

the opportunity for extended observations of grouse behavior. The shoulder-spot display was observed in many males on numerous occasions. By contrast, no females were observed using this display.

Copulation is the activity during which the shoulder-spot display has been most frequently seen in females of other grouse species (Lumsden 1970). However, our captive females rarely permit normal copulation, and the observation of copulation is very rare in captivity. Therefore, failure to observe the shoulder-spot display in female Ruffed Grouse may be attributable to the rarity of copulation by captive hens rather than to the absence of this display in female Ruffed Grouse.

The shoulder-spot display was most frequently observed in captive males performing what has been termed the "intimidation" display (Aubin, M.Sc. thesis, Univ. Alberta, Edmonton, Alberta, 1970) or "upright-cum-ruff" (Hjorth 1970) display. When a male performing the intimidation display is approached by an observer, the male usually attacks or retreats within a short time. However, some males are reluctant to do either, leading to an ambivalent situation. If the ambivalence is sufficiently intense, the male assumes a semi-upright posture, with all feathers except the crest sleeked. In this posture, he alternately approaches and retreats from an intruder, with his body held at a slight angle to the intruder. He may threaten to strike with his bill. Before this strike intention movement is made, the wings are withdrawn from beneath the contour feathers, and are slightly extended. The shoulder-spot display is performed just before the wings are extended (Fig. 1).

Close examination of birds performing this display revealed that the shoulder-spot is formed by exposure of the underwing coverts on the upper surface of the wing, as Lumsden (1970) thought. From examination and manipulation of the wings of live birds, it does not seem possible that a simple re-alignment of the underwing coverts could produce a shoulder-spot of the dimensions seen on many males. The exposure seems to be effected by movement of the patagial skin, accompanied by repositioning of the feathers. Apparently, the skin is drawn over the leading edge of the wing, and onto the upper surface. The coverts are then exposed to form the shoulder-spot. By varying the degree of skin movement and feather rearrangement, it would be possible for the bird to alter the dimensions of the shoulder-spot displayed.

Similarities between Ruffed Grouse and other grouse species in the method of effecting this display, and the context within which it is performed indicate the origin of the shoulder-spot display is similar in all grouse. These observations support the suggested evolutionary development, whereby the display is derived from what was originally a flight intention movement (Hjorth 1970, Lumsden 1970).

Financial support for the maintenance of the grouse colony was provided by the Ontario Ministry of Natural Resources and the University of Guelph.—ALLAN GARBUTT, *Dept. Zoology, Univ. Guelph, Guelph, Ontario N1G 2W1 Canada*. (Present address: 1424 Carlyle Rd., Calgary, Alberta T2V 2V1 Canada.) Accepted 3 Feb. 1980.

Wilson Bull., 93(1), 1981, pp. 99–103

The agonistic repertoire of Sandhill Cranes.—Detailed descriptions of agonistic displays are lacking for wild Sandhill Cranes (*Grus canadensis*). Walkinshaw reports that all cranes have some of the same aggressive displays (Walkinshaw, *Cranes of the World*, Winchester Press, New York, New York, 1973). Masatomi and Kitagawa (J. Fac. Sci., Hokkaido Univ., Ser. IV, Zool. 19:834–878, 1975) give a thorough description of agonistic behavior in the Japanese Cranes (*G. japonensis*) that facilitates description of such behavior in Sandhill Cranes. Voss (pp. 63–85 in *Eastern Greater Sandhill Crane Symposium*, R. D. Feldt, com-

piller, Michigan City, Indiana, 1977) describes agonistic behavior in captive and wild Greater Sandhill Cranes (*G. c. tabida*) on the summer range in Wisconsin. Here we present observations of agonistic behavior of migratory Greater Sandhill Cranes on their winter range in Florida and summer range in Wisconsin and year-round observations of the resident Florida Sandhill Crane (*G. c. pratensis*) based on approximately 700 h of fieldwork at Paynes Prairie, Alachua Co., Florida and at the International Crane Foundation, Baraboo, Wisconsin. We also include the contexts under which these agonistic behaviors were given. Approximately 80% of the birds observed in Florida had been captured (Nesbitt, pp. 299–303 in *Proceeding of the International Crane Workshop*, J. C. Lewis, ed., Oklahoma State Univ., Stillwater, Oklahoma, 1975), individually color marked and their sex and approximate age determined. Sex was determined by laparotomy or from postures assumed during Unison Calling, a sexually distinct display. Age was determined from plumage characteristics.

