

AGONISTIC BEHAVIOR IN THE MALE STARLING¹

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THE Starling (*Sturnus vulgaris*) has been the subject of much biological research and the important details of its life history in North America are known (Kessel, 1957). Nearly all of the literature on behavior of Starlings is anecdotal or fragmentary. However, Davis (1959) has named and described certain patterns used in courtship and also certain vocalizations. This report is restricted to the ethological description of agonistic behavior. The purposes were: (1) to identify and describe specific behavior patterns of male Starlings in aggressive situations, and (2) to analyze some relations of agonistic behavior to social organization.

MATERIALS AND METHODS

Caged birds.—The Starlings were housed in 6 × 6 × 6-foot cages. A special observation cage was 6 × 6 × 12 feet long. The birds were fed ordinary dog mash in standard poultry-chick feeders. Water was provided ad lib. in standard poultry water dishes. Perching bars were installed; some were adjustable as to length and location. Natural daylight was supplemented by 150-watt bulbs overhead. No attempt was made to control the length of day to conform with natural conditions; the lights were often on for several hours after sunset. The building was imperfectly heated; thus, the temperature varied but never reached freezing.

The caged birds were color-banded and their symbols were derived from the color combination (BY = Blue-yellow, e.g.).

Wild birds.—The wild birds observed were members of local populations breeding in the area. Many observations were obtained in a certain woodlot that contained a high density of territorial males. Identification of sex in spring was accomplished by use of the bill-color character (Witschi and Miller, 1938), namely, blue base in males and pink base in females.

Observational methods.—Observations of the caged birds were made through a one-way mirror and reported on a tape recorder. Data gathered on wild birds were necessarily qualitative since the availability of individuals could not be controlled. Also, a given individual was frequently inactive, absent, or doing the same thing for long periods of time.

Most of the results of the study of the caged birds apply to birds in non-breeding condition, but there was some indication of sexual behavior in the latter part of January 1964. This restriction was justified because the emphasis was directed to the role of agonistic behavior in flock organization.

Quantitative aspects.—Observations of dominance relations were made on

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a captive flock of 12 male Starlings. The dominance of one bird over another was regarded as demonstrated if on an encounter the opponent was physically displaced from its perch, regardless of the particular display causing displacement. No judgment of "win" or "loss" was made if neither bird was displaced. The observations were summarized in win-loss diagrams; the judgment of relative rank was based on how many encounters a bird won and with which bird it fought. When two birds appeared to be tied for a particular rank, the decision was made by qualitative remarks in the notes.

The data on the dominance hierarchy were gathered during two main periods: one beginning in the second half of July 1963 and another beginning at the end of December 1963. The second sample was larger in terms of hours of observation time.

A manipulation of the flock on 21 February 1964 consisted of the removal of six of the birds. Their symbols and rank in the hierarchy were as follows: WY-3, BW-4, YY-5, YW-9, WW-10, and W-11. On 22 February five new birds were color-banded and introduced into the cage. Observations of encounters were made and in this sample the initiator of all but one encounter was known. The dominance hierarchy was assessed as before.

RESULTS

General patterns of agonistic behavior.—Agonistic behavior was observed in wild birds much less frequently than in the caged birds, a natural corollary of the ease with which a bird can escape an aggressor. Severe fighting in the wild was rare but spectacular when it did occur. Early in the breeding season males sometimes fought to exhaustion at nest-holes. Pursuit without contact, in both males and females, was much more common than fighting. In the caged birds severe encounters followed intense dominance rivalry and were easily elicited by depriving the birds of food. After the return of food, the incidence of contact aggression was high. Undeprived birds showed relatively more threatening behavior; half the displays identified were at least partially threatening in appearance.

