

Diet of the corallivorous pufferfish *Arothron meleagris* (Pisces: Tetraodontidae) at Gorgona Island, Colombia.

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Abstract: The density and diet of *Arothron meleagris* and the abundance of corals are compared between Playa Blanca and La Azufrada reefs at Gorgona Island, Colombia. Corals, an important food resource for *A. meleagris*, are abundant after the widespread coral mortality caused by the El Niño event in 1982-83. Both puffer density and percent live coral cover were similar between reefs. The diet of *A. meleagris* showed strong preferences for the abundant *Pocillopora* spp. *Arothron* may affect the recovery of some eastern Pacific reefs, where the fish has been reported feeding on rare or less abundant corals. In contrast, the effect of *A. meleagris* on Gorgona reefs may be non significant; in fact, the fish may help the process of recovery, by fragmenting and dispersing colonies while feeding on pocilloporid corals, but not feeding on rare coral species.

Key words: Corallivory, Colombia, coral reefs, eastern Pacific.

Arothron meleagris (Bloch & Schneider) is an Indo-Pacific pufferfish (Tetraodontidae) that is widely distributed throughout the eastern Pacific Ocean. It lives on rocky shores, both on the mainland and offshore islands (Thomson *et al.* 1979). Although its diet consists largely of live corals (Glynn *et al.* 1972, Guzmán and Robertson 1989), it also feeds on tunicates (Hobson 1974), crustose coralline algae, sponges, echinoids, and other invertebrates (Guzmán and Robertson 1989). Guzmán and Robertson (1989) found that *A. meleagris* has the ability to switch its diet when changes on the coral composition occur. They also found that its feeding preference on several eastern Pacific reefs is not related in a consistent way to the abundance or availability of different coral species.

The coral reef community structure at Gorgona Island in Colombia, and the influence of corallivores have been examined by Prah1 *et al.* (1979), Cantera (1983) and Glynn *et al.* (1982). The reef-building corals at Gorgona are similar to Panamanian reefs, where pocilloporid corals are the dominant species. Glynn *et al.* (1982) reported that *A. meleagris* was one

of the corallivores that consumed the greatest amount of live coral, and fed mainly on pocilloporids. This inference was based on its abundance and feeding habits, and not on stomach contents. Prah1 (1983) reported 87% coral mortality at some reefs at Gorgona during the 1982-83 El Niño warming event, when most of the coral species, except *Pocillopora eydouxi*, were affected. By December 1987, live coral cover (only reported for La Azufrada reef) was 43% (Prah1 *et al.* 1988), with pocilloporid corals (*P. capitata?*) comprising 69% and *Psammocora* 30.5%. That unprecedented and catastrophic disturbance produced large changes in community structure at the level of species composition, abundance, and zonation. Therefore, changes in corallivore distributions and feeding habits might also be expected.

We present data from November 1989 concerning the diet and abundance of *A. meleagris* that complements previous studies at Gorgona and elsewhere in the eastern Pacific (*e.g.*, Glynn *et al.* 1972, Guzmán and Robertson 1989). The puffer's diet, and coral cover composition of two fringing reefs were compared. We also examined the relation bet-

ween puffer distribution in different habitats on a reef and habitat-related variation on its diet. This paper is the first of a series on the ecology of eastern Pacific coral reefs.

MATERIAL AND METHODS

Gorgona Island (44 km²) is located 56 km off the S.W. Colombian coast (2°58'N, 78°11'W). General descriptions of the flora, fauna and physical oceanography can be found in Prah *et al.* (1979), Glynn *et al.* (1982) and Rubio (1986). In the present study, coral distribution and coverage, and the pufferfish abundance and diet were determined at Playa Blanca and La Azufrada reefs, both located on the eastern side of the island, about 1 km apart from each other. The areas of those two reefs are approximately 15 Ha and 8 Ha respectively (Glynn *et al.* 1982).

