WESTERN RUBY-CROWNED KINGLET, *Corthylio calendula.*—A fairly common summer resident and breeder around the Gothic area.

AUDUBON'S HERMIT THRUSH, *Hylocichla guttata auduboni.*—A common summer resident at Gothic and found all the way up to an altitude of a little over 10,000 feet. A breeding pair had a nest in a low spruce not far from my cabin. By the end of July the entire family, parents and young, was frequently to be seen quietly searching for food on the ground in that vicinity. I caught one of them in a trap and banded it.

WESTERN ROBIN, *Turdus migratorius propinquus.*—A common summer resident throughout this part of Colorado. I found them all the way from Montane country up to the glacial snows around Emerald Lake and Virginia Basin, and in considerable numbers (See paragraph on Western Meadowlark).

MOUNTAIN BLUEBIRD, *Sialia currucoides.*—As common a summer resident, and nearly as widely distributed, as the Robin. I have seen them at an altitude of a little over 12,000 feet, but Bailey reports that they go as far as 13,000. I noticed that like the Eastern Bluebird they seem to feel most at home close to human habitations. We had several pairs nesting in and around our laboratory buildings and they were fairly tame.

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TERRITORY AS A RESULT OF DESPOTISM AND SOCIAL ORGANIZATION IN GEESE

BY DALE W. JENKINS

INTRODUCTION

TERRITORIES of birds have been carefully studied and variously defined from the standpoint of the function and result of territory. These studies have been concerned with breeding, nesting, pairing,

adequate food supply, and space between birds. Few detailed or quantitative studies have been made upon one of the main criteria by which we are aware of the presence and extent of territories, namely the contact behavior and relationships with other birds of the same species or other species.

The purpose of the present study was to attempt to find and measure aggressiveness, individual relationships, and social organization in birds under, as nearly as possible, natural social conditions, and to observe territory throughout the year from this viewpoint. The study was made on a Ridgway Fellowship at the University of Chicago, during the academic year, 1939–40. It was undertaken at the suggestion and under the direction of Dr. W. C. Allee. Grateful acknowledgements are made to Dr. Allee, Mrs. M. M. Nice, the late Dr. G. K. Noble, Dr. H. H. Shoemaker, Dr. S. C. Kendeigh and Dr. N. E. Collias for suggestions and helpful criticisms, to Mr. R. E. Smart for permission to use the sanctuary, and to friends who helped make the observations.

The social organization of a few domesticated birds, such as chickens, canaries, and pigeons, and of captive birds, has been carefully studied during recent years, and the types of social relationship are fairly well known.

Two main types of intraspecific social organization have been found in birds. The first, known as 'peck right,' was reported by Schjelderup-Ebbe (1922) in flocks of the common chicken. When schematically developed, this is a straight-line type of hierarchy in which one bird is dominant over all the rest and pecks all birds below it; a second bird immediately below pecks all below it, and so on down the line. Quite a number of species have been found to have this type of social organization. The second type is known as 'peck dominance,' and was reported by Masure and Allee (1934) in the pigeon. This type of social organization presents no absolute peck right over subordinates, but is based on peck dominance after many conflicts. The bird which has won most frequently in a pair-contact cannot always be predicted to win. Peck dominance has also been reported in the Shell Parakeet by Masure and Allee (1934); in Ring Doves by Bennett (1939); and in the Canary by Shoemaker (1939). These two types of peck order are not always distinct and may intergrade.

MATERIALS AND METHODS

The present study was based on three native species of geese and four native species of ducks. These included six Blue Geese, *Chen*

caerulescens, two Lesser Snow Geese, *Chen h. hyperborea,* and twenty-six Canada Geese, *Branta c. canadensis.* Some of these had been raised in Minnesota and released in the Jackson Park Bird Sanctuary, Chicago, Illinois, where these observations were made. The geese raised young, which were included in the observation.

These geese were not tame, and if they were disturbed by intruders, the Canada and young Blue Geese flew away in characteristic V-formation and returned only after a considerable lapse of time. The other geese, having one wing tip clipped, fluttered over the water to the other side of the lake in the sanctuary.

