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BEHAVIORAL IMPLICATIONS OF THE DEFENSE OF A SHOVELER BROOD BY COMMON EIDERS

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Several hundred pairs of Common Eiders (*Somateria mollissima*) breed in the Mast River delta at La Pérouse Bay, 40 km east of Churchill, Manitoba. Nesting was clumped and the incident described below happened in the vicinity of one of the nesting aggregations. I made the following observations during the first week of July 1977, when eider young were hatching.

A female Northern Shoveler (*Anas clypeata*) and a brood of 12 young about five days old were flushed from the vegetation at the edge of an island in the river delta. The female began leading the brood across open water toward an island 100 m away. A Herring Gull (*Larus argentatus*) flying above me immediately flew to the brood, making several progressively lower passes over them. Each time the shoveler rose out of the water at the gull with wings spread and bill open, issuing alarm calls. Five female eiders from an unknown location flew directly to the brood and landed in a close circle around the shoveler and her young. The gull swooped twice more over the brood and was repelled by several of the eiders rising out of the water. At that point, the gull ceased attacking and the shoveler, brood and eiders continued unharassed to the next island. The shoveler persistently rushed at the eiders with the head low and neck extended. In spite of this, the eiders maintained a tight formation around the shoveler and her brood at least until 15 min later, when they were lost from sight.

Crèche behavior is well documented in Common Eiders (Gorman and Milne, Ornis Scand. 3:21, 1972; Munro and Bédard, Auk 94:759, 1977), although the selective advantage of the associated behaviors remains controversial. The response of the female eiders described above closely resembled the behavior of "visiting" females when eider crèches are threatened by larid predation (Munro and Bédard, J. Anim. Ecol. 46:799, 1977). Munro and Bédard (Auk 94:759, 1977) attributed such behavior to latent broodiness in unsuccessful nesting females although this is qualified by the statement that females who fail early in incubation will be indifferent toward ducklings. However, Gorman and Milne (Ornis. Scand. 3:21, 1972) maintained that only females who successfully hatch young associate with crèches. Although I did not know whether or not the five eiders had bred successfully, it seems unlikely that latent broodiness in unsuccessful females was sufficient to explain the observed behavior. Since the eiders responded to a shoveler, perhaps the broodiness observed was due to a hormonal state maintained at a high level after successful nesting.

In a crèching system, many females who are hatching young will lose their young to crèches controlled by more dominant females (Munro and Bédard, Auk 94:759, 1977). Subsequent mixing of broods may make it impossible for the displaced females to keep track of their young, resulting in selection for generalized defense of crèches. Strong selection pressure for such behavior would explain why occasionally the individuals defended may be unrelated or even of a different species, due to the presence of a stimulus similar to that which elicits the correct response.

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PHYSICAL DEFORMITIES IN A POPULATION OF WINTERING BLACKBIRDS

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Bill deformities are usually reported as isolated sightings of single individuals. The significance of such abnormalities has been discussed (Fox 1952) but almost nothing is known about their frequency. We have found no data indicating the proportion of abnormalities that might be expected in a blackbird population. Individuals with abnormal bills have been reported for the Yellow-headed Blackbird (*Xanthocephalus xanthocephalus*; Easterla and Todd 1971) and the Red-winged Blackbird (*Agelaius phoeniceus*; Morton 1963). We report here several additional cases of abnormalities, most of which were in Red-winged Blackbirds and Brown-headed Cowbirds (*Molothrus ater*).

Observations of birds were made during March 1976, between November 1976 and April 1977, and from November 1977 through April 1978 at six backyard feeders in an urban area of northwest Ft. Worth, Tarrant Co., Texas. All sightings were made at a distance of 8 m or less. Birds at these feeders were principally Red-winged Blackbirds, Brown-headed Cowbirds, Common Grackles (*Quiscalus quiscula*), Great-tailed Grackles (*Cassidix mexicanus*) and House Sparrows (*Passer domesticus*). Counts were made to allow estimation of total numbers observed. Bill length was estimated visually on abnormal birds, and drawings were done to show the kinds of deformities noted (Fig. 1).

