Nesting Ecology of Spectacled Eiders on Kigigak Island, Yukon Delta NWR, Alaska, 2005

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21 September 2005

Summary: In order to continue monitoring productivity and annual survival, and estimate recruitment of spectacled eiders, the 14th consecutive year of sampling was conducted at Kigigak Island, Alaska. A total of 149 (n = 134 on traditional study plots) nests were located in 31 days. Relatively few nests were depredated (n = 8) or abandoned (n = 6) and nest success to 29 days was estimated as 83.5% (95% CI; 72.6 – 89.0). Mean nest initiation and hatch dates were 20 May and 19 June, respectively. A total of 94 adult females were recaptured or visually identified, 17 of which were originally banded as ducklings.

INTRODUCTION

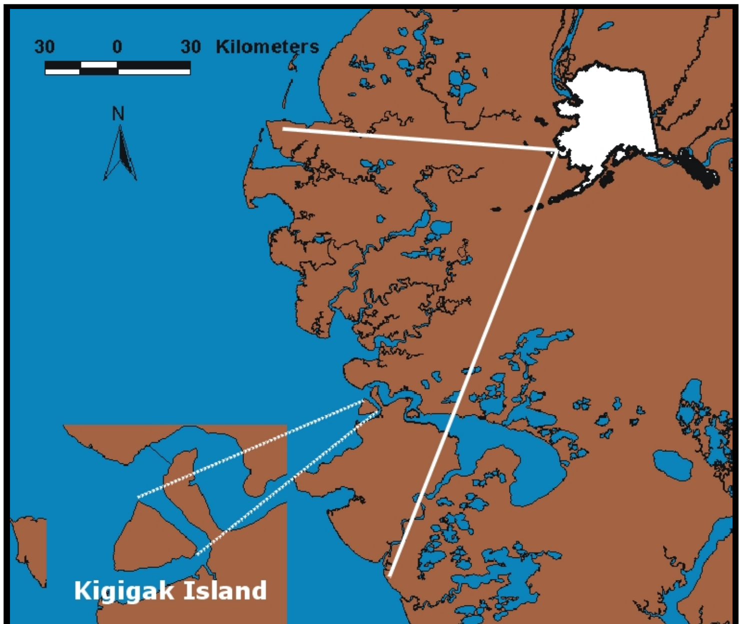
As recommended by the spectacled eider recovery team (USFWS 1996), fieldwork on Kigigak Island continued for the 14th consecutive year. Five researchers monitored spectacled eider (*Somateria fischeri*) nests between 26 May and 29 June. Broods were captured from 21-24 July.

Study Objectives:

1. Monitor clutch size, nest hatch date, and final nest status for estimation of productivity.
2. Resight, capture, and mark adult females for estimation of annual survival.
3. Capture and mark ducklings just prior to fledging for estimation of recruitment, natal fidelity, and age of first breeding.
4. Remove arctic fox (*Alopex lagopus*) prior to nest initiation

STUDY AREA

Kigigak Island (32.5 km²) (165°50'W, 60°50'N) is located along the outer fringe of Yukon Delta National Wildlife Refuge (YDNWR), near the mouth of Baird Inlet. The island, bordered by the Ninglick River and the Bering Sea, contains many shallow ponds, lakes, and a network of tidal sloughs. Habitat consists of low coastal tundra, sedges, and grasses. Spring and fall storm tides regularly inundate the island, except for upland areas, which are flooded only during severe storm tides.



Location of Kigigak Island on the coastal zone of the Yukon-Kuskokwim Delta, Alaska.

METHODS

Data Collection

Five researchers searched for spectacled eider nests on 46-0.17 km^2 plots selected from approximately 9 km^2 of the island (Fig. 1). These plots were previously identified as preferred spectacled eider nesting habitat (Harwood and Moran 1993). Additional nests were located opportunistically while moving between plots.

