Illustration of a Peculiar Social Tie Found in Domestic Ducks[1]

By

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(With 11 Text-figures)

Through the courtesy of Mr. M. Nakamata, Director of Sapporo Municipal Zoo, the present writers had an opportunity to observe the social structure of a mixedly reared flock consisted of 3 species of domestic birds, viz., turkeys (abbr. *T*, 3♂ 7♀), geese (*G*, 3♂5♀) and ducks (*D*, 6♂ 9♀), from Nov. 1954 to April '55 during the winter closing of the Zoo. (In total 24 days, in each day ca. 1.5–2 hrs.). Here it is proposed to report on a peculiar social tie found among the ducks during the observations.

As the social structure of the whole flock has already been published elsewhere (Oba & Sakagami '56), on this aspect there will be described here only the essential points to facilitate understanding of further explanations: Three species distinctly separate from each other (Figs. 1 B-F, 2). *T* formed the most loosely integrated flock with a marked behavioral independency in each individual. On the other hand, the group integration of *G* and *D* was very firm, with a distinct inter-indiv. synchronization of various behaviors, especially in locomotion. However, *D* was to be divided into 2 subgroups: The main group (*A*) consisted of 11 white ducks and a black female with white neck-ring (named *k*), and the minor subgroup named *M*, with which the present paper mostly concerns. This latter subgroup composed of 2♂ 1♀, i.e., a mallard-type pair (♂*a*, ♀*b*) and a male named with *m* plumage of brown and smeared white (Figs. 2–11). The group integration of *A* was very firm. Its separation into 2 or more subgroups was recorded in only 17 of 223 drawings of spatial distribution with the exception of *k*, which showed often a tendency to isolate from *A* (Figs. 2 & 11). Nextly the intergroup relations: Freedom of movements was most distinct in *T*, which approached *G* and *D* either individually or collectively without fear and aggressiveness. Against this approach, *D* (both *A* and *M*) were rather indifferent. They showed no fear reaction, or avoided *T* only *physically* when *T* approached too near to them. On the other hand, *G* expressed remarkable fear and escape reactions towards the approaching *T*. They were also aggressive to *D* and chased them violently when encountered. Attitude of *D* towards *G* was similar to that of *G* towards *T*, namely showing distinct fear and escape reactions. Consequently, the intergroup relation among 3 spp. is expressed as a sociogram in Fig. 1. A. Because of a well established *approach-avoidance* reaction-

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chain, there were found only rarely actual bodily combats among species. Therefore, the social equilibrium was governed mainly by *an order of uncontroled movement* rather than the peck order. This tendency became slightly obscure in 1955 affected by severe cold, though not eliminated even in this period (Figs. 4, 7).

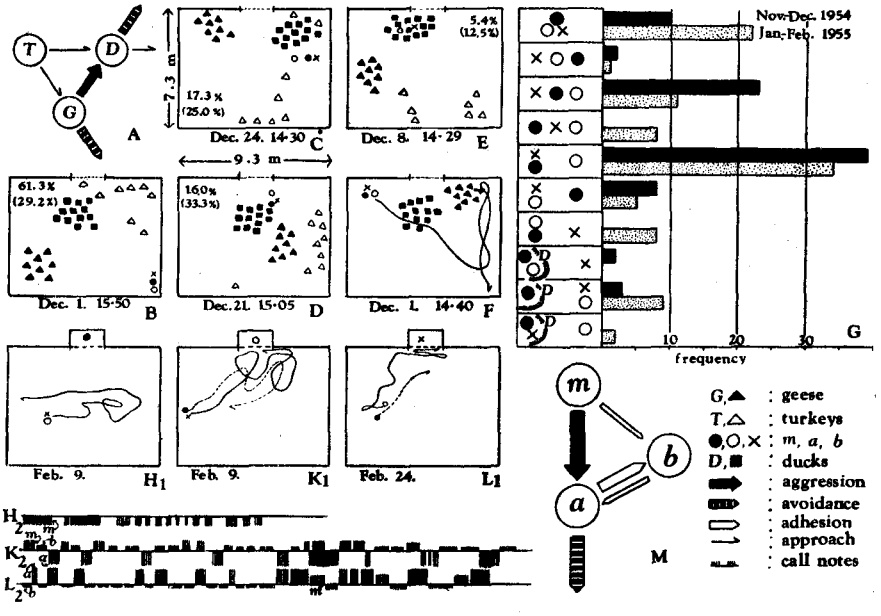
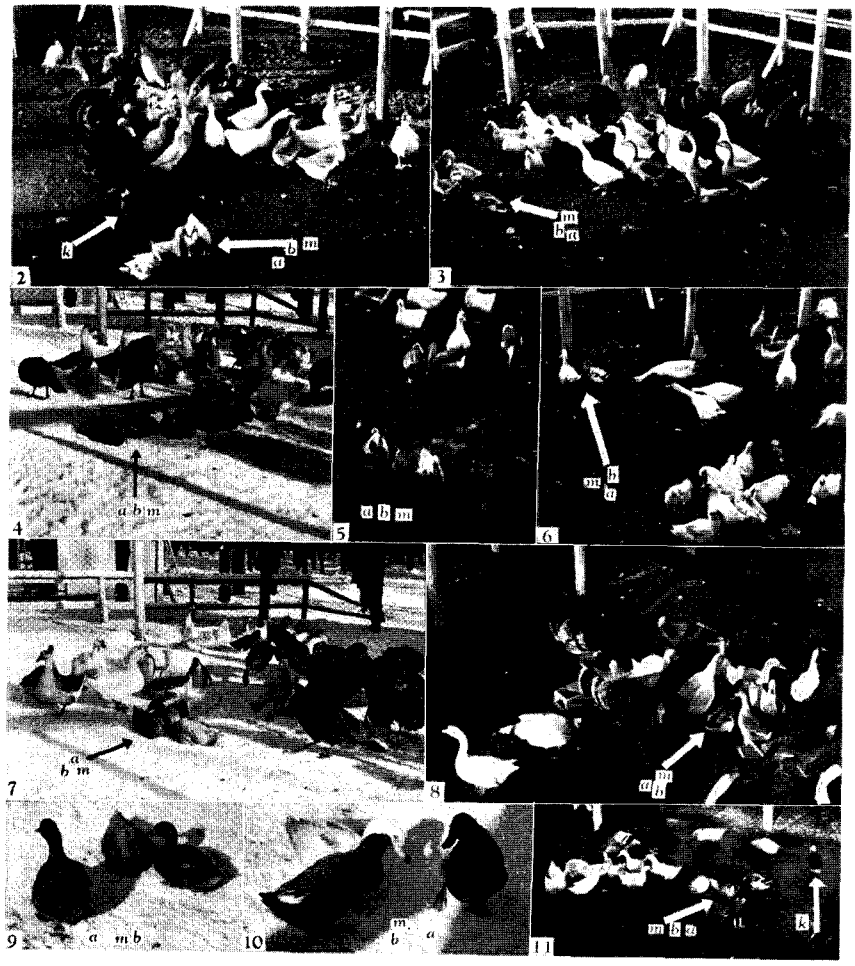