Highly dominant displays are given by individuals that have little or no fear of other cranes. If 2 highly aggressive cranes confront each other Bill Sparring usually results. This display begins when the 2 birds approach each other, some preliminary bill jabbing ensues, then with wings extended, neck feathers erect and bill tips close together (Fig. 1A), the birds vocalize and vault into the air throwing feet and wings forward (Fig. 1B). Substantial contact does not usually occur, but there is a risk of injury from feet or bill. In many instances, this display is very brief, lasting only 2 or 3 sec and does not progress beyond the initial bill jabbing. The victor stands his ground while the loser retreats giving any of the 6 escape postures described by Masatomi and Kitagawa (1975). Archibald reported a similar display in the Hooded (*Grus monacha*) (Animal Kingdom 77:19–24, 1974) and White-naped (*Grus vipio*) cranes (Animal Kingdom 76:17–21, 1973) as does Walkinshaw (1973) for Sandhills. Bill Sparring probably is important to the establishment of a dominance hierarchy. Kepler (pp. 177–196 in *Proceeding of the International Crane Workshop*, J. C. Lewis, ed., 1975) discusses the occurrence of a linear dominance hierarchy in a flock of 9 captive-reared Whooping Cranes (*G. americana*). A similar hierarchical system was noticed in the wild among adult male Sandhill Cranes and may exist through other social groups of sandhills as well. During another high intensity agonistic display, the Head Lowered Charge (Fig. 1D), the aggressor rushed quickly at another bird, neck extended, head, neck and body held horizontal, wings usually tight to the body. Sometimes flapping begins as the other bird is approached, the bill is open, and the aggressor often grabs the other bird by the wing or scapular feathers. A charge can occur during feeding where the aggressor, apparently feeding normally, moves closer to the offending individual. Then from the feeding position a charge erupts catching the other crane by surprise. Walkinshaw (1973) has generally described this behavior as occurring with all cranes. The Head Lowered Charge often leads to Aerial Pursuit, especially during the period when the birds are defending nesting territories. During Aerial Pursuits the aggressor may attempt to strike the fleeing bird with its feet. A dominant crane will displace a subordinate individual from a feeding or drinking site with a Bill Stab (Fig. 1E) directed at the back or back of the neck with bill either open or closed. The attacked bird simply moves a few steps, and the dominant bird assumes the feeding or drinking spot. Charges or stabs from the dominant individual often follow a full Bill Sparring episode. Following all high intensity agonistic displays, the dominating individual usually gives a Low Bow display (Masatomi and Kitagawa 1975, Voss 1977) during which the neck is arched and the head slowly lowered toward the ground displaying an expanded bright red comb. The display terminates with the head between the bird's legs and bill held vertically (Fig. 1F). As the head is lowered the bird emits a low growl. A Low Bow is often given by territorial birds upon landing near an intruder before any other signs of aggression are shown.

During agonistic episodes where the motivation levels are lower, any one of a series of generalized ambivalent displays may be seen. To drive other cranes from a defended territory