Various ducks were also on the sanctuary lake, and these included the Mallard, *Anas p. platyrhynchos;* Lesser Scaup, *Nyroca affinis;* the Redhead, *Nyroca americana;* and the Wood Duck, *Aix sponsa.* The Mallards were mostly tame, but the other ducks were wild; many wild ducks came into the sanctuary and their relationships with the geese were observed.

Since the Blue and Snow Geese were usually found together and behaved similarly, they were considered together. The Blue Geese were divided into two groups—one a family composed of two parents and two offspring, and the other of a male and a female which were usually closely associated. The Snow Geese probably were both males or at least of the same sex. Since geese show no sexual dimorphism in plumage or size, the sex was not definitely ascertained until their mating in the spring, when the information given below was finally completed.

It was necessary to recognize each individual bird in order to establish its social position. Attempts to mark the individuals in various ways, such as by shooting dye from a distance with a blowgun and water pistol and by trapping the birds, failed because of their wildness. It was necessary to learn the birds by their plumage, actions, and other characteristics. The following tabulation shows the symbols used and the status and recognition marks of each goose:

BLUE GEESE

Family

C—Father of family; all white head; usually main guard.

A—Mother of family; head white with dark stripes on side.

S—Immature in family; head partly white; wings unclipped; sex unknown.

B—Immature in family; head all black, turned white in spring; sex unknown.

Mated Pair

M—Male and mate of W; head white; dark stripe on back; white-margined feathers.

W—Female and mate of M; head entirely white.

SNOW GEESE

L—Left wing tip only dark; probably male; stayed with M and W.
R—Right wing tip only dark; usually alone.

CANADA GEESE

Certain birds with deformities and size differences were recognized, but since all the birds could not be differentiated, the intraspecific social organization could not be determined.

Observations were made throughout an eight-month period extending from October 18, 1939, to June 15, 1940. The data in this paper are compiled from the observations of about 420 hours in the field. The average peck frequency or rate of conflict was about three pecks per hour. The habits and actions of the geese were observed at all hours of the day and night, but most of the observations were made at feeding time in the late afternoon. The geese were fed grain and bread which was scattered on an island while the geese rested in a lagoon. If the geese were very hungry they would accept food thrown to them from outside the sanctuary fence.

A typical peck was delivered by the dominant bird forcefully striking with its bill at the posterior part of the subordinate bird. The pecked bird quickly moved away, often shaking the rump and tail from side to side, which seemed to denote subordinance, defeat, or loss of food. Actual chasing of a subordinate bird also was counted as a display of dominance.

OBSERVATIONS AND DISCUSSION

The data reported here are observations of despotism and defense behavior of individual, pair, and family; the social inter-actions and resulting territories and social order of geese and ducks. Before the territorial aspects are discussed, the observations on the social organization and despotism will be presented. Observations of the geese and ducks appeared to show not only an intraspecific social organization between members of the same species, but also an interspecific social organization between different species. The intraspecific social organization was found within each of the three species of geese studied, while the interspecific social organization was found between the three species of geese, between the four species of ducks, and between the geese and ducks.

INTRASPECIFIC SOCIAL ORGANIZATION

Fall and Winter Peck Order.—A definite 'peck right' type of social organization, greatly modified by strong family ties and by mated pairs, was observed in the geese. This is shown in the left half of Table 1. No

despotism existed in the family C, A, S, B, nor between the pair of mated birds M and W.

TABLE 1

INTRASPECIFIC SOCIAL ORGANIZATION OF BLUE AND SNOW GEESE

Peck order in fall and winter			*Peck order in mating and nesting time*		
Bird	*Number pecked*	*Birds pecked*	*Bird*	*Number pecked*	*Birds pecked*
C	4	R W L M	C	6	R B S W L M
A	4	R W L M	A	0	
S	4	R W L M	M	4	R B S L
B	4	R W L M	L	4	R B S W
M	2	R L	W	2	R S
L	2	R W	S	0	
W	1	R	B	0	
R	0		R	0	

All members of the Blue Goose family were dominant over the rest of the geese and ducks during the fall and winter and until the time of mating, when the family relations were broken on April 2, 1940.

The pecks occurring in conflicts between individual birds for the five and one-half months during the fall and winter are summarized in Table 2.

