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OBSERVATIONS ON THE BIOLOGY OF THE REDLIP BLENNY, *OPHIOBLENNIUS ATLANTICUS* (PISCES: BLENNIIDAE) ON THE COLOMBIAN COAST OF THE CARIBBEAN

By

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SUMMARY

During a 3 week study, a total of 55 individuals of the redlip blenny (*Ophioblennius atlanticus*) were observed for at least two 15-minute periods, and several for ten of such periods. The sizes of their territories were estimated, the color pattern of each specimen an intra and interspecific interactions were recorded. The mean territory size of the redlip blenny in the study area appeared to be greater than that of these blennies studied in Curaçao and Barbados by NURSALL (1977), the difference reflecting perhaps different methods of identifying the territories or a lower density of *O. atlanticus* in the Santa Marta area. Territories did not appear to be as consistently defended at the study area as at Barbados/Curaçao and our impression is that individuals holding large territories are less likely to defend their borders. It seems possible that light colored individuals are protected by their coloration from attack by dark colored territory owners. In territorial defense the redlip blennies grabbed each other tightly by the mouth and struggled in this position repeatedly for about 15 seconds. Interspecific antagonism was common in the present study, the redlip blennies defended their territory frequently against *Eupomacentrus dorsopunicans* or *E. partitus*.

RESUMEN

Durante un estudio de tres semanas, un total de 55 individuos del blénido *Ophioblennius atlanticus* fueron observados por lo menos durante dos períodos de 15 minutos para cada individuo y en algunos casos hasta por 10 de estos períodos. Se estimó el área de sus respectivos territorios y se tomó nota de los patrones de coloración de cada especimen y de las relaciones intra e interespecíficas de ellos. El tamaño promedio del territorio de estos blénidos resultó ser mayor que el de los respectivos territorios estudiados por NURSALL (1977) en Curaçao y Barbados. Esta diferencia posiblemente se debe a un método diferente de definir los territorios o refleja una densidad menor de la población de *O. atlanticus* en Santa Marta. Los territorios del área fueron defendidos con menor intensidad a como lo fueron los de Barbados/Curaçao y es nuestra impresión que individuos ocupando un territorio extenso tienden a defender sus límites en menor grado. El color claro de algunos individuos proba-

blemente los protege de agresiones por parte de individuos de color oscuro. En el acto de defensa territorial intraespecífica, los blénidos se agarran por sus bocas y se sacuden mutuamente durante aproximadamente 15 segundos, pudiéndose repetir esto varias veces. Con frecuencia se observaron defensas de los territorios dirigidas hacia los peces doncella *Eupomacentrus dorsopunicans* y *E. partitus*.

INTRODUCTION

The redlip blenny *Ophioblennius atlanticus* (VALENCIENNES) is a common inhabitant of the rocky substrate at Punta de Betín, Santa Marta, Colombia. The ecology and behavior of this species was studied on the coral reefs of Curaçao and Barbados by NURSALL (1977), but populations living in rocky habitats such as that near Punta de Betín have received almost no attention. It was the purpose of this study to determine the extent to which populations in such contrasting environments differ in their behavior and ecology.

THE STUDY AREA

The study area is at the leeward base of the peninsula Punta de Betín, on whose summit, some 24 m above sea level, INVEMAR overlooks the bay and port area of Santa Marta. In the past, numerous rocks rolled down the slopes into the sea, where they now cover most of the ocean floor near the shoreline (Fig. 1). A large number of fishes and invertebrates share this rocky habitat with redlip blennies; among the most conspicuous fishes are the following: *Aulostomus maculatus* (Aulostomidae); *Myripristis jacobus* (Holocentridae); *Cephalopholis fulva* (Serranidae); *Scorpaena plumieri* (Scorpaenidae); *Eupomacentrus dorsopunicans, E. partitus, Microspathodon chrysurus, Abudefduf saxatilis, A. taurus* (Pomacentridae); *Thalassoma bifasciatum* (Labridae); and *Sparisoma viride* (Scaridae). Typical invertebrates in the area include *Millepora complanata* (Hydrozoa); *Gorgonia ventalina, Bartholomea annulata, Palythoa caribbea, Montastrea annularis* (Anthozoa); *Spirobranchus giganteus* (Polychaeta); *Percnon gibbesi* (Crustacea); *Lima scabra* (Pelecypoda); *Echinometra lucunter,* and *Diadema antillarum* (Echinoidea).

