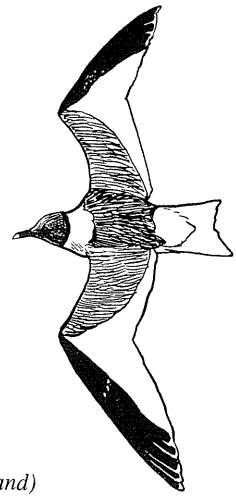
Breeding biology of Sabine's Gull *Larus sabini* in Northeast Greenland



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(Med et dansk resumé: Sabinemågens ynglebiologi i Nordøstgrønland)

The Sabine's Gull *Larus sabini* has been known to breed in Greenland since 1818 (Salomonsen 1950). It is very sparsely and patchily distributed in northwest Greenland and along the east coast north of Scoresby Sund (Forchhammer & Maagaard 1990). However, its breeding biology in Greenland has never been described in detail and the present knowledge is mainly based on short visits to a few breeding localities in East Greenland (Manniche 1910, Løppenthin 1932, Pedersen 1942, Rosenberg et al. 1970, Meltofte 1975, 1977).

The present study was carried out on the island Renskæret during 25 July - 11 August 1987 and 25-31 July 1988, during our employment at the weather station Danmarkshavn. Supplementary information from the area during the years 1986-90 was gathered by us and other personnel of the weather station. Data were obtained on breeding phenology, habitat and various other aspects of the breeding biology of Sabine's Gull, including the existence of post-hatching territories at the waterline.

Study area

The island Renskæret (76°41'N, 18°31'W) is one of several islands located south of the peninsula Kap Bismarck in the northern outlet of Dove Bugt (Fig. 1). Renskæret is a sparsely vegetated gneissic rock with a total area of 13.7 ha. The island is divided into four habitat types (Fig. 2 and 3):

I: Moist patches with a thick layer of mould, covered by a vegetation of Bryophytae, *Carex*, *Alopecurus alpinus* and *Festuca*.

II: Eroded bedrock, stony slopes and rocks with a patchy vegetation covering less than 20% of the area. Lichens, mosses, *Saxifraga*, *Carex*, *Festuca* and *Salix* are typical.

III: Banks of gravel with a maximum vegetation cover of 15%. The characteristic plants are the same as in habitat II.

IV: Gneissic rock and barren stone, sparsely vegetated.

Habitat type I covers 0.4 ha (3%), type II 3.6 ha (26%), type III 2.8 ha (21%) and type IV 6.9 ha (50%).

Climate and weather

The weather station Danmarkshavn and surroundings (Fig. 1) are located within the high-arctic re-

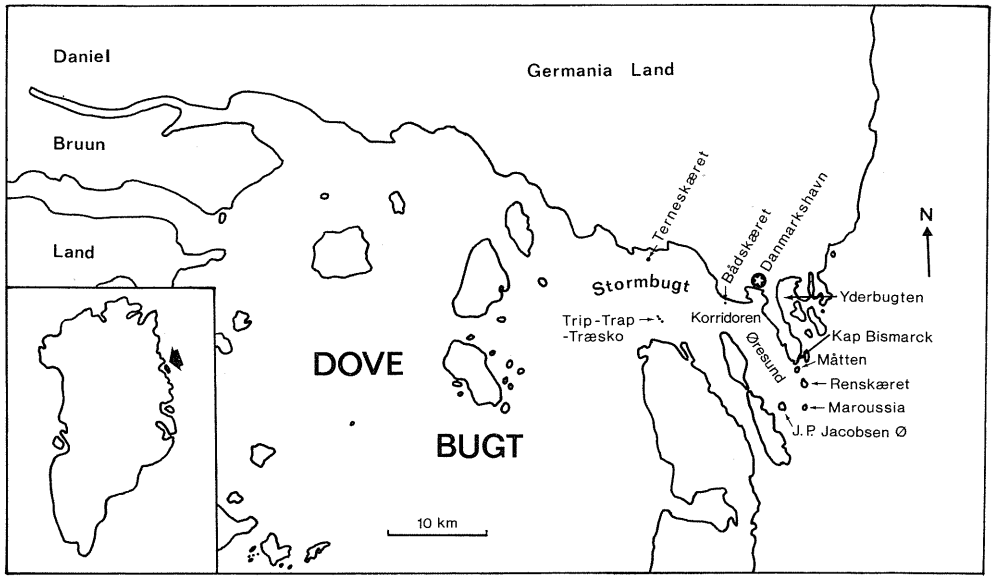

Fig. 1. Map of the northern part of Dove Bugt.
Kort over den nordlige del af Dove Bugt.

gion of Greenland. The mean temperature in July is +2.6°C.

