ARCTIC
VOL. 41, NO. 2 (JUNE 1988) P. 138-142

King Eider (*Somateria spectabilis*) Nesting in Association with Long-tailed Skua (*Stercorarius longicaudus*)

SVEN BLOMQVIST[1] and MAGNUS ELANDER[2]

(Received 11 May 1987; accepted in revised form 3 December 1987)

ABSTRACT. In High Arctic Northeast Greenland King Eiders (*Somateria spectabilis*) were found nesting in association with solitarily breeding Long-tailed Skuas (*Stercorarius longicaudus*). The association is demonstrated using spatial statistics analyses and timing of clutch initiations. Long-tailed Skuas' nests were evenly spaced in the 6.1 km^2 census area, whereas nine out of ten King Eider nests were located close to five different nests of Long-tailed Skua. It is suggested that the association may be a state of commensalism.

Key words: nest site selection, nesting association, spatial distribution pattern, commensalism, King Eider (*Somateria spectabilis*), Long-tailed Skua (*Stercorarius longicaudus*), Greenland, High Arctic

RÉSUMÉ. Dans l'Extrême-Arctique du nord-est du Groenland, on a trouvé des eiders à tête grise (*Somateria spectabilis*) qui avaient établi leur aire de nidification en association avec des labbes à longue queue (*Stercorarius longicaudus*) nichant en solitaires. On a démontré cette association en se fondant sur des analyses de statistiques spatiales et sur le moment du début de l'éclosion. Les nids des labbes à longue queue étaient répartis également dans les 6,1 km^2 de la zone de recensement, tandis que neuf nids d'eiders à tête grise sur dix étaient situés près de cinq autres nids de labbes à longue queue. On suggère que cette association pourrait être une manifestation de commensalisme.

Mots clés: choix de l'emplacement du nid, nidification en association, schéma de distribution spatiale, commensalisme, eider à tête grise (*Somateria spectabilis*), labbe à longue queue (*Stercorarius longicaudus*), Groenland, Extrême-Arctique

Traduit pour le journal par Nésida Loyer.

INTRODUCTION

The phenomenon of ducks nesting in association with colonially breeding hosts, such as gulls and terns, has long been recognized (Stefánsson, 1919:461; Bent, 1921:172; Bailey, 1925; Nyström, 1927). The first specific studies appeared in the 1930s (Fabricius, 1937; von Haartman, 1937; Bergman, 1939), and since then this phenomenon has been reported in, among other places, the Holarctic region for a number of duck species breeding in different habitats. Ducks associating with bird colonies having efficient anti-predator defense have reportedly had increased nesting success (Bergman, 1939; Olsson, 1951; Ahlén and Andersson, 1970; Bengtson, 1972; Dwernychuk and Boag, 1972; Newton and Campbell, 1975; Schamel, 1977; Gerell, 1985; Young and Titman, 1986; Götmark and Åhlund, 1988). Related cases of ducks associating with human settlements have also been described (Hagelund and Norderhaug, 1975; Meltofte, 1978).

Breeding ducks associating with solitary hosts, on the other hand, have been discussed thoroughly only by Giroux (1981) and mentioned briefly by other authors (Turner, 1886:136; Bent, 1925:82; Schiermann, 1927; Buturlin, 1931:67; Kessel *et al.*, 1964:42; Uspenski, 1965:128; Williams, 1967:122; Long, 1970:90-91; Fabricius, 1983a:31-33, 1983b:215-216). On Hold with Hope in Northeast Greenland, we discovered a spatial nest distribution pattern of King Eiders (*Somateria spectabilis*) and solitarily breeding Long-tailed Skuas (*Stercorarius longicaudus*), which we interpret as a case of nesting association. The inference is based on spatial statistical analyses and the timing of clutch initiations.

