TIMING, NUMBERS, AND HABITAT REQUIREMENTS OF CACKLING CANADA GEESE (Branta canadensis minima) STAGING ALONG THE ALASKA PENINSULA IN FALL

by

Robert E. Gill, Jr.,
Karen S. Bollinger
and
Margaret R. Petersen

Annual Report*
September 1986

U. S. Fish and Wildlife Service
Alaska Fish and Wildlife Research Center
1011 E. Tudor Road
Anchorage, Alaska 99503

Key words: Cackling Canada goose, population, fall staging, migration, habitat use, behavior, Alaska Peninsula, Ugashik Bay, Cinder River

* The data and interpretations presented here are preliminary and not for publication. Users of this information are encouraged to inquire for more carefully analyzed reports which will be available at a later date.

TIMING, NUMBERS, AND HABITAT REQUIREMENTS OF CACKLING CANADA GEESE (Branta canadensis minima) STAGING ALONG THE ALASKA PENINSULA IN FALL

by

Robert E. Gill, Jr.,
Karen S. Bollinger
and
Margaret R. Petersen

Annual Report*
September 1986

U. S. Fish and Wildlife Service
Alaska Fish and Wildlife Research Center
1011 E. Tudor Road
Anchorage, Alaska 99503

Key words: Cackling Canada goose, population, fall staging, migration, habitat use, behavior, Alaska Peninsula, Ugashik Bay, Cinder River

* The data and interpretations presented here are preliminary and not for publication. Users of this information are encouraged to inquire for more carefully analyzed reports which will be available at a later date.

TABLE OF CONTENTS

ABSTRACT

Field studies of fall staging cackling Canada geese (Branta canadensis minima) were conducted along the Alaska Peninsula at Ugashik Bay and Cinder River, Alaska, between 26 September and 19 October 1985. Birds were present at Ugashik Bay upon our arrival, but did not occur in numbers until 10 October. A peak population of 39,500 birds was recorded during an aerial survey on 14 October; 70% occurred at Cinder River and 30% at Ugashik Bay. The accuracy of this population figure was supported by aerial photographs and the ratio of marked to unmarked geese (1:65) that we observed at Ugashik Bay. The majority of birds, including those from Cinder River, departed the area between 16-18 October, most via a route up the Dog Salmon River to Wide Bay on the Pacific side of the Alaska Peninsula. The departure of birds coincided with the passage of major weather systems through the area and associated strong NW winds which would have sustained birds during a crossing of the Gulf of Alaska.

On the Ugashik study area geese confined the majority of their activity to less than 25% of the available habitat, focusing on an area of shallow lakes and expanses of mostly pure stands of Hippuris tetraphylla. While on these areas both adult and juvenile geese spent the majority of their time feeding (64% and 74%, respectively) but, unlike in previous years, there was no significant difference in time allocated to various behaviors between either age classes or sexes of geese.

INTRODUCTION

The dramatic decline in numbers of cackling Canada geese (Branta canadensis minima) since the 1960's (Raveling 1984) demands an understanding of the species' biology throughout its annual cycle. One of the least well known aspects of the biology of cackling Canada geese concerns the staging periods, particularly that in fall. During this period, what is thought to be the entire population of the smallest of the races of Canada geese stages for a 3-6 week period on fewer than 60 km^2 of estuarine habitat along the Alaska Peninsula, primarily at Ugashik Bay and Cinder River (Sellers in Timm 1980, 1982; Bollinger 1984; Bollinger and Sedinger 1985; Andrew 1985). It is at these sites that birds obtain the necessary nutrients to sustain them on what is thought to be a direct, non-stop migration across the Gulf of Alaska to southern British Columbia and areas as far south as northern California. While there exists considerable information on the use of Ugashik Bay by cackling Canada geese, much of it is fragmentary and deals with population assessment during various periods over the past 15 years, a time during which the population suffered an almost 90% decline. Only recently have important data been collected during prolonged on-ground stays at Ugashik Bay (Bollinger 1984, Bollinger and Sedinger 1985). Lacking, however, is a comprehensive assessment throughout the entire fall staging period of the types and amounts of habitat available to and used by cackling Canada geese, the individual roles played by the Ugashik and Cinder River estuaries in supporting respective segments of the population, and an accurate count of the numbers of birds using these areas in fall.

To this end a team of three U. S. Fish and Wildlife Service biologists conducted studies at Ugashik Bay between 26 September and 19 October 1985. The primary objectives of the study were to 1) assess the population of cackling Canada geese using the area by conducting aerial and ground censuses and by reading codes on neck-collared geese, 2) evaluate habitat available to and used by cackling Canada geese, 3) obtain time and activity budgets for the geese, and 4) monitor the migration of geese from the area.

STUDY AREA

The principal study was conducted at Ugashik Bay (57°30'N 157°33'W), a large estuary along the north side of the Alaska Peninsula about 140 km SSW of King Salmon, Alaska (Figure 1). The study area occurred on a large (10 km^2) expanse of vegetated intertidal habitat at the mouth of the Ugashik River. The area is composed of about 13% Hippuris tetraphylla flats, 11% intertidal mudflats, mostly along the Ugashik River, 10% shallow ponds (0.2-0.8 m deep), 5% deep lakes (0.8-1.5 m deep), 2% dry or intermittently flooded ponds, and 2% tidal sloughs. About 57% of the area is vegetated and grown to large stands of graminoids and sedges (primarily Calamagrostis spp., Agrostis fulva and Elymus arenarius), Puccinella phryganodes, Spergularia canadensis, Hippuris tetraphylla, and Potentilla Egedii. Dense mats of Rupia spiralis occur in the deeper ponds.

In addition to work at Ugashik Bay, we also conducted aerial surveys at Cinder River, a 100 km^2 estuary 40 km SW of Ugashik Bay. Detailed descriptions of the types and amounts of habitats in the Cinder River area have not yet been made (proposed for 1986).

METHODS

A. Population Assessment

Observations of neck-collared birds: We attempted to read codes on as many neck-collared geese as possible during our stay. Techniques were generally the same as those used in 1983 and 1984 (Bollinger and Sedinger 1985). Once a flock of geese was located the observer(s) sneaked to within 25-300 m of the group and hid in dense vegetation, usually along a pond edge or adjacent to the mudflats along the river. From there a 20-60 power spotting scope was used to read collar codes. During 1985 we also read a number of codes from a 3-m-high tower erected near the center of the study area (Figure 2). By using a Questar reflective magnifying scope we were usually able (depending on weather and viewing conditions) to read collars within a 400-500 m radius of the tower. For each group of geese observed we first obtained a ratio of the number of collared to uncollared birds in the flock. This estimate was usually refined several times depending on the length of the observation period and the degree to which the flock moved about while feeding. Ratios of collared to uncollared geese were also obtained by observing geese flying between roosting and feeding areas. During these observations we used binoculars and a spotting scope to follow flocks of birds as they flew perpendicular to us at distances of between 50 and 400 m. Birds rarely flew in anything but long lines when transiting

between the two areas, thereby making for near perfect viewing conditions. For birds on the ground, once we obtained an initial count of the marked and unmarked individuals, we next attempted to read as many collar codes as possible. If two observers were together, one usually observed while the other recorded information; however, the second observer frequently looked at neck-collared birds to verify reported collar codes. Finally, when a collared bird was identified we noted any associations between it and other collared or uncollared geese.

Ground surveys: Counts of birds using the Ugashik study area were obtained each time a flock of geese was flushed, either by bald eagles (Haliaeetus leucocephalus), by low flying aircraft, by ourselves, or by undetermined causes. In addition, we counted birds as they transited daily between feeding and roosting areas to the east and west of our cabin (Figure 2). On many occasions when the three of us were working different portions of the study area we obtained independent estimates of flock size, thereby allowing us to refine our daily estimates of the numbers of geese using the Ugashik study area.

Aerial surveys: Surveys of geese using Ugashik and Cinder River estuaries were flown on 12, 14, and 19 October 1985. Surveys on 12 and 14 October were flown in a Cessna 206 while the survey on 19 October was flown in a Cessna 185. On 12 and 14 October birds were counted by two front-seat observers (W. Butler and R. Gill) and on 19 October by observers in the right front seat (R. Gill) and left rear seat (K. Bollinger). Surveys were flown at 160 km/h and at an altitude of 90 m. Race track or figure "S" patterns were flown over all vegetated and unvegetated tidal habitat in both estuaries. For each group of geese that was seen, we obtained an estimate of the number of birds, noted its location on 1:63,360 maps, and described the habitat association(s). To determine the accuracy of our visual estimates of flock size we took a random sample of 35-mm color photographs of flocks of geese from which we first obtained a visual estimate of the number of birds in each flock. Using statistical methods which compare ratios of observed to actual numbers (counted from photographs), we established a population estimate and its 95% confidence intervals.

B. Habitat Use

Distribution of birds in habitat: For each flock of geese and each neck-collared bird that we saw, we noted its location on 1:63,360 U. S. Geologic Survey (USGS) maps and 1:60,000 Color Infrared (CIR) photographs. For detailed analysis of habitat use by geese at Ugashik Bay we plotted sightings (to within a grid-cell size of 2.25 ha) on photo overlays of a scale of 1:12,500. For each sighting we noted the time and, when possible, the elapsed time the birds used a particular area.

Vegetation type-mapping: To assess the distribution and size of major vegetative communities in the Ugashik Bay study area we used existing Bureau of Land Management CIR imagery (1:60,000) as well as vertical CIR imagery (about 1:5,000) taken by us on 11 October. Voucher specimens of most plants comprising each major community were collected during September 1985.

Habitat use and foraging requirements: To determine the extent of grazing by geese and the types and nutritional value of foods eaten by geese in the Ugashik Bay study area we stratified the habitat into four major types: inland lakes (including pond edges), mud lakes, river edges, and Hippuris islands. Within these habitats we randomly placed from three to six 1-m^2 exclosures. From each of these exclosures we removed all vegetative parts from above and below ground from within two 0.1-m^2 samples, one just prior to the arrival of the majority of birds and another as the geese were departing for the wintering grounds. In addition, samples were taken from similar habitats adjacent to each exclosure but available to geese. Foods eaten by geese will be determined through fecal analysis (Owen 1975). Droppings were collected several times throughout the study period in each of the major habitats used by geese. A sample equal to 10% of the number of foraging birds was collected immediately after the geese departed for roosts or after they had fed in an area for a minimum period of two hours. Samples of droppings were air dried in the field while plant samples were frozen within 24 hours of collection. Both plant and fecal samples were sent to the Agricultural and Forestry Experiment Station Laboratory, Palmer, Alaska, for analyses. Analyses will include: percent composition of each identifiable taxon; percent crude fat, total ash, neutral and acid detergent fiber; and percent N, P, K, Ca, and Mg.

C. Behavior

Time and activity budgets: As in 1983 and 1984, time and activity budgets were established for a sample of neck-collared geese. Behavior was recorded in conjunction with efforts to read codes on neck-collared birds. A continuous sampling scheme was used in 1985 which included the following categories of behavior: foraging, drinking, locomotion (walking, swimming, flying), maintenance (preening and bathing), alert, resting, and aggressive and submissive interactions (chasing and fleeing). Individual birds were followed for a minimum of 10 minutes and for up to one hour. A program was developed to allow direct data entry on an HP 71 calculator. These data were subsequently stored on microcassettes through an interface with an Epson microcomputer and then dumped to a Data General MV-8000 minicomputer for statistical analysis. Each observation period was considered a sample and the percent of time spent in each behavior was calculated for each sample period. Analysis of variance was then used to test for differences between sexes and among age classes for each behavior.

Migration: Information on the behavior of geese immediately before and during departure on their southward migration was obtained from nearly continuous observation during daylight hours from 16-18 October. One or more observers with spotting scopes and binoculars noted the movements of all flocks of geese about the main study area on those days. The information collected included the time of the sighting, the size of the flock, its behavior (milling, direct local flight, or departure flight), if on their departure flight the direction (true heading) until the birds were out of sight, and the estimated altitude when leaving the study area and when last seen. In conjunction with these observations we noted wind speed and visibility (laterally and vertically) each hour. These data were supplemented by National Weather Service data for this period from reporting stations at King Salmon, Port Heiden, Cold Bay, and Kodiak, Alaska.

D. General faunal assessment

In addition to detailed notes on cackling Canada geese, we kept daily records of all species of birds and mammals, recording their numbers, behavior, and location on the study area. These data are summarized in Appendix A.

RESULTS AND DISCUSSION

Environmental Conditions

Weather during the 24-day field effort (26 September - 19 October) was highly variable, ranging from clear, warm, and calm to frequent gales and storms (Appendix B). Measurable precipitation (mostly rain, but including snow, sleet, and hail) was recorded on 15 of the 24 days, totaling 13.4 cm (5.3 inches). Winds exceeded 25 km/h on 10 of 24 days. The daily high temperature averaged 6° C while the low averaged just above 0° C; however, during the last four days of our stay the high never exceeded 4° C while the low was close to or below freezing each day. On 18 October the temperature remained below -3° C all day and ice 1-3 cm thick formed on all but the largest freshwater lakes and brackish ponds. Temperatures remained below freezing in the area until mid-November.

Population Assessment

The chronology of use of Ugashik Bay by cackling Canada geese in 1985, based on ground counts, is summarized as follows. Birds were present on the study area upon our arrival on 26 September, but the population remained below 2,000 birds until 10 October when about 6,000 birds arrived (Figure 3). The population increased steadily to about 12,000 birds on 14-15 October and then dramatically declined to about 3,500 birds on 16 October and 1,500 birds on 17 October. On 18 October we recorded about 8,000 birds leaving the area and suspect these to have been mostly birds coming from Cinder River (see below).

Aerial surveys: Aerial surveys of Ugashik Bay and Cinder River were flown on 12, 14 and 19 October 1985. On 12 October 10,500 total cackling Canada geese were recorded; 86% occurred at Ugashik Bay while 14% were found at Cinder River (Table 1). Two days later a total of about 39,400 geese was counted, of which 29% were found at Ugashik Bay while 71% occurred at Cinder River. On the 19 October survey, following the observed departure of the majority of geese at Ugashik Bay, only about 2,400 total cackling Canada geese were seen, 95% of which were counted at Cinder River. A measure of the accuracy of these population counts, particularly that on 14 October, was derived by comparing the ratios of flock size for flocks that were counted (estimated numbers) and then photographed (actual numbers). The results of this analysis produced a corrected population estimate of 38,591 $\pm$ 4,095 cackling geese using the two areas on 14 October (95% confidence interval). This figure compares very favorably with that of Raveling et al. (1986), who estimated the autumn 1985 (= wintering grounds) population at 45,400 birds based on an inventory combining ground and air photo census techniques. Their estimate based on marked-unmarked ratios was between 45,700-55,900

for the same period, some 15-30% higher than our figure. We consider their estimate to be closer to the true population size since a few thousand geese had already been reported on the wintering grounds by 18 October (D. Zezulak, pers. comm.), the day the majority of birds using Ugashik Bay and Cinder River departed the area. Nevertheless, we feel that the limited area used by cackling Canada geese at the two sites and the short period during which they are present afford a unique opportunity to assess the post-breeding population of these birds prior to their fall migration.

Collar sightings and neck-band ratios: During 1985 we saw 302 total neck-collared geese, representing 146 individual birds (Table 2, Appendix C). About 215 person-hours were devoted to reading collars, for an average of 0.7 h/collar. It took over twice that (1.5 h) to read a new collar. However, once the majority of geese arrived on the area (after 11 October) the effort required to read a new collar fell to about 0.8 h/collar. Of the 146 unique collars read, the majority (64) were on birds collared on the breeding grounds during the previous three months. Of the remaining collars, 36 were from birds banded during 1984, 25 from 1983, 20 from 1982, and one collar, ACC, was on a bird collared in 1975.

