



NEWSLETTER

WET RAG

THE NEXT CLUB MEETINGS WILL BE HELD ON:

MONDAY 18 FEBRUARY AND MONDAY 18 MARCH 1985

Special guest at the february meeting will be Mark Spencer who will present two of his Audio Visuals one of which is a superb portrayal of Sydney Harbour.

A four page full colour re-view of the 1984 S.P.D. underwater photographer of the year competition has been published in the current issue of SCUBA DIVER magazine, available at most dive shops.

GEORGE ROBERTS PERPETUAL TROPHY

The february club meeting is the deadline for round 2 (5 slides) Club members who are into underwater photography especially those who new at the game are asked to get off their collective butts and support this worthy competition.

WHATS ON IN CLUB DIVING

17 - 2 - 85 PORT HACKING NOVICE DAY

Great time for new and old members to get together. B.B.Q. lunch afterwards at Jibbon Beach. 30 - 90 feet

3 - 3 - 85 TUGGERAH

Wreck dive out of Port Hacking. 150 feet

20 -21 april BERMAGUI

A few vacancies still exist for this week-end. Get your \$ 50 to me A.S.A.P. to take advantage of this great value diving week-end.

Anyone wishing to dive mid-week should give me a ring as I am a shift-worker and can arrange a mid-week dive.

PETER STRATFORD (DIVE ORGANIZER) 798 5757

A conspiracy of silence over the destruction of the Reef

Disturbing new reports about the crown of thorns starfish prompted this investigation by ROBERT RAYMOND whose film Life and Death on the Great Barrier Reef in 1969 first alerted television audiences to the nature and extent of their invasion.

FOR THOSE who believe — as many in Australia still do — that the crown of thorns came and went in the 60s and 70s, I have got bad news: the starfish is back on the Great Barrier Reef, in greater numbers and over a wider area than before.

The damage to many of the most accessible reefs is so serious that, for those who have yet to see the Great Barrier Reef, I have only this advice — choose your area carefully. And do not wait too long.

That this extraordinary situation has come about virtually without comment and especially without alerting our politicians is due to a range of factors which some might describe as a conspiracy of silence. It certainly can not be put down to lack of warning.

A slow, creeping conflict has been in progress now along the coast of Queensland for 30 years. One part of the struggle has been going on silently, beneath the ocean. The other part has been carried on decorously behind the facades of scientific institutions, with occasional strident sallies into the headlines.

But now, I believe, the struggle is about to erupt into the corridors of power in Canberra and perhaps on to the world stage. Before it is resolved it could affect the viability of the Queensland tourist industry, challenge the credibility of the Australian scientific establishment and bruise the reputations of one or two federal ministers.

The silent war is between the 2500 coral reefs that make up the Great Barrier Reef ecosystem and the millions of predatory crown of thorns starfish whose emergence in such vast numbers across the entire Indo-Pacific region is one of the strangest biological phenomena of this century.

The verbal battle is between those who see these happenings in terms of a "plague," a potential ecological disaster of enormous scientific and economic significance, and those who regard the starfish "outbreaks" as natural cyclical events which give no cause yet for undue alarm.

The first group includes a few scientists, led by Dr Robert Endean, associate professor in the department of Zoology at Queensland University, and a wide variety of people who make their living along the Queensland coast.

The second group consists of some tourist operators and resort publicists, the majority of Australian marine scientists and the Great Barrier Reef Marine Park Authority which is responsible to the nation for management of the reef area.

For the past 30 years, the well-trenched authorities have tried to keep the lid on — but not, I believe, for much longer. The threat shows all the signs of blowing up into the biggest environmental problem the federal government has faced — much wider in its implications than either the Franklin River dam or the Daintree rainforest road.

In the past few months, I have been exploring the ramifications of this confrontation which all this year has been quietly approaching the point of critical mass. With experienced professional divers and an underwater film crew, I have examined the impact of the starfish on reefs stretching from Lizard Island north of Cooktown to the Whitsunday Group nearly as far south as Mackay.

I have talked to boat captains, dive leaders, tour operators, resort proprietors and other people whose livelihood is tied up with the well-being of the reef.

I have taken Endean back to the coral cay off Innisfail where in 1969 I filmed his warning about the potential consequences of that first starfish outbreak and listened once again to his expression of anger and frustration at what he calls our lost opportunity to do something about a national environmental disaster.