When the first abnormal bird was seen approximately 100–150 Red-winged Blackbirds (99% males) were feeding daily. The total population observed was estimated at 500 to 1,000 birds based on the repeated return of birds with bill abnormalities. Thus the frequency of bill deformities was about 0.3 to 0.6% in the first time period and 0.5 to 1.0% in the second period.

Birds with deformities or disabilities may have re-

BIRD	LATERAL VIEW	UPPER LENGTH	LOWER LENGTH	MIDLINE DEVIATION
1	a	1.5 X NORMAL	NORMAL	SLIGHT
2	b	1.7 X NORMAL	0.5 X NORMAL	SLIGHT
3	c	1.5 X NORMAL	0.75 X NORMAL	MODERATE
4	d	1.2 X NORMAL	0.25X NORMAL	SLIGHT
5	e	1.5 X NORMAL	0.5 X NORMAL	SLIGHT
6	f	1.5 X NORMAL TOP	NORMAL	NONE
7	g	1.5 X NORMAL	0.5 X NORMAL	NONE
8	h	NORMAL	1.5 X NORMAL	NONE

FIGURE 1. Diagrams of bill deformities seen in mature male Red-winged Blackbirds in two populations. Birds 1–3 were seen during March 1976, birds 4–8 between November 1976 and April 1977.

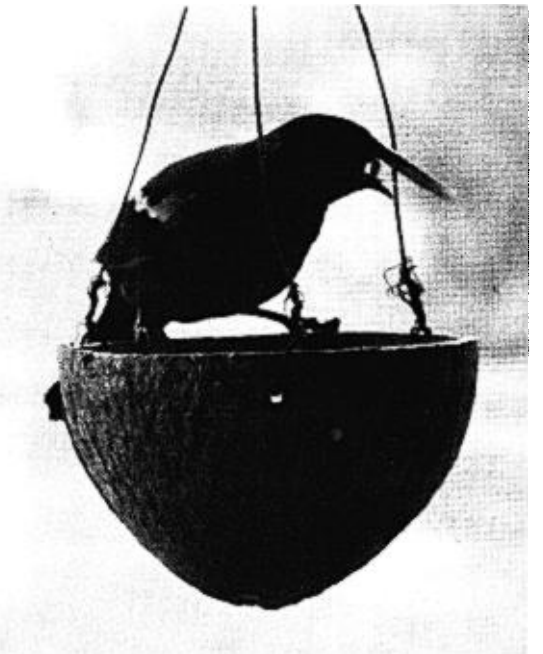

FIGURE 2. Abnormal Red-winged Blackbird (bird 2b in Fig. 1) observed in March 1976.

turned because they had difficulty feeding elsewhere. During the third observation period all identifiable marks were noted to determine the frequency of return of non-handicapped birds. The number of individuals with various abnormalities are given in Table 1. Birds with white feathers returned repeatedly and some remained in the area longer than the handicapped birds. Eighteen male Red-winged Blackbirds with abnormal bills were observed during the third time period. Based on an estimated number of 1,000 to 1,500 Red-winged Blackbirds seen, these figures suggest that 1.2 to 1.8% have bill deformities. Four male cowbirds were observed with bill deformities similar to those found in Red-winged Blackbirds (Fig. 1). None was seen in the first two periods. Approximately 500 to 1,000 cowbirds were observed during each time period. Thus the incidence of deformities in cowbirds was zero for the first two periods and 0.4% for the third period.

Leg and wing problems were probably greater than recorded in Table 1, because they were not always as apparent as were the bill deformities. Birds with such features were recorded as new sightings when more than one abnormal bird was observed at the same time or when a prolonged (two week or greater) time lapse had occurred since the previous sighting. Wing and leg problems were also seen in cowbirds and grackles. Some birds were missing a foot; at the other extreme an entire leg was missing. Leg deformities consisted of toes tightly curled, stiff knee joints, stiff hip, and bending of a leg joint at acute angles to the body. Wing problems involved drooping of one or both wings. White feathers ranged from one feather, to multiple single feathers, to large white patches scattered over the entire body. Bald spots on the head varied in extent (from approximately 0.5 × 0.5 cm to 1.0 × 1.5 cm) but all were located in the occipital and supraorbital regions. The skin of the denuded area was apparently normal in all but one Red-winged Blackbird where it was reddened and the bird scratched the area repeatedly. Nine birds with double abnormalities were seen (Table 2).

