LAB
14

Nesting Ecology of Spectacled Eiders on Kigigak Island, Yukon Delta NWR, Alaska, 1994

by

Tina Moran

January 1995

Key Words: spectacled eider, common eider, Kigigak Island, Yukon Delta NWR, nest success, nest-trapping, nasal marking, philopatry, blood sampling, lead

U.S. Fish and Wildlife Service
Yukon Delta National Wildlife Refuge
P.O. Box 346
Bethel, Alaska 99559

EXECUTIVE SUMMARY

Yukon Delta National Wildlife Refuge personnel studied spectacled eider productivity and ecology on Kigigak Island in 1994. Eighty-four spectacled eider nests were found and monitored. Peak nest initiation period for spectacled eiders was 19-22 May, with peak hatch 18-20 June. Mean complete clutch size was 5.4 eggs. Mean clutch size hatched was 4.3 eggs. Nest success was 70% (95% CI: 58.1-84.1%).

Fifty-three spectacled eiders were nest-trapped (11 from 1992, 16 from 1993) and one was caught incidentally with a mistnet. All females not previously banded were fitted with tarsal bands (metal and colored) and uniquely numbered nasal disks. Those that lost their disks from previous years received new nasal disks. An additional 9 marked birds were observed (8 on nests), 2 of which were positively identified from their nasal disks.

Fifty blood samples were taken from nest-trapped spectacled eider females for lead and DNA analysis. Four females (8.0%) had elevated lead levels.

ACKNOWLEDGEMENTS

Thanks go to YDNWR staff for their support, especially: Tommy Bayayok, Chris Harwood, Brian McCaffery, Gene Miller, John Morgart, Adrian Smith, George Walters, Mike Wege, and Robert Winkleman.

Thanks also go to: Barry Grand, Paul Flint, Margaret Petersen, and Karen Bollinger of NBS; Lynn Hayes-Creekmore, D.V.M of NWHRC(Madison)-NBS; Tim Bowman of MBM and volunteer Judy Williams.

TABLE OF CONTENTS

I. INTRODUCTION

The listing of spectacled eiders (*Somateria fischeri*) as a threatened species prompted Yukon Delta National Wildlife Refuge (YDNWR) to continue field work at Kigigak Island for a fourth straight year. A field camp staffed by 2-5 YDNWR and NBS personnel was maintained from 28 April-9 July 1994. Objectives included:

1) monitoring spectacled and common eider (*S. mollissima*) nesting chronology and productivity.
2) capturing and marking spectacled eider females for survival estimate.
3) drawing blood for Pb and DNA analysis
4) eliminating arctic fox (*Alopex lagopus*) from the island.
5) assisting with goose production survey.

II. STUDY AREA

Kigigak Island (32.5 km^2) is located on the west coast of YDNWR and lies at the mouth of Baird Inlet, bordered by the Ninglick River (Fig. 1). Permafrost underlies the island, which contains numerous shallow lakes and ponds, some of which are interconnected with tidal sloughs. The majority of the island contains intermediate habitat (grassflat containing some upland habitat). During the fall, the island is flooded by storm tides.

III. METHODS

A. Arctic Fox Removal

During early May, a team of 2 people searched possible arctic fox denning areas for active dens. Once a den was located, the fox was to be shot.

B. Resightings

Prior to nest initiation in spring, observers searched eider habitat with 60x spotting scopes, and observed from a tower with a Questar telescope recording possible observations of marked/unmarked female and marked male spectacled eiders. Each encounter received a separate entry with only data obtained from that observation. Data recorded included: type of marker, marker codes for nasal disks and plastic bands, sex, date and time, association, observer, UTM coordinates, and comments. Data were entered daily into a laptop.

C. Nest Searches

Plots (0.165 km^2) were again selected from an area stratified for spectacled eider nesting habitat (Harwood and Moran 1992). Nest search methods, data recorded, and success criteria were identical to 1993 (Moran and Harwood 1994). Nest site habitat types included sloughbank, lakeshore, pondshore, peninsula, and island, which were described in Moran and Harwood's 1994 report. Plots were searched twice and the search cycle of 10 days matched the nest visitation schedule. Eggs were candled during the latter part of incubation to predict hatch dates (Weller 1956). Data were entered daily into a laptop computer.

Additional eider nests were found incidentally during daily activities and during the search of a 0.33 km^2 goose production plot. All eider nests found were treated as those on eider plots. All but 2 spectacled eider nest sites from previous years (1991-1993) were also checked.

D. Nest Trapping and Marking

Hatch dates were estimated using a 24-day incubation period, and nest initiation dates were derived from egg laying sequence, float angle, and

IV. RESULTS

A. Arctic Fox Control

No active dens were found, though shallow diggings were occasionally found in upland areas. One adult male was shot and killed 30 April before eider arrival. One other fox was observed during nesting, but elimination attempts were unsuccessful.

B. Break-up Chronology

Spring break-up on Kigigak Island was "early" and very similar to 1993. Average hatch dates for most species of waterbirds on the YKD were 1-3 days earlier than any of the other early years (Stehn 1994). Melt water first formed on large (>10 m diam) ponds on 6 May and they were ice-free by 24 May. Snow cover was 10% by 17 May. Sloughs were 90% ice-free by 20 May.

C. Spring Arrival

Spectacled and common eiders were first observed on 11 May just beyond shore-fast ice (approximately 200 m from shore). Eiders were observed on the island 12 May. Peak arrival for both species was approximately 17 May. Eiders arrived as pairs, small flocks, or individuals. As in 1993, courtship displays and copulations were observed.

D. Nest survey

Spectacled eider nest searches started 23 May, 13 days after the first sighting of spectacled eiders. One 2-person team searched 4 plots per day completing the first search cycle of 33 plots by 1 June (Fig. 2).

The second search period occurred from 2 - 11 June. An additional person aided the search half way through the period. All 33 plots from the first cycle were re-searched. In addition, one goose production plot was searched.

A total of 167 eider nests was found on Kigigak Island, including 84 spectacled and 83 common eider nests (Figs. 3-4). Formal plot searches located 75% and 65.1% of the spectacled and common eider nests, respectively. Spectacled and common eider nests were found on 28 and 22 eider plots, respectively. The first search produced 52.2% and 55.9% of spectacled and common eider nests, respectively. The second search produced 41.8% and 35.6% of spectacled and common eider nests, respectively. Only 2 plots did not contain $\geq$1 nest of $\geq$1 these species (Table 1).

F. Nest Sites

Habitat

The majority of spectacled and common eider nests were found on shoreline habitat (pondshore and lakeshore)(Fig. 5). Intermediate habitat supported 73.8% of all spectacled eider nests, while grassflat supported 45% of all common eider nests. In 1993, habitat types were mislabeled (Moran and Harwood 1994) and intermediate habitat should have been the preferred nesting habitat for both species. Mean distances from water for spectacled and common eiders were 2.3 m (0.2 - 16 m) and 1.4 m (0.2 - 24.5 m), respectively.

Nest Site Fidelity

Thirty-six of 71 (50.7%) adult females, banded through 1993, have returned to the island (1993-94). Twenty-nine of the 36(40.8%) nested at least 1 year following banding. Five females banded in 1992 nested in successive years (1992-94). All known returning nesting females chose sites within 804 m of previous nests, but none used the same nest bowl (Figs. 6-7).

allowed nasal discs to fall off. Females from 1992, which still had plain yellow tarsal bands (6), received new coded yellow tarsus bands.

Eggs from 41 (78.8%) of 52 nests (trap sites)(1 female recaptured with her brood out of the nest bowl) hatched. Of the remaining 11 nests, 8 were abandoned, 1 depredated, 1 had an unknown fate, and 1 nest contained only goose eggs.

Several previously banded females were wary of the bow-traps. At least 5 females returned several times before finally settling on the nest, which was unusual compared to former trap attempts. One previously banded female permanently abandoned upon trap set-up. A few of these birds were nest trapped for the third year in a row. The sample size is small, however, a trend may be forming where repeatedly trapped females may abandon nests subsequent to bow-trap setup.

Two females that retained their nasal tags were not trapped due to a failed trapping attempt and an inability to locate the other's nest, respectively. Seven unidentified banded females nested, unfortunately, they were not recaptured. Only the yellow tarsus bands were observed.

An additional female was nest-trapped, but her leg broke during trapping and she died despite rehabilitation attempts.

Two of 5 females anesthetized with methoxyflurane abandoned their nests (Appendix A).

M. Blood Sampling

Blood was taken from 47 females for lead and DNA analysis. Preliminary analysis indicate 4 (8.5%) had elevated lead levels (Hayes-Creekmore pers. comm.). Three of the four had been previously banded in 1993. Two of the 4 nested successfully, the other 2 abandoned their nests after trapping was attempted, despite anaesthetizing. Three of these nests were located on the island periphery, easily accessible to hunters (Fig. 12).

N. Resightings

Five nasal tagged females were observed before nesting, one of which was identified. Reading nasal tags and tarsus bands proved difficult with 60x spotting scopes. Three individuals (1 with a nasal disc) out of 33 marked female spectacled eider observations were identified before nesting (two from the tower). Seventy-one total (marked, unmarked, and unknown) female spectacled eider sightings were recorded before nesting. Marked male spectacled eiders were not sighted.

O. Post-breeding Male Dispersal

Male spectacled eiders were observed in partial eclipsed plumage by 18 June. Most spectacled and common eider males departed between 10-13 June. The last male spectacled eider was observed on 27 June. The last male common eider was observed flying with a female along the coast on 25 June.

