Agonistic Social Behavior of Broad-nosed Caiman (Caiman latirostris) in Captivity: Implications to Reproductive Management

Luciano M. Verdade

CIZBAS / ESALQ
University of São Paulo
Caixa Postal 09
Piracicaba 13400 SP BRAZIL

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University of São Paulo
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Management programmes of crocodilians in captivity may imply in keeping adults for reproduction and / or rearing youngs with the aim of economic use, conservation of the species and education (Bustard, 1971 and Lang, 1987).

The social behavior of a species, despite the differences between wild and captive-born animals, affects directly its co-specific tolerance level and its aggressive behavior. Therefore, it is decisive for the success of keeping captive colonies, independently of the program objectives (Lang, 1987).

The study of crocodilian social behavior in the wild has been generally a difficult or nearly impossible task because most of its activity is performed at or below the surface of the water. However, progress has been made through studies in captivity, benefited by the large number of captive breeding programs which have been established during the last two decades. These studies allow the examination, at close range, of certain behaviors exhibited by animals accustomed to the presence of humans, which could hardly be documented in the wild. Despite high animal densities in captivity lead to an increase of social encounters, many of the observed interactions are usually specific and peculiar to the social behavior of a particular species (Lang, 1989).

Most of these studies in captivity have revealed details of mating, feeding techniques, care of youngs, and some social behaviors more similar to that of birds and mammals than that of other reptiles (Vliet, 1982 and 1986).

Garrick et al. (1978) described 18 different kinds of social communications for American alligator: eight visual, six vocal and four non-vocal acoustic signs, most of them discrete and non-gradual, that is, being demonstrated in a complete way or not being demonstrated at all. Ayarzaguena (1983) described for **Caiman crocodilus crocodilus** in Venezuela 13 visual and 9 sound kinds of social communication: six vocal and three non-vocal. Vliet (1989) includes not only visual and sound signals but also complex sound and possibly tactile communication channels among adult animals of both sexes. Lazell & Spitzer (1977) described a

possible play behavior showed by one young American alligator, which would be new among other reptiles.

The disposition of the communication channels between visual and sound systems among the several species of crocodilians seems to suffer selective pressure from their habitats. Visual signs seem to be more efficient in open environments, such as those occupied by **Crocodylus acutus** and **C. niloticus**. Sounds seem to be more efficient in dense vegetated swamps, such as those occupied by American alligator (Garrick & Lang, 1977). The adult animal density in a particular area is also related to the existence and intensity of certain behaviors or social communication signals (Vliet, 1989).

Aggressive behavior among territorial males during the reproductive station in Nile crocodile groups was observed by Cott (1961). Adults can also threaten or occasionally attack youngs, mainly when they get close to hatchlings, as noted by Hunt (1977) in **Crocodylus moreletti** in captivity. An American alligator adult female may also attack sub-adults in the wild when they get closer than 15 meters of her nest (Hunt, 1990). The aggressive behavior of adult **Crocodylus porosus** toward sub-adults over 90 to 120 centimeters long in certain places in Australia is the main cause for their elimination of places occupied by adults (Messel & Vorlicek, 1987). Even young American alligators may be aggressive among themselves in captivity if placed in high animal density enclosures, despite of being one of the most social species of the Order Crocodylia (Joanen & McNease, 1987).

According to Lang (1987), information related to the social organization of a species in the wild can provide good directions for the planning of crocodilians captive breeding. Territorial species tend to be less social and can become aggressive toward allies. These species require more area in their reproductive pens and / or must be kept isolated, in pairs, or in small groups of one male with some females. On the other hand, species which form large sazonal groups for reproduction tend to be more social and permit a larger population density in captivity. Species like American alligator and the estuarine crocodile (**C. porosus**) can be considered the opposite extremes in relation to the feature above. However, there is no safe and final information about some species of crocodilians. **Caiman crocodilus** is still found in large groups (Ayarzaguena, 1983 and Gorzula, 1978), but the same is no longer true for the broad-nosed caiman (Montes, 1983; Larriera, 1990; Verdade & Lavorenti, 1990 and Yanoski, 1990), although it is unknown if this species originally used to form large social groups.

Materials and Methods

Cases of agonistic interactions, which resulted in harms to at least one of the involved animals, were reported from August 1987 to December 1991 at the facilities of the Captive Breeding Program of the broad-nosed caiman of ESALQ / University of São Paulo, Piracicaba, Brazil.

Harms were identified as typical skin perforations caused by bites.

During this period, a total of 188 animals were spread in 34 enclosures, divided into groups with two to thirty animals, with a permanence time per animal per enclosure ranging from one month to four years, in order to meet the Program technical-operational needs.

Results and Discussion

The number of agonistic interactions reported during the study period can be considered small. However, they represented almost 15% of the global mortality rate of the Program, with almost 80% of the cases reported having resulted in death of one of the involved animals. It seems to be related to bacterial infections resulted from the harms, as described by Ramos et al. (in press) and Zwart (1978).

Most of the attacks occured soon in the first day of the group assembly or the new individual introduction into the group. However, sometimes the animals spent nine or even ten months living apparently peacefully together before fighting (Fig. 1). This sampling does not permit a conclusion about the required period to the settlement of a new hierarchical structure into a group, like a "pecking order" of domestic fowls, but possibly the first-day agonistic interactions must have distinct causes of those occured months later. A first-day fight seems obviously to be resulted of the introduction of a new individual in a stable group or of the group assembly itself through fomerly isolated animals. On the other hand, sometimes the apparent social balance of a group may be broken up by something new, like the approach of the reproductive period, a sudden weather change, or any other stressing factor such as capturing by humans, etc.