TABLE 2

SUMMARY OF INTRASPECIFIC PECKS (FALL AND WINTER ONLY)

C pecks	A—0 times	S pecks	C—0 times	M pecks	L—42 times
	S—0		A—0		W—0
	B—0		B—0		R—9
	M—18		M—24		
	L—24		L—32	L pecks	W—12 times
	W—7		W—10		R—22
	R—10		R—15		
				W pecks	R—2 times
A pecks	C—0 times	B pecks	C—0 times		
	S—0		A—0	R pecks	—0 times
	B—0		S—2?		
	M—19		M—4		
	L—30		L—10		
	W—8		W—1		
	R—9		R—7		

This is a modified peck order due to the toleration among members of the family and between the birds of the mated pair. Two pecks were observed in the family by the immatures, B and S; however, this represented attempts by B to get food from the bill of S, rather than true pecks.

The members of the family were always together, and the paired M and W were usually together with L, while R, the Snow Goose at the bottom of the peck order, was nearly always driven away or alone.

The mother, A, had an antipathy against L when attempts were made to invade territory, and gave L thirty severe pecks. The male, M, of the mated pair pecked L forty-two times. Another antipathy occurred in Snow Geese; R was viciously pecked twenty-two times, chased, and kept from eating by L. Geese low in the peck order bothered the ducks more than the superiors did.

Organized Despotism and Facilitation.—Geese were often noticed to defend or take the part of a mate or of another goose. Table 3 shows all possible combinations of the family working together except C, B, S; C, A, B; and A, B, S. M, W, and L made an unstable group. The table may be expanded to read, *e.g.*, C, A, S, and B were observed to dominate 10 Canada Geese, once; 26 Canada Geese, twice; etc.

TABLE 3

COMBINATIONS AND FACILITATION

C, A, S, B pecks (10 Can.) 1; (26 Can.) 2; (4 Can.) 3; (L) 1; (M) 1.
C, A, S pecks (10 Can.) 1; (2 Can.) 1.
C, A pecks (2 Can.) 4; (MWL) 1; (L) 3; (M) 1.
C, B pecks (10 Can.) 1; (10 Mal.) 1.
C, S pecks (3 Can.) 1; (1 Can.) 2; (MWL) 1.
A, B pecks (3 Can.) 1; (L) 1.
B, S pecks (M) 1.

M, W, L pecks (1 Can.); (S) 1; (R) 3.
M, W pecks (3 Can.) 2; (1 Can.) 2; (L) 5.
W, L pecks (R) 1.
M, L pecks none

The family group showed organized despotism through its strong integration and coöperation, resulting in the dominance of the family. Division of labor was noticeable. The father, C, was usually on guard while the rest of the family was feeding, and defended the family mainly from the larger Canada Geese; the mother, A, often defended the family against the other Blue and Snow Geese. The offspring were kept between the parents. This well-integrated family might be called a family supraorganism, since it performs the activities of a larger, more complex individual, through coördination of its components. This results in the dominance of the family, which is of survival value to its members in that they can feed first and rest in the center of the aggregation, and are not pecked or chased.

This organized despotism appears rather unusual, since Schjelderup-

Ebbe (1935), who has studied peck order extensively in many species of birds, states: "The writer has not been able to prove that organized despotism (by agreement between two or more individuals) exists in birds."

Change of Peck Order in Spring.—Throughout the fall, winter, and early spring, the peck order remained the same. During the coldest weather, while the lake was frozen, the geese and ducks were often huddled in an aggregation at the edge of the ice. During the latter part of March, the male Blue and Canada Geese became more active, and their response to the females became more evident. The males began chasing each other, honking loudly, and, after chasing other geese or ducks, ran back to the female and gave a 'Triumphgeschrei,' in which both male and female stood facing each other and bowed their heads together, honking loudly all the while.

Fortunately, as a result of extended observation just at this time, I saw what was probably the first actual breaking up of the Blue Goose family. This occurred at 11:00 A. M. on April 2, a very warm day. The father, C, kept the mother, A, close and occasionally pecked their offspring, S and B. Finally B was chased away and then S. The offspring were pecked by Canada Geese and by M, W, and L. They attempted to rejoin the mother, A, but were driven away by the father, C. Later that day, at 5:00 P. M., the offspring were again tolerated, and the father defended them against other geese. From April 2 until April 30, the offspring were driven from the family on warm days, and were tolerated on the cold days of Chicago's variable climate. After April 30, the offspring were never tolerated, and C began courting and mating with A.

