

A photograph of a Greater White-fronted Goose nesting in a field of tall, dry grass. The goose is positioned in the lower center of the frame, facing right. It has a white head and neck, a dark body, and a white patch on its forehead. The grass is a mix of green and brown, indicating a late summer or autumn setting. The background is filled with more of the same grass, creating a textured, natural environment.

**NESTING GREATER WHITE-FRONTED GOOSE
STUDY AT CD-5, 2017**

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NESTING GREATER WHITE-FRONTED GOOSE STUDY AT CD-5, 2017

FINAL REPORT

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INTRODUCTION

The first oil development in the Northeast Planning Area of the National Petroleum Reserve in Alaska (NE NPR-A) was constructed during 2014 and 2015 by ConocoPhillips Alaska, Inc., (CPAI) as part of the Alpine Satellites Development Plan (BLM 2004). The new development, named CD-5, consists of a gravel road and pipeline connected to the Alpine Facility on the Colville River delta, where produced oil is processed.

Niglivik, the Iñupiaq name for Greater White Fronted Goose (*Anser albifrons*), is a major subsistence species for local Iñupiaq people. At the request of the North Slope Borough per rezone ordinance 75-6-54 Stipulation 3.c.(1), CPAI is conducting a multi-year study of Greater White-fronted Geese (henceforth, White-fronted Geese) out of concern for potential development effects. ABR, Inc., was contracted in 2013 to conduct this study. The original pre-post construction study design for CD-5, approved by the North Slope Borough, includes collection of nesting data during 1 year of the pre-construction period (2013), during 2 years of the construction period (2014 and 2015), and during 2 years of the operation period (2017 and 2020). The goal of this study is to evaluate the effects of the 3 phases of development on the abundance, distribution, and nesting success of White-fronted Geese nesting in the CD-5 area.

In this report, we present the 2017 results of the White-fronted Goose nesting study with brief comparisons of results from 2013–2015. Required state and federal permits were obtained for all survey activities, including a Scientific or Educational Permit (Permit No. 17-132) from the State of Alaska and a Federal Fish and Wildlife Permit—Native Threatened Species Recovery Threatened Wildlife; Migratory Birds (Permit No. TE012155-6 issued under Section 10(a)(1)(A) of the Endangered Species Act [58 FR 27474-27480]).

STUDY AREA

The CD-5 drill site is located approximately 7 km west of the Nigliq Channel in the NE NPR-A (Figure 1). A gravel road (9.6 km long and with a 0.23 km² footprint) and 4 bridges connect CD-5 to

the CD-4 road on the Colville River delta. Construction of the CD-5 pad, gravel road, and bridges began in 2014 and, along with the pipeline, was completed in 2015. The Nuiqsut Spur Road (9.3 km) was constructed in 2014 and completed in 2015 by the Kuukpik Corporation from Nuiqsut to the CD-5 road, but it was open primarily to construction equipment during summer 2015. A laydown pad also was built in 2014 at the intersection of the CD-5 and Nuiqsut Spur roads. During winter 2016–2017, the GMT-1 drill pad and 12.3 km long GMT-1 road were constructed, tying into the CD-5 road from the west. Between 2014 and 2017, new construction (roads and pads) intersecting CD-5 study plots converted 0.04 km² of potential nesting habitat on study plots into the Human Modified habitat type (i.e., gravel).

Landforms, vegetation, and wildlife habitats in the NE NPR-A study area were described in the Environmental Impact Statement for the lease area and the ASDP (BLM 2004) and in Jorgenson et al. (2003, 2004). Coastal plain and riverine landforms dominate the NE NPR-A study area. On the coastal plain, lacustrine processes, basin drainage, and ice aggradation are the primary geomorphic factors that modify the landscape. In riverine areas along Fish and Judy creeks, fluvial processes predominate, although eolian and ice-aggradation processes also contribute to ecological development (Jorgenson et al. 2003).

Sixteen wildlife habitats occur on the 40 10-ha plots searched for nests. The most abundant wildlife habitats were Patterned Wet Meadow (28% of the plot area), Moist Sedge-Shrub Meadow (26%), Old Basin Wetland Complex (23%), and Moist Tussock Tundra (13%). Only 2 other habitats had >1% coverage: Shallow Open Water with Islands or Polygonized Margins (5%) and Sedge Marsh (2%).

METHODS

NEST PLOT SELECTION

We established 40 permanently fixed plots in 2013 to search for White-fronted Goose nests in each year of the study (Figure 1). We randomly selected plot locations from a 6 × 6 km grid centered on the CD-5 drill site. The grid contained 3,600 points spaced 100 m apart, of which 60

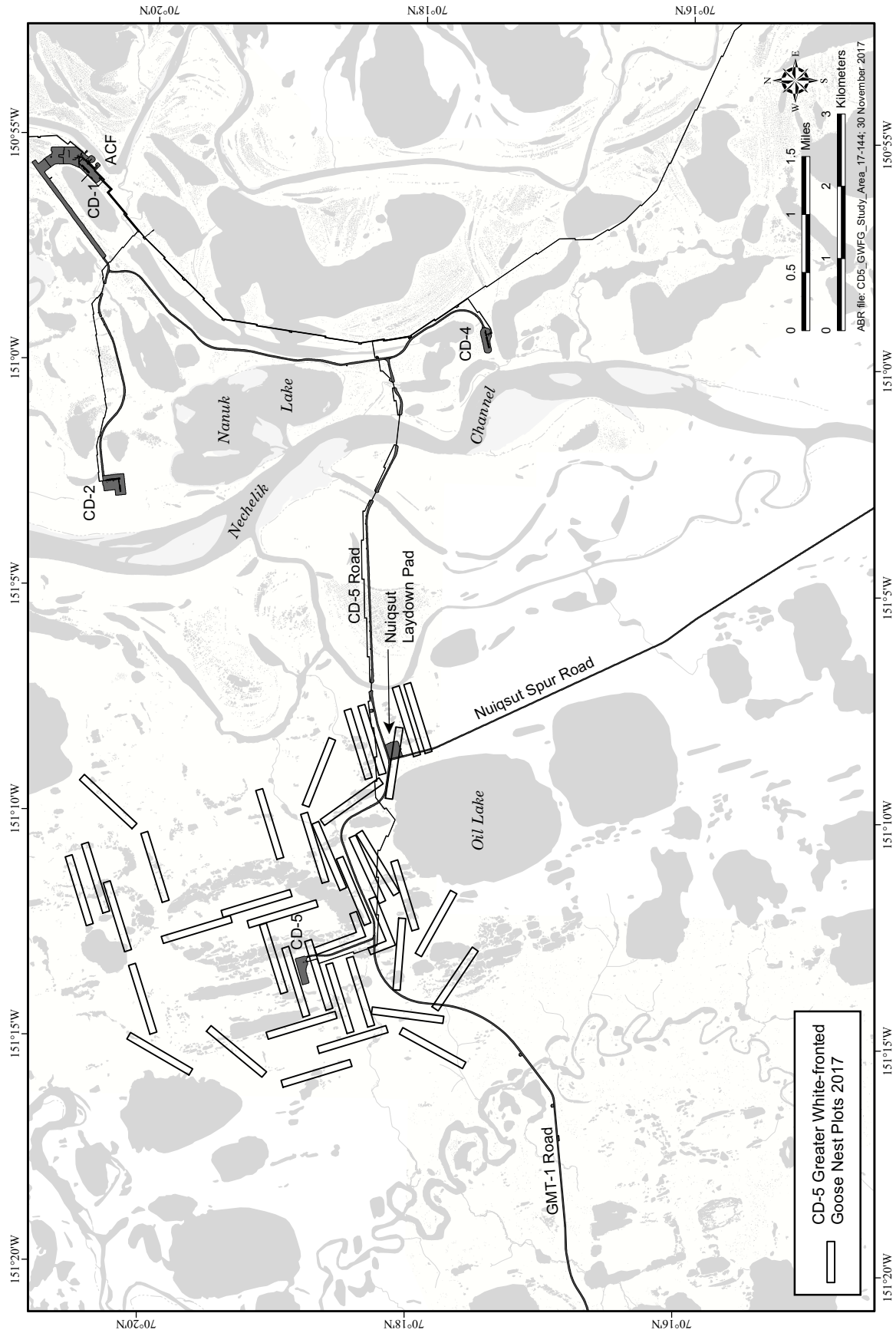


Figure 1. Plot locations for ground-based surveys of nesting Greater White-fronted Geese at CD-5, NE NPR-A, 2013–2015, 2017.

points were randomly selected. Each randomly selected point was used to locate the start of a 100 m × 1,000 m (10 ha or 0.1 km²) plot, oriented parallel to the nearest proposed road or pad. Plots were discarded if they overlapped a previously selected plot or had more than 25% of area in lakes. During nest searches, we completed a cluster of 1–5 plots each day, all within walking distance of each other (<2 km from the end of one to the start of another). Each successive day we alternated between clusters of plots that were near proposed facility locations and clusters that were far from facility locations. Plots were searched in the same order each year and within a 10-day calendar period, to avoid introducing a timing effect that might influence annual comparisons among plots. Unless stated otherwise, means are presented with standard errors (mean ± SE).