The high frequence of fights involving just two animals (almost 95%) can be due to two factors: sampling error, since the groups assemblages did not follow a research design but the immediate operational needs of the Program; or the grater tendence of isolated animals fight when suddenly put in touch with co-specifics. This would be similar to what Magnusson (1986) described for overhunted wild populations, where the remaining individuals may become more territorials. The most frequent fights in two-animal groups (Fig. 2) in relation to larger existing groups may be related to the factors above.

The enclosure animal density interferes remarkably in the agressiveness of individuals into a group. In general an increase in the animal density results in the increase of the social meeting frequence, and consequently in the agressiveness of the animals (Lang, 1987). However, the occurence of agonistic interactions more frequently in the density enclosures of 0.02 to 0.01 animal per square meter in relation to others up to 0.1 animal per square meter shows that possibly animal density was not the main cause for agonistic interactions in this case (Fig. 3).

The sex of involved animals, contrary to what could be supposed, did not interfere in the occurence of agonistic interactions. In other words: the frequence of fights among animals of the same sex was the same of among animals of the

opposite sex (Fig. 4). If the same occur with the wild populations, we can infer that the species possibly cannot stand large sazonal groups, although sometimes it is considered as social as **Caiman crocodilus** (Lang, 1987).

The origin of the animals was an important factor, but not decisive, to the occurence of agonistic interactions. Around 85% of the fights involved animals from different origin (Fig. 5). However, stressing situations such as capture, immobilization and change of enclosure can break up the social structure of a group, even temporarily, resulting in fights.

The agonistic interactions involved predominantly the biggest animals of the colony (Fig. 6), what is compatible to the observations of Ayarzaguena (1983) for **Caiman crocodilus crocodilus** during the summer time in the Venezuelan "llanos". There was no significant difference between animals of the same size (agressor and aggressed snout-vent length ratio from 0.8 to 1.2) and animals of different size (aggressor and aggressed snout-vent length ratio from 1.2 to 1.6), in relation to the occurence of fights (Fig. 7). However, the aggressor / aggressed weight ratio seems to be decisive. Most of the fights involved individuals which the weight ratio was up to 1.2 (Fig. 8). This difference between size and weight ratios as a predetermining factor for fight can be related to the growth curve of crocodilians, where from certain size on small length increases are followed by relatively bigger weight gains (McIlhenny, 1935; Coulson et al., 1973; Joanen & McNease, 1976 and 1979, National Research Council, 1983; Webb et al., 1983 and Brisbin, 1990).

The peak of agonistic interactions along the year coincides with the beginning of the reproductive activities (Fig. 9). There is no specific information for broad-nosed caiman about the time period between copulation and egg-laying. Larsen et al. (1988) cites a period of approximatelly 6 weeks between ovulation (and probably copulation) and egg-laying for the American alligator. If this pattern is the same for broad-nosed caiman, the peak of occurence of fights coincide with the copulation period. This would stress the role of sexual hormones on the aggresive behavior of the animals in consonance to Wittenberger (1981), citing Wilson (1975), Leshner (1978), and Brain (1979)[1]. There was no report of fights from April to May. This is probably due to the end of reproductive cycle and the reduction of general activity of the animals by the autumn (Lang, 1987).

[1] Wilson, E.O. 1975. Sociobiology: the new synthesis. Cambridge, Mass.: Belknap Press

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Brain, P.F. 1979. Effects of the hormones of the pituitary gonadal axis on behaviour. p.155-329. In: Chemical influences on behaviour. K. Brown e S.J. Cooper [Eds.]. New York, Academic Press

Conclusions

A) Although agonistic interactions may not represent the main cause of mortality in captivity, they can significantly reduce a captive colony of broad-nosed caiman.

B) Most of the agonistic interactions occur by the introduction of an animal into an enclosure formerly occupied by a lonely individual. Therefore, the permanence of isolated animals for long periods should be avoided.

C) Most of the agonistic interactions occur during the first day of the group assembly or the new individual introduction into the group. Therefore, this should be considered the minimun period of a new group observation in order to isolate and remove the individual which is antagonized.

D) Animals of the same sex do not present a different tendency to fight than animals of different sex. Therefore, sex seems not to be decisive in relation to social agressive behavior, at least in captivity.

E) Most of the agonistic interactions occur among adults with different origin. Therefore, considering the genetic management of the colony, new reproductive groups should be assembled by youngs or sub-adults.

F) Reproductive groups should preferably be assembled by animals which the weight ratio do not exceed 1.2.

G) The most adequate period to reproductive group assembly in São Paulo State, Brazil, in terms of aggressive social behavior, seems to be the autumn, from April to June.