Feeding behavior was the same in all birds with deformed bills. Extreme elongation of either mandible required the bird to turn its head on one side to pick up grain on a flat surface. Birds with abnormal bills tended to feed at deep feeders because the long mandible could be driven down into the seed until the shorter mandible was in contact with the grain (Fig 2).

Most of the birds with abnormal bills appeared to be in good condition. Two cowbirds, one Great-tailed Grackle and one Red-winged Blackbird appeared to be ill, with ruffled feathers and sluggish movements. Bird number 8 (Fig. 1) had roughened feathers and seldom remained stationary for any period of time. It repeatedly probed among its breast feathers (possibly for ectoparasites), but the length of the lower bill prevented the bird from grasping its feathers between the mandibles.

Many more deformities probably occurred than were seen. Many abnormal birds may have died owing to environmental pressures (e.g., predators, lack of food, temperature extremes), in perhaps a higher proportion than normal.

The abnormalities noted in these blackbirds could have resulted from trauma, infection, genetic defects, or developmental problems. The disproportionately high frequency of malformed bills and other abnormalities in one species (Red-winged Blackbird) makes trauma appear unlikely. Spontaneous mutations in chickens are known to produce abnormalities similar to those seen (Romanoff 1972), but little evidence supports the inheritance of bill abnormalities (Pomeroy 1962). Hodges (1952) suggested a genetic basis for two

TABLE 1. Number of males (M) and females (F) observed with abnormalities in populations of wintering blackbirds.

Abnormality	Red-winged Blackbird	Brown-headed Cowbird		Grackle		
				Common	Great-tailed	
	M	M	F	M	M	F
Bill						
Upper long	7	3	0	1	0	0
Lower long	8	1	0	0	0	1
Both long	1	0	0	0	0	0
Crossed bill	2	0	0	0	0	1
Leg						
Missing	9	5	0	1	1	2
Deformed	16	5	1	2	1	1
Wing						
Drooping	15	5	1	3	2	1
Feather						
Bald head	13	9	1	0	0	0
White	32	6	1	3	0	0
No tail	2	1	0	1	0	1
Total	105	35	4	11	4	7
Estimated no. of birds observed	1,000–1,500	500–1,000		50–100	25–50	

nestling American Robins (*Turdus migratorius*) with abnormal bills. The white feathers and bald spots we saw in the blackbirds suggest genetic defects (Sturkie 1941, Sittmann et al. 1966). Several chemical and physical agents have been shown to modify development leading to morphological changes similar to those caused by genetic defects (Roger et al. 1969, Romanoff 1972, Landauer and Salam 1973, Gilani 1974).

Some abnormalities in birds are thought to be associated with environmental contaminants. Bill abnormalities in a number of partridges (*Perdix perdix*) were apparently related to pollution in a coal mining area (Ash 1958). Gochfeld (1975) reported multiple abnormalities in terns, with feather defects occurring in 0.90% and bill defects in 0.17%. Mercury levels were higher in some abnormal birds, but no cause-effect relationship was established. Several types of abnormalities (involving feathers, legs, eyes, beaks, etc.) were reported in terns at frequencies of 0.1% in 1969 and 1.3% in 1970 (Hays and Risebrough 1972). These conditions resembled those produced experimentally by chlorinated dibenzo-p-dioxins and polychlorinated biphenyls.