Diet composition was studied in 10 speared fish at Playa Blanca reef, and 13 at La Azufrada reef. Stomach contents were extracted within 1h of collection and stored in ethanol (70%). All contents were oven-dried (65 to 80 °C) to a constant weight, then sorted under a dissecting microscope (*sensu* Guzmán and Robertson 1989). The percentage by weight of dry material in each identifiable group was recorded. At La Azufrada reefs, fish were collected at two different coral zones (*Pocillopora* and *Psammocora*).

At each reef, *A. meleagris* was censused along 5 belt transects (5-10 m wide depending on visibility) and the percent of substratum covered by live corals was estimated from 5 line transects. For both surveys, transects were run perpendicular to the shore, about 25 m apart, and extended along the depth gradient (1 to 10 m). Line transects totally covered 730 m and 766 m at Playa Blanca and La Azufrada reefs, respectively.

All data were arcsine transformed for statistical analyses.

RESULTS

In 1989, densities of *A. meleagris*, which did not differ between reefs ($t = .11$, $P > 0.05$), were 21.9 ± 6.2 ind./Ha and 25.8 ± 4.9 ind./Ha at Playa Blanca and La Azufrada reefs, respectively. Though densities at La Azufrada had declined from 34 ind./Ha in 1987 to 25 ind./Ha in

1989 (Guzmán and Robertson 1989), the difference was not significant ($t = .91$, $P > 0.05$).

As expected, the proportion of corals in the fish's diet was similar to the percent of coral cover found at each reef (Fig. 1). *Pocillopora* was more consumed than *Psammocora* at Playa Blanca ($t = 24.69$, $P < 0.01$), where *Psammocora* coverage was less than at La Azufrada ($t = 2.55$, $P < 0.01$). However, at La Azufrada *A. meleagris* consumed (regardless of reef habitat) similar proportions of both corals ($t = 1.39$, $P > 0.05$), in relation to their similar availability (Fig. 2). *Pocillopora* and *Pavona* cover were similar between localities ($t = .26$, $P > 0.05$ and $t = .69$, $P > 0.05$, respectively). Dead coral cover was not significant among reef sites ($t = 1.25$, $P > 0.05$) but it was 17% greater at Playa Blanca reef (Fig. 1).

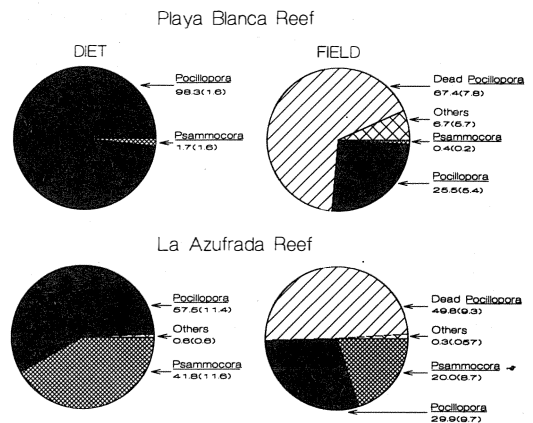


Fig. 1. Relative abundance of live and dead corals in the field, and diet composition of *Arothron meleagris* at Playa Blanca and La Azufrada reefs, Colombia. "Others" category in diet consists mainly of urchins and gastropods. "Other" corals were mainly pavonids. Values are means (standard error).

Furthermore, variation in *Arothron's* diet was related with the availability of corals within different reef zones at La Azufrada, where *Psammocora* is abundant and forms large dense patches in the upper slope and at the base of the reef (Fig. 2). Fish captured within the *Psammocora* zone contained in their stomachs 75% of that coral species, significantly more than *Pocillopora* ($t = 3.56$, $P < 0.01$). In the *Pocillopora* zone, *A. meleagris* consumed more *Pocillopora* than *Psammocora* ($t = 4.71$, $P < 0.01$).