Specific display patterns of male Starlings.—*Wing-flick* (Fig. 1). An important display consists of rapid flicking of the wings. The birds do not open and flap the wings but extend the wings from the wrist with the humerus remaining essentially folded to the body. The most common eliciting situation was the approach of a bird to another who was feeding; the latter displayed to the oncoming intruder, often continuing to feed while doing so. Subordinate birds displayed towards dominant ones as well as vice versa. The effect of the display on the intruder was variable, but a frequent characteristic was a pause, either momentary or prolonged. In 19 of 38 cases the display resulted in failure of the intruder to approach close enough to feed. In many cases

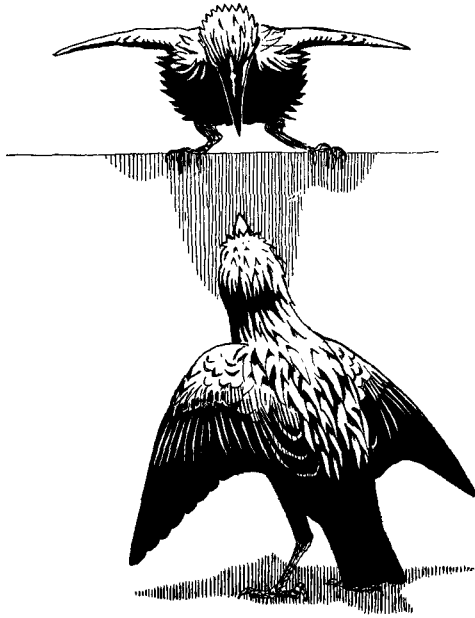


FIG. 1. *Wing-flick*. Assuming no previous encounters between these two birds, height may give the upper bird the decisive advantage.

the intruder responded with the same display before leaving or stopping. In a few cases both birds continued to display while the intruder continued to advance; when the intruder had cautiously approached, display ceased and both birds fed. In still fewer cases the display evoked outright attack by the intruder, who drove away the defending bird.

In wild birds the *Wing-flick* was common in birds feeding at a limited food source in winter. On a snowy morning in December 1963 about 20 Starlings were observed feeding on a pile of offal left by a deer hunter. Individuals, constantly repelled at one place, went around to the other side and tried to get to the food again. *Wing-flick* displays kept almost all birds nervously flicking their wings as they fed.

Vocalizations, usually high-pitched, segmented squeals, accompanied one-third of all such displays.

Fluffing (Fig. 2, right). The bird faces the opponent directly, the body feathers expanded and the crown feathers raised. A harsh vocalization accompanies the display and as the bird squeals the wings are flapped (not "flicked" as in *Wing-flick*). Mutual *Fluffing* between two antagonists was common and was sometimes prolonged if the birds reached an impasse in the en-

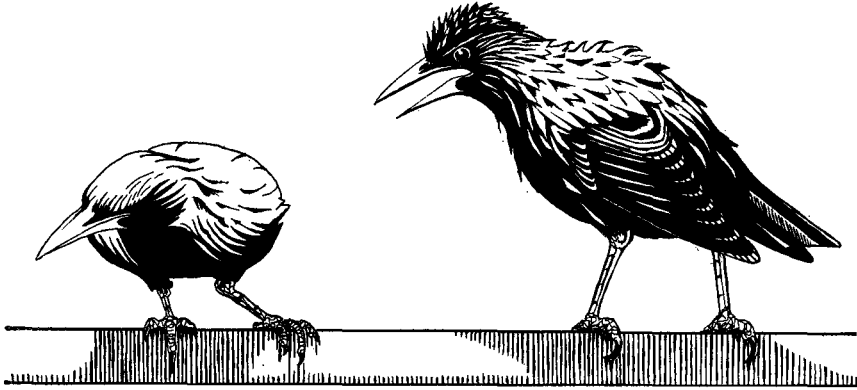


FIG. 2. (left) *Depressed Posture*. Intense form; in mild submission the bird may not bend low but merely leans away from the aggressor. (right) *Fluffing*. The feathers of the scapular area are often raised, as in this bird.

counter. The response behavior to Fluffing was highly variable (Tables 1 and 2). The usual stimulus evoking ordinary Fluffing was the approach of another bird. At times "approach" could mean even a very slight postural change in a bird 2 feet away. There seemed to be a difference in response to approach according to whether the intruder represented competition for a perching place, or whether he represented potential competition for food and water. The Wing-flick display was seldom given to an approaching bird unless the displayer was engaged in feeding, drinking, or bathing; on the other hand, fluffing was the response to random approach.