NEST SEARCHING

In 2017, we conducted a post-construction nest search of plots. Methods were the same as those used in 2013–2015 (Johnson et al. 2014, 2015; Rozell and Johnson 2016). Nests of Greater White-fronted Geese and other large waterbirds were recorded as they were encountered. We completed 1 nest search covering 3.96 km² in 40 plots during 8–18 June, commuting by truck or by helicopter from Alpine each day. The total nest searching area in 2014 and 2015 was 0.03 km² smaller than in 2013 due to the Nuiqsut Spur Road and Nuiqsut Laydown Pad, which intersected several study plots, and in 2017 another 0.01 km² of study area was covered by the GMT-1 road (Figure 1). A crew of 4 people spaced 25 m apart searched for nests by walking a zigzag pattern, to achieve total coverage of the tundra within each plot's boundaries. Plot boundaries were displayed on a moving map on handheld GPS units. Crew members searched for nests of large birds including Bar-tailed Godwits, waterfowl, loons, ptarmigan, and larids (gulls, terns, and jaegers); all other shorebird and songbird nests were not recorded. Nest searchers communicated with hand-held radios when nests other than of White-fronted Geese were spotted, to avoid flushing incubating birds. For each nest found, we recorded the species, location (GPS coordinates in WGS 84), status (active: nest attended or eggs

were warm; or inactive: unattended and without eggs), distance to nearest water (ephemeral or permanent water), distance to nearest waterbody (permanent water ≥0.25 ha in area), waterbody class, whether or not the bird flushed, the distance at which it flushed, the number of eggs, and the float angle of a sample of eggs from nests that were unoccupied or from nests where the incubating bird flushed. Eggs were floated in a small clear container of water to estimate the age of eggs and incubation start dates (Westerkov 1950, Mabee et al. 2006). We floated 1–3 eggs from all nests of White-fronted Geese (intentionally flushed) and from nests of Cackling/Canada Geese that were inadvertently flushed. Each floated egg was assigned an age from a float schedule based on the angle and position of the egg in the water column (Jerry Hupp, USGS, unpublished data). The float schedule provided estimates of ages in 2–4 d increments; we used the midpoint of the age range or the earlier date in the case of 2-d ranges. Nest data were recorded on a GPS and downloaded to a database at the end of each day.

A sample of nest contents was collected from all unattended nests and unattended nests were identified to species or species group based on the size and color pattern of contour feathers, down, or eggs in the nest (Anderson and Cooper 1994, Bowman 2004). Some nests remained unidentified because too few feathers were in the nest or feathers were not clearly definitive in determining species. Wooden survey stakes (45 cm high) were placed ≥15 m from active nest sites to assist in relocating the nest. Before we departed from waterfowl nests where the incubating bird was absent, eggs were covered with nest material and additional vegetation to conceal the nest from predators.

TEMPERATURE-SENSING EGGS

Artificial temperature-sensing eggs and data loggers were installed in 42 White-fronted Goose nests to record incubation activity and data on daily nest survival using the same methods as in 2013–2015. The eggs were constructed from plastic “Easter” eggs that were painted white. The thermistor (TMC1-HD, TMC6-HD, and TMC6-HA cables; Onset Computer Corporation, Bourne, MA) consisted of a 2.5 cm temperature

sensor taped to the inside of each egg. The thermistor cable (connected to the temperature sensor) exited the temperature-sensing egg where the egg was attached to a 15 cm threaded toggle-bolt (sheetrock wall anchor). The thermistor cable was connected to a small data logger (HOBO® models H8-002-02, U12-006, and U12-013, Onset Computer Corporation, Bourne, MA) external to the egg. Loggers were programmed to record nest temperature every 5 minutes. To establish baseline ambient temperatures for reference, one thermistor was attached to a nest stake at ground level and recorded temperatures every 15 minutes at a site centrally located in the study area.

All eggs were removed from nests before installing temperature sensors. The thermistor cable was hidden in a shallow trench (2–3 cm deep) leading to the data logger, which was sealed in a waterproof bag and buried 3–5 cm under the vegetation mat. To prevent the removal of equipment by geese or nest predators, the toggle-bolt on the temperature-sensing egg was pressed into a hole in the center of the nest bowl so that the wings of the bolt could act as barbs and hinder removal. After installation, the original eggs were returned to the nest and covered with down and vegetation. After the nesting season, artificial eggs and data loggers were retrieved and the temperature data were exported using BoxCar Pro version 4.0.7.0 or HOBOWare version 3.7.1, depending on the model of the data logger used.

Classifications of incubation activity were made using temperature data collected from the artificial eggs, applying rules of interpretation developed for White-fronted Geese in a previous multi-year study, which used time-lapse cameras in conjunction with temperature-sensing eggs (Johnson et al. 2003). Incubation classification was based on the minimum egg temperature during incubation (28.3 °C) and on the temperature changes between 2 consecutive 5-minute recording intervals. See Johnson et al. (2015) for detailed methods of temperature interpretation and calculation of incubation activity. Yearly comparisons of incubation behavior do not include 2013, because the data from that year lacked the detail required.

NESTING SUCCESS

We revisited all nests on 6–9 July to determine nest fates. A nest was considered successful if evidence suggested that at least 1 egg hatched. Hatch was determined by the presence at the nest of detached egg membranes, eggshells with thickened membranes that peeled easily from the shell, eggshell pipping fragments (less than 5 mm), and eggshell tops or bottoms. The presence of yolk, blood, eggshells with holes, egg fragments with attached membranes, or the total absence of egg remains was recorded as nest failure. Any evidence of predators at the nest (fox scent, fox scat, or a disturbed nest site) was recorded as supplemental information, but only eggshell evidence was used to judge nest fate.

Temperature data from nests with installed thermistors also were reviewed for indications of hatch or failure. Temperatures from failed nests typically drop abruptly and quickly begin tracking ambient temperatures. Temperature records during hatching of successful nests typically show a long period of nest attendance followed by increasingly frequent breaks 24–36 h before the female and brood leave the nest (Johnson et al. 2003) and the increase in break frequency is apparent in the graph of nest temperature against time as a gradual cooling of the nest temperature. The female and brood were judged to have departed the nest when 5 consecutive records had an average nest temperature <9 °C or temperature appeared to track ambient temperatures. The hatch date of a nest was recorded as the day before the female and brood departed the nest.

Apparent nesting success was estimated by dividing the number of nests that hatched by the number of nests found, including nests that were inactive at discovery. Apparent nesting success is generally acknowledged to overestimate success because it does not take into account the length of time nests are exposed to predators and other risk factors (Mayfield 1961). We report apparent nesting success for all nests found, because it is easily calculated for large numbers of nests without the added disturbance or expense of periodic visits or monitoring devices. For those nests containing temperature-sensing eggs, we used daily survival rates (DSR) to calculate unbiased estimates of nesting success. DSRs were estimated in program

MARK (White and Burnham 1999), which we used to examine competing models with covariates of year, nest age, and date using Akaike Information Criteria corrected for finite sample size (AIC_c). We constructed 6 models: constant (assuming non-varying DSR), year, age, date, year + age, and year + date.

Nesting success over the incubation period was calculated by raising the DSR to the exponent of the number of days of incubation. The incubation period for White-fronted Geese on the North Slope of Alaska is reported to be 25 d (Ely and Dzubin 1994). We used 24 d for the incubation period for White-fronted Geese which was the modal incubation length for nests at CD-5 in 2013–2015 from successful nests with a known hatch date. We estimated incubation start dates and nest initiation dates for White-fronted Geese and Canada Geese using egg-flotation data (described above) or by backdating in the case of nests with known hatch dates. We used the youngest (last-laid) egg floated in each nest to arrive at the start date for incubation. The date of nest initiation was calculated by multiplying the clutch size by the estimated laying interval (1.33 d/egg; Ely and Dzubin 1994, Mowbray et al. 2002, Burgess et al. 2013) and backdating from the incubation start date.

HABITAT MAPPING AND ANALYSIS

A wildlife habitat was assigned to each nest by plotting its coordinates on the wildlife habitat map. For each bird species, habitat use (% of all nests in each identified habitat type) was determined. Habitat availability also was calculated as the percent of each habitat in the total area on the 40 plots.

We conducted a statistical analysis of habitat selection of White-fronted Goose nests to evaluate whether habitats were used in proportion to their availability. We combined 4 years of nest search data in the analysis of habitat selection. We inferred selection (preference or avoidance) from comparisons of observed habitat use with random habitat use by means of Monte Carlo simulations (1,000 iterations). We defined habitat preference (i.e., use > availability) as observed habitat use greater than the 95% confidence interval of simulated random use. Conversely, we defined

habitat avoidance (i.e., use < availability) as observed habitat use below the 95% confidence interval of simulated random use. The simulations and calculations of confidence intervals were conducted with Microsoft® Excel. Details are provided by Johnson et al. (2015).

PREDATOR SCANS

We conducted predator scans visually on all plots to determine the types and numbers of potential nest predators in the CD-5 area. Binoculars were used to search for avian predators (i.e., jaegers, gulls, raptors, ravens, and owls) and mammalian predators (i.e., foxes and bears) during each scan. On each plot, we conducted 2 scans of 10 min each for predators inside or within 300 m outside of the plot boundary. Predator scans were conducted on the center line of each plot at the beginning and again at the end of the nest-search effort (1 km apart): 10 min before the start and 10 min after the end of the nest-searching effort for each plot. Level of predator activity in the area was represented by the number of predator observations per 10 min scan. Observations of predators seen incidentally during nest searches also were recorded.

DATA MANAGEMENT

All data collected during nest searches were compiled into a centralized database following CPAI's data management protocols (version 10.3, CPAI 2017). Locations of nests were recorded on a GPS receiver with decimal-degree coordinates in the WGS 84 map datum and later transferred into the NAD 83 map datum. Uniform attribute data were recorded for all observations and proofed after data collection and proofed again during data entry. Survey data were submitted in GIS-ready format with corresponding metadata.

RESULTS AND DISCUSSION

SEASONAL CONDITIONS IN THE STUDY AREAS

The average monthly temperature when birds arrived in the study area during May 2017 was -2.3 °C, which is near the long-term average recorded at the Alpine weather station (mean = -2.4 ± 0.8 °C; $n = 7$ years). However, daily low air temperatures at

inland locations in Anaktuvuk Pass and Umiat remained near or below freezing throughout the breakup period, slowing regional breakup, and contributing to a protracted breakup in the study area. In 2017, all water flow in the Colville River delta remained well within channel banks and no flooding events were reported in or near the CD-5 study area (Michael Baker 2017). Snow depth recorded on 15 May was slightly above average (96.5 cm) compared with the 7-year mean (80.9 ± 1 cm). Alpine was snow-free by 26 May, which is near the median snow-free date for the area (24 May). Aerial photos taken in the CD-5 and GMT study area illustrate snow-free tundra on 1 June (Michael Baker 2017), but snow may have disappeared as early as 26–28 May.

Mean temperatures recorded at Alpine during 1–15 June were colder than those during mid-to-late May. Only 9 thawing degree-days (TDD) were recorded during the first 2 weeks of June compared with 22 TDD between 15 and 31 May. Cumulative TDD (31 d) measured during the period of peak nest initiation for waterfowl (15 May–15 June) was well below the long-term mean (51 ± 12 TDD; $n = 7$ years; Alpine weather station) primarily due to unseasonably cold June temperatures.