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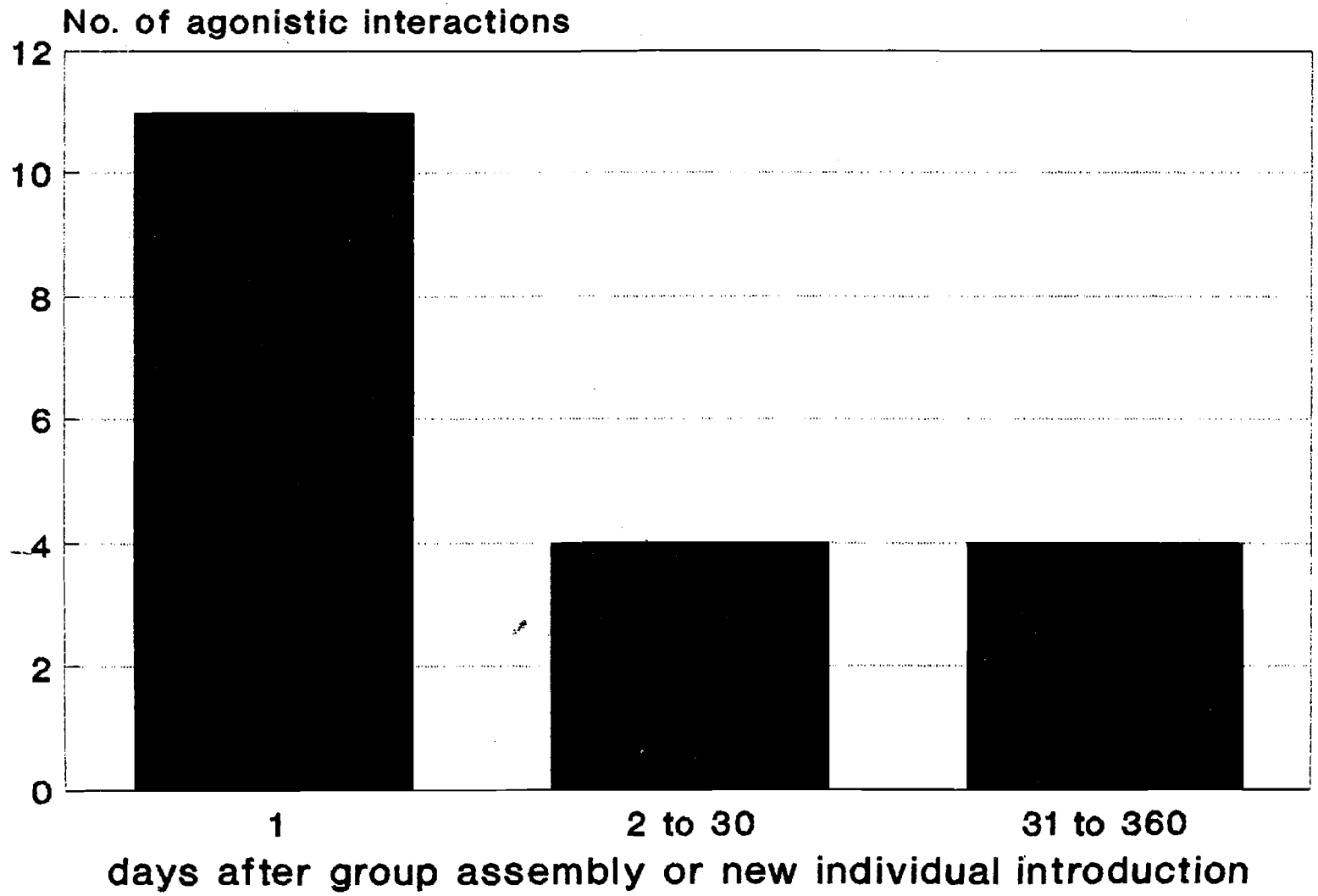
Figure 1: Time period between group formation or new individual introduction and occurence of agonistic interaction



