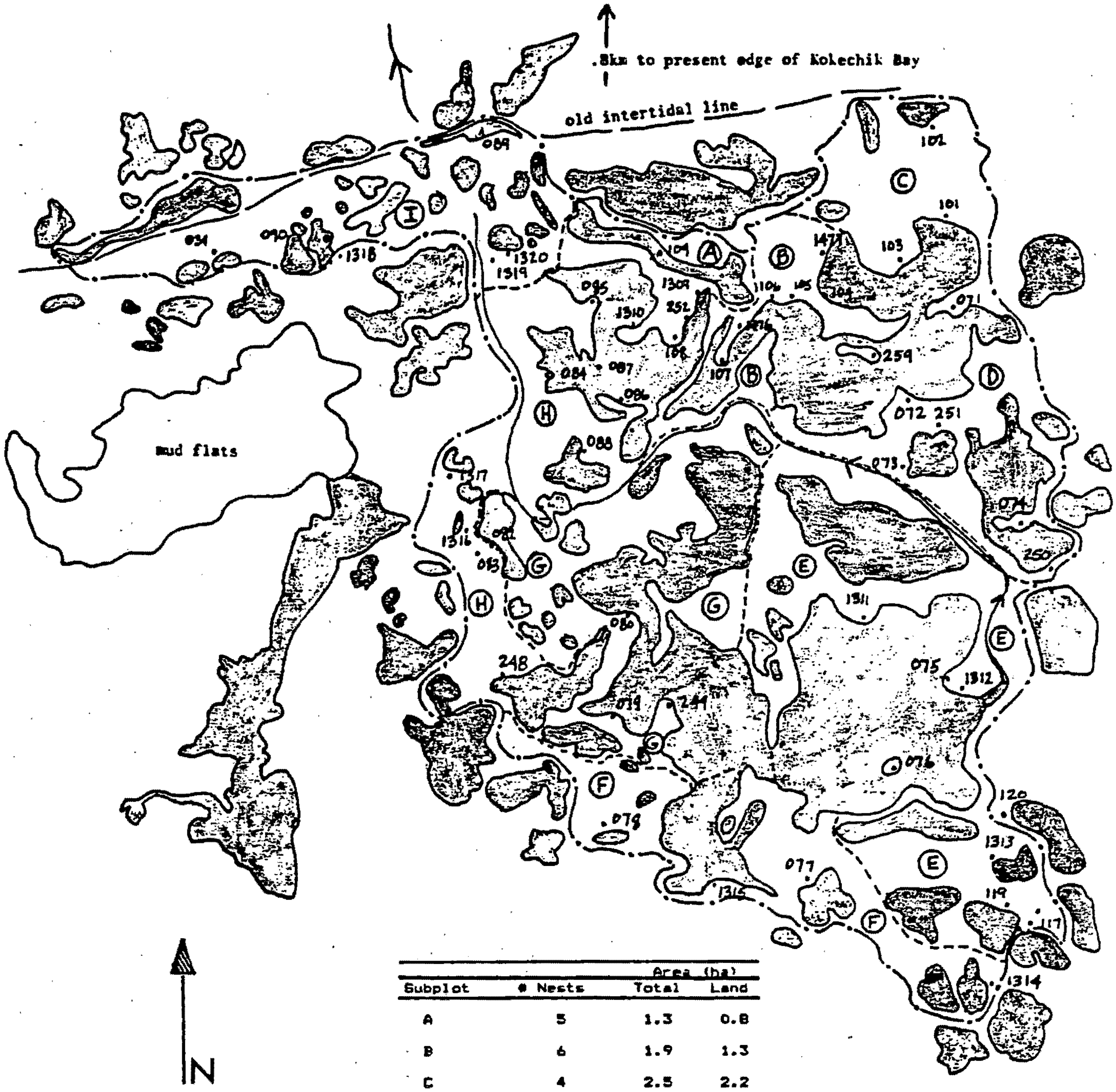
plot boundary
subplot boundary
slough
pond

Scale: 1cm ≈ 63m

		Area (ha)	
Subplot	# Nests	Total	Land
A	8	3.9	2.0
B	1	2.8	1.7
C	4	4.7	1.8
D	8	3.0	1.6
E	13	6.2	2.9
Total	34	20.6	10.0

Figure 12. Validation plot IV, Kokechik Bay, 1984.