In 2017, open water on large lakes (>5 ha) developed later than it did in the 3 previous years. Ice cover on large lakes was estimated visually during aerial surveys for loons during 21–24 June (Johnson et al. 2018). Ice coverage on lakes in 2017 (82%) was 13% above the 4-year average ($69 \pm 7\%$; $n = 22$ lakes). Despite winter 2016–2017 having the warmest temperatures recorded for the past 16 years (Michael Baker 2017), lake ice estimated in late June 2017 was more extensive than at the same time in 2016 (49%).

DISTRIBUTION AND ABUNDANCE

Three species of geese nested on the 40 10-ha plots in the CD-5 area in 2017, and their combined nests accounted for 94% of all nests recorded (Figure 2, Table 1). White-fronted Geese were the most abundant nesting waterfowl (38.4 nests/km²) and Cackling/Canada Geese were second in abundance (8.8 nests/km²). One Brant nest also was found. White-fronted and Cackling/Canada Goose nests were widely distributed among the

plots. The mean number of White-fronted Goose nests found was 3.8 ± 0.4 nests/plot (Table 2). The most White-fronted Goose nests on plots 20 (9 nests) and 9 and 35 (8 nests each). Only 2 plots contained no White-fronted Goose nests. Nesting densities of White-fronted Geese and Cackling/Canada Geese have increased annually since the first year of this study. In 2013, only 21.8 nests/km were reported for White-fronted Geese and only 1.5 nests/km² were found for Cackling/Canada Geese. Populations of both species on the Arctic Coastal Plain (ACP) have been steadily increasing over the last 2 decades (Wilson et al., *in prep.*)

HABITAT USE

Although White-fronted Geese nested in 5 habitats, 88% of nests were in just 3 habitats: Old Basin Wetland Complex, Patterned Wet Meadow, and Moist Sedge-Shrub Meadow (Figure 3, Table 3). White-fronted Geese were the only species for which sample size of nests was adequate to test for habitat selection. A Monte Carlo analysis of habitat selection using 473 White-fronted Goose nests from 4 years of this study found nesting White-fronted Geese used all habitats in proportion to availability except for Patterned Wet Meadow, which was a preferred habitat and Shallow Open Water with Islands or Polygonized Margins, which was avoided (Table 4). Cackling/Canada Geese nested in 4 habitats, with a largest proportion of nests in Old Basin Wetland Complex (57%) and in Shallow Open Water with Islands or Polygonized Margins (26%), which was avoided by White-fronted Geese. Compared with White-fronted Geese, Cackling/Canada Goose nests tended to be in the wetter habitats, on islands or shorelines of water bodies (Figure 3, Table 3).

NEST INITIATION AND INCUBATION

We floated eggs from 192 White-fronted Goose nests and 14 Cackling/Canada Goose nests in 2017 to estimate nest age and the start of incubation. By the time nest searching began on 8 June, we estimated 66% of the White-fronted Geese had initiated incubation compared with 99% of nests in 2015 on the same date. The median start date of incubation for White-fronted Geese in 2017 was 7 June (range = 30 May–14 June), which was closest in timing to 2014 (9 June, range 30 May–15

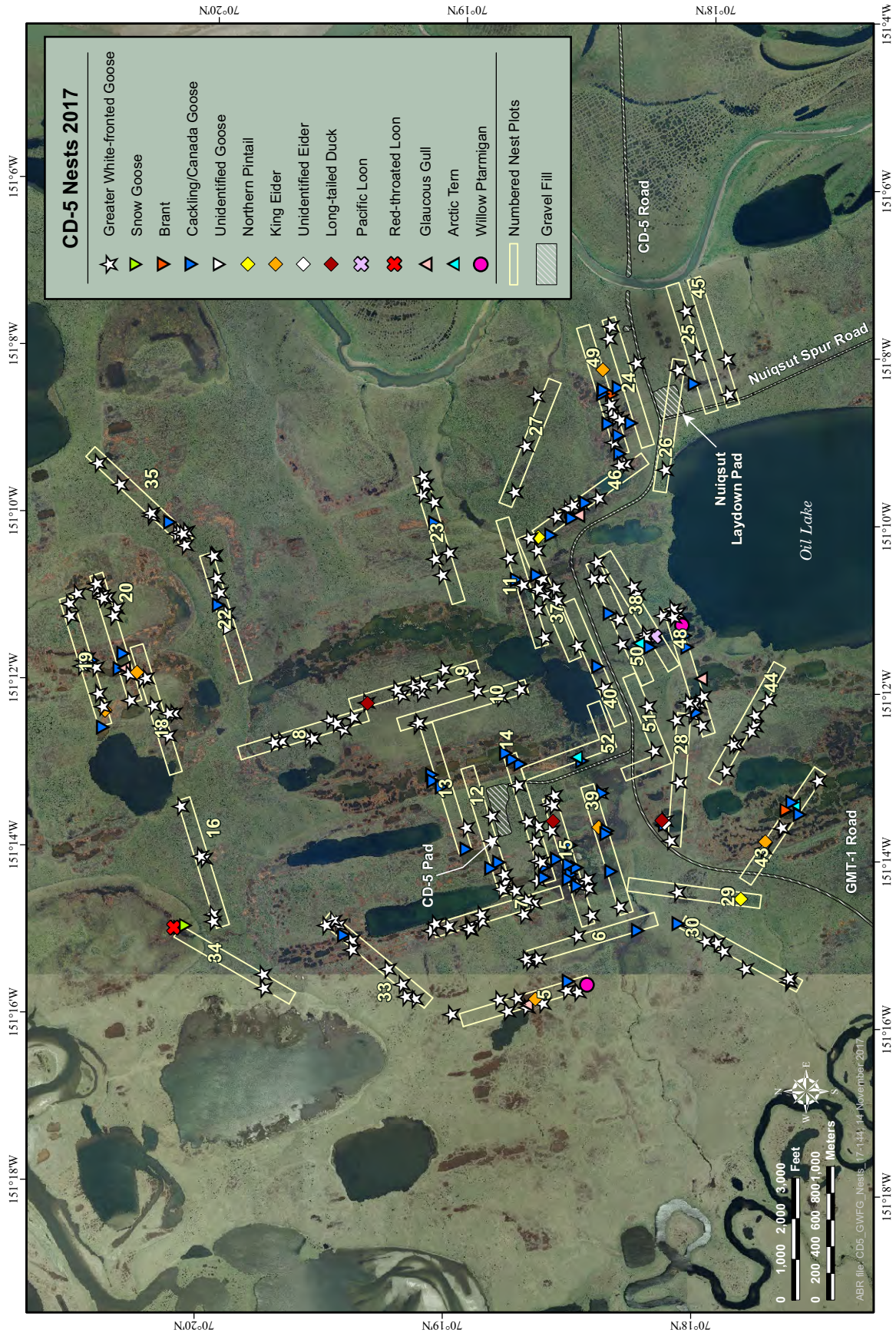


Figure 2. Nest locations of Greater White-fronted Geese and other species on nest plots at CD-5, NE NPR-A, 2017.

Table 1. Number and density of nests and apparent nesting success for birds at CD-5, NE NPR-A, 2017.

Species	Nests on Plot		All Nests ^a				Apparent Nesting Success (%) ^c
	Total	Density (nests/km ²) ^b	Total	Successful	Failed	Unknown	
Greater White-fronted Goose	152	38.4	212	114	95	3	55
Snow Goose	–	–	1	–	–	1	–
Brant	1	0.3	2	1	1	–	50
Cackling/Canada Goose ^d	35	8.8	57	10	46	1	18
Unidentified goose ^e	1	0.3	1	–	1	–	0
Northern Pintail	2	0.5	2	1	–	1	100
King Eider	4	1.0	5	1	4	–	20
Long-tailed Duck	2	0.5	2	–	1	1	0
Red-throated Loon	–	–	1	–	–	1	–
Pacific Loon	1	0.3	1	–	–	1	–
Glaucous Gull	2	0.5	4	–	1	3	0
Arctic Tern	2	0.5	4	–	–	4	–
Total	202	51.0	292	127	149	16	46

^a Includes nests located outside plot boundaries.

^b Density calculations based on 3.96 km² search area. After 2013, 0.04 km² of the study area has become human modified habitat.

^c Apparent nesting success = no. nests successful/(no. successful + no. failed) × 100; successful nests hatched ≥ 1 egg.

^d Nest belonging to either Cackling or Canada goose.

^e Nest failed and belonged to an unidentified goose.

June). The start date for incubation in 2017 falls between start dates recorded for 2013 (14 June, range = 6 June–18 June), and 2015 (3 June, range = 27 May–11 June), which were relatively late and early breakup years, respectively (Figure 4). At most nests (76%), incubation was initiated 6–10 June 2017 (Figure 4). The median date of nest initiation (first egg laid) for White-fronted Geese in 2017 was 3 June (range = 21 May–11 June). Mean clutch size for nests with complete clutches (floated eggs > 3 d old) was 3.7 eggs (± 0.12 , $n = 178$ nests), a slight decrease from the means in of the 3 previous years of this study: 2013 (3.8 ± 0.18 eggs/nest, $n = 55$ nests), 2014 (3.8 ± 0.17 eggs/nest, $n = 88$ nests), and 2015 (4.0 ± 0.14 eggs/nest, $n = 148$ nests).

The median incubation start date for Cackling/Canada Geese in 2017 was 6 June (range = 31 May–11 June, $n = 14$ nests). The dates of nest initiation for Cackling/Canada Geese ranged from

26 May to 6 June, and the median date was 1 June ($n = 14$ nests). Mean clutch size for nests with complete clutches was 4.1 eggs (± 0.32 , $n = 13$ nests), and ranged from 3 eggs (± 0.91) in 2013 to 5 eggs (± 0.3) in 2015, but sample sizes for all years were low (4–13 nests).

TEMPERATURE-SENSING EGGS

Of the 42 thermistors and data-loggers installed in White-fronted Goose nests in 2017, 31 produced temperature data that could be used to quantify incubation behaviors. Twenty nests were monitored with thermistors to day of hatch and brood departure and 11 nests were monitored to day of failure (Tables 5 and 6, Figure 5). Eleven data-loggers were missing in July during nest checks or failed to provide useful data. Three of these data-loggers were removed from nests, likely by a nest predator (e.g., fox or bear), and were not found within ~20m of the nest site. Another 4

Table 2. Number of nests and apparent nesting success of Greater White-fronted Geese at CD-5, NE NPR-A, Alaska, 2017.

