ALGAL OVERGROWTH- DOES IT RELATE TO NUTRIENTS FROM TOUR VESSELS AND PONTOONS.

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INTRODUCTION.

'At the Agincourt Reef complex, 40 miles northeast of Port Douglas, the two large, fast catamarans, Quicksilver 1 and Quicksilver 2, visit two permanently moored pontoons situated at Agincourt 16013-d and at Agincourt 3, bringing with them up to 290 passengers daily.

Biologists from Reef Biosearch visit the same snorkelling sites on these reefs daily. In December 1986, it was noticed by Dr A. Ayling and ourselves that a mustard coloured algae was appearing in one area and was apparently causing mortality in some corals.

It was thought that this could be a summer phenomenon which would die out over winter. However the algae continued to expand over the cooler months. In July 1987 it was decided to study the alga in more detail and to examine its distribution in the Agincourt complex.

METHODS OF STUDY.

1. bverall distribution.

All backreef areas of the Agincourt complex have been surveyed using two snorkellers swimming 10 to 20 metres apart to 'detect presence'or absence of the algae. The total distance covered using this method is approximately 8 miles.'

At sites where the algae is present its distribution'has been mapped,. With the use of aerial photographs taken at 5,500' and 2,500',known features on the reef could be plotted and baselines established so the geographical distibution of the algae could be mapped.

Within areas of algal presence, a series of 4 adjacent 0.25m by 0.25m quadrats were permanently marked and % cover of the algae was estimated. These quadrat sites were scattered at strategic known positions on the distribution map.

2. Benthic Line Transects.

A series of permanent 20m variable direction benthic line intercept transects have been established at the two reefs with moored pontoons. At each, 3 localities each with 5 transects have been set up using fishing line and flagging tape to mark the exact course of the transect. A total of 600m of transect has been established. Intercepts of all benthos >1cm is recorded. Corals are identified to species where possible. Data is collected bimonthly at pontoon sites and quarterly at the remaining sites

RESULTS.

The Alga- Identification, Methods of Reproduction and Attachment.

The alga has been tentatively identified by Dr I. Price as Chrysophaeum taylori with affinities to the Chrysophyta. The only record the author has found on the alga was when it was first described in 1941 in the Carribean (Lewis et al, 1941). It is a unicellular alga which forms colonies 1-6cm in height of a tubular shape. Its colour is a mustard yellow. The cell is pear shaped with a base at the neck to which is attached a group of fine threads. One'of the field characteristics of the alga is its extreme fragility- the mere waft of a hand is sufficient to break it into tiny pieces. It is probable that the threads are an important attachment mechanism at the cellular level and its fragility merely enhances its distribution. The alga reproduces asexually by zoospores but its sexual reproduction has not been recorded.

Microhabitat Preferences.

The algae preferentially attaches to unconsolidated coral rubble, usually from branching corals. However, when space is limited by its own high cover it will attach to live branching corals. The corals that appear to be most readily affected include-

Porites cylindrica
Porites nigrescens
Echinopora horrida
Hydnophora rigida
Paraclavarina triangularis

However Seritopora hystrix and some corymbose Acroporiids may also be affected (eg: A. cerealis, A. nana, A. nasuta). In November 1987, the first evidence of algal growth on massive corals was observed on Lobophyllia, Symphyillia and Platygyra.

When the algae is rubbed away from the live coral, the tissue often appears healthy beneath (no signs of stress or bleaching). At other times the coral is obviously recently

dead beneath and around where the algae grows.

Geographical Distribution.

There are many algae that attach to the dead bases of coral colonies and some that even grow over live corals, however, Chrysophaeum taylori has only been found at two localities on, Agincourt 16013d, where the original pontoon has been established for nearly 4 years. These localities are the Eastern and Western points of the reef. The algae is virtually absent from the central backreef area where the pontoon i's sited. It has only been recorded at depths greater than 3.5m, probably because of its fragility and susceptibility to wave action. Its presence has been confirmed at15m but the maximum depth for growth has not been estabished.

The areas of algal presence expanded considerably from August to October 1987, beginning as isolated pockets which both spread outwards at the rate of about 4cm/ month, and disseminated to form new clumps nearby. One clump 8cm across was found in November 1987 adjacent to the central pontoon in an otherwise algal free' area,.

In the areas of heaviest algal growth, cover of up to 65% has been recorded using the quadrat method. The second set of data from the permanent benthic line transects is now due for collection and will be very useful in determining temporal change in algal cover.

Predators.

There are large numbers of roving herbivores in the area including Scarids (S. rivulatus, S. altipinnus, S. sordidus) and Acanthurids (A. xanthopterus). Most observations have shown fish to select algae other than C. taylori. An exeption is Zebrasoma velliferum which has been seen on occasion to eat this species.

DISCUSSION

Possible Causes of Algal Overgrowth.

At present we have insufficient information to determine whether this particular alga is expanding because of some "natural" cause, or whether its growth can be related to human use of the reef.

Natural perturbations which could contribute to its expansion

include cyclical phenomena, El Nino or more likely a combination of several factors. If the previous distribution of the al-ga was not cosmopolitan, perhaps the increase in international diving tourism has brought algal spores to Barrier Reef waters and we are seeing the initial stages of what could be an increasing problem.

If human use of this reef by the pontoon and tour vessels is a catalyst'for this algal overgrowth, it seems likely that nutrient input may be a key factor. Because of this possibility, Quicksilver now records daily information regarding the different categories of nutrient input. This includes;

1. Food scraps. (Number of buckets of meat scraps entering the water)
2. Seabird faeces.(Total numbers of birds present on the pontoons and moored vessels are recorded as the Qucksilver approaches.)
3. Algal growth on vessel hulls. (This is scrubbed off about once a week- estimates of dry weight per square meter will be measured.)
4. "Island effect." The pontoon creates an artificial substrate for algae and other benthos which helps maintain a large population of browsers (especially Siganus spp and Xyphosus sp.) This probably helps to concentrate and recycle nutrients in the pontoon vicinity. Measurement of faecal fallout at the pontoon could be used to compare with control sites.
5. Sullage. This is not discharged at the reef, but is pumped out in the shipping channel 15m SE of the reef site. Occasionally there is a malfuntion in a rubber seal producing a continuous drip so the outflow pipes are checked twice daily.

If it is nutrients from the pontoon causing algal overgrowth, an explanation as to why it is densest away from the pontoon needs to be put forward. One possiblity could be current regimes. Because the reef faces SE, during the SE trades it has been noticed that eddy systems develop at the East and West point of the reef. Possibly these eddies draw water from the central-section and trap it and any nutrients it holds, in these areas. Further investigation with the use of drogues or dyes may be useful in answering this question.

Different species of algae may cause overgrowth on nutrient rich reefs. The physiological adaptations of the species, its ability to vegetatively reproduce and its dominance amongst other species at the commencement of nutrient input may determine which species will predominate. For example Norman Reef, where the Hayles catamarans visit, have experienced comparable algal overgrowth of a different species, however this may be a short term summer phenomenon.

ACKNOWLEDGEMENTS

The authors would like to thank Drs A. & A. Ayling for, their valuable comments in the field and Prof. H. Choat for his encouragement and comments on the project.

REFERENCES

Lewis, I.F. & Bryan, H.F. 1941. A new prototype from the dry Tortugas. Amer. Journ. Bot. 28:343-348.