Water temperature varies between 23 °C and 33 °C (mean, 27.6 °C) and salinities average 35.2‰, with a maximum of 36.8‰ and a minimum of 28.9‰ (data from 1979). The extreme values reflect the rather strong seasonal changes associated with the presence or absence of stormy winds, locally known as "brisa". These winds prevail during the dry season from December to March (HERRMANN, 1970), and may reach a velocity of 30 m/s or more. They blow seaward and cause a complete exchange of the bay's water by driving out to the sea the warmer, more often than not, polluted, surface water. This water is replaced with cooler and cleaner water of higher salinity from the depths of the neighboring ocean. During the wet season from July to November, nearby creeks and rivers empty an enormous amount of freshwater into the bay, sometimes with a dramatic decrease in salinity and increase in water temperature. Also, there are some rather constant currents of water that circle in the bay and move towards the open

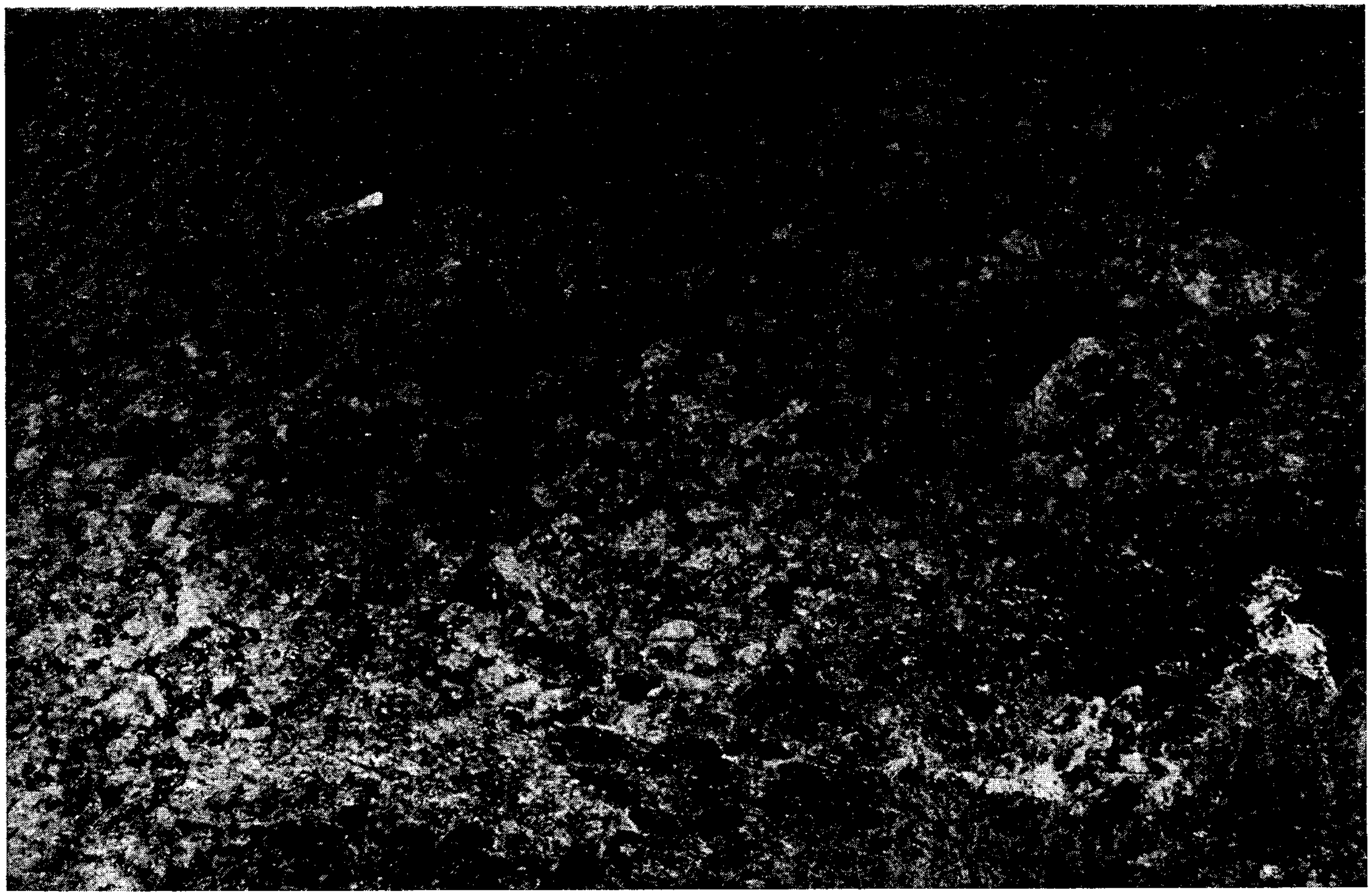

Figure 1. The study area, in the leeward base of the península Punta de Betín, Colombian Caribbean Sea.

sea. These currents carry away most of the waste, trash and pollutants produced by the port, so the study area is seldom as heavily contaminated as its location (less than 100 m from the nearest docked ship) would suggest. Nevertheless, within the past six years most of the former wealth of coral growth described by ANTONIUS (1972) has succumbed to the influences of the port.

MATERIALS AND METHODS

The sizes of the territories of 55 redlip blennies were estimated by marking or noting the boundaries of the area that an individual occupied and in which it was not seen to lose encounters with conspecifics. The distances between marked points on the substrate that delimited the territory were measured and recorded on a crude map drawn on an underwater writing tablet. Sufficient inter-point distances were measured so that the territory on the map could be subdivided into triangles, each side of which represented a known inter-point distance. The map was redrawn to scale in the laboratory, using a ruler and compass, and the area of the territory measured with a planimeter. Vertical surfaces of rocks were measured if their area was greater than $0.5\ m^2$.

The physical features of the substrate (color, number and sizes of rocks, etc.) were subjectively assessed. No attempt was made to determine the proportion of the substrate covered by sessile plants or invertebrates, except for a rough estimate of the percentage of the surface covered by the zoanthid *Palythoa*.

