The Study of Agonistic Behavior in the Uinta Ground Squirrel

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The most direct and complete method of measuring agonistic behavior is to count the frequency of occurrence of various behavior patterns. Agonistic behavior includes attack, escape, threat, and passivity. Submissive behavior was divided into two categories: (a) posture with high or raised head, shoulders low, and tail not to one side; (b) a posture with head down or sharply turned up in a corner, shoulders low, and tail not to the side.

In order to minimize the behavioral artifacts of "unnatural" behavior studies, yet to maximize agonistic behavior in a natural population, a food source was placed in an area of known high Uinta ground squirrel density. This area was located on the periphery of the Research Station. Animals in this area were habituated to humans, thus facilitating observations. Competition over the food source provided an opportunity to observe agonistic behavior in a population unrestricted in its movements. The study began July 8 and terminated August 19. A food can two inches in diameter was filled with grain sorghum and Purina rabbit chow and placed in the central activity area of a population of approximately 13 ground squirrels. A blind was erected 15 feet from the food source for observation. Observation generally took place between 9:00 a.m. and 12:45 p.m., peak activity hours, and less frequently between 5:00 and 6:30 p.m. In the 22-day period, 2410 minutes of observation were spent, averaging 109.5 minutes per day. All agonistic encounters were recorded and 213 encounters were described in detail. The number of agonistic encounters per hour was recorded and an activity census was taken at 10 minute intervals in a 3 foot circumference around the food source. An Agfa Optima 500 camera with a 35 mm. lens and a Kodak Super 8 movie camera were used to document some of the behavioral sequences.

In reviewing the data (included in complete report submitted to Grand Teton National Park), we feel it is safe to draw some conclusions concerning the agonistic behavior of the Uinta ground squirrel, Spermophilus (Spermophilus) armatus.

First, most encounters do not begin with any form of initial contact, however, when contact is initiated, the most prevalent type is naso-nasal contact between juveniles or when a juvenile approaches an adult. Initial contact of any form is rare between adult animals.

In most cases, the younger animal initiates contact. Such a pattern could be attributed to status within the age hierarchy. Adult animals do not need to establish their position in the hierarchy each time they meet, therefore, they omit initial contact. Juveniles still establishing their rank initiate contact each time they meet. Contact may reduce antagonism, therefore, the insecure juvenile is that much more likely to initiate contact than risk an aggressive encounter.

Reactions to initial contact include counter threat, passivity and retreat in that order of frequency. There seems to be no significant difference in reactions to either naso-nasal, naso-anal, or neither, however, there does seem to be a higher incidence of counter threat without initial contact than there is with initial contact. There also seems to be greater passivity and retreat after initial contact and significantly less without contact. We may assume, then, that initial contact, either naso-nasal or naso-anal, reduces agonistic behavior among squirrels. Without it, counter threat behavior is far more likely to develop.

Reactions most prevalent are counter threat reactions between juveniles lacking initial contact. One must take into account that more juvenile-juvenile encounters were seen than any other type of encounter because of the abundance of that age group. For that reason, the highest incidence of occurrence of a particular reaction is in the juvenile-juvenile age groups. It is significant to note that counter threat behavior did not occur after naso-nasals in adult encounters and naso-anals in adult-to-juvenile encounters. We may summarize that most counter threat reactions are between juveniles with no preceding introduction, that passivity is most common in all age encounters after naso-nasal, and that retreat is common among all ages with no initial contact. Significant differences in reactions between age encounters are lacking.

Submissive postures were often lacking. Submissive posture b (see above for description) was most common, a significantly less common. Neither posture occurred in a meeting between two adults. Posture b was most frequent among juveniles, a most frequent between a juvenile and an adult. Neither posture was common during or after passivity or retreat, however, both were common before retreat. We may conclude that most encounters were either terminated before submissive behavior was exhibited or that the nature of the encounter included actions of submissiveness other than the a and b postures recorded. It is thought that submissiveness was not shown between adults because all adults in the population were of equal status in the face of the heavily balanced population of juveniles.

The fact that b was most common between juveniles and a between juveniles and adults suggests that in an encounter which involves a juvenile approaching an adult, submissive posture involves a raised head position rather than a lowered position to appear to be a greater threat to the adult animal than it is in reality. The hierarchy of age establishes the juveniles as subordinate to begin with, but the raised head submissive posture may be an effort to establish a dominant position before the adult, while acting within a subordinate framework as the younger animal. The lowered head position between juveniles is perhaps the true submissive posture between equals in age status and is related only to the particular situation.

Of the three circling encounters observed, all occurred between juveniles and all were preceded by naso-anal contacts. Most circles were of short duration and all terminated in either both animals eating or one animal eating and the retreat of the other. Rather than any kind of agonistic behavior, circling seems to be recognition and exploratory behavior of another individual. Rarely does aggressive behavior follow. It seems to be the recognition of dominance rather than the establishment of such.

Boxing and batting are definitely interpreted as agonistic behavior. In contrast to circling where all encounters are preceded by naso-anal contact, no boxing encounters begin with such contact. They are either initiated by naso-nasal contact or rushing. Boxing can be interpreted as surprise behavior by an animal caught off guard by another entering his zone of defense without warning. The original animal instinctively defends himself and strikes at the threat before chasing it out of the vicinity or retreating himself. Such encounters seem to have little to do with rank in the hierarchy. More likely, they are related to the immediate situation only.