Plot	Number of Nests			Apparent Nesting Success (%) ^a
	Total	Successful	Failed	
5	3	2	1	67
6	3	1	2	33
7	6	0	6	0
8	6	4	2	67
9	8	5	3	63
10	4	3	1	75
11	4	1	3	25
12	4	1	3	25
13	0	0	0	–
14	6	5	1	83
15	4	0	4	0
16	4	0	4	0
18	5	3	2	60
19	7	6	1	86
20	9	5	4	56
22	4	3	1	75
23	5	5	0	100
24	2	1	1	50
25	2	1	1	50
26	2	2	0	100
27	2	2	0	100
28	2	1	1	50
29	1	0	1	0
30	6	3	3	50
33	7	3	4	43
34	2	0	2	0
35	8	7	1	88
37	4	3	1	75
38	1	1	0	100
39	1	0	1	0
40	1	0	1	0
43	3	1	2	33
44	4	2	2	50
45	1	0	1	0
46	4	3	1	75
48	7	4	3	57
49	4	1	3	25
50	4	0	4	0
51	2	1	1	50
52	0	0	0	–
Total	152	80	72	
Mean	3.8			48
SE	0.4			5
<i>n</i> (plots)	40			38

^a Apparent nesting success = no. nests successful/(no. successful + no. failed) × 100; successful nests hatched ≥1 egg.

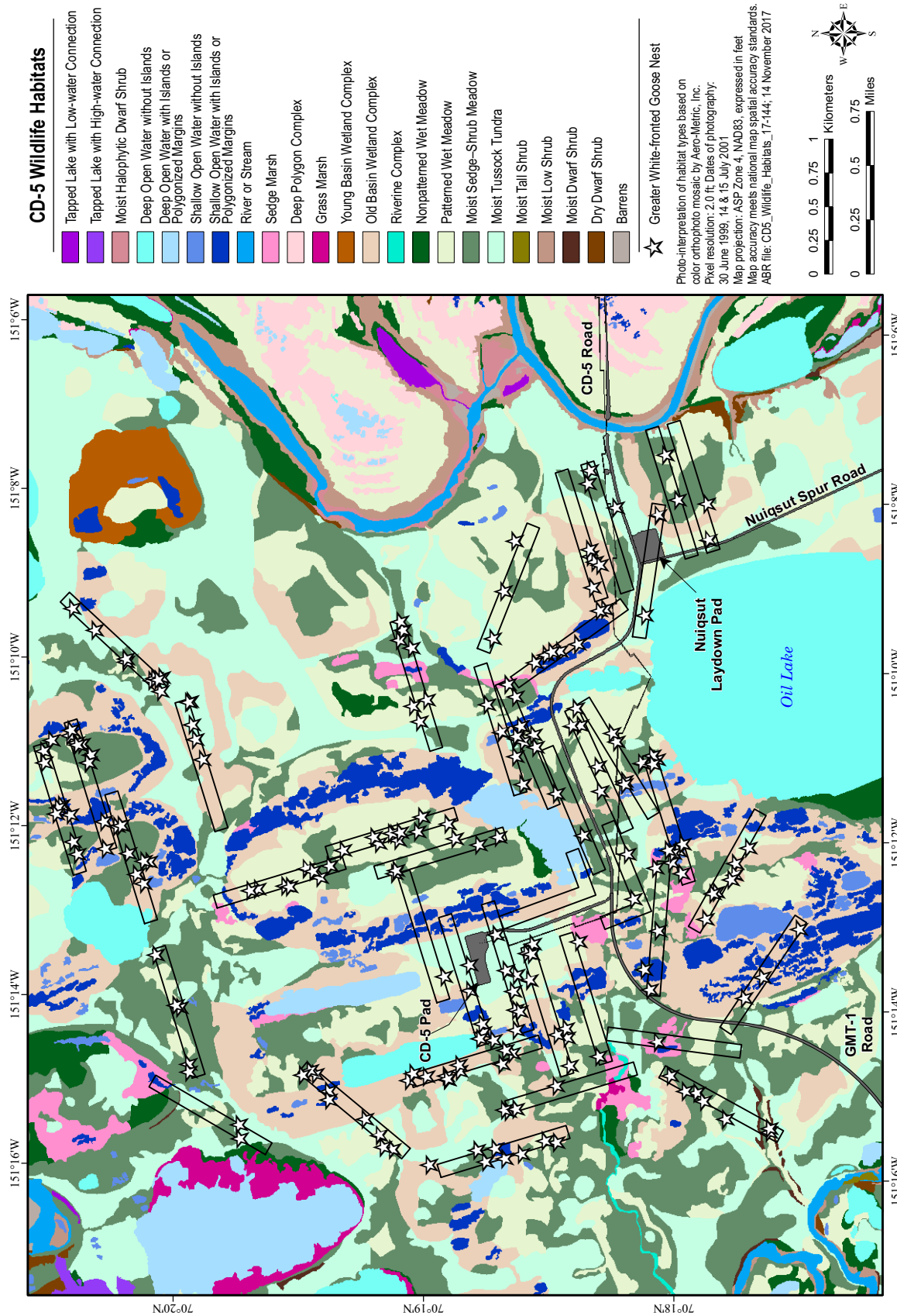


Figure 3. Nest locations of Greater White-fronted Geese and habitats in the area of nest plots at CD-5, NE NPR-A, 2017.

Table 3. Habitat use (%) by nesting birds on nest plots at CD-5, NE NPR-A study area, 2017.

Habitat	Greater White-fronted Goose ^a	Brant	Cackling/Canada Goose ^b	Unidentified Goose	Northern Pintail	King Eider ^a	Long-tailed Duck	Pacific Loon	Glaucous Gull	Arctic Tern	Total Nests	Habitat Use (%)
Shallow Open Water with Islands or Polygonized Margins	0	100	26	0	0	25	0	0	50	0	39	19
Sedge Marsh	1	0	6	0	0	0	0	0	0	0	16	8
Old Basin Wetland Complex	30	0	57	100	0	50	0	100	50	100	73	36
Patterned Wet Meadow	34	0	11	0	0	25	100	0	0	0	59	29
Moist Sedge-Shrub Meadow	24	0	0	0	100	0	0	0	0	0	4	2
Moist Tussock Tundra	11	0	0	0	0	0	0	0	0	0	12	6
Total Nests	152	1	35	1	2	4	2	1	2	2	202	100

^a Includes nests identified to species from feather and down samples.

^b Nest belonging to either Cackling or Canada Goose.

Table 4. Habitat selection by nesting Greater White-fronted Geese on nest plots at CD-5, NE NPR-A study area, Alaska, 2013–2015, 2017.

Habitat	Area (km ²)	No. of Nests	Use (%) ^a	Availability (%)	Monte Carlo Results ^b	Sample Size ^c
Deep Open Water without Islands	0.03	0	0	0.2	ns	low
Deep Open Water with Islands or Polygonized Margins	0.07	0	0	0.5	ns	low
Shallow Open Water without Islands	0.11	0	0	0.7	ns	low
Shallow Open Water with Islands or Polygonized Margins	0.85	3	0.6	5.3	avoid	
River or Stream	<0.01	0	0	<0.01	ns	low
Sedge Marsh	0.32	9	1.9	2.0	ns	
Grass Marsh	<0.01	0	0	<0.01	ns	low
Old Basin Wetland Complex	3.73	126	26.6	23.3	ns	
Riverine Complex	0.02	0	0	0.1	ns	low
Nonpatterned Wet Meadow	0.04	0	0	0.2	ns	low
Patterned Wet Meadow	4.52	156	33.0	28.2	prefer	
Moist Sedge-Shrub Meadow	4.07	123	26.0	25.5	ns	
Moist Tussock Tundra	2.10	56	11.8	13.2	ns	
Tall, Low, Dwarf Shrub	0.03	0	0	0.2	ns	low
Barrens	<0.01	0	0	<0.01	ns	low
Human Modified	0.09	0	0	0.5	ns	low
Total ^d	15.99	473	100	100		

^a Use (%) = (nests / total nests) × 100.

^b Significance calculated from 1,000 simulations at $\alpha = 0.05$; ns = not significant, prefer = significantly greater use than availability, and avoid = significantly less use than availability.

^c “Low” = expected number <5.

^d Total area searched over 4 years of this study.

data-loggers recorded erroneous data that may have resulted from damage to the logger or the attached thermistor. The remaining 4 problem data-loggers recorded temperatures that tracked ambient rather than nest temperature. Among all instrumented nests, 24 nests were successful and 18 nests failed. The apparent nesting success for nests with temperature sensors in 2017 (57%, $n = 42$ nests) was slightly higher than the apparent nesting success for White-fronted Geese without sensors (54%, $n = 170$). This suggests that the disturbance caused by instrumenting nests does not compromise the success of the nests.