A new peck order, which lasted from April 2 until June 15, or longer, is given on the right side of Table 1. This table shows the reversals and loss of dominance of the immatures, S and B, when the family broke up. The parents, C and A, maintained top positions, while M, L, and W became dominant over S and B. Table 4 gives a summary of the pecks observed after the break-up of the family.

The immatures, S and B, were pecked by all but R. The immatures themselves pecked no other birds. A vicious fight occurred on April 30 between M and L. This was probably a challenge fight started by L, perhaps over M's mate, W, with which L had attempted to mate. This attempt of L, a Snow Goose, to mate with a female Blue Goose is very interesting. Some systematists regard the Blue Goose as a color phase of the Lesser Snow Goose, and hybrids are known.

TABLE 4

SUMMARY OF INTRASPECIFIC PECKS (APRIL 2, TO JUNE 15)

C pecks	A—0 times	M pecks	L—15 times	S pecks	B—0 times
	M—5		W—0		R—0
	L—43		S—2		
	W—3		B—1	B pecks	S—0 times
	S—16		R—1		R—0
	B—7				
	R—3	L pecks	W—5 times	R pecks	——0 times
			S—13		
A pecks	C—0 times		B—0		
	M—0		R—2		
	L—1				
	W—0	W pecks	S—3 times		
	S—0		B—0		
	B—0		R—3		
	R—1				

INTERSPECIFIC SOCIAL ORGANIZATION

Interspecific social relations of birds have received little attention from ornithologists, except for chance observations at feeding stations and especially at nests. A very definite interspecific social organization was found between the groups and three species of geese and four species of ducks studied. This was a 'peck-right' type of social organization. The relationships of the birds in the interspecific peck order are shown in Table 5.

Size is an important factor but is not the only factor causing interspecific dominance. The members of the family of Blue Geese were dominant over the Canada Geese, which were almost twice the size of the Blue Geese. The parents, C and A, were still dominant, even after the break-up of the family.

A summary of the interspecific pecks for the whole period of observation is given in Table 6. Some reversals were observed which

TABLE 5

INTERSPECIFIC SOCIAL ORGANIZATION

Species	*Species and Groups pecked*
Fam. Blue	pecks Scaup, Wood, Redhead, Mallard, Snow G., M, W. Blue, Canada G.
Canada G.	pecks Scaup, Wood, Redhead, Mallard, Snow G., M, W. Blue
M, W. Blue	pecks Scaup, Wood, Mallard, Snow G.
Snow G.	pecks Scaup, Wood, Redhead, Mallard
Mallard	pecks Scaup, Wood, Redhead
Redhead	—
Wood	pecks Scaup
Scaup	—

TABLE 6

SUMMARY OF INTERSPECIFIC PECKS

Species or group	*Species pecked*	*Pecks*	*Back pecks*	*Species or group*	*Species pecked*	*Pecks*	*Back pecks*
Fam. Bl. G.	Canada G.	259	0	Snow G.	Mallard	28	0
	M, W Blue G.	99	6		Redhead	1	0
	Snow G.	185	13		Wood	3	0
	Mallard	44	0		Scaup	2	0
	Redhead	3	0				
	Wood	4	0	Mallard	Redhead	3	2
	Scaup	6	0		Wood	6	0
					Scaup	1	0
Canada G.	M, W Blue	65	5				
	Snow G.	87	18	Redhead	Wood	0	0
	Mallard	9	0		Scaup	0	0
	Redhead	3	0				
	Wood	6	0	Wood	Scaup	8	0
	Scaup	7	0				
				Scaup	—	0	0
M, W Blue G.	Snow G.	72	18				
	Mallard	6	0				
	Redhead	0	0				
	Wood	1	0				
	Scaup	2	0				

deserve explanation. The reversals against the family are due to the ostracizing of the immatures, S and B, at the beginning of the mating season.