I have also questioned scientists at our leading research facility on tropical marine life — the Australian Institute of Marine Science, near Townsville — and at James Cook University, Queensland University and the Lizard Island Research Station. And I have interviewed

the chairman and other officers of the marine park authority.

Just what the re-appearance of the starfish means for the long-term existence of the Barrier Reef is still a matter for scientific dispute, as we shall see. But what indisputably lifts the crown of thorns problem right out of the scientific arena is that its resurgence has coincided with the greatest boom in tourism in Queensland's history. It is the threat to this industry which may soon make all Australians as familiar with the habits of this marine predator as they are with rabbits, locusts, mice or any other plague-prone animal.

The crown of thorns starfish, *Acanthaster planci* — a large, spiky member of the phylum of echinoderms — used to be recorded occasionally but attracted little attention, distributed as it was in small numbers on coral reefs across the Indo-Pacific region from the Red Sea to the Gulf of California.

It was observed that the adult lived principally on corals and that its preferred diet seemed to be the polyps of hard *Acropora* corals, the colorful staghorns and plates which are such a spectacular feature of the Great Barrier Reef.

When feeding, the starfish spreads itself over live coral and extrudes its stomach through a vent under the centre of its body. Digestive juices are released over the coral polyps, which are dissolved. The starfish sucks the products of digestion back into its body, leaving the calcareous structure of the coral white and bare like a skeleton.

A large adult starfish, which at five years of age may be nearly half a metre in diameter, eats an area of coral about equal to its own size in a few hours. It kills a square metre or more of reef in a day and moves on, inching its way slowly on hundreds of small tubed feet beneath its spreading arms. Despite their lack of speed, crown of thorns starfish are quite mobile.

On a healthy, living coral reef the starfish in their usual numbers — perhaps 10 or 20 to the hectare — made little or no impression. The patches of dead coral they left behind were recolonised by coral larvae from nearby communities. Although the female starfish produced vast numbers of eggs each

season, natural balances of some kind (which are still not well understood and have been little studied) kept the adult population fairly stable. Starfish and corals co-existed.

Some time in the late 1950s, however, profound changes in the starfish populations began to occur in the Indo-Pacific region. In widely separated areas — including Tahiti, Hawaii, Okinawa and the Red Sea — waves of starfish numbering tens or hundreds of thousands appeared on reefs, destroying up to 90 per cent of the coral cover.

The first large outbreak on the Great Barrier Reef was reported from Green Island in 1962. The starfish had killed most of the coral on the surrounding reef by 1966 and other infestations were reported from reefs down the Queensland coast as far as Townsville.

The Queensland government commissioned Endean, an expert on tropical marine animals and toxins, to investigate. After a two-year study in conjunction with the Queensland Fisheries department, he concluded that the outbreaks were not normal and presented a serious long-term threat to the reef. He called for immediate control measures and a full-scale research program.

Some action ensued but, about 1972, the "plague" began to wane as rapidly as it had appeared. The armies of predators had disappeared by the mid-1970s. The momentum of scientific interest died away — as did funds and the incentive for research. The "natural cycle" adherents appeared to be vindicated.

In addition, the passage in 1975 of the Great Barrier Reef Marine Park Act and the setting up of the authority seemed to guarantee the future of this remarkable natural feature (later to be added to the World Heritage list).

But in 1980, quite suddenly and inexplicably, the crown of thorns began to appear again in large numbers.

An army of adult starfish had advanced up the reef slope at Green Island by 1982 and overwhelmed the regenerating coral. Estimates put the numbers on this one reef as high as two million.

Reports accumulated from up and down the coast make clear that most of the reefs in the middle third of the Great Barrier Reef — from Townsville north to Lizard Island — are undergoing a second invasion and suffering even more severe damage than they did first time around. But, this time, the attacks are spreading into both northern and southern thirds of the marine park.

Our recent survey down the reef has convinced me that the situation is far more serious than the one I saw in 1969 and that the consequences, while still largely incalculable, could be drastic.

We began by chartering the *Reef Explorer*, one of the modern boats operating out of Cairns to meet the growing interest in diving and snorkelling on the Reef.

Our survey started at Lizard Island, to the north of Cooktown, where the line of reefs forming the Outer Barrier runs comparatively close to the coast. One of Lizard's chief attractions has always been its fringing reefs, and particularly the gardens of richly assorted corals studded with giant blue and green clams in the shallow bays right in front of the resort. Where they are easily accessible to even the most inexperienced diver or snorkeller.

