PRELIMINARY INFORMATION ON THE EFFECTS OF *DRUPELLA* SPP. GRAZING ON THE GREAT BARRIER REEF.

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INTRODUCTION

In April 1987, while carrying out biological survey work for the West Australian (WA) Department of Conservation and Land Management (CALM) on the Ningaloo fringing reef tract, we first became aware of the coral grazing activities of the gastropod *Drupella* (Ayling and Ayling 1987). During that survey it became clear that damage caused by *Drupella* on the Ningaloo reefs was of the same level as that due to crown-of-thorns grazing on coral reefs.

Prior to 1987 we had not observed *Drupella* on the Great Barrier Reef (GBR) in spite of extensive observations and surveys of coral communities over an eight year period. However, following our return from WA, and our observations of *Drupella* grazing activities there, we looked at the GBR with new eyes. Since that time we have made surveys on almost 100 different reefs, from the turbid fringing reefs of Cape Tribulation, Magnetic Island and the Whitsunday Islands to outer shelf reefs such as the Ribbon Reefs and a range of mid-shelf reefs from Princess Charlotte Bay (14°S) to the Whitsunday Group (20°S), and we have found several species of *Drupella* to be present on all of them. Observations by other aware observers have reported *Drupella* from the Swain Group of reefs and the Capricorn-Bunker Group at the southern end of the GBR (22-23°S) and from Torres Strait (10°S).

In this report we will present a summary of early surveys made on the GBR between 1987 and 1990 and the results of a more detailed survey of *Drupella* damage carried out on 50 reefs in the Cairns Section of the GBR (14°30'S-18°S) in early 1991.

PRELIMINARY SURVEYS

Our initial surveys showed that the most abundant species on the GBR was *Drupella rugosa*, a species with many small nodules that ranges in size as an adult from 20-25 mm and occasionally to 30 mm. A larger species, identified by Ian Loch of the Australian Museum as *D. cornus* and ranging in length from 32-40 mm is occasionally found. Although identified as *D. cornus* this species is slightly different from the species found at Ningaloo. There is also a smaller unknown species of *Drupella* ranging from 12-15 mm in length that we have only encountered a few times.

D. rugosa collected from any single location generally had a bimodal length frequency, with thin-lipped juveniles in one peak and adults in the other. This suggests that these gastropods reach an asymptotic size at which growth slows markedly or stops.

Preliminary counts using 20 x 1 m visually searched transects on Norman Reef (16°25'S) recorded mean densities of 1.1 per sq m. However, *D. rugosa*, being

smaller and more secretive than the species found at Ningaloo, is not easy to count visually and some preliminary destructive searches of sq m quadrats on Low Isles off Port Douglas revealed mean densities of almost 20 per sq m.

D. rugosa eats approximately the same range of coral species as did the *Drupella* at Ningaloo (Ayling and Ayling 1987). We recorded the coral species being grazed by *Drupella* on four reefs off Cooktown (table 1) and found that they preferred pocilloporids and most *Acropora* species but were occasionally found eating a few other species including *Porites* colonies.

Table 1. *Drupella* Grazed Corals Observed on Four Reefs off Cooktown.

Species	No. Colonies Grazed	Species	No. Colonies Grazed
Seriatopora hystrix	48	*A. polystoma*	3
Stylophora pistillata	3	*A. digitifera*	2
Pocillopora damicornis	13	*A. lutkeni*	2
Montipora incrassata	4	*A. microphthalma*	2
Acropora elseyi	22	*A. nobilis*	2
A. nasuta	21	*A. sarmantosa*	2
A. tenuis	12	*A. selago*	2
A. aculeus	8	*A. azurea*	1
A. formosa	8	*A. humilis*	1
A. longicyathus	7	*A. nana*	1
A. microclados	4	*A. palifera*	1
A. millepora	4	*A. secale*	1
A. brueggemanni	3	*A. yongei*	1
A. divaricata	3	*Porites nigrescens*	1
A. gemmifera	3	*Porites* sp.	1

During a trip in July 1990 to look the extent of the damage caused by TC Ivor we made spot checks on a number of reefs between Lizard Island and Princess Charlotte Bay (14°S-14°30'S) . On about 6 of these reefs *Drupella* damage was marked, especially on Davie Reef a small outer reef that had a high level of damage at all three sites visited. Although no quantification of *Drupella* damage was made at these reefs it was decided that some method of damage estimation should be developed for use during future surveys.

THE EFFECTS OF *DRUPELLA* GRAZING IN THE CAIRNS SECTION OF THE GBR.