The literature contains little indicating the proportion of abnormalities one might expect in a population uncontaminated by synthetic pollutants. Hicks (1934) reported total abnormalities of 5.4% in a very large sample of Starlings (*Sturnus vulgaris*). Over 60% of these defects consisted of missing toenails, a condition that would not have been noted in our study. He reported 1.04% foot and leg problems, 0.06% wing problems and 0.11% white feathering. By comparison, we found abnormality frequencies of 2.5% in the feet and legs, 1.5% in the wings, and 3.2% in the plumage. Abnormal bills were reported by Hicks in 0.38% of his sample. An incidence of bill abnormality well under 0.5% has been suggested for birds in the wild (Pomeroy 1962). Frequency of all abnormalities in Red-winged Blackbirds in this study was estimated to be 7.0 to 10.5%, with bill abnormality frequencies of 0.3–

TABLE 2. Blackbirds with double abnormalities.

Bird	Abnormality					
		Leg				
	Bill	Missing	Deformed	Wing	White	Bald
Great-tailed Grackle	+		+			
Brown-headed Cowbird		+				+
Red-winged Blackbird						
Bird 1		+				+
2			+			+
3			+			+
4	+		+			
5			+		+	
6				+	+	

0.6, 0.5–1.0 and 1.2–1.8% for the three study periods.

Within the past 15 years, blackbirds have become the specific targets of new avicidal chemicals. Apparently no one has investigated possible hazards to adult birds not killed by these compounds or to their offspring. We hope that this report will lead to more widespread observations to detect abnormalities in birds which come into contact with agricultural chemicals.

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THE UROPYGIAL GLAND OF THE SOOTY TERN

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The classical experiments of J. B. Watson and K. S. Lashley (1915) on the Sooty Tern (*Sterna fuscata*) resulted in the now widely accepted idea that this bird becomes waterlogged if it rests on water. In one of a series of tests on Sooty and Noddy (*Anous stolidus*) terns, the authors reported (1915:39): "One noddy and one sooty were held in the water and at times immersed in it for a period of 10 minutes. The birds were then placed gently on the surface. The noddy immediately raised itself and flew over to the land. The sooty was helpless under these conditions. While in the water it floundered about, getting the tips of its wings out, but could not rise. Since it was becoming more and more waterlogged, I rescued it . . . ." In other tests, the two terns were placed in cages over water; Sooty Terns, but not Noddy Terns, became waterlogged in as little as 25 min. The conclusions from these tests that Sooty Terns become waterlogged and may drown if they alight on water have led subsequent investigators to speculate on their pelagic behavior. For example, Ashmole (1963:30) in his studies of the breeding and feeding biology of these terns believed that they "would never deliberately rest on the water for more than a minute or so . . . ." Sooty Terns normally feed by dipping, without plunging below the surface (Ashmole and Ashmole 1967). Austin (1961:133) stated: "The Sooty Tern, one of the most pelagic of all terns, practically never enters the water, but snatches its food daintily from the surface in flight. Another pelagic species, the Noddy, often settles on water where fish are schooling and feeds like a gull." Dinsmore (1972:171) reported that Sooty Terns ". . . apparently seldom rest on water. As Sooties inhabit the open oceans during the nonbreeding season, birds from some colonies must fly continuously for 6 months or more." Finally, Serventy et al. (1971:29) noted: "The Sooty Tern can apparently sleep on the wing—or do without it altogether—for it is found over the open oceans many days from land and cannot rest on the sea since its plumage becomes waterlogged owing to the inefficiency of the preen gland."

Although waterlogging in the Sooty Tern might be due to a number of factors (e.g., feather structure or chemical composition of the preening oil), the present report addresses itself solely to this species' uropygial gland as it might relate to the putative waterlogging property.

Weight. In 1860, Crisp presented data that suggest uropygial glands of waterbirds are heavier than those of landbirds. Elder (1954) and Kennedy (1971) subsequently confirmed Crisp's belief. Nonetheless, variations in uropygial gland weights are poorly understood and scantily documented. In conjunction with my investigation emphasizing *S. fuscata*, glands from 5 genera and 13 species (including *fuscata*) of terns were weighed and compared with the birds' fresh body weights. Body weights ranged from 46 g (*S. albifrons*) to 698 g (*S. caspia*). Body weight and uropygial gland weight are positively correlated (Fig. 1; regression line, least squares method, $r = 0.87$). Specifically the