The frequency with which we read collars was directly related to the number of birds using the study area. Of the 146 codes identified, 125 (86%) were read after 11 October, when the majority of geese arrived on the area. Overall, each collar was seen on an average of two different days (the same collar was frequently read several times during a single day by 1-3 observers); the range extended from one day for 76 (52%) of the collars to nine days for six of the collars.

During the study we obtained ratios of collared to uncollared birds from 103 flocks of geese totaling about 26,000 birds (Table 3). The overall ratio over 20 days of observation was 1:65. This ratio, times the total number of marked birds (n=146), resulted in a peak population estimate of 9,500 geese for the Ugashik Bay study area, a figure close to that derived from visual ground counts (Figure 3). Our overall ratio is very similar to that derived by Raveling et al. (1986) for birds on the wintering grounds during winter 1985-86 (1:60). Their ratio was adjusted for erroneous collar sightings, usually collars seen on only one occasion (1% of total) for which the majority turned out to be codes that did not exist or were on a bird known to have died prior to the reported sighting. Despite over 50% of our codes having been seen only once, such an adjustment was probably not necessary for the Ugashik data since all of our reported codes were valid and none was from individuals known to have died prior to our sighting them.

Habitat Use

Distribution of habitats: The main Ugashik Bay study area encompassed about 10 km^2 (Figure 1). Over the area, three distinct physiographic zones, oriented roughly NE to SW, are recognizable (Figure 2). Along the western side of the Ugashik Peninsula is a 1-km wide band of shallow lakes, most of which are interconnected by narrow channels. Of the 12 distinct lakes within this area, the largest is about 8 ha, most being 5-7 ha in size. Next occurs a somewhat narrower band of smaller but deeper lakes. Our cabin was located on the largest of these, a long, narrow lake of about 10 ha in size. Adjacent to these lakes and extending to the Ugashik River occurs a

broad band of tidally influenced vegetation. A few small ponds occur on this area, but most of it is interwoven by a dozen or more tidal distributaries that extend inland to some of the larger lakes. This outer band of vegetation is itself divided into 2-3 zones, each associated with former beach ridges, and each characterized by one or more dominant plants. The most coastal of these is a very narrow, often irregular, band of pure Hippuris. At low tide a progressivly wider band of intertidal mudflats extends from the northwest corner on around to the southeast side of the study area. Off the extreme east side of the main peninsula occurs a large embayment which, over the past 20-30 years, appears to have silted in and is now being colonized by extensive stands of almost pure Hippuris.

A detailed analysis of the amounts and distribution of habitats within the study area will be conducted during the 1986 field season.

Association of geese with habitats: During the course of the study we determined broad habitat associations of 114 flocks of geese, totaling about 95,000 bird-days of use (Table 4). The great majority of geese (71%) were associated with the shallow inland lakes, followed by those using Hippuris flats (20%) and mudflats (7%). Less than 2% of the birds were associated with habitats other than these. Within these broad habitat types geese exhibited marked preferences for certain areas, specifically the west-central portion of the inland lakes, the Hippuris flats along the south side of the study area, and the extensive Hippuris flats to the east (Figure 4). However, these data suffer from certain biases, the most important being the lack of systematic and equal coverage of all portions of the study area. Instead, we tended to concentrate our efforts where we could obtain the easiest access to the greatest number of birds. Nevertheless, the location of these areas in relation to our camp required extensive walking, on a daily basis, over the majority of the study area. In addition, from the tower we were able to obtain over 30 hours of observations of birds using the north 1/3 of the study area and during the three aerial surveys we obtained an unbiased assessment of habitat use and distribution by the geese. From these three methods we believe we obtained a true picture of the distribution of geese on the study area.

Feeding and nutrient requirements of geese: As of this writing much of the data on foods available to and eaten by geese have not been completely analyzed. The raw data from analyses of six fecal samples and 13 plant samples, representing five major taxa of potential goose foods, are presented in Appendix D. These results support one observation in particular which was repeatedly seen during the study, and that is the apparent preference by geese for the new, subterranean shoots of Hippuris and the almost complete avoidance of the above-ground parts. The values for percent total nonstructural carbohydrates (TNC) for the below-ground portion of Hippuris were almost ten-fold greater than the above ground parts. These represented the highest values among all plants analyzed from Ugashik and they were very similar to those for other major foods (Triglochin palustris) eaten by cackling Canada geese while on the breeding grounds on the Yukon Delta (Sedinger and Raveling 1984). Unfortunately, our samples of Triglochin from the Ugashik Bay study area were of insufficient quantity to determine values for TNC and lipids, but it is reasonable to expect similar values for Triglochin from the Alaska Peninsula. What remains to be done during the 1986 field season is to determine the proportions of each taxa of prey in the

diets of geese.

Behavior

Time and activity budgets: During 1985 we constructed time and activity budgets for 59 birds of known age and sex, based on a total of 29.4 h of observation (Appendices E and F). The great majority of observations (86%) were of adult birds. We found no significant differences between adult males and adult females in the amount of time they spent in any behavior except submissive; females spent 0.3% (± 0.1 S.E.) and males spent 0.1% (± 0.05 S.E.) in submissive behavior ($P > 0.05$). Because differences between sexes were so minor, we combined activity budgets for all adults. We also combined information for hatching-year and second-year birds under one category, juveniles, because of the small number of individuals and the limited amount of time during which we observed them. Although the differences we observed between adults and juveniles were not statistically significant, we present them separately because of our small sample size of juvenile behavior.

Adults spent about 65% of their time feeding, followed by 11% in maintenance activities, 9% resting, 8% moving about, and 6% being alert. Juveniles, as might be expected, spent noticeably more time feeding (74%) and being alert (11%), and less time moving about (4%) and in maintenance activities (4%) than did adults (Table 5). The fact that most of the juveniles were hatching-year birds and therefore not undergoing molt while at Ugashik, may have accounted for the marked difference in time spent in this behavior between the two age classes.

Migration: The migration of cackling Canada geese from the Ugashik Bay area was spectacular in 1985. Departure of the main body of geese began on the afternoon of 16 October and continued through the evening of 18 October, although some 2,000 cacklers had already arrived on the wintering grounds by the 16th, indicating a minor departure from the area before 14 October. During the period 16-18 October about 14,000 geese were observed leaving the Ugashik study area. Geese departed in flocks ranging from fewer than a dozen birds to one of about 2,400 birds; 61% of the 80 flocks we monitored were of 100 birds or fewer while an additional 19% were composed of between 100 and 200 birds (Table 6).

The rates of departure from the area varied during the three days. Beginning on 16 October about 800 birds/h departed during a brief period between 1630-1930 (AST). From daybreak until 1300 on 17 October the ceilings were lower than 200 m and lateral visibility was less than 10 km; no birds were observed flying during this period. Between 1330 and 1900 that day there was a pronounced movement of birds from the area, averaging 483/h (Table 7). On 18 October migration was first noted at sunrise when a flock estimated at 2,400 birds departed the main study area. Migration continued throughout the day at an average rate of 1,082 birds/h (Table 7); however, 83% of more than 8,600 birds that we watched depart that day, did so before noon. We do not know if geese continued to depart during darkness these three days, but during the evening of 17 October (2000-2400) and during the early morning of 18 October (0500-0600) we heard geese flying to the E over the cabin.

Almost all flocks of geese that departed the Ugashik study area exhibited

the same behavior. Most of the 14,000 birds we watched leave the area were first seen (often first heard) as they took flight from the shallow lakes on the main study area. Flocks would immediately begin to climb and by the time they were over the east side of the study area most were at 150-300 m altitude. All 80 flocks departed the area on direct headings of between 060-160° (true north); however, the great majority of flocks (70%) departed on a heading of between 101-120° (Table 8, Figure 5). These included some 4,100 birds in 21 flocks that were first seen coming from SW of the main study area near the mouth of the King Salmon River (Figure 1). That these flocks were probably birds coming from Cinder River is suggested by two observations: 1) we watched them come from beyond any known area used by geese in Ugashik Bay, and 2) we counted almost 14,000 geese leaving the Ugashik area, which exceeded by 3,000-4,000 the combined maximum daily counts of geese using the Ugashik study area between 16 and 18 October, suggesting a major influx of birds from elsewhere (Figure 3).

Given the prevailing weather conditions during 16-18 October, it seems likely that the majority of birds from both Ugashik Bay and Cinder River crossed the Alaska Peninsula through the pass leading to Wide Bay. During the three days we monitored migration, the skies were mostly overcast with ceilings usually below 300-400 m. Of the numerous passes through this portion of the Alaska Range (Cinder River to Ugashik), only the one at the head of the Dog Salmon River, leading to Wide Bay on the Pacific side of the Alaska Peninsula, is below 300 m (actual height 30-50 m above sea level). The next pass south of Ugashik Bay/Cinder River that would have allowed birds access to the Gulf of Alaska under those ceiling conditions was along the Meshik and Aniakchak rivers, 75 km SW of Cinder River. To the north the next access to the Gulf of Alaska is east of Becharof Lake at Puale Bay, a distance of over 100 km from Ugashik Bay. Not surprisingly then, the departure heading of most birds coincided with a route that would have taken the birds across the Alaska Range in the vicinity of Wide Bay, a distance of only 50 km from Ugashik Bay (Figure 5).

Local weather conditions appeared to dictate the movement of the birds, and other passes (e.g., Puale Bay) may sometimes be used when local conditions preclude use of the Wide Bay pass. On three occasions, after several flocks of geese had departed the study area on a 120° heading, the local ceiling suddenly dropped below 150 m and there was no visible access to the Pacific side of the Alaska Peninsula. All of the flocks lost altitude rapidly when 5-8 km away and then returned to the area, most of them flying 10-20 m above the ground. On the other hand, when the Wide Bay pass appeared obscured but ceilings locally and to the north were about 500 m, we watched two flocks fly over the study area from the SW (heading 060°, apparently from Cinder River), then up the Ugashik River toward Becharof Lake until just past the village of Ugashik (Figure 1). During this time the ceiling began to lift to the SE in the vicinity of Wide Bay and the birds turned on an estimated heading of about 130-150° and flew up the Dog Salmon River, in the direction of Wide Bay, until out of sight.

The timing of the departure of geese during 16-18 October appeared to be correlated with local and enroute weather conditions (Figures 6-11). On 16 October the departure of birds coincided with the passage of a cold front through the area the previous evening (Figure 6) and a low pressure trough

which moved through the immediate area between 1600-1700 AST on the 16th (Figure 7). Beginning at 1400 on 16 October and continuing until about 1630 we recorded considerable local movement of birds (unlike any we had previously observed), which we believe was probably premigratory "restlessness." The movement involved numerous flocks (n = 48) flying back and forth between the shallow lakes on the main area and a large Hippuris "island" along the SE edge of the study area (Figure 2). Eleven of the flocks that flew from the main area to the Hippuris flats remained separated from each other and the main group of geese, so we were able to determine the time each spent on the area. During early October geese normally flew from the shallow lakes to the Hippuris flats and fed for an entire low tide cycle. During this premigratory period, however, the birds remained for periods ranging from less than 5 minutes to 30 minutes before returning to the shallow lakes area. All of these birds had to fly directly into 30-50 km/h winds to return to the lakes. That they even flew to the Hippuris flats in the first place is odd since at the time the Hippuris was completely covered by an exceptionally high tide. During this same period we observed another eight flocks, ranging in size from 12 to 240 birds, leave the Hippuris area and climb to an altitude of about 300 m on headings of between 100 and 130°, only to return once they reached the south side of the Ugashik River. Some returned to the flooded Hippuris flats, but most flew back to the shallow lakes on the main study area. After 1630 h, with the passage of the low pressure trough, and until 1930 h, all of the flocks (n = 17) we observed flying from the shallow lakes and the Hippuris flats departed the area to the ESE; none was seen returning.

On 17 October a similar pattern was recorded. Observations began at 1000 that day, but the first flock was not seen moving from the shallow lakes to the Hippuris flats until 1330 h, about one hour after low slack tide. During the next three hours, up to the time when the tide inundated the Hippuris, we recorded 1,309 birds (= 28 flocks) flying to the Hippuris flats and 3,109 birds (= 17 flocks) flying from the Hippuris back to the shallow lakes. As during the previous day, birds had to fly against 30-50 km/h headwinds to return to the shallow lakes. Surprisingly, the majority of birds (67%) leaving the flats for the shallow lakes did so in two large flocks at 1430 h, well before the tide had begun to reach the base of the vegetation. Equally surprising were the nine flocks of geese (440 birds) that flew to the Hippuris flats at high tide and joined 700 geese that had been swimming on the area the previous hour. The combined flocks remained on the flooded Hippuris flats for about 45 minutes before they got up and flew back to the shallow lakes. After all birds had moved off the Hippuris flats (about 1600 h), we noted the first birds departing the Ugashik study area on migration that day. This departure also coincided with increased winds of 40-65 km/h from the NW (Figure 8) and much improved visibility and ceilings extending from the NW portion of the study area around to the NE. The ceiling to the NE was estimated at 600 m and to the E and S at between 300 and 450 m. Blue skies could be seen on the Pacific side of the Alaska Range through three passes immediately east of Ugashik and south to Wide Bay pass. At 1621 h all of the birds (about 2,500) on the main study area got up. A group of about 700 broke off from the main body of birds and departed the area on a heading of 130°. No major departure was noted from the area after this despite favorable winds (from 280° at 30-50 km/h) and what appeared to be ample access to the Gulf of Alaska through several passes in the immediate area, including Wide Bay.

On 18 October we observed a major departure of geese that began at sunrise and continued through our departure from the study area at about 1800 h. Local weather conditions in the morning included surface winds from the NW at 30-50 km/h, generally overcast skies with scattered snow squalls, and temperatures below -4° C (Figure 9). By 1600 h that day most lakes were covered by ice that was 1-3 cm thick. Unlike the "restless," local flying which was common the previous two days, the migration of geese on 18 October was well defined and directed. Of the 53 flocks observed that day, only one flew to the Hippuris flats and returned to the shallow lakes and only six flocks, totaling 273 birds, departed on direct headings and then shortly returned to the area. A strong NW flow of up to 50 km/h at the surface and 90-110 km/h at 650 mb (about 3,500 m altitude) persisted in the area during the morning and early afternoon, but by late afternoon surface winds had diminished as another large weather system moved east across the northern Bering Sea (Figure 10). The low pressure system in the north Gulf of Alaska remained stationary and produced strong NW winds (45-55 km/h surface; 75-100 km/h at 650 mb) south of the Alaska Peninsula and across most of the Gulf of Alaska (Figure 10). By 19 October weather conditions favorable for migration had passed. By 1500 h that day a high pressure ridge had formed south of the Alaska Peninsula and a major low pressure system had moved into the northern Bering Sea (Figure 11). Winds over the study area and well over the western Gulf of Alaska were calm.

That cackling Canada geese availed of specific weather conditions to complete their fall migration in 1985 appears certain. However, the storm that brought favorable winds for migration in 1985 also brought freezing temperatures that caused ice to form on the shallow lakes and prevented geese from further feeding and roosting on them. Geese may normally remain as long as possible in order to gather the nutrients required to complete their migration. They may, however, have evolved a migration strategy that allows them to leave sooner if their migration will be aided by local and enroute weather systems. A discussion of the probable route(s) taken, the duration of the flight, and the physiological conditions of the birds awaits further analyses and completion of the 1986 field season.