During January-March 1991 we made surveys of a wide variety of reef organisms on 50 reefs in the Cairns Section of the GBR Marine Park in a project funded by the GBRMPA and coordinated by Bruce Mapstone and Howard Choat of JCU. As part of this study the effect of *Drupella* grazing on coral communities was quantified.

On each reef 3 sites were surveyed on the front (windward) face and another 3 sites on the back (leeward) face. Four replicate 30 x 1 m transects were searched for coral colonies that had been damaged by *Drupella* grazing and the number

recorded, along with simultaneous counts of the number of undamaged colonies. For large coral masses, such as *Acropora* staghorn and bottlebrush thickets and extensive *Montipora* or *Turbinaria* plates and whorls, each 0.5 m square of the coral mass was defined as a 'colony'.

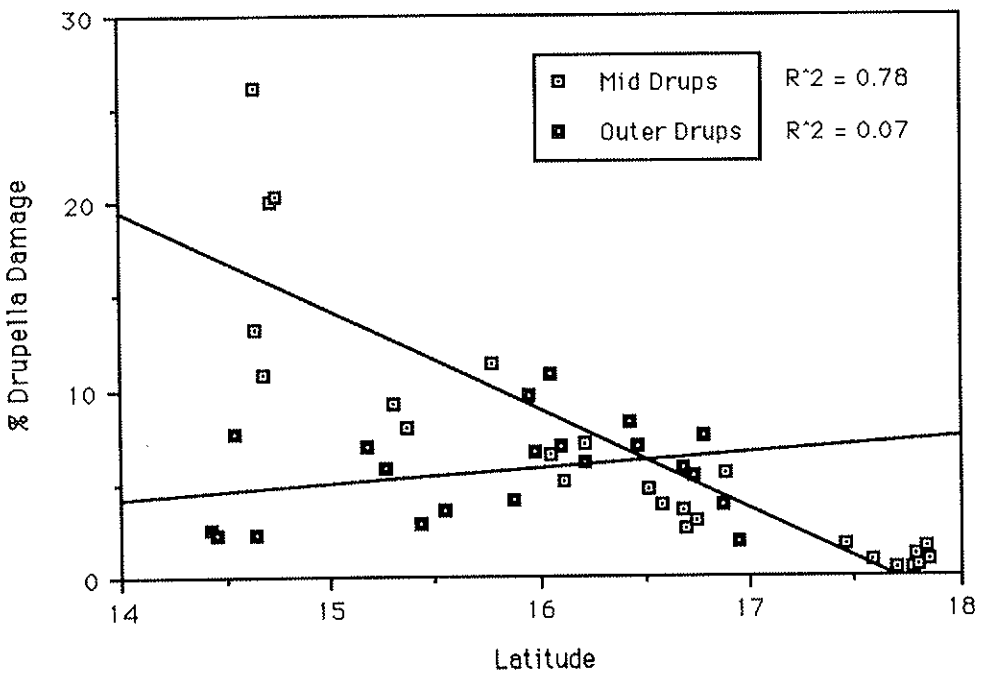
The results were converted to a percentage of the total corals that were damaged at each site and a mean percentage damage calculated for the entire reef (6 sites). Overall reef-wide damage figures ranged from an insignificant 0.4% to over 26% of coral colonies. The grand mean damage level for all 50 reefs was 6.6%. There was a significant S - N increase in the extent of *Drupella* damage on mid-shelf reefs of the Cairns Section, but this was not reflected on outer shelf reefs (table 2, figure 1).

Table 2. Summary of Damage Patterns in the Cairns Section.

Bold figures record mean percentage of total corals damaged; figures in brackets are mean total no. of corals per 30 sqm, followed by no. reefs surveyed in each area.

Area	Inner Shelf	Mid-Shelf	Outer Shelf
Innisfail/Tully		**0.9** (80.4) n=8	
Cairns		**3.9** (52.5) n=6	**4.9** (48.1) n=5
Port Douglas	**23.7** (35.7) n=1	**6.2** (92.7) n=3	**7.4** (81.9) n=8
Cooktown		**9.5** (88.8) n=3	**4.8** (134.4) n=4
Lizard Island		**18.1** (74.7) n=5	**3.7** (122.4) n=4

Figure 1. Patterns of *Drupella* Damage in the Cairns Secion.



The maximum recorded damage at any site was on the front reef of Nymph Island (14°40'S), north of Lizard Island where 48.3% of corals were damaged.

It appeared that a greater percentage of corals were damaged on reefs where coral cover had been reduced by TC Ivor 12 months before (Done et al. 1990).

Our survey in WA showed that *Drupella* grazing can be as destructive to hard corals over large areas as *Acanthaster* grazing. This survey suggested that these gastropods are present on at least some parts of the GBR in sufficient numbers to cause significant coral death.