STUDY AREA

The field data were collected during the Swedish Northeast Greenland Expedition — Myggbukta 1979. The study area is located in the High Arctic, on Hold with Hope near Myggbukta (73°29′N, 21°34′W), a former Norwegian radio station and weather observatory in Northeast Greenland (Fig. 1). The cen-

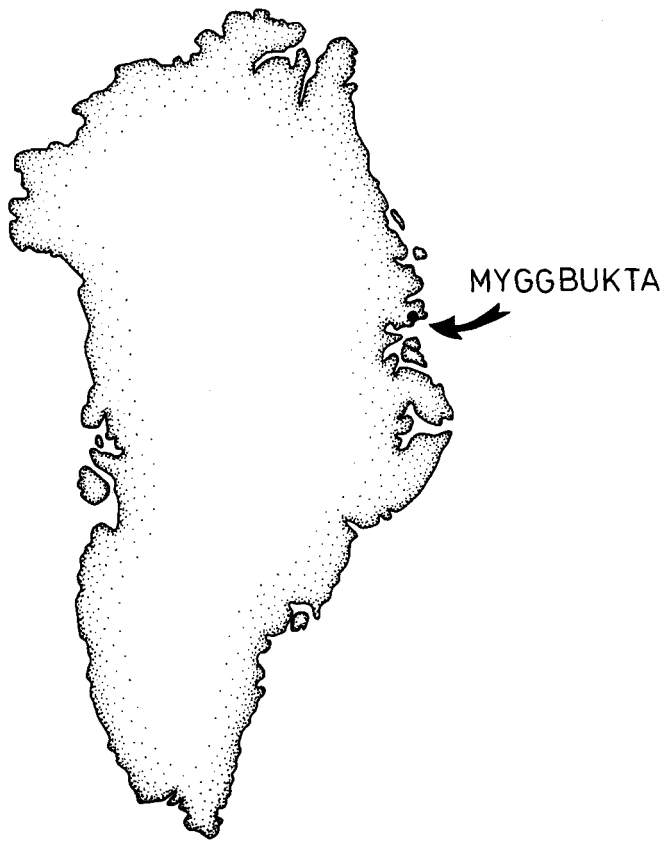

FIG. 1. Map of Greenland with study area at Myggbukta indicated.

[1]Department of Zoology, University of Stockholm, S-106 91 Stockholm, Sweden; present address: Askö Laboratory, Institute of Marine Ecology, University of Stockholm, S-106 91 Stockholm, Sweden
[2]Carl Barks väg 28, S-163 58 Spånga, Sweden

sus area at the head of Mackenzie Bugt comprises 6.1 km^2 of flat coastal plain below 50 m a.s.l. (Fig. 2). The surface drainage is interrupted by a well-preserved Quaternary beach-ridge system, forming some 200 small and shallow, permanent or temporary, water bodies. The absence of concealing vegetation and the relatively flat topography facilitated the surveying of birds and nests.

The only small rodent in the area, the collared lemming (*Dicrostonyx groenlandicus*), was abundant in 1979. Lemming predators, such as Long-tailed Skua, Snowy Owl (*Nyctea scandiaca*) and arctic fox (*Alopex lagopus*), occurred frequently. The arctic fox, the most prominent predator, feeds not only on lemmings, but often also on eggs and birds (*cf.* Meltofte *et al.*, 1981; Quinlan and Lehnhausen, 1982). The carcass of a female King Eider, leg ringed on her nest a few days earlier, was found at an inhabited fox den in the census area (Elander and Blomqvist, 1986). Other mammalian predators, such as stoat (*Mustela erminea*) (Rosenberg *et al.*, 1970; Meltofte *et al.*, 1981) and wolf (*Canis lupus*) (Dawes *et al.*, 1986), appear less frequently in this part of Greenland and were not observed during the study. A detailed description of the study area and the expedition is found in Elander and Blomqvist (1986).

FIELD DATA AND STATISTICS

Six pairs of Long-tailed Skua nested in the census area (Fig. 3). The regularity of the spread of their nest sites was measured using the *G* statistic of Brown and Rothery (1978). Our *G* value of 0.90 demonstrates an even distribution of nests and suggests the operation of a nest spacing mechanism resulting from territorial behaviour (see Maher, 1974; Andersson, 1976; Kampp, 1982).