CONCLUSIONS

The importance of Ugashik Bay and Cinder River to fall staging cackling Canada geese cannot be overstated. The entire population appears dependent upon very limited types and amounts of habitats within these two relatively small estuaries. Work during the 1985 field season greatly refined population estimates of birds using the two areas and helped explain temporal and spatial patterns of use of these areas, especially by birds at Ugashik Bay. However, in 1985 we found that the great majority of birds used Cinder River, an area for which we have only the most basic information pertaining to cackling Canada geese. The role played by the Cinder River area in supporting this population of Canada geese must be understood before management practices can be implemented.

ACKNOWLEDGMENTS

The flight crews and administrative personnel of Peninsula Airways, King Salmon, Alaska, were most helpful in setting up our camp and in assuring our timely departure. Likewise, the staff of the Becharof/Alaska Peninsula NWR were very accommodating while we were in King Salmon as were staff of the Alaska Department of Fish and Game who arranged for us to use their bunk house. We especially thank William Butler, U. S. Fish and Wildlife Service, for flying the aerial surveys and taking the aerial photography. Lastly, we appreciate the time and effort spent by U. S. Fish and Wildlife Service personnel in renovating the Ugashik Bay cabin.

LITERATURE CITED

Andrew, J. M. 1985. Ascertainment report for the expansion of the Cinder River State Critical Habitat Area. Unpubl. U. S. Fish and Wildlife Service Rpt., Anchorage, Alaska. 17 pp.

Bollinger, K. S. 1984. Observations of cackling Canada geese and emperor geese on the Alaska Peninsula during fall migration - 1983. Unpubl. U. S. Fish and Wildlife Service Rpt., Anchorage, Alaska. 17 pp.

Bollinger, K. S. and J. S. Sedinger. 1985. Cackling Canada geese on the Ugashik Bay Peninsula, Alaska, during fall staging/migration - 1984. Unpubl. U. S. Fish and Wildlife Service Rpt., Anchorage, Alaska. 26 pp.

Owen, M. 1975. An assessment of fecal analysis technique in waterfowl feeding studies. J. Wildl. Manage. 39: 271-279.

Raveling, D. G. 1984. Geese and hunters of Alaska's Yukon Delta: Management problems and political dilemmas. North. Amer. Wildl. and Nat. Resources Conf. Trans. 49:555-575.

Raveling, D. G., D. S. Zezulak, and J. G. Silveira. 1986. Distribution and abundance of cackling geese during winter 1985-86 and comparisons to 1982-83, 1983-84, and 1984-85. Unpublished Progress Rpt. to U. S. Fish and Wildlife Service, Anchorage, Alaska. 61 pp.

Sedinger, J. S. and D. G. Raveling. 1984. Dietary selectivity in relation to availability and quality of food for goslings of cackling geese. Auk 101: 295-306.

Timm, D. E. 1980. Annual report of survey and inventory activities- waterfowl. Fed. Aid in Wildl. Rest. Proj. W-19-1, Job No. 10.0. Alaska. 34 pp.

Timm, D. E. 1982. Annual report of survey and inventory activities- waterfowl. Fed. Aid in Wildl. Rest. Proj. W-19-2, Job No. 11.0. Alaska. 48 pp.

U. S. Fish and Wildlife Service. 1976. North American Bird Banding Manual, Vol. 1. Washington, D.C.

Table 1. Results of aerial surveys of cackling Canada geese at Ugashik Bay and Cinder River on 12, 14, and 19 October, 1985.

Area	Survey Date 12 OCT	14 OCT	19 OCT
Ugashik Bay	9,000	11,986	121
Cinder River	1,512	27,431	2,240
Total	10,512	39,417*	2,361

* Original estimate. See Results section for corrected estimate.

Table 2. Daily frequency of neck collars read on cackling Canada geese at Ugashik Bay - Pilot Point, Alaska, between 26 September and 19 October 1985.

	Date																						
	September					October																	
	26	27	28	29	30	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Total Collars Read	0	0	1	0	1	8	16	12	6	3	0	0	10	0	0	4	35	60	68	54	0	24	0	0
New Collars Read	0	0	1	0	1	8	7	0	0	0	0	0	4	0	0	3	23	37	37	10	0	15	0	0
Cumulative New Collars	0	0	1	1	2	10	17	17	17	17	17	17	21	21	21	24	47	84	121	131	131	146	146	146
Cumulative Total Collars	0	0	1	1	2	10	26	38	44	47	47	47	57	57	57	61	96	156	224	278	278	302	302	302

Table 3. Ratios of uncollared to collared cackling Canada geese seen at Ugashik Bay during fall 1985.

Date	Total birds	No. flocks	No. collared	Ratio
Sep 28 - Oct 11	2,999	13[1]	63	1:47
October 12	5,041	9	71	1:70
October 13	7,416	6	91	1:80
October 14	3,286	10	40	1:81
October 15	2,859	5	59	1:47
October 16	2,337	18	36	1:64
October 17	1,083	32	18	1:59
October 18	829	10	15	1:54
Total	25,850	103	393	1:65

[1] During this period a single flock was seen each day, except for one day on which no flocks were observed.

Table 4. Distribution of flocks of cackling Canada geese among habitats on the Ugashik Bay study area during fall 1985.

Habitat type	% of habitat on study area	% of habitat used by birds	Bird-days of use	No. flocks observed
Shallow lakes	10.0	41.0	67,991	64
Hippuris flats	13.0	42.0	18,942	34
Mudflats	11.0	13.0	6,240	14
Other	66.0	1.0	1,450	2
Total	100.0		94,623	114

Table 5. Percent ($\bar{X} \pm$ S.E.) of time cackling Canada geese spent in different behaviors at Ugashik Bay during fall 1985.

Behavior	Adults (n = 51)	Juveniles[1] (n = 8)
Feeding	64.4 ± 4.4	73.9 ± 10.0
Maintenance	10.9 ± 2.9	4.0 ± 3.1
Resting	9.2 ± 2.9	6.8 ± 4.5
Locomotion	7.9 ± 1.1	3.9 ± 1.6
Alert	6.3 ± 0.9	10.9 ± 3.5
Intraspecific	0.9 ± 0.4	0.2 ± 0.1
Drinking	0.3 ± 0.1	0.3 ± 0.2
Total	99.9	100.0

[1] Juveniles include hatching-year and second year birds. In this instance all hatching-year birds (n = 5) were females and all second year birds (n = 3) were males. Adults include all third-year and older birds.

Table 6. Distribution of flock sizes of cackling Canada geese departing the Ugashik Bay area between 16 and 18 October 1985.

Flock Size	Date			No. Flocks	(%)
	16 OCT	17 OCT	18 OCT		
0-50	7	3	15	25	(31)
51-100	5	5	14	24	(30)
101-150	1		9	10	(13)
151-200	1		4	5	(6)
201-250			5	5	(6)
251-300			1	1	(1)
301-351	1		2	3	(4)
351-400				0	(0)
401-451	1			1	(1)
451-500			2	2	(3)
>500*	1	2	1	4	(5)
Total	17	10	53	80	(100)

* Included a flock of 600 on 16 October, flocks of 700 and 1,500 on 17 October, and a flock of 2,400 on 18 October.

Table 7. Daily rates of departure ($\bar{X} \pm$ S.E.) of cackling Canada geese from the Ugashik Bay area between 16 and 18 October 1985.

Date	Observation period	Migration period	No. flocks	X rate/h	Total birds
16 October	1400-1930	1630-1930	17	797	2,392
17 October	1000-1900	1330-1900	10	483	2,657
18 October	0900-1700	0900-1700	53	1,082	8,658
Totals	21.5 h	16.5 h	80	830	13,707

Table 8. Departure headings of flocks of cackling Canada geese from Ugashik Bay, 16-18 October 1985.

Date	Heading[1] 61-80	81-100	101-120	121-140	141-160	Total
16 October	2	3	4	2	6	17
17 October	1	1	4	3	1	10
18 October	1	1	48	3	0	53
Total	4 (5%)	5 (6%)	56 (70%)	8 (10%)	7 (9%)	80

[1] Headings are degrees from true north.

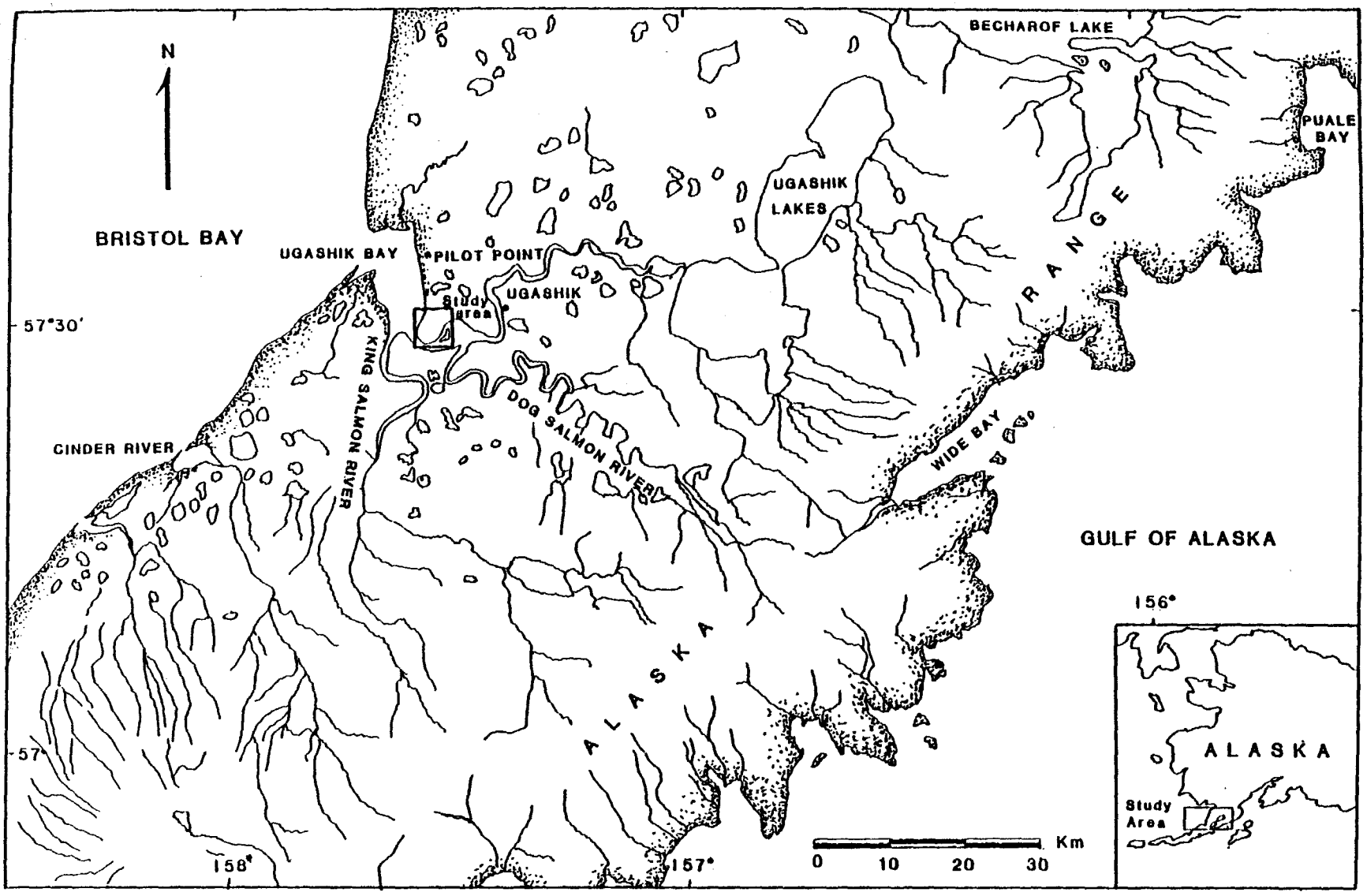

Figure 1. Location of the Ugashik Bay and Cinder River Study areas.

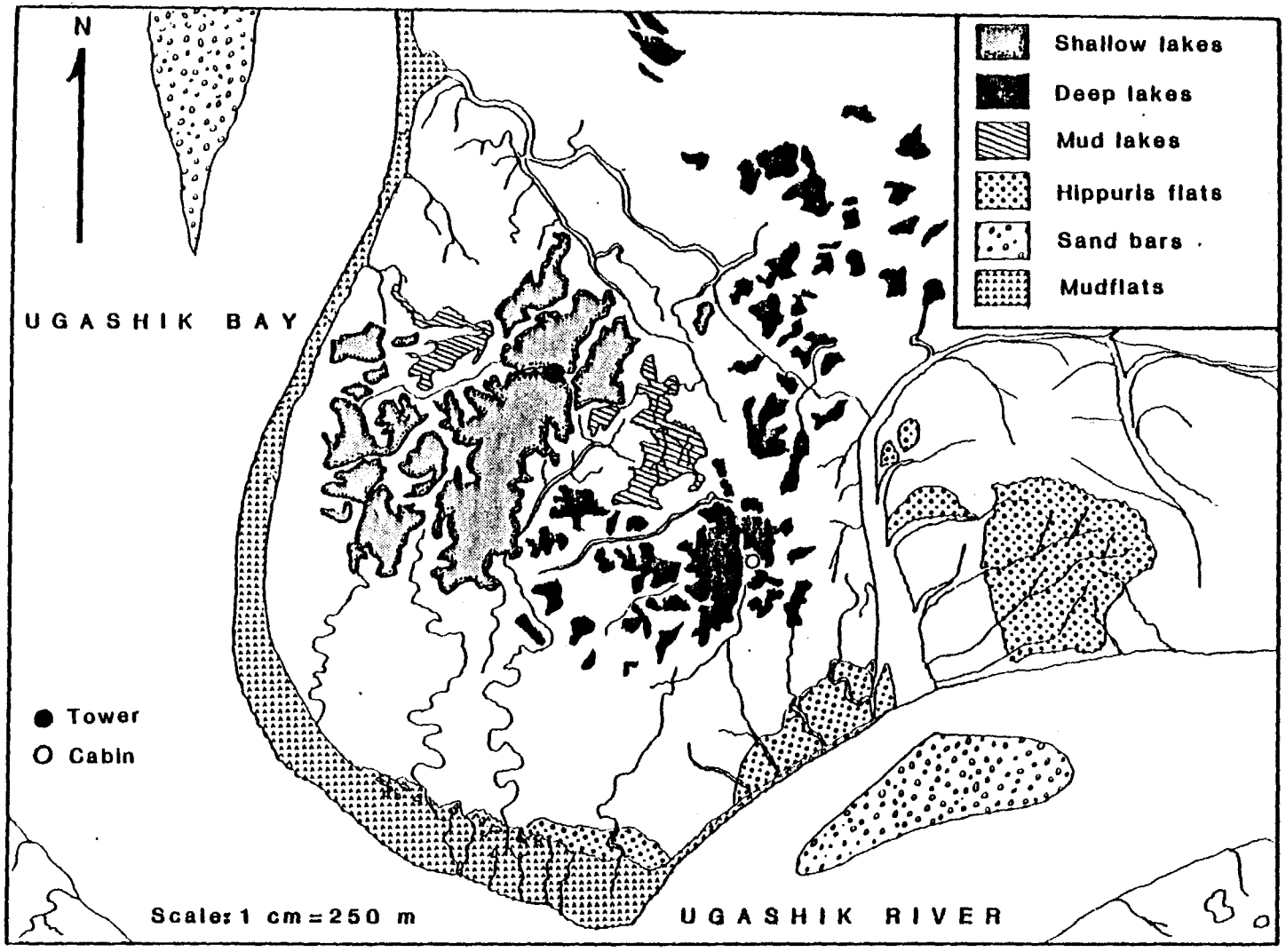

Figure 2. Major habitats used by cackling Canada geese on the Ugashik Bay study area during 1985.