In 1986-88, openings in the sea-ice appeared during late May and early June. By June/July most of the ice was gone in Stormbugt, Korridoren and Øresund. Dove Bugt remained covered with ice until late August.

Compared with 1986-88, the ice break-up in Øresund and Korridoren was 2-3 weeks delayed in 1989. On 12 July, the islands Måtten, Renskæret, Maroussia and J. P. Jacobsen Ø were still surrounded and connected with the mainland by ice (Boertmann et al. 1990). Most of Korridoren and Øresund were covered with ice until the end of July. On 11 August, open water was found in Øresund and Korridoren, while most of Dove Bugt was covered with ice and remained so throughout the summer (Ole Olesen pers. comm.).

In 1990, ice break-up in Korridoren and Øresund occurred about two weeks earlier than in 1986-88, and it was possible to visit Renskæret as early as 16 July.

In 1986-89, minimum temperatures below freezing occurred during late August and early September. Ice-floes were present to a varying extent throughout the summer at the islands south of Kap Bismarck and in Øresund and Korridoren. However, permanent ice-cover first occurred in late September/early October.

Material and methods

During the first day of each of the two study periods, hatched broods and nests with eggs were located and mapped with respect to habitat (Fig. 2, 3). Diameter and depth of nests were measured and lining determined. In 1987, eggs were weighed and measured using a Pesola spring balance (0.1 g scale) and a slide gauge (0.1 mm scale), respectively. Nests found were visited regularly in order to determine hatching dates and hatching success.

A total of 29 chicks were ringed. Chicks caught in 1988 were also marked with coloured tape-flags. Age of older chicks were estimated by comparison with chicks of known age.

Movements of parent birds and their chicks were followed during the post-hatcing period.

Behaviour observed within and between Sabine's Gull families during the study periods were noted. In mid-August 1987, the activity of eight pairs with chicks at the waterline was observed with a 20×60 spotting scope. Duration and type of behaviour were noted.

Besides the study on Renskæret, additional observations from 1986 to 1988 were made during boat-trips in Øresund and Stormbugt and brief visits to the islands Maroussia, Måtten and J. P. Jacobsen Ø. A visit to Renskæret and Maroussia was

made on 19 July 1990 where number and contents of nests were noted.

Mean values are given with ± 1 standard error throughout the text.

Results

Arrival

Due to the severe ice situation in Dove Bugt it was not possible to visit Renskæret during the arrival period of Sabine's Gull. The earliest observation in the Dove Bugt area is 22 June in 1989 (Boertmann et al. 1990).

Colonies and non-breeding birds

The Sabine's Gull was not observed in 1986, neither at Renskæret nor in the remaining part of Dove Bugt (Forchhammer 1990).

In 1987, 28 pairs bred on Renskæret (Fig. 2, Tab. 1). In addition, two pairs bred successfully on Maroussia. On 9 August, 15 adult birds, probably non-breeders, were seen foraging at J. P. Jacobsen Ø; no breeding was recorded on this island. One adult was seen in Stormbugt on 16 August, but no breeding was recorded on the skerries Trip-Trap-Træsko, Terneskæret and Bådsskæret, where the Arctic Tern *Sterna paradisaea* breeds.

In 1988, the colony on Renskæret numbered 17 breeding pairs (Fig. 3, Tab. 1). Måtten, Maroussia and J. P. Jacobsen Ø were not visited in 1988. A total of six adults was observed in Stormbugt on 10 August. No breeding was recorded on Trip-Trap-Træsko or Bådsskæret.