KOKECHIK BAY
VALIDATION PLOT V (Cackler)--1984
(map 1)



Subplot	# Nests	Area (ha) Total	Land
A	5	1.3	0.8
B	6	1.9	1.3
C	4	2.5	2.2
D	6	6.0	2.0
E	9	10.1	4.0
F	4	4.3	3.0
G	5	7.0	3.1
H	11	6.1	2.9
I	6	5.0	3.1
Total	56	44.2	22.4

Figure 13. Validation plot V, Kokechik Bay, 1984.

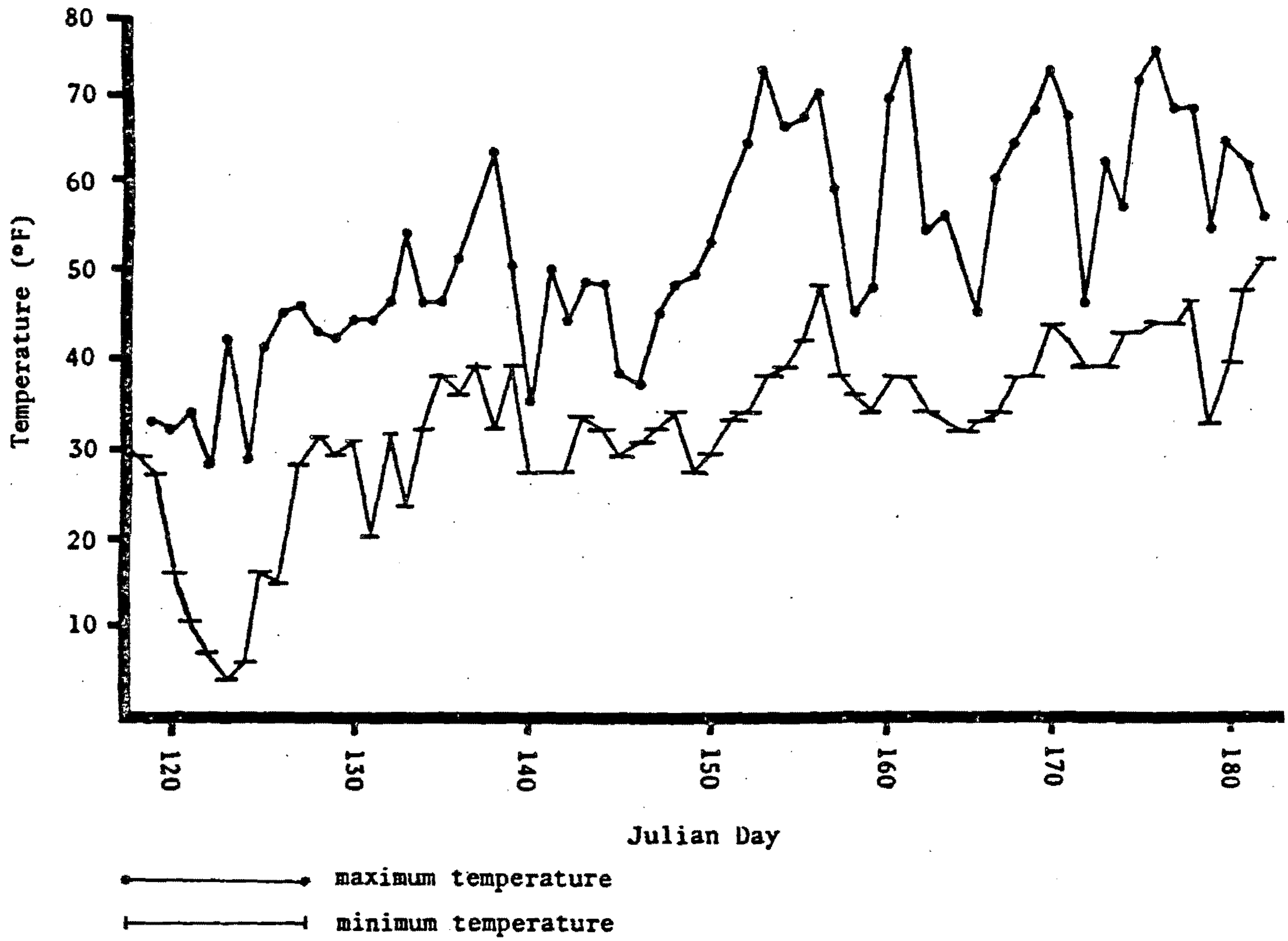


Figure 14. Daily minimum and maximum temperatures at Kokechik Bay, 1984.