Data were recorded according to guidelines for spectacled eider research developed by the USGS – Alaska Science Center (Grand 1993). On the initial nest visit, a white flag was placed approximately 3m from the nest, nest location was documented with UTM coordinates, and nest site type (slough bank, lakeshore [>3m wide], poolshore [<3m wide], peninsula, island, mudflat, grassflat, displaced island, mud island) and number of eggs were recorded. Each egg was uniquely numbered in order to measure length and width (± 1mm), and determine number of new, depredated, or inviable eggs. Each egg was floated (Westerkov 1950) and candled (Weller 1956) to estimate days of incubation. Nests were revisited every 7 days until hatch. On the initial visit and on each subsequent revisit, we documented whether the nest was covered and eggs were warm, presence/absence of the female and male, band status of the female, and nest status (laying, incubating, depredated, abandoned, hatched, and other [primarily all eggs inviable]). On all nest visits, we attempted to identify marked females by reading band codes with spotting scopes or binoculars. If unsuccessful, females were captured.

In 2005, 114 females were resighted or captured prior to hatch, of which 94 were previously marked (recaptures).

Bownet traps (Salyer 1962) and mist nets were used to trap spectacled eider females approximately 1-2 days prior to hatch. Hatch date was calculated based on egg float and candling data, assuming a 24-day incubation period (Dau 1974). Females were marked with a U.S. Fish and Wildlife Service metal leg band and a yellow, plastic, alphanumeric leg band and nasal disk (Lokemoen and Sharp 1985). Culmen and tarsal lengths (± 1mm) and mass (± 1g) were recorded. In 2005, Alaska Sea Life Center personnel assisted with trapping in order to obtain 3cc's of blood from 16 females with clutches of all viable eggs and 14 females that were incubating ≥ 1 inviable egg.

Brood drives were conducted to capture ducklings at approximately 35 days of age. This was accomplished by gently flushing ducklings and attending females into mist nets placed on ponds. Female ducklings were marked with both a U.S. Fish and Wildlife Service metal leg band and a yellow, plastic, alphanumeric leg band. Male ducklings were marked only with a U.S. Fish and Wildlife Service metal leg band. Previously marked adult females were captured or visually identified, and bands and nasal disks were placed on unmarked adult females. We recorded the mass, tarsus, and culmen of all captured individuals.

Data Analysis

Nest initiation dates were estimated by backdating egg float and candling data, assuming a 24-day incubation period (Dau 1974) and a laying rate of one egg per day (Grand and Flint 1997). Only nests that survived to incubation were used to calculate initiation dates. Hatch date was estimated similarly from nests that survived to hatch.

Clutch size was defined as the total number of eggs laid in a nest. Mean values were reported for egg widths and lengths and egg volume was calculated according to Petrula (1994).

Nests were defined as successful if ≥ 1 egg hatched. Nest success was estimated using the model of Dinsmore et al. (2002). A constant daily survival rate and an overall exposure period of 29 days were assumed (Harwood and Moran 1993). Apparent fate of all eggs was assessed. Eggs were classified as hatched if membranes or ducklings were observed. Depredated eggs exhibited obvious signs of predation (i.e., several or all eggs missing or broken). If the clutch was intact or had hatched, cold egg(s) were assumed to be abandoned. If abandonment occurred after trapping the female, we assumed it was human caused. If eggs damaged during trapping did not hatch they were classified as damaged in trapping. We documented inviable or addled eggs. When nest or egg fate was unknown, egg fate was classified as unknown.

RESULTS

Nesting chronology, location

During 31days of nest searching and monitoring, 149 nests were located, of which 134 were located on traditional study plots. Estimated nest initiation dates ranged from 10 May to 15 June, with mean nest initiation date on 20 May (Fig. 2). Estimated hatch dates ranged from 9 June to 13 July, with mean hatch date on 19 June (Fig. 3). Most nests were located along lakeshores and poolshores (Fig. 4).

Clutch and egg size

Clutch size ranged from 1 – 7 eggs (Fig. 5), with mean clutch size of 4.8 eggs (Table 1). Mean egg length, width, and volume were 68.0mm, 45.5mm, and 141.7cc, respectively (Table 2).