Although up to 50 adult Sabine's Gulls were observed at Renskæret on 22 August 1989, only one pair with two very small chicks was found on the island. On 18 August, 25 adults, probably non-breeders were seen in a flock at J. P. Jacobsen Ø. On the 22nd, four adults were seen on Maroussia. No breeding was recorded on these islands (J. Graugård in litt.).

In 1990, 35 nests were encountered on Renskæret but the colony was estimated to number at least 50 breeding pairs. One pair bred on Maroussia.

Nests, egg-laying and eggs

Nests of Sabine's Gulls on Renskæret were confined to slopes and plains of strongly eroded bedrock (habitat II) and to banks of gravel (habitat III) (Fig. 2, 3).

Of the 11 nests found in 1987, nine were placed in patches of *Salix* and *Carex* and two on the surface of barren gravel. In 1988, nine nests were found. Of these, five were placed in patches of *Salix* and *Carex*, two in patches of *Carex* and *Cerastium*, and two on the surface of barren gravel. The nests were partly lined with *Carex*, *Cerastium*, mosses and old twigs of *Salix*. Diameter and depth of 20 nests averaged 105.2 ± 3.7 mm and 25.3 ± 1.2 mm, respectively. Mean distance from nest to shore was 45.8 ± 4.5 m in 1987, and 40.4 ± 9.2 m in 1988.

The egg-laying was not followed. However, using an incubation period of 23-25 days (Cramp & Simmons 1983) the egg-laying period was estimated from the hatching dates (Tab. 1). Estimated in this way, egg-laying occurred from 27 June to 19 July in 1987, and from 27 June to 8 July in 1988. In 1990, the first clutches hatched around 16-17 July, indicating that egg-laying began on 22-23 June.

In 1987, the mean clutch size was 2.0 ± 0.2 (n = 10), in 1988 1.8 ± 0.2 (n = 9), and in 1990 1.8 ± 0.1 (n = 35).

In 1987, 15 eggs from eigth clutches were weighed and measured on 5 August. The mean weight was 19.3 ± 0.8 g. The mean length was 42.1 ± 0.6 mm and mean diameter was 30.8 ± 0.3 mm. The eggs were incubated by both sexes.

Territoriality

In 1987, five of the 11 nests were found in a concentrated group with an inter-nest distance of 6.7 ± 1.4 m. The remaining nests were more widely scattered (Fig. 2).

Except for two nests, being 7 metres apart, the nine nests found in 1988 were regularly distributed on the island (Fig. 3). However, since only 39% (1987) and 50% (1988) of the breeding Sabine's Gulls were found on nests, the observed distribution of nests may not accurately reflect the actual distribution.

Aggressive interactions during the incubation and post-hatching period were mainly intraspecific. The resident pairs rarely reacted on intruding or overflying Arctic Terns. During the post-hatching period a distance of less than two metres between families of Arctic Terns and Sabine's Gulls was accepted without any interactions. In contrast, intruding or overflying Sabine's Gulls immediately provoked threat-displays by the resident pairs, often followed by flight-pursuits.

Hatching and young

Hatching occurred between 23 July and 11 August in 1987, and between 23 and 30 July in 1988 (Tab. 1). During the visit to Renskæret 19 July 1990, three clutches were hatching and six were hatched.

Tab. 1. Size and hatching date of the clutches of Sabine's Gull laid on Renskæret in 1987 and 1988.
Størrelse og klækningsdato for fundne Sabinemåge-kuld på Renskæret i 1987 og 1988.

Pair No. *Par nr.*	Clutch size *Kuld-størrelse*	No. of young hatched *Antal pulli klækket*	Hatching date *Klækningsdato* Observed *Observeret*	Estimated *Estimeret*
1987				
1	?	2	–	23 July
2	?	2	?	?
3	?	1	?	?
4	2	1	1 August	–
5	?	1	?	?
6	?	2	–	25 July
7	?	2	?	?
8	?	1	?	?
9	?	2	?	?
10	?	2	?	?
11	?	2	?	?
12	?	1	–	1 August
13	3	0	–	–
14	2	0	–	–
15	?	1	–	29 July
16	1	1	after 10 August	–
17	?	1	?	?
18	?	2	?	?
19	?	1	?	?
20	2	0	–	–
21	2	2	10, 11 August	–
22	2	1	after 1 August	–
23	2	2	1, 2 August	–
24	?	2	?	?
25	?	1	?	?
26	?	1	?	?
27	2	2	after 10 August	–
28	2	1	between 4-10 August	–
1988				
1	2	2	25, 26 July	–
2	3	3	26-28 July	–
3	2	2	–	23, 24 July
4	?	2	?	?
5	?	2	–	24 July
6	1	1	28 July	–
7	?	1	–	24 July
8	2	2	28, 29 July	–
9	?	1	–	23 July
10	?	3	?	?
11	2	2	29, 30 July	–
12	2	2	27, 28 July	–
13	?	2	?	?
14	?	2	–	23, 24 July
15	?	1	–	24 July
16	1	1	29 July	–
17	1	1	29 July	–