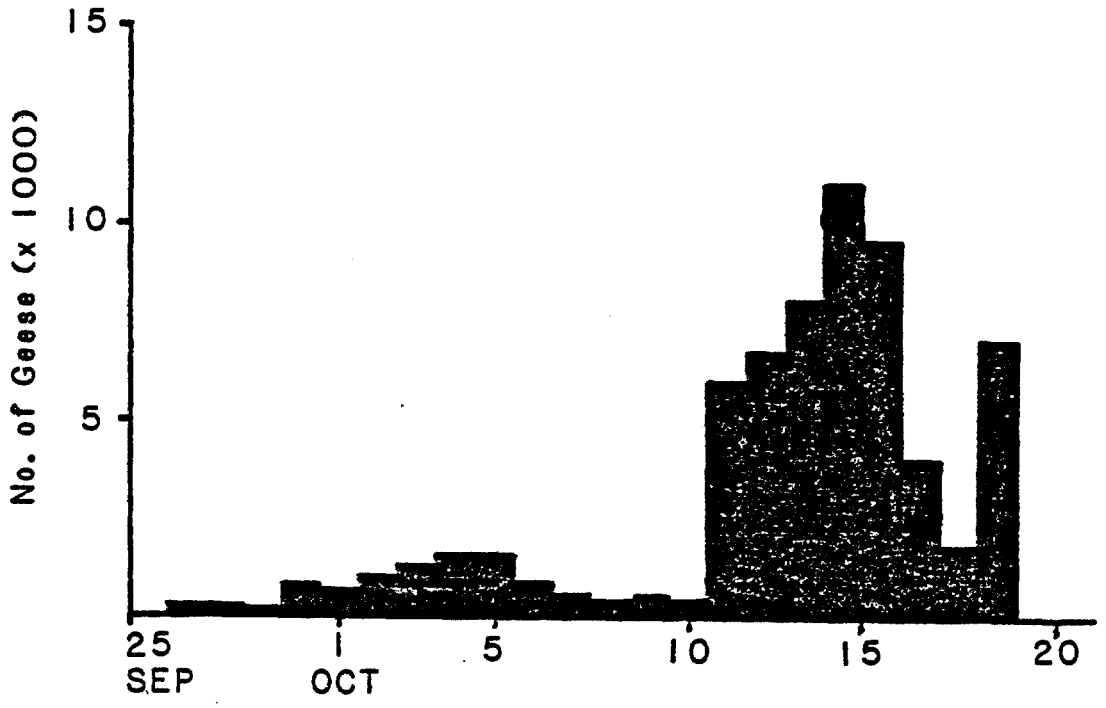

Figure 3. Maximum daily counts of cackling Canada geese using the Ugashik Bay study area during fall 1985. All numbers were derived from ground counts.

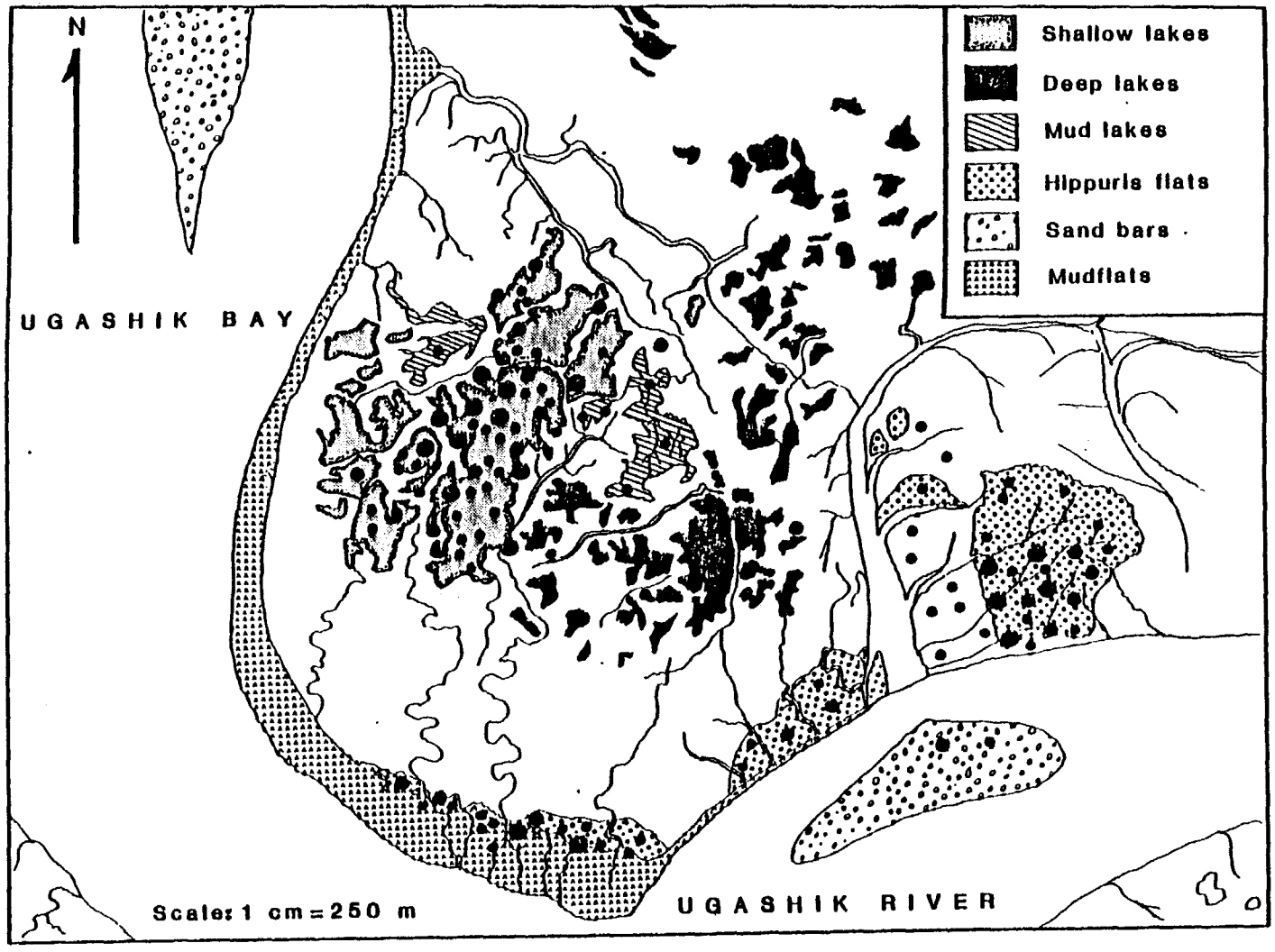

Figure 4. Distribution of flocks of cackling Canada geese on the Ugashik Bay study area during fall 1985. Large circles equal flocks greater than 1,000 birds, medium circles represent flocks between 500 and 1,000 birds, and small circles represent flocks of fewer than 500 birds.

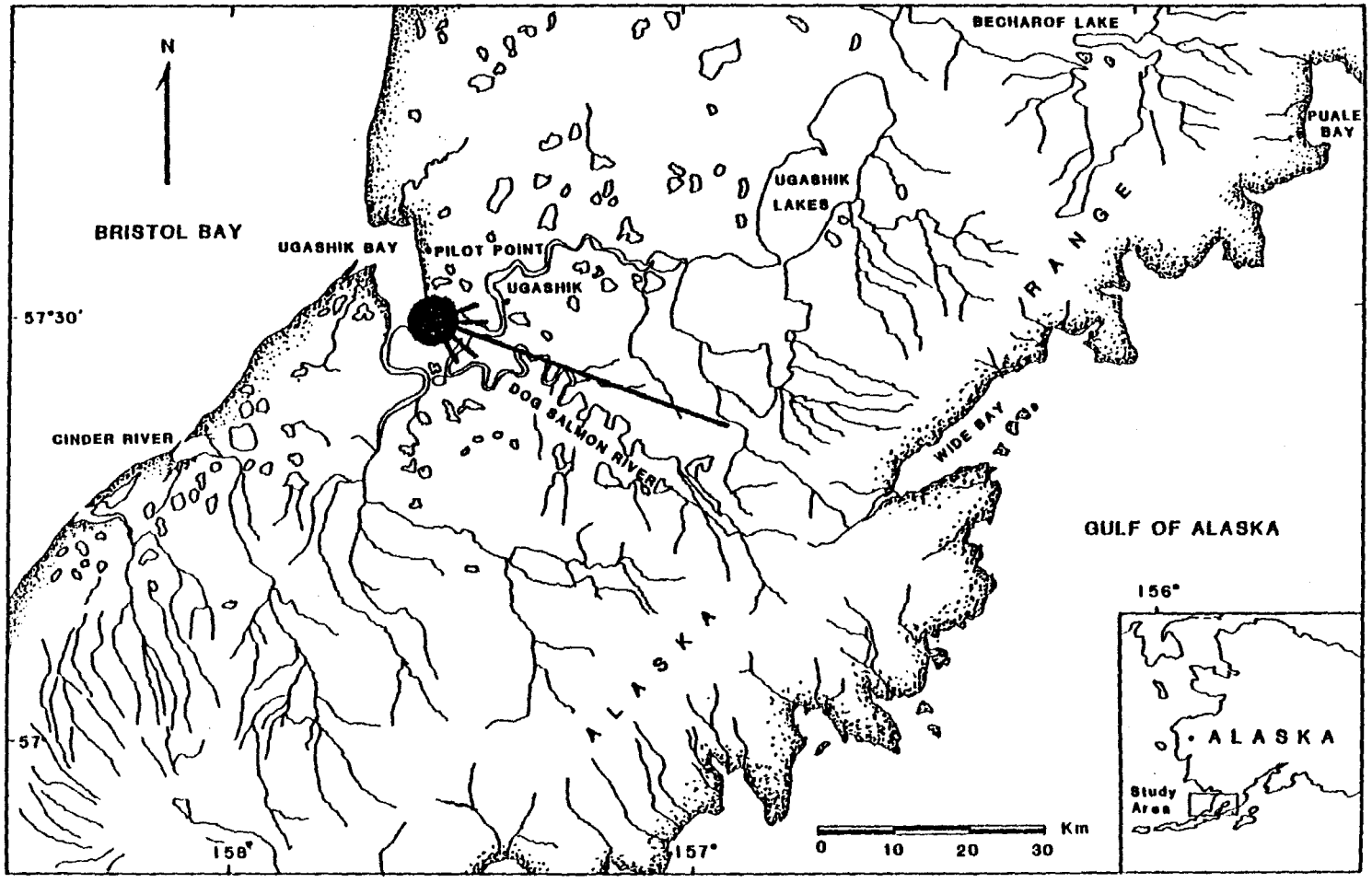

Figure 5. Departure headings of flocks of cackling Canada geese from the Ugashik Bay study area, 16-18 October 1985.

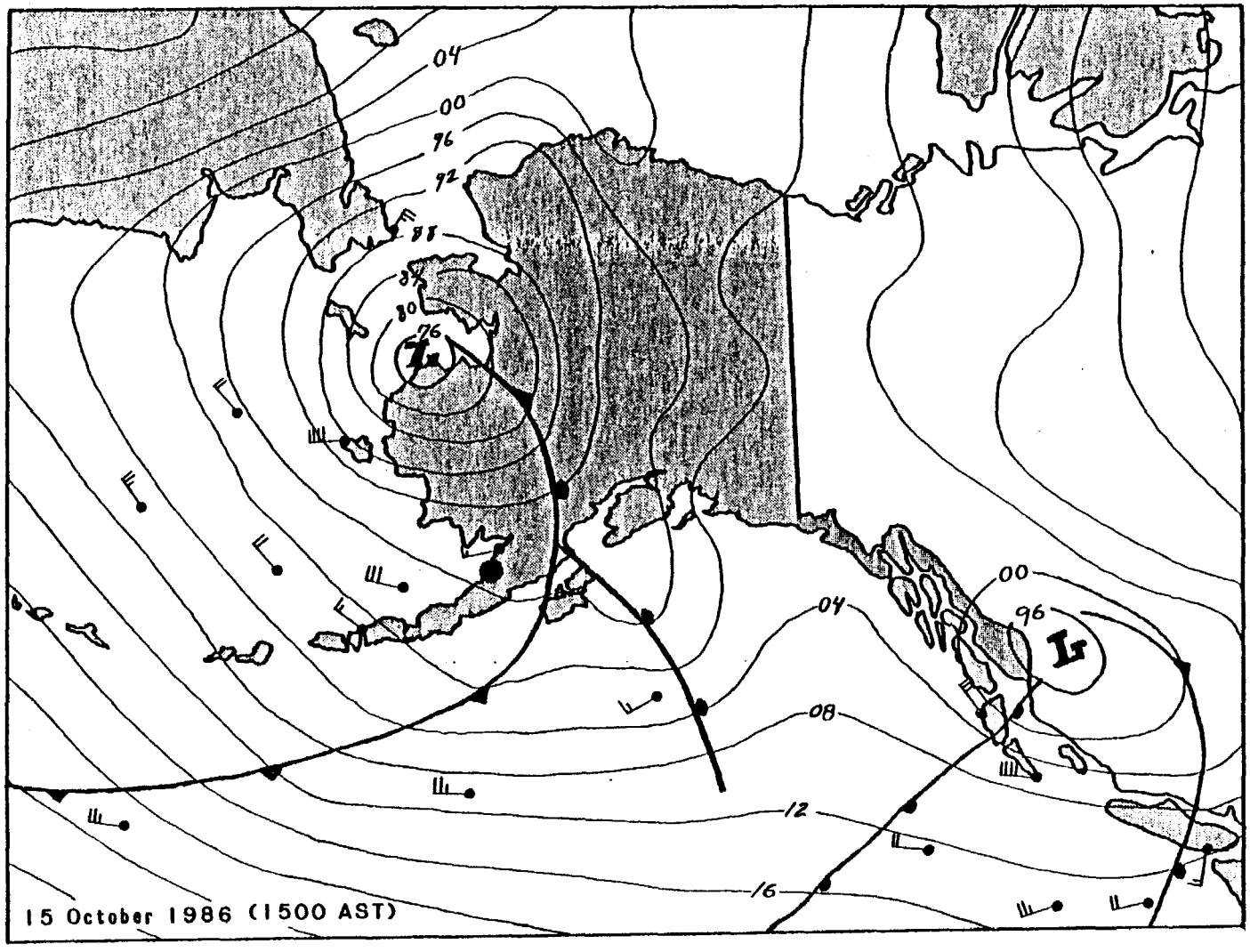

Figure 6. Weather conditions on 15 October prior to the major departure of cackling Canada geese on their fall migration.