The Long-tailed Skua defends its eggs and young by mobbing potential predators and is at the same time a predator of the eggs of other birds (Andersson, 1971; Maher, 1974; Meltofte *et al.*, 1981; Kampp, 1982; Elander and Blomqvist, 1986). Superimposing the spatial nest distribution of the King Eider around Myggbukta on that of the Long-tailed Skua, we found most King Eider nest sites to be located in the vicinity of skuas' nests. Out of ten King Eider nests, nine were found in proximity to five different nests of Long-tailed Skua (Fig. 3). The distance between nests ranged from 18.5 to 304 m, with an arithmetic mean of 153 m and a median of 133 m. The randomness of the distribution pattern of eiders' nests was tested by a nearest neighbour analysis (Clark and Evans, 1954; combined with

FIG. 2. Southward view across the census area. Some 200 tarns and ponds of the coastal plain are dammed by a well-preserved beach-ridge system. (Photo: M. Elander.)

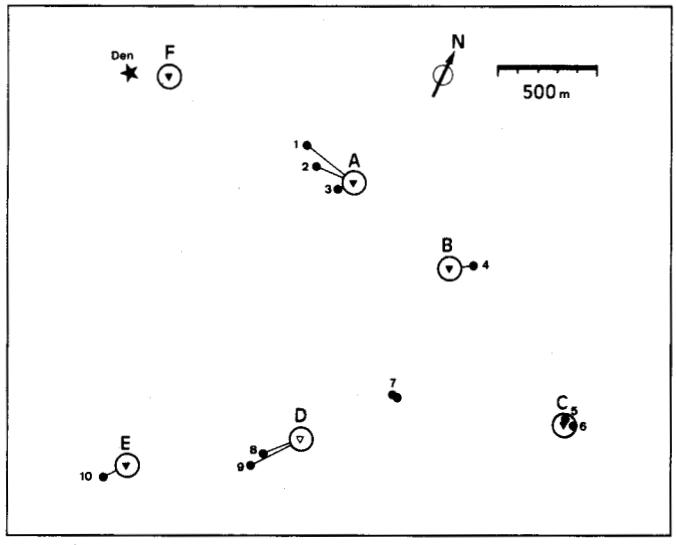

FIG. 3. Relative location of nests of Long-tailed Skua (*Stercorarius longicaudus*) (▼; ▽ indicates location of newly hatched pulli) and King Eider (*Somateria spectabilis*) (●). Associated nests are connected with a solid line or located within guide circles. An occupied den of arctic fox (*Alopex lagopus*) (★) is indicated.

Rohlf and Sokal, 1981:Table 11), and a high statistical significance for non-random clustering was found ($R = 0.37$, $c = 3.65$, $p < 0.0004$). The flat topography and general uniformity of the study area justify the statistical method used (*cf.* also Ripley, 1979). Microhabitat differences were assumed to be negligible for the nest site selection, particularly since the melt-off of snow was essentially finished well before clutch initiation.

The timing of clutch initiation for associating King Eiders was compared with that of their respective Long-tailed Skua host (Fig. 4) to determine whether the association was consistent with an active choice on the part of the eider and therefore part of a true association. Of the nine eider pairs associated with skuas, it was possible to determine or estimate clutch initiation of six, either by direct observation or through back calculation from hatching dates. An incubation period of 23 days was chosen from a reported range of 22-24 days (Johnstone, 1961; Parmelee *et al.*, 1967; Norderhaug, 1977). The initiation of the skuas' egg laying was estimated from hatching dates, using an incubation period of 25 days (Maher, 1974). A laying interval of one egg per day was assumed for both species. All six eider clutches were shown to have been initiated after or concurrently with their respective Long-tailed Skua (Fig. 4). Female King Eiders may in principle be able to associate even before the clutch initiation by the host, since the Long-tailed Skuas show aggression toward heterospecific intruders within their territories even prior to laying of their first egg. A muskox (*Ovibos moschatus*) was on one occasion fiercely mobbed by a pair of skuas when grazing near the future nest site.