V. DISCUSSION

A. Nesting

Nest success did not significantly change for spectacled eiders and common eiders from 1993. There is no clear reason why nest success was relatively stable on the island. Flooding has not been a factor during the nesting period. Predation is a major source for nest failure on the island. Reduction of arctic fox may be a possibility, though they are not the only major predator on the island. The high density of glaucous gulls (*Larus hyperboreus*) (Harwood and Moran 1993) is also a concern. Eider project personnel was downsized to 2 people during most of the nest searching period. Personnel increased by 3 during hatch/trapping period. Also, sections of the island were searched in rotation to minimize disturbance. Personnel working

LITERATURE CITED

Bart, J. and D.S. Robson. 1982. Estimating survivorship when subjects are visited periodically. Ecology 63: 1078-1090.

Bellrose, F.C. 1976. Ducks, geese, and swans of North America. Third ed. Stackpole Books, Harrisburg, PA. 540pp.

Dau, C.P. 1974. Nesting biology of the spectacled eider (*Somateria fischeri*) (Brandt) on the Yukon-Kuskokwim Delta, Alaska. M.S. Thesis, Univ. of Alaska, Fairbanks. 72pp.

Doty, H.A. and F.B. Lee. 1974. Homing to nest baskets by wild female mallards. J. Wildl. Manage. 38: 714-719.

Dzubin, A. and E. Cooch. 1992. Measurements of geese: general field methods. California Waterfowl Assoc. 20pp.

Grand, J.B. 1993. Standard operating procedures for spectacled eider field work. U.S. Fish and Wildl. Serv., Anchorage, AK. 7pp.

_____ and P.L. Flint. 1993. MAYDATES and SURVBR programs for the analysis of nesting success data. Unpubl. Rep. U.S. Fish and Wildl. Serv., Anchorage, AK. 16pp.

Harwood, C.M. and T. Moran. 1991. Nesting chronology, reproductive success, and brood rearing for spectacled and common eiders on Kigigak Island, 1991. Unpubl. rep. U.S. Fish and Wildl. Serv., Bethel, AK. 26pp.

_____ and _____. 1993. Productivity, brood survival, and mortality factors for spectacled eiders on Kigigak Island, Yukon Delta NWR, Alaska, 1992. Unpubl. rep. U.S Fish and Wildl. Serv., Bethel, AK. 54pp.

Johnson, D.H. 1979. Estimating nest success: the Mayfield method and an alternative. Auk 107: 595-600.

Klett, A.T., H.F. Duebbert, C.A. Faanes, and K.F. Higgins. 1986. Techniques for studying nest success of ducks in upland habitats in the prairie pothole region. U.S. Fish and Wildl. Serv. Resour. Publ. 158. 24pp.

Lokemoen, J.T., H.F. Duebbert, and D.E. Sharp. 1990. Homing and reproductive habits of mallards, gadwalls, and blue-winged teal. Wildl. Monogr. 106. 28pp.

Mayfield, H. 1961. Nesting success calculated from exposure. Wilson Bull. 73: 255-261.

_____. 1975. Suggestions for calculating nest success. Wilson Bull. 87: 456-466.

Moran, T. and C.M. Harwood. 1994. Nesting ecology, brood survival, and movements of spectacled eiders on Kigigak Island, Yukon Delta NWR, Alaska, 1993. Unpubl. rep. U.S. Fish and Wildl. Serv., Bethel, AK. 25pp.

Rotella, J.J. and J.T. Ratti. 1990. Use of methoxyflurane to reduce nest abandonment of mallards. J. Wildl. Manage. 54: 627-628.

Sayler, J.W. 1962. A bow-net trap for ducks. J. Wildl. Manage. 26: 219-221.

Schamel, D.L. 1974. The breeding biology of the pacific eider (*Somateria mollissima v-nigra* Bonaparte) on a barrier island in the Beaufort Sea, Alaska. M.S. Thesis, Univ. of Alaska, Fairbanks. 95pp.

Stehn, R., R. Platte, M. Wege, and G. Walters. 1994. Population size and production of geese nesting on the Yukon-Kuskokwim Delta, Alaska. Revised Field Report. National Biol. Survey, Anchorage, AK. 17pp.

Wakely, J.S and H.L. Mendall. 1976. Migrational homing and survival of adult female eiders in Maine. J. Wildl. Manage. 40(1): 15-21.

Weller, M.W. 1956. A simple field candler for waterfowl eggs. J. Wildl. Manage. 20(2): 111-113.

Table 1. Number of spectacled eider and common eider nests, Kigigak Island, 1994.

		SPECTACLED EIDER SEARCH PERIOD			COMMON EIDER SEARCH PERIOD			
PLOT TYPE	PLOT NUMBER	1	2	INC*	1	2	INC*	TOTAL
EIDER	2	0	1	0	1	0	0	2
"	3	3	0	1	0	0	1	5
"	4	0	2	0	0	0	0	2
"	5	1	0	0	0	0	0	1
"	6	0	1	0	3	2	0	6
"	7	0	2	0	3	1	0	6
"	8	2	0	0	0	0	0	2
"	9	0	2	1	0	0	0	3
"	10	0	0	0	0	2	0	2
"	11	1	1	0	0	0	0	2
"	12	2	1	0	1	0	0	4
"	13	1	0	0	0	0	0	1
"	14	1	1	0	0	1	0	3
"	15	2	2	1	0	0	1	6
"	16	1	1	0	1	0	0	3
"	17	3	1	0	0	0	0	4
"	18	1	0	1	1	0	1	4
"	19	3	0	0	1	0	0	4
"	20	1	3	0	1	0	0	5
"	21	1	0	0	0	0	0	1
"	22	0	0	0	1	0	0	1
"	23	3	1	0	2	0	0	6
"	24	0	2	0	1	0	0	3
"	25	2	1	0	5	1	0	9
"	26	0	3	0	1	0	0	4
"	27	2	0	0	1	0	0	3
"	28	1	0	0	7	0	0	8
"	29	2	1	0	0	2	1	6
"	30	0	0	0	1	12	1	14
"	31	0	0	0	0	0	0	0
"	32	0	0	0	0	0	0	0
"	33	0	1	0	1	0	0	2
"	34	2	1	0	0	1	0	4
SUBTOTAL	33	35	28	4	33	21	5	126
GOOSE PROD.	151	2	--	0	0	--	0	2
INCIDENTAL				15			24	39
SUB-TOTAL	34	37	28	19	33	21	29	
TOTAL	34	84			83			167

*Nests found on plot incidentally

Table 2. Eider clutch size frequencies, Kigigak Island, 1994.

	Clutch Size									
Species	1	2	3	4	5	6	7	8	9	10
Spectacled Eider (n=70)	0	1[a]	3	8	17	34	7	0	0	0
Common Eider (n=79)	1	2[b]	3	9	25	30	7	0	1[c]	1[c]

[a] Nest depredated during laying.
[b] Nest abandoned during laying.
[c] Nest contained dumped eggs by definition ($\geq$ 8 eggs) (Belrose 1976).

Table 3. Eider clutch size averages[a], Kigigak Island, 1994.

	Spectacled Eider			Common Eider		
Category	$\bar{x}$	n	SE	$\bar{x}$	n	SE
Mean clutch size						
All nests	5.4	70	1.1	5.5	77	1.2
Successful nests	5.6	57	0.9	5.5	64	1.2
Mean hatched clutch size						
All nests	3.4	69	2.1	3.5	75	2.0
Successful nests	4.3	56	1.4	4.2	62	1.4

[a] Data from nests with unknown fates or whose fates may have been influenced by visitor impact were eliminated. Eggs with unknown fates were considered unhatched.

Table 4. Eider nest success, Kigigak Island, 1992-1994.

Method	Spectacled Eider			Common Eider		
	1992	1993	1994	1992	1993	1994
MAYDATE[a]						
Total nests	64	74	80	94	72	79
Exposure (days)	1043	1025	1223	1647.5	972	1267
Nests failed	3	16	15	8	26	15
Daily survival rate	0.9971	0.9844	0.9877	0.9951	0.9734	0.9882
% Successful	92.0	63.4	70.0	87.3	47.0	71.6
95% CI	83.5-101.2	50.4-79.5	58.1-84.1	79.2-96.1	34.9-63.1	60.3-85.1
SURVBR[b]						
Daily survival rate	0.9971	0.9832	0.9894	0.9947	0.9745	0.9901
% Successful	92.0	61.3	73.4	86.1	48.5	74.9
Apparent						
Total nests	64	75	80	91	74	80
Nests hatched	60	58	65	81	47	65
Nests failed	4	17	15	10	27	15
% Successful	93.8	77.3	81.3	89.0	64.8	81.3

[a]MAYDATES is a dBase program that calculates 95% confidence intervals and Mayfield nest success estimates (Grand and Flint 1993).
[b]SURVBR is a dBase program that calculates 95% confidence intervals and Bart and Robson maximum likelihood estimates (Grand and Flint 1993).

Table 5. Hatching success and fate of eider eggs, Kigigak Island, 1994.