The Charge. A Starling charging an opponent exhibits all the postural components of Fluffing, the difference being the advance on the opponent. Charging may be slow or fast; in the fast form the bird moves swiftly, while in the slow form the bird simply walks. As with ordinary Fluffing a harsh vocalization is given. The result of Charging is usually the escape of the bird being charged; but sometimes the opponent responds with a Charge of his own or with the Tall Posture (see below). If the Tall Posture was given, the bird was able to resist displacement in many cases, regardless of his position in the dominance hierarchy. In one case the adversary responded with a Charge of his own and by Dance-fighting (see below) won the encounter.

Sidling. Sidling occurs when an intruder comes near a nest-hole which belongs to a bird. This bird attacks the intruder. The behavior which was seen exclusively in the wild consists of walking or "sidling" toward the intruder along a limb. Sometimes short, sidewise hops were used, and often it was clear that the aggressor was not facing the intruder. There were fre-

TABLE 1
RESPONSE OF THE OPPONENT TO 71 THREAT DISPLAYS

Behavior	Per cent
Escape	19.7
Tall Posture	19.7
Charge	11.5
Dance-fight	6.6
Bill-fence	6.6
Avoidance (in-flight)	1.6
Depressed	1.6
Not identified	32.8

quently long pauses between steps or hops, during which the bird might give the Wing-waving or Crowing displays (see below). In the usual case the intruder seemed to be oblivious until the owner was quite close. Davis (1959) described the behavior in reference to the defense of a nest-hole; in one case a defending male gradually forced an intruder 50 feet along a wire away from the hole. My observations tend to confirm that the behavior is associated exclusively with territorial conflict. Sidling did not always result in departure of the intruder; once the owner approached to within one foot of the intruder, who then attacked and drove the defending male away. In another type of situation, seen several times, the defending bird sidled toward the intruder but stopped and went into the Wing-waving display before attacking and routing the intruder. The intruder on one of these occasions had been Wing-waving also. Finally, on several occasions the owner stopped the display without apparent cue or cause.

Twitching. During the 1964 spring season of vigorous nest-hole defense, a striking behavior was seen in wild males. One male was defending a hole in the eave of a building, and at the time was perched in the top of a nearby poplar tree. An intruder landed in the tree about 10 feet from the defender. The latter, who had been Crowing vigorously (see below), ceased suddenly on the appearance of the intruder. Both sat quietly for some minutes. Then the defending male began Crowing softly and continued for about 2 minutes. Suddenly he stopped, assumed an alert pose, and began twitching his wings

TABLE 2
EFFECT OF 61 THREAT DISPLAYS ON THE THREATENED BIRD

Result on threatened bird	Per cent
He was displaced	29.5
He adjusted without displacement	29.5
He dominated his threatener	41.0

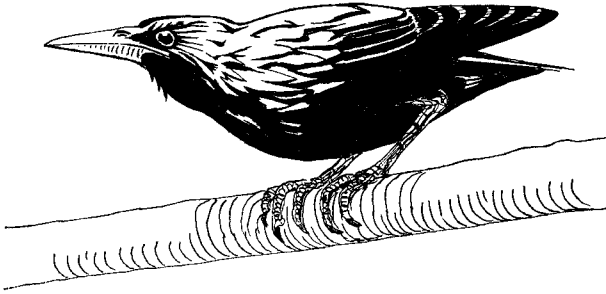


FIG. 3. *Horizontal Posture*. The basic pose is clearly an intention movement to launch flight.

and tail. The wings were not opened but rather "clutched" closer to the body (the reverse of the "flicking" seen in the Wing-flick). The tail jerked through a vertical arc and there was some lateral spreading as well. Each twitching session consisted of three or four movements. The first time the defending male twitched the intruder moved away about one foot; the second time, about 6 inches, and on the third display the intruder flew away, whereupon the defender pursued him out of sight. In another incident about the same time (April 1964), the two birds displayed in more or less continuous fashions; both flew away together. This behavior was observed by Davis (1959) on several occasions of prolonged fighting for a nest-hole. In one case the Twitching occurred intermittently for 3 days.