INTERPRETATION AND DISCUSSION

We propose that the clustered nest distribution of the King Eider (Fig. 3) and the timing of clutch initiation (Fig. 4) are not incidental but adaptive. A suggestive parallel involving a wader is reported from northern Alaska, where Bar-tailed Godwit (*Limosa lapponica*) were found to associate with solitarily breeding Long-tailed Skuas (Maher, 1959).

Successful reproduction for female King Eiders in an area containing several egg predators requires elaborate mechanisms to minimize clutch predation. The presence of Long-tailed Skuas may in fact act as a cue in nest site selection by King Eiders (*cf.* Bergman, 1957; Koskimies, 1957). By selecting a nest site in close proximity to that of a Long-tailed Skua, King Eider may benefit from the skua's general defense of its own clutch against predators such as the arctic fox. Moreover, during laying, when eggs are particularly vulnerable, King Eiders always conceal their eggs with ripped-off vegetation and later also with down whenever the female leaves them unattended (Lamothe, 1973; pers. obs.). The hazards of avian predation during laying are illustrated by our finding the fragments of a pecked first egg in the nest cup of one eider. Bird predators peck eggs, whereas arctic foxes typically carry them away or completely break them (McEwen, 1958; Lamothe, 1973; Quinlan and Lehnhausen, 1982). We have never observed a Long-tailed Skua flush an eider off her nest once she had started to incubate. The behaviour developed by the King Eider appears to be an intricate trade-off between the possibility of having the clutch predated by the host pair of Long-tailed Skua and being defended by the host against other skuas and other predators, such as the arctic fox.

In general, nesting associations of bird species that utilize only passive protection of their eggs with hosts exerting an active and efficient anti-predator defense may be viewed as commensalism. Initially, individuals of the associating species select nest sites within the area defended by the host, thereby benefitting from indirect protection. Associated commensals, as the King Eiders in the present case, may consequently be regarded as scroungers. With an increasing degree of association (more associates and shorter distances), the probability of detection and predation on the host and its nest increases (*cf.* Curio, 1976). Thus, the host can be expected to show antagonism toward the associates, in addition to the common predator-prey relationship (*cf.* Dawkins and Krebs, 1979).

Female King Eiders were actually attacked by Long-tailed Skuas when prospecting potential nest sites by foot or when

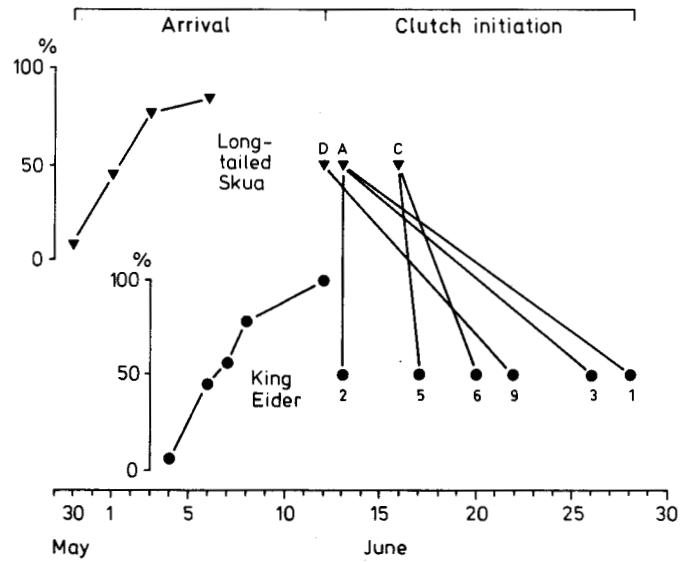

FIG. 4. Timing of events in the census area. Shown to the left is the course of spring arrival of Long-tailed Skua (*Stercorarius longicaudus*) (▼) and King Eider (*Somateria spectabilis*) (●) expressed as percent of respective final breeding population. Shown to the right is clutch initiation for individual pairs of the two species, with associated King Eider nests connected to their respective host. Letters and numerals correspond to Figure 3.