Although the relationship among the Canada Geese, the Blue Geese, M and W, and the Snow Geese looks like peck dominance, it is because M, W, and L were dominant over a few crippled and small Canada Geese. There was no pecking back and forth, so that no true reversals were noticed in the geese. The relation between the Blue Geese, M and W, and Snow Geese, L and R, is due to L being dominant over W, while M was dominant over both L and R.

The relations of the ducks were not observed enough for any conclusions to be made. A duck with food was often chased by a subordinate. The order of feeding and the formation in moving toward food followed the sequence of the interspecific peck order in that the most dominant group fed first, followed by the next in dominance, down the scale.

TERRITORIAL RELATIONS

Territory is used here in a broad sense, being applicable in non-mating and non-nesting times as well as during mating and nesting

times. *It is any area in which despotism is shown resulting in the defense against other organisms, and is usually formed around some site or object such as nest, offspring, mate, food, etc. It is a result of despotism and social organization, and it may be fixed or evanescent in time and variable in size and shape.*

Establishment and maintenance of territorial boundaries appears to be the most important factor causing pecking in geese. However, the territory itself and the territorial boundaries are not the causes of pecking and social organization, but *are expressions or results of despotism or dominance, defense, or both.*

The family organization was the most important factor in producing despotism and defense pecking in the fall and winter, but in the spring the female mate became the most important, even to the extent of causing disintegration of the family.

Territories with definite boundaries are established and maintained around, or because of, despotism resulting in defense of: (1) the family including young; (2) the female mate; (3) the nest; (4) a place factor or certain location, or a position with reference to the rest of the birds; (5) a combination of these.

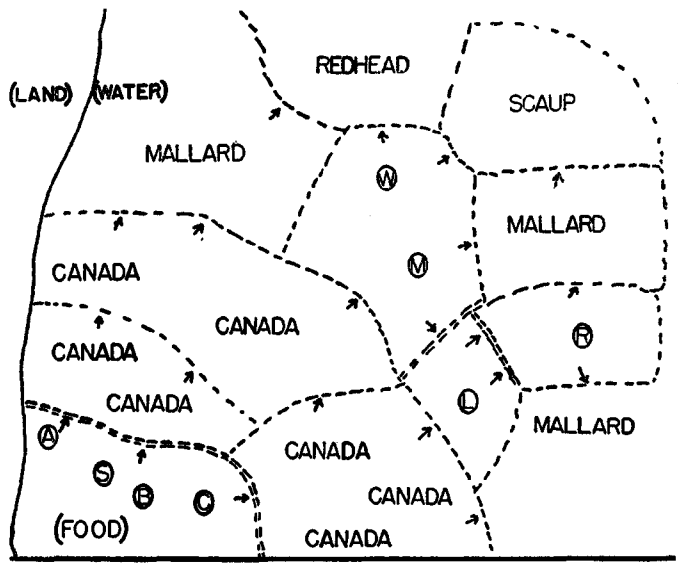
1. Family Territory.—The family territories of geese were definite, defended areas which also moved when the families moved. The territories varied in shape and size, and were maintained in all types of activities throughout the year except during the reproductive period. The families of Canada Geese broke up early in March and, as stated before, the Blue Goose family disintegrated on April 2.

All members of the family joined in the establishment and defense of the territorial boundaries. The coöperation of the Blue Goose family is shown in Table 3. As was stated before, the father, C, was usually on guard and defended the family from the Canada Geese, while the mother, A, often defended the family from the other Blue and Snow Geese. The offspring sometimes helped but were usually kept between the parents. A typical feeding territory of the family of Blue Geese is shown in Text-figure 1. Territorial boundaries of the families while feeding were well defined and the boundaries vigorously maintained.

While the families were resting and sleeping, the boundaries of territories were not so rigidly defended. Text-figure 2 shows the geese in a typical resting formation. The territory of the Blue Goose family was in the center of the group of birds and was about 35 feet in diameter, and it was defended about two hours. The other Blue and Snow Geese were tolerated in the territory of the family of Blue

Geese if the Canada Geese were not present. During the cooler days of autumn, the territory of the Blue Goose family was not maintained so rigidly, especially if the Canada Geese were not near.