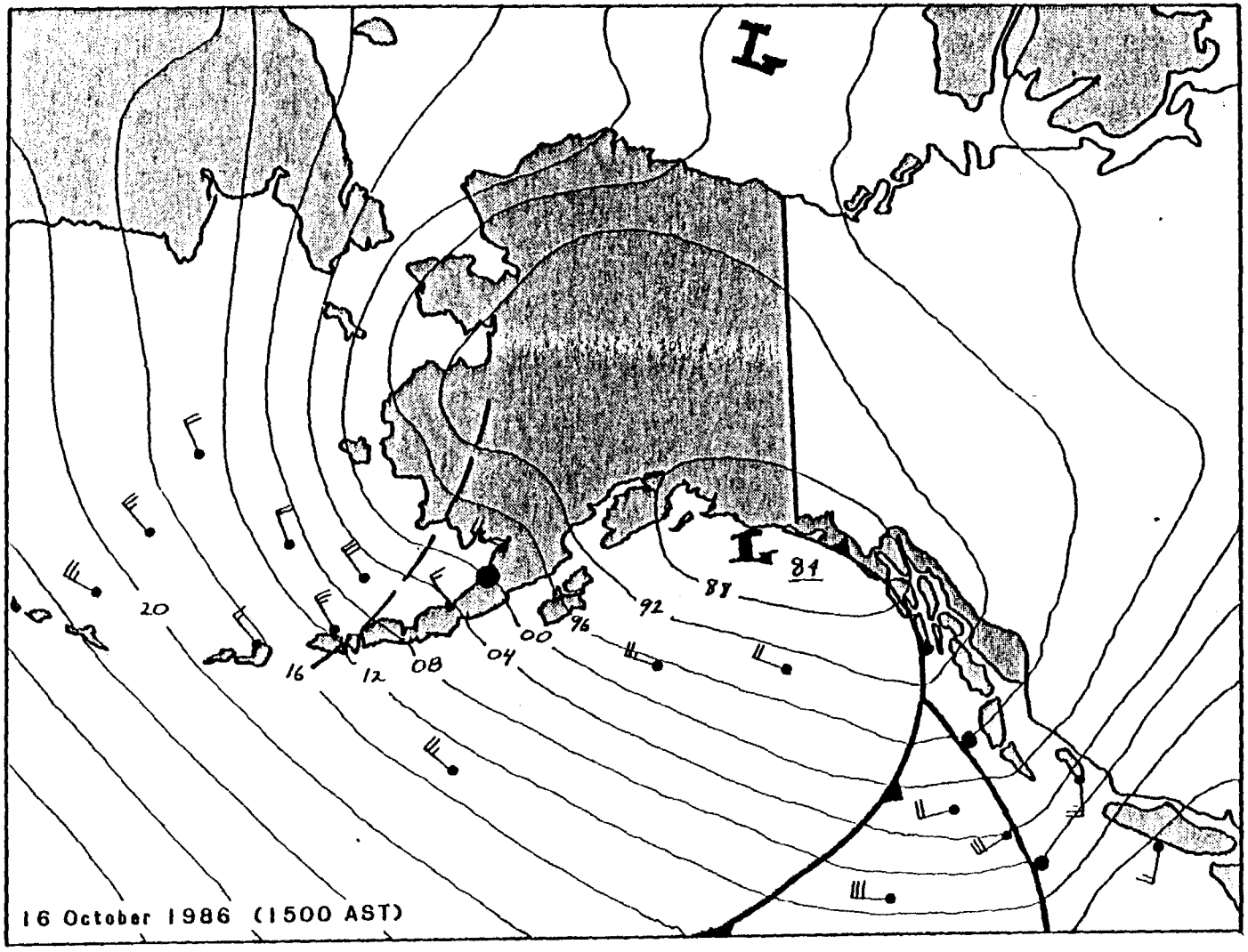

Figure 7. Weather conditions on the afternoon of 16 October 1985 when most of the cackling Canada geese began to depart from the area on their fall migration.

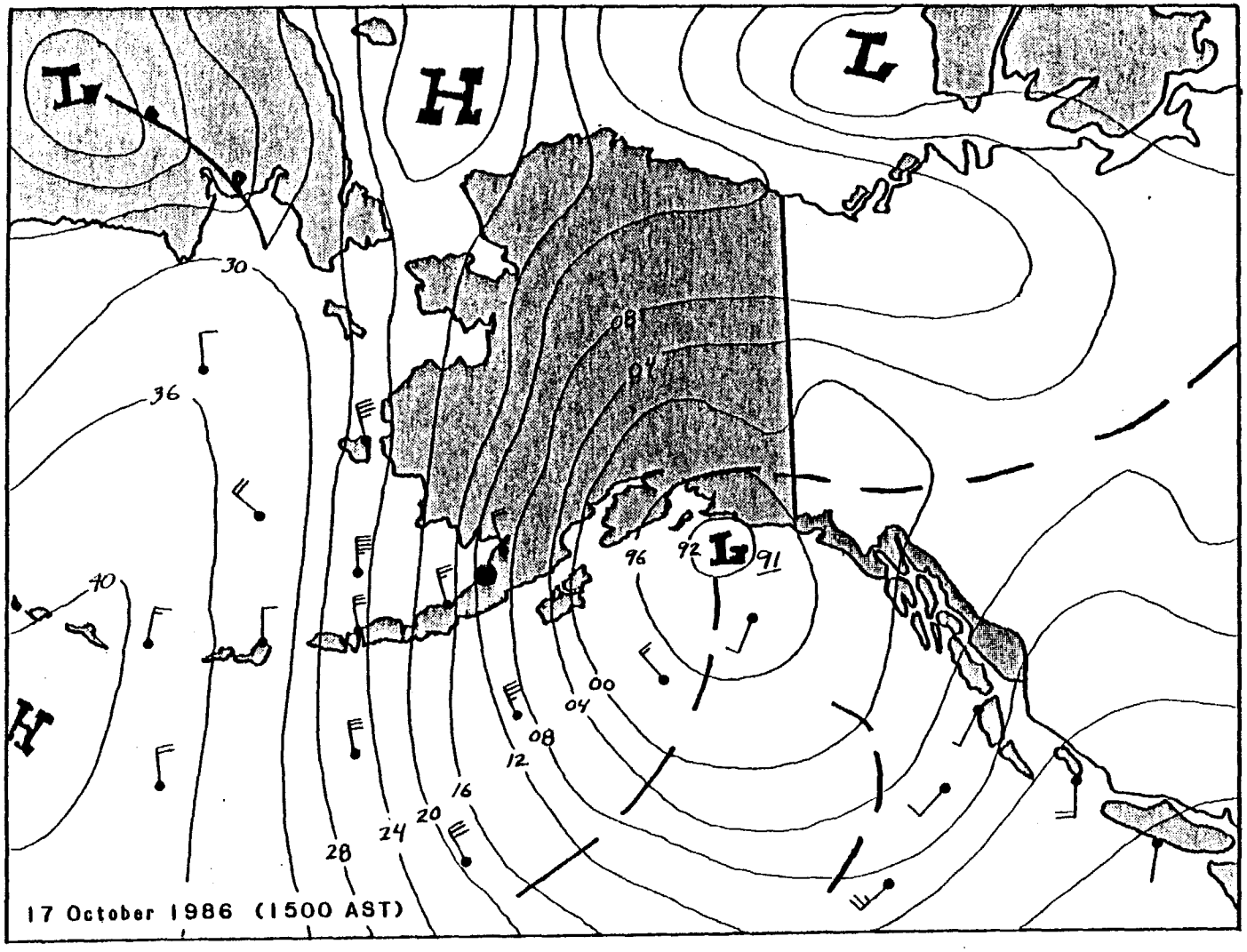

Figure 8. Weather conditions on the afternoon of 17 October 1985 when most of the cackling Canada geese were departing on their fall migration.

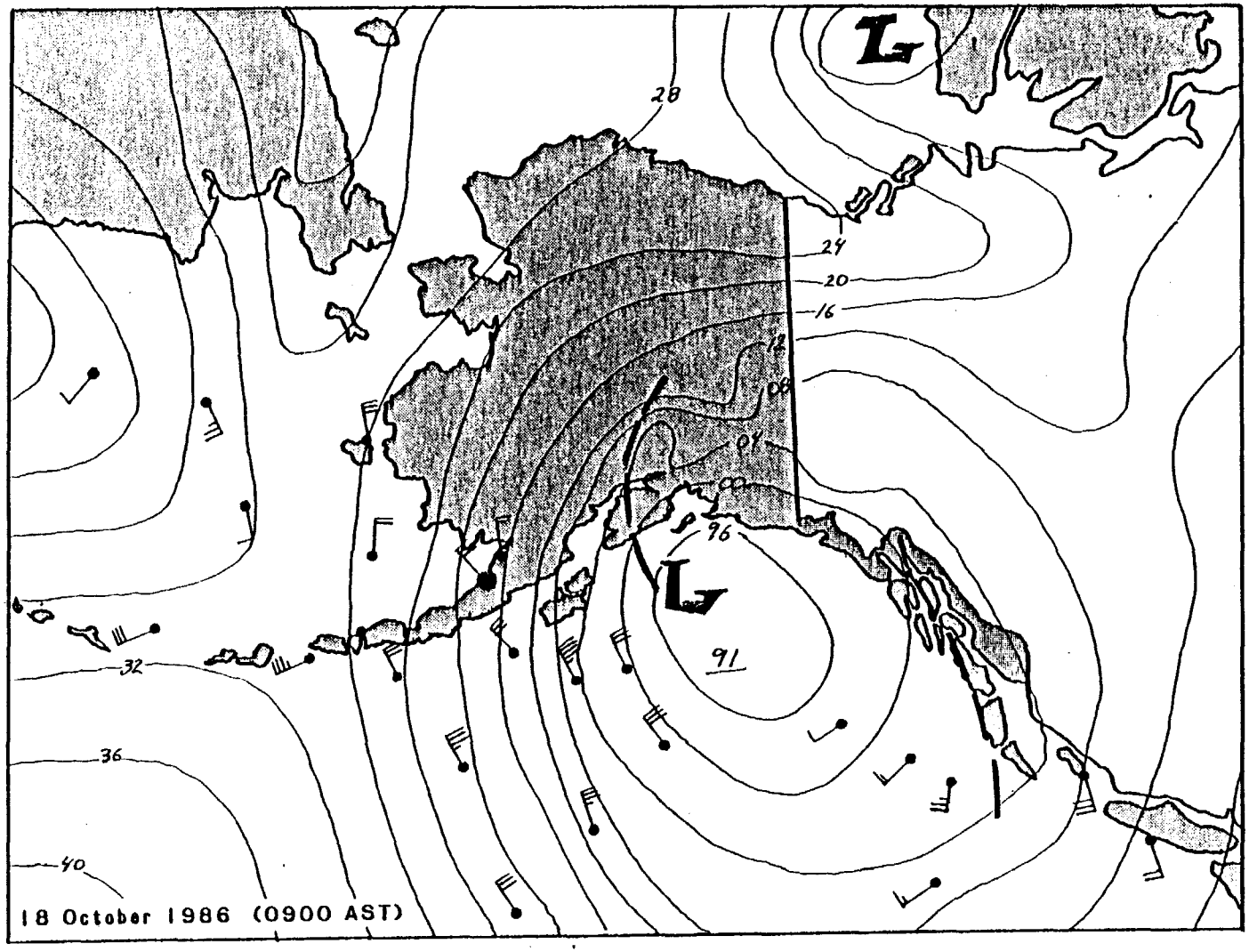

Figure 9. Weather conditions on the morning of 18 October 1985 when a major departure of cackling Canada geese occurred.

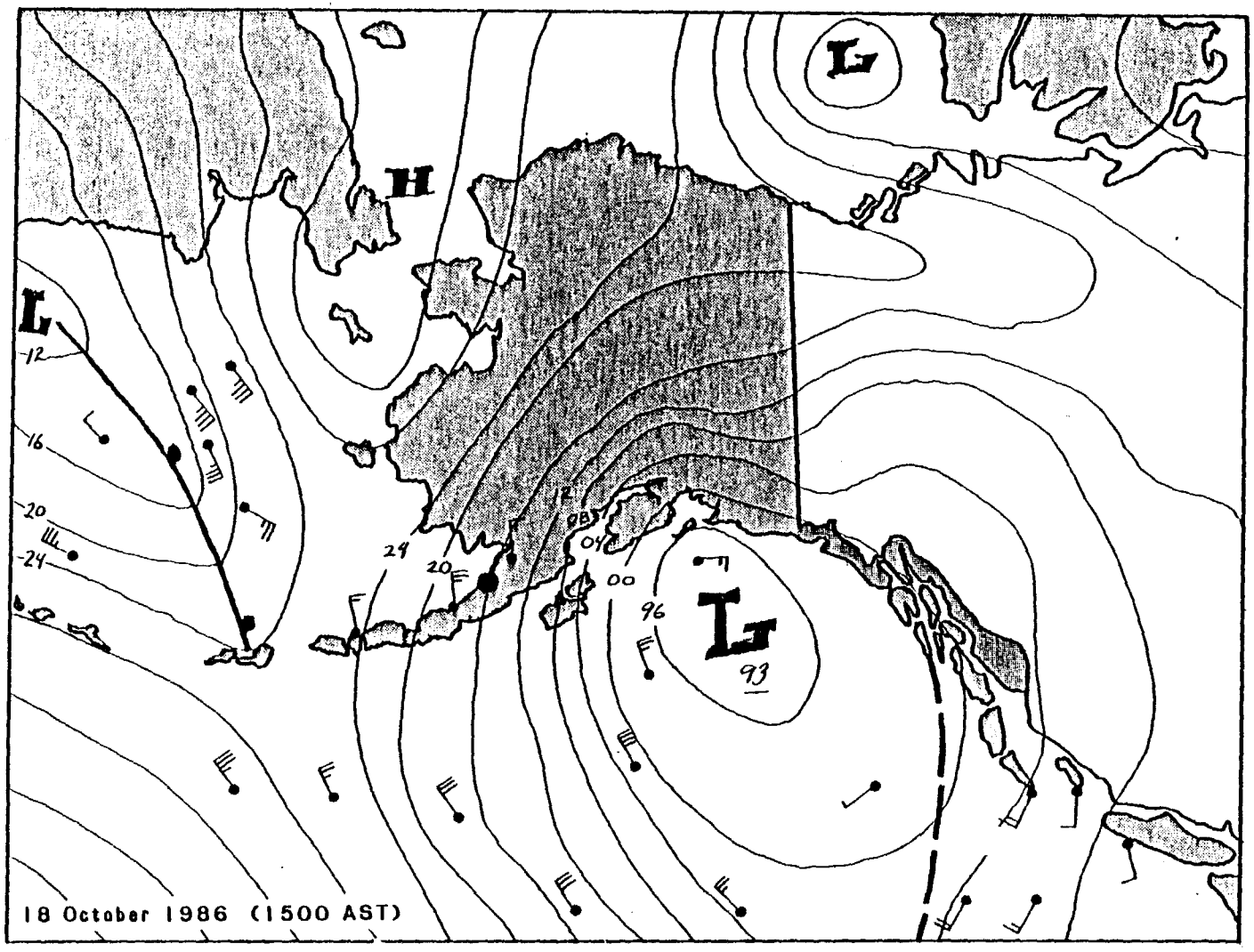

Figure 10. Weather conditions on the afternoon of 18 October 1985 when ponds and lakes began to freeze over and most of the cackling Canada geese had departed the study area.