returning by foot to their nests. Similar mobbing harrassment has previously been observed elsewhere in Northeast Greenland (pers. obs. on Hochstetter Forland; Meltofte *et al.*, 1981) and is also reported from eastern Canada involving breeding Arctic Terns (*Sterna paradisaea*) and associating Red-breasted Mergansers (*Mergus serrator*) (Young and Titman, 1986:2340). Assuming, however, that female eiders can withstand agonistic behaviours of the skuas and that the reproductive output, at least sometimes, is higher for associating individuals, a state of commensalism may be maintained.

The simplicity of the habitat and of the avian community described in this study is seldom met with outside of the Arctic. Nesting associations of ducks with solitarily breeding hosts having an efficient predatory deterring defense may therefore be an overlooked phenomenon. Nesting association with solitary hosts may influence spatial distribution patterns more than hereto adopted, with implications for theories on habitat use and nest site selection of birds in general (*cf.*, *e.g.*, Hildén, 1965; Klopfer and Hailman, 1965; Fretwell, 1972:115-165; Cody, 1985).

ACKNOWLEDGEMENTS

We are grateful to Lars Silén (Department of Zoology, University of Stockholm, Sweden) and to Orlogskaptajn Mogens Guldbrandsen (Leader of the Sirius Sledge Patrol) for their encouragement and interest in our Northeast Greenland expedition, during which the field data for this study were collected. We are much indebted to Ragnar Elmgren, Frank Götmark and Christer Wiklund for critically reading drafts of the manuscript and to John T. Cayford for linguistic improvements. This study was supported financially by Åke Stordahls Minnesfond, Helge Ax:son Johnsons Stiftelse, Naturvetenskapliga föreningen vid Stockholms universitet resefond and Fondet for Dansk-Svensk Samarbejde.

REFERENCES

AHLÉN, I., and ANDERSSON, Å. 1970. Breeding ecology of an Eider population on Spitsbergen. Ornis Scandinavica 1:83-106.

ANDERSSON, M. 1971. Breeding behaviour of the Long-tailed Skua *Stercorarius longicaudus* (Vieillot). Ornis Scandinavica 2:35-54.

———. 1976. Population ecology of the Long-tailed Skua (*Stercorarius longicaudus* Vieill.). The Journal of Animal Ecology 45:537-559.

BAILEY, A.M. 1925. A report on the birds of northwestern Alaska and regions adjacent to Bering Strait. Part IV. The Condor 27:164-171.

BENGTSON, S.-A. 1972. Reproduction and fluctuations in the size of duck populations at Lake Mývatn, Iceland. Oikos 23:35-58.

BENT, A.C. 1921. Life histories of North American gulls and terns. Order Longipennes. Washington: United States National Museum Bulletin 113:1-345.

———. 1925. Life histories of North American wild fowl. Order Anseres (part). Washington: United States National Museum Bulletin 130:1-376.

BERGMAN, G. 1939. Untersuchungen über die Nistvogelfauna in einem Schärengebiet westlich von Helsingfors. Acta Zoologica Fennica 23:1-134.

———. 1957. Zum Problem der gemischten Kolonien: die Reiherente (*Aythya fuligula*) und die Lariden. Die Vogelwarte 19:15-25.

BROWN, D., and ROTHERY, P. 1978. Randomness and local regularity of points in a plane. Biometrika 65:115-122.

BUTURLIN, S.A. 1931. On the question of certain birds as nuisance. Moscow: Nature and Socialistic Economy 4(4-5):66-68. (In Russian; main parts translated into French in Le Gerfaut 23:18-22.)

CLARK, P.J., and EVANS, F.C. 1954. Distance to nearest neighbour as a measure of spatial relationships in populations. Ecology 35:445-453.

CODY, M.L. 1985. An introduction to habitat selection in birds. In: Cody, M.L., ed. Habitat Selection in Birds. Orlando: Academic Press. 3-56.

