FEEDING NICHE OF *DRUPELLA* (MURICIDAE: PROSOBRANCHIA) IN THE CORAL REEFS OF BUNAKEN ISLAND, INDONESIA

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ABSTRACT

Feeding scars were counted on hard corals to estimate the food spectrum of the corallivorous gastropod *Drupella cornus*. on reef flats. A total of 94 scars were occupied by *D. cornus* on the three most abundant coral genera: *Montipora*, *Porites,* and *Acropora*. The snails displayed a high degree of selective feeding by feeding on only 3 genera out of 28 coral genera available in the study area.

INTRODUCTION

Taxa feeding on coral polyps are the crown-of-thorns, *Acanthaster planci*, muricid snails, and coral fish, such as chaetodontids. The fish do not leave clear feeding scars on the corals. The muricid snails *Drupa ricinus, D. rubusidaeus,* and *Coralliophila violacea* are mainly solitaire or in pairs, so their feeding scars do not appear clearly. The asteroid *A. planci* produces big scars. When the polyps have been eaten, the white coral skeleton lights up on the surfaces of otherwise brownish corals. Scars left by *A. planci* are mainly seen on the large tabulate *Acropora*. Species of *Drupella* are gregarious and leave big scars. Two species of *Drupella* occur on the reef, viz., *Drupella cornus* (Röding 1798) and *Drupella rugosa* (Born 1778). The *Drupella* species are so small, that they are able to prey on the small branching corals.

D. cornus (Röding 1798) is a senior synonym of *Purpura elata* Blainville 1832, and *Ricinula spectrum* Reeve 1846 (Middelfart 1997). *D. cornus* is characterized by entirely white shells, while *D. rugosa* has purple aperture.

D. cornus was very abundant on the reef flats of northern Sulawesi. Dako (1996) found an average density of 6.06 ind./m^2 (22 % of the total prosobranchia on the reefs, Boneka 1998). Fujioka & Yamazato (1983) stated that *D. cornus* preyed on the polyps of scleractinian corals, whereby the snail could cause significant damage to the coral reefs. Our aim was to study which corals *D. cornus* would feed on and whether a preference could be detected. Feeding of *D. cornus* is reliably determined because of the feeding scars found on corals. The snails that have low degree of migration and they usually gather in small groups. To our knowledge there are no other records of the characteristics of the feeding niche of *D. cornus*.

The concept of niche was introduced by Elton 1927 and redefined by Hutchinson in 1959. The fundamental niche is defined as the tolerance to any factor influencing the survival of a given species in the environment. Individual species usually only occupy a part of this niche. The level of interspecific competition decides the limits of the realised niche. (Krebs 1985, Schoener 1974)

MATERIALS AND METHODS

Sampling was carried out in May 1997 at two locations on the southern and eastern coasts of Bunaken Island (1°24'30"-1°38'50" N and 124°45'30" E) 15 km NW of Manado City. Coral-reefs, mangrove, seagrass, and white-sandy bottom occur along the coast of Bunaken Island. Coral reefs are established

on all coastal edges, about 100-200 meter from the shore line. Offshore the reef flat ends abruptly with a steep wall. During low tide the bottom is covered by about 1.0-1.5 m water (neap low tide). The highest tidal amplitude is about 2 m. Seagrass and narrow mangrove forest usually occur behind the reef flats.

The coral genera and coverage were recorded along a 100 m line transect by snorkelling and SCUBA diving (UNEP 1993). The divers noted the occurrence of all taxa with the exception of dead hard corals, soft corals, ascidians, algae, and echinoderms. Coral genera occurring in both sites were compared by means of similarity Index, 2c/(a+b), in which a = number of species in one location, b = number of species in other site, and c = species occurring in both communities (Krebs 1985).

Usually *Drupella* were located on or near corals with feeding scars (Boneka 1998). All snails were collected around the feeding scars and subsequently identified to species level in the laboratory. The shell length was measured with an of accuracy 0.05 mm.

Feeding scars found within 4 x 100 m were counted, and the coral genus was noted. Feeding scars without snails were ignored. The scar size was not measured (many scars on branching corals).

RESULTS

Drupella and feeding scars.