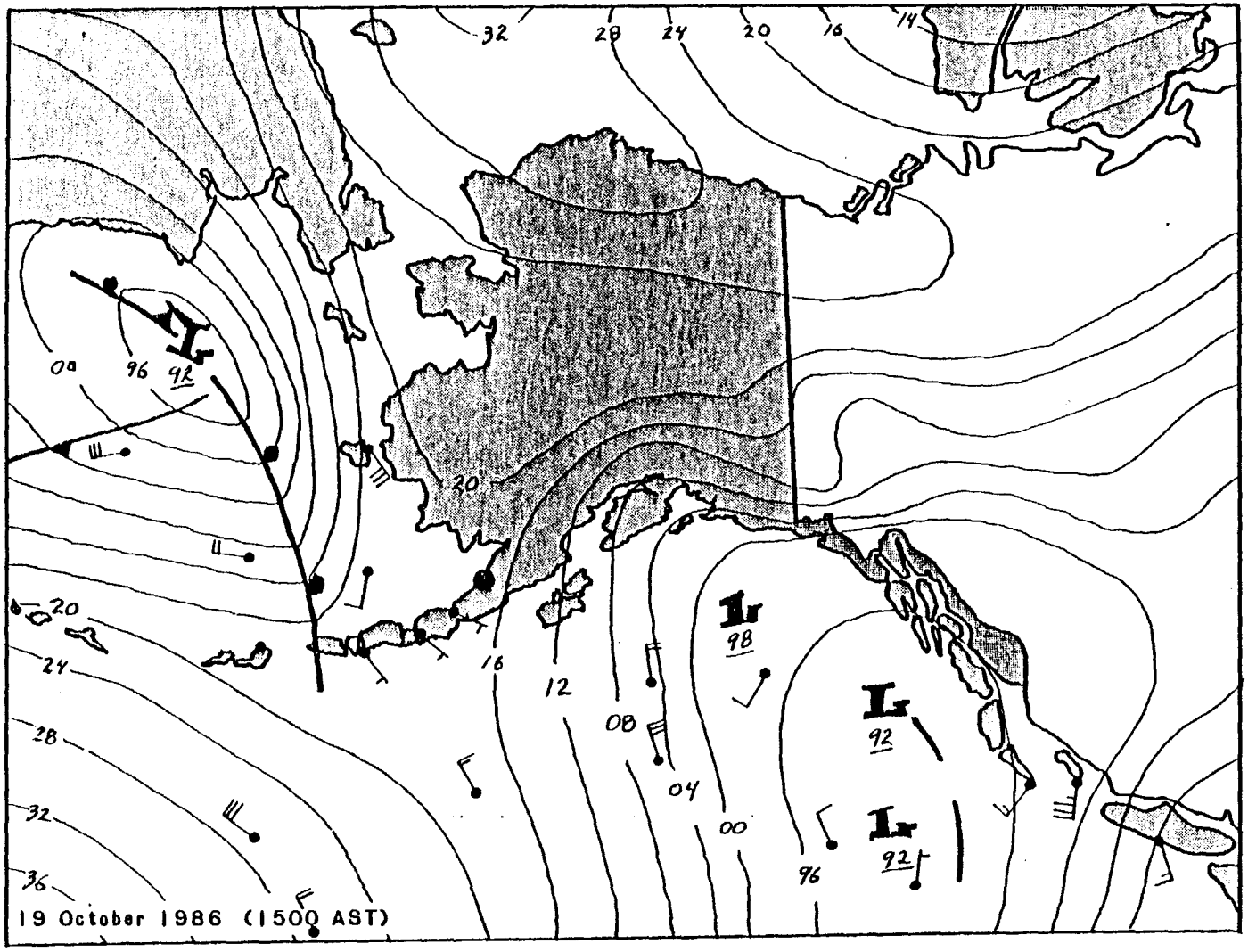

Figure 11. Weather conditions on the afternoon of 19 October 1985 after the cackling Canada geese had departed the Alaska Peninsula.

APPENDIX A

TRIP REPORT:

BIRDS AND MAMMALS RECORDED AT UGASHIK BAY AND CINDER RIVER, ALASKA PENINSULA, SEPTEMBER 26 - OCTOBER 19, 1985

by

Robert Gill, Jr.
Karen S. Bollinger
and
Margaret R. Petersen

U. S. Fish and Wildlife Service
Alaska Fish and Wildlife Research Center
1011 E. Tudor Road
Anchorage, Alaska 99503

November 8, 1985

INTRODUCTION

From 26 September through 19 October 1985, biologists with the Division of Research, U. S. Fish and Wildlife Service, were present at Ugashik Bay, along the NE side of the Alaska Peninsula, in conjunction with a study of fall staging cackling Canada geese (Branta canadensis minima). During our stay we kept records of all birds and mammals we saw. These records for 60 species of birds and 9 species of mammals are summarized here in annotated accounts. The first sentence of each account gives the status of the species for the Ugashik area during the period of our visit.

The majority of our observations were obtained from on-ground studies in upper Ugashik Bay, but also included records obtained during aerial surveys on 12, 14, and 19 October of greater Ugashik Bay and the Cinder River estuary 40 km to the southwest.

The avifauna of the area was dominated by waterfowl (22 species plus 2 races), followed by shorebirds (16 species), passerines (6 species), raptors, including owls (6 species), gulls and terns (5 species plus a hybrid), procellarids (2 species), and loons, grebes, and cormorants (1 species of each). Large numbers of most species of waterfowl and shorebirds were present upon our arrival (Table 1, this appendix). A major weather system on 9-10 October brought a significant influx of new species and an increase in the numbers of other species, while at the same time large numbers of individuals of several other species, particularly shorebirds, departed the area. An even larger weather system from 16-19 October with sustained NW to N winds of 25-50 km/h coincided with the departure of most species save for small numbers of waterfowl and gulls.

ANNOTATED ACCOUNTS - BIRDS

Gavia stellata. Red-throated Loon. Uncommon fall visitant on upper Ugashik Bay and adjacent lakes, where we saw two adults and heard another bird calling.

Podiceps grisegena. Red-necked Grebe. A single bird in alternate plumage was seen opposite our cabin on 26 September.

Puffinus tenuirostris. Short-tailed Shearwater. Uncommon visitant to Ugashik Bay, its occurrence probably being associated with storms in the Bering Sea. We saw one bird flying S over our inland study area on 16 October and throughout our stay found five other beach-cast birds along the shore of our main study area.

Oceanodroma furcata. Fork-tailed Storm-Petrel. A single bird was seen flying overland to the S behind our cabin on the afternoon of 16 October.

Phalacrocorax auritus. Double-crested Cormorant. Uncommon fall visitant to Ugashik Bay, where we saw a flock of 75 on the water immediately off of South Spit.

Cygnus columbianus. Tundra Swan. Common fall migrant seen almost daily on lakes adjacent to upper Ugashik Bay. Large numbers of birds occurred after 6 October through 17-18 October, primarily on the larger lakes N of Pilot Point.

Anser albifrons (frontalis). Greater White-fronted Goose. Uncommon fall migrant at Ugashik Bay, where we recorded it on 10 different days, usually as singles or in a family group. No noticeable migration by this species occurred through the area.

Chen caerulescens. Snow Goose. Uncommon fall migrant at Ugashik Bay and Cinder River. A movement of a few hundred birds occurred through Ugashik Bay on 12-14 October. Use of Ugashik Bay by this species varies, with several thousand having been recorded there in fall in previous years.

Chen canagica. Emperor Goose. Common fall migrant in outer Ugashik Bay and Cinder River estuary, where 1,009 and 12,880 birds were recorded, respectively, during an aerial survey on 14 October. On 30 September and 1 October several flocks of 25-75 birds were observed flying inland up the Dog Salmon River at an altitude of 175-300 m, suggesting geese cross this part of the Alaska Peninsula when moving to wintering areas along the south side of the Alaska Peninsula. Also of note was the sighting on three days of a juvenile Emperor Goose that had apparently been "adopted" by a pair of Cackling Canada Geese.

Branta bernicla (nigricans). Brant. An uncommon fall migrant on Ugashik Bay. We observed them on 12 days in October, usually on the main study area and mostly as juveniles among large flocks of cackling Canada geese.

Branta canadensis (minima) and B. c. (taverneri). Canada Goose. The race B. c. minima was an abundant fall migrant on estuarine marshes and intertidal mudflats of Ugashik Bay and Cinder River. A few hundred birds were present upon our arrival, but between 10-15 October about 12,000 birds moved onto the main study area. On 14 October an additional 29,000 birds were found at Cinder River and Hook Lagoon, representing a total population of about 41,000 birds. On 19 October less than 3,000 total birds were present at Ugashik Bay, Cinder River, and Hook Lagoon. The race B. c. taverneri was also recorded among flocks of B. c. minima, but numbers never totaled more than a few hundred birds.

Anas crecca (carolinensis) and A. c. (crecca). Green-winged Teal. The race A. c. carolinensis was an abundant fall migrant at Ugashik Bay and Cinder River. Several thousand used the main study area and were found in equal numbers on ponds and sloughs along the SW portion of Ugashik Bay and at Cinder River. Several hundred remained on intertidal habitats of Ugashik Bay after the majority of other waterfowl had departed the area on 19-20 October. A single A. c. crecca was seen among a hundred A. c. carolinensis on 28 September.

Anas platyrhynchos (platyrhynchos). Mallard. Abundant fall migrant on intertidal flats of Ugashik Bay and Cinder River; much less common on vegetated intertidal habitats. Several thousand were still present at Ugashik Bay and Cinder River on 19 October after the majority of other waterfowl had departed.

Anas acuta (acuta). Northern Pintail. This was the most abundant waterfowl occurring in the Ugashik Bay and Cinder River areas, with several thousand using both lakes and intertidal habitats. The majority of birds left the area on 17-18 October, but a few thousand remained along intertidal sloughs on 19 October.

Anas clypeata. Northern Shoveler. Common fall migrant on intertidal marshes. We recorded birds daily, usually a few pairs, but flocks of up to 20-30 birds were seen on occasion. Among species of dabbling ducks using the area, shovelers were the last to reacquire their alternate plumage.

Anas strepera (strepera). Gadwall. Abundant fall migrant at Ugashik Bay, where we found birds associated with lakes supporting large stands of Ruppia spiralis. Lakes near the mouths of the Dog and King Salmon rivers supported the most birds, numbering several thousand on our 14 October aerial survey, with flocks of 300-500 birds being common. All birds had departed the area by 19 October.

Anas penelope. Eurasian Wigeon. Common fall migrant, seen almost daily among flocks of A. americana on our main study area. Our high count was 6 among 143 A. americana on 4 October. Our conservative estimate is that A. penelope occurred among A. americana at a ratio of 1:40-50.

Anas americana. American Wigeon. Abundant fall migrant, being the most abundant duck on marshes and ponds in the Ugashik area until the second week of October. Often we found them associated with A. strepera. Most birds departed the area between 14-18 October; none was found on the 19 October aerial survey.

Aythya americana. Redhead. Two pairs were observed feeding among a mixed flock of ducks on our main study area on 13 October. Try as we might, we could not turn them into A. ferina.

Aythya marila. Greater Scaup. Uncommon fall migrant on coastal marshes and sloughs, where we recorded birds on 12 days, usually in ones, twos, or threes, with our highest count being 40 on the Ugashik River on 4 October.

Polysticta stelleri. Steller's Eider. Uncommon fall migrant on upper Ugashik Bay, but sometimes abundant over outer Ugashik Bay and Cinder River. We observed a flock of 75+ female-plumaged birds flying high to the SE over our main area on 29 September. Birds were not recorded again until 15 October and then they were seen daily until our departure.

Clangula hyemalis. Oldsquaw. Uncommon fall migrant on the area, but flocks of several hundred were seen migrating to the ESE over the area at 500+ m altitude on 17 and 18 October.

Melanitta nigra. Black Scoter. Uncommon fall migrant about upper Ugashik Bay, with a single flock of 30 birds seen flying E over the main study area on 9 October.

Melanitta perspicillata. Surf Scoter. A single adult male was among the flock of M. nigra seen on 9 October.

Melanitta fusca. White-winged Scoter. Fairly uncommon fall migrant on the Ugashik River and lakes adjacent to upper Ugashik Bay. Birds were observed on nine days, including small groups of mostly juveniles on the Ugashik River and adjacent lakes, and larger flocks migrating high and to the E.

Bucephala albeola. Bufflehead. A female was seen on a pond on the main study area on 3 October.

Mergus serrator. Red-breasted Merganser. Locally abundant fall migrant on ponds and larger lakes in both the Ugashik and Cinder River areas. On 12 October flocks of 700 and 2,200 birds were found on two large lakes 6 km SSE of South Spit in Ugashik Bay, and a flock of 1,400 birds was seen on a large lake 6 km S of the mouth of Cinder River estuary. When first observed all birds were in extremely dense flocks in the centers of the lakes, but subsequently took flight upon our approach.

Haliaeetus leucocephalus (alascanus). Bald Eagle. Common permanent resident on the Alaska Peninsula and fall visitant to Ugashik Bay and Cinder River. We observed adults almost daily, especially once large numbers of geese and ducks began using the main study area. Of several attempts by eagles to take ducks and geese, none was observed to be successful.

Circus cyaneus. Northern Harrier. Uncommon fall migrant, with females and juveniles apparently preceding males. We observed 11 birds on 9 different days with only females/juveniles (7) being seen through 8 October and only males (4) after 11 October.

Buteo lagopus. Rough-legged Hawk. Rare fall migrant at Ugashik Bay. We saw a single adult flying E on 5 October. Also on this day we observed, at some distance, an all dark buteo flying E over the same area and suspect that it may also have been this species.

Falco peregrinus (Pealei). Peregrine Falcon. Uncommon fall migrant in upper Ugashik Bay, where birds (both adults and juveniles) were seen over the main study area on 12 occasions on 7 different days. None was observed taking prey but aeveral made concerted efforts at it, and all birds, save for geese, generally took flight when a falcon was in the immediate area.

Falco rusticolus. Gyrfalcon. Fairly common fall visitant to the Ugashik Bay area, where we observed birds on over 25 occasions on 14 different days, mostly on the main study area. None of the birds was observed taking prey but geese often flushed at approach of a Gyrfalcon, unlike their response to a Peregrine Falcon.

Pluvialis squatarola. Black-bellied Plover. Fairly common fall migrant on the main study area and adjacent intertidal flats, where birds (usually singles or pairs) were seen daily. Our largest flocks were of 30 birds on 29 September and 12 birds on 16 October. A single bird was seen at Ugashik Bay on the 19 October aerial survey.

Pluvialis dominica (fulva). Lesser Golden-Plover. Also a fairly common fall migrant through the Ugashik area. Birds were recorded on most days, usually in ones and twos, but flocks of as many as a dozen were seen.

Tringa melanoleuca. Greater Yellowlegs. Abundant and very vocal fall migrant on estuarine marshes at Ugashik Bay and Cinder River. The largest flock we recorded using the main study area was of 252 birds on 28 September, but several flocks of 50-75 birds were noted daily on the area. By 12 October numbers were noticeably lower and on 16-17 October a wave of migrants passed over the area from the NW. During these two days several flocks, usually of 200-400 birds (largest 700), were seen flying E up the Ugashik River at 250-400 m altitude.

Limosa lapponica (baueri). Bar-tailed Godwit. Fairly common fall migrant at Ugashik Bay, especially in late September, when we noted several flocks of 100-200 birds flying over the main study area from the bay to inland high tide roosts. Sightings of much smaller flocks continued through 16 October.

Limosa fedoa. Marbled Godwit. A single bird (probably the same individual) was seen with flocks of 22-37 L. lapponica on 1, 9, 12, and 16 October. In each instance the Marbled Godwit was the last bird in the longest leg of the "V" formation. If this bird migrated with the Bar-tailed Godwits, and if it had sufficient energy reserves to complete the journey, there might soon be a new continental record for the species.

Arenaria interpres. Ruddy Turnstone. A single juvenile was noted along vegetated mudflats on our main study area on 18 October.

