



FIG. 1. Subadult Bald Eagles observed/km of shoreline during aerial surveys, Chippewa National Forest, Minnesota, 1977-78.

We interpret the mid-April peak as a migratory wave. The decline that followed may be due partly to continued northward migration and partly to shifts to small creeks not covered by our surveys. Several groups of eagles were observed on such creeks and may have been attracted by spawning suckers (*Catostomus commersoni*, *Moxotoma macrolepidotum*), which are important Bald Eagle foods in the Spring (Dunstan and Harper, J. Wildl. Manage. 39: 140-143, 1975). We suggest that as the number of spawning fish declines, eagles begin to search for food, and tend to move to large lakes where more abundant food supplies may exist during summer and autumn. Because riparian areas are being developed rapidly for housing and recreation, inventory of existing undeveloped shoreline and the acquisition of habitat or conservation easements by responsible agencies seems appropriate.

*Acknowledgments.*—We thank L. A. Diffley for assistance with field work, N. S. Fraser for help with manuscript preparation, and L. Oosterhuis for drawing the figure. We are grateful for funding provided by the National Wildlife Federation, the Hunt-Wesson Corporation, the Caleb Dorr Fund, the Malvin and Josephine Herz Foundation, the Minnesota Agricultural Experiment Station, and the U.S. Forest Service.—JAMES D. FRASER AND L. D. FRENZEL, Dept. Entomology, Fisheries and Wildlife, Univ. Minnesota, St. Paul, Minnesota 55108; JOHN E. MATHISEN, U.S. Forest Service, Cass Lake, Minnesota 56633; AND MARK E. SHOUGH, Bemidji Airlines, Inc., Bemidji, Minnesota 56601. (Present address of JDF: Dept. Fisheries and Wildlife Sciences, Virginia Polytechnic Institute and State Univ., Blacksburg, Virginia 24061.) Accepted 20 Mar. 1985.

*Wilson Bull.*, 97(3), 1985, pp. 366-368

**Skua predation on penguin eggs: the influence of egg quality and location.**—Versatile predatory birds such as the *Catharacta* skuas (Murphy, Oceanic Birds of South America, American Museum of Natural History, New York, New York, 1936) face two potentially conflicting requirements. On the one hand they must be able to assess prey profitability with

minimum expenditure of time or energy (Hughes, *Am. Nat.* 113:209–221, 1979). On the other hand they must regularly sample potential sources of prey so that new sources do not go unexploited. Such sampling is often, and I believe reasonably, invoked to explain deviations by birds from the predictions of short-term maximization of energy gain (e.g., Krebs, pp. 23–63 in *Behavioural Ecology*, J. R. Krebs and N. B. Davies, eds., Blackwell, Oxford, England, 1978). The present study of Subantarctic Skuas (*Catharacta antarctica*) shows that they possess the ability to discriminate items of different profitability. They nevertheless do sometimes take prey (broken egg shells) that in all normal circumstances have zero value. I attribute this to the need to sample the environment continually in order to discover new prey sources.

Throughout the Antarctic (Jouventin and Guillotin, *Terre et Vie* 33:109–127, 1979) and Subantarctic (Stonehouse, *F.I.D.S. Sci. Repts. No. 14*:1–25, 1956) penguin colonies are harassed by *Catharacta* skuas. At Marion Island (46°53'S, 37°52'E) in the Southern Ocean, Subantarctic Skuas are major egg predators of Macaroni Penguins (*Eudyptes chrysolophus*), which nest in colonies of up to about 200,000 pairs. Skuas continually patrol the penguin colonies, and, whenever an egg is exposed, snatch it up and then usually carry it beyond the colony to eat. As a result, the land bordering the colony is littered with discarded penguin egg shells and eggs with holes. Yet the skuas do not continually investigate such eggs. This suggests that the skuas use the location of the egg, within the colony vs without, as a cue on which to base the decision whether or not to approach.

To test this, eggs were placed at various distances from the penguin colony and among the nesting penguins. This preliminary experiment failed because penguins kicked aside, attempted to incubate, or otherwise molested test eggs placed within the colony. Accordingly, two experiments were carried out that showed that skuas used both the location (Experiment one) and condition (Experiment two) of the potential egg prey as cues. The experiments were completed between 27 December 1983 and 12 January 1984, at the very end of the Macaroni Penguin incubation period.