	Spectacled Eider	Common Eider
Egg Hatching Success (all nests)		
Total nests	70	82
Eggs laid	324	366
Eggs hatched	241	260
% hatched	74.4	71.0
Egg Hatching Success (successful nests)		
Total nests	55	64
Eggs laid	282	298
Eggs hatched	241	260
% hatched	85.5	87.2
Egg Fate		
Laid[a]	442	435
Hatched	241	260
Unhatched	144	90
Depredated	59[b]	46
Abandoned (natural causes)	8	24
Abandoned (human induced)	41	0
Addled	21	6
Runt	0	1
Damaged (visitor/trap)	5	-
Unknown	46	69

[a] Number of eggs laid is larger than number used in egg hatching success calculation because eggs from nests whose fates were unknown or influenced by visitor impact were not used.

[b] Five eggs (5 nests) were depredated subsequent to trapping. Trapping activity may have attracted predators and/or caused females to abandon their nests.

Table 6. Measurements of 53 nest-trapped adult female spectacled eiders, Kigigak Island 1994.

Measurement	Mean	SE	Range
Weight (g)	1149	88.9	950 - 1400
Wing (mm)	251.3	5.8	239 - 260
Culmen (mm)	25.8	1.6	22.3 - 30.9
Tarsus (mm)	57.0	1.8	53.5 - 60.8

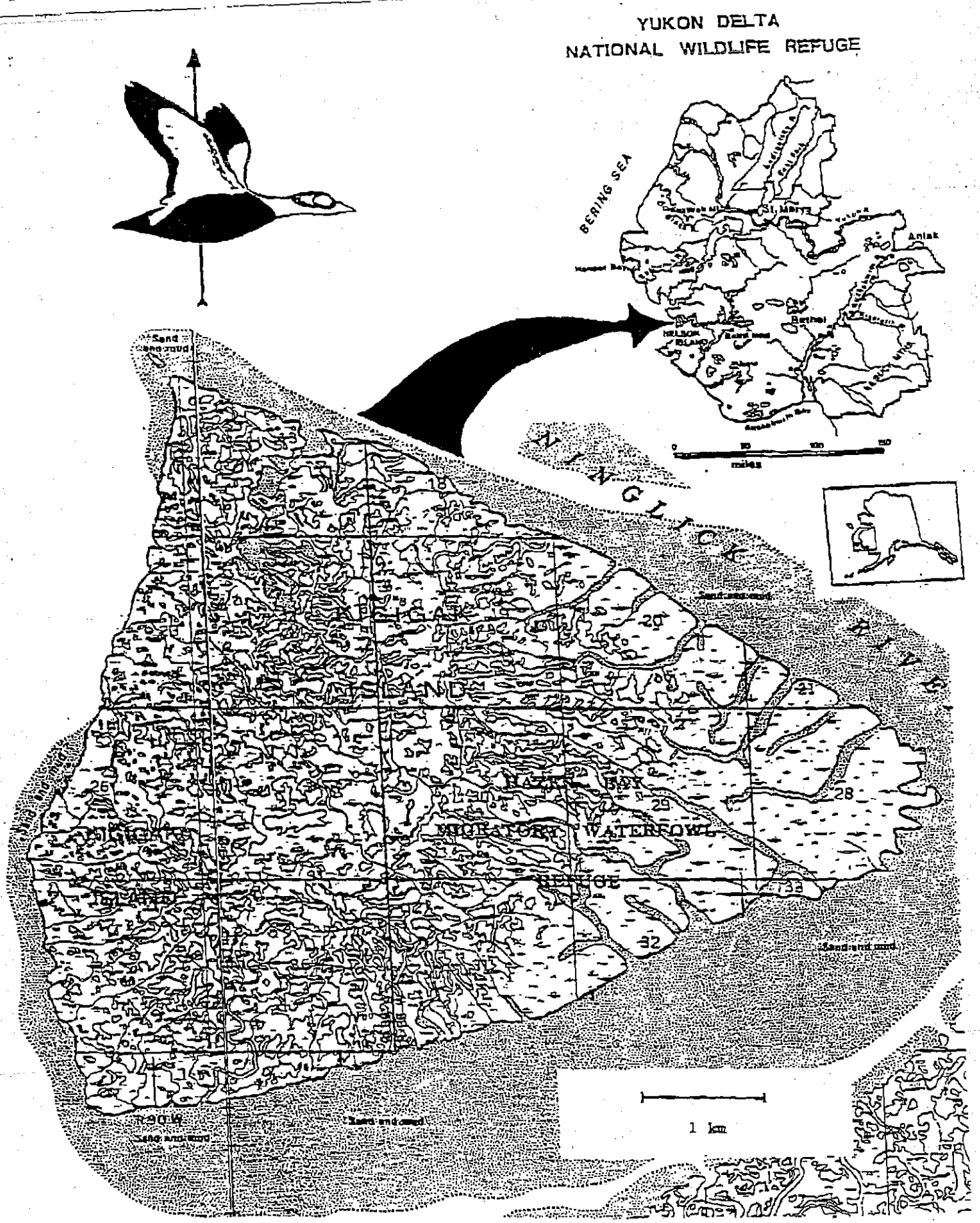


Figure 1. Kigigak Island, YDNWR, Alaska.

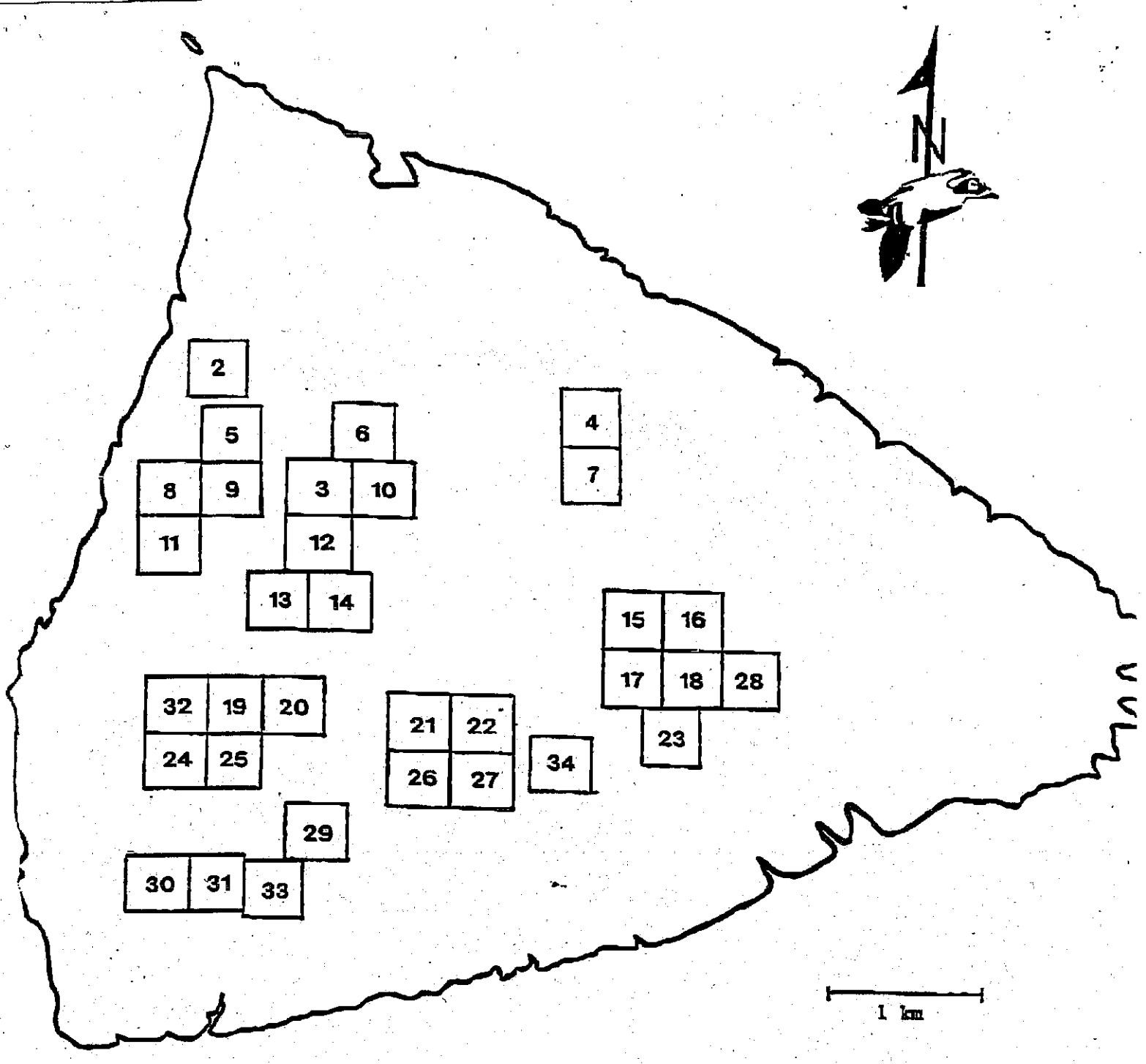
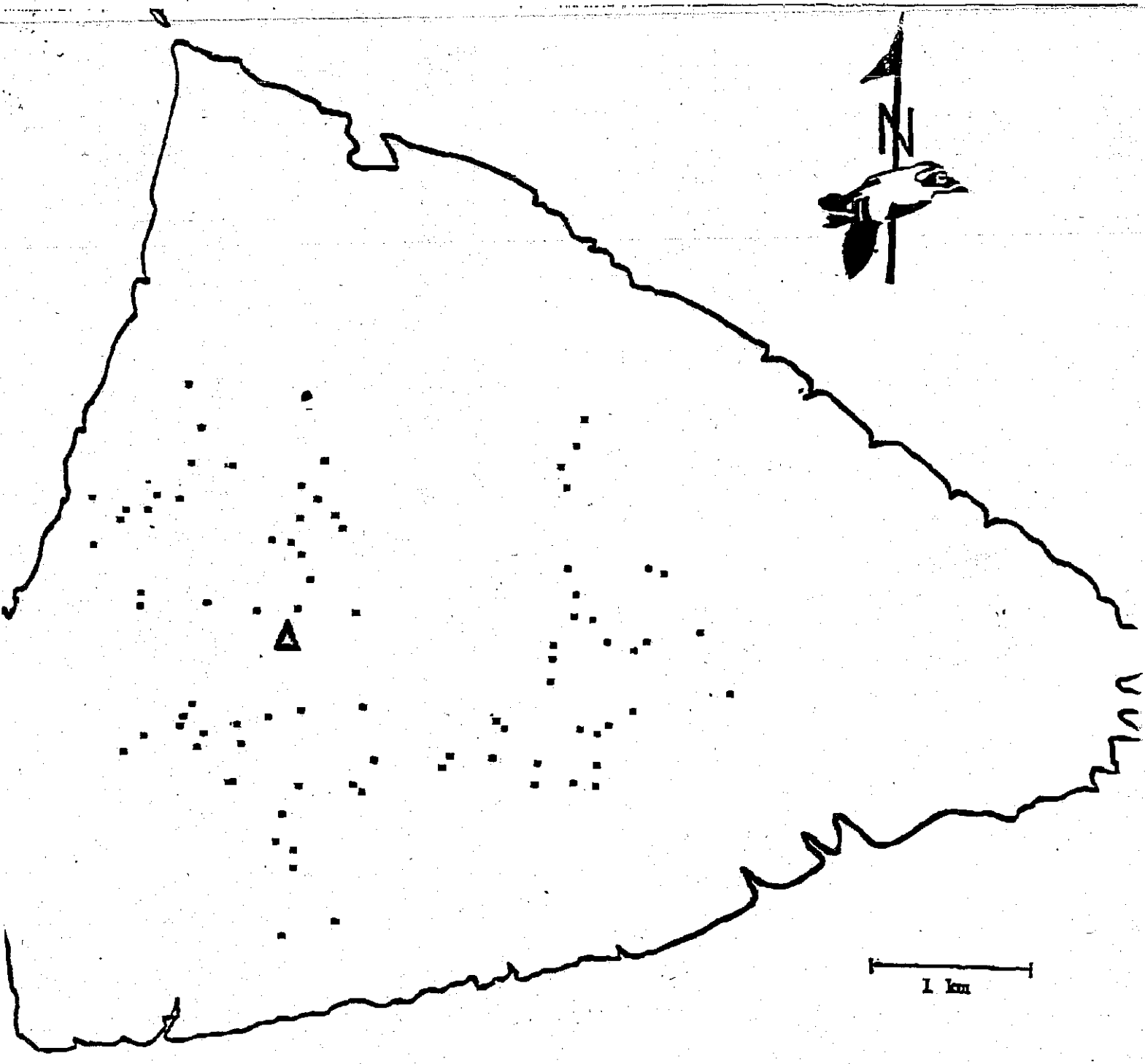