Individuals were identified primarily on the basis of their territory, since NURSALL (1977) established the reliability of this method for redlip blennies. However, length, color and general marking, of the fish were noted as a partial check of this method. Length of each individual was roughly measured (to the nearest 5 mm) by measuring the distance it spanned while resting on a rock. Identifiable features on the rocks were sufficiently numerous so that the distance between two such features at each end of the fish could be measured after the fish left its perch. This method of measuring length provided a good estimate of the size classes of the population and obviated the capture or sacrifice of a large sample of fish in an area where it is desirable to disturb the fauna as little as possible.

The color of each specimen was recorded by assigning the specimen to one of three categories: dark, bicolored or pale. There was some overlap in categories and in several cases an arbitrary decision was made in assigning an individual to a category. However, our color descriptions seem to be consistent with those of BÖHLKE & CHAPLIN (1968) and NURSALL (1977).

Most specimens were observed (while the observer snorkeled) for at least two 15 minute periods, and several individuals were observed for 10 of such periods. For all individuals the periods were separated by several days during the 3 week study (June 13 - July 4, 1980). In addition, 3 separate censuses of 45 minutes each were made July 2-4, during which all *E. partitus* and *E. dorsopunicans* swimming within 1 meter of each blenny were counted.

On August 4, 1980, two specimens of medium size (5.8 cm and 7.0 cm) were collected in the study area by chasing them into hollows in the rocks and *Millepora* formations. They were then driven into plastic bags by probing the hollow with a diver's knife. Both specimens showed the two colored pattern, brownish anteriorly and gray-white posteriorly. They were placed in an aquarium whose floor (30 cm x 80 cm) was covered with coral rubble and several light-colored stones. Black and white tiles were used to form a number of crevices to serve as hiding places and look-out perches. The water level was kept at 20 cm and water was continuously recycled and aerated with a pump and filter system. Filamentous algae were provided, which, according to RANDALL (1968), is almost the exclusive food of the redlip blenny.