Depressed Posture (Fig. 2, left). When Starlings yield to another in an encounter, they display their subordination by a depressed posture which is variable but which has three constant characteristics: (1) the head is turned away from the opponent; (2) the plumage is tightly sleeked; and (3) the bird bends in a low crouch on the perch. In the caged birds the display was commonplace. A bird displaying submission seemed to be reluctant to give up his perching place. In many cases the depressed posture was followed by cessation of the aggression. A subordinate bird was once seen to hold a depressed posture, in an awkward position, for 15 seconds. In the wild, depressed postures were seen infrequently; a male returning to his nest-hole was surprised at the entrance by the emergence of the female; he immediately assumed a depressed posture.

Horizontal Posture (Fig. 3). The most intense of all threat displays seen was the Horizontal Posture. The behavior consists of a low crouch with the head drawn back on the shoulders. The bird orients toward the opponent with the plumage sleeked but not compressed. The orientation is maintained even if the opponent is flying, and no vocalization was ever heard during the

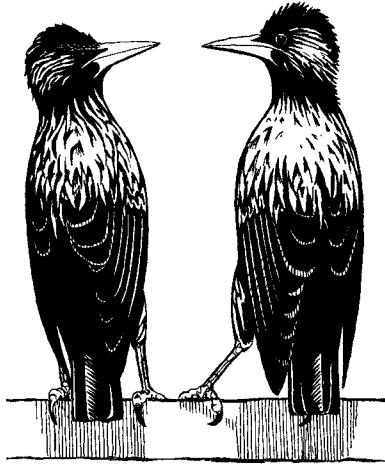


FIG. 4. *Tall Posture*. The erect stance is very striking to observe.

display. When seen in the wild, attack or pursuit followed it promptly. The display in the wild occurred three times when a returning male discovered another male in his territory. Once the defending male displayed from a housetop, then flew directly to a Starling (presumably a male) on a lawn 150 feet away where a severe fight took place on the ground; the birds were so exhausted that they lay in place for more than 5 minutes before departing. This method of attack differs from charging by being swift. It includes no vocalizations and has none of the postural characteristics of Charging.

The display was seen in the caged birds. In January 1964 the two top birds in the hierarchy (Y and BY) persecuted other birds by swift and unpredictable aggression; the Horizontal Posture was a common preface to vicious attack; it was not related to dominance status.

The Tall Posture (Fig. 4). The Tall Posture is usually a mutual display by two birds, and consists of each jerking the body taller in small increments in response to the movements of the other. In the large majority of cases (22 of 25) in which there was displacement, the bird that became taller dominated (perhaps only for that encounter). In most encounters involving the Tall Posture, however, the outcome was adjustment without displacement; usually one of the birds yielded by giving the Depressed Posture (Fig. 2). In some cases the dispute was not settled by the Tall Posture and Bill-fencing usually followed (see below). The most common stimulus for the display was the arrival of another bird at an occupied perch. In two encounters of 25, the taller bird was displaced by Bill-fencing, and in one case there was no visible height difference. In the other 22 the taller won.



FIG. 5. *Dance-fighting*. The actual attack is made with the feet rather than the beak, analogous to a captor pouncing on prey.

In wild birds the Tall Posture was seen only in the roosting situation. In July 1963 a large flock of Starlings was roosting in densely foliated maple trees on the poultry farm of the Pennsylvania State University. The birds arrived at the roost well before dark, but observation was difficult because of the leaves. However, several times birds landed on a limb between two others, whereupon all three engaged in mutual tall posturing. If both perched birds displayed, escape of the intruder was the rule; but many times the intruder overcame the resistance of one bird and succeeded in perching.