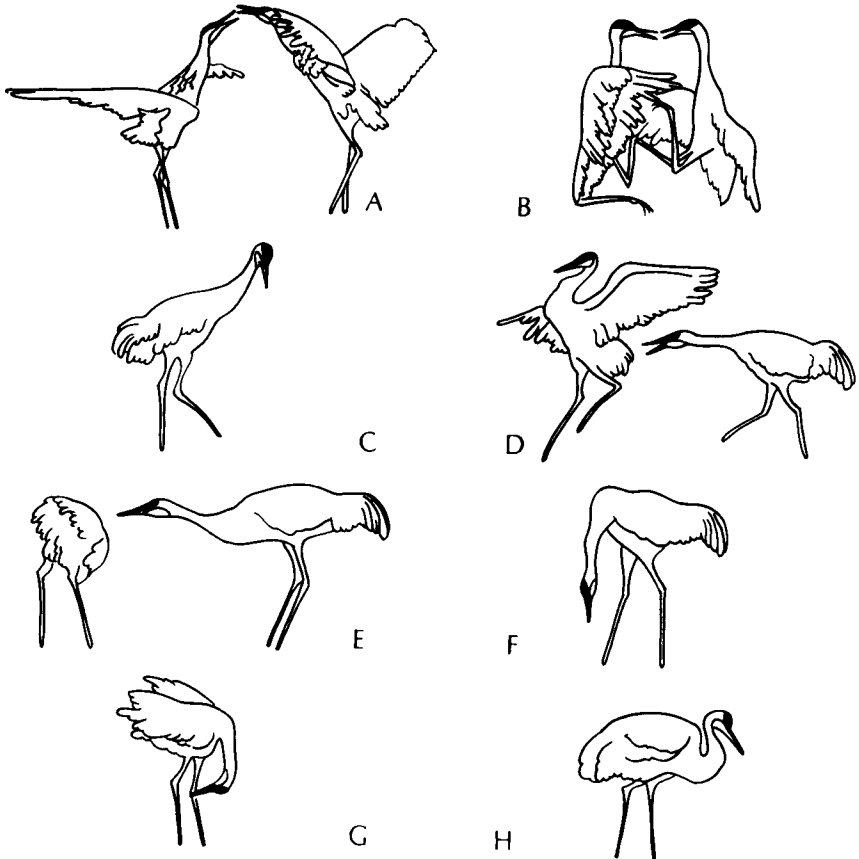


FIG. 1. Common agonistic displays of Sandhill Cranes: (A, B) Bill Sparring; (C) Directed Walk Threat; (D) Head Lowered Charge; (E) Bill Stab; (F) Low Bow; (G) Generalized Body-Wing Shaking; (H) Neck Retracted Submissive Posture.

or a feeding area, the dominant individual or pair (and their chick, if present) give a Directed Walk Threat or Adornment Walking (Masatomi and Kitagawa 1975, Voss 1977) often with a characteristic vocalization (Slow-rattle Family Call; Nesbitt and Bradley, in press) given in unison, by all defending cranes. This display is an exaggeration of the normal upright walking movement directed at a particular individual. The displaying bird circles the opponent with a stiff gait characterized by animated head pumping and tertials slightly raised. With each step the neck is extended and the bill pointed at the other crane. Periodically, the bill is angled downward displaying an expanded, bright red comb (Fig. 1C). The Directed Walk Threat is apparently equivalent to a display described by Archibald (1974) for the Hooded Crane. The individual toward which this behavior has been addressed usually moves away quickly with head lowered and body held horizontally. Other adornment displays described by Masatomi and Kitagawa (1975) for *G. japonensis* seem to represent variations in

the intensity of adornment walking in sandhills. If the offending individual does not retreat as a result of the Directed Walk Threat a charge or stab may occur. If the aggression level is not high, one of several ritualized general threat displays may ensue. The Generalized Body-Wing Shaking (Voss 1977) (Fig. 1G), similar to the Low Bow, has been described for several species of cranes (Archibald 1974; Walkinshaw 1973; Paulsen, Dansk Ornithol. For- enings Tidsskr. 69:119–122, 1975). But it is less intense and general rather than directed. Body-Wing Shaking begins as a stylized feather maintenance movement, contains a less dramatic bow and terminates with displacement preening of the legs or belly. Again a low growl is given as the head is lowered. In Sandhill Cranes other forms of bowing described by Masatomi and Kitagawa (1975) appear to be less intense versions of the Low Bow. The Unison Call may function as a generalized aggressive display (Archibald, Ph.D. diss., Cornell Univ., Ithaca, New York, 1976). A pair will often Unison Call before aggressive episodes or after successfully driving intruders from a defended territory. The Crouch Display observed by Voss (1977) principally in young cranes was noticed among the Florida birds only once, given by a young crane. In the wild it is perhaps a seldom given display that in adult birds transmits little or no agonistic information. When 2 cranes with lower aggressive motivation are close together, they often engage in displacement foraging or preening. These are transitional behaviors leading to normal feeding or preening and away from aggressive encounters.

In fearful situations, birds of the year and other subordinate individuals wishing to avoid attack, assume a Neck-retracted Submissive Posture (Voss 1977) (Fig. 1H), during which the comb is constricted and dull in color. A crane, fearful of attack from another crane, may feign the precopulatory display with wings spread and beak held above horizontal at a 45° angle, thus changing the motivation of the attacker. When approached by a mammalian predator, Sandhill Cranes give a predator threatening Spread-Wing Display (Voss 1977), consisting of an upright posture with wings held high and half-open. The head is held high with the beak pointed directly at the predator. If the predator does not retreat, then the bird approaches, thrusts the bill forward and hisses. A crane was observed successfully fending off the attack of a juvenile Bald Eagle (*Haliaeetus leucocephalus*) using bill jabs with vaults and forward thrusting of the feet and wings. Such movements, similar to Chasing and Kicking (Voss 1977), are generally equivalent to the movements that have been stylized into Bill Sparring, but without the characteristic vocalizations. A similar attack behavior and hissing has been observed during trapping operations when oral tranquilizers were used. Attacks were directed at tranquilized cranes that did not react normally to unaffected birds. Presumably this is the type of attack that has resulted in severe injuries to cranes (Walkinshaw, Michigan Acad. Sci., Arts, Letters 40:75–88, 1965). The attack method described by Altmann (J. Mammal. 41:525, 1960) employed by a pair of adult cranes with a chick to drive off a moose (*Alces alces*) incorporated these same movements.