In 1987, 10 out of 20 eggs hatched. All 16 eggs in the nine nests found in 1988 did hatch.

Egg-shell removal, as reported by Brown et al. (1967) and Abraham (1986), was observed.

The hatching of siblings was asynchronous. Two two-egg clutches were followed in 1987, and five two-egg clutches and one three-egg clutch in 1988. In all cases, the hatching interval was one day between first and second egg, as was the interval between second and third egg in the single three-egg clutch.

In 1987, a total of 19 chicks were weighed and

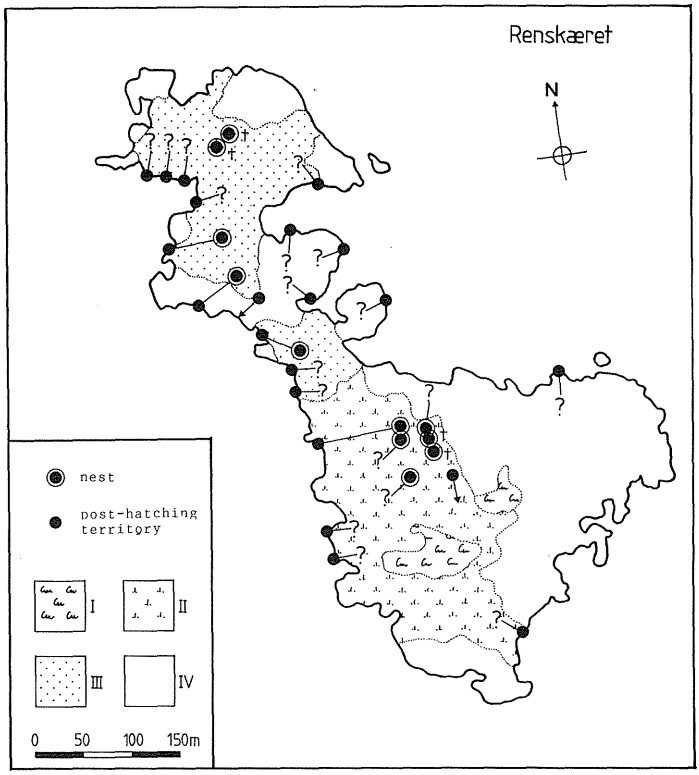

Fig. 2. Distribution of the 28 Sabine's Gull pairs on Renskæret, 1987. Nests and respective post-hatching territories are connected with lines. ?: location of nest/post-hatching territory unknown. Arrows indicate movements of newly hatched broods. †: nest deserted. Habitat types are given in the text.
Fordeling af de 28 Sabinemågepar på Renskæret, 1987. Reder og tilhørende territorier i ungeperioden er forbundet med linier. ?: placering af rede/territorium i ungeperioden ukendt. Pile angiver bevægelser af nyklækkede kuld. ◉: rede: ●: territorium i ungeperioden. †: rede forladt. Biotop-typer er beskrevet i teksten.