In Experiment one, five Macaroni Penguin eggs were placed in each of the following four locations: (a) on the ground and not obscured by grass, 20 m from the edge of the penguin colony, (b) as (a) but 50 m from the edge of the penguin colony, (c) in a Southern Giant Petrel (*Macronectes giganteus*) nest that was transferred, by lifting the entire tussock grass mat that constituted the nest, from the petrel colony to a position 5 m from a (b) egg, and (d) in a Southern Giant Petrel nest that was unoccupied but still in situ within the petrel colony and also about 50 m from the edge of the penguin colony. The test eggs were predated penguin eggs with small holes such that, when the eggs were placed hole downward, they appeared intact. Macaroni Penguin eggs resemble in size, color, and shape the eggs of the Southern Giant Petrel. The eggs were filled with earth so that they weighed approximately the same as whole eggs. The eggs were checked 1, 2, and 6 h after placement. I then determined which eggs were undisturbed and which had been moved or broken open by skuas. Once an egg was opened and the earth contents revealed, the skuas left the egg. There were no other predators that might have disturbed the eggs.

Experiment one was repeated twice. There were no significant differences between treatments (a) and (b) nor between treatments (c) and (d) (cf. Andersson and Wiklund, *Anim. Behav.* 26:1207–1212, 1978). Eggs in petrel nests (treatments [c] and [d]), however, were taken more rapidly than eggs placed on the ground (treatments [a] and [b]). After one hour, 6 of 20 eggs placed in nests had been taken compared with 3 of 20 eggs on the ground. After six hours, 17 of 20 eggs placed in nests had been taken compared with 7 of 20 eggs on the ground ( $\chi^2 = 10.42$ ,  $df = 1$ ,  $P < 0.01$ ).

In Experiment two, 10 Southern Giant Petrel nests were removed from the petrel colony and placed as five pairs 50 m from the edge of the penguin colony. The two nests of a pair

were 2–3 m apart. One Macaroni Penguin egg was placed in each nest. Each pair of nests included one nest holding an empty egg with the hole visible and uppermost (“broken egg”) and another nest containing an earth-filled egg with the hole invisible (“intact egg”). The eggs were checked 1, 2, and 6 h after placement. The experiment was repeated twice, at intervals of five and three days. On the nine occasions (out of 15 pairs of nests) that the first egg taken could be identified, the intact egg was always taken before the broken egg (Binomial test,  $P = 0.002$ ), which was left alone. On three occasions both eggs were taken by the time of the same hourly check, but on the three occasions neither egg was taken after 6 h.

The two experiments demonstrate that skuas take eggs placed within nests more rapidly than eggs placed on the ground, and that intact eggs are taken more rapidly than broken eggs. The skuas’ ability to use the cues of prey condition and location ensures that they usually concentrate their search on the most profitable eggs, namely those within the colony. But broken eggs also were occasionally taken. This may be the result of errors in recognition, or it may be an instance of the sampling behaviour that enables skuas to discover and then exploit new sources of food.

*Acknowledgments.*—Scientific research at Marion Island is carried out under the auspices of the South African Committee for Antarctic Research. Financial and logistical support of the Dept. Transport is gratefully acknowledged, as are grants from the Royal Society, the Percy Sladen Memorial Fund and the British Ornithologists’ Union. J. Cooper and Drs. K. Bildstein, P. Evans, and J. Lucas commented constructively on a draft of this paper. M. Mitchell helped with the typing.—M. DE L. BROOKE, *Percy Fitzpatrick Institute, Univ. Cape Town, Rondebosch 7700, South Africa.* (Present address: *Edward Grey Institute, Zoology Dept., South Parks Road, Oxford OX1 3PS, United Kingdom.*) Accepted 30 Jan. 1985.

*Wilson Bull.*, 97(3), 1985, pp. 368–370

**Early autumn movements and prebasic molt of Swainson’s Thrushes.**—It is generally assumed that most north temperate migratory passerines, other than some flycatchers and swallows, molt in the vicinity of their breeding areas and then migrate (Dwight, *Ann. New York Acad. Sci.* 13:73–360, 1900; Payne, pp. 104–155 in *Avian Biology*, Vol. 2, D. S. Farner and J. R. King, eds., Academic Press, New York, New York, 1972). Here I present molt data for adult Swainson’s Thrushes (*Catharus ustulatus*) that were captured during late July to mid-September at sites away from their breeding range.

Molt data for Swainson’s Thrushes were collected from three banding stations: Berne, Albany County, New York; Long Point Bird Observatory (LPBO), Long Point, Ontario; and Prince Edward Point Bird Observatory (PEPT), Prince Edward Point, Ontario. At Berne I operated about 15 mist nets daily during late July through mid-September 1982, and from mid-August to early September 1983. Data were collected using a system similar to that of the British Trust for Ornithology (BTO) molt card (Snow, *British Trust for Ornithology Field Guide No. 11*, 1967) whereby the stage of molt of each flight feather is scored on a scale of 0–5 (see Cherry and Cannell, *J. Field Ornithol.*, in press). My method differs from the BTO scores in that 1 = feather missing or in pin, and 2 = feather breaking out of pin to less than one-third grown. The BTO system was used at LPBO in 1977 and 1978, and at PEPT in 1979. Not all birds captured at LPBO and PEPT were examined for molt. I