INCUBATION BEHAVIOR

Excluding the days of instrumentation, hatch, and failure, temperature-sensing eggs monitored

nest temperature in 20 successful nests for 9–22 d (mean = 15.5 ± 0.8 d) and in 11 failed nests for <1–15 d (mean = 7.4 ± 1.8 d). When egg thermistors were deployed in White-fronted Goose nests, the incubating birds were flushed from their nests, and the length of time females at successful nests took to return to incubate averaged 80 ± 9 min (range 25–175 min, $n = 20$ nests; Table 5). Females from nests that later failed took longer to return to nests after instrumentation (mean = 135 ± 34 min, range 40–410 min, $n = 11$ nests; Table 6). However, the relationship between nest fate and the amount of time to resume incubation has varied yearly. In 2014, successful nesters took almost twice as long to return to nests (mean = 153 ± 32 min, $n = 18$ nests) as failed nesters (mean = 80 ± 14 min, $n = 7$ nests). In 2015, failed nesters returned to

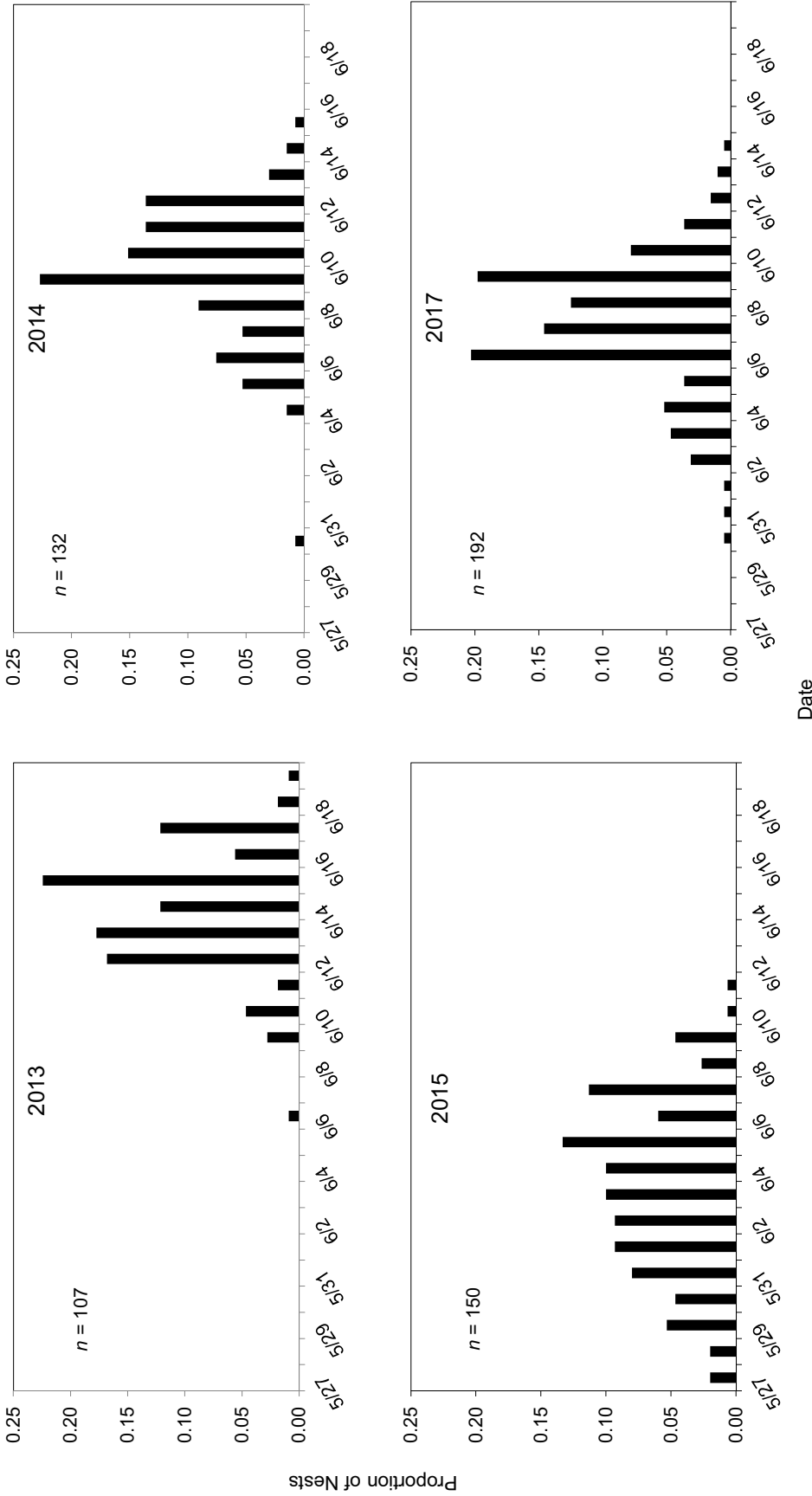


Figure 4. Incubation start dates (proportion of nests), estimated by egg flotation, for Greater White-fronted Goose nests at CD-5, NE NPR-A, 2013–2015, 2017.

Table 5. Nest history and incubation activity of Greater White-fronted Geese at successful nests monitored by thermistors at CD-5, NE NPR-A, 2017.

Nest	Date Instrumented	Incubation Start Date ^a	No. Eggs	Date of Hatch	No. Days Monitored ^b	Initial Time Off Nest (min) ^c	Incubation Constancy (%) ^b	Recess Frequency (no/d) ^b	Mean Recess Length (min/recess) ^b
100	8 June	6 June	4	29 June	20	110	97.9	1.6	12.3
127	13 June	7 June	3	30 June	16	90	98.6	1.0	18.7
133	14 June	7 June	4	30 June	15	110	96.9	2.1	16.5
157	16 June	11 June	2	4 July	17	80	95.7	2.0	23.1
158	16 June	6 June	3	29 June	12	45	98.5	0.7	22.0
170 ^{d,e}	17 June	9 June	4	–	–	–	–	–	–
177	18 June	7 June	5	30 June	11	145	83.6	8.8	24.4
200	10 June	4 June	4	27 June	16	40	88.3	7.2	22.5
202	10 June	6 June	3	29 June	18	115	99.5	0.5	10.5
234 ^{d,e}	14 June	10 June	5	–	–	–	–	–	–
258	17 June	5 June	4	28 June	10	55	99.8	0.2	10.0
271	18 June	5 June	4	28 June	9	30	92.1	4.7	18.8
323	13 June	12 June	5	5 July	21	60	99.5	0.5	10.4
327	14 June	5 June	3	28 June	13	50	96.8	2.4	17.2
363	18 June	8 June	2	1 July	12	175	99.0	0.5	20.6
407	10 June	8 June	3	1 July	20	75	91.0	4.9	24.6
412	11 June	11 June	3	4 July	22	140	95.1	3.2	21.2
413	11 June	5 June	4	28 June	16	65	99.0	0.5	22.2
420 ^{d,e}	12 June	8 June	2	–	–	–	–	–	–
428	12 June	7 June	2	30 June	17	80	99.2	0.6	12.7
438	13 June	6 June	5	29 June	15	40	99.6	0.4	15.0
456	15 June	9 June	3	2 July	16	65	94.5	3.2	19.3
459	16 June	7 June	3	30 June	13	25	99.9	0.1	15.0
485 ^{d,e}	18 June	10 June	2	–	–	–	–	–	–
Median/ Mean ^f	14 June	7 June	3.4	30 June	15.5	80	96.2	2.3	17.9
SE			0.2		0.8	9	1	0.5	1.1
<i>n</i>	24	20	24	20	20	20	20	20	20

^a Calculated by subtracting 24 d from day before hatch date.

^b Excludes day of instrumentation and hatch.

^c Amount of time female was off nest following instrumentation.

^d Thermistor data was not available because data-logger was damaged or missing (e.g., removed from nest by fox or bear).

^e Incubation start date calculated using egg-float data.

^f Median dates, mean numerical values.

Table 6. Nest history and incubation activity of Greater White-fronted Geese at failed nests monitored by thermistors at CD-5, NE NPR-A, 2017.

Nest	Date Instrumented	Incubation Start Date ^a	No. Eggs	Date of Failure	No. Days Monitored ^b	Initial Time Off Nest(min) ^c	Incubation Constancy (%) ^b	Recess Frequency (no/d) ^b	Recess Length (min/recess) ^b
118	12 June	8 June	2	28 June	15	195	99.9	0.2	10.0
124	12 June	6 June	4	27 June	14	55	100	0	0.0
162	16 June	8 June	1	20 June	3	170	94.8	2.4	24.2
230	13 June	9 June	2	28 June	14	50	98.4	0.7	16.1
269	17 June	9 June	2	20 June	2	410	89	5.8	27.0
270 ^d	17 June	7 June	2	–	–	–	–	–	–
276	18 June	10 June	3	22 June	3	40	96.9	2.4	14.6
300 ^d	8 June	31 May	1	–	–	–	–	–	–
310	11 June	7 June	3	13 June	1	45	94.1	3	15.0
329 ^d	14 June	8 June	5	–	–	–	–	–	–
334 ^d	15 June	7 June	4	–	–	–	–	–	–
337	15 June	9 June	4	24 June	8	185	96.8	1.3	33.5
403 ^d	10 June	9 June	3	–	–	–	–	–	–
404	10 June	6 June	3	11 June	0	200	85.6	1	67.5
418 ^d	11 June	5 June	1	–	–	–	–	–	–
448 ^{d,e}	15 June	–	4	–	–	–	–	–	–
461	16 June	10 June	1	1 July	14	85	96.5	2.7	15.1
469	17 June	2 June	5	25 June	7	45	98.3	1.7	11
Median/ Mean ^f	14 June	6 June	2.8	24 June	7.4	135	95.5	1.9	21.3
SE	–	–	0.3	–	1.8	34	1.4	0.5	5.4
<i>n</i>	18	5	18	11	11	11	11	11	11

^a Calculated using egg-float data.

^b Excludes day of instrumentation and failure.

^c Amount of time female was off nest following instrumentation.

^d Thermistor data was not available because data-logger was damaged or missing (i.e., carried away by fox or bear).

^e No egg-float data recorded, therefore no estimation of incubation date.

^f Median dates, mean numerical values.

nests on average <10 min (mean = 94 ± 3 , $n = 5$) later than successful nesters.

The mean incubation constancy for successful and failed nests was lower in 2017 than it was in previous years, with females spending $96.2 \pm 1.0\%$ ($n = 18$ nests) of the time incubating at successful nests and $95.5 \pm 1.4\%$ ($n = 11$ nests) at failed nests. In 2014 and 2015, the mean incubation constancy was $\geq 99\%$ at successful and failed nests. At successful nests in 2017, White-fronted Goose females took 2.3 ± 0.5 incubation recesses/day ($n = 20$ nests), with recess duration of 17.9 ± 1.1 min (Table 5). Females at nests that failed took an average of 1.9 ± 0.5 recesses/day (mean = $21.3 \pm$

5.4 min; Table 6). The frequency and duration of recesses/day was higher than in 2 previous years (2014 and 2015), when ≤ 1 recess/day of ~ 10 min was more typical of incubation recesses.