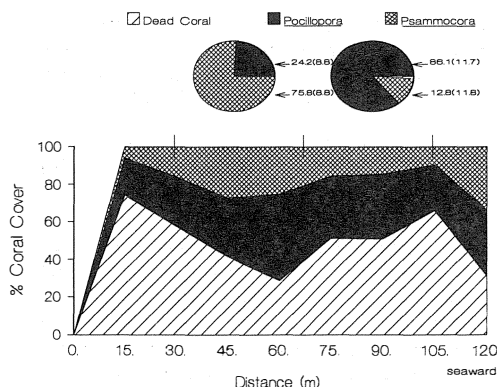


Fig. 2. Changes in the percentage cover of live and dead corals along a 120 m transect perpendicular to the shore, from the lagoon to the reef base (layer graph); and puffer's diet at each reef zone within the reef profile (pie diagrams), La Azufrada reef, Colombia. Diet values are means (standard error).

DISCUSSION

At Gorgona Island the 1982-83 El Niño event caused a reduction in coral cover in excess of 50% (Prah 1983). Six years after coral mortality, the Playa Blanca and La Azufrada reefs have about half of their total areas covered with living corals, and pocilloporids are still abundant and widely distributed within each reef.

Both puffer density and percent live coral cover did not differ between reefs, in spite of La Azufrada reef being twice the size. Guzmán and Robertson (1989) reported no relationship between puffer and coral densities, and suggested that puffer density on eastern Pacific reefs is not set by coral availability. Similar or higher population densities are known from reefs in Panama, where the total area of live coral is less than 2% (Guzmán and Robertson 1989). The patterns of both variation in density of pufferfish and resource abundance may suggest that populations are recruitment-limited rather than resource-limited.

A. meleagris feeding preferences have been shown to be complex and variable. In some places it behaves as a passive generalist, consuming corals in relation to their availability. In others it is an active generalist, broadening its diet by selecting the rarer corals (Guzmán and Robertson 1989). At Gorgona Island, the fish showed strong preferences for what was available, both within reef zones and the whole reef area.

A. meleagris may affect the recovery of some eastern Pacific reefs, on one hand, by feeding on rare corals (e.g., *Psammocora* at Caño Island, Costa Rica), but on the other hand, the puffer's apparent ability to change the diet, may favor the re-establishment of some coral species, as is the case for *Pocillopora* at Caño Island (Guzmán and Robertson 1989). Rare coral species observed at Gorgona Island (e.g., *Pavona varians*, *P. clavus*, *Porites* spp.) were not eaten by the puffer. This may be explained by the sedentary nature of the fish, which concentrates its feeding movements to certain areas of the reef, where there are large monospecific coral stands. Therefore, the effect of *A. meleagris* on Gorgona reefs may be remote; in fact, the fish may help the process of recovery by fragmenting and dispersing colonies while feeding upon *Pocillopora* and *Psammocora*, as observed at the lower reef slope and reef base. Coral dispersion and fragmentation have been found to be an important aspect of the recovery of Panamanian and Costa Rican reefs (Guzmán and Cortés 1989, Glynn 1990).

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RESUMEN

Se comparan la abundancia de coral, y la densidad y la dieta del pez timboril *Arothron meleagris* de los arrecifes de Playa Blanca y La Azufrada, Isla Gorgona, Colombia. Ciertas especies de coral, recurso alimenticio principal de *A. meleagris*, continúan siendo abundantes después de 6 años de la mortandad masiva ocurrida a causa del fenómeno de El Niño 1982-83. La densidad del pez y el porcentaje de coral vivo fue similar para ambos arrecifes estudiados. *A. meleagris* demostró una marcada preferencia por el coral más abundante o disponible del arrecife (*Pocillopora*). *Arothron* posiblemente influye en la recuperación de ciertos arrecifes coralinos del Pacífico Oriental, debido a que puede consumir ciertas especies de coral raras

o poco abundantes. Por el contrario, en Gorgona el efecto posiblemente sea poco evidente, ya que el pez posiblemente ayude en el proceso de recuperación, debido a que, durante su alimentación, fragmenta y dispersa los corales.

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