

territory and observations were repeated. For the next two weeks, a fresh fudge brick was placed adjacent to the territory on each day, but no observations were taken. On the final day, bricks were again placed inside and outside the territory and observations were repeated.

Analyses presented here are based on attack intensity,  $K$ , for *A. triostegus*, *Z. flavescens* and tilapia, before and after experience with tilapia as:  $K = D \div P$  where:  $D$  = defence per cell =  $A \div I$ ,  $P$  = an expected probability of attack as one in the core of the territory, 0.5 in the border and zero in all other cells. When  $D > 0$  and  $P = 0$ ,  $K$  was set at three and was always held to a maximum of three.

Feeding on the fudge brick by tilapia closely resembled the actions of a benthic herbivore. It was characterized by repeated 'bumping' nips delivered in quick succession.

Prior to experience with tilapia, more defence was shown to both familiar competitors than was shown to tilapia throughout the defended space (Fig. 1) (rank sum  $P < 0.05$ ). After experience with tilapia no differences were seen (rank sum  $P > 0.1$ ). Comparison of 'before' and 'after' values for tilapia showed an increase in defence (rank sum  $P < 0.01$ ) with no consistent changes for the other species. There was a trend for the change in defence in the core shown to *A. triostegus* to correlate positively with that shown to *Z. flavescens* but it was insignificant. No such trend was seen in the border areas. The occasional attack on tilapia prior to experience usually resulted when the newly introduced tilapia charged the damselfish. Such attacks quickly decreased. The only attacks on *T. duperry* also occurred when it charged the damselfish.

Adult *E. fasciolatus* are capable of learning to attack new species of opponents. Low initial attack rates were

expected since tilapia exhibits a generalized predator morphology and *E. fasciolatus* does not attack large-mouthed predators unless they come near its refuge. Innate recognition of competitor morphology cannot account for these results. Present work is directed toward determining whether this change in behaviour depends on the type of feeding movements shown by the novel opponent. Competitor recognition based on feeding type could operate independently or in concert with innate recognition of competitor morphology. It would produce interspecific aggression characterized both by plasticity and by a lack of maladaptive attacks on non-competitors due to mistaken identity.

This is contribution No. 605 of the Hawaii Institute of Marine Biology. Research was supported by NSF Grant BNS77-16857.

G. S. LOSEY, JR.

Department of Zoology and Hawaii Institute  
of Marine Biology,  
University of Hawaii,  
Box 1346,  
Kaneohe, HI 96744, U.S.A.

## References

- Miller, R. J. 1978. Agonistic behavior in fishes and terrestrial vertebrates. In: *Contrasts in Behavior* (Ed. by E. Reese), pp. 281-311. New York: John Wiley.
- Thresher, R. E. 1976. Field experiments on species recognition by the threespot damselfish, *Eupomacentrus planifrons* (Pisces: Pomacentridae). *Anim. Behav.*, 24, 562-569.
- Tinbergen, N. 1951. *The Study of Instinct*. Oxford: Clarendon Press.

(Received 17 February 1981; revised 1 May 1981;  
MS. number: AS-124)

## The Concept of Rape in Non-humans: A Critique

It has become fashionable in the animal behaviour literature to use human metaphors or analogies to describe and explain non-human behaviour. Words such as incest, homosexuality, prostitution, adultery, slavery, orgasm and rape have been applied to a wide array of phenomena in a diversity of species. We believe that there are serious problems associated with the application of such anthropocentric and emotionally charged words to the behaviour of non-human animals.

In particular we object to the current use of the word rape to describe certain non-human behavioural events. Several recent papers have reviewed the occurrence of rape-like behaviour in non-humans and some have even suggested functional explanations for such behaviour which are intended to apply to a wide range of species including humans (LeBoeuf 1978; Alcock 1979; Thornhill 1980). We criticize the use of the term rape to describe these phenomena because of the denotative and connotative problems with the word.

Beach (1978, 1979) has warned both of the danger of taking words from common usage and applying specialized meaning to them without definition, and of resorting to Humpty-Dumptyism (taking a word from common usage and redefining it to mean only what you want it to mean). Both of these problems exist in the current application of the term rape to non-human behaviour. Alcock (1979, page 224), for example, discusses the function of rape in humans, mallard ducks and laughing gulls with-

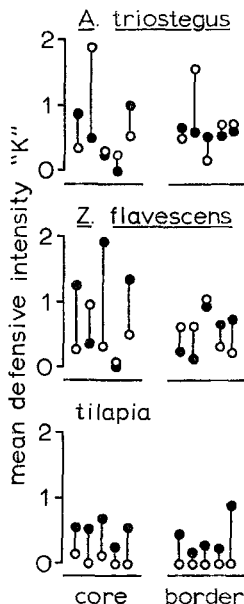


Fig. 1. Defensive intensity of five damselfish in the core and border areas of their territory. The two data points connected by a line are before (open circles) and after (solid circles) two weeks of experience with tilapia for each individual damselfish.

out providing an explicit definition. Similarly, Abele & Gilchrist (1977) discuss the adaptive significance of male homosexual rape among *Acanthocephalan* worms without defining the term. Finally, Thornhill (1980) has redefined the term from its commonly accepted definition to fit the needs of his specific research interests. We argue that to apply a human label to the behaviour of non-humans does not necessarily make the events the same. Indeed, to use such a label may imply false similarities and mislead about the motivation (proximal causes) and functions (ultimate causes) of the animal's behaviour.