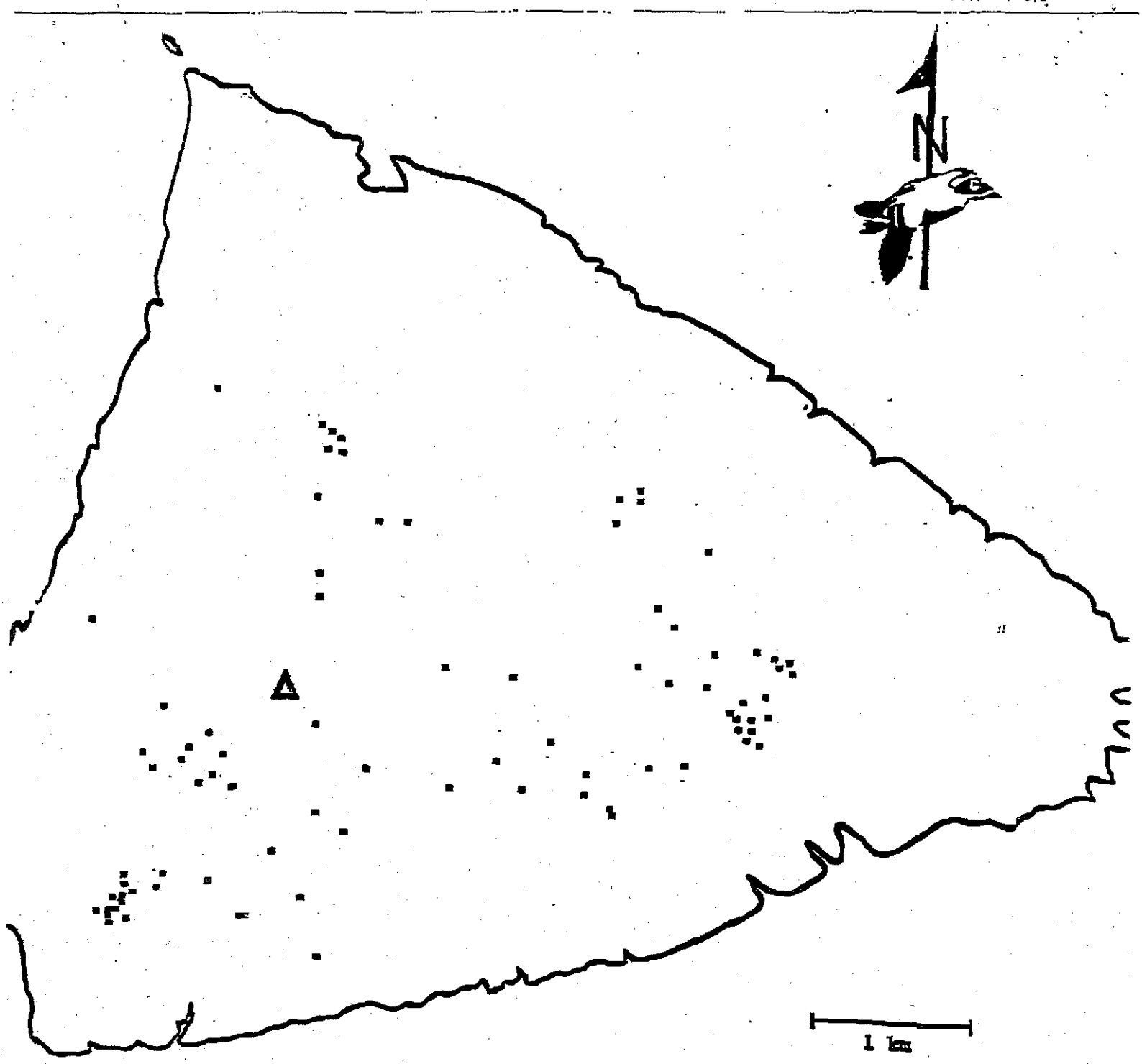
Figure 2. Distribution of eider nesting plots, Kigigak Island, 1994.



▪ Spectacled eider nest

Δ Camp Location

Figure 3. Distribution of spectacled eider nests, Kigigak Island, 1994.



▪ Common eider nest

Camp Location

Figure 4. Distribution of common eider nests, Kigigak Island, 1994.