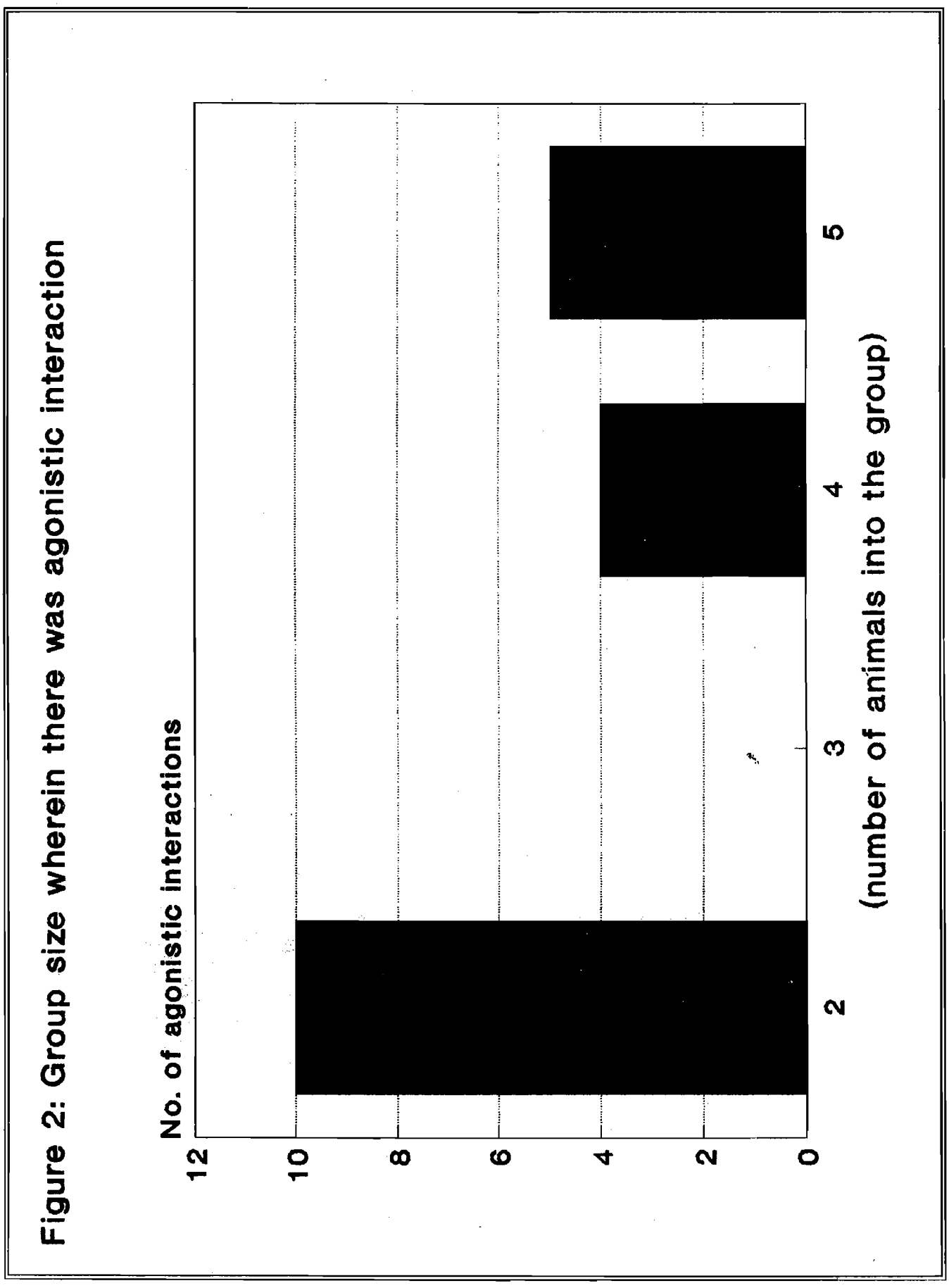


Figure 2: Group size wherein there was agonistic interaction

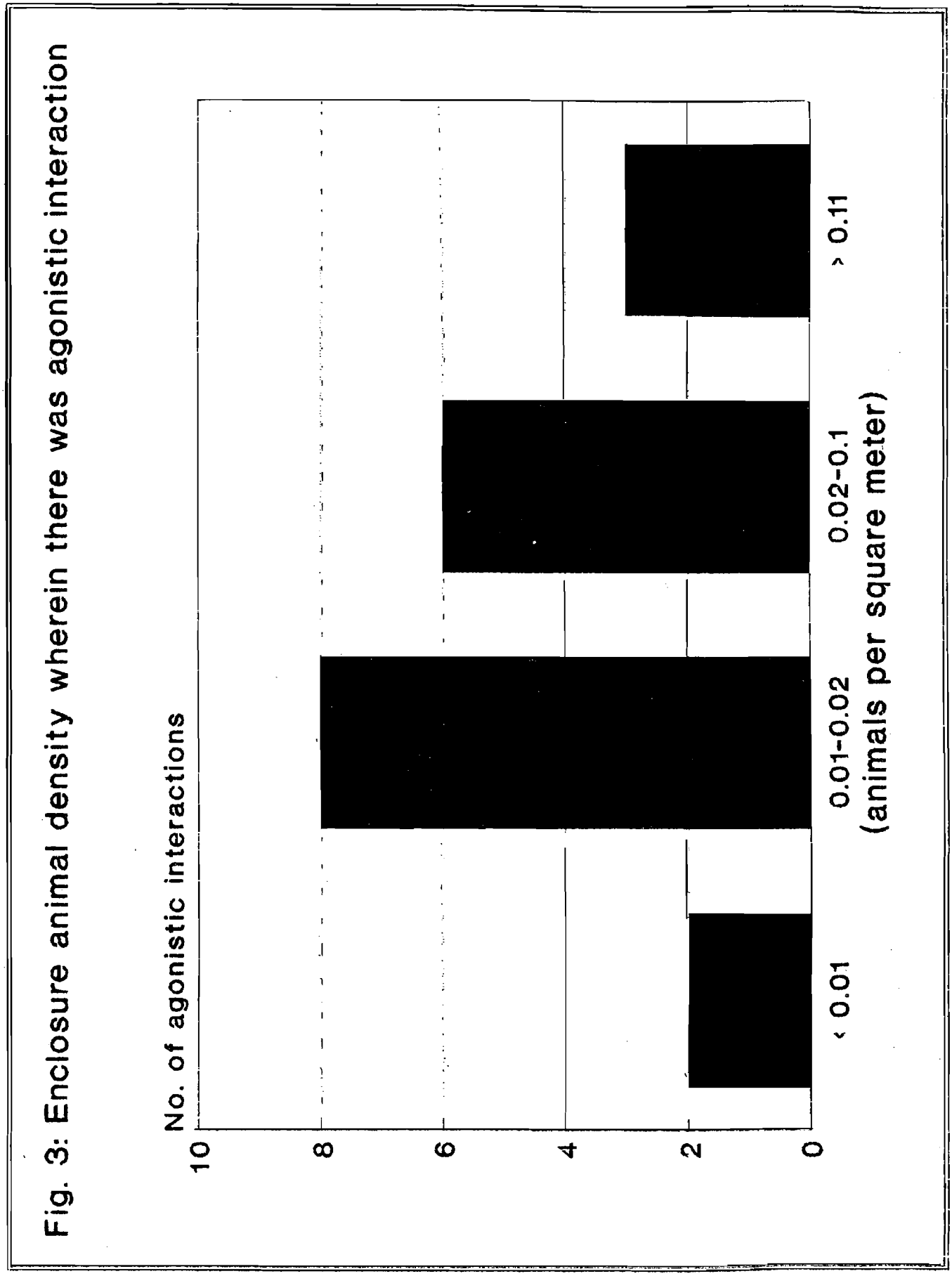


Fig. 3: Enclosure animal density wherein there was agonistic interaction