In 2017, the incubation activity of White-fronted Geese was difficult to interpret from the temperature data for several nests, and required altered temperature cutoffs for recesses. The increases observed in recess frequency and duration resulted in nest temperatures dropping below 9°C for at least 5 5-minute periods of time. In previous years, nest temperatures below 9°C for ≥ 25 min would indicate the end of incubation, but in 2017 such decreases in nest temperatures

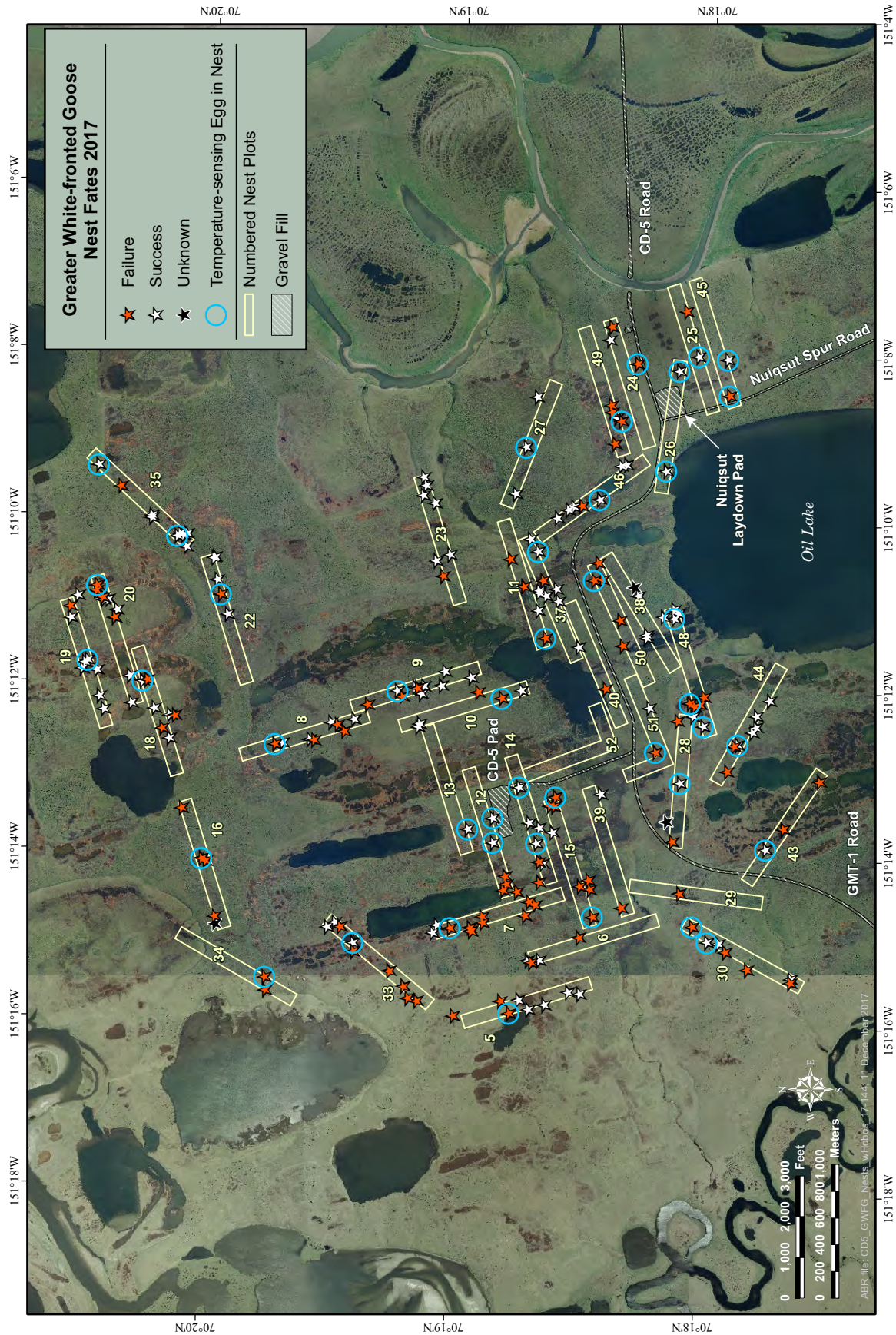


Figure 5. Nest fates of Greater White-fronted Geese and location of temperature-sensing eggs at CD-5, NE NPR-A, 2017.

occurred in several nests at which females subsequently continued to incubate. In 2 failed nests, incubation extended >4 days beyond the estimated hatch date. In these nests we suspect that the nest was depredated but the female may have returned to incubate the thermistored artificial egg. Without direct observation or monitoring with cameras, predation events can be difficult to interpret from nest temperature data alone.

In 2017, bears were a regular presence in the CD-5 study area during the incubation period and peak hatch for geese. Two to 3 grizzly bears were observed from the CD-5 pad or road for 7 days between 23 June and 6 July and spent much of these days foraging in the area (CPAI security report submitted to Alaska Department of Fish and Game, 2017). Bears have been spotted in the CD-5 study area in past years but these sightings were usually brief and infrequent. The presence of bears in the study area for 2 weeks in 2017 could explain not only the decreased incubation constancy (flushing geese from nests) but also the missing data-loggers, which were staked down to make it difficult for smaller predators (e.g., fox and gulls) to remove.

The days of instrumentation, nest hatch, and failure were not included in incubation activity summaries because partial days of incubation are not adequate for measuring recess frequency or time off nest and because the exact time of hatch or failure could not always be discerned from temperature records. Females at failed nests often have lower nest attendance on the final day of incubation, but this is difficult to quantify without a definitive time for nest failure.

NESTING SUCCESS

In 2017, 92% of 212 White-fronted Goose nests were active when found. Our methods do not account for partial predation (loss of less than the entire clutch of eggs) but we did find evidence of partial predation at 1 active nest during the nest search. Seventeen inactive nests were found with eggs crushed or otherwise damaged or with nest contents missing. Apparent nesting success (the percentage of nests hatching ≥ 1 egg) for all White-fronted Goose nests (including those outside plots) was 55% (Table 1). The apparent nesting success was comparable in all years of this study

except for 2015 when nesting success was much greater (Figure 6)

A simple evaluation of whether human activity (traffic and construction) affected nesting success of White-fronted Geese is to evaluate whether nests that failed were nearer to oilfield facilities than those that hatched (Figure 7). In 2 of 4 study years (2014 and 2015), successful nests were nearer to the road and pad than were failed nests. The operational principle assumed in this evaluation is that the closer nesting geese are to facilities and the higher levels of human activity (e.g., people, traffic, construction activity) at those facilities, the more often geese will flush or leave their nests making them more prone to predation. The relative activity on roads and pads (i.e., potential for nest disturbance) in the CD-5 study area has varied annually with the phase of oilfield development. In 2013, before any construction in the CD-5 area, there was essentially no difference between successful and failed nests in their distance to the future location of roads and pads. Roads and pads constructed the following winter (2014) were unable to support vehicles during the breeding season and were largely unused. Activity on CD-5 roads and pads probably peaked in 2015. Only in 2017, during operational use of roads and pads were failed nests closer on average to oilfield activity than successful nests. Thus there is no consistent relationship between proximity to facilities, construction activity, and nest failures. One possible explanation for the decreased distance of failed nests in 2017 was that grizzly bears were observed near CD-5 over multiple days during the incubation period and likely preyed on nests as well as flushed nesting geese in the area. Other predators than grizzly bears (birds and foxes) undoubtedly also contributed to higher predation rates we observed in 2017.

The apparent nesting success of Cackling/Canada Geese was very low in 2017, at 18% (46 of 57 nests failed; Table 1). In contrast during 2015, Cackling/Canada Geese, like the White-fronted Geese, had much higher nesting success with 81% of nests hatching ≥ 1 egg. Cackling/Canada Geese build large nests with more down than White-fronted Geese, and are much more conspicuous on the landscape. This may have made the Cackling/Canada Geese more susceptible

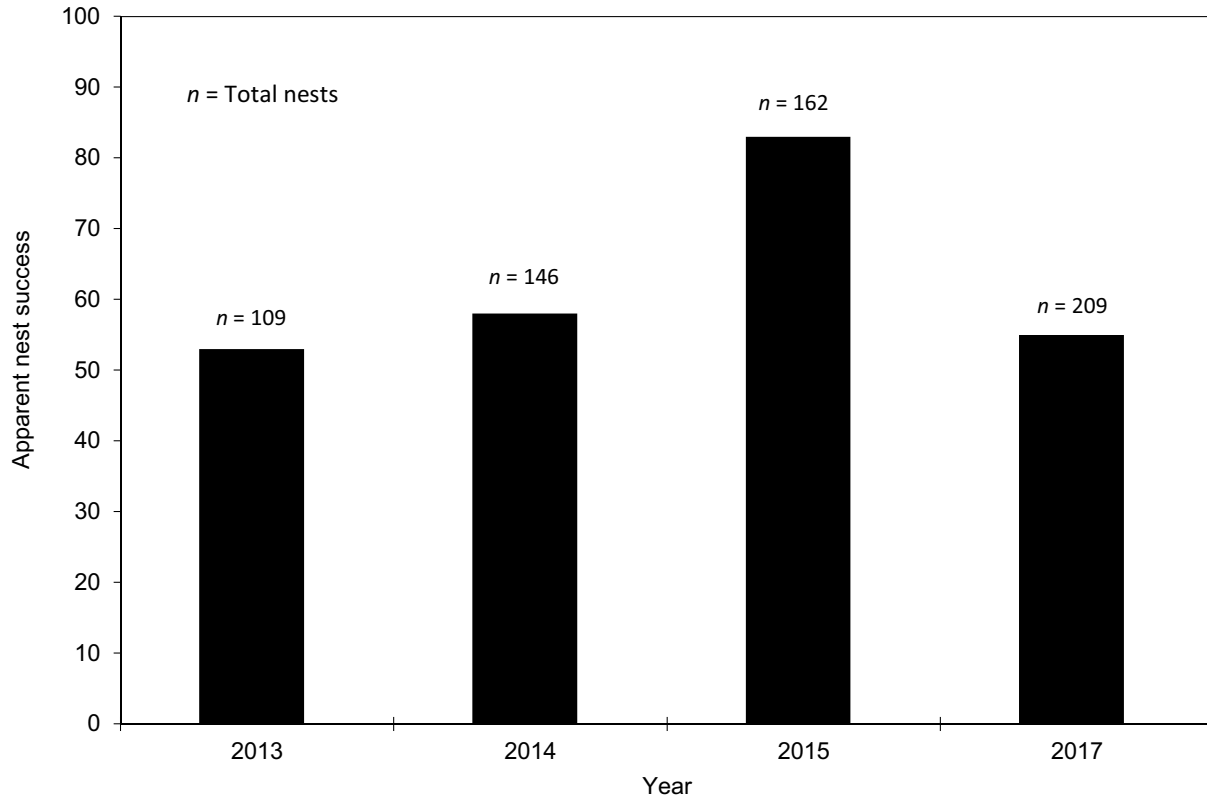


Figure 6. Apparent nesting success (%) and number (n) of Greater White-fronted Goose nests at CD-5 study area, NE NPR -A, 2013–2015, 2017.

to predation in a year with high grizzly bear activity.