Nest success and apparent egg fate

Fate of 129 nests was determined and used in estimation of nest success (Table 3). Of these nests, 8 were depredated, 6 were abandoned, and 115 hatched. Estimated nest success to 29 days was 83.5% (95% CI; 72.6 – 89.0; Table 3). Fate of 674 eggs was determined, and apparent egg hatching success was 57.4% (Table 4). Of 674 eggs, 12% were inviable or addled, 8.6% were depredated, and fate of 18% was unknown. Four eggs (0.6%) were abandoned from human cause and none were damaged in trapping (0%; Table 4).

Female and brood capture, male departure

Of 149 nests, 106 (71.1%) were attended by marked females, 30 by unmarked females, and marked status of 13 females was not determined. Ninety-four (88.7%) of

106 marked females were identified (44 nest trapped, 50 visually). Seventeen (18%) identified females were originally banded as ducklings, of which 11 of these were observed for the first time in 2005 (Table 5). Twenty of 30 unmarked nesting females were trapped and marked.

Between 21 and 24 July, 105 (54 males, 51 females) ducklings were captured and banded. Twenty-three adult females were captured or visually identified with broods; 11 of these individuals were captured or visually identified during nesting. One captured adult female, resighted for the first time, was originally banded as a duckling in 1999. Another captured adult female was originally banded as a duckling in 2004, and although this female was associated with a brood, and another adult female, it is unknown if a nest was attempted. This is the first nesting ground observation of a 1 year-old eider.

The last male spectacled eider was observed on 20 June.

Mortality

No adult females or ducklings apparently died as a result of biological activity. One adult female, banded in 1998, was found dead and sent to the regional office in Anchorage. No obvious external trauma was observed. One nest with a clutch of four eggs was abandoned due to investigator disturbance.

DISCUSSION

Nest success and apparent nesting effort in 2005 were among the highest levels observed. This may have been related to elimination of eight arctic foxes prior to nesting and little presence of mink during nesting. However, presumed excellent potential spectacled eider productivity across the Yukon-Kuskokwim Delta (Fischer et al. 2005) makes assessing effectiveness of arctic fox removal on Kigigak Island in 2005 challenging.

To estimate recruitment, ~35-day old ducklings are marked with metal and tarsal leg bands. In 2005, 11 females marked as ducklings were observed nesting for the first time.

Relatively more ducklings banded in 1999 and 2002 have been detected nesting. While uncorrected for detection or age-specific breeding probability, this result is suggestive of greater recruitment from those cohorts. A closer inspection of nest success showed both years to be relatively good for production on Kigigak Island and across the Yukon-

Kuskokwim Delta (Fischer et al. 2005). Years of good production may be particularly influential to the persistence of this population on the Yukon-Kuskokwim Delta.

Age-specific variation in productivity and survival have important implications for population structure (Gotelli 1998), especially in long-lived, K-selected species like spectacled eiders. Knowledge of this variation is needed for accurate modeling of spectacled eider population dynamics (Moran 2000), which helps managers make more informed decisions. This study has excellent potential for investigating such variation, and age-specific clutch size and nest initiation date should now be examined. Continued banding of ducklings and resighting of individuals on nests will allow estimation of age-specific survival (Blums et al. 1996), breeding probability (Clobert et al. 1990, Blums et al. 1996), and nest success. Given limited and fragmentary information currently available on these topics, such an effort would provide valuable information for management of spectacled eiders in particular, and ecology of ducks in general.

ACKNOWLEDGEMENTS

Funding was provided by YDNWR, U.S. Fish and Wildlife Service – Endangered Species, and the Black Brant Group. Thomas Olson of Hooper Bay, Thomas Jones of Chevak, and Sam Anaruk of Bethel deserve acknowledgement for their role in nest searching and trapping. In addition, both Thomas' helped capture broods. Their ability to maintain a positive attitude and genuine interest in this work also contributed to a good camp atmosphere. Fred Broerman (YDNWR), Bill O'Connell (Alaska Sea Life Center) and Paul Flint (Alaska Science Center) are also thanked for assistance with this year's data collection. Pilots George Walters, Robert Sundown, and Mike Rearden provided many hours of safe flying, kept us well supplied with fresh water and food, and facilitated camp set-up and break-down.

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Table 1. Mean clutch size for spectacled eider nests.