RESULTS AND DISCUSSION

Table 1 summarizes the size and physical characteristics of the territories and the length and color of the blennies (dark, bicolored or pale). Figure 2 illustrates the tendency for individuals of similar coloration to occupy adjacent territories.

The mean territory size (m^2) for each group (dark, bicolored or ligth) was greater than for the blennies in Curaçao and Barbados, which were 0.45 and 0.58, respectively (NURSALL, 1977). Possibly this difference reflects different methods of identifying the territory. The Santa Marta territories should perhaps be regarded as home ranges. Although the blennies fed in these areas, we could not determine if the entire feeding area was defended. NURSALL (1977) concluded that territory and home range coincided in the redlip blenny: this resident fish "clearly recognizes the boundary, and defends it...". Thus, only part of each "territory" of the Santa Marta population may be equivalent to a territory in Nursall's study.

On the other hand, if the areas were in fact sufficiently comparable in both studies to permit comparison, then the larger territories reported in the present study may indicate (a) less available food, (b) fewer available hiding places, (c) fewer individuals per unit area of substrate, (d) fewer predators, (e) geographical variation (genetic) in territorial defense behavior, or (f) any combination of the above.

We found no indication that food availability was the major factor that determined territory size. Food appeared plentiful in numerous unoccupied areas adjacent to territories. To be sure, pale individuals living on large rocks with sparse algal growth frequently fed on the adjacent ocean floor where growth was more abundant; but their territories (rock and ocean floor) were not significantly larger than some territories that were entirely rock or entirely ocean floor.

Figure 2. Locations of territories of 54 individuals of *Ophioblennius atlanticus* at Santa Marta, Colombia. Shoreline and several rocks shaded for reference. Individuals were dark (solid), bicolor (partially shaded circles) or light (open circles).

The availability of suitable hiding places appeared important for the establishment of all territories, and quite possibly the preferred territories have both adequate food supplies and hiding (also lookout) places. Many large individuals occupied small territories adjacent to large crevices, from which they rarely strayed. In these cases food appeared to be abundant, and shelter seemed adequate for predator avoidance and territory defense. Such a territory may increase life span and/or increase the size of even young individuals by reducing the number of risky forays away from shelter, and by minimizing the energy required to defend the territory. Another case of small territories occurred on a highly irregular (numerous knobs and pockets) and densely vegetated rock where seven medium-sized individuals occupied small territories adjacent to a smooth, bare rock twice its size, where only one medium-sized blenny lived. It appeared that both food supply and hiding places affected territory size in this case.

Since the densities of the individuals at Curaçao and Barbados were not reported, there is no way to compare our finding regarding the effect of density on territory size. However, we infer that most of the territories NURSALL (1977), studied were contiguous. In the present study, there were numerous areas between territories that appeared suitable for territories, but which were unocuppied. This implies a lower density and perhaps a spreading out of the territory due to lack of conflict with other blennies at the border. It is of interest that the density of O. *atlanticus* on an inshore, reef in St. John, Virgin Islands was 0.65 individuals/m^2 (RANDALL, 1968). The density of blennies in our study area was considerably lower (0.29 individuals/m^2), although our figure might have been higher if our fish had been poisoned, as was the population reported by RANDALL.

The data in neither the Barbados/Curaçao nor the Santa Marta study demonstrate the effect of predator density or genetic variation on territorial defense behavior.

Finally, territory size probably is affected by the sex, age, reproductive condition and previous experiences of the individuals in a populations should be described at least in terms of the distribution of individuals by sex and age classes. Since the distribution of these traits was unknown in both the Barbados/Curaçao and Santa Marta populations, it is possible that the two populations differed significantly in this regard, and if so, this may explain the observed differences in mean territory size.

NURSALL (1977) reported that both sexes were higly territorial, with limited extraterritorial feeding, and that probably "recruitment to the status of territorial adult is through juveniles that take up interstitial territories...". We saw no evidence of interstitial territories held by younger individuals, but actually only two small individuals were observed in the study. One of these seemed to have a secure territory several meters from the nearest territory (and hence apparently not defended) and the other one moved about on a rock within the territories of two larger individuals. The larger individuals appeared to accept the small individual and no agonistic encounters were observed. The small blenny was pale, one of the larger individuals was bicolor (though darker than usual), and the other large specimen was completely dark one of the few instances where a dark individual shared a rock with an individual other than another dark one.