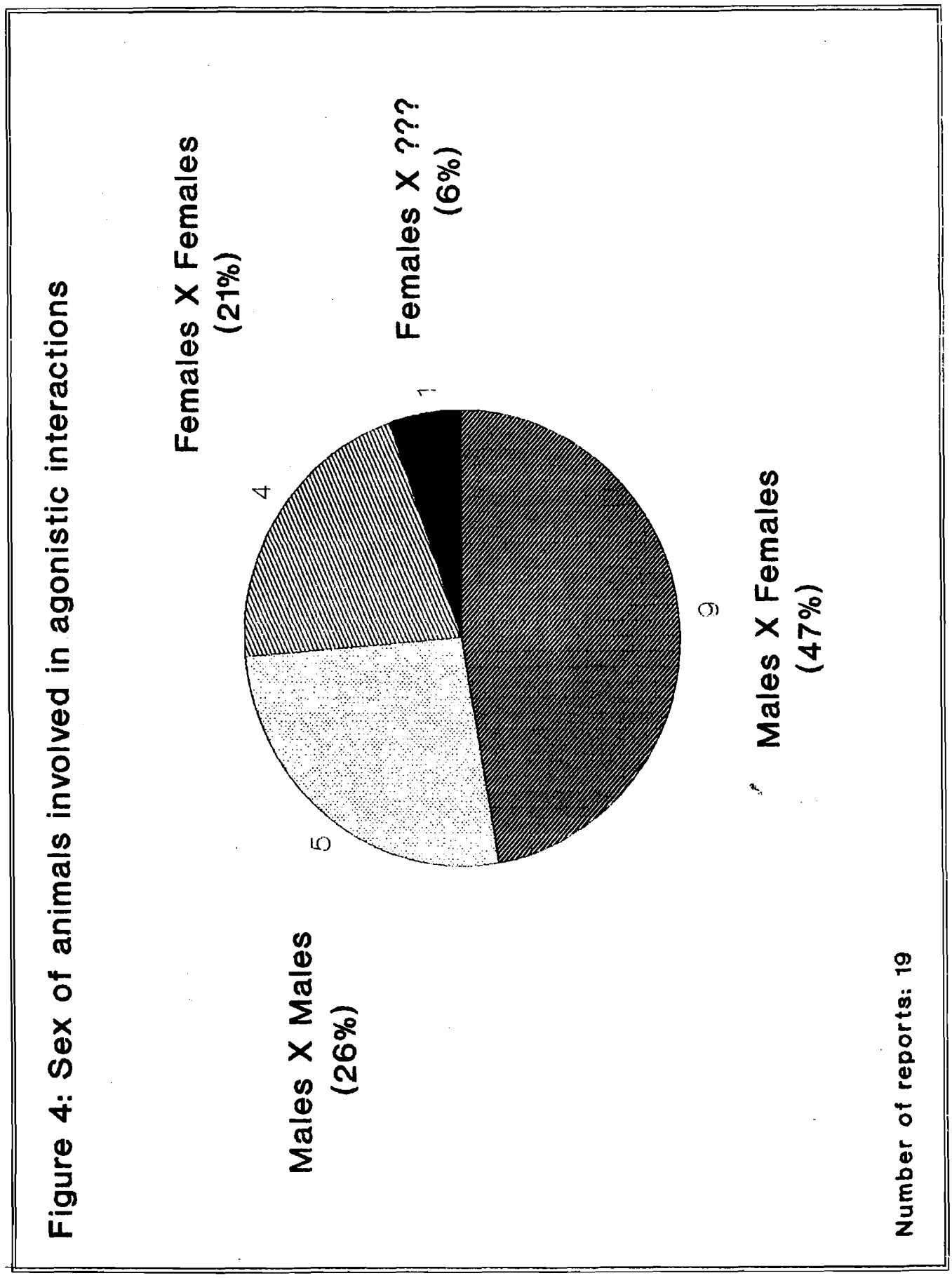


Figure 4: Sex of animals involved in agonistic interactions
Females X Females
(21%)
Females X ???
(6%)
Males X Males
(26%)
Males X Females
(47%)
4
1
5
9
Number of reports: 19

