In each of the preceding examples, the primary song of each species was demonstrated to have either an intrasexual or an intersexual function; none showed that primary songs serve a dual function. Dual function of primary song has been experimentally demonstrated in the Cuban Grassquit (*Tiaris canora*). Songs used to court females are longer and contain more syllable types than those which are used in male/male interactions (Baptista, J. Ornithol. 119:91–101, 1978). In the present study, it was shown that a Five-striped Sparrow changed the complexity of his songs and song bouts according to the context in which they were sung. The songs of males singing in the presence of a female, consisted of numerous note complex types occurring together within a song, and song bouts consisted of many nonrepetitive song types. During a male/male interaction (i.e., after playback), the songs and song bouts became less complex and more stereotyped. Songs often consisted of only one note complex type and, within a song bout, song types were sung repetitively. Thus, it appears that songs of Five-striped Sparrows play a dual role and are influenced by both intra- and intersexual selection; their songs are short, simple, and stereotyped when used for male repulsion, and are longer, more complex, and variable when used for female attraction or stimulation. This may be the first evidence of a species exhibiting repertoire elasticity within songs, as well as between bouts, and how it is related to the sexual context in which it occurs.

Sandhill Crane use of nest markers as cues for predation.—Many authors have raised concerns about increased nest predation on study species as a result of investigator activities. Examples include research on waterfowl (e.g., Hammond and Forward, J. Wildl. Manage. 20:243–247, 1956; Strang, J. Wildl. Manage. 44:220–222, 1980), larids (e.g., Robert and Ralph, Condor 77:495–499, 1975; Fetterolf, Wilson Bull. 95:23–41, 1983), and passerines (e.g., Lenington, Auk 96:190–192, 1979), but see Nichols et al. (Auk 101:398–402, 1984). Although increased nest predation has often been observed, there is little information about how the predators are attracted to nests. I describe here direct observations of a Sandhill Crane (*Grus canadensis*) locating shorebird nests by cueing in on nest markers.

The observations were made in 1983, during a study of breeding Red-necked Phalaropes (*Phalaropus lobatus*) at the Queen's University Tundra Biology Station at La Pérouse Bay, 40 km east of Churchill, Manitoba (58°24′N, 94°24′W). The 2-km² study area is in the delta of the Mast River, characterized by numerous small islands dominated by 0.2–1.0 m high willow (*Salix brachycarpa*) and dwarf birch (*Betula glandulosa*), and sedges (e.g., *Carex aquatilis*). A more detailed description of the study area is provided by Jefferies et al. (Can. J. Bot. 57:1439–1450, 1979).

From mid-June to late July, the locations of 50 phalarope nests and 130 Semipalmated Sandpiper (*Calidris pusilla*) nests were marked with 50-cm high unpainted wooden stakes that were placed 2–3 m south to southeast of each nest. In addition, 3061 Snow Goose (*Chen caerulescens*) nests were staked similarly on the shorebird site and in the surrounding

area. There were 150–200 other stakes in the area, marking nest sites used by geese and shorebirds in previous years, as well as banding locations for Willow Ptarmigan (*Lagopus lagopus*).

On 13 July at 18:45 EST, I observed two Sandhill Cranes walking through the study area. Detailed observations were made on the individual nearest to me for 45 min, during which it walked approximately 600 m. The crane usually moved slowly with its head bent close to the ground, occasionally probing vegetation. Its searching pattern was occasionally punctuated by greatly intensified searches which consisted of the bird moving back and forth quickly over areas approximately 2 m², peering at the ground intently for 30–60 sec at a time. These intensive searches occurred at only seven specific locations; all were around nest stakes. All nest stakes within 25 m of the crane were explored by the bird. Four of the seven stakes marked Semipalmated Sandpiper nests, in three of which the eggs had hatched previously; the eggs in the fourth had already been taken by an unknown predator. Two of the seven markers indicated phalarope nests, both of which contained eggs. The seventh stake had been used the previous year to mark a Snow Goose nest. On two occasions the crane ran very quickly toward nest stakes from 15 to 20 m away, immediately adopting its intensified search behavior upon reaching the stake.

No predations were observed directly. Although my view of the crane was obscured by vegetation when it investigated the first nest, I later discovered that the eggs from this phalarope nest had, in fact, been taken. The other active nest was well concealed and apparently overlooked by the crane. However, an immediate inspection of the other phalarope nests that had been active when checked within the previous 2 days revealed that the contents of 7 of 19 nests had been preyed upon. The ground around three of these depredated nests was perforated by holes like those made by a crane probing with its bill. The eggs in most Semipalmated Sandpiper nests had already hatched prior to this observation (C. L. Gratto, pers. comm.).