CURIO, E. 1976. The Ethology of Predation. Berlin: Springer-Verlag. 250 p.

DAWES, P.R., ELANDER, M., and ERICSON, M. 1986. The wolf (*Canis lupus*) in Greenland: a historical review and present status. Arctic 39:119-132.

DAWKINS, R., and KREBS, J.R. 1979. Arms races between and within species. Proceedings of the Royal Society of London, B 205:489-511.

DWERNYCHUK, L.W., and BOAG, D.A. 1972. Ducks nesting in association with gulls — an ecological trap? Canadian Journal of Zoology 50:559-563.

ELANDER, M., and BLOMQVIST, S. 1986. The avifauna of central North-east Greenland, 73°15'N-74°05'N, based on a visit to Myggbukta, May-July 1979. Meddelelser om Grønland, Bioscience 19:1-44.

FABRICIUS, E. 1937. Några iakttagelser rörande viggens, *Nyroca fuligula* (L.), beroende av måsfåglarna som häckfågel i skägården. Ornis Fennica 14:115-125. (In Swedish with German summary.)

———. 1983a. The Canada Goose in Sweden. SNV PM 1678. National Swedish Environmental Protection Board, Box 1302, S-171 25 Solna, Sweden. 85 p. (In Swedish with English summary.)

———. 1983b. Kanadagåsen — en livskraftig femtioåring i Sverige. Fauna och flora 78:205-222. (In Swedish with English summary.)

FRETWELL, S.D. 1972. Populations in a Seasonal Environment. Monographs in Population Biology No. 5. Princeton: Princeton University Press. 217 p.

GERELL, R. 1985. Habitat selection and nest predation in a Common Eider population in southern Sweden. Ornis Scandinavica 16:129-139.

GIROUX, J.-F. 1981. Ducks nesting in association with Canada Geese. The Journal of Wildlife Management 45:778-782.

GÖTMARK, F., and ÅHLUND, M. 1988. Nest predation and nest site selection among Eiders *Somateria mollissima*: the influence of gulls. Ibis 130:111-123.

HAGELUND, K., and NORDERHAUG, M. 1975. Studies of the productivity of the Svalbard Eider (*Somateria mollissima* [L.]) under optimal conditions. Oslo: Norsk Polarinstitutt Årbok 1973:163-174.

HILDÉN, O. 1965. Habitat selection in birds. A review. Annales Zoologici Fennici 2:53-75.

JOHNSTONE, S.T. 1961. Breeding the King Eider, 1961. The Avicultural Magazine 67:196-197.

KAMPP, K. 1982. Notes on the Long-tailed Skua *Stercorarius longicaudus* in West Greenland. Dansk Ornithologisk Forenings Tidsskrift 76:129-135.

KESSEL, B., SPRINGER, H.K., and WHITE, C.M. 1964. June birds of the Kolomak River, Yukon-Kuskokwim Delta, Alaska. The Murrelet 45:37-47.

KLOPFER, P.H., and HAILMAN, J.P. 1965. Habitat selection in birds. Advances in the Study of Behavior 1:279-303.

KOSKIMIES, J. 1957. Terns and gulls as features of habitat recognition for birds nesting in their colonies. Ornis Fennica 34:1-6.

LAMOTHE, P. 1973. Biology of King Eider (*Somateria spectabilis*) in a fresh water breeding area on Bathurst Island, N.W.T. M.Sc. thesis, Department of Zoology, University of Alberta, Edmonton, Alberta, Canada. 125 p.

LONG, R.J. 1970. A study of nest-site selection by island-nesting anatids in central Alberta. M.Sc. thesis, Department of Zoology, University of Alberta, Edmonton, Alberta, Canada. 123 p.

MAHER, W.J. 1959. Habitat distribution of birds breeding along the upper Kaolak River, northern Alaska. The Condor 61:351-368.

