

INTERSPECIFIC AGGRESSION BETWEEN BLACK-CAPPED AND MOUNTAIN CHICKADEES AT WINTER FEEDING STATIONS

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Dominance-subordination relationships in animals have long been of interest and birds are one of the better studied groups in this respect. Many studies of marked individuals, both captive and free-living, have established factors that are important in determining the outcome of aggressive interactions between conspecifics. At the interspecific level it often is simply stated that members of one species are dominant over those of another, although instances have been noted in which dominance may be shown by members of either of two interacting species (Hinde 1952:31-32; Gibb 1954:518), or where the usual dominance pattern occasionally may be reversed (Colquhoun 1942:236). Detailed studies of interspecific dominance-subordination relationships involving marked birds of known history are, however, wanting.

While investigating relationships between Black-capped (*Parus atricapillus*) and Mountain (*Parus gambeli*) Chickadees in one of the few areas where they exhibit year-round sympatry, I observed frequent interspecific aggressive interactions at winter feeding stations. Birds did not appear to be determining the outcome of encounters on the basis of some obvious feature such as size. In addition, the two species have similar ecological requirements and are taxonomically closely related. These conditions presented possibilities that (1) factors not readily apparent might be involved in establishing dominance; (2) the dominance-subordination relationships might have ecological significance; and (3) some indication of evolutionary divergence of behavior patterns might be obtained. Thus, an analysis of winter interspecific dominance-subordination relationships was undertaken.

For purposes of comparison, the following brief account of intraspecific social behavior on the study area is included. Mountain Chickadees usually remain paired for life and occupy virtually the same breeding territories in successive years. In winter they form small

flocks (usually two to five birds), and the ranges of these flocks do not change much in succeeding years. Interactions at feeding stations have been used to obtain information about intra- and interflock social organization (Dixon 1965; Minock 1971). Black-capped Chickadees at Beaver Mountain also remain paired; however, they range somewhat more widely than Mountain Chickadees in winter and in summer (Minock, unpubl.). Also, they seem more likely than Mountain Chickadees to occur as individuals or pairs in winter, although this may simply be a result of low population density in what is marginal habitat for the species (Minock, unpubl.).

METHODS

The study area was in a mixed aspen-conifer forest at an elevation of 7300 ft in the Bear River Mountains approximately 30 miles NE of Logan, Utah.

Observations were made on 108 days during the winters (1 September through 30 April) of 1966-67, 1967-68, and 1968-69. Field observations began in the morning and usually lasted 2-4 hr. Birds were trapped using a modification of the trap described by Bailey (1951). They were color-banded with two color bands and one aluminum band, and their rectrices were painted stripe combinations using Testor's airplane "dope" to facilitate individual recognition at greater distances. Sex was determined by wing length and/or breeding season behavior.

Feeding stations were established at which a walnut with the shell partially removed was suspended from a thin wire. This permitted only one bird to feed at a time. Twenty-three stations were used during the course of the study; however, some were in operation to a considerably greater extent than others. The operation of a particular station, or the desirability of creation of new stations, was determined by knowledge of spatial and dominance relationships between birds under consideration.

Seven categories of dominance-subordination interactions were counted (tables 1, 2):

Supplanting attack—one bird flew at a second that left its perch. This could result in the supplanter landing on or near the perch where the supplantee had been. Also tallied as supplanting attacks were instances wherein one bird flew close by another which left its perch.

Physical attack—one bird flew at and made contact with another.

Chase—instances of obvious pursuit.

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TABLE 1. Encounters in which Black-capped Chickadees were dominant over Mountain Chickadees.