In the study area, the two species of *Drupella* were inactive and cryptic. Without the feeding scars, it would not be possible to recognize the snails in the field. We found one scar where *D. rugosa* occurred alone. However, low numbers of *D. rugosa* were sometimes mixed with *D. cornus*, but the material of *D. rugosa* was very limited so we did not include this species in the diet analysis.

The number of scars surrounded by living snails were counted at 68 scars/ 400 m^2 on the southern and 26/ 400 m^2 on the eastern coast. The numbers on the southern coast were significantly higher (χ^2=18.77; P<0.05). Each scar was surrounded by a group of snails (2-18 individuals), but the numbers were difficult to score on branching *Acropora*. The snails easily detached and fell down among corals on the bottom.

Feeding scars of *Drupella cornus* were only found in three genera of coral. The frequency of scars on these genera were significantly different between the two sites (Chi-square test χ^2=29.49, P<0.05). Scars were dominant on *Porites* at the eastern site and on *Montipora* at the southern site.

A total of 94 scars recorded in both sampling sites: 74 % on the *Montipora*, 14 % on *Porites*, and 12 % on *Acropora* Based on this total number of feeding scars, the preference hierarchy of *D. cornus* on corals was *Montipora, Acropora, Porites* (Figure 1). The 3 coral genera selected by *Drupella* were apparently the commonest corals in the sampling sites (Table 1). *Drupella* was never found associated with algae and soft coral.

The length size distribution of *Drupella cornus* versus food items did not reveal a significant difference (F=1.22, P< 0.05).

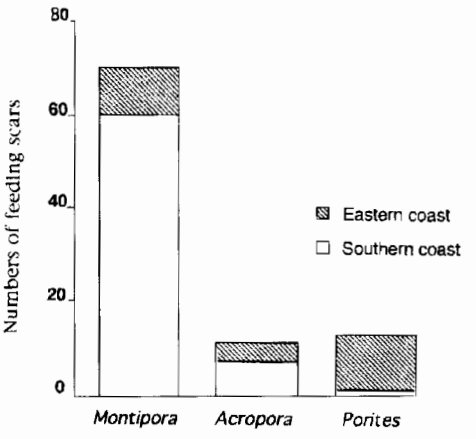

Figure 1. *Drupella cornus*, numbers of feeding scars found on the three genera at Bunaken Island, May 1997.

Table 1. C = coral cover, F = the frequency occurence of the coral genus, X = mean size of colony.

Genera	Southern Bunaken			Eastern Bunaken		
	C (cm)	F	X	C (cm)	F	X
Montipora	1471	63	23.35	1246	56	22.25
Acropora	1090	35	31.14	391	7	55.86
Porites	537	22	24.41	921	35	26.31
Favia	107	7	15.29	45	4	11.25
Merulina	77	3	25.67	44	3	14.67
Symphyllia	80	1	80.00	8	1	8.00
Favites	75	5	15.00	69	4	17.25
Goniastrea	65	4	16.25	248	6	41.33
Millepora	47	3	15.67	11	1	11.00
Montastrea	45	2	22.50	—	—	-~
Coeloseris	35	1	35.00	—	—	—
Cyphastrea	30	1	30.00	—	—	—
Oulophyllia	30	1	30.00	10	1	10.00
Pachyseris	20	1	20.00	—	—	—
Platygyra	20	1	20.00	36	2	18.00
Astereopora	20	1	20.00	—	—	—
Pocilopora	15	1	15.00	—	—	—
Fungia	13	2	6.50	10	1	10.00
Hydnopora	4	1	4.00	113	4	28.25
Seriatopora	5	1	5.00	—	—	—
Alveopora	——	——	——	90	2	45.00
Diploastrea	——	——	——	8	1	8~00
Echinopora	——	——	——	67	3	22.33
Galaxea	——	——	——	204	11	18.55
Goniopora	——	—-	——	40	1	40.00
Leptoria	——	——	——	158	6	26.33
lobophyllia	——	——	——	38	3	12.67
Stylophora	——	——	——	70	5	14.00
Algaeassambles	878	19	46.26	155	3	51.67
Coraline algae	552	12	46.00	279	5	55.80
Turf algae	1081	19	56.89	—	—	—
Zoanthid	56	2	28.00	—	—	—
Ascidian	45	1	45.00	54	7	7.71
Soft coral	607	15	40.47	2346	63	37.24
Sponges	30	1	30.00	11	1	11.00
Macroalgae	30	1	30.00	—	—	—
Death coral with algae	1390	33	42.12	1533	40	38.33
Death algae	98	3	32.67	539	14	38.5
Rubles	1334	28	47.64	777	19	40.89
Limestone rocks	35	1	35.00	359	7	51. 29
Sand	77	2	38.50	120	3	40.00

There was no evidence of food partitioning based on life stage (Fig. 2).