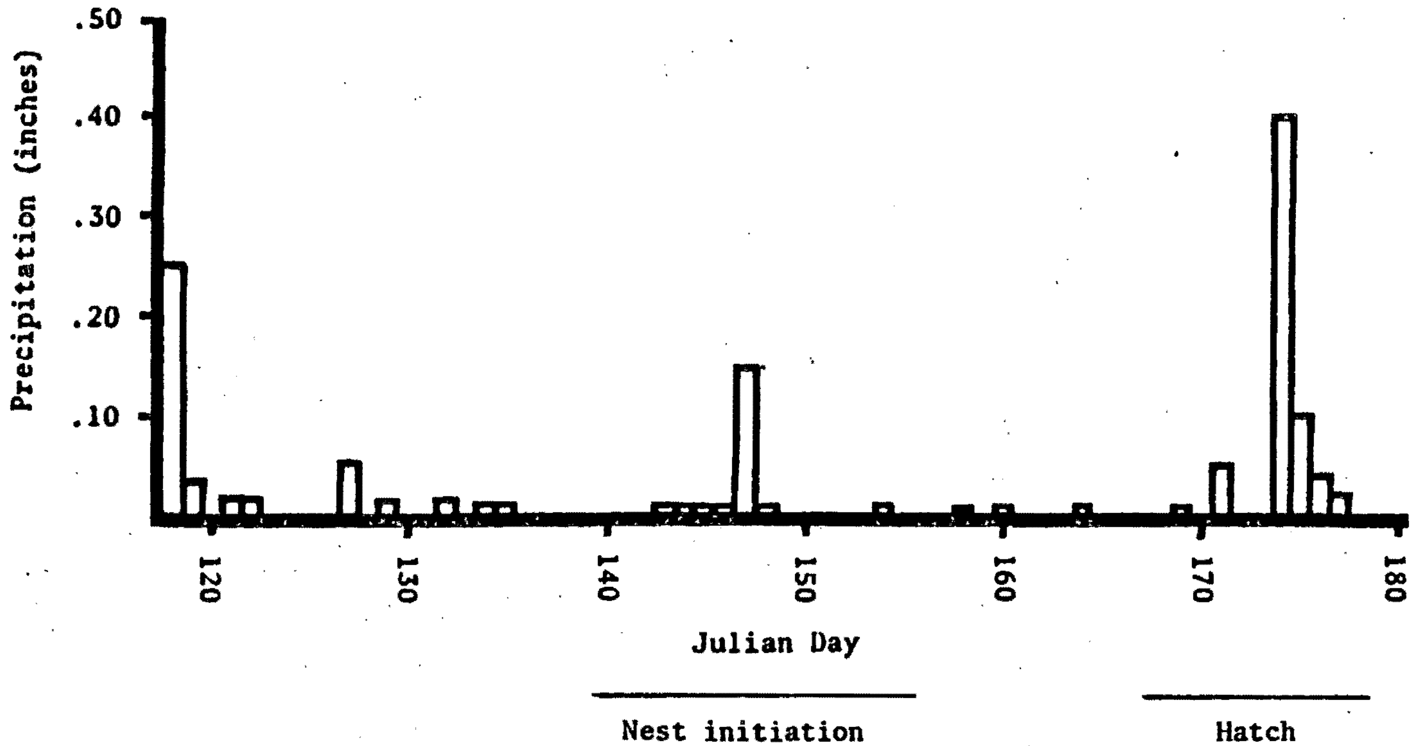


Figure 15. Precipitation received at Kokechik Bay, 1984, in relation to nest initiation and hatch among Pacific black brant, cackling Canada geese and emperor geese.