All shorebird nest markers were removed immediately, and in the ensuing weeks the contents of only one more nest were preyed upon; the eggs in the other 11 hatched, as did eggs in three more nests discovered after 13 July. This drop in predation may not have been due to the absence of markers, but of the cranes themselves, since they were not seen again on the study area after I flushed them following my initial observations.

These observations extend previous reports concerning the opportunistic nature of Sandhill Crane feeding behavior. In addition to eating a large variety of plants and invertebrates (Walkinshaw, The Sandhill Crane, Cranbrook Inst. Sci. Bull. 29, 1949; Mullins and Bizeau, Auk 95:175–178, 1978), Sandhill Cranes have preyed upon ducklings (Littlefield, Wilson Bull. 88:503–504, 1976), Canada Goose (*Branta canadensis*) eggs (Hoffman, Wilson Bull. 92:122, 1980), Willow Ptarmigan chicks, and Snow Goose eggs (Harvey et al., Wilson Bull. 80:421–425, 1968).

My observations also provide evidence that Sandhill Cranes are capable of associating a food source with a particular (in this case artificial) visual cue. This is analogous to experimental findings on associative learning in Carrion Crows (*Corvus corone*) (Croze, Searching Image in Carrion Crows, Paul Parey, Berlin, 1970). An interpretation of associative learning, rather than simply a strategy of investigating novel stimuli regardless of past experience, is suggested because the crane ignored other novel items such as brightly colored flagging tape and 1-m high blue stakes marking locations where adult ptarmigan were captured. Although cranes had been seen regularly in the surrounding area before these observations, they were seen only briefly twice on the shorebird study area 5 and 8 days before. Prior to this observation, cranes may have associated markers with Snow Goose nests outside the study area, although such depredations had never been observed. However, in 1984 two cranes were seen taking Snow Goose eggs on one occasion (R. F. Rockwell, pers. comm.). On the

day the phalarope nests were preyed upon, no Snow Goose nests were active, and only approximately 7% of all markers in the shorebird study area indicated nests containing eggs.

Three explanations other than nest markers being used to detect the nests may be discounted: (1) habitat cues were unlikely because of the varied nature of nest sites ranging from damp sedge areas to drier sites dominated by willows; (2) trails in the vegetation, resulting from our visits, were minimized because all nests were on small islands, and many were checked by us without walking on land; (3) even if Sandhill Cranes possess a sufficiently developed olfactory system, in most cases scents were not available since terminated nests had not been visited for weeks, and the abandoned Snow Goose nest was ignored by us all season.

Nest markers have seldom been shown conclusively to be of importance as cues to predators in nest predation, although it has frequently been acknowledged that markers pose a potential problem, particularly for such opportunistic predators as corvids (Hammond and Forward 1956). Picozzi (J. Wildl. Manage. 39:151–155, 1975) used artificial nests resembling those of Red Grouse (*Lagopus l. scoticus*) to study predation on marked and unmarked nests and found Carrion Crows learned to locate nests by the presence of brightly marked nest stakes. Predation was higher in marked than unmarked nests, even when markers were placed 10 and 20 m away. A similar study of predation on Sage Grouse (*Centrocercus urophasianus*) nests by Common Ravens (*Corvus corax*) suggested similar conclusions (Autenrieth, Sage Grouse Management in Idaho, Idaho Dept. Fish and Game, Wildl. Bull. No. 9, 1981).

Generally, birds which use active defense or inaccessibility to deter predation (e.g., most colonial species) will not be affected as strongly by nest markers. However, the evidence presented here of opportunistic predation by cranes, and the findings of others on corvids suggests that investigators studying birds that rely primarily upon crypsis for nest defense should be particularly cautious with nest markers.

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Northern Harrier kills Sandhill Crane. — On 2 August 1983 I observed an adult female Northern Harrier (*Circus cyaneus*) attack and kill a 5-week old Sandhill Crane (*Grus canadensis*). This attack occurred at approximately 10:00 at the Big Hole National Battlefield, 19 km west of Wisdom, Beaverhead Co., Montana. The juvenile crane was accompanied by two adults and one other juvenile. The cranes were foraging in a wet meadow at the time of the attack.

The young cranes were approximately 8 m from the adults and 2 m apart when the harrier made four passes to within 1 m and attacked. Both juvenile cranes looked up at the harrier as it passed overhead; the crane that was being attacked crouched down during the passes, while the other juvenile watched passively. The adults continued feeding, seemingly unaware