Calidris mauri. Western Sandpiper. Rare fall migrant at Ugashik Bay and Cinder River. On 1 October we saw one adult in arrested pre-basic molt and one juvenile; on 4 October two juveniles were seen along the Ugashik River.

Calidris melanotus. Pectoral Sandpiper. Common fall migrant on estuarine marshes along the Ugashik River, where several dozen birds, mostly juveniles associated with C. acuminata, were seen daily through the first week of October. Thereafter, less than half a dozen birds were seen daily through 16 October.

Calidris acuminata. Sharp-tailed Sandpiper. Common fall migrant (only juveniles seen) on estuarine marshes of upper Ugashik Bay, where it outnumbered C. melanotus by a ratio of 6-10:1. The largest flock we observed was of 26 birds. Four birds collected on 7 October had lipids averaging 40-50% of whole body weight. Numbers of birds had noticeably decreased by 16 October, but several were seen feeding in frozen marshes on the main study area on 18 October.

Calidris ptilocnemis (couesi). Rock Sandpiper. Uncommon fall visitant to upper Ugashik Bay, but more common towards the coast. We saw birds on four occasions, usually associated with C. alpina. The few thousand small sandpipers recorded on the 19 October aerial survey of Ugashik Bay and Cinder River are thought to have been mostly this species.

Calidris alpina (pacifica). Dunlin. Abundant fall migrant on intertidal flats and estuarine marshes of Ugashik Bay and Cinder River. Several hundred used the main study area throughout our stay and flocks totaling 15,000 and 35,000 birds were recorded at Ugashik Bay and Cinder River, respectively, on our 14 October aerial survey. The majority of birds had departed the area by 19 October.

Limnodromus griseus (caurinus). Short-billed Dowitcher. Common fall migrant on estuarine marshes in upper Ugashik Bay. Birds were seen daily in flocks averaging a dozen or more birds (largest 45) until the second week of October and then only in groups of 2-5 through 18 October.

Limnodromus scolopaceus. Long-billed Dowitcher. Uncommon fall migrant. We saw 12 individuals on five different days.

Gallinago gallinago (delicata). Common Snipe. Fairly common fall migrant on marshes of the main study area. We saw 2-4 birds almost daily from our arrival through 8 October, including one individual in display flight on 3 October.

Phalaropus lobatus. Red-necked Phalarope. Uncommon fall migrant in upper Ugashik Bay, where on six days we saw a total of 13 birds, mostly juveniles.

Phalaropus fulicaria. Red Phalarope. On 12 October two juveniles were seen on a pond on the main study area at Ugashik Bay.

Larus philadelphia. Bonaparte's Gull. Common fall migrant on ponds and estuarine waters of Ugashik Bay and Cinder River. Birds were seen daily feeding in ponds on the main study area, including what we believe to be the same bird seen feeding for 15 consecutive days at the same location on a pond near our cabin. Birds were still present in the area on the 19 October aerial survey.

Larus canus. Mew Gull. Common fall migrant on estuarine waters of Ugashik Bay and Cinder River, especially toward the coast at these sites. The most seen by us was 500+ birds at South Spit, Ugashik Bay, on 14 October.

Larus glaucescens. Glaucous-winged Gull. Fairly common fall visitant to upper Ugashik Bay; abundant on outer coast, where a few thousand birds (mostly adults) were seen on aerial surveys on 14 and 19 October. Several hundred others fed daily on the exposed mudflats and bars of Ugashik Bay. A single hybrid adult Glaucous-winged x Herring Gull (L. glaucescens x L. argentatus) was seen flying over and sitting on a pond on the main study area on 17 October.

Rissa tridactyla. Black-legged Kittiwake. An adult was seen over the main study area at Ugashik Bay on 13 October, and a juvenile was seen at about the same location on 16 October. None was seen along the outer coast on any of the aerial surveys.

Sterna paradisaea. Arctic Tern. A bird in alternate plumage was seen feeding on the lake fronting our cabin on 27 September.

Asio flammeus. Short-eared Owl. Uncommon fall migrant on marshes of upper Ugashik Bay, where we saw single birds on three occasions. In past years when populations of small rodents have been high, numbers of Short-eared Owls using the area in fall have been much greater (KB, pers. observation).

Corvus corax. Common Raven. Fairly common fall visitant to Ugashik Bay and Cinder River. We saw birds almost daily; 1-2 birds per day through 8 October and then 3-4 per day thereafter until our departure.

Lanius excubitor. Northern Shrike. A second-year bird was seen at our cabin on 3 October and an adult was seen being mobbed by several Lapland Longspurs (Calcarius lapponicus) along the Ugashik River on 18 October.

Passerculus sandwichensis. Savannah Sparrow. Uncommon fall migrant over marshes of upper Ugashik Bay. A small wave of migrants passed through the main study area between 29 September and 1 October.

Passerella iliaca. Fox Sparrow. A juvenile was perched atop our cabin on the morning of 8 October.

Calcarius lapponicus (alascensis). Lapland Longspur. Abundant fall migrant at upper Ugashik Bay and along the outer coast of the bay and at Cinder River. Several small waves of migrants passed through the areas with the most noticeable movement occurring during the last week of September and into the first week of October when flocks of 20-50 birds were common on the main area.

Plectrophenax nivalis. Snow Bunting. Uncommon fall migrant in upper Ugashik Bay; abundant along the outer coast at Ugashik Bay and Cinder River, especially after mid-October. A few hundred were seen in numerous small flocks along the Bristol Bay coast between Ugashik Bay and Cinder River on an aerial survey on 19 October.

ANNOTATED ACCOUNTS - MAMMALS

Sorex cinereus. Masked Shrew. Individuals were found dead on the main Ugashik Bay study area on 9 and 11 October.

Erethizon dorsatum. Porcupine. Fairly common on the Ugashik Bay study area, where we saw a total of eleven individuals on five separate days, the most being four along about 3 km of the Ugashik River on 8 October.

Delphinapterus leucas. Beluga. Common in Ugashik Bay and upriver at least as far as the E side of our main study area. We saw them in the river on four occasions, the largest group being six.

Eschrichtius robustus. Gray Whale. A single animal was seen in Ugashik Bay about 2 km N of the mouth of the King Salmon River on 28 September. On 14 October we saw 12+ whales within 1/2 to 4 km of shore off the mouth of Cinder River.

Vulpes vulpes. Red Fox. Fairly common on the marshes and adjacent intertidal flats of upper Ugashik Bay and Cinder River, where we saw a total of twelve animals on eight different days.

Ursus arctos. Grizzly Bear. Fairly common on areas adjacent to Ugashik Bay and Cinder River. Upon our arrival we saw fresh tracks on our main study area and two bears were seen SW of us across the Ugashik River on 12 and 14 October. Two bears were also seen near the mouth of Cinder River on 19 October.

Lutra canadensis. River Otter. One was seen swimming in a small pond on our main study area at Ugashik Bay on 5 October and numerous scats were found elsewhere on the area during our stay.

Phoca vitulina. Harbor Seal. Common in Ugashik Bay and smaller sloughs along the upper bay and river. We saw animals on eight different days, usually in ones and twos, but as many as five were seen at one time.

Rangifer tarandus. Caribou. Fairly common on the Ugashik Bay study area, where over time numerous paths have been worn through the marsh. We saw groups of up to eight animals on the area on five separate occasions, and once saw a group of four caribou swim the Ugashik River from the S and cross the main study area to the N.

Table A-1. Chronology of bird observations at Ugashik Bay, Alaska, 26 September - 19 October 1985.

	September					October																		
TAXA	26	27	28	29	30	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Red-necked Grebe	x																							
Taverner's Canada Goose	x		x	x						x			x			x			x				
Cackling Canada Goose	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Northern Pintail	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Green-winged Teal	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Gadwall	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	
American Wigeon	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	
Greater Scaup	x	x		x		x	x	x	x	x		x		x							x	x		
Gyrfalcon	x		x			x		x	x		x			x		x	x	x		x	x	x		
Lesser Golden-Plover	x	x	x	x	x	x	x	x	x	x	x	x	x	x					x	x		x	x	
Greater Yellowlegs	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	
Pectoral Sandpiper	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x			
Sharp-tailed Sandpiper	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	
Dunlin	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	
Short-billed Dowitcher	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	
Common Snipe	x	x	x			x	x	x	x	x	x	x	x							x				
Glaucous-winged Gull	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Arctic Tern		x																						
Common Raven		x	x	x	x	x	x	x	x	x		x	x	x	x	x	x	x	x	x	x		x	x
Lapland Longspur		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	
Emperor Goose		x	x	x	x	x	x	x	x	x							x	x	x					
Mallard		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Northern Shoveler		x	x	x		x	x	x	x	x	x	x	x	x	x		x	x	x	x	x	x	x	
Eurasion Wigeon		x	x			x	x	x	x	x	x		x			x	x	x	x	x		x	
Northern Harrier		x			x	x			x	x			x			x	x							
Black-bellied Plover		x	x	x	x	x	x	x	x	x	x	x	x	x	x		x	x	x	x	x	x	x	x
Bonaparte's Gull		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	

Table A-1. Cont.

	September					October																
TAXA	26	27	28	29	30	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Tundra Swan		x	x		x	x	x	x	x	x	x		x	x	x	x	x	x	x	x	x	x		x
Greater White-fronted Goose			x			x	x	x	x	x	x						x			x		x		
Mew Gull			x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Common Teal			x																					
Savannah Sparrow				x	x	x																		
Bald Eagle					x	x		x	x	x	x	x	x	x		x	x	x	x	x	x	x	x	x
Red-necked Phalarope					x		x	x	x														x	x
Bar-tailed Godwit					x	x	x	x				x	x	x			x		x	x	x			
White-winged Scoter					x				x					x		x	x	x	x		x	x	x	x
Long-billed Dowitcher					x			x					x			x				x				
Western Sandpiper						x			x															
Brant						x	x		x	x	x					x		x	x	x	x		x	x
Steller's Eider						x														x	x	x	x	x
Northern Shrike								x															x	
Red-throated Loon								x										x						
Bufflehead								x																
Rock Sandpiper									x											x	x		x	x
Rough-legged Hawk										x														
Peregrine Falcon										x	x		x	x			x	x	x		x			
Fox Sparrow													x											
Short-eared Owl													x				x				x			
Red-breasted Merganser														x				x	x	x	x	x	x	
Black Scoter														x										
Surf Scoter														x										
Snow Goose														x			x	x	x	x	x		x	
Double-crested Cormorant																	x							
Snow Bunting																	x				x		x	
Oldsquaw																	x		x	x	x	x	x	x
Red Phalarope																	x							
Redhead																		x						

Table A-1. Cont.

	September					October																		
TAXA	26	27	28	29	30	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Black-legged Kittiwake																		x		x				
Marbled Godwit																					x			
Short-tailed Shearwater																					x			
Fork-tailed Storm-Petrel																					x			
Glaucous-wingedxHerring Gull																						x		
Ruddy Turnstone																							x	
New taxa	17	11	3	1	5	3	0	3	1	2	0	0	2	4	0	0	4	2	0	0	3	1	1	0
Total taxa per day	17	25	27	23	27	33	28	33	33	31	26	23	30	30	19	25	34	31	31	34	36	28	30	16
Cumulative new taxa	17	28	31	32	37	40	40	43	44	46	46	46	48	52	52	52	56	58	58	58	61	62	63	63

Appendix B. Environmental conditions at Ugashik Bay, Alaska, during fall 1985.

Date	Temperature (°C) Min.	Max.	Visibility (km)	Wind Dir.	Speed	Precipitation (cm)	Cloud Cover (tenths)
26 SEP	7.0	14.0	65	SE	20-35km/h	0.0	9-10
27 SEP	5.5	11.0	60+	S	8	0.3	8-10
28 SEP	1.5	10.0	20-60	S-E	5-55	0.1	6-10
29 SEP	4.5	7.0	15-50	S	20-50	1.5	8-10
30 SEP	1.5	8.0	65	SW	8	0.0	3-8
1 OCT	1.5	6.0	65	W	5-20	0.3	7-10
2 OCT	-1.0	7.0	65	S	5	0.0	3-7
3 OCT	-1.5	8.0	65	W-NW	5	0.0	1-4
4 OCT	-1.5	10.0	65	NE-SE	5	0.0	2-6
5 OCT	-3.0	8.0	40-60	E-SE	5-30	0.8	6-10
6 OCT	5.5	7.0	15-20	E-SE	15-20	1.8	10
7 OCT	1.0	10.0	10-60	NE-SE	5-65	2.4	8-10
8 OCT	1.0	9.5	30-40	SW-W	8-12	0.0	8-10
9 OCT	3.0	7.0	8-15	SW-NW	40-60	2.1	10
10 OCT	1.0	6.0	40-60	NW	15-20	0.4	10
11 OCT	2.0	4.5	60+	E-SE	5-10	0.0	2-10
12 OCT	-1.0	5.5	35-55	E-SE	5	0.5 (snow)	8-10
13 OCT	-1.0	3.5	25-50	NW	5-12	0.5	5-10
14 OCT	-4.0	4.0	20-60	SW	0-8	0.0 (frost)	0-10
15 OCT	4.5	5.5	15-55	NW-SW	5-12	0.5	6-10
16 OCT	1.0	4.0	20-50	NW	40-50	1.0	6-8
17 OCT	-1.0	1.5	8-60	NW	30-60	0.7 (hail)	8-10
18 OCT	-6.5	-3.0	0-60	NW	15-30	0.2 (sleet)	4-10
19 OCT	-8.0	-4.0	20-40	N	10-25	0.3 (snow)	10

Appendix C. Neck-collared cackling Canada geese seen at Ugashik Bay - Pilot Point, Alaska, between 26 September and 19 October 1985.

COLLAR CODE	AGE-SEX[a]	CAPTURE		DATE SEEN		NO. DAYS SEEN
		DATE	LOCATION	FIRST	LAST	
AAC	11-0	1974	Yukon Delta	13 OCT	13 OCT	1
A41[b]	AFY-M	AUG 82	Kokechik Bay	14 OCT	15 OCT	2
A56	FY-M	"	" "	12 OCT	12 OCT	1
A96[b]	AFY-F	"	" "	14 OCT	15 OCT	2
9A9	SY-F	JUL 84	Kokechik Bay	14 OCT	14 OCT	1
C99[b]	AFY-M	AUG 82	Kigigak Island	17 OCT	17 OCT	1
0C6[b]	ATY-F	JUL 84	Kokechik Bay	12 OCT	15 OCT	4
3C4[b]	SY-M	"	" "	14 OCT	14 OCT	1
3C5	SY-M	"	" "	14 OCT	15 OCT	2
4C7	ASY-M	JUL 85	Kokechik Bay	14 OCT	14 OCT	1
6C6	ASY-F	"	" "	14 OCT	15 OCT	2
8C2	ASY-F	"	" "	12 OCT	15 OCT	4
9CI	ASY-M	"	" "	14 OCT	14 OCT	1
9C5	ASY-F	"	" "	13 OCT	14 OCT	2
9C6	ASY-M	"	" "	15 OCT	15 OCT	1
E03[c]	FY-F	AUG 82	Kigigak Island	12 OCT	14 OCT	3
E68	AFY-M	AUG 83	Hazen Bay	13 OCT	13 OCT	1
E85	HY-M	AUG 85	Hazen Bay	1 OCT	5 OCT	9
E86	ASY-M	"	" "	1 OCT	15 OCT	9
E88	HY-F	"	" "	1 OCT	15 OCT	9
E97	HY-F	"	" "	1 OCT	15 OCT	9
1E3	ASY-M	AUG 85	Hazen Bay	13 OCT	13 OCT	1
1E9	HY-F	"	" "	13 OCT	13 OCT	1
3E7	ASY-F	"	" "	15 OCT	15 OCT	1
HIO	ATY-M	JUL 84	Hazen Bay	30 SEP	8 OCT	3
H12	ATY-F	"	" "	14 OCT	14 OCT	1
H40	ASY-M	JUL 85	Hazen Bay	1 OCT	17 OCT	9
H41	ASY-F	"	" "	1 OCT	17 OCT	9
H47	ASY-F	"	" "	13 OCT	15 OCT	2
H48	ASY-F	"	" "	14 OCT	14 OCT	1
H54	ASY-M	"	" "	13 OCT	15 OCT	2
H55	ASY-F	"	" "	13 OCT	17 OCT	3
H58	ASY-M	"	" "	13 OCT	15 OCT	2
H63	ASY-M	"	" "	14 OCT	14 OCT	1
H72	HY-F	AUG 85	Hazen Bay	2 OCT	15 OCT	8
H77	HY-F	"	" "	8 OCT	8 OCT	1
H85	ASY-F	"	" "	13 OCT	13 OCT	1
H86	HY-M	"	" "	13 OCT	13 OCT	1
H87	HY-F	"	" "	13 OCT	15 OCT	2
H88	HY-F	"	" "	13 OCT	15 OCT	2
H96	HY-F	"	" "	13 OCT	15 OCT	2

Appendix C. continued.