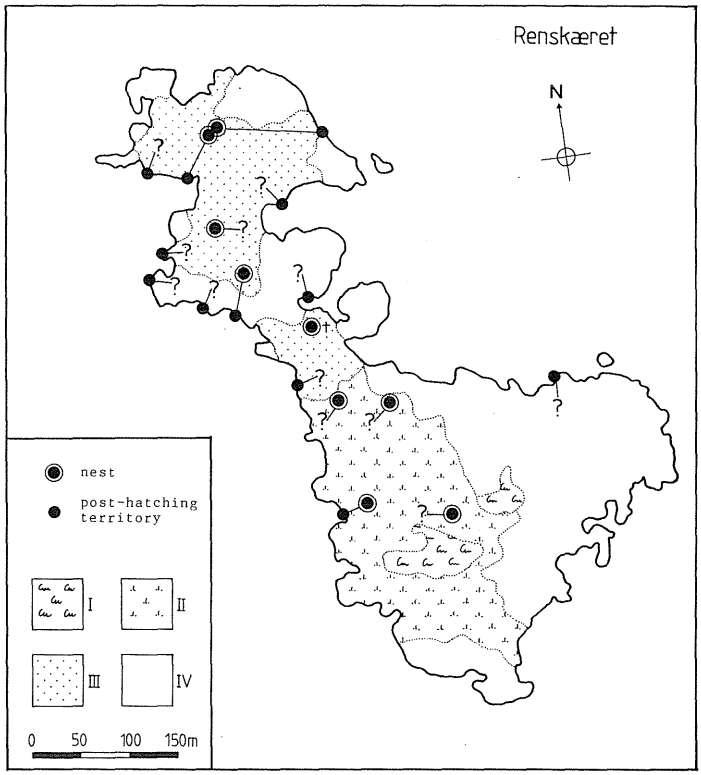

Fig. 3. Distribution of the 17 Sabine's Gull pairs on Renskæret, 1988. See Fig. 2 for further explanation.
Fordeling af de 17 Sabinemågepar på Renskæret, 1988. Se Fig. 2 for videre forklaring.

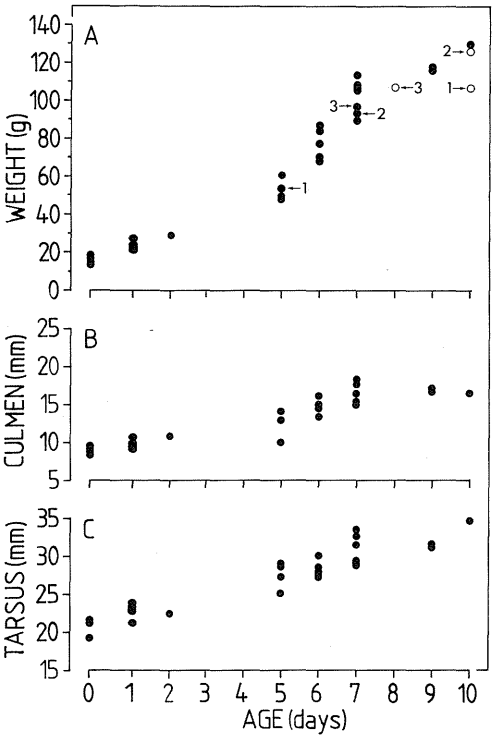

Fig. 4. Growth of 30 Sabine's Gull chicks on Renskæret 1987-88. A: weight (○ repeat weighings of numbered chicks); B: culmen; C: tarsus.
Vækst af 30 Sabinemåge-unger på Renskæret, 1987-88. A: Vægt (○ nummereret unge genfanget og vejet senere); B: næb; C: tars.

measured. Three were recaught and weighed again. In 1988, 11 chicks were weighed and measured; none were recaught. Data on body weight and length of culmen and tarsus for chicks aged 0-10 days are presented in Fig. 4 for both years combined, as no differences between seasons were apparent. The mean body weight, mean tarsus length and mean length of exposed culmen of five newly hatched Sabine's Gull chicks were 16.5 ± 0.4 g, 20.1 ± 0.4 mm and 9.1 ± 0.2 mm, respectively.

Movements

Within 24 hours after hatching, the first hatched chicks left the nest but stayed in close vicinity of the nest until the remaining egg(s) hatched. Thereafter the families moved to the waterline where they stayed until the chicks fledged.

Behaviour and post-hatching territories

In 1987, observations were made of eight families at the waterline during 10 and 11 August. Total observation-time was 255 minutes comprising three periods between 14:35 and 17:58 UTC and three periods between 23:40 and 02:30 UTC. At three observation-sites one, three and four families were under observation, respectively. Data on the behaviour of adults and chicks are summarized in Fig. 5.