Year	n	$\overline{X}$	S.D.
1992	64	5.5	0.8
1993	74	5.2	1.1
1994	70	5.4	0.9
1995	92	4.7	1.1
1996	106	5.1	0.8
1997	132	4.9	0.8
1998	104	4.5	0.8
1999	121	4.8	0.9
2000	117	5.0	1.1
2001	22	4.0	0.9
2002	143	5.2	1.1
2003	131	4.7	1.3
2004	147	5.0	1.1
2005	147	4.8	1.0

Table 2. Mean length, width, and volume of spectacled eider eggs.

		Length (mm)		Width (mm)		Volume (cc)[a]	
Year	n	$\overline{X}$	S.D.	$\overline{X}$	S.D.	$\overline{X}$	S.D.
1993	72	67.7	1.8	45.5	1.2	140.2	9.2
1994	362	67.9	4.8	45.5	2.1	140.6	16.7
1995	405	68.2	4.2	45.4	2.6	140.0	28.0
1996	470	68.2	5.6	45.4	3.0	-	-
1997	624	67.9	4.7	45.3	2.5	139.6	21.2
1998	448	67.6	5.7	45.1	2.8	137.6	17.6
1999	580	67.4	4.3	45.0	2.6	136.6	20.0
2000	593	67.4	4.1	45.2	2.4	137.7	17.0
2001	134	67.5	2.5	45.2	1.5	138.4	11.6
2002	730	68.1	4.7	45.5	3.4	142.2	16.6
2003	534	68.0	3.2	45.5	1.8	141.1	0.7
2004	736	68.0	2.6	45.5	1.2	141.3	10.4
2005	674	68.0	3.3	45.5	2.5	141.7	17.3

[a] Volume = length x width^2 / 1000 (Petrula 1994).

Table 3. Estimates of nest success for spectacled eider nests.

Year	n	DSR[a]	Exposure Days	Apparent Success %	Mayfield Success %[b]	95% Mayfield C.I.
1992	64	0.997	1043	95.0	92.0	83.5-101.2
1993	74	0.984	1025	78.4	63.4	50.4-79.5
1994	73	0.986	1099	79.5	67.1	54.6-82.4
1995	95	0.985	1451	76.8	64.2	53.1-77.5
1996	113	0.993	1969	87.6	81.3	72.8-90.8
1997	138	0.992	2429	86.2	79.6	71.7-88.4
1998	111	0.994	1770	90.1	83.5	74.8-93.1
1999	127	0.986	2102	77.2	66.8	57.5-77.6
2000	118	0.99	2038	83.1	75.1	66.0-85.4
2001	39	0.909	295.5	7.7	6.3	2.5-15.6
2002	136	0.988	2356	76.2	70.7	62.0-80.6
2003	131	0.968	2104	48.9	39.1	29.8-48.0
2004[c]	154	0.986	---	81.8	68.5	57.2-77.5
2005[c]	129	0.994	---	89.1	83.5	72.6-89.0

[a] daily survival rate

[b] estimates exclude nests whose fates were suspected of being influenced by visitor impact, specifically trapping

[c] estimated using model of Dinsmore et al. (2002)

Table 4. Apparent fate of spectacled eider eggs.

Year	Egg Fate (%)									
	Hatched	Depredated	Abandoned (natural cause)	Abandoned (human cause)	Inviable/ Addled	Damaged in Trapping	Collected	Unknown	Total Eggs	Total nests
1992	76.3	5.4	7.9		1.7	0.6	0.8	6.8	354	64
1993	62.3	22.6	2.1	2.1	2.8	1.0	0.0	0.1	390	75
1994	54.5	13.3	1.8	1.8	4.8	1.1	0.0	10.4	442	84
1995	52.0	25.7	0.4	0.4	7.1	2.7	0.0	12.1	479	103
1996	69.7	6.4	4.5	4.5	5.5	3.4	0.0	10.3	594	120
1997	63.0	12.8	1.3	13	9.9	0.1	0.0	7.8	690	147
1998	81.9	9.0	0.4	0.4	4.2	0.4	0.0	1.0	480	111
1999	73.8	17.9	3.2	3.2	5.5	1.0	0.0	3.5	602	134
2000	70.5	10.9	0.1	0.1	9.2	0.3	0.0	7.2	587	119
2001	7.7	88.8	3.5	3.5	0.0	0.0	0.0	0.0	143	43
2002	65.3	20.3	0.1	0.7	10.9	1.1	0.5	1.6	744	143
2003	40.9	42.4	3.0	0.2	9.5	0.3	0.0	3.7	597	135
2004	71.6	15.5	1.5	1.1	4.1	0.1	4.9	1.2	754	157
2005	57.4	8.6	3.4	0.6	12.0	0.0	0.0	18.0	674	140