BcC MC	Suppl. attack	Chase	Feeding dominance	Physical attack	Resist	Attacking trapped bird	Retreated from	Totals
<i>Male</i>								
Male	105	27	47		9		10	198
<i>Male</i>								
Female	73	13	28	2	1		1	118
<i>Male</i>								
? ^a	57	22	16	1	1		5	102
<i>Female</i>								
Male	22	1	15	1	1		6	46
<i>Female</i>								
Female	14		22		3		2	41
<i>Female</i>								
?	1		5					6
?								
Male	12	1	1			3	2	19
?								
Female	13	4				1	3	21
?								
?	34	17	4	1		1	5	62
Totals	331	95	138	5	15	5	34	613

^a ? indicates sex not determined either because bird was not banded, complete band combination was not seen, or sex-determining criteria were indecisive.

Retreated from—one bird retreated at the approach of a second toward its general vicinity. The dominant bird was not definitely flying at the subordinate one as in the case of a supplanting attack.

Feeding dominance—one bird fed three or more times with no visits to the nut by another bird that was in the vicinity, or one bird fed at the nut while a second was perched within a few feet in the same tree. Not more than one of the first type was tallied between two birds during one continuous observation period at a feeding station, but all of the second type I saw were counted.

Resist—a bird held its perch when being flown at or by.

Attacking trapped bird—bird landed on trap containing another bird and pecked at it through the wire or exhibited other aggressive behavior toward it.

Occurrence of any of the above categories is referred to in the text as an "encounter" or a "contest." Supplants or physical attacks that occurred during the course of a chase were tallied as well as the chase itself. Initial departures from a fixed position at the beginning of a chase were recorded as supplants.

TABLE 2. Encounters in which Mountain Chickadees were dominant over Black-capped Chickadees.

MC BcC	Suppl. attack	Chase	Feeding dominance	Physical attack	Resist	Attacking trapped bird	Retreated from	Totals
<i>Male</i>								
Male	40	14	12	5	1		4	76
<i>Male</i>								
Female	57	14	10	1	3		10	95
<i>Male</i>								
? ^a	21	4					2	27
<i>Female</i>								
Male	3		1	1	2			7
<i>Female</i>								
Female	5		1					6
<i>Female</i>								
?	1	1						2
?								
Male	15	2	2		1			20
?								
Female	7		1			1		9
?								
?	4				1			5
Totals	153	35	27	7	8	1	16	247

^a ? indicates sex not determined either because bird was not banded, complete band combination was not seen, or sex-determining criteria were indecisive.

TABLE 3. Comparative weights and wing lengths.

Weight	Males	Females
<i>P. atricapillus</i>	$\bar{x} = 11.6$ g ($n = 6$)	$\bar{x} = 10.9$ g ($n = 5$)
<i>P. gambeli</i>	$\bar{x} = 11.7$ g ($n = 21$)	$\bar{x} = 11.0$ g ($n = 11$)
<i>P. gambeli</i> ^a	$\bar{x} = 11.56$ g ($n = 14$)	$\bar{x} = 10.51$ g ($n = 8$)
Wing length		
<i>P. atricapillus</i>	$\bar{x} = 67.5$ mm ($n = 6$)	$\bar{x} = 64.2$ mm ($n = 4$)
<i>P. gambeli</i>	$\bar{x} = 69.7$ mm ($n = 5$)	$\bar{x} = 65.3$ mm ($n = 5$)
<i>P. gambeli</i> ^a	$\bar{x} = 69.95$ mm ($n = 43$)	$\bar{x} = 66.41$ mm ($n = 33$)

^a These data from Behle (1956). The rest are from specimens in the Utah State University collection.

Certain interactions occurred which were counted as instances of dominance and subordination for both participants. Physical attacks directed at a stationary bird were thus also recorded as resists, since the attackee held his ground until hit. Likewise, instances where one individual flew close by a second that held its ground were tallied as supplanting attacks for the former and resists for the latter. Interactions of these types occurred 23 times, and are referred to as cases of two-way aggression.

Occasionally, one bird was simultaneously dominant over more than one individual. This was most frequent in the case of feeding dominance, but could also occur in chases or cases of being retreated from. When this happened, a separate encounter was tallied for the dominant bird and each bird that was subordinate to it.