———. 1974. Ecology of Pomarine, Parasitic, and Long-tailed Jaegers in northern Alaska. Pacific Coast Avifauna 37:1-148.

McEWEN, E.H. 1958. Observations on the Lesser Snow Goose nesting grounds, Egg River, Banks Island. The Canadian Field-Naturalist 72:122-127.

MELTOFTE, H. 1978. A breeding association between Eiders and tethered huskies in North-east Greenland. Wildfowl 29:45-54.

———, ELANDER, M., and HJORT, C. 1981. Ornithological observations in Northeast Greenland between 74°30' and 76°00'N. lat., 1976. Meddelelser om Grønland, Bioscience 3:1-53.

NEWTON, I., and CAMPBELL, C.R.G. 1975. Breeding ducks at Loch Leven, Kinross. Waterfowl 26:83-102.

NORDERHAUG, M. 1977. Studies of the King Eider (*Somateria spectabilis*) in Svalbard. Oslo: Norsk Polarinstitutt Årbok 1976:271-283. (In Norwegian with English summary.)

NYSTRÖM, E.W. 1927. Mitteilungen über Brutvögel und Nestanalysen von dem Grundträsk-See (Kirchspiel Esbo, Südfinnland). Ornis Fennica 4:65-69.

OLSSON, V. 1951. The birds in the Källskär, Hävringe and Hartsö archipelagoes, results of a bird census made in 1949. Vår Fågelvärld 10:145-175. (In Swedish with English summary.)

PARMELEE, D.F., STEPHENS, H.A., and SCHMIDT, R.H. 1967. The birds of southeastern Victoria Island and adjacent small islands. Ottawa: National Museum of Canada Bulletin 222:1-229.

QUINLAN, S.E., and LEHNHAUSEN, W.A. 1982. Arctic fox, *Alopex lagopus*, predation on nesting Common Eiders, *Somateria mollissima*, at Icy Cape, Alaska. The Canadian Field-Naturalist 96:462-466.

RIPLEY, B.D. 1979. Test of "randomness" for spatial point patterns. Journal of the Royal Statistical Society B 41:368-374.

ROHLF, F.J., and SOKAL, R.R. 1981. Statistical Tables. 2nd ed. San Francisco: W.H. Freeman and Company. 219 p.

ROSENBERG, N.T., CHRISTENSEN, N.H., and GENSBØL, B. 1970. Bird observations in Northeast Greenland. Meddelelser om Grønland 191(1):1-87.

SCHAMEL, D. 1977. Breeding of the Common Eider (*Somateria mollissima*) on the Beaufort Sea coast of Alaska. The Condor 79:478-485.

SCHIERMANN, G. 1927. Notizen zu "Brutnachbarschaften" der Vögel. Beiträge zur Fortpflanzungsbiologie der Vögel mit Berücksichtigung der Oologie 3:159-162.

STEFÁNSSON, V. 1919. My Life with the Eskimo. New York: The Macmillan Company. 538 p.

TURNER, L.M. 1886. Contributions to the natural history of Alaska. Results of investigations made chiefly in the Yukon District and the Aleutian Islands; conducted under the auspices of the Signal Service, United States Army, extending from May, 1874, to August, 1881. Arctic Series of Publications Issued in Connection with the Signal Service, U.S. Army, No. 2. Washington, D.C.: Government Printing Office. 226 p.

USPENSKI, S.M. 1965. The geese of Wrangel Island. The Wildfowl Trust Annual Report 16:126-129.

VON HAARTMAN, L. 1937. Till kännedomen om viggens, *Nyroca fuligula* (L.), häckningspsykologi i skärgården. Ornis Fennica 14:125-134. (In Swedish with German summary.)

WILLIAMS, C.S. 1967. Honker. A Discussion of the Habits and Needs of the Largest of our Canada Geese. Princeton: D. van Nostrand Company. 179 p.

YOUNG, A.D., and TITMAN, R.D. 1986. Costs and benefits to Red-breasted Mergansers nesting in tern and gull colonies. Canadian Journal of Zoology 64:2339-2343.