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Breeding Arctic Terns Kill Lemmings

M.L. MALLORY,[1,2] K.A. BOADWAY,[3] J.J.T. BOADWAY[3] and J.A. AKEAROK[1]

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ABSTRACT. Arctic terns (*Sterna paradisaea*) are well known for exhibiting vigorous defense of nests at their breeding colonies. However, in 2008 we observed a previously unreported behavior by terns. We watched chick-rearing adult terns attacking collared lemmings (*Dicrostonyx groenlandicus*), which included repeatedly lifting them into the air and dropping them to the tundra until they died. Terns attack certain birds and mammals that intrude on their breeding territory but do not attack other species that are known to depredate eggs, suggesting that the ability of terns to discriminate threats is imperfect.

Key words: arctic tern, collared lemming, *Dicrostonyx groenlandicus*, *Sterna paradisaea*

RÉSUMÉ. Les sternes arctiques (*Sterna paradisaea*) sont bien connues pour la défense rigoureuse des nids de leurs colonies de reproduction. Cependant, en 2008, nous avons observé un comportement chez les sternes qui n'avait jamais été signalé auparavant. Nous avons vu des sternes adultes en train d'élever leurs petits s'attaquer à des lemmings à collerette (*Dicrostonyx groenlandicus*), notamment en les soulevant sans cesse dans les airs et en les laissant tomber sur la toundra jusqu'à ce qu'ils meurent. Les sternes attaquent certains oiseaux et mammifères qui s'infiltrent dans leur territoire de reproduction, mais elles ne s'attaquent pas aux autres espèces qui s'adonnent à la déprédation d'œufs, ce qui laisse croire que l'aptitude des sternes à discriminer les menaces est imparfaite.

Mots clés : sterne arctique, lemming à collerette, *Dicrostonyx groenlandicus*, *Sterna paradisaea*

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The arctic tern (*Sterna paradisaea*) is a small, migratory, ground-nesting seabird (Hatch, 2002), which has a circumpolar breeding range and nests in colonies containing up to several hundred pairs in the Canadian High Arctic (Mallory and Gilchrist, 2003). When a predator approaches, terns exhibit group defense of the breeding colony. For most avian predators (e.g., gulls, jaegers), terns mob and chase the bird away. For predators approaching on the ground (generally mammalian), terns also attack and mob the intruder, repeatedly diving and striking at its head and using their sharp bills with sufficient strength to pierce the skin and draw blood (in the case of humans; summarized in Hatch, 2002).

We studied arctic terns at a colony in Queen's Channel in the Canadian High Arctic (Fig. 1; "Nasaruvaalik Island"; 75.82° N, 96.31° W) during the breeding seasons of 2007 to 2009 (generally between 15 June and 15 August each year). Approximately 300 pairs of terns nested within 2–10 m of each other on one end of a small island (colony area ~0.125 km^2), along with several pairs of common eiders (*Somateria mollissima*), long-tailed ducks (*Clangula hyemalis*) and Sabine's gulls (*Xema sabini*). These species may nest in close association with terns because a tern colony provides strong protection against most predators (Hatch, 2002; Nguyen et al., 2006). During the years of study, terns laid eggs between 1 and 10 July, and they defended their nests vigorously against researchers, polar bears (*Ursus maritimus*), and arctic foxes (*Vulpes lagopus*) entering the colony. In 2008, the island experienced a high abundance of collared lemmings (*Dicrostonyx groenlandicus*; see Bêty et al., 2002 for discussion of lemming cycles). Many lemmings had burrows within the limits of the tern colony, where they fed principally on purple saxifrage (*Saxifraga oppositifolia*). Although lemmings are herbivores, they will gnaw on antlers or skeletons on the ground (presumably to get calcium and minerals; pers. obs.), but they are not reported as predators of bird nests (e.g., Wilson and Ruff, 1999). Nonetheless, breeding terns appear to perceive most vertebrates moving on the ground in their territories as potential threats and will hover above a moving object and dive at it. For example, terns dive at ducks and gulls, including chicks of both species, that are walking along the ground through their territories, a behaviour that has also been noted at other colonies (Hatch, 2002). Also, while trapping nesting terns, we had to reel in a metal bow-net trigger mechanism (0.5 cm diameter × 15 cm long) on the end of the trip cord. We regularly had up to 10 terns diving at this trigger as we dragged it across the ground through several territories.