Birds are designated by a combination of numerals and letters. Numerals specify individuals and letter denotes species and sex. The letter "w" appears in the designations of birds that were not known to establish breeding territories.

Except where otherwise indicated, all statistics were calculated using the chi-square test with two by two contingency tables and application of a correction for continuity. All encounters are treated as independent observations.

RESULTS

Fifteen individually marked Black-capped Chickadees and 24 individually marked Mountain Chickadees were seen in interspecific encounters over three winters. The numbers, respectively, for each of the three successive winters were 5 and 10, 9 and 9, and 9 and 12. Unmarked birds of both species also were observed in interspecific encounters.

Black-capped Chickadees were dominant over Mountain Chickadees in the majority of

encounters in all three winters: 141 of 146 cases in 1966-67; 78 of 90 in 1967-68; and 394 of 624 in 1968-69 (tables 1, 2). The difference from a 1:1 distribution is significant ($P < 0.001$, χ^2) even for 1968-69. However, since Mountain Chickadees won a substantial number of contests, further analysis is undertaken. Several factors are considered in respect to their bearing on the outcome of encounters.

Size. Size alone probably is not an important determinant in the outcome of encounters. Museum data show that differences in weights for individuals of the same sex are negligible (table 3). While the wing length measurements are longer for *gambeli* (table 3), the wings of these birds appear to be more pointed, and may not be any larger in surface area.

Weights were not obtained for birds in the study, but judging from wing length the implications from museum specimens are supported by examples such as the following. While mc83M, the most successful Mountain Chickadee versus Black-caps, had a longer than average wing length (71.0 mm), this measurement was less than that for mc34M (72.5 mm) who usually lost versus Black-caps. Mc94F, who was quite aggressive toward Black-capped Chickadees, had a less than average wing-length (64.0 mm). Bc93M, the Black-cap who lost most frequently, had a less than average wing length (66.0 mm); however, he was usually successful against Mountain Chickadees other than mc83M (see below).

Size differences may partly account for the

TABLE 4. Results of encounters with male Mountain Chickadees versus male and female Black-capped Chickadees.

	Male Black-capped Chickadees	Female Black-capped Chickadees
Male Mountain Chickadees ($n = 7$ vs. males, 6 vs. females) won	76 ($n = 4$)	95 ($n = 4$)
Male Mountain Chickadees ($n = 11$ vs. males, 6 vs. females) lost	198 ($n = 7$)	46 ($n = 6$)

Difference vs. males and vs. females: $P < 0.001$.

TABLE 5. Encounters of Mountain Chickadee mc83M versus Black-capped Chickadees.

	bc93M	bc83M	Females	Sex ?	Total
mc83M won	(1) ^a 48	2	18	11	79
mc83M lost	(1)	0	0	1	2

^a Parentheses indicate cases of two-way aggression.

differences found in relation to sex since males are larger than females.

Sex. Male Mountain Chickadees won versus female Black-capped Chickadees significantly more often than versus males (table 4). Of 184 Mountain Chickadee wins where the sex of both participants is known, 95 (52%) involved male Mountain Chickadees versus female Black-caps. In 46 cases, however, Black-cap females were dominant over male Mountain Chickadees. Female Mountain Chickadees were dominant over male Black-capped Chickadees only seven times (six of these involved new arrival mc94F to be discussed later). Also, if it were not for the relationship between two particular birds (mc83M and bc93M, see below), the per cent of encounters won by Mountain Chickadee males against Black-cap males would have been much lower.

Individual differences. Individual differences in birds are important in determining the outcome of encounters. Mc83M illustrates this; during the winter of 1968-69 he had a won-lost record of 79:2 against Black-capped Chickadees (table 5). It would have been informative had he been observed in more encounters with different males. Mc83M was also very aggressive in intraspecific encounters.