Several indications suggest that pairs with broods settle at the waterline and defend small feeding territories. First, the amount of time spent in territorial defence is considerable (Fig. 5A). Second, chicks swimming offshore as a response to disturbance (by us) returned to the same place at the coast instead of moving further away from us. Third, when foraging on crustaceans on the water, chicks were ignored by the neighbouring pairs if staying within a given distance from their parents. This distance varied from 10 to 20 metres. Finally, the pairs with colour-marked chicks stayed at the same place throughout the observation periods.

Adults were not observed foraging in these post-hatching territories.

Alarming, aerial attacks and distraction displays were generally observed as described by Brown et al. (1967). Cryptic behaviour by parent birds, as reported by Abraham (1986), was not observed by us.

Departure

On 21 August 1987, one pair with two large unfledged chicks, nine adults and 13 juveniles were present on Renskæret. On 25 August, a total of six adults and six juveniles was counted. The family observed on the 21st was not seen. On 2 September, two adults were encountered on the island. In 1988, Renskæret was visited once during late August. Several adults and juveniles were present, but no pairs with chicks. The last visit to Renskæret in 1989 was on 22 August. One pair with a brood and about 50 adults were encountered (J. Graugård in litt.).

Food

Sabine's Gulls mainly fed on small fish or crustaceans in the waters around Renskæret. Together with Arctic Terns they occurred in concentrated flocks over small areas of water (indicating patchily distributed food resources). Only once did we observe an adult feed on insects on land. Feeding behaviour was tern-like. Observations of Sabine's Gulls were confined to Stormbugt, Øresund, around the islands south of Kap Bismarck and along the outer coast northwards to Yderbugt (Forchhammer 1990). In spite of several trips

1986-89, the only observation of Sabine's Gulls inland was in 1989, when two adults were seen in the western parts of Daniel Bruun Land (Boertmann et al. 1990). It thus appears that Sabine's Gulls in Dove Bugt rarely or not at all feed in inland marsh-habitats.

Only two observations of Sabine's Gulls preying on Arctic Tern eggs or chicks were made during our study. This potential food supply seemed not to be important since unguarded Arctic Tern chicks usually were left in peace, even when found near Sabine's Gulls.

Young were fed by regurgitation. In addition, young foraged on crustaceans and insects during the post-hatching period (Fig. 5B).

Discussion

With egg-laying initiated in late June and departure of juveniles and adults occurring in late August/early September, the entire breeding cycle of the colony on Renskæret is completed in about ten weeks. This is three weeks more than found in East Bay on Southampton Island in Canada (Abraham 1986). The longer breeding cycle on Renskæret may be possible because open water, and thus access to food, is found as late as mid-September or even later. Ice-floes begin to clog East Bay in mid-August (Abraham 1986).

In both study years the mean clutch size on Renskæret was lower than reported from Canada (Sutton 1932, Parmelee et al. 1967, Abraham 1986) where three-egg clutches are common. This difference in clutch size may be connected with the difference in feeding habitat. At Renskæret, Sabine's Gulls feed mainly at sea and must leave their broods in order to gather food. On the marshy tundra of East Bay food is abundant within the nesting habitat, enabling the parents to feed their chicks often and with little energy expended per foraging trip (Abraham 1986).

The hatching success in 1987 (50%) was low compared with the hatching success of 83% observed at East Bay (Abraham 1986). This was primarily due to nest-desertion owing to disturbance. In addition to the authors, the island was visited by several people from Danmarkshavn in 1987. In 1988, Renskæret was only visited by one of the authors and a hatching success of 100% was recorded. No eggs were lost to predators.