Table 5. Numbers of adult females detected first nesting that were banded as ducklings.

Year Banded	Year First Detected							
	1999	2000	2001	2002	2003	2004	2005	Total
1999	---	---	0	6	3	0	1	10
2000	---	---	---	0	1	2	1	4
2002	---	---	---	---	---	4	7	11
2003	---	---	---	---	---	---	2	2
Total	---	---	0	6	4	6	11	27

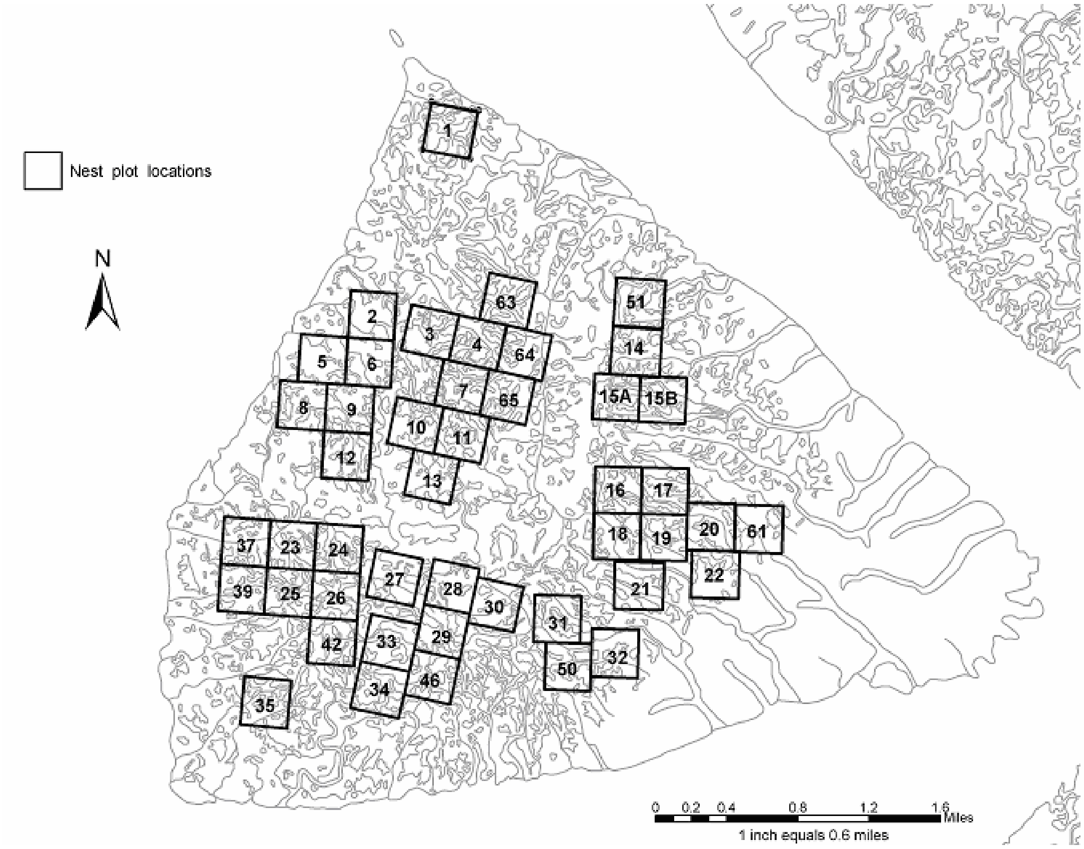

Fig. 1. Locations of plots (N = 46) searched for spectacled eider nests on Kigigak Island, Alaska.