Bc93M was responsible for a large portion (57 of 76; 75%) of total Black-cap male losses to Mountain Chickadee males. However, against Mountain Chickadees other than mc83M, bc93M fared more as might be expected (table 6). Of 184 Mountain Chickadee wins where the sex of both participants is known, 63 (34%) involved bc93M and/or mc83M.

Site of encounter. Evidence that the site of an encounter is important in determining the outcome of interspecific aggression comes primarily from one flock of Black-capped Chickadees during the winter of 1968-69. The flock consisted of three birds: bc83M, his mate of the past breeding season, bc83F, and bc82wF (unpaired the preceding spring) in her second winter on the area.

Winter flock range, as used below, is an area in which members of a particular flock were observed regularly and where members of other flocks were seldom seen. However, the important point is that there were certain locations (i.e., feeding stations) at which some Black-capped Chickadees were more likely to lose encounters than at other locations.

Bc83M's success ratio against all Mountain Chickadees outside his flock's range is significantly lower than that on it (table 7). This is also true of encounters versus males, but not in encounters versus females. Here he won consistently regardless of location. Twelve instances of interspecific dominance by bc83M at a new station on 11 January 1969 are not included in table 7 because it is uncertain whether this site was on his winter range.

Bc84F had approximately similar records on and off her flock's range, but only five encounters were in the latter category. Bc82wF's win-ratio (versus males and total) off her range is significantly lower than that on it (table 8). This third-ranked bird had considerably more encounters off the flock range than the other two members. Perhaps low-ranked birds avoid intraflock competition by independent wandering.

Another instance of subordination to a Mountain Chickadee male by a Black-cap male while off his range involved bc51M during the winter of 1968-69. Bc51M was supplanted by mc84M twice in this context on 26 March. During the same observation period, bc51M was dominant over mc87F three times. Bc51M was a bird in his fourth winter on the area and had a past history of dominance in encounters with Mountain Chickadees.

TABLE 6. Encounters of Black-capped Chickadee bc93M versus Mountain Chickadees.

	mc83M	mc84M	mc87M	mc34M	mc81wM ₁	Females	Sex ?	Total
bc93M won	(1) ^a 1	26	15	(2)17	(1)2	36 ^b	25	122
bc93M lost	(1)48	0	2	(2) 2	(1)5	4 ^c	10	71

^a Parentheses indicate cases of two-way aggression.

^b One was mc94F.

^c All were mc94F.

TABLE 7. Encounters of Black-capped Chickadee bc83M versus Mountain Chickadees on and off his winter flock's range.

	On range				Off range			
	Males (n = 5)	Females (n = 3)	Sex ?	Total	Males (n = 4)	Females (n = 2)	Sex ?	Total
bc83M won	(5) ^a 5 ^a	(2) 3 ^b	18	110	3	9	2	14
bc83M lost	(5) 6 ^b	(2) 2 ^c	2	10	7	0	5	12

^a Parentheses indicate cases of two-way aggression.

^b All versus mc81wM₁.

^c Both versus mc94F.

Difference vs. males: $P < 0.001$; vs. females: NS, $0.7 < P < 0.8$; vs. sex?: $P < 0.01$; vs. total: $P < 0.001$.

Prior residence and previous interspecific experience. The effects of previous interspecific experience and recent arrival upon the outcome of aggressive encounters may be inferred by examination of interactions involving new arrivals to the area. It is likely, but not certain, that these birds came from areas where both species were not present. Arbitrarily, new arrivals are defined as unbanded birds, or birds that had not been banded more than 2 weeks.

The win ratio for new arrival Black-capped Chickadees versus resident Mountain Chickadees was significantly higher than the ratio of resident Black-capped Chickadees versus resident Mountain Chickadees (table 9). The win ratio of new arrival Mountain Chickadees versus resident Black-capped Chickadees was higher, but not significantly so, than the ratio for encounters between residents of both species (table 9). Black-caps won 8 of 13 encounters between new arrivals of both species, and the Black-cap loser was probably a female in four cases.