Fig. 1. (A-M). Various social relations in a small group of domestic ducks. (Explanations in text).

Next, the structure of *M*-subgroup comes under consideration. Its social tie was surprisingly firm and not loosened under various situations, namely, at rest (Figs. 1 B-E, 2), locomotion (Figs. 3,5,6), feeding (Figs. 8, 11) and under the snowy condition (Figs. 4,7,9,10). Separation was recorded in only 13 of 163 drawings in Nov.-Dec. 1954, increased in Jan.-Feb. '55 but still only 31/104. Various patterns of spatial relation between *A* and *M* (when *M* not separated) and their percentage are shown in Figs. 1 B-E.[1] Thus, the separation *M* and *A* is clearly recognized, though the union of two subgroups, in parallel with the general tendency in the whole flock mentioned above, occurred more frequent in Jan.-Feb. under the severe cold.

Curiously enough, this separation of *A* and *M* was not caused by the attack

1) Total obs. numbers were 150 (Nov.-Dec.) and 72 (Jan.-Feb.), respectively. Percentage in Jan.-Feb. in parentheses.



Figs. 2-11. Illustration of various face-to-face situations. (Explanations in text).

$A \rightarrow M$.[1] The following cases were observed as the processes of separation : 1. Spontaneous separation of M from A. 2. Absence of synchronization in M against the spontaneous locomotion of A. 3. Ditto, when chased by G. 4. Separation caused by intra-M conflict referred to later. There were recorded a certain number of pecks by M towards the approaching A (Obs. number : a 13, m 9, b 8). As all the reactiosn were, however, so low-energetic that the principal cause of separa-

1) In general, each species group seems to reach a relatively stable equilibrium. The intragroup pecks were very rare except for the turkeys at the feeding situation.

tion must be sought rather in the absence of behavioral synchronization between *A* and *M*. Unfortunately, it could not be learned whether all the ducks were brought to the Zoo through the same way or not. It is remarkable, however, that a group separation can persist during a considerable period without apparent conflicts. This was especially impressive when *M* passed through the resting *A* group (Fig. 1 E).

Intra-*M* relationship is also noteworthy. Dominating pecks were observed only between *m* and *a* (*m*→*a*, 33 times, reversed cases not observed. Namely, the peck right type of Allee '52). It is very interesting that this domination of *m*→*a* was frequently observed while *M* was escaping from the chase of *G*. The dominant status of *m* is also doubtless from the spatial relation of 3 individuals in resting condition (Fig. 1 G). The most frequently observed spatial pattern was the separation of *a* from *m* & *b*. Distance between. *m*-*a* was generally 3 times as large as that of *a*-*b* (Fig. 9). Further approach of *a* to *b* released often the attack *m*→*a* (Fig. 10). When 3 individuals stood in a row, *m* usually occupied the position between *a* and *b*. This tendency was distinct throughout the observation period, though severe cold decreased the aggression *m*→*a*, hence increased the bodily contact (Figs. 1 G, 4,7,9,10). Furthermore, the pattern *m b a* often caused the attack *m*→*a*, then escape of *a* accompanied by *b*, consequently the displacement of the whole *M* group as mentioned above as the process of separation *A*-*M* No. 4 (Figs. 2, 5 most clearly 11). It happened that, in this situation, *M* encountered *G* directly and suffered the violent chase by the latter.