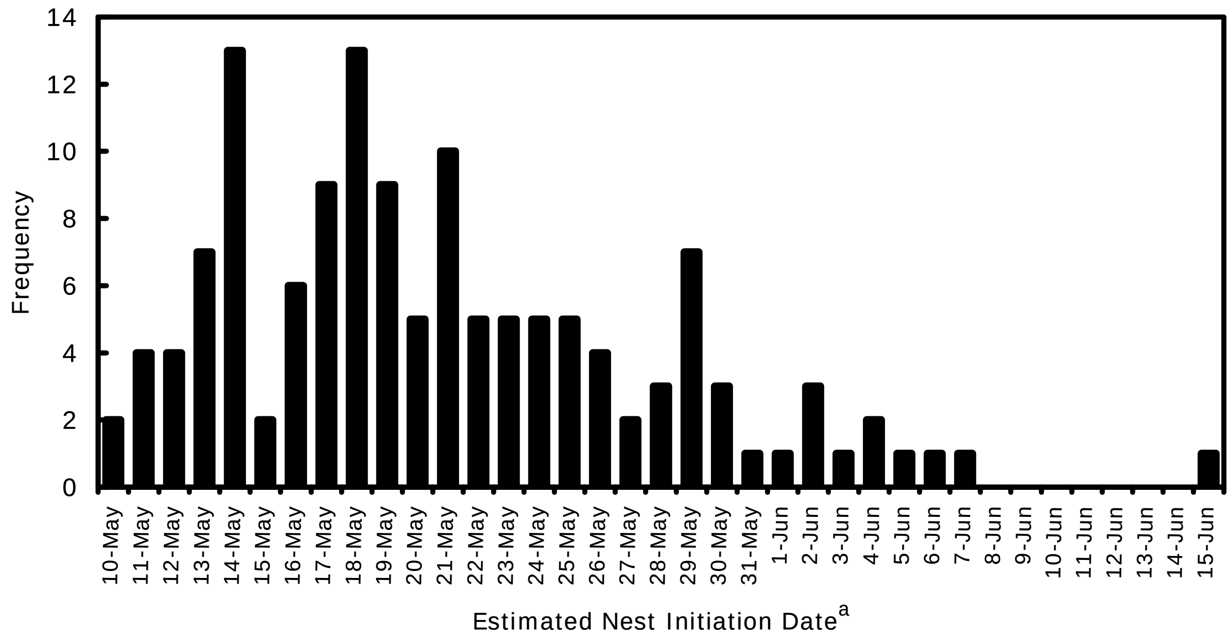

Fig. 2. Estimated nest initiation dates for spectacled eider nests. [a]Estimates assume an incubation period of 24 days and a laying rate of one egg per day.