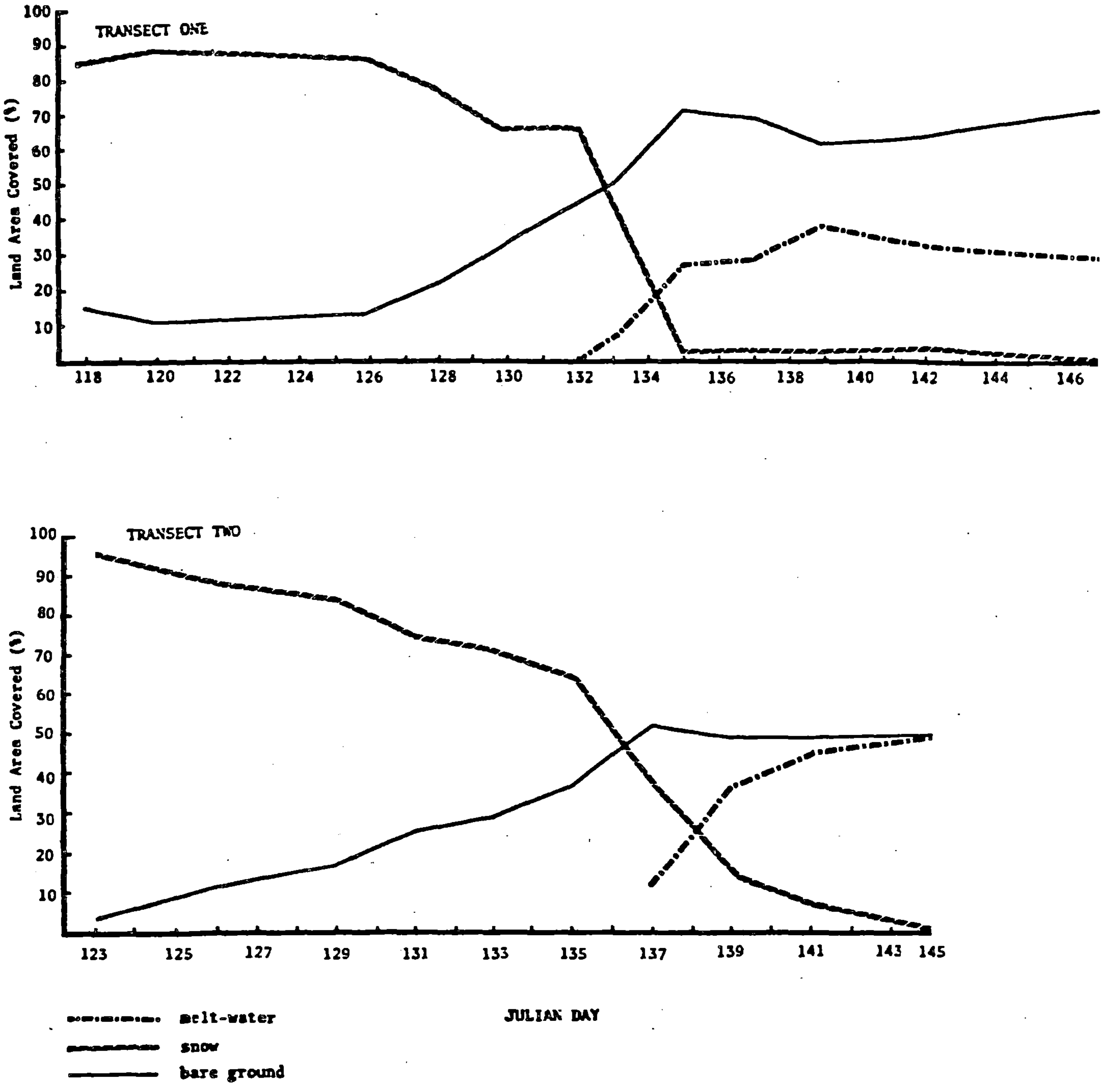


Figure 16. Percent of land area covered by melt-water, snow and ice, and bare ground along snow transects at Kokechik Bay, 1984.