But we found most of this coral dead and rotting, crumbling to the sea floor. The starfish were present in large numbers on surrounding reefs, continuing the destruction.

South from Lizard Island stretches a remarkable line of reefs, forming an almost continuous barrier along the outer edge of the continental shelf, broken only by a few narrow passages. Here the warm surface waters are constantly enriched by upwelling currents from the abyssal depths. As a result, the coral plateaus and canyons of the Ribbon Reefs shelter perhaps the greatest diversity of corals and marine life to be found in the entire Great Barrier Reef area.

This is where the *Reef Explorer's* skipper, Kerry Piesch, has been bringing his diving parties for the past 10 years. Overseas divers have found little anywhere else in the world to equal the profusion of corals here. But these, like the shallower platform reefs far to the south, are under savage attack.

On almost every reef we found populations of feeding starfish. A few reefs were still virtually intact but others were a wasteland of brown algae.

I asked Piesch why one reef on his chart, near No 9 Ribbon Reef, had been inscribed "Atomic Bommie."

"Well, that's just aptly named," he said. "It used to have beautiful coral, big plates and staghorn, where we took people regularly — especially from overseas. Then we found the crown of thorns beginning to work on it, so we decided to leave it for a while. We came back six months later and it literally looked as if an atomic bomb had been dropped there. It was just devastated. It was actually devoid of any fish life, too. Just nothing left."

"There's definitely a big change going on. I don't know what it means scientifically but it's a pity to see those brilliant colors and those big areas of coral just devastated."

What is happening to the Ribbon Reefs may have particular significance. There has been a great deal of evidence, from other areas as well as the Great

Barrier Reef, of starfish activity on reefs in comparatively calm shallow waters. It was not known for sure whether the starfish would want to face the conditions on the Outer Barrier where currents and wave conditions are severe. It was not even known how deep the starfish could go.

We found many feeding on the ocean side of the Outer Barrier walls, despite the surging backwash from the rollers breaking on the reef crest. Others were apparently climbing from the gloomy depths. This behaviour and the growing areas of dead coral here suggest that no reefs can be considered immune from attack.

Green Island has a special place in the history of the starfish phenomenon, as it has in the history of the Queensland tourist industry. And it may yet achieve notoriety as well as fame, if some American tourist sues Qantas for false advertising.

Because it lies only 20km off the coast, opposite Cairns, Green Island was the first true coral island to be developed as a resort along the reef.

The reef around Green Island was until the 1960s a carpet of living corals, anemones, sponges and molluscs. This magnificent display was easily accessible on foot at low tide or by snorkelling or drifting in a glass-bottomed boat over the forests of blue, pink and yellow staghorns and fish.

The coral around Green Island has been literally obliterated.

Off the north-western corner of the island, the glass-bottomed boats still make trips with people who have paid to see the famed "wonders of the Great Barrier Reef." I took a trip in one boat and Walt Deas, our underwater cameraman, filmed the route that we followed. What he recorded was an unrelieved landscape of brown, silt-covered, algae-festooned dead and dying coral. The boatman gave the passengers bread to attract a few fish into the field of view.

There are stories of a worried visitor who inquired why all the coral was brown and dead-looking, to be told that what he was looking at was the famous "sleeping coral" of Green Island which blossoms into living color only at night. (Which is true of some corals — but they do have to be alive to manage this transformation!)

Just beside the jetty, close to the beat where the boats pick up their passengers, we found someone who is trying to do something about replacing the vanished coral. His name is Peter Tibbs and he has been diving on the reef for 12 years. He has a busy dive shop in Cairns but his consuming interest is in transplanting living corals.

Tibbs has a contract with the Green Island management company and a permit from the State Fisheries department to collect clumps of living corals

from an outlying reef and transplant them around Green Island. We watched Tibbs perform this relatively simple operation. Using snorkelling gear, he dived in about three metres of water and removed branches of staghorn from the reef. He placed these in the bottom of his speedboat and, when he had about a dozen pieces, headed off to Green Island. He has found that half-an-hour or so out of the water seems to do the coral animals no harm.

At his chosen site, Tibbs planted the branches of staghorn in the sand half a metre or so apart. He told me that some become dislodged by the tides or die but a surprising number survive and develop a firm base. Staghorn is one of the fastest growing of corals so Tibbs hopes that, within a year or two, he will have produced a small but attractive coral garden close to the beach where people will be able to wade or swim and inspect it.