Using incubation data from monitored White-fronted Goose nests, we compared 6 models of daily survival rates (DSR), which is the probability of a nest surviving 1 d. We evaluated models of constant DSR (no covariates) and those containing year, date of failure, clutch age, and the additive models of year + date of failure, and year + clutch age. Although each of the models was plausible (range of AICc weights = 0.09–0.21), none were clearly superior. Date of failure and clutch age did not improve model predictions over the top model of constant survival (AICc weight = 0.21). After constant DSR, the second best model (AICc weight = 0.20), included year only and this annual model is most compelling. According to this annual model, DSR and overall nest survival improved each year 2013 to 2015, then decreased to near 2013 levels in 2017 (Figure 8). The DSR for monitored nests in 2017 was 0.975 ± 0.008 , compared with 0.971 ± 0.007 in 2013, $0.986 \pm$

0.006 in 2014, and 0.989 ± 0.005 in 2015. The estimated probability a nest would survive a 24 d incubation period (overall nest survival) in 2017 was 0.54 compared with 0.49 in 2013, 0.71 in 2014, and 0.77 in 2015 (Figure 8). Apparent nesting success for nests with thermistors was slightly higher (57%) than estimates of nesting success from DSR, but as discussed in the methods, apparent nesting success tends to be biased high relative to DSR estimates that account for length of exposure (days monitored). We did not calculate DSR for other species of geese or waterfowl.

OTHER NESTING BIRDS

DISTRIBUTION AND ABUNDANCE

We found 292 nests belonging to 11 identified species of birds on and near nest plots in 2017 (Figure 2, Table 1), an increase from 207 total nests in 2015. Only 7% of these nests belonged to species other than geese. Among the large

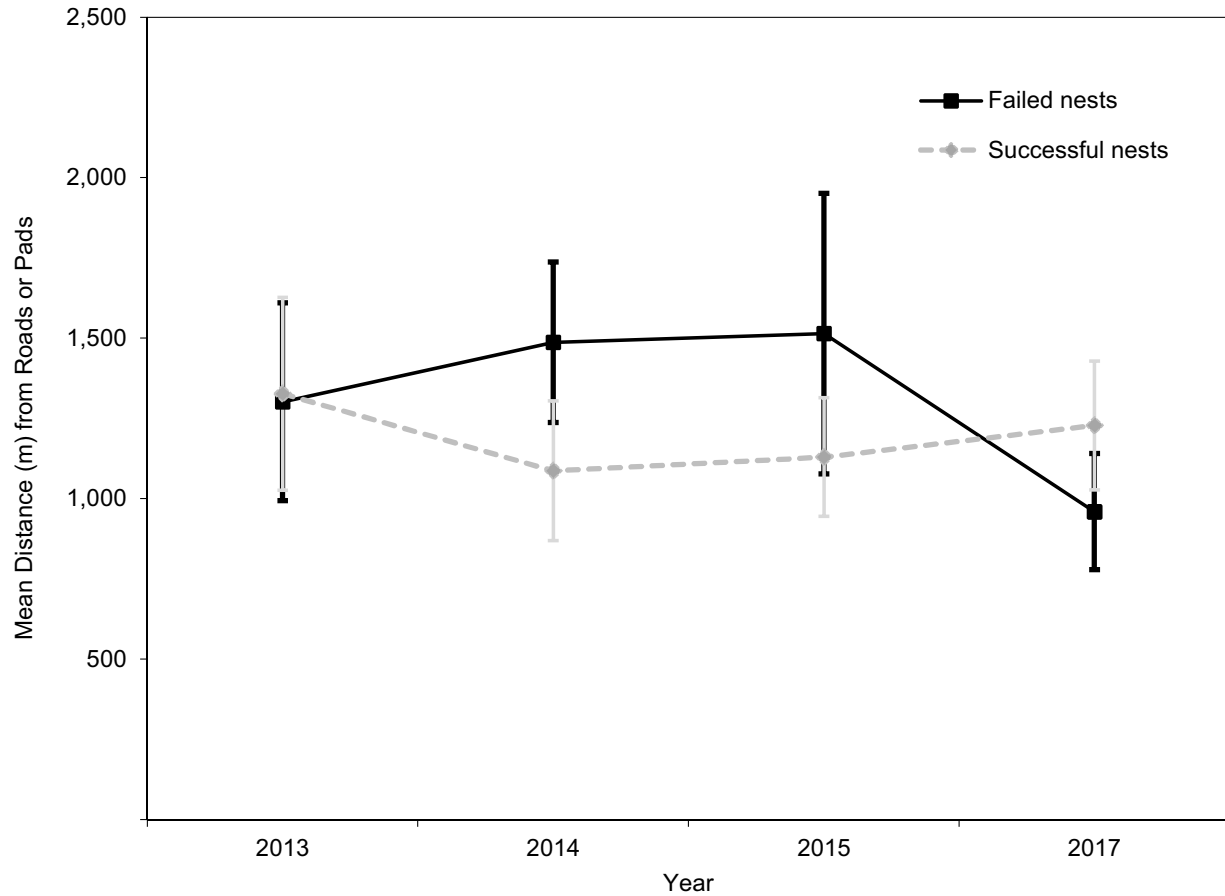


Figure 7. Mean (\pm 95% CI) distance of successful and failed Greater White-fronted Goose nests from roads or pads at CD-5, NE NPR-A.

waterbirds nesting on plot, we found 4 King Eider nests, 2 Long-tailed Duck nests, 2 Northern Pintail nests, and 1 Pacific Loon nest. Other species nesting on or off plot included Red-throated Loon (1 nest), Glaucous Gull (4 nests), and Arctic Tern (4 nests).

With 4 nests, King Eiders (1.0 nests/km²) were the third most common large waterbird nesting on plots in 2017 (Figure 2, Table 1). Only 1 out of 5 King Eider nests (1 nest was off plot) was successful (apparent nesting success = 20%). For the second year in a row, a Pacific Loon nest was found on plot but its nest fate was unknown. One Red-throated Loon nest was discovered just off plot in 2017, but its nest fate also was unknown. Spectacled Eiders were observed on a couple occasions flying in our study area, but no nests were found.

HABITAT USE

Nests of species other than geese were located in the same 6 habitats used by geese (Table 3). The 4 King Eider nests were found in 3 different habitats: Old Basin Wetland Complex, Shallow Open Water with Islands or Polygonized Margins, and Patterned Wet Meadow. Glaucous Gull and Arctic Tern were found in Old Basin Wetland Complex and Shallow Open Water with Islands or Polygonized Margins. The greatest species diversity was found in Old Basin Wetland Complex (6 species, including goose species), followed by Patterned Wet Meadow (4 species), and Shallow Open Water with Islands or Polygonized Margins (4 species). Northern Pintail was the only species other than White-fronted Goose found in Moist Sedge-Shrub Meadow.

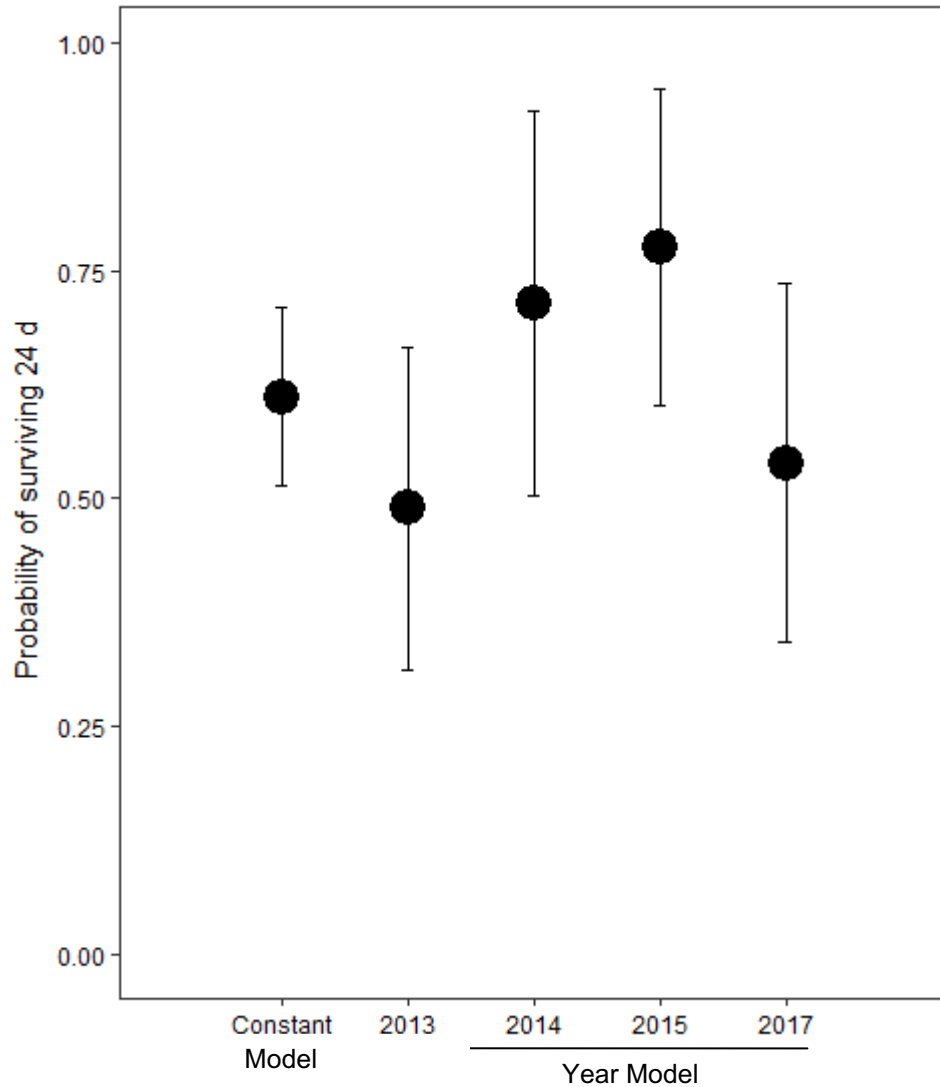


Figure 8. Overall nest survival (24-day incubation period) of Greater White-fronted Geese from 2 models of daily survival rates, the constant model with no covariates and year model with 4 covariates for each year of the study, at CD-5, NE NPR-A, 2013–2015, 2017.