Tumbling also lacks initial contact. The data show that equal frequency occurred between crosswise and lengthwise orientation. We have interpreted the action as agonistic behavior brought on by surprise. It usually occurs when one animal is rushed or approached suddenly in an unexpected manner. The short duration of most tumbles suggests that the intent of the initiator is not to antagonize the opposing animal any more than possible, however, on occasion tumbling is repeated a number of times with equal force which suggests that tumbling can be used in a fully agonistic manner. The terminal postures of eating suggest that the encounter is not always a serious one.

Chases occur primarily between juveniles and generally lack initial contact or are initiated by naso-nasal contact, or boxing. To a lesser degree, chases are initiated by naso-anal contact, tumbling, mounting, or squeezing. No chases involved a juvenile chasing an adult. Most chases terminate with both animals in alert postures, both eating, or one in alert and one in a stay-threat posture. All are terminated by the chaser who stops before he reaches the animal he is pursuing. Chasing seems to be the final segment of an agonistic encounter showing who is dominant and who is subordinant. However, the fact that the pursuer never catches up to the animal retreating but always stops after a sufficient distance shows that most chases are not initiated with intent to overtake and continue the encounter.

Chasing serves to impress the subordinate animal with his subordinance. Terminal postures of alertness can be interpreted as an awareness of danger by both animals. Their postures of eating suggest that the encounter is forgotten or has been directed in other channels. In the case of one animal remaining in stay-threat position, the subordinate is ready to continue the encounter if necessary, however, this rarely happens.

Terminal postures most common after circling, boxing, tumbling, or chasing, are alert postures among adults. Juvenile encounters rarely terminate in alert postures. Stay-threat postures are far more common. Such a pattern can be attributed to the adults' greater awareness of danger than the young, as well as their relative stability in the hierarchy. The young may not only be less aware of external threat, but also may still be jogging for position in the hierarchy, hence stay-threat postures. The young are far more willing to continue an agonistic encounter to prove their dominance than an adult whose position is secure.

Most vocalization occurs among animals either before or during boxing, batting, circling, tumbling, chasing, or squeezing. Although it was difficult always to tell which animal vocalized and to classify his vocalization, most common sounds were "grinds", "chirps", and sharp "cheeps." Grinding is most prevalent during boxing, batting, tumbling, and squeezing encounters. Cheeps are most commonly vocalized in chases, and squeezing and "chirps" in circling postures. Vocalization rarely occurs during initial contact perhaps because its function is to connote either warning or attack in most cases.

Squeezing generally occurs when two or more animals crowd around a food source. The majority of squeezing encounters lack initial contact, however, when established, they always include naso-anal contact because the animal always approaches from the rear. Most squeezing occurs between juveniles. We have interpreted squeezing as a mechanism to avoid confrontation by being so close to another animal as to make confrontation impossible, or as a means of admitting subordinance by the squeezed. Generally, the animal who approaches a feeder slowly and progresses toward the food source in several successive squeezes is successful in producing a minimum of antagonism. The animal who rushes in is usually confronted and forced out. Squeezing is an antagonism-reducing mechanism.

In general, we conclude that the increase of squirrels in an area makes for fewer formalities. Activity, vocalization, and short, quick encounters are increased. When 10-12 animals feed together, very little agonistic behavior occurs. Chases and tumbling are prevalent. In spite of interaction between juveniles and adults, there is no seeming dominance over the juvenile by the adult. Such behavior may be explained by general excitement over new and more abundant food (as was the case). Increased encounters in turn, influence the duration of encounters which influences their gravity. Thus, the greater the number of animals present, the less serious each encounter is, and the less pressing is hierarchy pressure.

Agonistic behavior is increased immediately after a major encounter between two animals. The initial encounter may occur without provocation. The immediate reaction is grinding, pushing, and chasing among other members of the colony. The pattern may also be interpreted as a reshuffling of positions around a food source and a natural reaction of chasing and tumbling to make space for each animal in the new formation.

The study involved problems which should be discussed. First of all, the study was limited in length due to the early date of hibernation among

the animals in the Jackson Hole area. Hibernation occurs during the third week of August, generally between August 20-24. Because the study did not begin until the first week of July, agonistic behavior occurring in the spring was not observed, therefore, the study does not give an accurate picture of general agonistic behavior.

Secondly, the population used was a domesticated population living in unnatural circumstances. Although it was free-living, it did not occupy the accustomed habitat of its species. The colony inhabited the grounds of the Research Station, and was habituated to humans. It was chosen for its familiarity with humans which facilitated observation, and for clear visibility of the population during feeding periods due to short grass in the field. Although it is believed that the actual postures of the animals were not altered by their "domestication", the frequency and circumstances of encounters might have been different from those in the field.

Thirdly, the data-taking process could not help but be subjective. Encounters occurred so rapidly that it was difficult for an individual observer to remember and record all postures preceding, during, and following an encounter. Recording vocalization was equally difficult without a tape recorder. Vocalizations varied with the circumstance and with the listener.

Lastly, data results and conclusions are not entirely accurate as few encounters included all postures designated in categories. Observation was at fault in part, however, many encounters did not follow or include expected sequences. In compiling the data into a coherent whole, encounters and their related postures had to be juggled one way or another to fit into some kind of logical framework. As a result, a margin of error exists in the data.

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