In spite of the domination by *m*, *a* remained always as a member of *M*. This suggests the consistent adhesion of *a* to *b*. This is understandable from the lack of isolation of *a* while *M* separated into two sub-subgroups (Fig. 1 G) and the immediate reaction of *a* to various behaviors of *b*. To examine this interindividual adhesion, a simple separation experiment was carried out from Feb. 2. to 24.

One or two of the 3 members were confined within the roost attached to the

Results of separation experiment

Type of separation		No. trial	Strength of social tie (in each trial)[1]					
			To confined individuals			To not confined individuals		
Confined	Not		*a*	*m*	*b*	*a*	*m*	*b*
am	*b*	3			− − ±			
ab	*m*	4		− − − −				
mb	*a*	4	⧺⧺+⧺					
a	*mb*	2		− −	+ ±	+ + +	+ ±	− −
m	*ab*	3	− − −		− − −			
b	*am*	2	⧺⧺	− ±		− −	− −	+ + +

1) Strength of social tie was expressed as degrees ⧺ (strong, vigorous searching and calling reaction), + (distinct unstability with calling), ± (only weak reactions), −(almost indifferent).

aviary by shutting the door. Behavior of individuals not confined was observed during ca. 15 minutes in each trial (18 in total).

As seen in Table and Figs. 1 H-L, the absence of *b* released an intensive exploratory behavior of *a* and reciprocal calling between *a* and *b* at the door, but not so distinctly those reactions of *m*. Moreover, reactions of *b* against the absence of *a* were, though not so intense as in the reversed combination, yet distinct, if compared with the relation *m-b* in which *b* showed only slight reactions to the absence of *m*. Control experiments by the confinement of the members of *A* released no detectable reactions of *M* members. The adhesiveness among *M* members is, therefore, expressed as the following order : $a \rightarrow b \gg m \rightarrow b \geqq b \rightarrow a \gg b \rightarrow m$; $m \rightarrow a \rightleftharpoons a \rightarrow m$. Thus, the social structure of this subgroup is based on this adhesiveness and the domination $m \rightarrow a$ mentioned above, and can be shown as the sociogram in Fig. 1 M. Absence of any adhesion between *a* and *m* was confirmed by their behaviors in the spring after the death of *b* in March. Drawings of spatial positions show the following records : *m* in *A*, *a* isolated (48 times). *vice versa* (4), both in *A* (15), both extra *A* being isolated from each other (1). From these results, it is also suggested that the formation of *M* was caused mainly by a definite behavioral trend of *a*.

It is very probable that this peculiar social tie is related to the competition of two males for one female. Very interesting, however, is the absence of mating and related behaviors of both *a* and *m* to *b* throughout the observation. Nevertheless, a considerable number of mating acts were found in *A* group and some male ducks of this subgroup (mostly a male named *l*) often came to *M* to mate with *b*. The actual mating act between *b* and these males was observed 7 times. In all cases, both *a* and *m* showed a distinct excitation but did not try to inhibit the act or to attack the intruders except one occasion in which *a* tried to disturb, but very timidly, the mating between *b* and *l*. Against the opinion that the observed facts may be due to the lack of mating drive in *a* and *m*, one curious record was made as follows : Once *a* left *b*, entered into *A*, mated with a white female and thereafter immediately ran back to *b*. Such a tendency to mate with the individuals other than the partner was also repeatedly observed in *G* which loosened their firm group integration in March and entered into the pair formation. Therefore, it must be remembered, that, at least in domestic birds, the pair formation and primary sexual drive do not always coincide with each other.

The structure of *M* group described above may be based on an equilibrium resulted by numerous interindividual coactions which are partially extinct at the time (attack $m \rightleftarrows a$, now only unilaterally; mating between *m*, *a* and *b*, now absent). Stereotyped patterns at resting may also represent such an equilibrium. The position of *a* is quite unique, because of a probable adjustment to the conflict between negative (*m*) and positive (*b*) stimuli. The clear solution of the development of this unique social tie is impossible. The present paper deals with only the description of a peculiar case of group structure found in the ducks. It may serve,

however, as an example of the possibility that the combination of various social relations sometimes brings up the persistence of a quite complicated social structure.

The writers would like to express their sincere thanks for all the members of Sapporo Municipal Zoo, especially to Director M. Nakamata and Mr. Y. Gotô for their kindness in allowing free use of animals, and to Mr. K. Mikamo, whose photographs form an indispensable part of the present paper. Finally, it is their great pleasure to dedicate this article to Prof. Tohru Uchida on the occasion of his sixtieth birthday.

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