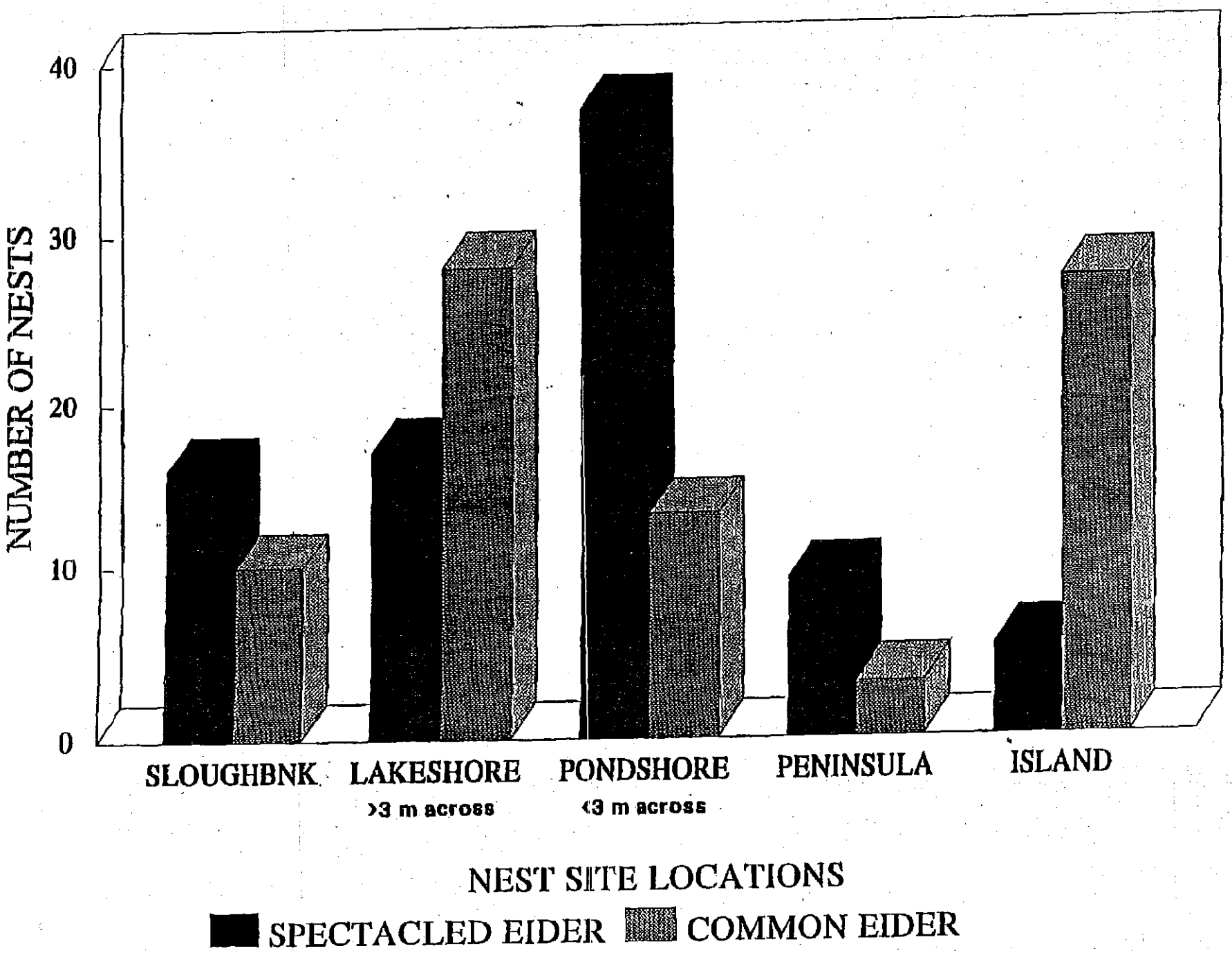


Figure 5. Frequencies of eider nest site locations, Kigigak Island, 1994.

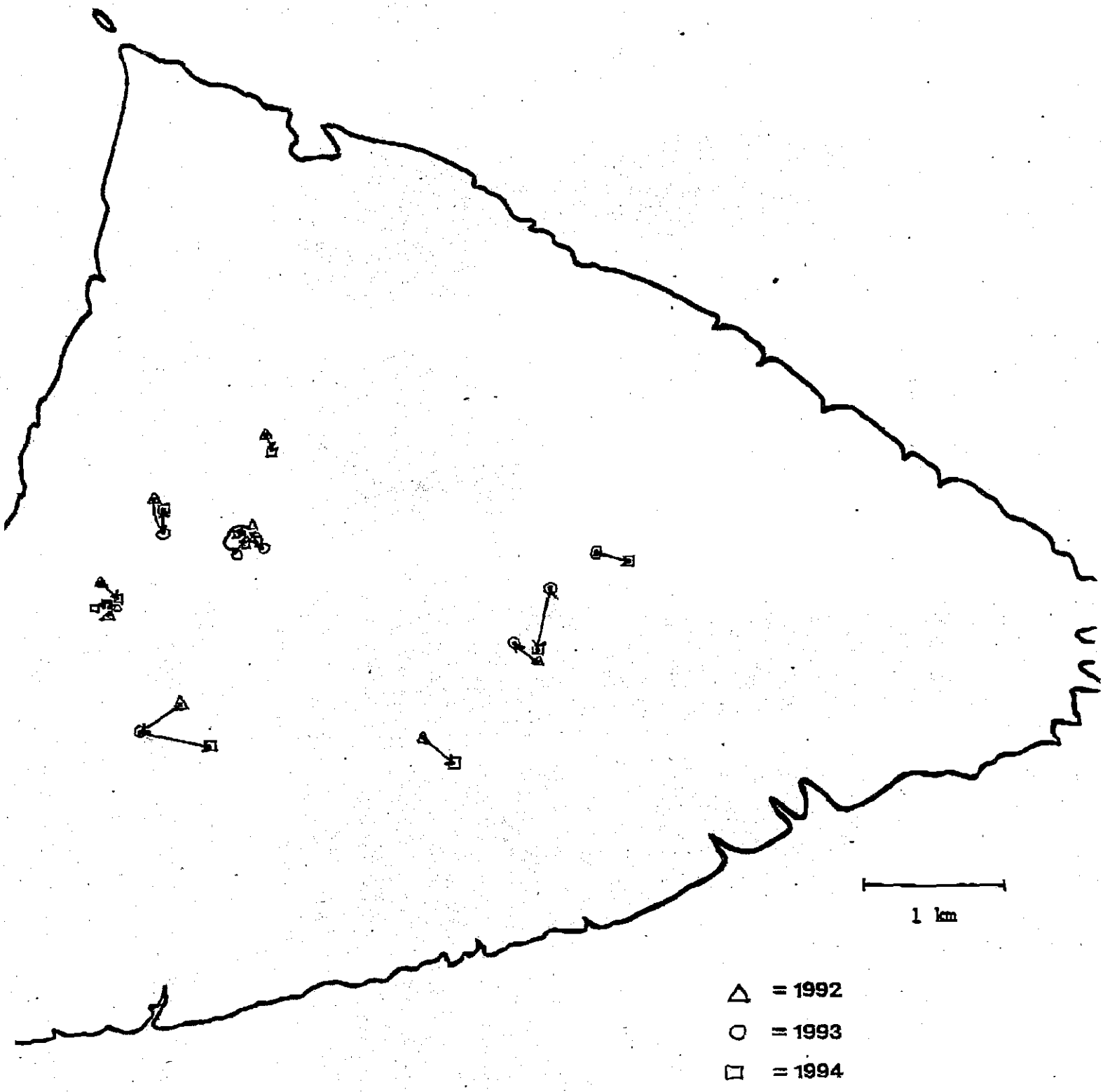


Figure 6. Nest locations (1992–1994) of resighted and/or recaptured spectacled eider females originally banded in 1992, Kigigak Island.

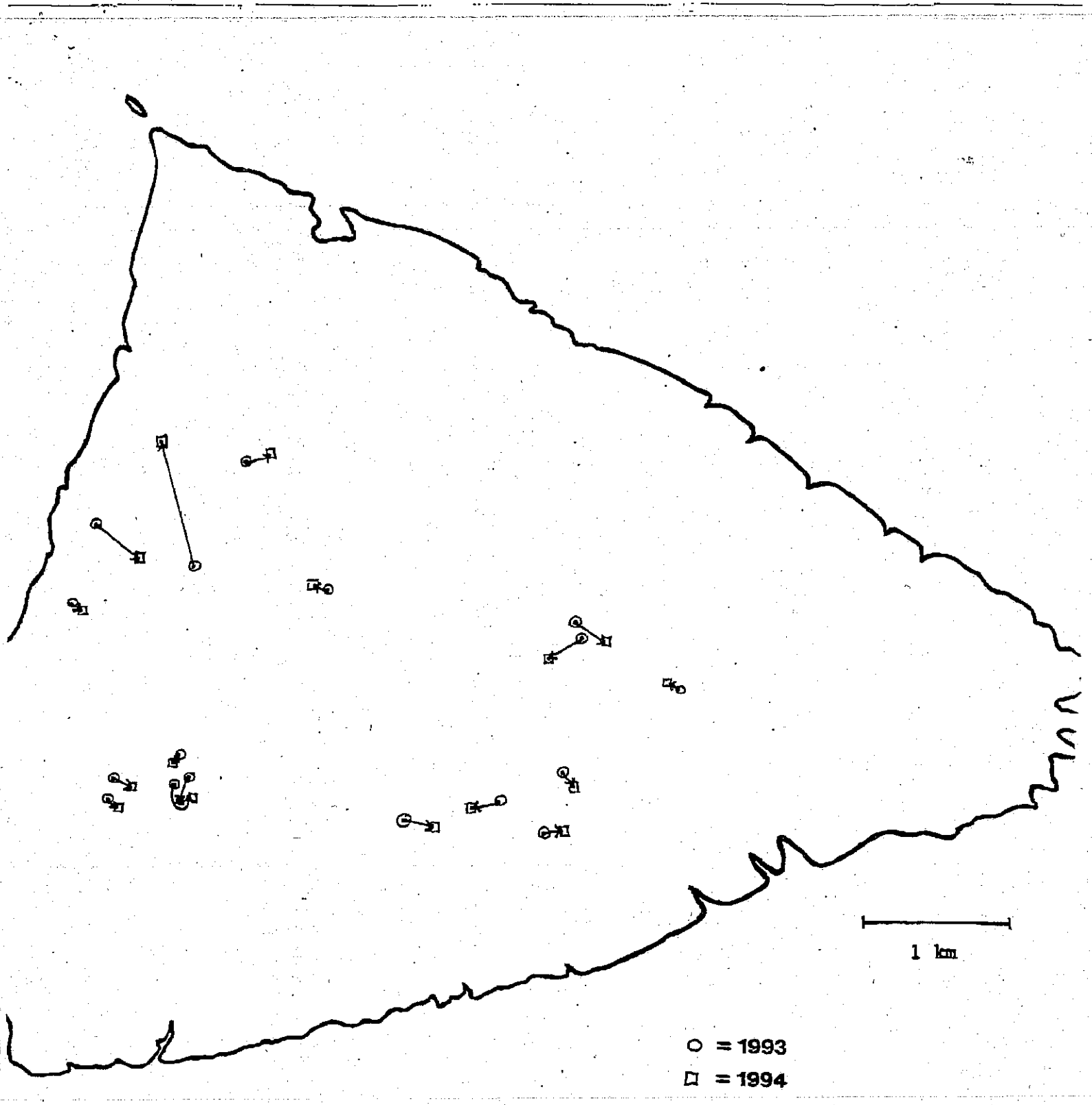


Figure 7. Nest locations (1993, 1994) of resighted and/or recaptured spectacled eider females originally banded in 1993, Kigigak Island.