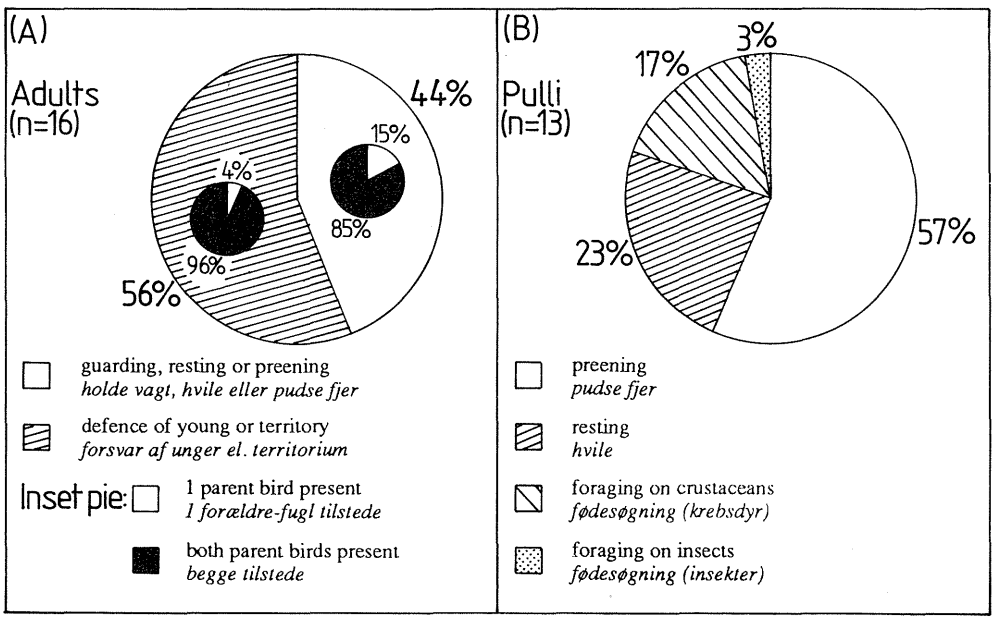

Fig. 5. Activity of Sabine's Gull families at the waterline of Renskæret, 10-11 August 1987. Age of chicks was estimated to 6-12 days. A total observation time of 255 minutes for both parent birds and chicks was partitioned as shown. Inset pie in A indicate percent of time with one and both parent birds present, respectively.
Aktivitet af Sabinemåge-familier ved vandkanten på Renskæret, 10-11. august 1987. Alder af pulli estimeredes til 6-12 dage. En total observationstid på 255 minutter for både forældrefugle og pulli er fordelt som vist i henholdsvis A og B. Indsatte cirkel i A angiver tilstedeværelsen af en eller begge forældrefugle.

Photo: Mads Forchhammer.

The mean weight of newly hatched chicks on Renskæret was almost the same as found at East Bay (Abraham 1986). The East Bay Sabine's Gull chicks grew from 10% to 90% of the adult weight within 13 days (Abraham 1986). We did not weigh chicks older than 10 days. However, our growth curves (Fig. 4) for chicks up to ten days old are very similar to those found by Abraham (1986).

In East Bay, chicks as young as 2-3 days were seen pecking at adult chironomids and tipulids (Abraham 1986), and it is known that these insects constitute a substantial part of the diet of chicks (Abraham & Ankney 1984). Whether the feeding on crustaceans and insects (Fig. 5B) play a similar role in the food supply of Sabine's Gull chicks on Renskæret is unknown.

It appears likely that the nidifugous habit and feeding behaviour of Sabine's Gull chicks is essential for their rapid growth rate. In view of this, the apparent existence of post-hatching territories on Renskæret is of speciel interest. These territories, defended by the parents, serve as undisturbed feeding areas for the chicks and allow them to maximize their food intake. Abraham (1986) did not report such post-hatching territories which may be due to the difference in breeding habitat. At East Bay, abundant food is found within the nesting habitat: the marshy tundra (Abraham 1986). On Renskæret, food is limited around nesting sites where vegetation is sparse and no freshwater ponds are found. Consequently, all families leave the nesting habitat and settle along the waterline of the island.

Flocks of non-breeding birds near the breeding colonies have been observed at several localities in East Greenland (Løppenthin 1932, Bird & Bird 1941, Pedersen 1942, Hjort et al. 1983, Boertmann et al. 1985, Hjort et al. 1988, D. Boertmann in litt., this study). It has not, to our knowledge, been reported elsewhere. The significance of the presence of these non-breeders is unclear. They could be young pre-breeding birds. An alternative hypothesis is that a marginal breeding area like Greenland is frequented by a number of summering gulls (probably young adults) that attempt to breed when and if conditions are favourable, i.e., use an opportunistic breeding strategy.