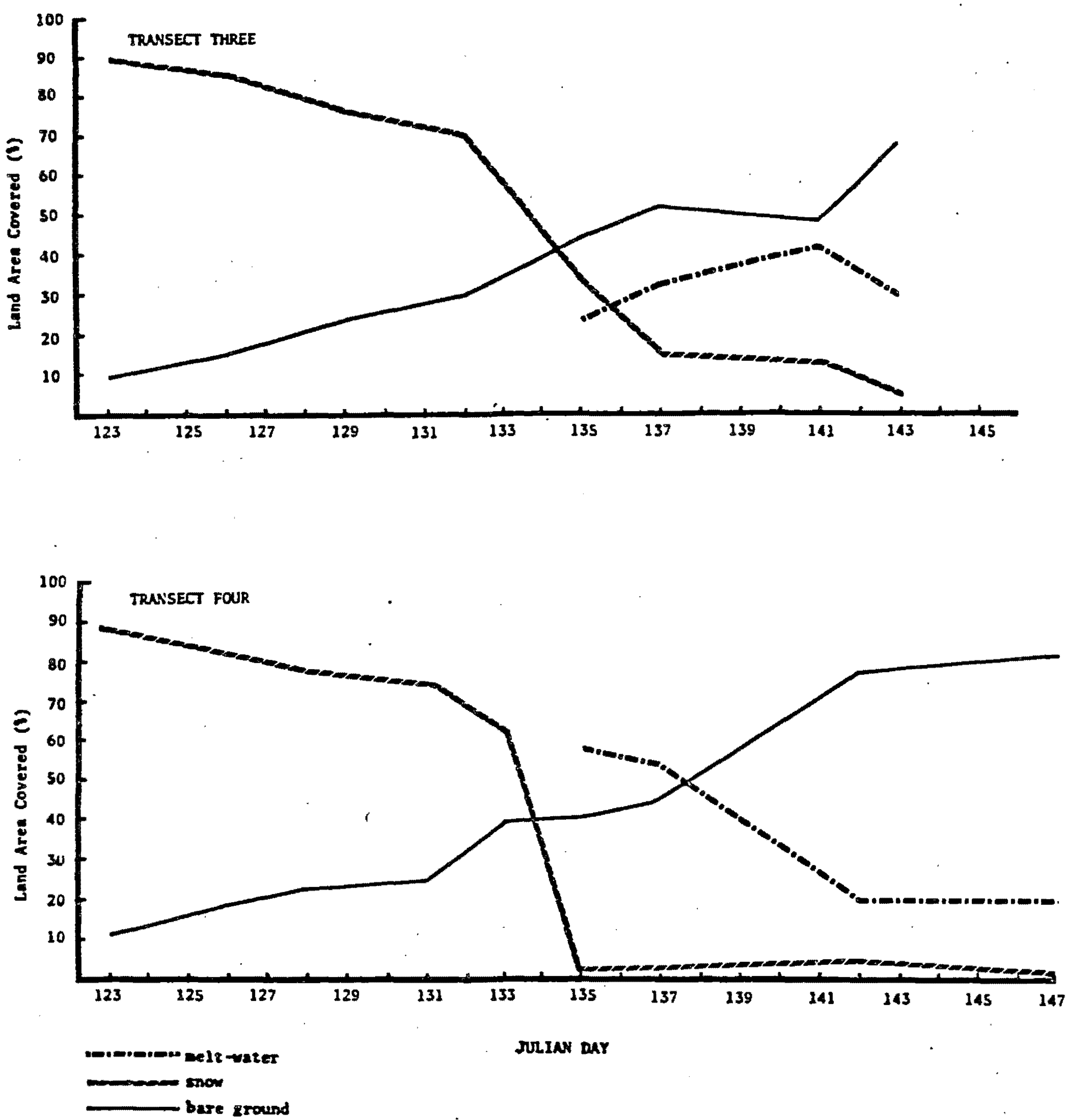


Figure 16 (cont.). Percent of land area covered by melt-water, snow and ice, and bare ground along snow transects at Kokechik Bay, 1984.