DISCUSSION

There seems to be a perception, both on the GBR and in WA, and in the wider context, that *Drupella* grazing is a new problem and anthropogenic effects must somehow be responsible. The emotive word 'outbreak' is being used to describe the high density populations that have been located.

Our contention is that this is not a new phenomenon. We started seeing *Drupella* on all reefs visited after our return from WA. This new awareness has now spread to other people and new examples of damage on the GBR are reported regularly. It is possible that prior to this awareness reefs devastated by *Drupella* were attributed to crown-of-thorns grazing. If a devastated reef is found after the event, how do we decide which grazer was responsible? During GBR-wide crown-of-thorns surveys in 1985 Moran et al. (1988) declared Tydeman Reef, which is adjacent to Davie, to have been devastated by crown-of-thorns in the past. In view of our observations of extensive *Drupella* damage on Davie Reef and on other reefs in the area in 1990 it may be that *Drupella* grazing was responsible for the coral damage observed on Tydeman that was attributed to crown-of-thorns.

Jack Moyer, who reported damage over relatively small areas of reef in Japan and the Philippines, blamed siltation from coastal development for the supposed increase in *Drupella* numbers (Moyer et al. 1982). The WA populations could hardly be attributed to this cause as the entire coast is a desert with 200 mm annual rainfall and very low human use apart from fishing. The highest density populations found to date on the GBR are remote from centres of population and from possible man-induced water quality changes.

Table 3. Lethrinid Density on NW Cape and the GBR

Figures shown are grand means per ha from a variable no. of sites.

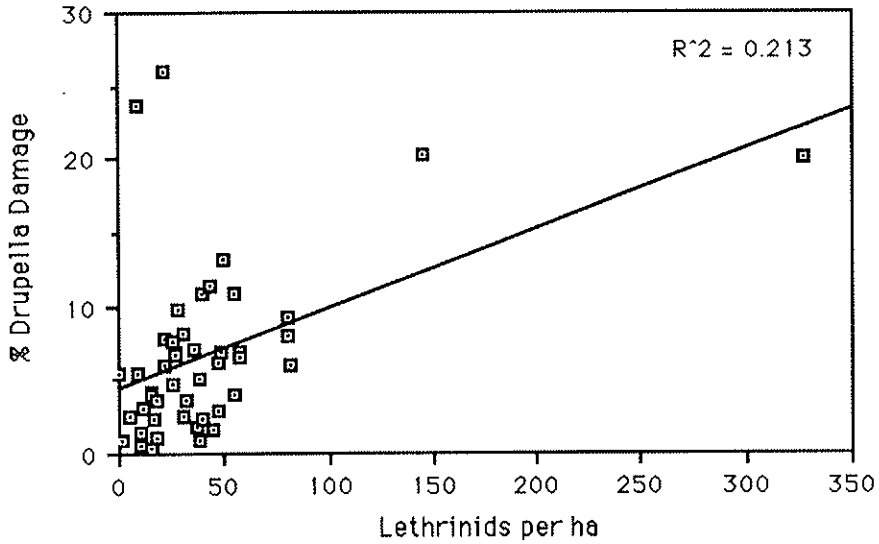
	NW Cape	GBR	
		Cairns	Central
Family	13 sites	47 reefs	3 reefs
Lethrinidae	200	40	26

In Ningaloo where there is a recreational fishery for the common local lethrinids it has been suggested that fishing pressure has encouraged the high density *Drupella*

populations. Lethrinids are potential predators, at least of small *Drupella* - it is hypothesised that removal of the fish by fishing pressure has resulted in increased densities of *Drupella*. Our data suggest that high numbers of *Drupella* are not correlated with low numbers of their potential major predators: the fish families lethrinidae and large labrids. Densities of these families on NW Cape were many times greater than in any GBR sites (table 3) and yet destructive populations of *Drupella* are not widespread on the GBR.

Densities of lethrinids on the northern Cairns Section reefs were greater than those on the southern reefs - the opposite of what might be expected if these fish were affecting *Drupella* numbers. A plot of lethrinid density against the percentage of *Drupella* damaged corals on the 50 reefs surveyed in 1991 showed a positive correlation (figure 2), indicating that removal of lethrinids by fishing pressure is unlikely to have been responsible for the high densities of *Drupella* observed on the Lizard Island area reefs.

Figure 2. Relationship of *Drupella* Damage to Lethrinid Density.



Our conclusion is that the problem is not as simplistic as some previous studies have suggested. We need a lot more information on the biology and ecology of *Drupella* before the reasons for the apparent population fluctuations can be understood.

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