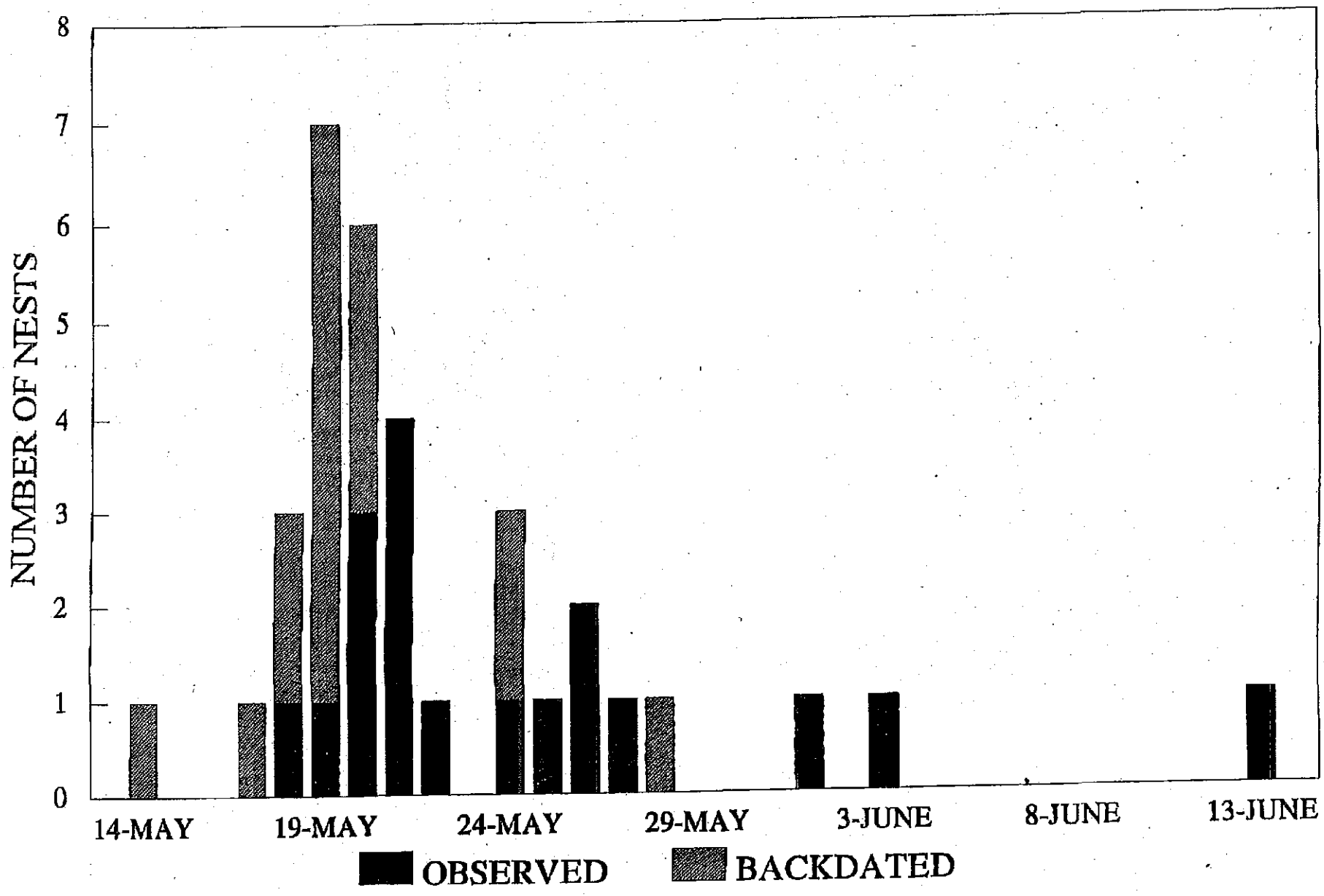


Figure 8. Nest initiation dates for spectacled eiders, including both observed and those backdated from known hatch dates, Kigigak Island, 1994.

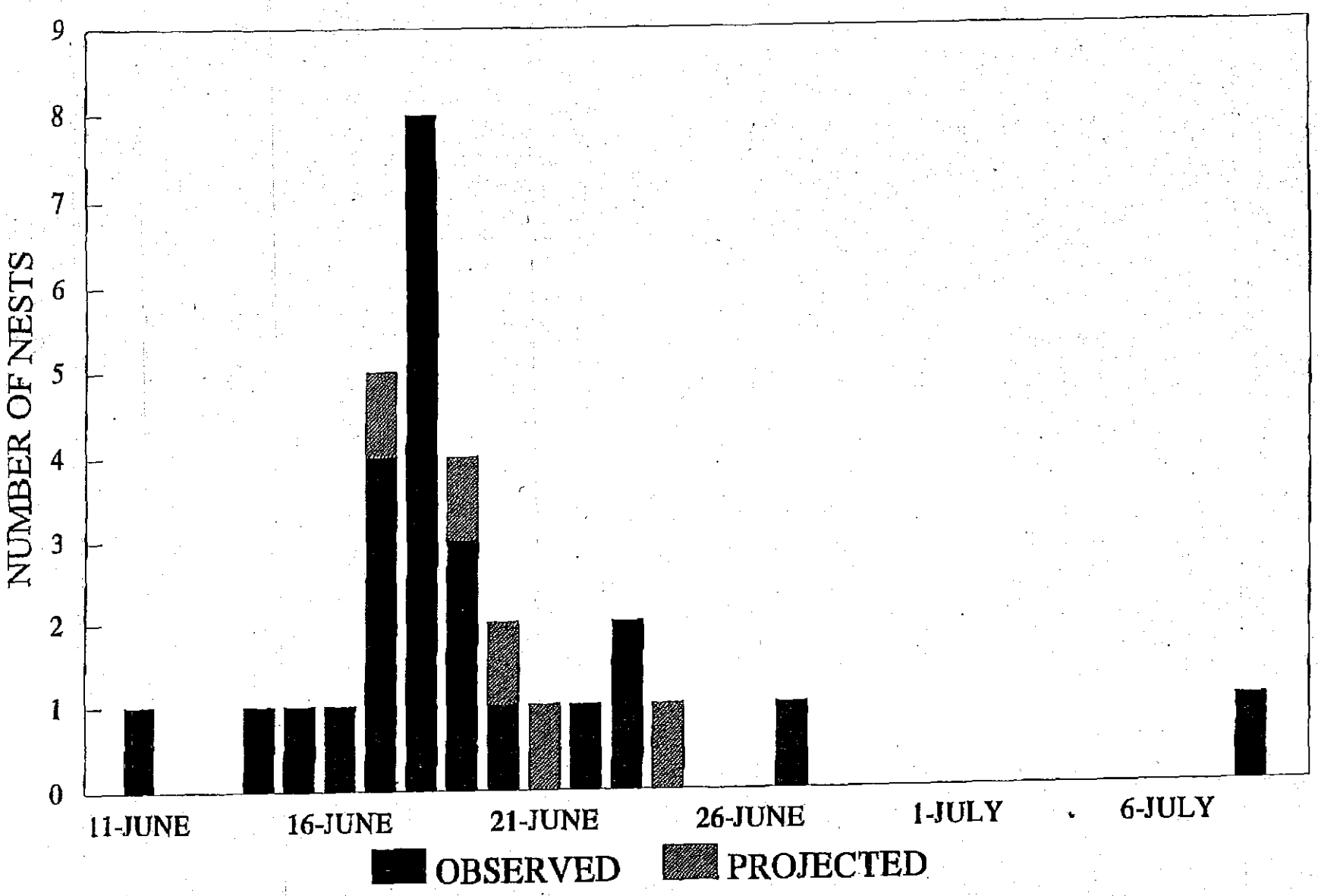


Figure 9. Hatch dates for spectacled eiders, including both observed and those projected from known initiation dates, Kigigak Island, 1994.