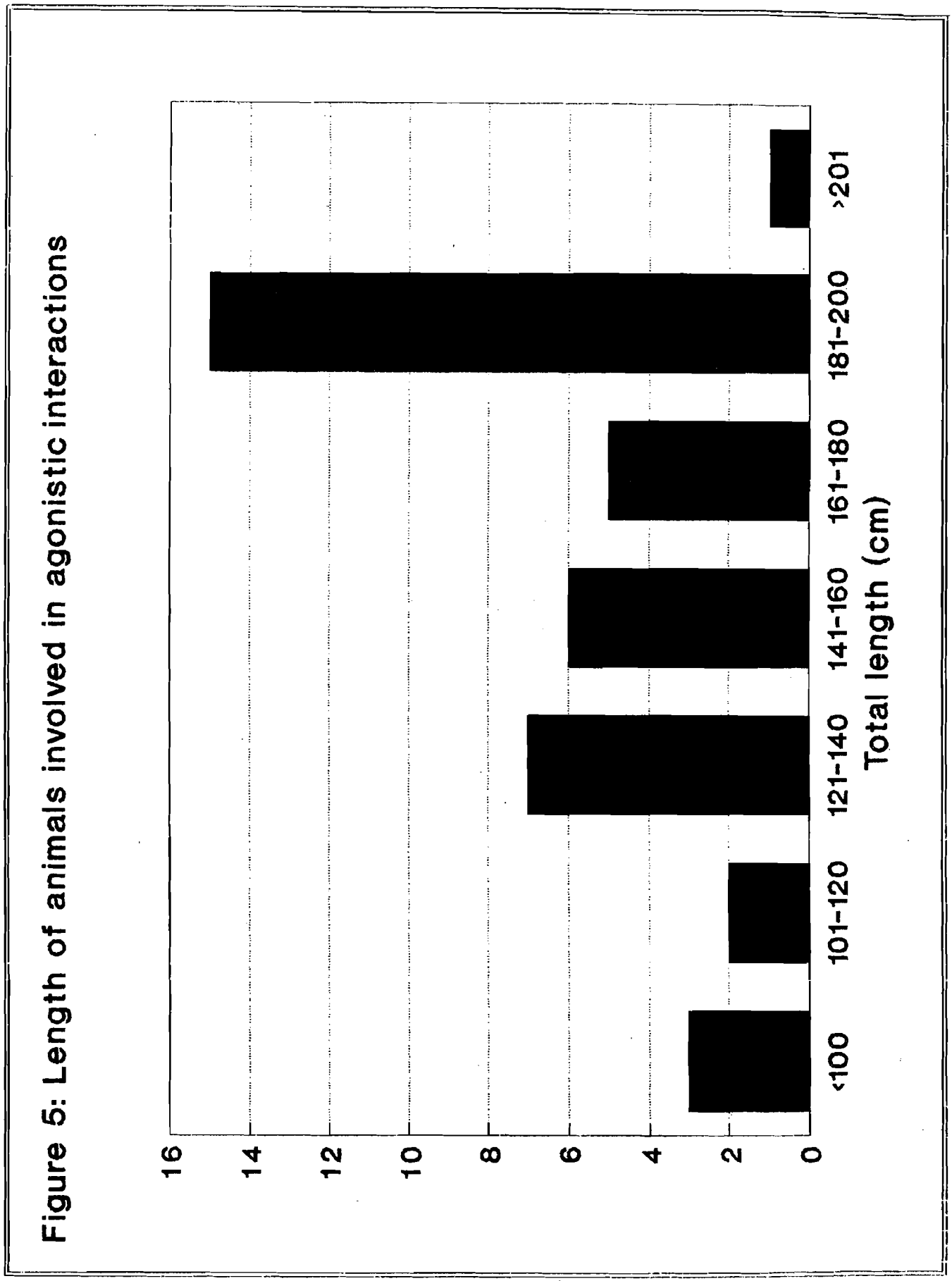


Figure 5: Length of animals involved in agonistic interactions

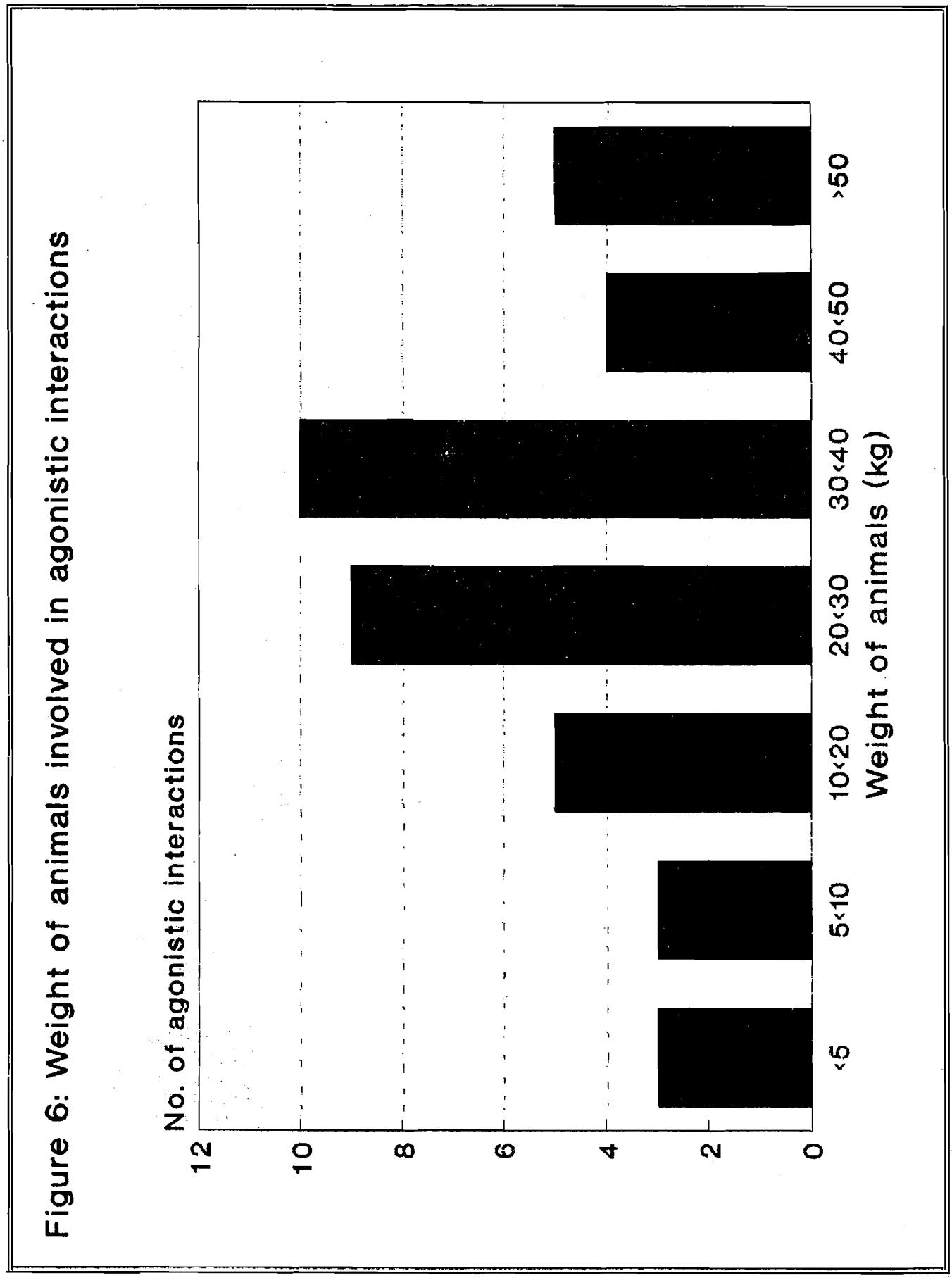


Figure 6: Weight of animals involved