Bill-fencing. Practically all Bill-fencing followed failure of a bird to dominate the opponent by the Tall Posture. The postural components of Bill-fencing are the same as for the Tall Posture: a stiffly erect attitude and raised crown feathers. The jabs with the beak are traded one-for-one and in intense

situations continue until one bird yields and escapes or gives the Depressed Posture. This posture may or may not be followed by cessation of the attack. The display was not seen in the wild. No vocalization was heard during Bill-fencing in the laboratory.

Supplanting Attack. The Supplanting Attack of the Starling seems to be little different from that seen in many songbirds. The aggressive bird simply jumps or flies toward a perch occupied by another bird. In the laboratory seldom was the victim taken unaware; he usually escaped easily. Surprise attacks occurred, however, and often resulted in fighting. Vicious Bill-fencing was the usual manner of fighting in contested supplantings, and in no case did both birds remain on the perch in question even though one might have shown intense submission. Many of the supplantings seen in the wild differed from the laboratory situation in that the attacker did not aim at the exact spot occupied by the victim; the aggressor might land as much as 2 feet from where the other had sat.

Dance-fighting (Fig. 5). A typical Dance-fight begins when an aggressive bird jumps into the air, feet extended toward the opponent. The response of the opponent is to dodge the aggressor and then jump into the air in return or else to escape. The display is very swift and the jumps by each bird may number as high as four. Usually the display ended as quickly as it had begun. Dance-fighting was never followed by pursuit, and the damage done by the fight is slight if any. Bathing behavior was always accompanied by much Dance-fighting, and even a subordinate bird would return in a moment to displace his attacker in this situation. Only two instances of Dance-fighting at the feeder were ever observed. In the wild the display was seen only a few times, all of them in the flock feeding situation in fall and winter. Encounters in the wild were limited to a single jump, the victim escaping.

Wing-waving (Fig. 6). Wing-waving is a flamboyant display seen in the breeding season and on warm days in the fall. The perched bird gives a characteristic vocalization called "screaming" by Davis (1959), and simultaneously waves the wings in rotating fashion. Although both wings are waved together they are not necessarily in synchrony. Between sessions of Wing-waving the wings are left partially extended or drooping. In every case of Wing-waving observed the feathers of the crown were raised, and in the intense form of the display they were fully erect, giving the bird a "big-headed" appearance.

Wing-waving males often perched in trees near their nest-holes; this was particularly true in the early part of the breeding season (approximately late February).

Crowing (Fig. 7). Crowing was the name given by Davis (1959) to describe a characteristic vocalization and the accompanying behavior. It was



FIG. 6. *Wing-waving*. Note vertically flexed tail; flexure occurs with each burst of vocalization. The bird perches near the defended nest-hole.

seen in both caged and wild birds, beginning about the middle of February. Males spent much time in the spring simply perched near their nest-holes Crowing. The body posture is similar to that in *Wing-waving* (aside from the obvious difference in wing motion); the body is held at a variable angle from upright to horizontal. The tail is flexed vertically during vocalization and the hackles of the throat are puffed out and vibrated, apparently mechanically and passively, by the sound-producing apparatus, giving the bird the appearance of having a "beard." Usually the crown feathers are depressed; the bill is pointed upward and is opened only slightly. Table 3 summarizes the differences and similarities between *Crowing* and *Wing-waving*.

Wing-waving was seldom seen in the close presence of a female unless an intruder or competing male was also present. On the other hand, *Crowing* occurred in the presence of either sex. In the prelaying period Starlings frequently gathered in the top of a still-leafless tree and crowded for the last quarter hour before flying off to roost for the night. Two males owning holes less than 15 feet apart, who squabbled during the day over the boundaries of their territories, often sat in this tree *Crowing*, apparently at ease with each other. About a dozen birds were in this group but sex determination by binoculars was impossible. Thus, the presence of females in this group was not known.

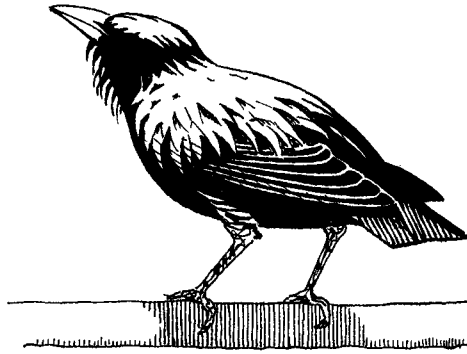


FIG. 7. *Crowing*. Note puffed throat feathers, tightly depressed crown, and nearly closed beak. Often the bird rises to an almost vertical position.