The territories maintained by the families while moving were very interesting, and one common arrangement is shown in Text-figure 3. The swimming order was not always constant. In my observations, there seemed to be a tendency, when food furnished the stimulus to move to a new place, for the dominant group often to be out in front, but if the birds were moving to a resting place, the dominant Blue



TEXT-FIGURE 1

Territories of families, mates, and individuals while feeding. November 22, 1939.

Goose family frequently trailed the rest of the geese in the rear and center.

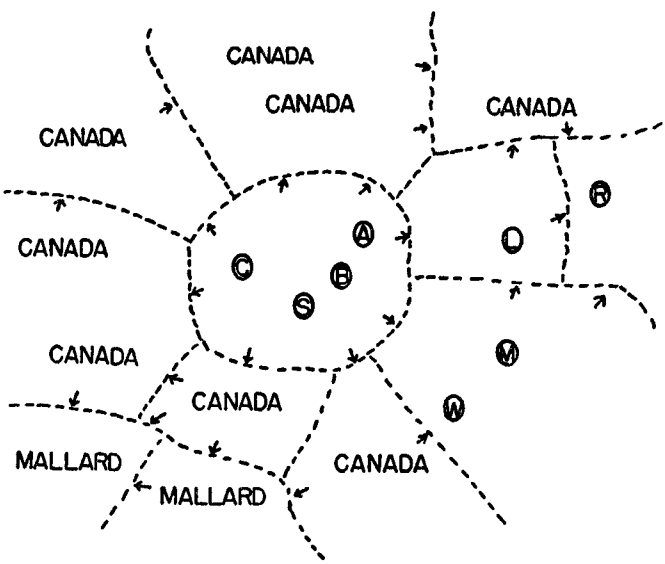
2. Mated-female Territory.—The mated female was the center of a territory which was vigorously and sometimes viciously defended by the mated male. This territory was a defended area of definite size, which moved around with the female. The mated female, which had previously defended her offspring, no longer took part in self defense or in maintaining boundaries.

The mated male viciously drove away all other birds attempting to enter the territory, and also the immatures attempting to rejoin their mother. The mated-female territory was defended throughout

the year if there was no family, but not as vigorously in the fall and winter as in the mating season.

There is a very strong bond between mates in geese; often when one is killed the survivor never remates.—Heinroth (1912). Geese are said to mate for life, and McAtee (1924) records a pair of Canada Geese mated for forty-two years and another pair mated for twenty years. In both cases, when one of the pair was killed, the mate died in a few months.

The size of the mated-female territory was only a few feet in di-



TEXT-FIGURE 2

Territories of groups while resting.

ameter early in the mating season, but increased later. It did not vary in size with the activities of feeding, resting, and moving as much as did the family territory. At courting time the other birds were chased away as far as fifty feet from the mated female. During several observed copulations of the Blue Geese, the mated-female territory was not large in diameter, and was located in the middle of the lake. The paired birds swam side by side dipping their bills to the water in unison and then lifting up and flapping their wings. The male then fluttered up on the back of the female and copulation occurred quickly. Several unsuccessful attempts had occurred previously.

The males of both geese and ducks were very active and aggressive

at mating time, and more despotism than usual was shown, while the females completely lost their aggressiveness.

These results of observations of birds under natural conditions agree well with the results of Allee, Collias, and Lutherman (1939), who have shown the effect of the male hormone, testosterone, in raising injected chickens to higher places in the peck order; and Bennett (1940), by injecting the same hormone into Ring Doves, caused them to peck more and become more dominant.

3. Nesting Territory.—A nest was an object around which there was a protected or defended area. This territory was often combined with the mated-female territory, which was very large at this time. The nest area was protected, but if the female wandered away from the nest, it, rather than the nest territory, was defended, at least early in the nesting season.

It has often been noticed that birds are dominant in the region of their nests, and much has been written about this. Lorenz (1931) found Jackdaws to be dominant in the region of their nests, and Shoemaker (1939) found that Canaries, subordinate in neutral territory, become dominant in their nesting territory.

The nests of the geese were scattered over the sanctuary and the neighboring area outside the sanctuary. None of these nests were close to each other, and since the nests were not built until all the geese were mated and dispersed, few geese came in contact, so that the nesting-territory boundaries could not be definitely located. The birds were secretive in their habits near the nests, but loud honking or calling indicated that a goose or duck had trespassed on a nesting territory. The Blue Geese, M and W, had a nest at the end of an island where all the geese had slept previously. In 1940, four young were raised by the pair, C and A, but these disappeared when half grown. M and W had no offspring. Several broods of Canada Geese were raised. The nesting territories were fixed in one place and were protected after mating until offspring appeared.