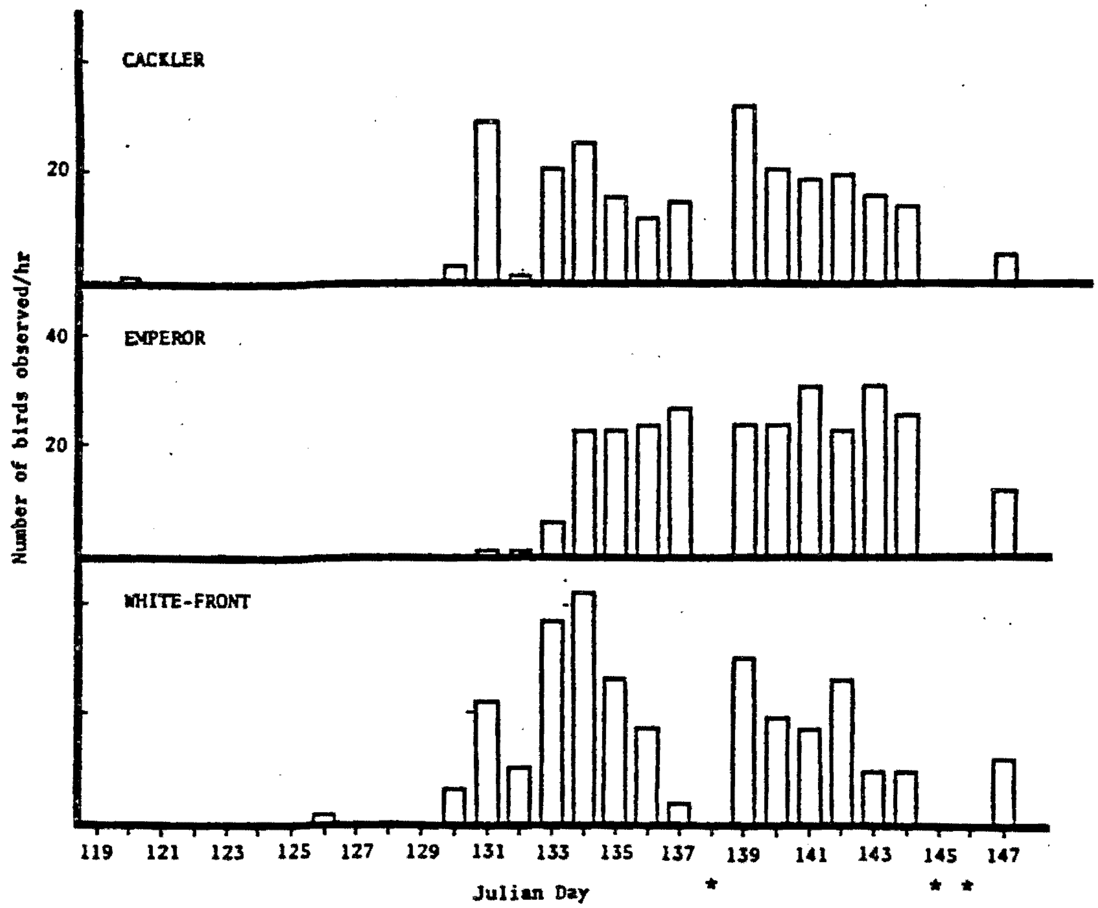


Figure 17. Number of cackling Canada geese, emperor geese, and Pacific white-fronted geese observed per hour during stationary migration counts at Kokechik Bay, 1984.

*No migration watch this day.

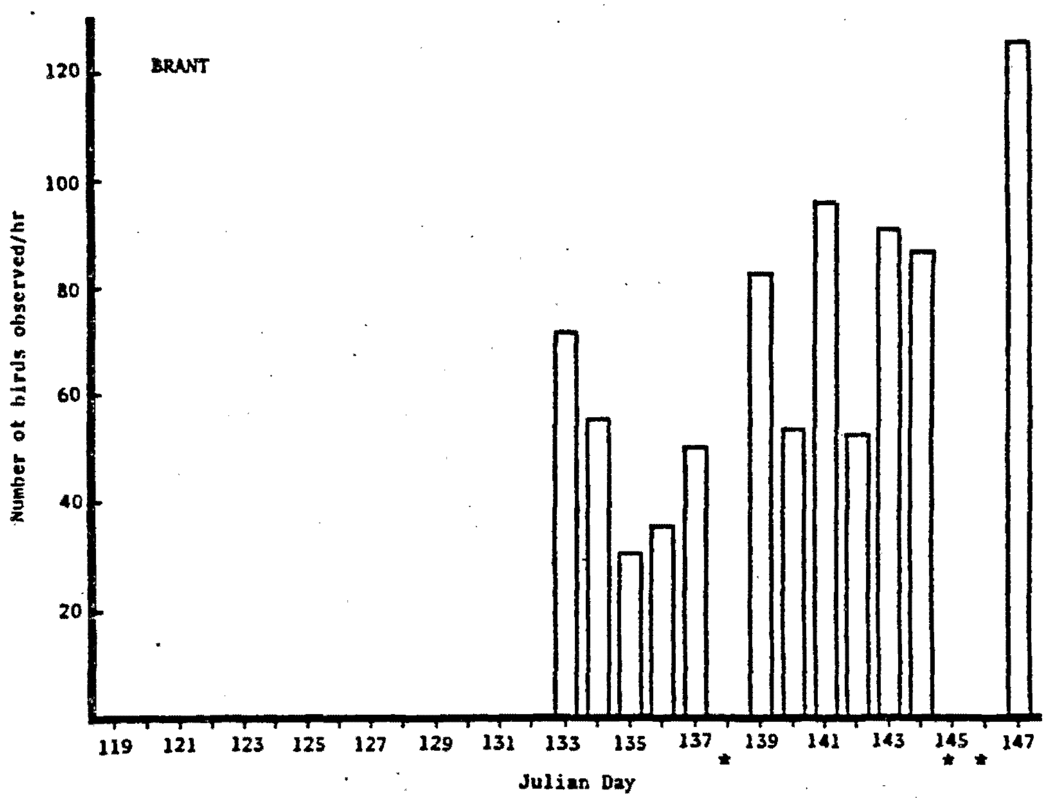


Figure 18. Number of Pacific black brant observed per hour during stationary migration counts at Kokechik Bay, 1984.