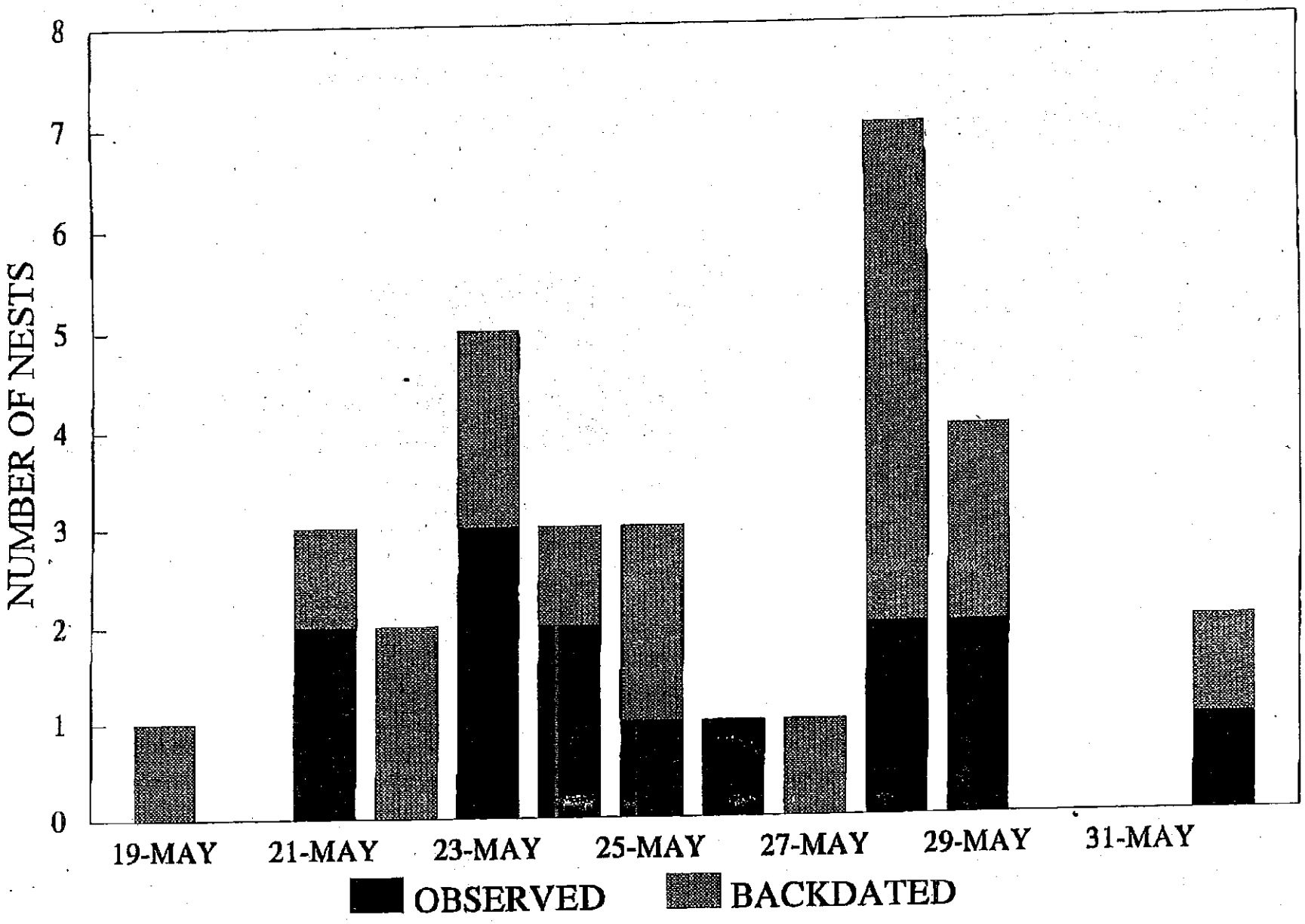


Figure 10. Nest initiation dates for common elders, including both observed and those backdated from known hatch dates, Kigigak Island, 1994.

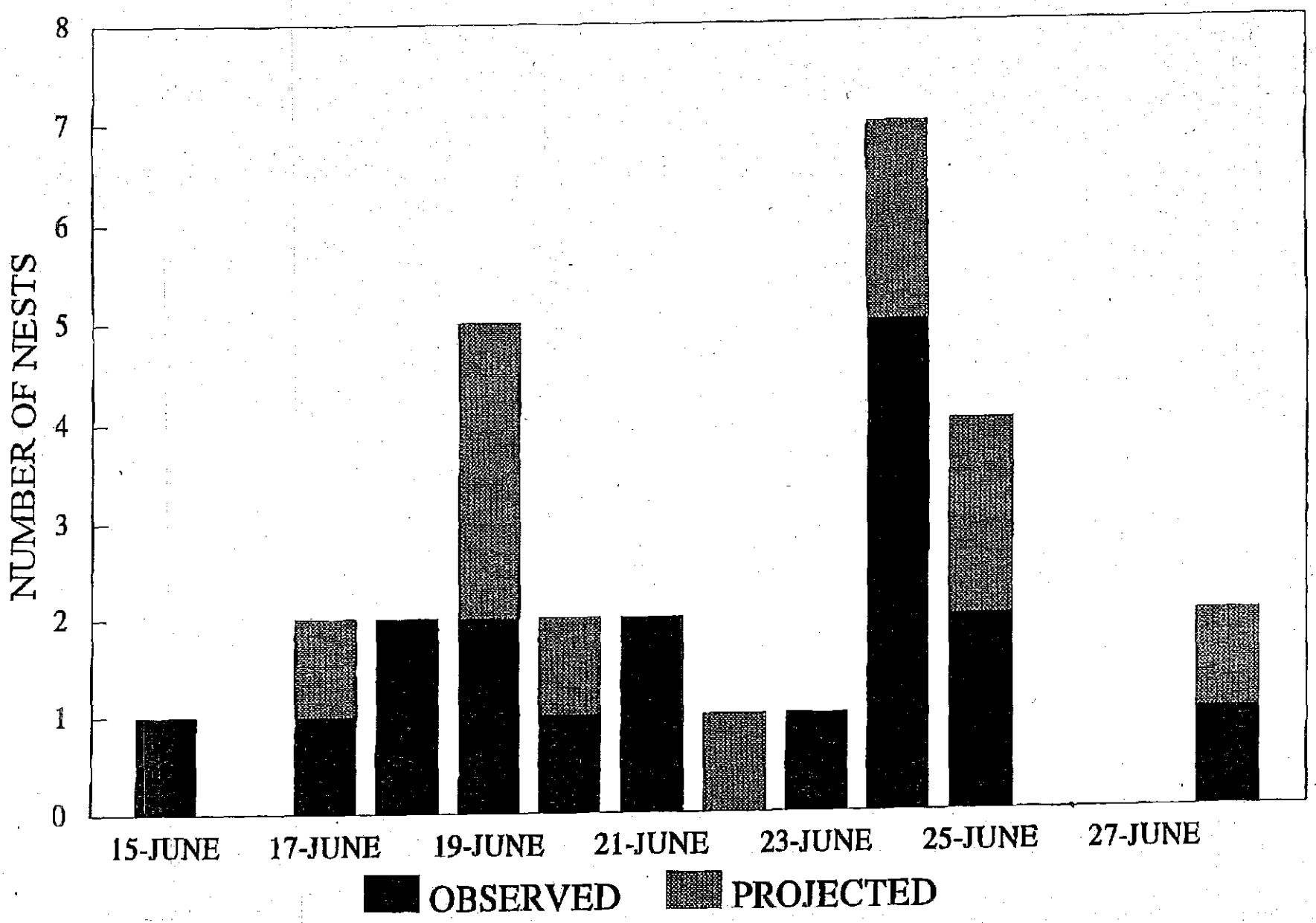


Figure 11. Hatch dates for common eiders, including both observed and those projected from known initiation dates, Kigigak Island, 1994.

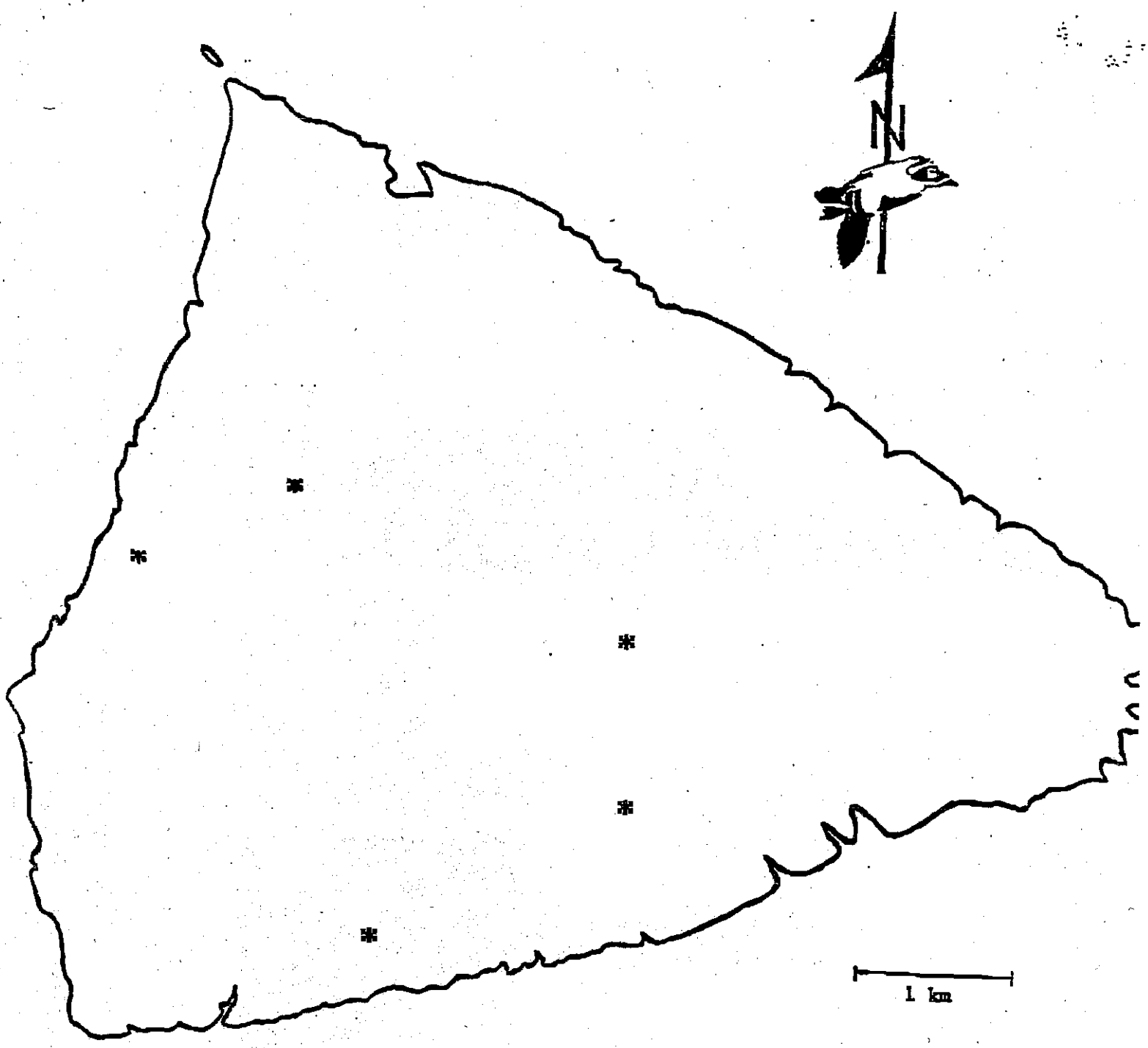


Figure 12. Nest locations of spectacled eider females exposed to lead.