in agonistic interactions

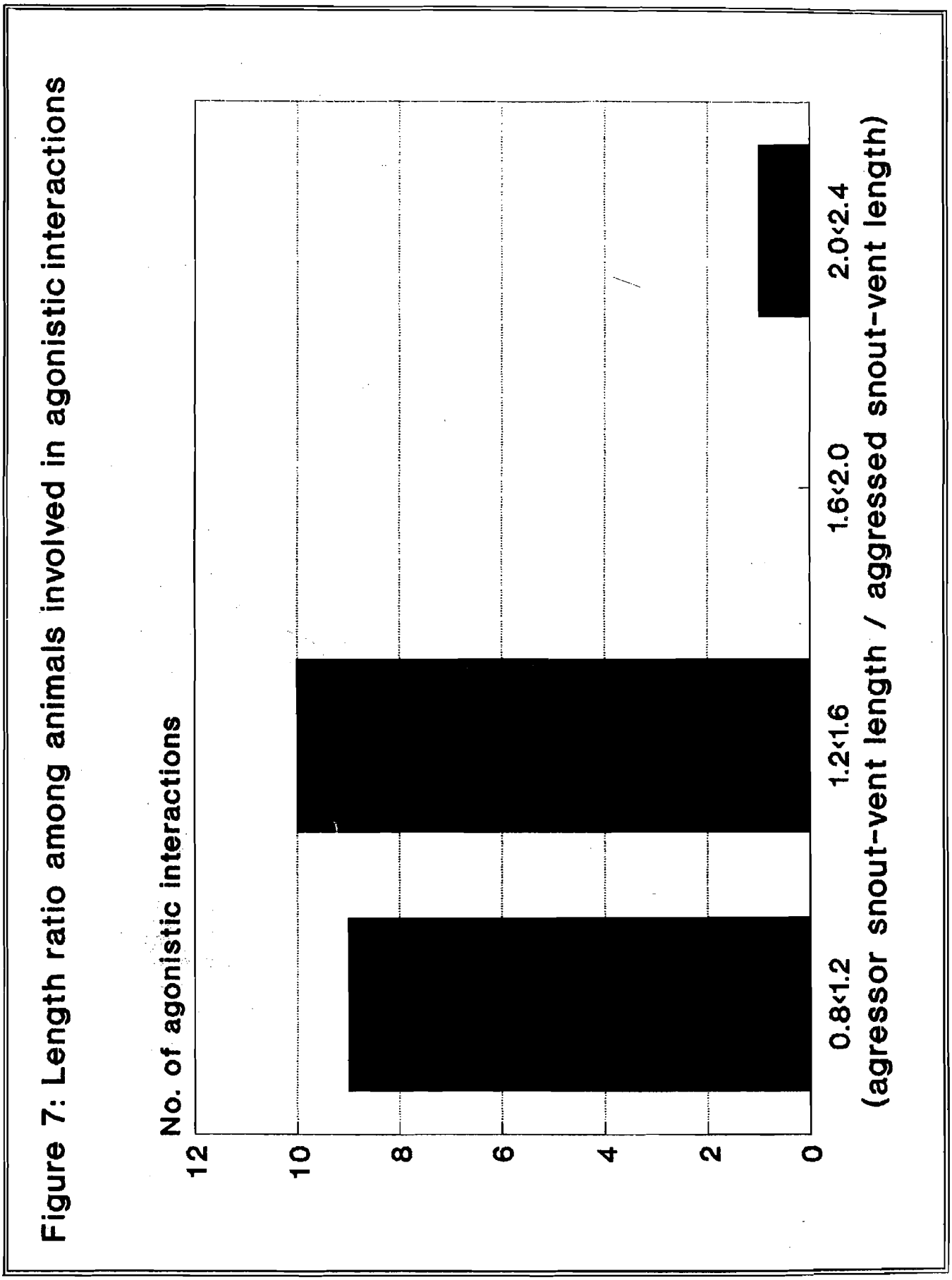


Figure 7: Length ratio among animals involved in agonistic interactions

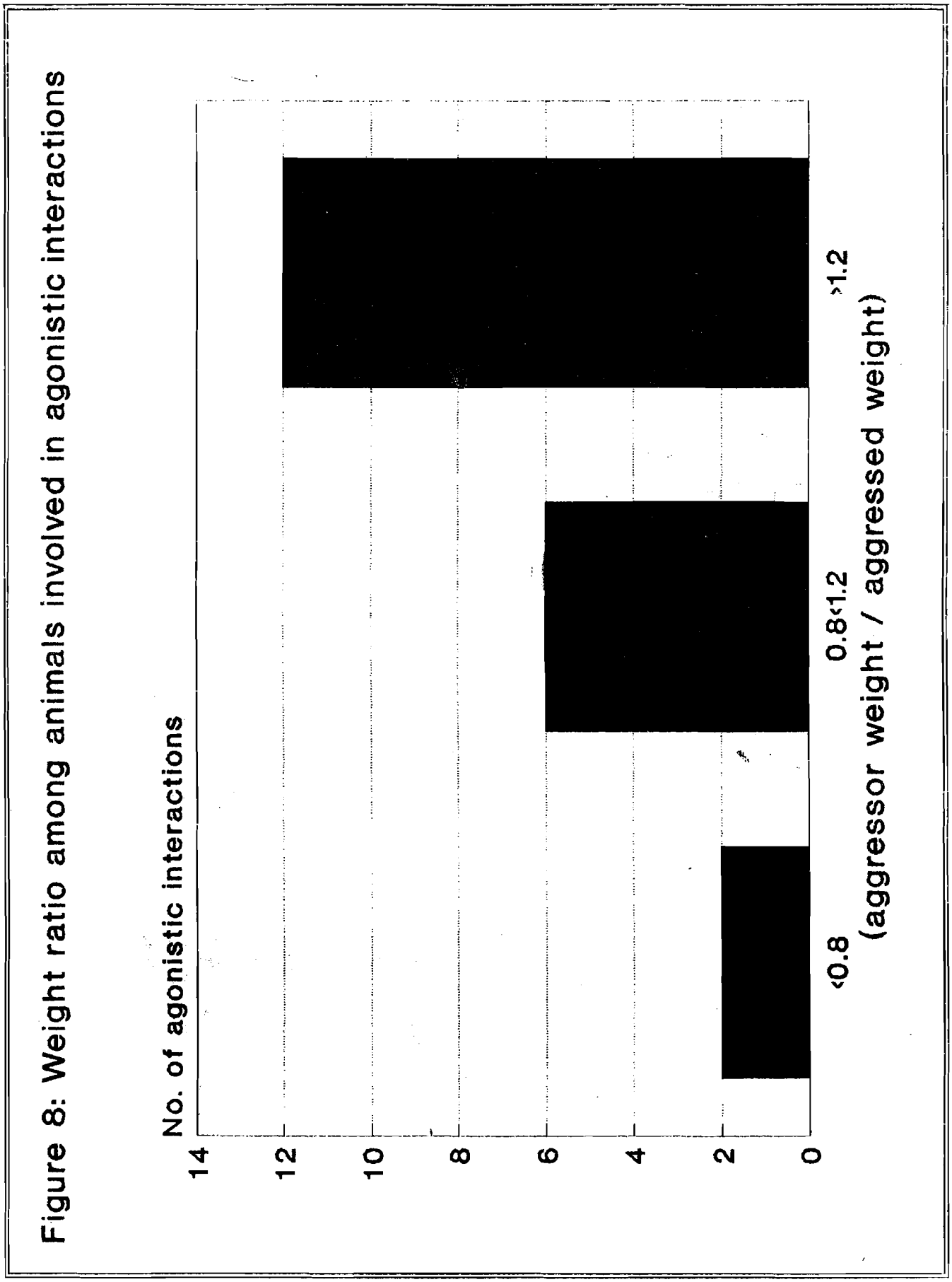