4. Place Factor (Certain location, or position with reference to the rest of the birds).—Several locations were sometimes defended by dominant geese, such as an area where food was thrown to the geese. The nest locality was a location which was defended. In swimming or walking to food, the front or foremost position of the group of birds was defended by the most dominant bird or birds. Sometimes in moving to a resting area, a bird that was perhaps low in the peck order and that was on guard at the previous location would lead the groups of birds, especially after giving an alarm. The Snow Goose,

L, while sixth in the intraspecific peck order, was a nervous bird and was often on guard and led the birds in moving.

5. Combination of the above factors.—The family, of course, was composed of both the offspring and the parents, which included the mated female. She and the nest formed a combination, because both were defended by the male at the same time, and perhaps a place factor would be included.

VARIABILITY OF TERRITORIES

These territories are not stationary areas without movable boundaries, but are variable in size, shape, and the amount of time they were defended. Some of the factors which cause, or are correlated with, the variability of time, size, and shape of the defended territories are: (1) time of the year; (2) temperature; (3) various activities of the birds, such as feeding, resting, sleeping, moving, mating, and nesting; and (4) sexual activity and social relations of the birds.

The effect of the time of the year is closely correlated with the effect of temperature which is, in turn, correlated with sexual activity and behavior. *The effect of the temperature was very evident, and the size of the territory was found to be approximately directly proportional to the average decrease of temperature in the autumn and average increase of temperature in the spring, slightly modified by daily temperature variations and the variation from morning to night.*

During very cold weather, when the lagoon was frozen, the geese and ducks formed a large aggregation. Despotism was at a minimum and social toleration was evident. The defended areas were very small and were reminiscent of the nesting territories of colonial-nesting species like terns and gulls. Temperature had a decided effect upon the activities of the geese. During the autumn the geese were more active on the warm days and were inactive when it was cool, especially during early morning and late evening. When the weather was warmer for a while during the winter, the aggregation broke up and the geese separated at noon into families and pairs, but became aggregated again in the evening.

The break-up of the family appeared to be dependent upon an increase in temperature correlated with the approach of the breeding season. The increase in the size of the territory culminated in the nest territory, and after nesting the family territory was established and the cycle started over again.

The territories of the groups while feeding were vigorously defended, and there was an order which the groups followed in feeding.

As soon as the dominant Blue Goose family finished feeding, the Canada Geese followed and then the mated pair, M and W, and in sequence down the interspecific peck order. Any deviation from this order caused pecking and fighting. If the geese were very hungry, many fights occurred at the tension lines. Text-figure 1 shows the relations of the birds while feeding.

The territories of the groups while resting and sleeping were not defended as rigidly as when feeding. Text-figure 2 shows the typical resting territories. A bird was always on guard, night and day, and any warning given when the birds were resting caused alertness and great alarm.

The guarding procedure was very interesting and was observed many times. When the geese were separated into families, one bird of each family usually was noticed with its head up, looking around, while the others fed or rested. In the Blue Goose family, C usually was on guard during the non-breeding season while the family fed or rested. This watchfulness was alternated with the mother, A, when C fed or rested. During the mating season the father, C, was continually on guard, and the female, A, never took an active part. These guarding activities were characteristic of the other families and pairs.