Detailed observation of a few individuals suggests that Mountain Chickadee behavior toward Black-capped Chickadees changes with experience or length of time on the area.

During the course of this study, mc34M showed typical subordination to Black-caps, but behaved differently during the winter of

1963-64, a period when Black-capped Chickadees were first settling on the study area (Dixon and Gilbert, pers. comm.). On 16 January, 21 March, and 23 March 1964, mc34M was dominant in encounters with Black-capped Chickadees. However, on 16 April two Black-capped Chickadees exhibited feeding dominance over mc34M.

Mc81wM₁ remained in the same area from the day he was banded in January 1968 until March 1969. On 5 days in March and April 1969, he was in a new area some 700 m distant. On 4 of these days, he won 19 of 40 encounters with Black-capped Chickadees. His behavior toward them was quite aggressive and if not indicative of naivete toward Black-caps in general, it was at least so for the particular Black-caps involved. After initially challenging Black-caps in this area, mc81wM₁ acted in a subordinate manner, at least with respect to bc83M.

Recent arrival mc94F initially challenged, but subsequently was subordinate to, bc83M and his mate bc83F in several encounters on 26 March 1969. However, dominance was not clearly established between her and bc93M 42 days after she was banded.

In addition to the foregoing, alpha Mountain Chickadee males, typically birds that had been on the area for some time, usually were subordinate to Black-capped Chickadees in

TABLE 8. Encounters of Black-capped Chickadee bc82wF versus Mountain Chickadees on and off her winter flock's range.

	on range				off range			
	Males (n = 3)	Females (n = 3)	Sex ?	Total	Males (n = 4)	Females (n = 2)	Sex ?	Total
bc82wF won	5	8	2	15	5	(2) ^a 5	1	11
bc82wF lost	7	0	1	8	44	(2) 2	0	46

^a Parentheses indicate cases of two-way aggression.

Difference vs. males: $P < 0.05$; vs. females: NS, $0.3 < P < 0.4$; vs. total: $P < 0.001$.

TABLE 9. Encounters with respect to residency status.

	New arrival BcC ($n \cong 3$) vs. resident MC ($n = 7$)	New arrival MC ($n \cong 5$) vs. resident BcC ($n = 9$)	Resident BcC ($n = 12$) vs. resident MC ($n = 22$)
Mountain Chickadee won	2	20 ^a	179
Black-capped Chickadee won	28	40	404

^a At least 12, perhaps all 20, involved mc94F. Difference between new arrival Black-capped Chickadees vs. resident Mountain Chickadees and residents of both species: $P < 0.01$, between new arrival Mountain Chickadees vs. resident Black-capped Chickadees and residents of both species: NS, $0.7 < P < 0.8$.

aggressive encounters (e.g., mc84M, mc34M, mc54M).

Presence of male flock-mate. In 1968–69, the won-lost record for female Black-caps versus male Mountain Chickadees was 18:60 when a male flock-mate was present. Without a male flock-mate present, it was 3:30. This difference may be suggestive, but it is not significant ($0.1 < P < 0.2$). No differences are apparent with or without a male present for the other 2 years of the study (Totals; 11:2 with male present, 14:3 without male present).

Sound signals. Both Mountain and Black-capped Chickadees have a number of calls, as well as primary song, in their vocal repertoires (Odum 1942; Dixon, unpubl.). Included are calls used mainly by males in aggressive encounters at close quarters around feeding stations in winter. Among Mountain Chickadees, this vocalization is referred to as an attack call (Dixon 1970). The call most frequently used in this context by Black-capped Chickadees is one that has a melodious, whistled quality sounding like "slee-slur," or sometimes "sleelop-cheelop" (Dixon, pers. comm.). This call is apparently the one Odum (1942) calls a dominance note and describes as "cheelup" or "che-up-che."