Males often crowed, as well as wing-waved, during the pauses between sidling-threat advances, but the actual competing for dominance by means of *Crowing* noted in the laboratory by Davis (1959) was not recognized; all displacements in the *Sidling-threat* situation appeared to be due to the imminence of attack or the actual attack by the sidling bird.

The function of *Wing-waving* remains obscure. Davis (1959) suggested that it served as communication to indicate at a long distance the presence of a bird that owned a territory.

TABLE 3
THE DIFFERENCES AND SIMILARITIES BETWEEN WING-WAVING AND CROWING
Characters without overlap between the two displays are marked**.

Character	Wing-waving	Crowing
Body posture	Horizontal to 45° angle	Horizontal to 45° angle
Wings**	Waved in circular, asynchronous fashion, or held drooping	Folded against body
Tail	Flexed vertically	Flexed vertically
Throat feathers	Puffed out, vibrated but not conspicuously	Puffed out, vibrated conspicuously
Crown feathers**	Conspicuously erect (Fig. 5)	Depressed (Fig. 6)
Bill	Sometimes widely agape, usually always open; pointed upward	Opened slightly; may be closed; pointed upward
Vocalizations	Higher pitched than crow—more stereotyped; always present in wing-waving	Vigorous but of measured tempo; quite complex with much imitation

TABLE 4
THE PERCENTAGES OF WINS OF 12 MALE STARLINGS IN AGONISTIC ENCOUNTERS
"Win" is defined as a physical displacement. Number in () is the size of sample.

Symbol	First period observations July-August 1963	Second period observations Dec. 1963-Jan. 1964
Y	81 (37)	100 (57)
BY	68 (59)	94 (90)
WY	42 (53)	50 (28)
BW	29 (31)	64 (47)
YY	70 (27)	50 (14)
YG	84 (56)	46 (107)
R	41 (29)	37 (30)
BW	43 (44)	39 (38)
YW	24 (38)	21 (33)
WW	50 (18)	11 (56)
W	33 (33)	22 (23)
BR	11 (37)	2 (51)

The dominance hierarchy.—From the beginning it was apparent that the flock of Starlings was not organized into a social hierarchy of the "peck-right" type (Armstrong, 1947; Allee, 1951). Birds displaced one another at the feeder with no seeming order. Encounters were recorded by the identity of the participants; word descriptions of the action were often included, and after about a week a tentative hierarchy was recognized. At the end of the July-August period the order of the flock was well understood.

TABLE 5
THE RELATIVE FREQUENCY DISTRIBUTION OF APPROACHES AND/OR ATTACKS BY VARIOUS BIRDS
Social rank in descending order (based on the overall win-loss diagram for July-August 1963).

Symbol	Won against a:		Lost to a:	
	Dominant	Subordinate	Dominant	Subordinate
Y	—	8	—	1
YY	0	2	0	2
BY	0	10	0	5
WY	4	8	2	4
YG	2	15	0	0
RW	2	1	6	5
R	2	3	3	0
WW	0	1	2	1
BW	5	0	4	1
W	5	1	3	0
YW	1	0	1	0
BR	5	—	7	—

TABLE 6
A COMPARISON OF THE OBSERVED AND EXPECTED VALUES OF THE NUMBER OF BIRDS
APPROACHING AND/OR ATTACKING SUBORDINATES

Symbol	Hypothetical probability of encounters with subordinates	Encounters with subordinates	
		Observed	Expected
Y	1.00	9	9
YY	0.91	4	4
BY	0.82	15	12
WY	0.73	12	13
YG	0.64	15	11
RW	0.55	6	8
R	0.45	3	4
WW	0.36	2	1
BW	0.27	1	3
W	0.18	1	2
YW	0.09	0	0
BR	0.00	0	0

In a flock of 12 birds, 66 pair-combinations are possible. Of this number eight were never observed in the July–August period, and seven were never observed in the December–January period; in the latter YY had no encounters with two different birds; no other bird had more than one unresolved relation.

