

Mobbing Behavior by *Stegastes albifasciatus* (Pomacentridae), a Territorial Mosaic Damselfish

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Mobbing of potential predators, a behavior long known for birds, has only recently been reported for fishes. Mobbing by fishes has been simply defined as the assemblage of individuals around a potentially dangerous predator (Dominey, 1983). Possible functions of this behavior include advertisement of the presence of a predator (Dominey, 1983), driving the predator from a given area, or cultural transmission of predator identity (Curio, 1978). Mobbing behavior has been reported chiefly from colonial-nesting fishes, and serves to protect nesting adults rather than eggs present in a nest (Fricke, 1973; Dominey, 1983). It has also been reported for non-territorial and occasionally territorial coral-reef species (Motta, 1983). Here I report mobbing behavior by the damselfish *Stegastes albifasciatus* (Schlegel et Müller), a non-nesting inhabitant of coral reef flat territorial mosaics.

A territorial mosaic consists of contiguous territories occupied for long periods of time by single animals (Keenleyside, 1979). Pomacentrid territorial mosaics are characterized by having single adults of both sexes occupying and defending small areas of the substrate, usually in patches of coral rubble (Sale, 1974). Territories are relatively stable and non-overlapping (Keenleyside, 1979), except in heterospecific mosaics where territory boundary overlap can occur (Donaldson, 1981). Mosaic territories support feeding, breeding (courtship and nesting), sheltering and resting activities (Keenleyside, 1979) but function primarily as a means for protecting a limited food source, usually benthic algae (Low, 1971; Vine, 1974; Ebersole, 1977; Hixon, 1980).

Methods

Observations of mobbing behavior by *Stegastes albifasciatus* were made at three 5 m² reef flat study sites on Guam, Mariana Islands, during a 1980–81 study of damselfish species

interactions (Donaldson, 1981). The study sites are described as follows:

Site 1. Located at Tanguisson Reef on a reef flat 20 m above the surge zone in a depth of 1.5 m. The substratum consisted mainly of coral rock pavement and rubble interspersed with patches *Acropora*, *Favia*, and *Pocillopora* spp. corals. Inhabitants of the territorial mosaic included *Stegastes albifasciatus*, and the pomacentrids *Chrysiptera leucopomas* (Lesson), and *C. leucopomas-amabilis* phase (Allen, 1975).

Site 2. Located in Tumon Bay on a reef flat 50 m above the surge zone in a depth of 1.0 m. The substratum consisted of coral sand and rubble, and patches of *Acropora aspera*. Inhabitants of this mosaic were *S. albifasciatus*, and the pomacentrids *S. lividus* (Bloch et Schneider), *S. nigricans* (Lacepède), and *Dascyllus aruanus* (Linnaeus).

Site 3. Located in Pago Bay on a reef flat 30 m above the surge zone in a depth of 1.5 m. The substratum consisted of broken coral rock pavement, coral rubble and sand. Benthic algal growth was considerable. Inhabitants of this mosaic included *S. albifasciatus*, and the pomacentrids *S. nigricans*, *Chrysiptera biocellatus* (Quoy et Gaimard) and *C. glaucus* (Cuvier).

Results

No evidence of nesting by *S. albifasciatus* on any of the study sites was observed. Rather, damselfishes were observed feeding, clustering (Thresher, 1980), sheltering and engaging in intra- and interspecific agonistic behavior.

A total of seven separate observations of mobbing behavior were made between the three study sites (Table 1) during one hour observation periods. They are described as follows:

Site 1. Mobbing behavior by *S. albifasciatus* was observed on four consecutive mornings (0900–1100 h) in June, 1980. Mobbing was directed against a pair of scorpionfishes, *Scorpaenopsis diabolus* (Cuvier), each measuring approximately 30 cm SL, which occasionally entered the study site mosaic. The intruders were almost always positioned parallel to one another and occasionally their bodies touched. A single *S. albifasciatus*, resident in the territory where the intrusion occurred, rose above the territory, milled about (Thresher, 1980) and then ap-

proached the scorpionfishes from either the side or the back of the intruders but never from the region of the head. During the approach the damselfish was joined by two to five damselfishes of the mosaic in a similar manner. Mobbing damselfishes repeatedly dove to within approximately 20 cm of the heads of the scorpionfish under attack, performed lateral displays, often with erect dorsal fins, exhibited bodyshaking, and then spun away with a flip of the caudal fin, often passing well above the intruder's head. The intruding scorpionfishes appeared to ignore the mobbing at first and then slowly swam out of the mosaic. Pursuit of the intruders, once outside of the mosaic, was not observed.

Site 2. A single observation of mobbing behavior was observed at this site during an afternoon (1400 h) in March, 1981. A single juvenile moray eel, *Lycodontis javanicus* (Bleeker), ca. 80 cm SL, entered the mosaic through an adjacent patch of *Acropora aspera*. Five *S. albifasciatus*, joined by a single *S. lividus* from the mosaic, commenced milling above the eel and then alternately mobbed the head region of the eel, passing within approximately 10 cm of the side and back of the head, but avoiding the mouth. Lateral displays, dorsal fin erections and body-shaking were also observed of the mobbing damselfishes. Pursuit by two *S. albifasciatus* continued 0.5 m past the boundary of the mosaic as the eel left the mosaic.

Site 3. During two late afternoon (1700–1800 h) observations in Pago Bay during April, 1981, mobbing by 5–7 *S. albifasciatus* and 1 *C. biocellatus* was directed against a small (ca. 45 cm SL) eel, *Echidna nebulosa* (Ahl), which foraged on the mosaic. Methods of approach and agonistic behavior were the same as those described for Site 2, except that pursuit of the intruder extended 1 m past the mosaic boundary during

the second observation.