APPENDIX A

Methoxyflurane use with spectacled eiders on Kigigak Island

Use of methoxyflurane was reduced this year on Kigigak Island after questions were raised regarding its need when working with spectacled eiders. Specifically, did nest abandonment rate from trapping necessitate methoxyflurane use and are there health risks to both birds and humans.

A formal experiment was not conducted to test effectiveness of methoxyflurane, however, 1994 results were interesting. Twenty-two females were caught on nests >2 days before hatch. Seven abandoned, 14 incubated through hatch and 1 nest fate was unknown. Five females were anaesthetized: two abandoned and three hatched eggs. Thirty females were captured $\leq$2 days before hatch. One abandoned, 1 left after depredation, and 27 hatched eggs (2 anaesthetized). Spectacled eiders' frequency of abandonment may increase if captured $\leq$ 2 days of hatch, but use of methoxyflurane may reduce abandonment if females are trapped earlier.

on a glaucous gull project spent minimal time walking the island, especially known eider nesting areas reducing disturbance.

Relatively high nest success on Kigigak Island may influence nest site fidelity. Successfully nesting mallard and gadwall females have shown higher rates of nest site fidelity than unsuccessful females (Doty and Lee 1974, Lokemoen et al 1990). Wakely and Mendall (1976) reported that common eiders in Maine showed a "strong tendency to home to specific nesting islands". Our sample size is still low, however preliminary results show a high percentage of spectacled eider females are returning to the island and all known returning females nest in the vicinity of former nest sites. There is not enough evidence to show that the pattern of return is either random chance or intentional. According to Lokemoen et al. (1990) and Doty and Lee (1974), nesting females may increase their probability of nest success by returning to productive and familiar sites.

B. Resighting

Resightability and the accuracy of identification of marked spectacled eiders were diminished due to high loss of nasal tags between 1993 and 1994. Identification of those that retained their nasal tags was difficult unless the observer had a spotting scope and was able to observe the bird on a nest. Stainless steel washers should increase marker retention and reduce the need to recapture every banded bird for identification. Unfortunately, the new washers cover part of the markers' symbols, thus reducing the pool of useable letters.

VI. CONCLUSION

The species has been listed as threatened. Most of the evidence contributing to that listing came from the Yukon-Kuskokwim Delta (YKD). More breeding biology information is needed to make sound management decisions. Survival rates, lead contamination, and nest site fidelity should continue to be monitored. Lead poisoning could be a potential problem if females always return to the same breeding area or lack the ability to adapt to another area. If lead is a major source of mortality in that area, a significant portion of the population (YKD) could be lost.

A two year old female, banded as a duckling, successfully nested approximately 750 m from her mother's nest sites.

G. Nesting Chronology

Nest initiation for both spectacled and common eiders was 2 days after arrival. Peak nest initiation and hatch for spectacled eiders was 19-22 May (range = 14 May - 13 June) and 17-19 June (range = 12 June - 8 July), respectively (Fig. 8-9). Nest initiation and hatch for common eiders exhibited bimodal peaks: 23, 28-29 May (19 May - 1 June) and 19, 24-25 June (15 - 28 June), respectively (Figs. 10-11).

H. Incubation Periods

Incubation periods for 7 spectacled eider nests ranged from 23-24 days as determined from egg laying sequences and observed hatch dates. Exposure periods were 28-31 days.

I. Clutch Size

Spectacled and common eiders had identical median clutch sizes of 6 eggs (Table 2). Mean complete clutch sizes for spectacled and common eiders were 5.4 eggs (range=3-7) and 5.5 eggs (range=1-7), respectively (Table 3). The minimum number of hatched eggs was based on the number of pipped eggs, ducklings, or egg shell membranes present after hatch. The number of hatched eggs based on membranes was biased low. Two hundred and twenty-nine spectacled eider eggs were present at last visit before hatch compared with 181 membranes found after hatch comparable figures for common eider were 284 and 223 (not including eggs that were known to be depredated, addled, or did not hatch). Twelve spectacled eider nests contained at least 1 addled egg, including 1 nest with a completely addled clutch (6). Mean egg measurements for spectacled and common eiders were: length - 69.4 mm (SE = 2.9 , n = 405) and 75.1 mm (SE = 3.1, n = 414) and width - 45.4 mm (SE = 2.5, n = 405) and 50.0 mm (SE = 1.5, n = 414), respectively.

J. Nest Success and Survival

Mayfield and Bart-Robson 1994 nest success estimates were 70.0% and 73.4%, respectively, for spectacled and 71.6% and 74.9%, respectively, for common eiders (Table 4). Nest success estimates were not significantly different from 1992 and 1993, though common and spectacled eider nest success appeared higher than 1993.

K. Egg Hatching Success

Apparent egg hatching success rates for all spectacled and common eider nests were 74.4% and 71.0%, respectively (Table 5). For successful nests, hatching success was 85.5% and 87.2%, respectively.

L. Trapping and Marking

Fifty-three female spectacled eiders were nest-trapped, banded, and measured between 11 and 28 June (Table 6). One additional non-breeding female spectacled eider was caught in flight with a mistnet and increased the number of adult female spectacled eiders banded on the island (1992-1994) to 96. Twenty-seven of the 54 were new captures; recaptures included 11 banded 1992 and 16 banded 1993. One female from 1992 was banded as a duckling.

Nineteen of 52 female spectacled eiders receiving numbered nasal tags in 1993 were recaptured in 1994, including 5 females banded in 1992 and recaptured in 1993. Sixteen of these lost their nasal tags. Recaptured birds were fitted with new nasal tags (except 1, which was still in good condition) and stainless steel washers. Nylon washers, used in 1992 and 1993, eroded and

candling data. Bownet traps (Sayler 1962) and mistnets were used to nest trap females 1-3 days before hatch. As in 1993, each spectacled eider was fitted with a U.S. Fish and Wildlife Service metal band (left leg), yellow with letter/numbered tarsal band (right leg), and a yellow, circle-shaped nasal disk with a black letter and number. Measurements (wing, culmen, tarsus) and weight were recorded (Dzubin and Cooch 1992).

Methoxyflurane was used during banding only on birds whose eggs were >2 days from hatch and/or were "difficult to handle." After banding, they were placed 1-2 m from nest to prevent accidental stumbling into the nest bowl while "waking." Biologists left before females awoke to minimize nest desertion (Rotella and Ratti 1990). Females were observed from afar to monitor recovery.

E. Blood Sampling

Blood samples were taken from captured spectacled eider females. Up to 6 ccs of blood were taken from each spectacled eider for lead (Pb) and DNA analysis (population genetics). Analysis was done by National Biological Survey-National Wildlife Research Center in Madison, Wisconsin.

F. Analyses

1. Nesting chronology

Mean nest initiation dates (Julian) for spectacled and common eiders were calculated only from nests located during laying. Mean hatch date (Julian) for eiders was calculated only from nests visited at hatch.

Assuming 1 egg was laid per day, hatch dates were projected and initiation dates were backdated for spectacled eider nests with known initiation dates and known hatch dates, respectively and assumed incubation (24 days) began with deposition of the last egg (Dau 1974). Corresponding common eider dates assumed incubation (26 days) began with deposition of the third egg (Schamel 1974). Observed rather than calculated hatch dates were used whenever available to calculate Mayfield nest success estimates (Mayfield 1961,1975).

2. Nest success

Mayfield nest success estimates were calculated for spectacled and common eiders following conventions established by Klett et al. (1986). Confidence intervals were calculated from standard error of daily survival rate (DSR) (Johnson 1979).

Dbase software calculated nest success estimates and 95% confidence intervals (Grand and Flint 1993). MAYDATES program calculated a Mayfield estimate, while SURVBR program calculated a Bart and Robson maximum likelihood estimate (Bart and Robson 1982). Programs and data entry were modified to accommodate successful nests visited after hatch. When the exact hatch date was unknown, probable exposure of the final interval was 50% of that interval. This is comparable to treatment of nests visited after failure. Daily mortality was assumed to be constant. Overall exposure periods for spectacled and common eiders were 29 and 28 days (Harwood and Moran 1992), respectively. Nest success was also calculated by the "apparent" method, which is the percentage of nests found that hatched at least 1 egg.

3. Egg hatching success

Eider egg hatching success (Apparent) was determined for all nests. Eggs with unknown fates or destroyed by visitor activity were omitted from analysis.