During daily colony visits in late July 2008, we noticed several dead lemmings in the tern colony, but we did not

[1] Canadian Wildlife Service, Environment Canada, Iqaluit, Nunavut X0A 0H0, Canada
[2] Corresponding author: mark.mallory@ec.gc.ca
[3] Department of Biology, University of New Brunswick, 10 Bailey Drive, Fredericton, New Brunswick E3B 5A3, Canada

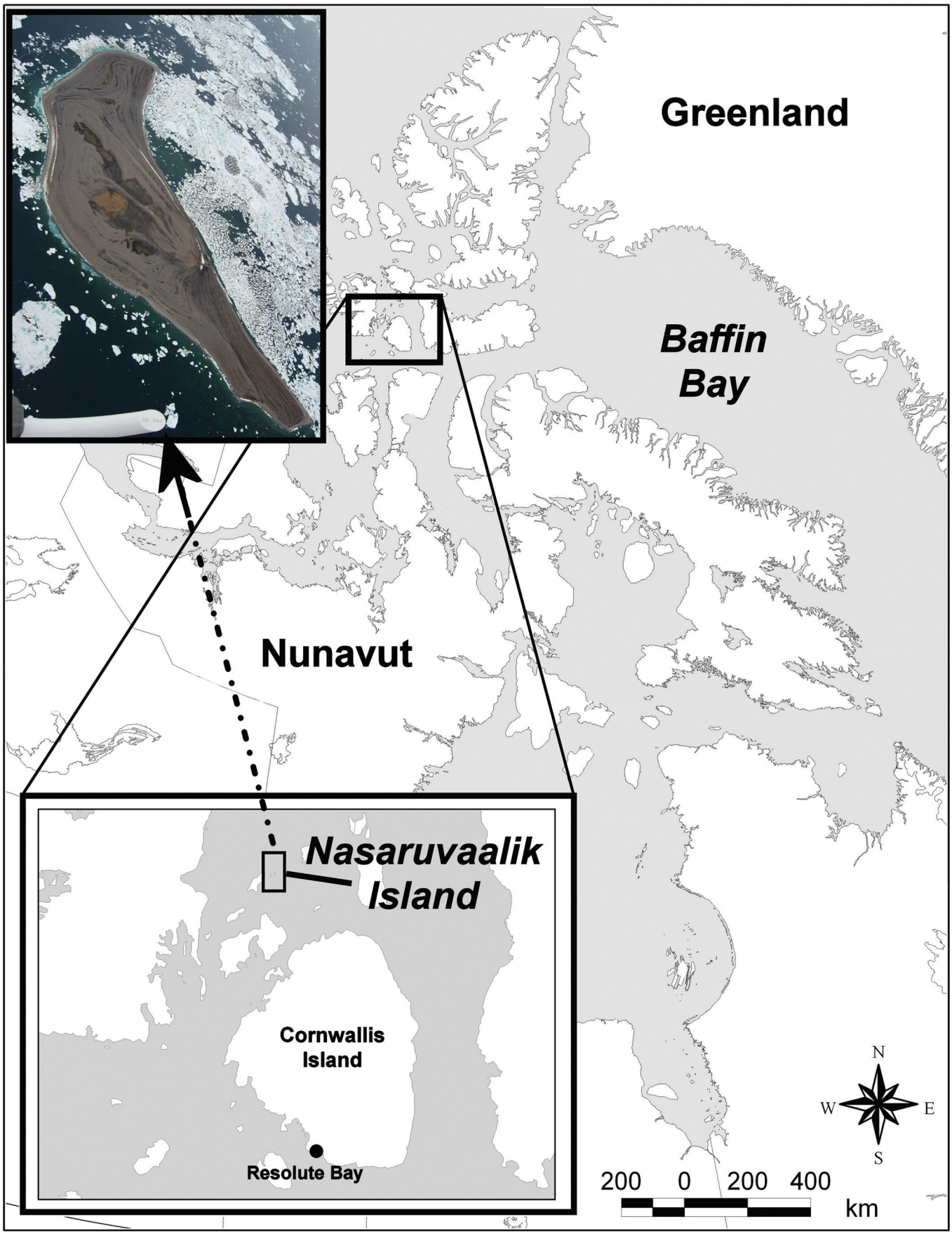

FIG. 1. The study site, unofficially known as "Nasaruvaalik Island," north of Cornwallis Island. The island supports colonies of both terns and lemmings.

know what caused the mortality. However, on 31 July 2008, when using 15–60× spotting scopes to conduct time-activity budgets on chick-rearing terns 5–50 m from the blind, we observed several adults diving at lemmings moving within the colony. The terns involved appeared to be principally those with nests near the lemmings, consistent with Drury's (1960) suggestion that in Arctic colonies, only a few terns at a time (those with nearby nests) mob predators. Not only did the terns use their bills to strike the lemmings, but they picked many of them up repeatedly and dropped them in the same spot (i.e., did not travel horizontally with the lemming) from heights estimated at up to 3 m. The terns never landed on the ground during the attacks. After being attacked, lemmings would run either to a hole or out of the tern's territory, or if sufficiently wounded, they would lie motionless on the ground. Once the intruder was out of the territory or motionless, the terns returned to their nest sites. We observed this behavior on numerous occasions during late July and early August throughout the colony and estimated that at least 20 lemmings were injured or killed in this manner. To our knowledge, this is the first report of arctic terns killing mammals.