Discussion

Patterns of mobbing behavior directed against intruding predators by *Stegastes albifasciatus* were essentially the same at all three sites. Differences existed however in the proximity and direction of approach relative to the position of the head of the intruder. Mobbing damselfishes tended to orientate towards and approach closer to the heads of intruding eels but did not do so with intruding scorpionfishes. The behavior towards scorpionfishes suggests the possibility of some form of predator recognition ability in mobbing damselfishes. An ability to recognize potential predators would be useful in conveying information of the relative dangerousness of the intruder (Dominey, 1983). While eels and scorpionfishes are both successful predators, their methods of feeding are different. Scorpionfishes possess a highly specialized method of suction feeding which is quite efficient in capturing nearby prey (Grobeck, 1983). Mobbing damselfishes passing too closely to the head of a scorpionfish could fall victim to such a means of predation. Moray eels, lacking this ability, appear to lunge at prey and may also restrict most of their feeding to nocturnal periods when potential prey are resting and less capable of avoiding predation (Hiatt and Strasburg, 1960, but see Hobson, 1968, 1974). Mobbing damselfishes, if responsive to the difference in predator feeding ability, practice a different means of approach while mobbing eels which allow them to pass much closer to the intruder. The butterflyfishes, *Chaetodon frembili* Bennett, *C. unimaculatus* Bloch and *C. auriga* Forsskål, apparently mobbing moray eels, *Gymnothorax* (= *Lycodontis*) *meleagris* (Shaw et Nodder), *G. eurostus* (Abbott) and Muraenidae sp., passed

Table 1. Summary of mobbing events by damselfish observed in three study sites at Guam, Mariana Islands.

Site	Intruder species	No. intrusions/h	Total intrusions	Ratio of mobbing responses to intrusions	No. of participants
1	<i>Scorpaenopsis diabolus</i>	1	4	1 : 1	3–6
2	<i>Lycodontis javanicus</i>	1	1	1 : 1	5+1*
3	<i>Echidna nebulosa</i>	1	2	1 : 1	5–7+1**

(* Denotes 5 *Stegastes albifasciatus* plus 1 *S. lividus*. ** Denotes 5–7 *S. albifasciatus* plus 1 *Chrysiptera biocellatus*.)

close to and even touched the heads of these predators (Motta, 1983).

Recognition of apparent predators and their subsequent harassment by potential prey apparently occurs among *Caesio cuning* (Bloch) confronted by moray eels (Eibl-Eibesfeldt, 1962), and *Dascyllus trimaculatus* (Rüppell), a nesting damselfish which harasses barracuda (Sphyraenidae), triggerfishes (Balistidae) and even octopus (Fricke, 1973). Dominey (1983) reported that bluegill sunfish, *Lepomis macrochirus* Rafinesque, mobbed snapping turtles *Chelydra serpentina serpentina*, effective ambush predators which intrude upon colonial nests, but did not respond to intruding painted turtles, *Chrysemys picta picta*, which offer no apparent threat. Adult bluegills also did not respond to largemouth bass, *Micropterus salmoides* (Lacépède), and chain pickerel, *Esox niger* Lesueur, which are effective predators of juveniles.

Advertisement of the apparently recognised intruding predator was also indicated. Each episode of mobbing commenced with a single individual responding to a violation of its territorial area and it was joined by other damselfishes over time. Advertisement is useful in alerting members of the mosaic to the potential threat of the intruder. Since scorpionfishes and eels rely upon the element of surprise in capturing their prey, advertisement of their presence by mobbing reduces predator success. Such an outcome has been suggested for bluegill sunfish which mobbed intruding snapping turtles and effectively deterred this ambush predator by advertising its presence (Dominey, 1983).

The degree of aggression during mobbing while driving away predators varies in fishes. Although intruding predators were eventually driven from territorial mosaics by mobbing damselfishes, the extent of aggression displayed was limited to behavioral displays with only occasional pursuit. No contact between the intruding predator and the mobbing damselfishes was ever observed although such activity occurs among some butterflyfishes (Motta, 1983). Damaging aggression (Curio, 1978) during mobbing has been observed of black basses (*Micropterus* spp.) which repeatedly attacked an intruding softshell turtle (*Trionyx ferox*) by biting and grabbing its tail and legs (Dominey, 1983). The ability to successfully inflict damaging aggression by

mobbing fishes might very well be tempered by their ability to recognise and determine the relative dangerousness of the predator.

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キオビスズメダイの mobbing 行動

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鳥類で古くから知られていた mobbing 行動が、魚類でも最近明らかにされつつある。魚類の mobbing は捕食者の周囲に群らがる行動と定義されている。mobbing は捕食者の存在を知らせ、追い払うために行なわれると考えられている。mobbing 行動は主として巣を形成する魚類に見出されている。

Guam 島のスズメダイ科魚類の種間関係の研究中に、キオビスズメダイの mobbing 行動が観察された。観察を行なった際に本種は巣を形成していなかったが、サツマカサゴとドクウツボに対して mobbing 行動を示した。

2尾のサツマカサゴがなわばり内に侵入すると1尾のキオビスズメダイがなわばり内で上昇し、侵入者の背後や側方から接近した。この間に2~5尾のキオビスズメダイが加わり、体側面を誇示したり、体をふるわせたり、背鰭をたてたり、尾鰭を振りながら回転したり、侵入者の頭上を横切ったりした。侵入者がなわばり外へ去ると、キオビスズメダイは追跡はしなかった。

ドクウツボに対しては5尾のキオビスズメダイが mobbing 行動を示した。ドクウツボの頭部背面や側面を10 cmの距離を保って何回も通過した。この際、口の周囲は通らなかった。体をふるわせたり、背鰭をたてたり、体側面を誇示する行動も観察された。