Figure 8: Weight ratio among animals involved in agonistic interactions

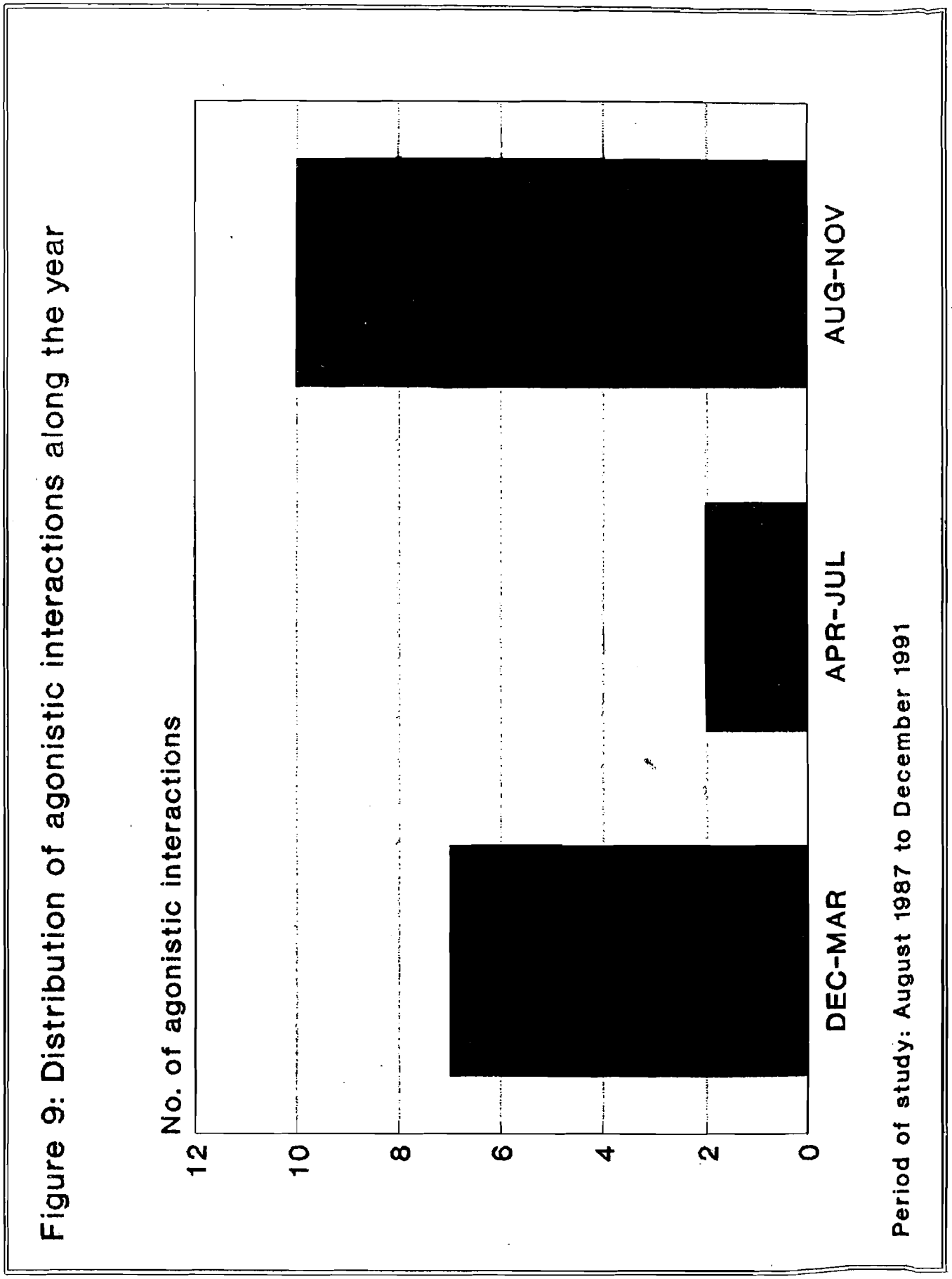


Figure 9: Distribution of agonistic interactions along the year