For example, the single defining characteristic of rape, as it is commonly defined, is that a sexual act is forced upon an individual against its will. Thus, by using rape to describe non-human mating, one implies that the raped individual's motivation and/or preference for a given sexual partner are known. These are often difficult criteria to demonstrate in non-humans (and humans as well) because behavioural indices of unwillingness such as struggle, resistance or escape behaviour are not sufficient in and of themselves as evidence of motivational state. Behavioural assessments of unwillingness may be incorrect because individuals may show struggle and resistance as a normal part of their sexual behaviour, presumably even when they are willing to mate (e.g. northern elephant seals, Cox & LeBoeuf 1977; mink, marten and sable, Ford & Beach 1951). Other evidence of motivation, such as experimental preference tests or intraspecific comparisons of the behaviour in different contexts, must be presented. Frequently the term rape has been applied to non-humans without such evidence.

The redefinition of commonly used words with generally accepted definitions, such as rape, to fit the needs of one's particular research area can only result in confusion and misunderstanding. For example, Thornhill's (1980) definitional requirement that rape results in the enhanced fitness of the rapist departs from the common definition where no such requirement is made. Thus, Thornhill requires that rape be defined by the functional outcome (or adaptive significance) to the rapist as well as by the immediate causes or motivation of the raped individual. Clearly, confusion would result when animal behaviourists using Thornhill's definition attempt to discuss rape with sociologists using the common definition.

We also feel that there are serious connotative problems associated with using the term rape to describe non-human behaviour. Rape is an emotionally charged word that carries with it a wide range of social and ethical implications. By using the term to describe non-human behaviour, we are forcing certain human cultural standards on non-humans. We assume that scientists who apply the term to non-human behaviour do not intend these connotations, yet they cannot be avoided.

What then is the solution? First, we argue that the term rape should not be applied to non-human behaviour because the term is sensationalistic because of its connotations. The loose application of such words as rape is imprecise and does not further the goals of science. Second, we suggest that the warnings previously issued by Beach (1978) be kept in mind when making interspecific behavioural comparisons: detailed intraspecific comparisons should always precede interspecific ones; the adaptiveness and function of behaviours should not be assumed to be the same across species; and where possible, the same definitions of behaviour should be used to lessen confusion. Finally, since we believe that these non-human behaviours are real and worthy of study, we recommend an alternative term be used to describe them.

We suggest that the term 'resisted mating' be used to provide a purely descriptive characterization of the behaviour of a mating pair when one partner shows active resistance, struggle and/or escape behaviour. It implies nothing about the motivation of the resisting animal and can be used regardless of whether or not the individual is actually willing to mate. If it is possible to assess the proximal motivation, through the means suggested earlier, then other more specific terms could be used such as 'forced mating' (unwilling and resisted mating) or 'willing resistance' (willing but resisted mating). To ensure the broadest useful application of these terms, we urge that the adaptive significance of these acts not be prescribed as part of their definitions. We believe that by avoiding the term rape and using the terms suggested here, confusion can be lessened and broadly comparative research can be facilitated.

DANIEL Q. ESTEP  
KATHERINE E. M. BRUCE

Department of Psychology,  
University of Georgia,  
Athens, GA 30602.

## References

- Abele, L. G. & Gilchrist, S. 1977. Homosexual rape and sexual selection in *Acanthocephalan* worms. *Science*, N.Y., **197**, 81-83.
- Alcock, J. 1979. *Animal Behavior: An Evolutionary Approach*, 2nd edn. Sunderland, Mass.: Sinauer Associates.
- Beach, F. A. 1978. Sociobiology and interspecific comparisons of behavior. In: *Sociobiology and Human Nature* (Ed. by M. S. Gregory, A. Silvers & D. Sutch), pp. 116-135. San Francisco: Jossey-Bass Publishers.
- Beach, F. A. 1979. Animal models and psychological inference. In: *Human Sexuality: A Comparative and Developmental Perspective* (Ed. by H. A. Katchadourian), pp. 98-112. Berkeley: University of California Press.
- Cox, C. R. & LeBoeuf, B. J. 1977. Female incitation of male competition: a mechanism in sexual selection. *Am. Nat.*, **111**, 317-335.
- Ford, C. S. & Beach, F. A. 1951. *Patterns of Sexual Behavior*. New York: Harper & Row.
- LeBoeuf, B. J. 1978. Sex and evolution. In: *Sex and Behavior* (Ed. by T. E. McGill, D. A. Dewsbury & B. D. Sachs), pp. 3-33. New York: Plenum Press.
- Thornhill, R. 1980. Rape in *Panorpa* scorpionflies and a general rape hypothesis. *Anim. Behav.*, **28**, 52-59.

(Received 12 January 1981; revised 22 June 1981;  
MS. number: AS-132)

## Referents of Animal Communication

Learning what information is made available by signals is fundamental in studying animal communication. However, disagreement exists over the kinds of referents that signals can have. Most broadly and usefully, a 'referent' is anything becoming knowable or predictable through performance of a signal: who and where the signaller is, what it may be doing or about to do, aspects of its internal state, and things or events other than itself. In contrast, some ethologists hold that referents must be things apart from signallers. This particularly narrow view fails even to encompass much of the information in