NEST PREDATORS

In 2017, as in previous years of this study, gulls and jaegers were the most abundant and widespread nest predators observed both during predator scans and in incidental observations on nest plots (Appendix A). Potential avian nest predators seen on plots during predator scans included Glaucous Gulls (59% of 165 sightings; 1.21 ± 0.25 gulls/scan), jaegers (37%; 0.75 ± 0.17 jaegers/scan), Common Raven (3%; 0.06 ± 0.06 ravens/scan), and Northern Harrier (raptors: 3%;

0.04 ± 0.04). Parasitic Jaegers accounted for 93% of all jaeger observations on plots ($n = 60$ jaegers), followed by Long-tailed Jaegers (7%). No mammals were observed on plots during predator scans. The proportion of avian predators observed outside of plots (within 300 m of plot boundaries) was similar to that observed on plot during predator scans. One Pomarine Jaeger was recorded this year during predator scans flying outside plot boundaries. A single red fox was also observed off plot during predator scans (Appendix A). During

predator scans, Glaucous Gulls were seen on 30 of 40 plots and jaegers were seen on 29 of 40 plots (Appendix A). The mean number of predators observed during a predator scan has varied each year of this study (Figure 9).

The species composition of predators seen incidentally during nest searching was similar to that seen during predator scans. One mammalian predator (red fox) was observed on plot during incidental observations (Appendix A). Glaucous Gulls were the most common predators (48% of 124 predator sightings) on plot during incidental observations, followed by jaegers (45%) and Common Ravens (6%; Appendix A). No raptors were observed incidentally on plot, although 1 Peregrine Falcon was observed outside plot boundaries. Three red foxes were also recorded outside plot boundaries.

The summer of 2017 was the first in 4 years of the CD-5 White-fronted Goose project where gulls were more abundant than jaegers during our predator scans and incidental observations. Aerial surveys for birds on the ACP also found an increase in observations of Glaucous Gulls over the years, while counts of jaeger species have declined

since 2007 (Wilson et. al, *in prep*). Summer 2017 also was the first summer that red foxes were observed in the study area. Between 2013 and 2015, only arctic foxes were recorded in the study area. Although we never recorded arctic foxes during predator scans or incidentally during nest searches in 2017, they were seen on several occasions from the CD-5 road as we were transiting the study area. Bears also were not observed by nest-searchers or otherwise reported in CD-5 area during the White-fronted Goose nest-searching period (8 June–18 June), but as mentioned previously (see INCUBATION BEHAVIOR), grizzly bears were regularly observed in the area in late June and early July during nest-incubation and peak hatch of geese.

The use of the Nuiqsut spur road connecting to the CD-5 road has increased the potential for nest predation and disturbance by humans in the CD-5 study area. Since 2014, the residents of Nuiqsut were able to use the new roads from their village to expand their hunting grounds. In 2017, hunters on ATVs were observed several times using the roads to look for caribou, and on one occasion a hunter was seen out on the tundra.

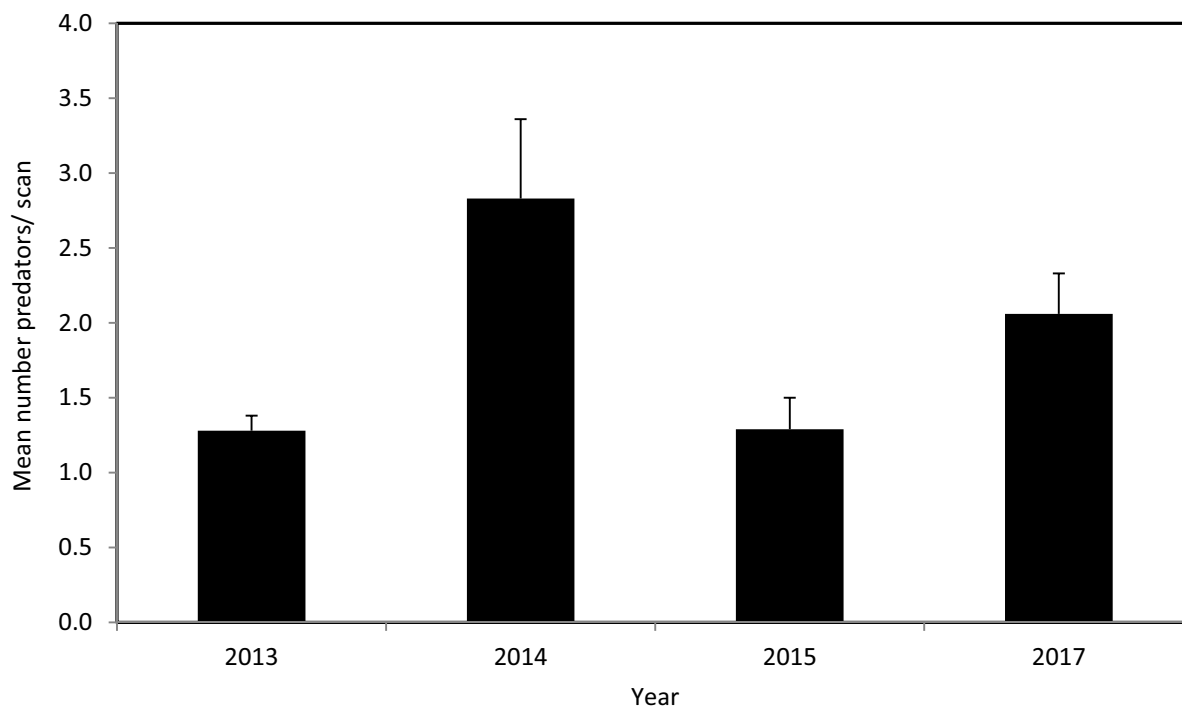


Figure 9. Mean number (+SE) of potential nest predators observed during predator scans (10 min/scan, 2 scans/plot) on 40 nest-plots at CD-5, NE NPR-A, 2013–2015, 2017.

Hunters in our study area could inadvertently disturb nesting geese and damage nests. During nest-searching in 2017, we also noticed considerable habitat damage from ATVs (trails) on a few study plots. This damage may have occurred prior to the breeding season, as no ATVs were seen on the tundra during any of our field work. The collection of goose eggs by locals has also been reported in the vicinity of the study area, and though we suspect little to no egg-harvest in our study area, this activity could potentially affect overall nesting success.

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PERSONAL COMMUNICATIONS

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Appendix A. Number of nest predators observed in and near 40 10-ha nest plots in the CD-5 study area, NE NPR-A, 2017. Predators include Long-tailed, Parasitic, and Pomarine jaegers (jaeger); Glaucous Gull (gull); Common Raven (raven); Peregrine Falcon and Northern Harrier (raptor); Red Fox (mammal).

Plot	Incidental Observations ^a																		
	Predator Scans					On Plot					Outside Plot ^b								
	Jaeger	Gull	Raven	Raptor	Mammal	Total	Jaeger	Gull	Raven	Raptor	Mammal	Total	Jaeger	Gull	Raven	Raptor	Mammal	Total	
5	1	2	0	0	0	3	2	6	0	0	0	8	2	0	0	0	0	0	0
6	2	3	0	0	0	5	4	6	0	0	0	10	1	3	0	0	0	0	2
7	1	2	0	0	0	3	1	2	0	0	0	3	1	1	0	0	1	4	0
8	0	6	0	0	0	6	0	3	0	0	0	3	1	0	0	0	0	3	0
9	1	3	0	0	0	4	0	3	0	0	0	3	4	5	0	0	0	1	0
10	1	1	0	0	0	2	1	8	0	0	0	9	2	2	0	0	0	9	0
11	6	2	0	0	0	8	0	4	0	0	0	4	1	0	0	0	0	4	0
12	2	3	0	0	0	5	2	1	0	0	0	3	0	0	0	0	0	4	0
13	2	3	0	0	0	5	2	3	0	0	0	5	1	3	0	0	0	1	0
14	0	0	0	0	0	0	2	7	0	0	0	9	0	0	0	0	0	4	0
15	2	2	0	2	0	6	3	0	0	0	0	3	1	2	0	0	0	0	0
16	0	0	0	0	0	0	1	0	0	0	0	1	2	2	0	0	0	3	0
18	1	6	0	0	0	7	3	5	0	0	0	8	4	4	0	0	0	4	0
19	1	4	1	0	0	6	1	0	0	0	0	1	1	2	0	0	0	8	0
20	1	9	0	0	0	10	0	0	0	0	0	0	1	8	1	0	0	3	0
22	0	6	0	0	0	6	0	0	0	0	0	0	0	5	2	0	0	10	0
23	5	0	0	0	0	5	2	0	0	0	0	2	0	0	0	0	0	7	0
24	2	0	0	0	0	2	1	6	0	0	0	7	0	0	0	0	0	0	0
25	1	2	0	0	0	3	0	1	0	0	0	1	2	2	0	0	0	0	0
26	2	0	0	0	0	2	0	3	1	0	0	4	4	1	0	0	0	4	0
27	1	4	3	0	0	8	0	5	0	0	0	5	2	3	1	0	0	5	0
28	5	1	0	0	0	6	0	0	0	0	0	0	1	0	0	0	0	6	0
29	2	2	0	1	0	5	0	2	0	0	0	2	1	0	0	0	0	1	0
30	5	0	0	0	0	5	0	6	0	0	0	6	0	0	0	0	0	1	0
33	2	4	0	0	0	6	0	2	0	0	0	2	0	2	0	0	0	0	0
34	0	8	0	0	0	8	0	1	0	0	0	1	1	2	0	0	0	2	0