In conslusion, the breeding biology of Sabine's Gull in Greenland differs in several respects from that found in Canada. Further investigations are needed, however, to fully clarify the breeding strategies of the Sabine's Gull in Greenland.

Photo: Lars Maagaard.

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Resumé

Sabinemågens ynglebiologi i Nordøstgrønland

I forbindelse med et to-årigt ophold på vejrstationen Danmarkshavn, Nordøstgrønland studeredes Sabinemågens ynglebiologi på Renskæret, der ligger 9-10 km syd for Danmarkshavn i den nordøstlige del af Dove Bugt (Fig. 1). Undersøgelsen fandt sted i juli/august 1987 og juli 1988.

Renskæret er en 13,7 ha stor, sparsomt bevokset klippeø. Klimaet er højarktisk med ringe nedbør og fast havis det meste af året. I normale år går isen i begyndelsen af juni, og i midten af juli er det meste af isen forsvundet fra vandene omkring Renskæret. Isflager i varierende mængde forekommer hele sommeren, men havet fryser først til ult. september/pri. oktober.

Æglægningen påbegyndes i slutningen af juni, og æggene klækker i slutningen af juli og begyndelsen af august. Afrejse sker gradvist fra med./ult. august til pri. september, hvilket giver en ynglecyklus på godt 10 uger.

Rederne anlægges på flader af stærkt eroderet grundfjeld (habitat II) eller skærver (habitat III) (Fig. 2, 3).

I 1987 talte kolonien på Renskæret 28 par, i 1988 17 par (Fig. 2, 3) og i 1990 mindst 50 par. Sent opbrud af havisen gjorde, at kun ét par ynglede i 1989, selvom godt 50 Sabinemåger var tilstede. 1986 var ligeledes et "overspringsår", hvor der ikke observeredes Sabinemåger i Dove Bugt. På naboøen Maroussia ynglede i 1987 to par og i 1990 et par.

I 1987-88 fandtes ialt 20 reder. Gennemsnitlige diameter og dybde var henholdsvis 105,2 ± 3,7 mm og 25,3 ± 1,2 mm. Rederne var delvist foret med strå og kviste. Mål og vægt for 15 æg i 1987 var henholdsvis 42,1 ± 0,6 × 30,8 ± 0,3 mm og 19,3 ± 0,8 g.

Den gennemsnitlige kuldstørrelse på Renskæret var to æg.

Ud fra fangst og genfangst af dununger konstrueredes vækstkurver for vægt, tarsus og næb (Fig. 4). Kurverne ligner meget dem, der er fundet for Sabinemåger på Southampton Island, Canada.

Efter klækningen forlod familierne redepladserne og slog sig ned ved vandlinien. En aktivitets-undersøgelse af familierne her viste bl.a., at dununger (6-12 dage gamle) brugte 20% af tiden på at fange krebsdyr og insekter (Fig. 5). Desuden observeredes fodring af dununger, både ved redeplads og ved vandlinien.

Adulte Sabinemåger blev primært observeret fouragerende i saltvand, hvor de fangede småfisk eller krebsdyr.

Observationerne tyder på, at Sabinemåge-parrene forsvarer et lille territorium ved vandlinien, inden for hvilket ungerne kan fouragere i fred. Noget tilsvarende er

ikke kendt andre steder, men kan være en forudsætning for ungernes hurtige vækst i Grønland. I Canada yngler Sabinemågen på fugtig tundra, hvor der formodentlig er rigelig føde til ungerne i redens umiddelbare omgivelser. Sabinemågeunger finder en væsentlig del af deres føde selv, i tillæg til det som forældrene bringer til dem.

Flokke af ikke-ynglende fugle nær ved kolonierne er observeret ved flere af ynglelokaliteterne i Østgrønland, hvilket ikke er rapporteret uden for Grønland. De ikke-ynglende flokke kan være unge uerfarne individer. Alternativt kan det være oversomrende individer, som opportunistisk forsøger at yngle når og hvis forholdene tillader det.

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