During incubation and chick-rearing, arctic terns are generally larger than 100 g (93–139 g; Hatch, 2002). The mean mass of 22 lemmings we caught between 3 and 8 July 2008 was 53 ± 4 SE g (range 25–97 g). Although we did not weigh the lemmings that were killed, from our blind we described them as "both large and small," with terns usually lifting the smaller ones. Therefore, it seems likely that terns were lifting lemmings into the air that were at least 25% of their body mass.

At some Arctic seabird colonies, the addition of marine-derived nutrients to the terrestrial environment by nesting seabirds (guano, dropped food, mortality) allows for relatively lush growth of vegetation, which in turn creates suitable habitats for other organisms like insectivores and herbivores (Polis et al., 1997; Michelutti et al., 2009). At Nasaruvaalik Island, the area within and near the tern colony is comparably "lush," although vegetation was almost 100% small, low saxifrage tussocks, as well as moss carpet and lichen—that is, nothing that lemmings could hide in. Nonetheless, lemmings apparently exploit the food resources that proliferate near the tern colony on an otherwise minimally vegetated island. Because we observed this behaviour only in 2008, we predict that in most years with low lemming abundance, aggressive behaviour by nesting terns probably precludes persistence of lemmings anywhere in the colony with high tern densities. Since there are also lemming burrows outside the colony, we do not believe that lemmings live within the colony to benefit from the protection provided by the terns against avian predators (gulls, jaegers, ravens), as other bird species apparently do. The extent to which lemming mortality due to tern attacks might exist at other arctic tern colonies is unknown. Nasaruvaalik Island differs from nearby islands, as most other islands with nesting terns in this region are either smaller with no vegetation (hence no food for lemmings), or larger, in which case they probably support mammalian predators (Mallory and Gilchrist, 2003).

Our study provides additional support for the idea that arctic terns are aggressive during nesting and attack intruders of many vertebrates that enter their territory, even those that are not predators (e.g., eiders, although they could accidentally crush tern eggs). However, there are exceptions. At our site, snow buntings (*Plectrophenax nivalis*), a small passerine, red knots (*Calidris canutus*), a medium-sized shorebird, and eastern High Arctic brant (*Branta bernicla hrota*), a small goose, regularly land within and walk through the colony, and we have not witnessed tern aggression towards any of these species. The fact that some birds (e.g., ruddy turnstones, *Arenaria interpres*) are not attacked even though they may depredate nests (Hatch, 2002) suggests that such events are uncommon, or that the terns' discrimination between threats and non-threats is imperfect.

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REFERENCES

Bêty, J., Gauthier, G., Korpimäki, E., and Giroux, J.-F. 2002. Shared predators and indirect trophic interactions: Lemming cycles and Arctic-nesting geese. Ecology 71:88–98.

Drury, W.H. 1960. Breeding activities of long-tailed jaeger, herring gull and arctic tern on Bylot Island, Northwest Territories, Canada. Bird-Banding 31:63–79.

Hatch, J.J. 2002. Arctic tern (*Sterna paradisaea*). In: Poole, A., and Gill, F., eds. The birds of North America, No. 707. Philadelphia: The Birds of North America, Inc.

Mallory, M.L., and Gilchrist, H.G. 2003. Marine birds breeding in Penny Strait and Queens Channel, Nunavut, Canada. Polar Research 22:399–403, doi:10.1111/j.1751-8369.2003.tb00121.x.

Michelutti, N., Keatley, B.E., Brimble, S., Blais, J.M., Liu, H., Douglas, M.S.V., Mallory, M.L., Macdonald, R.W., and Smol, J.P. 2009. Seabird-driven shifts in Arctic pond ecosystems. Proceedings of the Royal Society B 276:591–596.

Nguyen, L.P., Abraham, K.F., and Nol, E. 2006. Influence of arctic terns on survival of artificial and natural semipalmated plover nests. Waterbirds 29:100–104, doi:10.1675/1524-4695(2006)29[100:IOATOS]2.0.CO;2.

Polis, G.A., Anderson, W.B., and Holt, R.D. 1997. Toward an integration of landscape and food web ecology: The dynamics of spatially subsidized food webs. Annual Review of Ecology and Systematics 28:289–316.

Wilson, D.E., and Ruff, S. 1999. The Smithsonian book of North American mammals. Washington, D.C.: Smithsonian Institution Press. 750 p.