

concept of territoriality in reef fishes.

Territorial behavior is a conspicuous determinant of social organization in many reef fishes. Field observations have indicated that an accurate description of a given organization must consider not only conspecific encounters, but also those involving members of the other species which make up the behavioral community. Data, relevant to the above consideration, were gathered on the reef for the three-spot damselfish, *Eupomacentrus planifrons*, at intervals throughout the year.

Experiments determined 1) the greatest distance from its residence ("distance of first attack") that a territorial male would initiate attacks on given individuals of various species, and 2) number of attacks that such a male directed at "intruders" when the latter were placed adjacent to its residence.

The "distance of first attack" was found to be characteristic for each "intruding" species: conspecifics—farthest from, congeners—slightly closer to, and the remaining species—closest to the residence. Territorial males appeared to ignore any given fish until it had reached its respective boundary. Over a broad range, size within a given species appeared unimportant. The number of attacks directed at "intruders" adjacent to the residence was, however, less clearly species-specific. Both parameters varied seasonally in a parallel fashion.

Results demonstrated that territorial males of *E. planifrons* not only recognize different species of reef fishes, but also they possess territories whose areas of defense vary depending on the particular species of intruder present at the time. Random observations on other species of reef fishes indicate that this important feature of interspecific aggression is not unique to the single species tested here. (Supported by grant GB31000X and Graduate Fellowship, both from the NSF.)

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Mother-offspring conflict. (Introduced by M. Willson)

Arguing from the work of W. D. Hamilton, mother-offspring conflict is shown to be an inevitable consequence of natural selection operating on sexually reproducing organisms. Such conflict is in theory expected from the moment of fertilization, whether the offspring is independent of its mother or not. In general, conflict is expected to increase during the period of parental investment. Data from mammals and birds support the analysis. (Supported by NIH Postdoctoral Fellowship.)

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Reproductive competition and the evolution of sociality.

Group-living intensifies reproductive competition for both dominants and subordinates; hence, tendencies for individuals to live in groups containing competitors should evolve only when external

selective forces (e.g., predators) overcompensate the disadvantages. Social behavior evolves when it enhances the primary functions of group-living and because group-living allows for greater reproduction by individuals showing nepotism and participating in systems of reciprocity.

Analysis of nepotism (kin selection) involves demographic and other considerations. One's closest relative may be his most direct competitor; extreme competition and cooperation may both occur between two close relatives; and though genetic relatedness varies greatly within a honeybee colony if the queen mates but twice, discrimination seems lacking.

Parents may use some offspring to increase their own reproduction via others. This phenomenon, extending from early abortions to sterilization of adult offspring, becomes crucial when parental reproduction overlaps that of descendants, as in eusocial insects and humans. When altruism is likely to be directed only toward siblings, alleles for selfishness may win only if they increase the reproduction of the parent. Such selection may prevail when altruism is unlikely to be directed at non-siblings; the return is to the parent. A theory heavily invoking such parental "manipulation" seems more easily to account for much of insect eusociality than does kin selection.

Kin selection, surprisingly, has rarely been applied within groups because (1) eusocial insects do not obviously favor closer relatives within colonies, (2) genetic relationships within vertebrate groups are rarely known, and (3) most social scientists still do not accept that a history of differential reproduction is the key to understanding human sociality. Human social groups, nevertheless seem remarkable examples of the interaction of nepotism, reciprocity, and parental manipulation of offspring.

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The effects of rearing conditions on the development of preferences in White Peking ducklings.

Previous research by the author has demonstrated that White Peking ducklings reared in isolation and in the dark preferred to stay near a female Rouen duck as opposed to a female chicken or a female White Peking duck. The purpose of the present experiments was to more closely approximate the natural conditions under which ducklings normally form an attachment to see if the same preference manifests itself under these conditions. Hence, the effects of communal rearing in the darkness and in the light were investigated in these experiments. A different group of eight subjects was tested each day for seven days. A bird was tested by simultaneously exposing it for 15 min. to the three live female models mentioned above. The amount of time that each subject spent with each adult model or in an empty quadrant was recorded. Previous experiments done by the author have indicated that White Peking ducklings reared in the dark and in isolation preferred the Rouen model. The results of these experiments indicated that when White Peking ducklings were reared communally in the dark they preferred either duck model more than the chicken model. When they were reared communally in the light they preferred