Despite his enthusiasm, Tibbs is seriously concerned at the spreading impact of the crown of thorns starfish.

"There's no doubt in my mind that it's destroying the reef," he told me. "Whether it's going to regenerate I'm not sure but it certainly is destroying it and it's a bigger problem than anyone is caring to admit." I asked Tibbs why he thought that others, such as the marine park authority, apparently do not see what he sees.

"I don't believe they go out there as often, nor do they go to as many reefs, nor have they seen it for as long as I have," he said.

One ironic and potentially embarrassing consequence of the destruction of the coral around Green Island is the way in which it could backfire on the intense drive to step up tourism from the US to northern Queensland.

The new international terminal at Cairns — financed by the city council — proudly welcomed the first of the new twice-weekly Qantas jumbo services, this year flying direct from Los Angeles and San Francisco, packed with Americans.

One of the prime targets for these eager tourists is Green Island, for the handsome brochures being handed out by Qantas in the United States describe Cairns as "the gateway to the Great Barrier Reef" and Green Island as "a true coral cay and part of the Great Barrier Reef."

Visitors to Green Island are promised that from glass-bottomed boats they will "view the spectacular underwater life of the reef," including "magnificent coral formations." On most of the tours listed, Green Island is the only opportunity for seeing the Great Barrier Reef.

I spoke to some of the Americans who had come trustingly to Green

Island and found them rather less inclined to swallow the "sleeping coral" explanation than are the locals. It seems only a matter of time before bad publicity begins to spread back home.

The Hayles family, which has run boats to Green Island for generations and the resort itself, is acquiring bigger and faster catamarans in order to reach the more remote reefs where there is still coral to be seen. But for such craft there is not much change out of \$1 million or so and the price of a day ticket is high — up to \$50 or more. Most visitors to Cairns seeking the Barrier Reef "experience" must still make do with what they find at Green Island.

I asked Blake Hayles, the present head of the family, whether he thought it fair that people from all over Australia and elsewhere should still be led to believe that they can come to Green Island "and see the Great Barrier Reef."

"Yes, the coral is a problem," he said. "We've noticed a certain amount of deterioration over the years, despite considerable work in transplanting coral. Unfortunately, the old crown of thorns has done a lot of damage. But there's absolutely no doubt that people can still come here and see the Great Barrier Reef. It has certainly deteriorated; there's no doubt about that. But we're still sending away many thousands of very, very happy people who've come a long way to see it."

The interesting thing about this admission of damage by the crown of thorns is that until quite recently Blake Hayles was one of a group of tourist operators in north Queensland who maintained vehemently that there was absolutely no problem with the reef and that the starfish "threat" was wildly exaggerated.

It is this attitude which has quite obviously contributed to the lack of concern in both state and federal government departments — compounded, by a matching policy of reassurance on the part of many scientists.

We went south from Cairns to Beaver Cay, off Innisfail, and found in the person of a boat operator named Perry Harvey all the frustrations of an eyewitness to disaster who simply cannot make anyone listen.

In considering the experience of Harvey on the reef over the past 30 years against the professional certitudes of the marine park authority and its highly qualified scientific staff, we have the classical confrontation of the untrained but involved observer versus the expert.

Harvey went to Queensland 32 years ago and began a lifelong love affair with the reef. He first worked on glass-bottomed boats at Green Island "when the coral there was as magnificent as

you could find anywhere in the world," he told me — and he has dived on reefs all over the Pacific and the Caribbean.

Some 22 years ago Harvey found Beaver Cay, a reef with a small white sand crown, 40km off the coast at Mission Beach, near Dunk Island. He devoted himself to the task of introducing visitors to its richness and variety.

Every day since then, during the season from about May to November, Harvey makes a run with his boat from Mission Beach out to Beaver Cay, usually picking up people from Dunk Island on the way.

On the two to three-hour trip out he gives his passengers a detailed lecture on what they are going to see. His brown, wiry, energetic figure is then in perpetual action all around the anchorage, as he runs people to and from the cay, and takes them over the reef in his glass-bottomed boat.

Each year, over the Christmas or New Year period, Harvey takes his boat and a load of passengers up the Great Barrier Reef to Cape York, diving, snorkelling, and inspecting the reefs with his glass-bottomed boat on the way.

