SHORT COMMUNICATIONS

AGGRESSIVE ENCOUNTERS BETWEEN TUNDRA SWANS AND GREATER WHITE-FRONTED GEESE DURING BROOD REARING[1]

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Interspecific aggression in waterfowl (Anatidae) is relatively common (McKinney 1965; Kear 1972; Savard 1982, 1984), but interactions leading to mortality of one of the combatants are rarely-observed in the wild. A recent debate (Livezey and Humphrey 1985a, 1985b; Nuechterlein and Storer 1985a, 1985b; Murray 1985) has centered on the proximate and ultimate causes of interspecific territoriality and killing in the steamer-ducks (*Tachyeres* spp.), a group of large-bodied anatids. We report here aggressive encounters between Greater White-fronted Geese (*Anser albifrons*) and Tundra Swans (*Cygnus columbianus*) during brood rearing on the Yukon-Kuskokwim Delta, Alaska, which on two occasions resulted in the death of a White-fronted Goose gosling.

Greater White-fronted Goose families aggregate after hatch (Ely 1979) and remain in "brood groups" until fledging (C. Ely, unpubl.). Little is known of the behavior of Tundra Swans during brood rearing, but families remain solitary after hatch, and probably hold territories until the young fledge (Kear 1972).

We observed families of Greater White-fronted Geese between 9 July and 10 August 1985 when goslings and

Tundra Swan cygnets were between two and seven weeks old. Observations were made from blinds atop 4-m high towers which were placed adjacent to two areas used by the geese during brood rearing. Without disturbing broods, blinds were entered through canvas tubes connecting the entrances of the blinds to access sloughs.

We observed 12 encounters between adult swans and two different groups of Greater White-fronted Goose families. In every instance an adult swan, acting alone, attacked one of the two groups. For six of the incidents we were able to determine that the attacking swan was associated with a mate and cygnets (brood size two to eight); the attacking bird was probably the cob as females rarely fight (Scott 1977).

Interactions were always initiated by swans, which often attacked the geese at distances greater than 300 m from their own family. Swans initiated attacks by flying or running (after they molted their remiges) into the middle of a brood group and repeatedly chasing the nearest bird. During four encounters, the swan grabbed a goose by the nape of the neck and sat or stood on its back, often trampling and biting the back of the neck and pulling out feathers. The pinned goose generally lay motionless on the ground until the swan stepped off, at which time the goose, if capable, fled.

Geese responded to charging swans by attempting to run away or by flying (prior to wing molt). If overtaken, geese often threatened (Fischer 1965) the swan, and on two occasions counter-attacked. In the latter instance, adult geese within the brood group repeatedly bit the swan, and beat the swan with their wings until they were repelled. On one occasion the goose being trampled by a swan was released when another adult goose from the group attacked the swan.

Attacks by two different swans (with two and three cygnets) on the same group of geese resulted in the

death of six-week-old goslings on 7 and 9 August. The goslings involved had almost completed their postnatal molt (their heads retained some down) and weighed at least 1,500 g (the average weight of two goslings captured a week earlier). Both goslings repeatedly escaped (four and five times) after the swan caught them by the nape of the neck with its bill and pinned them to the ground. Eventually the goslings were recaptured and the attacking swan sat or stood on them for 3 to 5 min while trampling their backs and tugging and pecking the backs of their necks and heads; in each case the gosling did not move after the departure of the swan. The carcass of one of the birds was scavenged within 30 min by a pair of Glaucous Gulls (*Larus hyperboreous*) and an arctic fox (*Alopex lagopus*), thus confirming the death of the gosling, while the other gosling remained motionless and was presumed dead.

Aggressive behavior of captive breeding swans is well documented, and penned swans have been reported to attack and drown ducks and ducklings (Kear 1972). However, references to aggression between swans and other anatids in the wild are rare (e.g., Brazil 1983), and such behavior is thought to be "atypical in the wild" (Kear 1972:102). It seems probable that attacks by swans on geese during brood rearing are instances of territorial defense, a premise corroborated by our observations of swan families with a constant number of cygnets in the same locations throughout brood rearing.

Incidents of interspecific territorial defense have been categorized either as situations where the benefits of exclusion actually exceed the costs of territory defense or as cases of mistaken identity (review in Wittenberger 1981). Livezey and Humphrey (1985a) and Nuechterlein and Storer (1985a) have recently identified both or the former of these explanations respectively as contributing to the evolution of interspecific aggression in steamer-ducks. In addition, both groups of investigators have suggested that attacks of steamer-ducks function as displays to females and hence potentially enhance mate acquisition and promote sexual selection.

