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Predation and Caching of Seabirds by Red Foxes (*Vulpes vulpes*) on Baccalieu Island, Newfoundland

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Red Foxes (*Vulpes vulpes*) prey on and cache many burrow- and cliff-nesting seabirds on Baccalieu Island, Newfoundland, possibly for use in winter when food is scarce or unavailable. The large seabird population do not appear to be threatened by the small number of foxes on the island, although the situation is potentially dangerous for burrow-nesting species (Leach's Storm-Petrels (*Oceanodroma leucorhoa*), Atlantic Puffins (*Fratercula arctica*)).

Key Words: seabirds, predation, foxes, caches, Newfoundland, Leach's Storm-Petrel, Atlantic Puffin, Red Foxes.

Nesting on cliffs and in burrows are considered to be antipredator adaptations (e.g. Tuck 1961). Both aerial and terrestrial predators, however, are often successful against these birds (Nettleship 1972; Montevecchi 1978; Jones and Byrd 1979). In this paper cases of predatory and caching activities by Red Foxes (*Vulpes vulpes*) on cliff- and burrow-nesting seabirds on Baccalieu Island, Newfoundland (48°07'N, 54°12'W), are described.

Foxes were first seen on the island in winter 1959–1960, when pack ice jammed the 3.2 km channel separating the island from the mainland (E. Blundon and P. Rice, Baccalieu Island, personal communication). Currently they are the only mammals that inhabit the island. Baccalieu Island (6 × 1 km) supports hundreds of thousands of breeding pairs of Leach's Storm-Petrels (*Oceanodroma leucorhoa*, possibly the largest colony in the world), and many thousands of Black-legged Kittiwakes (*Rissa tridactyla*), Atlantic Puffins (*Fratercula arctica*), and Common Murres (*Uria aalge*) (Brown et al. 1975).

In 1976–1978, we found expanses (hundreds of square metres) of petrel nesting ground on grassy slopes dug out by foxes (Figure 1). In 1978, we found fragments in fox scats or chewed remains of 11 eggshells of murres, kittiwakes, puffins, and Northern Gannets (*Morus bassanus*). Some eggshells may have been discarded by Common Ravens (*Corvus corax*) and subsequently chewed up and ingested by foxes.

On 11 June 1978, in part of an active fox den and in an adjacent burrow-like excavation (about 1.5 × 1 × 1 m), we found a cache containing fresh carcasses of 30 petrels, 3 kittiwakes, 3 puffins, a Common Murre, and a Fox Sparrow (*Passerella iliaca*), all adults. In August 1980, two other fox caches were located about 1.5 km away in an area where another den was suspected (a kit sighted with an adult fox on 21 June). One cache contained the fresh carcasses of at least 27 petrels (two chicks), 29 puffins (four chicks); the other contained 15 petrels, 9 puffins, a fledgling kittiwake, and a murre chick (K. Brink and D. Roby, University of Pennsylvania, personal communication).

We do not know the extent to which foxes cache prey elsewhere. Arctic Foxes (*Alopex lagopus*) are known to hoard substantial food in a single location, though Red Foxes are not (D. Macdonald, Oxford University, personal communication). Many uneaten, discarded, petrel carcasses were found on the island, especially in the wooded areas (cf. Kruuk 1972).

We first witnessed predation on 23 June 1979 at 11:25, when a Red Fox, walking along a cliff top, caused a large number of nesting kittiwakes and murres to scatter in panic from the ledges below. The fox climbed down the nearly vertical cliff and carried a murre egg up the cliff and out of view. Sixteen murre eggs were taken in this way in 95 min. On 28 June 1979, we again saw a fox climb down this cliff, scaring off the kittiwakes and murres. This time the fox dug a



FIGURE 1. An area where burrows of Leach's Storm-Petrels were dug out by Red Foxes (photo: W. A. Montevecchi)

puffin out of a burrow in a grassy area among the ledges and carried it off.

The Red Fox population on Baccalieu apparently includes two or more adult breeding pairs, as kits have been seen in most years, and two active dens were found in 1978. In winter, Willow Ptarmigan (*Lagopus lagopus*), a few small land birds, and berries may provide foxes with limited food. The vertical cliffs around the island's perimeter and absence of beaches preclude scavenging on marine invertebrates and carrion. Winter food shortages apparently keep the population in check, and foxes may have to cache sizable quantities of seabirds to survive. No decline in seabird numbers in the 20 years foxes have lived on the island is evident, though such changes would not be easily detectable in view of the absence of standardized estimates of the large populations of burrow-nesters. Marine birds with low reproductive rates may be very seriously affected by additional sources of adult mortality. Petrels and puffins, whose nest-site selection patterns have evolved on islands free of land predators, are particularly vulnerable to foxes; adults of cliff-nesting species are less likely to be preyed on even in areas accessible to foxes. The extirpation by foxes of any seabird species on Baccalieu Island seems unlikely. However, in view of depredations foxes have inflicted on seabird islands (Jones and Byrd 1979) and the apparent lack of alternative prey on Baccalieu, we conclude that systematic efforts should be made to assess the foxes' impact.

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