Territories did not appear to be as consistently defended at Punta de Betín as at Barbados/Curaçao. In fact, two large pale individuals, while maintaining favored perches, regularly shared much of the same rock with no attempt to displace each other, and they sometimes fed close to each other and exchanged places. Our impression is that individuals holding large territories are less likely to defend their borders, even when the resident is close to the transgressor, but quantitative data are needed to verify this possible relationship between territory size and degree of agonistic reaction to transgressors. Also, it is not clear if all transgressors are responded to, identifically under the same circumstances.

When we released a captive individual (which had turned pale in captivity; see below) into the study area, it settled in the very center of a dark blenny's territory, on top of a rock covered with *Palythoa caribbea.* The owner of the territory did not react at all to the introduced blenny during the half hour we remained in the vicinity observing the fish; and furthermore, two dark brown individuals that apparently lived at least partly within the boundaries of the same territory ignored the light blenny completely. This observation differs from some that NURSALL (1977) made under comparable circumstances. In our case it seems possible that the light color protected the individual from attack by the darker owner(s) of the territory into which it was placed.

Interspecific antagonism in NURSALL's study was not common, but in the present study at least one incident an hour was observed in which a redlip blenny defended his territory against another species, almost always *Eupomacentrus dorsopunicans* or *E. partitus.* On one occasion a medium-sized dark blenny chased from its territory a dusky damselfish *E. dorsopunicans* that was more than twice its size. In another instance, a medium-sized bicolored blenny spotted the signal jumps of a small bicolor damselfish *E. partitus,* about a meter from its perch (but still within the blenny's territory). The blenny suddenly dashed from its perch, chased the damselfish away, and remained in the general vicinity of the encounter, where it fed for several minutes. In both cases the coloration of the blenny resembled that of the intruding damselfish.

Thirty-five percent of our population were either light or bicolored, thus differing in this respect from NURSALL's populations. We observed a tendency for pale blennies to locate territories on light substrates (Table 1), in accordance with BÖHLKE and CHAPLIN's (1968, p. 562) observation: "Young fish are pale, particularly posteriorly, and even adults often pale considerably when on a light background". NURSALL (1977) specimens were predominantly dark chocolate brown, but turned pale and blotchy around the head when under stress. Occasionally he found specimens with creamy white body and darker head. He did not note a relationship between body color and substrate. Our observations of two captive individuals in an aquarium did not resolve the issue of whether we are dealing with unpigmented morphs which selection has favored for a light background, or individuals that are genetically identical with regard to color, but which assume a color appropriate to the substrate. Our two captive specimens adopted a paler color and their brownish front parts turned light gray, blotched with light-brown rounded patches about the size of their eyes, and unlike any coloration we observed in their natural habitat. They maintained this coloration throughout the time they spent in captivity, except once, when one individual, which had hidden behind the dark brown filter box, turned brown, although not as dark as is usually observed in the field. The two blennies soon established preferred localities in the aquarium, and in spite of their apparent well-being, one of the fishes died on 20 August in its light gray color with brownish blotches. The color of this dead blenny is remarkable, as all other alcohol-preserved specimens of *O. atlanticus* in the collection at INVEMAR are dark brown, like the free-living individuals we observe in the study area.

The remaining individual was kept 20-22 August in a black container in the aquarium but it never changed from its light gray color with brown blotches, even on this dark substrate.

Light, bicolored and dark individuals tended to form loose clusters (Figure 2). It is possible that these clusters represent age groups, since some bicolored individuals on dark substrates were adjacent to bicolored individuals on light or medium substrates. On the other hand, the occurence of light individuals together on the same rock may simple indicate that they migrated to a substrate appropriate to their coloration (if coloration is genetically determined); or that they changed color when they became situated on the light substrate.