In all cases for which it could be determined, swans involved in aggressive encounters were paired and had young. Swans maintain long-term pair bonds, and males invest significantly in the young after hatch (Scott 1980). Therefore, interspecific attacks probably do not function as courtship displays or promote sexual selection in Tundra Swans.

Little is known of the diet of Tundra Swans and Greater White-fronted Geese during brood rearing. However, they both feed on cereal crops during winter (Glazener 1946, Sherwood 1960, Nagel 1965, McFarland and George 1966), and we observed families of both species grazing on lake edges and feeding on pond weed (*Potamogeton* spp.) during brood rearing. Thus it is plausible that aggression of swans towards geese reduces competition for food during brood rearing.

Tundra Swans are substantially larger than Greater White-fronted Geese and are probably at little risk of being injured during attacks. Chasing and fighting are undoubtedly energetically demanding, but this may be inconsequential in males if, as in most Anserinae, they

have substantial energy reserves during brood rearing (see Raveling 1979) because they invest little or no energy in incubation and egg formation (Scott 1977). Accordingly, it seems likely that there is little selection pressure against selective interspecific aggression in Tundra Swans, as also hypothesized by Livezey and Humphrey (1985a) and Nuechterlein and Storer (1985a) for steamer-ducks. However, it may be presumptive to try to determine the adaptiveness of interspecific aggression in swans without a better understanding of the probable selection regime under which such behaviors evolved, and of their natural history (Jamieson 1986).

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GEOGRAPHIC VARIATION IN SOCIAL STRUCTURE AND BEHAVIOR OF *APHELOCOMA ULTRAMARINA*[1]

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The study of geographic variation in social structure may reveal flexibility of social behavior in a species and suggest correlations with environmental factors. Geographic variation in social structure has not been established previously for *Aphelocoma ultramarina* (Gray-breasted or Mexican Jay). In this paper we report observations on group size and composition from a population of *A. u. couchii* inhabiting the Chisos Mountains of Texas and compare them to published results for *A. u. arizonae* gathered using similar methods in the Chiricahua Mountains of Arizona (Brown and Brown 1985). In addition, we describe a vocalization found in one population but not the other.

The field work was done in the Chisos Mountains by Brown on 26 to 29 July 1970, and by Strahl on 6 to 13 June 1981. These jays live in all-purpose, group territories that are essentially mutually exclusive. To count the members of a group we induced them to fly across an opening in the forest by playing their calls with a tape recorder. These calls included the common flock calls as well as the *Rattle* call described below. Systematic counts of group size were not made in 1970. Of the 26 groups counted in 1981, half were counted

on two to six occasions at least a day apart; the remainder, on only one day. We used the highest of the available counts for each group. Since the groups counted only once were not significantly different in average size from those counted more often (t-test, $P > 0.05$), we combined data for all 26 groups. The mean group size was 4.5 birds (± 1.14 SD; omitting birds of the year). We observed six groups of three, eight of four, five of five, and seven of six.

For *A. u. arizonae* Brown and Brown (1985) reported group sizes in May and June 1976, from five to 13, averaging 8.7 (± 2.3 SD, $n = 33$). In a smaller number of flocks ($n = 6$, 7) mean group size varied from 6.7 to 17.5 for the period 1969 to 1983. Mean group size was significantly higher in *A. u. arizonae* in 1976 than in *A. u. couchii* in 1981 (Mann-Whitney U-test, $P < 0.001$).

The composition of groups (specifically the number of breeding females per group) was probably also different in the two populations. The *Rattle* call is given only by breeding females of the Steller's Jay, *Cyanocitta stelleri,* and the Scrub Jay, *A. coerulescens* (Brown 1964, and pers. observ. of banded Scrub Jays in California). Therefore, we used the number of birds giving *Rattles* in response to a stimulus *Rattle* in each group to estimate the number of females in groups of *A. u. couchii*. *Rattles* were given in response to the stimulus in 22 of the 26 groups. In no group was more than one bird observed to *Rattle*. In one case a bird that had been incubating left her nest to *Rattle* at the tape, thus confirming her sex, since only females incubate in this species (pers. observ.).

A second type of evidence consistent with the hypothesis of one breeding female per group in *A. u. couchii* arises from our observations on the number of