Aggression was often observed during and after unpaired dancing bouts between non-breeding cranes. Aggressive attacks were also launched at individuals apparently preoccupied in another behavior such as Bill-Raising (Masatomi and Kitagawa, 1975:Fig. 119), unilateral stretching or sitting.

All of these displays have been observed in both sexes, though Bill Sparring appears more pronounced in males. Sub-adult cranes exhibited the same aggressive displays, but the frequency and intensity of the displays were much reduced when compared with paired males. Among 4 of 5 distinctly marked breeding pairs the male consistently took the leading role in territorial defense. Within the fifth pair, the male and female were equally aggressive, both initiating an equal number of encounters. Females and young of the year commonly participate in Directed Walk Threats, and occasionally Charges. Other displays appear much less frequently. The hierarchical position of the pair or family seems to depend on the

position of the male. The aggressiveness and therefore the hierarchical position of a male relates to the presence of a chick. Pairs without chicks tend to be lower in the order. For example, the dominant pair of the 5 marked pairs had 1 chick in 1977. In 1978, they were chickless and were dominated by 2 previously subordinate pairs, both with chicks.

The frequency of agonistic encounters involving adult Florida cranes increased during the period when young of the previous year were separated from the family group (February and March). The frequency remained high until just before the eggs hatched, then the level declined and the number of encounters remained low until several weeks after hatching. This lowered aggression period corresponds with the period in which Bennett (Auk 95:411–413, 1978) noticed little response from territorial cranes to the play back of tape recorded calls.

We wish to thank K. S. Voss and C. B. Brownsmith for their comments on early drafts of this manuscript. This study was in part a contribution of the Federal Aid to the Wildlife Restoration Program, Florida Pittman-Robertson Project W-41.—STEPHEN A. NESBITT, *Florida Game and Fresh Water Fish Commission, Wildlife Research Laboratory, 4005 S Main St., Gainesville, Florida 32601* AND GEORGE W. ARCHIBALD, *International Crane Foundation, Baraboo, Wisconsin 53913. Accepted 1 Nov. 1979.*

Wilson Bull., 93(1), 1981, pp. 103–107

Notes on the Slender Antbird.—The Slender Antbird (*Rhopornis ardesiaca*), first collected somewhere in eastern Brazil by Prince Maximilian von Wied (Beiträge zur Naturgeschichte von Brasilien, Vol. 3, 1831), was until recently known from 3 specimens: the male type, another male from Ituaçu, in south-central Bahia, and a female from the town of Boa Nova just down the Rio de Contas (Naumberg, Bull. Am. Mus. Nat. Hist. 76:231–276, 1939). Emil Kaempfer collected the last 2 specimens in 1928. Naumberg suggested that Kaempfer's "Boa Nova" was another town with the same name, northwest across the Rio São Francisco; but Kaempfer was at the second Boa Nova in 1927, not 1928. Moreover, Wied is likely to have collected the type near the first Boa Nova, which he passed en route from Vitória da Conquista to Salvador.

From 3–9 December 1974, we studied Slender Antbirds in patches of dry forest on Fazenda Alvorada, just north of the first Boa Nova (14°20'S, 40°11'W). A good, if scattered, population exists in these patches, which are gradually being cleared for cattle pastures. In 1977, H. Sick collected a male at Boa Nova after we mentioned our observations to him.

Habitat and foraging.—Boa Nova lies at 700 m elev., below 800–1000 m ridges of the northern end of a broad plateau that stretches southwest past Vitória da Conquista nearly to the valley of the Rio Pardo in the state of Minas Gerais (Fig. 1). This plateau is the main ridge of southeastern Bahia, forming a border between wet coastal forests (which include some patches of dry forest in the upper basins of small rivers) and the desert scrub or "caatinga" of the interior.

The natural vegetation of this rolling plateau varied within short distances from wet cloud forests (1500–2000 mm annual rainfall) on the eastern escarpments to caatinga in such rain-shadow areas as the lee slopes around Boa Nova, but the summit was mainly a dry forest (800–1000 mm rainfall) with many "cipós" or lianas—a "mata de cipó." The scattered remaining patches of dry forest have a strange appearance, with scattered white trunks of small trees above a dense layer of midstory trees and vines. The understorey is fairly open, but blocked here and there by lianas and by patches of huge terrestrial bromeliads (*Aechmea* sp.). In the forest, bromeliads tend to sit high on tree trunks; but at the borders between dry