The Black-cap dominance note was uttered (either soon before, during, or close after the encounter) in at least 10 interspecific chases, supplanting attacks, or physical attacks with Black-capped Chickadees dominant. It was used once in this context when the determination of the winner was uncertain. The Mountain Chickadee attack call was employed in at least 17 interspecific chases, supplants, or physical attacks with Mountain Chickadees dominant. It was used once in this context when the determination of the winner was uncertain. Many interspecific encounters were silent.

At the intraspecific level both these calls serve as threats, which in combination with other behavior (e.g., movement toward the adversary), or at times alone, cause the subordinate to give ground (Odum 1942; Dixon 1970). No such function seems attributable to these calls at the interspecific level. Subordination was never observed in an interspecific encounter in response only to one of these calls. If the addressee acted in a subordinate manner, there was always some other aggressive behavior involved on the part of the caller (i.e., chase, supplant, or physical attack). I also observed instances wherein the calls were given, without other accompanying aggressive behavior, and no submissive response by the congener was apparent. These situations included instances when a bird continued to feed at the walnut or continued some other activity, and cases in which the bird giving the call actually was losing an interspecific encounter. There were 16 cases of no apparent response by Mountain Chickadees to the Black-cap dominance note, and nine cases of failure of Black-capped Chickadees to respond to Mountain Chickadee attack calls. Both calls sometimes are exchanged intraspecifically in situations where dominance is not clearly established (i.e., near boundaries). Interspecific exchange of these calls was never obviously apparent, although there were a few instances in which both may have been used in close succession in the same interspecific encounter.

Several other vocalizations were also heard in winter when both species were present. The data here are inconclusive, but my impression is that it is unlikely that any of them functions in a significant way in communication at the interspecific level other than, perhaps, letting a bird's presence be known.

Variations of the familiar "name" call ("chick-a-dee-dee") of either or both species often are heard when both species are present. Often no response was apparent, but upon three occasions what may have been answering back and forth interspecifically was heard. On one of these occasions it sounded more as if the Mountain Chickadees were responding to the Black-caps than vice versa.

DISCUSSION

As has been reported among other parids (Brian 1949:144; Colquhoun 1942:236; but see Hinde 1952:31–32; Gibb 1954:518), there is a consistent dominance-subordination relationship between the two species I studied. Black-capped Chickadees usually are able to

dominate Mountain Chickadees in aggressive interactions around feeding stations. This is consistent with the brief statement of Beidleman (1955). However, Wing (1946) reported Mountain Chickadees dominant over Black-caps, but the number of observations was not given. I found that cases of Mountain Chickadee dominance are not infrequent, and some factors influencing the outcome of encounters are demonstrated. Sex, individual differences in birds, and site of encounters in relation to Black-cap winter ranges certainly are quite important. Other factors that seem to have an effect, but less certainly so, are previous interspecific experience in combination with length of time on the area. Age is difficult to separate from length of time on the area and previous interspecific experience, since older chickadees are most often previous residents. Thus, age may be important by itself, but this was not shown.

Some of the factors important interspecifically, for example, sex, site of encounter, and previous experience, are similar to those that influence dominance-subordination relationships in groups of conspecifics (e.g., Dixon 1963, 1965; Minock 1971). Other factors that are important intraspecifically were not important at the interspecific level. Thus, sound signals sometimes were uttered, but appeared to be ignored in interspecific aggressive interactions.

I observed little to indicate that either species makes significant use of visual signals (with the possible exception noted below) in intraspecific or interspecific agonistic situations. The latter is not surprising if the former is indeed correct. Further analysis is needed at the intraspecific level before definite conclusions can be reached. However, if visual signals are important they are apparently not as obvious to a human observer as is the case intraspecifically and interspecifically among some British titmice (Hinde 1952; Stokes 1962a, b).