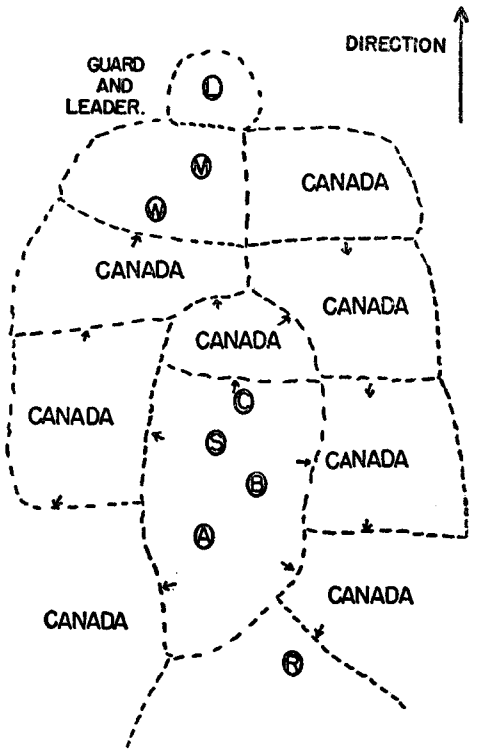
Guarding appears to be the primary defense mechanism of the territory and is performed by one bird of the group at a time. The guard of a dominant group serves a double function, that of locating danger and giving a warning to its own group, and of keeping the dominance of the group on display as a constant reminder to the birds lower in the peck order. Guarding in the subordinate groups appears to be watchfulness for the dominant groups and for outside danger.

At night the birds often slept on an island in the middle of the lagoon. The Blue and Snow Geese slept on shore with a bird on guard, L in two instances. The Canada Geese slept on the lake. In very cold weather all the geese and ducks rested and slept in a single, large, compact aggregation on ice or land, with no evident territorial boundaries. During this time, the whole aggregation often had only one guard. This guard usually was L, or some other nervous bird. In the large aggregation there was no correlation between guarding and dominance. If the whole group was frightened, most of the geese looked around and gradually resumed their resting or activities until only one bird remained on guard.

Moving territories of the groups were of special interest because the boundaries were maintained even though the geese were moving from

one area to another. Text-figure 3 shows a typical moving group of territories.

These territories were maintained whether the geese were walking on land or swimming in the lake. In flying, the young Blue Geese entered the symmetrical V-formation at any point. It was not determined whether territories existed in the air.



TEXT-FIGURE 3

Territories of groups while moving.

During the autumn the geese often made a circuit from the east side of the sanctuary in the morning, to the middle of the lake during midday, to the west side of the island in the evening to feed, and to an island in the middle of the lake at night, where they slept. There were no moving territories in the winter when the lake was frozen.

Perhaps the broad sense in which the word 'territory' is used in this paper will not be liked by some who wish to confine the word to the nesting area during the breeding cycle. However, certain definite

territories are defended and maintained in other parts of the year. A term other than territory might be used, or a description of the type of territory given (as in this paper) such as 'family territory' and 'feeding territory of the family.'

The territories were based on despotism or aggressiveness of the birds to each other, which was shown and measured in this study. After the territories were established they were of great value to the birds in preventing further despotism. These territories were also based on, and related to, the intraspecific and the interspecific social organizations.

The territories prevented further despotism by keeping birds separated from each other, and resulted in a remarkable organization that kept the rate of pecking and fighting of these 42 geese and over 50 ducks to about three pecks per hour, or slightly over 1200 pecks in the 420 observation hours of the eight-month period.

SUMMARY

1. A definite 'peck-right' type of intraspecific social organization (modified by family ties and mated pairs) was found in Blue, Snow, and Canada Geese, under approximately natural social conditions.

2. Family relations and ties are strong outside of the mating and nesting season. In the breeding season, the adult males become despotic and cause a disruption of the families, resulting in a change of peck order, due to the offspring being driven from the families.

3. There is definite evidence of organized despotism and facilitation, resulting in dominance of well coördinated groups as families.

4. An interspecific type of social organization was found between the species and groups of geese and ducks.

5. Establishment and maintenance of territorial boundaries appears to be the main cause of pecking, which is a display of despotism due to (a) family including young; (b) female mate; (c) food; (d) nest; (e) nesting and sleeping place; (f) position with reference to the rest of the birds; (g) some combination of these.

6. Territory is used here in a broad sense, being applicable in non-mating and non-nesting times, as well as during mating and nesting times. It is any area defended against other organisms, and is usually centered around some bird or birds or other object. It may be fixed or evanescent and variable in size and shape. The types recognized are: (a) family territory; (b) mated-female territory; (c) feeding territory; (d) nesting territory; (e) resting territory; (f) resting and sleeping territory; (g) moving territory.

7. The size and shape of the territories varied directly with the temperature (within limits), and with such activities of the geese as feeding, resting, sleeping, and moving.

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