If the bicolored individuals are young fish, as BÖHLKE and CHAPLIN (1968) suggest, then their grouping together may mean only that young tend to stay in family groups. However, there is considerable overlap between the sizes of the dark forms and the light and bicolored forms. Moreover, it is not known how much variation occurs in size among adults, and all dark forms may indeed be older than lighter forms, but simply smaller due to environmental influences such as food deprivation. Thus, coloration may possibly be a better indicator of age than size.

The data (Table 1) regarding the association between bicolored redlip blennies and bicolor damselfish, and between dark blennies and dusky damselfish is inconclusive, but the possibility cannot be discounted that young damselfish associate with blennies that have similar coloration (or vice versa). Mimicry among marine fishes is quite common (RUSSELL *et al.*, 1976) and the question of possible mimicry in these species warrants further investigation.

The behavior of individuals in our population appeared to differ in several respects from that which NURSALL (1977) described for his coral reef populations. Our specimens did not seem to be particularly cautious

Table 1. Summary of data for *Ophioblennius atlanticus* and its territory, based on 54 specimens at Santa Marta, Colombia. *Substrates:* Rocky (R), irregular surface of rock (I) or smooth surface of rock (S); color of substrate dark (D), medium (M) or ligth (L). Numbers of fish on substrate in each of these categories indicated in column next to substrate destignation.

* Number of individuals (in parentheses) of *Eupomacentrus partitus* (b) or *E. dorsopunicans* (d) observed within 1 m of a blenny during 3.45 - minute census periods.

Color of Individual *	Total length (cm)	Depth of Territory (m)	Size of Territory (m^2)	Substrate Texture	Substrate Color
Dark (d, 3)	7.43 S.D. = 1.12	1.26 S.D. = 0.70	1.17 S.D. = 0.76	R 13 I 19 S 3	D 20 M 8 L 7
Bicolor (b, 1)	7.18 S.D. = 0.68	1.85 S.D. = 0.73	2.41 S.D. = 1.87	R 4 I 1 S 6	D 5 M 1 L 5
Light (b, 3) (d, 1)	7.00 S.D. = 1.31	1.40 S.D. = 0.55	1.61 S.D. = 0.78	R 0 I 0 S 8	D 0 M 1 L 7

around *Diadema antillarum,* as did his ("...if pressed will seek shelter behind it"). Dark blennies in particular appeared rather casual around this sea urchin, which was abundant in the study area. They frequently rested beneath several urchins, even when apparently not threatened.

In territorial defense, the most violent behavior reported by NURSALL (1977) was nipping. Although he does not describe nipping in detail, two large pale specimens in the present study fought in a manner more violent than nipping. They grabbed each other tightly by the mouth and struggled in this position for about 15 seconds. They released their grip for a few seconds and then grabbed each other again by the mouth and resumed the struggle for about 10 seconds, after which one sought security in a crack. Whether or not the two fangs in the bottom of the buccal cavity were used in this grip could not be determined.

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LITERATURE CITED

ANTONIUS, A. 1972. Occurrence and distribution of stony corals (Anthozoa and Hydrozoa) in the vicinity of Santa Marta, Colombia. Mitt. Inst. Colombo-Alemán Invest. Cient., Santa Marta, 6: 89-103.

BÖHLKE, J. E. & C. C. G. CHAPLIN, 1968. Fishes of the Bahamas and Adjacent Tropical Waters. The Acad. Nat. Sci. Philadelphia. 711 p.

HERRMANN, R. 1970. Deutungsversuch der Entstehung der "Brisa", eines föhnartigen Fallwindes der nordwestlichen Sierra Nevada de Santa Marta, Kolumbien. Mitt. Inst. Colombo-Alemán Invest. Cient., Santa Marta, 4: 83-95.

NURSALL, J. R. 1977. Territoriality in redlip blennies (*Ophioblennius atlanticus* Pisces: Blenniidae). J. Zool., London, 182: 205-222.

RANDALL, J. E. 1968. Caribbean Reef Fishes. T. F. H. Publ., Neptune City (New Jersey). 318 p.

RUSSELL, B. C., G. R. ALLEN & H. R. LUBBOCK. 1976. New cases of mimicry in marine fishes. J. Zool. London, 180: 407-423.

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