Changes in rank occurred in the time between the two observation periods; most were small, but BW rose five places while YG descended three places. BW (Table 4) won a higher per cent of his encounters in the second period, but this figure tells little about the bird's aggressiveness: it does not tell whether BW sought the encounters that he won, which is a much better indicator of aggressiveness. Table 5 shows the relative frequency of voluntary approaches (and attacks) made by the birds of the flock, for the July–August observation period. For example, WY won against a dominant bird four times and against a subordinate bird eight times. It also lost to a dominant twice and to a subordinate four times.

If approach (or attack) occurs on a random basis, then the probability that an opponent is a subordinate is 1.00 for the *alpha* bird and 0.00 for the *omega* bird. Therefore, we may examine the data and ask if the birds in the flock approached (or attacked) subordinates more or less than expected by chance (Table 6). The number of encounters expected by chance, against which the observed values were compared, were computed by multiplying the hypothetical probability by the total number of encounters in which both individuals were identified, that is, the data of Table 5. For example, WY had 12 encounters with subordinates. On a chance basis 0.73 times 18 or 13 should have been with subordinates. When the observed and expected values

TABLE 7
THE NUMBER OF INDIVIDUALS OVER WHICH EACH BIRD ALWAYS WON, FOR BOTH
JULY–AUGUST 1963 AND DECEMBER 1963–JANUARY 1964
Dominance hierarchy in descending order (based on the overall win–loss
diagram for the period in question).

August 1963		December 1963–January 1964	
Symbol	Number	Symbol	Number
Y	5	Y	11
YY	4	BY	8
BY	4	WY	4
WY	2	BW	5
YG	5	YY	5
RW	2	YG	2
R	1	R	2
WW	2	RW	4
BW	2	YW	1
W	3	WW	1
YW	1	W	1
BR	0	BR	0

are summed for groups of four birds, the numbers observed clearly are indistinguishable from chance expectation.

Qualitative remarks in the notes seemed to indicate that the dominance hierarchy underwent a change toward more rigidity with time. Observations of the frequency of agonistic behavior were not taken, but the birds seemed to fight with less vigor and less often. Existing data offer a way to substantiate the claim of greater rigidity. Table 7 shows the number of individuals over which each flock member always won, for both observation periods. (It is fully recognized that given enough observation time, very likely *no* bird will win 100 per cent of the time over any other bird.) The data show that in spite of the longer duration of the second period, the top birds do have more complete dominance than in the first period, indicating greater rigidity.

The replacement of six birds of the flock with five new birds was a dramatic event. Out of a total of 152 encounters observed, 75 per cent were between the birds ultimately emerging as the top five members of the new hierarchy. The six lowest members of the flock made only seven of the 76 approaches (Table 8). The bird GG initiated 24 approaches and won every one. The bird Y did not make any approaches or attacks immediately following the introduction. On the day after introduction, however, Y had a total of nine encounters during observation with BY and GG, winning over the latter by six to three. The most vicious fighting was seen between GG and BY (the former *beta* bird); it may be significant that GG dominated the proceedings after introduction

TABLE 8
THE RELATIVE FREQUENCY DISTRIBUTION OF 76 APPROACHES AND/OR ATTACKS
BY VARIOUS BIRDS

Social rank in descending order (based on the overall win-loss diagram
for 22 February-3 March 1964) (* = new birds).

Symbol	Won against a:		Lost to a:	
	Dominant	Subordinate	Dominant	Subordinate
Y	—	11	—	1
GG*	2	22	0	0
BY	4	9	3	0
YG	1	4	0	0
D*	3	4	5	1
RR*	1	1	1	0
RW	1	0	0	0
RY*	0	0	0	0
WR*	2	0	0	0
R	1	0	0	0
BR	0	—	0	—

almost completely. BY challenged him immediately on introduction; the two fought "tooth and nail" with GG emerging dominant over BY.