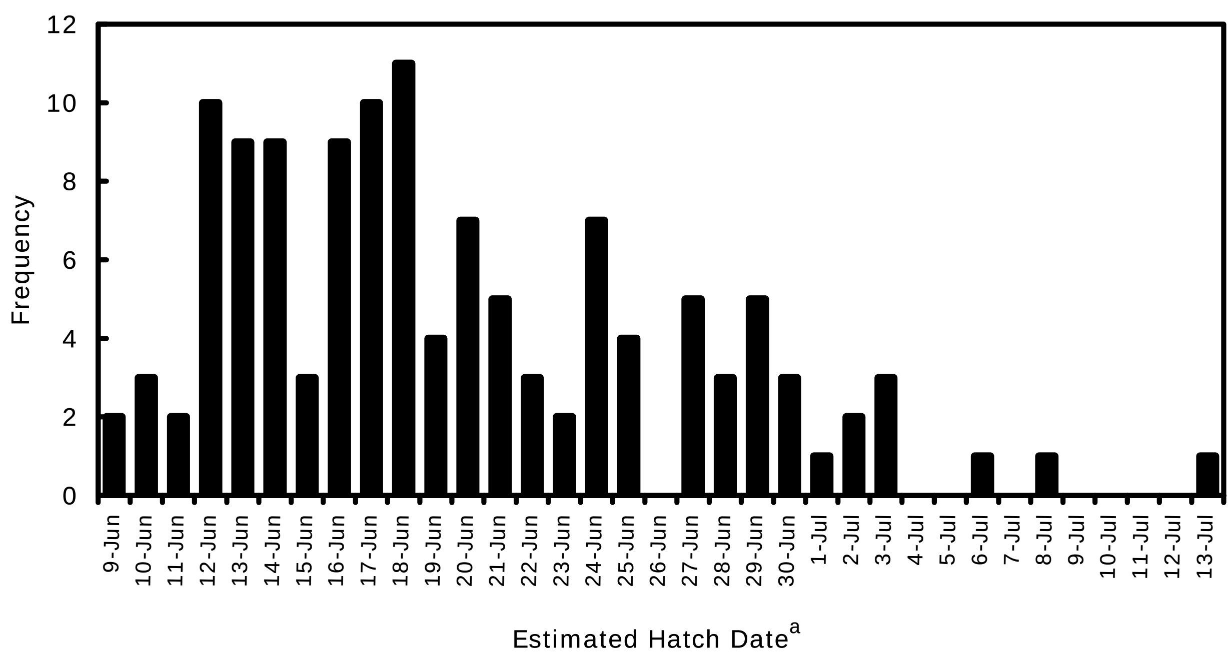

Fig. 3. Estimated hatch dates for spectacled eider nests. [a]Estimates assume an incubation period of 24 days.

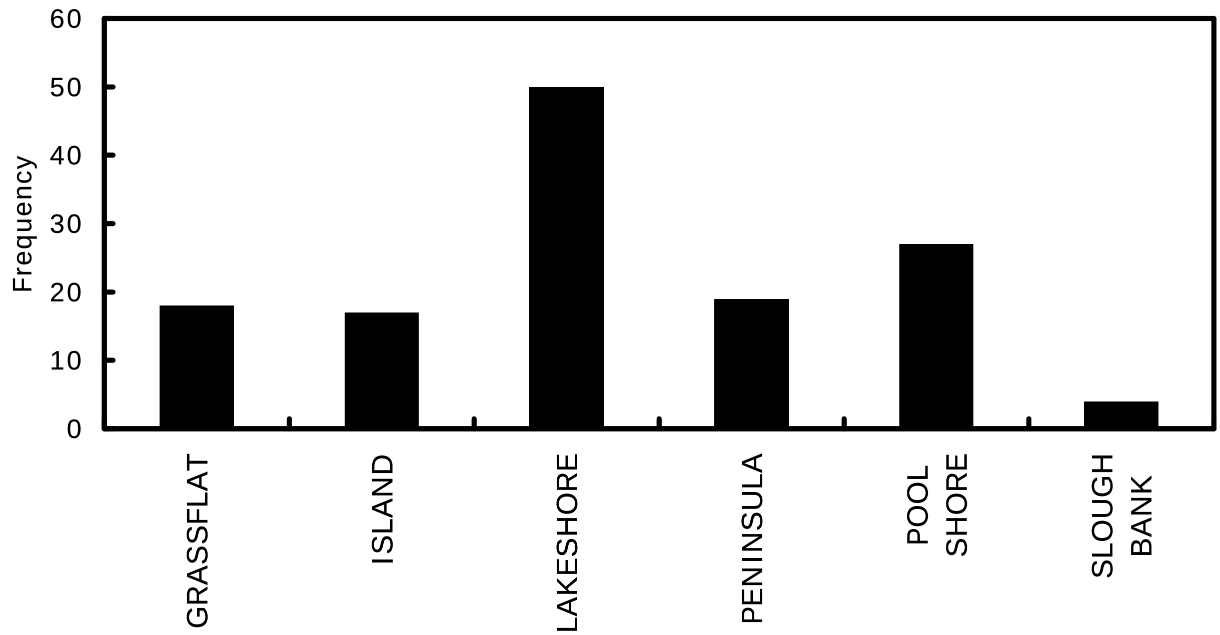

Fig. 4. Nest site frequencies for spectacled eider nests.

Fig. 5. Clutch size frequencies for spectacled eider nests.