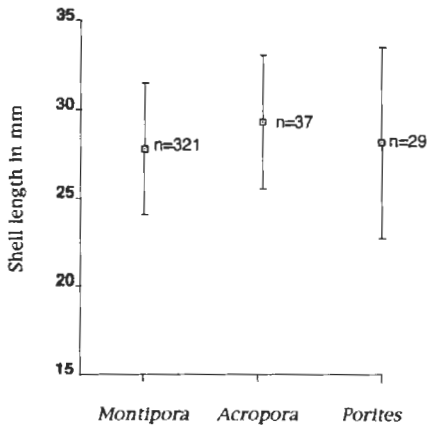

Figure 2. Shell mean size of *Drupella cornus* preyed on coral polyps, n = individual numbers, bar = sd. Bunaken Island, May 1997.

Diversity of corals.

A total of 28 coral genera were recorded at the two sites. The mean size of colonies is shown in Table 1. There were 20 genera at the southern site, and 21 genera to the east. Only some coral genera occurred at both sites (reflected in a similarity index of 37 %). *Montipora, Acropora,* and *Porites* were the most common genera of scleractinian corals and occurred at both sites.

The percentage coverage was 35.9 % by *Montipora*, and the rest was 19.5 % by *Acropora*, and 19.2 % by *Porites*. *Acropora* had the biggest colony mean size: 31.1 cm on the south coast and 55.8 cm on the east coast.

The total live coverage of corals was 37.4 % at the southern site and 38.2 % at the eastern site. The live coverage reached about 52 % in 10 m depth (Lalamentik 1996).

DISCUSSION

Coral reef communities are rich in species (Kohn 1997), which can coexist because of partitioning of the resources. Differentiation of the niche is important in accordance with the exclusion principle of Gause (Schoener 1974). In general, the species would occupy a specialised ecological niche in order to be packed into the available resource space. The niche breadth should be smaller in the tropics (Krebs, 1985, p.533)

D. cornus preyed on the three coral genera *Montipora, Acropora, Porites*, which is in agreement with previous findings on Sesoko Island (Fujioka & Yamazato 1983). By choosing 3 food genera, out of 28 available in the nature, the snails displayed a narrow ecological niche on the reefs. On the other hand, the three coral genera were the most abundant in the study area (south 81 %; east 66 % coverage).

When we studied the habitats of *Drupella* each assemblage of snails lived isolated on heads of corals. Adult snails seemed to be stationary so the selection process towards the specific food source may have occurred at the time of larval settlement. However, this hypothesis has to be tested by experiments. It is unknown how snails react to displacement, e.g. caused by storms, and snails may crawl to neighbouring corals after settlement.

Drupella cornus has been able to combine selective feeding with food availability. Unfortunately the population of its sympatric relative, *Drupella rugosa*, was too small to be included in this study. Otherwise we could investigate if the two species partitioned the food resource of coral polyps. Niche segregation of sympatric species has been demonstrated in three species of the snail *Drupa* at Enewetak atoll (Thomas & Kohn 1990) and in chaetodontid fishes (Anderson *et al* 1981).

ACKNOWLEDGEMENTS

The present paper is based on the thesis of junior author Delsy Cussoy submitted to the Faculty of Fishery and Marine Science, Sam Ratulangi University in fulfilment of the requirements of the degree of B.Sc. We thank Dr. Alan Kohn for suggestions, Dr. Peter Middelfart for confirming the snail species

name and Dr. Hans Ditlev for discussion on coral reefs and confirming the coral genera. This work was supported by DANIDA through the Tropical Marine Mollusc Programme (TMMP).

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