DISCUSSION OF RESULTS AND CONCLUSIONS

Specific display patterns of male Starlings.—The Wing-flick display appears to serve as both a threat and a bluff; when given by a subordinate bird to a dominant bird, it usually causes the latter a moment's hesitation—which enables the bluffer to grab another morsel before being driven off. Its use as a threat requires little discussion. Use of a threat display may be a mechanism for permitting some greater variety of action of individuals, as compared to a more rigidly despotic type of hierarchy exemplified by the domestic fowl (Collias, 1951), but with yet a measure of social control over the individual. Charging seems to be an intense form of the ordinary threat, and as such we can posit no fundamental difference in its motivation.

That the Sidling was in fact aggressive in motivation was not understood at first because of the subtlety and unpredictability of its outcome. Its aggressive motivation now seems clear, but the explanation for the passive demeanor of the displaying birds remains obscure. The Twitching display was seen too few times to determine its agonistic role.

In the Tall Posture, a correlation exists between the height of the displaying bird and dominance. Wynne-Edwards (1962) presents evidence that Starlings return to the same spot on the limb to roost; the Tall Posture would seem to be an efficient mechanism for minimizing strife in the nightly settling-

down process in roosts. Bill-fencing, a display closely related to the Tall Posture, seems to be a more intense form of the latter, but to understand it will require more detailed work on the Tall Posture. The Depressed Posture of the male Starling seems to be very similar to the display called submissive in the Jackdaw (*Corvus monedula*) described by Lorenz (1952), who concluded that the display serves to appease aggressors. The same conclusion is reached for the Starling, although tentatively.

Quantitative aspects.—Derivation of the dominance hierarchy by means of the win-loss diagram confirmed that the Starling shows "peck-dominance" rather than "peck-right" in caged situations.

The conclusion that the hierarchy in the flock became more rigid is based on subjective statements in the taped notes and on the data in Table 7. In a species showing peck-dominance, the probability that any bird will dominate another in 100 per cent of their encounters diminishes with the amount of time spent watching them. Since the second observation period was longer than the first, cases of 100 per cent domination should have been fewer than in the first period; and the fact that they had more is interpreted as demonstration that the hierarchy had become more rigid.

Introduction of new birds into a stable flock caused much excitement, but fighting was limited almost totally to birds ultimately emerging in the top half of the social order. One bird initiated one-third of all encounters.

SUMMARY

Wild and caged Starlings were studied to describe the behavior patterns of agonistic significance. Wild birds were watched in all seasons, while study of the caged birds was confined mainly to birds in nonbreeding condition. Twelve displays were recognized as having aggressive implications. Only superficial consideration was paid to the vocal aspects of behavior, but some calls seem to be aggressive in motivation and may constitute in themselves agonistic displays. Two displays were seen exclusively in wild birds; there were no displays different in quality seen in the caged birds.

Study of the dominance hierarchy in the caged birds showed that it was of the peck-dominance type, in which no bird is immune to attack from subordinates. The hierarchy shifted unexplainably, but became more rigid with time.

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DEPARTMENT OF ZOOLOGY, PENNSYLVANIA STATE UNIVERSITY, UNIVERSITY PARK,
PENNSYLVANIA, 10 MAY 1965

NEW LIFE MEMBER



Dr. B. Franklin McCamey, Jr. has recently become a Life Member of the Wilson Ornithological Society. Dr. McCamey

has been the Executive Secretary of the Hawk Mountain Sanctuary Association and naturalist at the Sanctuary, but this spring he became Director of the new Cincinnati Nature Center at Milford, Ohio. A graduate of Yale University and Yale Forestry School, he holds a Ph.D. from the University of Connecticut. His ornithological interests include population dynamics, photography, and banding. He is currently a vice-president of the Eastern Bird Banding Association. He is also a member of the AOU, The Wildlife Society, Society of American Foresters, Sigma Xi, Ecological Society of America, and the Northeastern Bird Banding Society. Dr. McCamey is married, has one married daughter, and includes among his interests most phases of outdoor activity.