If, as the evidence from the effect of previous experience and length of time on the area suggests, Mountain Chickadees learn not to challenge Black-capped Chickadees, does the process involve interspecific recognition of individuals? Individual recognition functions effectively in the reduction of strife and in maintenance of dominance-subordination relationships within conspecific groups of animals (Collias 1944). In this study, differential responses did occur between one bird and different congeners (e.g., bc93M to mc83M and mc87M (tables 5, 6); or mc94F to bc93M and

bc83M (p. 458). Also, the different responses to congeners of different sexes implies that differences are detected. Thus, if actual recognition of individuals does not occur, at least differences in appearance and/or behavior are perceived.

That these differences do not have identical effects between as within species is suggested by the fact that interspecific dominance-subordination relationships are not always as might be expected from knowledge of the intraspecific situation. For example, mc84M was dominant over mc83M in encounters on mc84M's range. Yet, at the same location mc83M was dominant over bc93M while mc84M was subordinate to bc93M. Mc84M, alpha male of his flock, was also less successful than the beta bird (mc87M) of his flock against another Black-capped Chickadee (bc83M).

In 3 years I observed the category "physical attack" at least 12 times in interspecific encounters and only once for certain in intraspecific encounters (between two *gambeli*). Since congeners do not usually travel together on the study area, there should be more opportunity for intra- than interspecific interaction. Thus, overt aggression is apparently more frequent at the interspecific level. This result is similar to that in British titmice (*P. major*, *P. caeruleus*, *P. palustris*; Hinde 1952:88) where "combat" occurred more frequently interspecifically than intraspecifically in reproductive fighting. However, Morse (1970) found intraspecific interactions within foraging flocks of winter birds to be more overtly aggressive than interspecific interactions. Morse's findings may differ because he (1) is dealing with morphologically more distinct species; (2) may, unlike the situation in this study, not be dealing with stable intraspecific flocks with well-established dominance relationships; and (3) considers both "chases" and "fights" as overt aggression. Wiens (1965) found that diving ("a highly aggressive action") was more prevalent in interspecific than intraspecific territorial interactions between Red-winged Blackbirds and Common Grackles. The results among chickadees and titmice seem to correspond more with this situation than Morse's.

If flying at another bird is considered a display, then it is my impression that most cases of interspecific physical attack resulted from failure to respond to (= recognize) a display. Thus, what would otherwise be a supplanting attack becomes a physical attack when the attackee fails to give ground and the attacker does not veer off. This failure to respond to a

display, combined with lack of effective interspecific vocal communication, may necessitate a relatively overt process for the establishment of interspecific dominance-subordination relationships. The process of establishing intraspecific dominance-subordination relationships for a new arrival or intruding neighbor could be less overt because of effective communication.

Lack of interaction away from feeding stations in both the breeding and nonbreeding seasons along with use of different preferred tree types among the mixed timber at Beaver Mountain suggest that behavioral interactions probably are of little importance in avoidance of competition between these species in this area (Minock, unpubl.). Nonetheless, the results reported here reinforce the idea that investigators looking for ecological effects of agonistic behavioral interactions between potentially competing species may sometimes have more to contend with than the total dominance of one species by another.

SUMMARY

Aggressive interactions between color-marked Mountain and Black-capped Chickadees at winter feeding stations were studied in an area of year-round sympatry in northern Utah in three winters. Black-capped Chickadees usually were dominant over Mountain Chickadees. However, since Mountain Chickadees won a substantial number of contests, an analysis of several factors bearing on the outcome of encounters is made. The ones having the greatest effect are sex of the participants, individual differences in birds, and site of encounters in relation to Black-cap winter ranges. Other factors that seem to have an effect, but less certainly so, are previous interspecific experience in combination with length of time on the area. Interspecific response to sound signals was not evident in aggressive encounters.

Some comparisons with the situation in other parids are made. Relationships to intraspecific dominance-subordination responses are discussed.

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