COLLAR CODE	AGE-SEX[a]	CAPTURE DATE	CAPTURE LOCATION	DATE SEEN FIRST	DATE SEEN LAST	NO. DAYS SEEN
OH8	ASY-M	AUG 85	Kokechik Bay	14 OCT	15 OCT	2
6H6	HY-F	"	" "	15 OCT	15 OCT	1
8H1	HY-F	"	" "	15 OCT	17 OCT	2
J57	ASY-M	JUL 85	Kokechik Bay	12 OCT	14 OCT	3
J75	ASY-M	"	" "	14 OCT	14 OCT	1
J84	ASY-F	"	" "	14 OCT	15 OCT	2
J91	ASY-F	"	" "	14 OCT	14 OCT	1
L17	AFY-M	NOV 82	Tule Lake NWR	13 OCT	13 OCT	1
L43	AFY-M	"	" "	11 OCT	15 OCT	5
L70	AFY-M	"	" "	17 OCT	17 OCT	1
L77	AFY-M	"	" "	15 OCT	15 OCT	1
44L	ATY-F	OCT 83	Klamath Basin	13 OCT	13 OCT	1
64L	TY-F	"	" "	13 OCT	15 OCT	3
N02	ATY-M	NOV 83	Klamath Basin	13 OCT	13 OCT	1
N20[b]	FY-F	"	" "	2 OCT	3 OCT	2
N47	ATY-F	"	" "	28 SEP	4 OCT	4
N80	ATY-M	"	" "	14 OCT	17 OCT	3
N85	TY-F	"	" "	17 OCT	17 OCT	1
5N5	AFY-F	JAN 83	Sacramento NWR	12 OCT	13 OCT	2
6N5b	AFY-F	"	" "	1 OCT	15 OCT	6
8N5	AFY-F	"	" "	12 OCT	14 OCT	3
51N	ATY-F	DEC 83	Sacramento NWR	12 OCT	12 OCT	1
52N	TY-F	"	" "	12 OCT	12 OCT	1
54N	ATY-F	"	" "	12 OCT	12 OCT	1
58N	ATY-M	"	" "	12 OCT	12 OCT	1
83N	ATY-M	"	" "	11 OCT	12 OCT	2
P18	AFY-F	NOV 82	Tule Lake NWR	13 OCT	13 OCT	1
P74	FY-F	"	" "	12 OCT	15 OCT	2
P88[b]	AFY-M	"	" "	14 OCT	17 OCT	2
OPO	ASY-M	JUL 85	Kokechik Bay	2 OCT	3 OCT	2
IP2	ASY-F	"	" "	14 OCT	15 OCT	2
1P3	ASY-M	"	" "	14 OCT	14 OCT	1
3P6	ASY-M	"	" "	14 OCT	14 OCT	1
4P4	ASY-M	"	" "	12 OCT	12 OCT	1
6P6	ASY-F	"	" "	17 OCT	17 OCT	1
7PO	ASY-F	"	" "	2 OCT	3 OCT	2
7P3	ASY-F	"	" "	13 OCT	13 OCT	1
7P9	ASY-M	"	" "	14 OCT	15 OCT	2
9P5	ASY-M	"	" "	13 OCT	15 OCT	2
01P	ASY-F	"	" "	12 OCT	14 OCT	2
05P	ASY-F	"	" "	13 OCT	14 OCT	2
08P	ASY-F	"	" "	13 OCT	13 OCT	1

Appendix C. continued.

COLLAR CODE	AGE-SEX[a]	CAPTURE DATE	CAPTURE LOCATION	DATE SEEN FIRST	DATE SEEN LAST	NO. DAYS SEEN
15P	ASY-F	JUL 85	Kokechik Bay	15 OCT	15 OCT	1
24P	ASY-M	"	" "	8 OCT	14 OCT	3
25P	ASY-M	"	" "	17 OCT	17 OCT	1
32P	ASY-M	"	" "	17 OCT	17 OCT	1
37P	ASY-M	"	" "	12 OCT	14 OCT	2
38P	ASY-F	"	" "	17 OCT	17 OCT	1
42P	ASY-M	"	" "	17 OCT	17 OCT	1
44P	ASY-M	"	" "	14 OCT	14 OCT	1
47P	ASY-F	"	" "	17 OCT	17 OCT	1
48P	ASY-F	"	" "	14 OCT	14 OCT	1
53P	ASY-F	"	" "	8 OCT	14 OCT	4
54P	ASY-M	"	" "	13 OCT	17 OCT	2
62P	ASY-F	"	" "	13 OCT	13 OCT	1
70P	ASY-M	"	" "	14 OCT	15 OCT	2
74P	ASY-F	"	" "	8 OCT	8 OCT	1
89P	HY-M	AUG 85	Kokechik Bay	14 OCT	15 OCT	2
T67	AFY-M	NOV 82	Tule Lake NWR	12 OCT	15 OCT	4
6T3	TY-F	NOV 83	Klamath Basin	14 OCT	17 OCT	3
7TO	ATY-F	"	" "	12 OCT	14 OCT	3
7T2[b]	ATY-F	"	" "	14 OCT	14 OCT	1
9T5	ATY-M	"	" "	13 OCT	13 OCT	1
9T6	TY-M	"	" "	12 OCT	15 OCT	4
V21	AFY-F	NOV 82	Tule Lake NWR	2 OCT	2 OCT	1
V54	AFY-F	"	" "	13 OCT	14 OCT	2
V62[b]	AFY-M	"	" "	14 OCT	15 OCT	2
X09	AFY-F	NOV 82	Tule Lake NWR	17 OCT	17 OCT	1
Y12	ATY-M	OCT 83	Klamath Basin	14 OCT	17 OCT	2
Y14	TY-F	"	" "	15 OCT	15 OCT	1
Y33	ATY-F	"	" "	15 OCT	15 OCT	1
Y80	ATY-M	NOV 83	Klamath Basin	15 OCT	15 OCT	1
Z23	ATY-F	DEC 83	Sacramento NWR	13 OCT	15 OCT	3
Z48	ATY-M	"	" "	12 OCT	12 OCT	1
Z52	ATY-M	"	" "	14 OCT	14 OCT	1
006	ASY-F	NOV 84	Tule Lake NWR	13 OCT	13 OCT	1
018	ASY-M	"	" "	14 OCT	14 OCT	1
032	ASY-M	"	" "	13 OCT	15 OCT	3
035	ASY-F	"	" "	14 OCT	14 OCT	1
045	ASY-F	"	" "	13 OCT	13 OCT	1
054	ASY-F	"	" "	17 OCT	17 OCT	1
062	ASY-M	"	" "	2 OCT	15 OCT	6
081	SY-F	"	" "	14 OCT	15 OCT	2

Appendix C. continued.

COLLAR CODE	AGE-SEX[a]	CAPTURE DATE	CAPTURE LOCATION	DATE SEEN FIRST	DATE SEEN LAST	NO. DAYS SEEN
087	ASY-M	NOV 84	Tule Lake NWR	7 OCT	17 OCT	1
092	ASY-F	"	"	12 OCT	15 OCT	4
312	ASY-M	"	"	14 OCT	14 OCT	1
328	ASY-F	"	"	13 OCT	15 OCT	2
358	ASY-F	"	"	13 OCT	13 OCT	1
359	ASY-M	"	"	12 OCT	12 OCT	1
369	SY-M	"	"	17 OCT	17 OCT	1
372	SY-F	"	"	13 OCT	14 OCT	2
392	ASY-M	"	"	13 OCT	13 OCT	1
393	ASY-F	"	"	13 OCT	13 OCT	1
395	ASY-F	"	"	13 OCT	13 OCT	1
424	ASY-F	"	"	11 OCT	13 OCT	2
433	SY-F	"	"	12 OCT	15 OCT	3
440	ASY-M	"	"	14 OCT	14 OCT	1
473	SY-M	"	"	15 OCT	15 OCT	1
476	SY-M	"	"	17 OCT	17 OCT	1
482	SY-M	"	"	1 OCT	2 OCT	2
485	ASY-M	"	"	12 OCT	13 OCT	2
494	SY-M	"	"	14 OCT	15 OCT	2
528	SY-M	"	"	14 OCT	14 OCT	1
530	ASY-F	"	"	2 OCT	2 OCT	1
579	ASY-M	"	"	17 OCT	17 OCT	1

[a] Age denoted is present age. Age and sex codes are from the U.S. Fish & Wildlife Service (1976) as follows:
Sex: M=male, F=female, 0=unknown; and
Age: HY=Hatching Year, SY=Second Year, ASY=After Second Year, TY=Third Year, ATY=After Third Year. Where present age is known beyond "ATY" (i.e., fourth year and older), we have designated this as FY=Fourth Year or AFY=After Fourth Year, or, in the case of collar AAC, have given the age numerically in years.

[b] Also observed at Ugashik Bay in 1984.

[c] Also observed at Ugashik Bay in 1984 and 1983.

Appendix D. Values of analyses[1] run on goose fecal and plant[2] samples collected at Ugashik Bay and Cinder River, Alaska, during fall 1985.

Sample (#)	Dry wt. (g)	% dry matter	% ash	% NDF	% ADF	% Fat	% TNC	N	P	% k	Ca	Mg
Fecal												
Sample (1)	34.8	16.9	29.3	47.8	36.8	1.60	10.55	2.18	0.42	1.57	0.29	0.35
Sample (2)	37.4	16.2	23.8	51.6	35.2	2.54	6.07	2.89	0.43	1.89	0.40	0.45
Sample (3)	31.1	14.8	24.5	47.0	34.1	2.48	6.17	2.76	0.50	1.83	0.30	0.42
Sample (4)	24.5	15.6	22.7	48.7	35.4	2.56	6.27	2.75	0.47	1.66	0.38	0.46
Sample (5)	32.1	91.7	34.2	42.6	37.0	1.28	14.14	2.17	0.45	1.51	0.28	0.37
Sample (6)	24.5	98.1	22.1	47.9	34.2	1.98	9.66	2.87	0.53	2.00	0.38	0.42
Vegetation												
Spurgularia (1)	7.1	14.8	10.5	61.6	31.4	2.08	7.27	2.43	0.29	0.73	0.60	0.33
Potentilla (2)	3.5	20.6	16.6	45.3	37.5	3.70	2.29	1.53	0.22	0.92	1.35	0.58
Puccinellia (4)	11.0	16.8	6.5	56.3	24.2	2.52	21.11	1.80	0.25	0.93	0.32	0.15
" (5)	19.1	21.9	14.1	51.4	26.7	2.50	23.00	1.60	0.22	1.23	0.50	0.18
" (11)	5.8	18.3	27.1	55.7	33.8	2.38	11.25	1.65	0.22	0.65	0.29	0.31
" (12)	34.6	21.5	65.0	67.6	55.3	0.62	1.50	1.07	0.18)	0.33	0.82	0.57
Hippuris (7)	18.6	9.9	24.3	58.5	57.1	1.42	3.68	2.06	0.23	0.44	0.90	0.53
" (10)	4.5	10.0	17.5	53.2	52.0	1.36	3.68	1.16	0.11	0.35	0.72	0.47
" (6)	10.8	15.9	15.0	26.1	18.7	0.84	33.06	1.99	0.47	1.38	0.30	0.26
" (8)	18.3	16.4	23.1	32.8	26.8	0.56	23.90	1.79	0.41	1.08	0.40	0.36
" (9)	4.8	18.3	10.1	28.4	21.9	1.10	31.07	1.88	0.48	1.46	0.23	0.20
Triglochin (13)	1.7	36.7	*	35.2	10.7	*	*	3.07	0.36	1.28	0.25	0.19
" (14)	1.0	41.3	*	32.9	7.5	*	*	2.91	0.38	1.41	0.28	0.19

[1] Material was dried to 60° C. NDF = neutral detergent fiber, ADF = acid detergent fiber, TNC = total nonstructural carbohydrates.

[2] Species of plants are: Spurgularia canadensis, Potentilla Egedii, Puccinellia phryganodes, Hippuris tetraphylla, and Troglochin palustris.

* Not enough material to derive values.

Appendix E. Number of birds followed and length of observations of cackling Canada geese for which time and activity budgets were derived.

Age[1]	No. birds observed		No. hours observed	
	males	females	males	females
Juveniles				
Hatching-year	0	5	0.0	2.5
Second-year	3	0	1.3	0.0
Subtotal	3	5	1.3	2.5
Adults				
After-second-year	19	17	8.4	8.3
Third-year	1	1	0.3	0.2
After-third-year	1	2	0.2	1.5
Fourth-year	0	2	0.0	1.6
After-fourth-year	4	4	1.8	3.3
Subtotal	25	26	10.7	14.9
Total	28[2]	31[3]	12.0	17.4

[1] Age classes follow U. S. Fish and Wildlife Service (1976).

[2] The 28 males observed represented 15 different birds. The duplicate observations were accounted for by two after-second-year birds (H40 and 062) which were followed on 5 and 8 different occasions, respectively, totaling 2.1 and 4.1 hours of observation.

[3] The 31 females observed represented 22 different birds. The duplicate observations were accounted for by three after-second-year birds (H41, H47, and 1P2) which were followed on 4, 3, and 2 different occasions, respectively, totaling 2.5, 1.2, and 0.8 hours of observation.

Appendix F. Duration of observations (minutes, $\bar{X} \pm$ S.E.) of cackling Canada geese followed for time and activity budgets.

Age[1]	Males	Females
Juveniles		
Hatching-year	0.0	29.9 ± 3.9 (5)
Second-year	26.1 ± 3.5 (3)	0.0
Adults		
After-second-year	27.0 ± 2.6 (19)	29.4 ± 3.2 (17)
Third-year	19.5 (1)	11.4 (1)
After-third-year	12.0 (1)	39.5 ± 5.7 (2)
Fourth-year	0.0	46.8 ± 19.2 (2)
After-fourth-year	26.6 ± 1.3 (4)	49.2 ± 23.7 (4)
Total all adults	26.0 ± 2.1 (25)	34.3 ± 4.4 (26)

[1] Age follows U. S. Fish and Wildlife Service (1976).