*No migration watch this day.

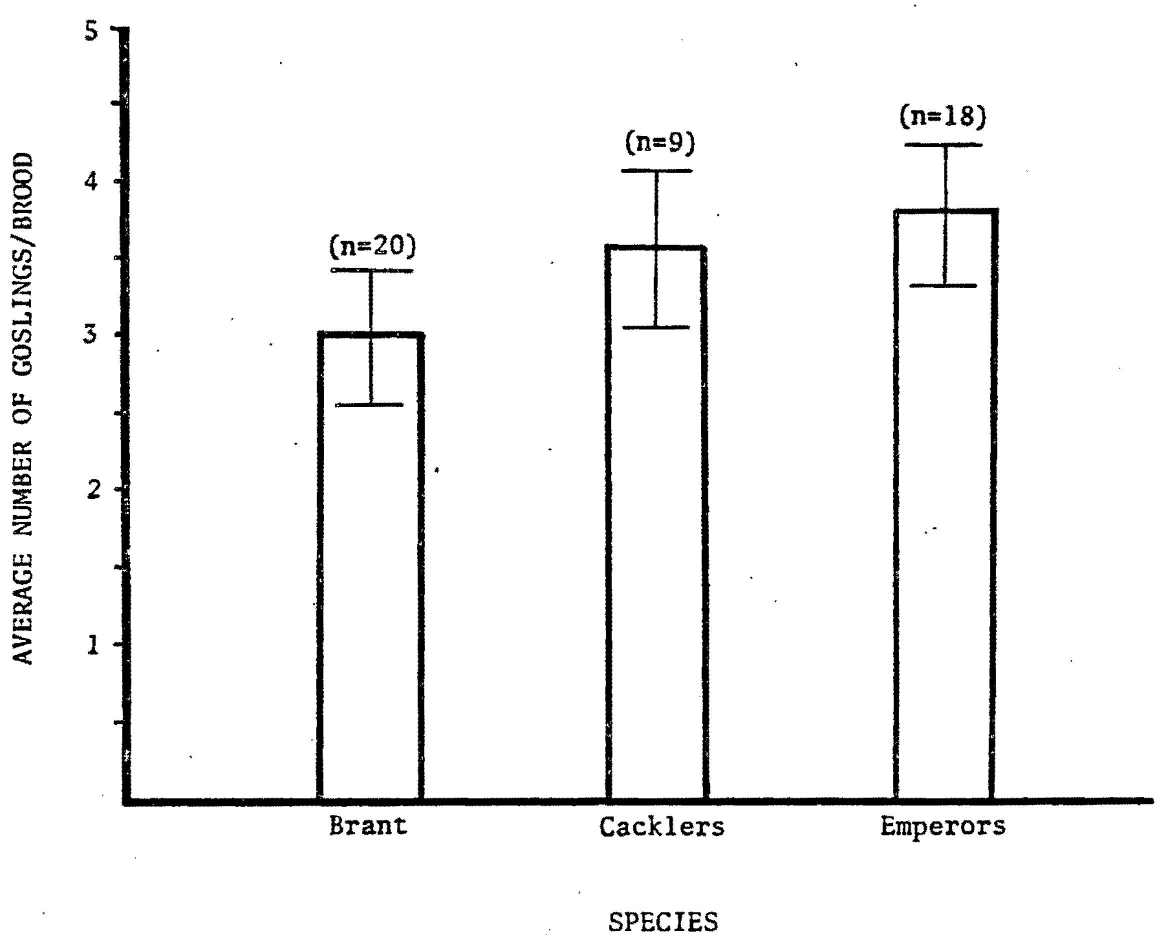


Figure 19. The number of Pacific black brant, cackling Canada goose, and emperor goose broods observed between June 22 and July 4 at Kokechik Bay, 1984. Average number of goslings per brood with standard errors are indicated.