For 30 years, therefore, Perry Harvey has been a close and involved observer of the Great Barrier Reef. He is in a position where he sees more of the reef than most people. And, although he has no formal scientific training, his views and experience deserve serious consideration.

And Harvey's view — expressed to me over visits to Beaver Cay this year together with explicit demonstrations of what he is talking about — is that there is a severe, widespread and accelerating deterioration of the Great Barrier Reef as a whole.

"I can honestly tell you — and I'd like to be able to say differently — that between here and Cape York I don't know of any reef that's not been damaged by starfish.

"I mean, some reefs are better than others. But, compared to 20 years ago when all the coral was alive, now most of the reefs are at least 50 percent damaged. And some of the Ribbon Reefs are far more dead than that. Some of them are 90 percent dead and it's no different once you get north of Lizard Island. Some reefs are better than others but they're all damaged to some extent."

Here Harvey made a point which may explain much of the polarisation of views between him (and others such as Edean) and the scientific establishment.

"This is probably the problem, where you hear the experts saying: 'Oh, these are normal reefs — half live coral, half dead coral.' And they say that's the normal, balanced reef. But they haven't been here really long enough to see

really good coral. And the fact is that, if they had been diving as long as I have and had seen the corals before they died, they would know that these reefs are not first-rate coral any more — only second-rate. And to see them deteriorate over the years is absolutely heart-breaking, sickening."

As a matter of interest, no one to whom I spoke at the authority while making this survey had known the reef for even 10 years and I found no marine scientist except Endean who could speak of it before the starfish outbreaks.

Beaver Cay provides yet another case history. A mere handful of starfish had appeared on the reef, when we filmed there in 1969, although Green Island to the north had been devastated by then.

But the once luxuriant reef is like a battlefield. Patches of beautiful staghorn and other corals remain where Harvey can still show his visitors what the reef once looked like. But most of it has been destroyed by two massive invasions of starfish.

Harvey says that the present infestation is more punishing.

For Beaver Cay and scores of similar reefs down the coast, the fate of Green Island looms perilously close. Harvey has done all he can to save it, both by injecting the starfish with a toxic solution of copper sulphate and by organising hand collections.

The injector gun, adapted from a device used on the land for drenching stock, is supplied by a back-pack. A snorkeller working over the shallow reef can dispose of scores of starfish an hour.

This method was developed by the marine park authority but has never been widely used — mainly because the copper solution corrodes the equipment, making it difficult to handle. There is also a question-mark over the possible consequences of introducing a toxic heavy metal into the reef environment.

The most widely used technique of keeping starfish numbers down in a particular area, such as Beaver Cay, is by physically removing them from the coral. Harvey has been doing this for years, although it has finally become a losing battle.

Every couple of weeks, a little group of volunteers from Mission Beach go out with Harvey on his boat to clean up a patch of the best remaining coral. Most of them are young and out of work but they do not expect to be paid. They have a genuine interest in preserving Beaver Cay and spend all day diving, with snorkelling gear, to prove it. With short, hooked sticks they pluck starfish out of the staghorn coral and tip them into floating dustbins tethered in groups.

I watched them collect more than 100 in about 20 minutes. When the buckets are full, they tow them to the beach and dump the starfish. In this way, Harvey and his helpers have collected more than 18,000 starfish. But the remaining areas of good coral continue to shrink between collections.

Harvey believes that, with even a modest amount of help from the authority, not only Beaver Cay but other reefs might have been saved.

"A team of professional divers could have cleared the whole of this in four to six weeks and then our volunteers might have managed to defend it," he told me. "The point is that there are only about 10 reefs along the entire coast that people visit regularly, in glass-bottomed boats. They could have been saved. It would cost a bit of money but now that tourism is the number two industry in Queensland, you'd think it would be worthwhile."

What frustrates Harvey and others involved with the reef is persistent lack of interest by the authority in any form of local control. A few experiments took place on Green Island years ago but nothing practical has come from them.

The kind of possibilities being ignored were illustrated vividly by an experiment we filmed at Beaver Cay. It was based on information that Harvey obtained from an American tourist who took the day trip to Beaver Cay last year. On hearing about the crown of thorns, the American told Harvey that commercial oyster beds off the eastern coast of the United States once had been threatened by a different kind of starfish.

The American fisheries authority eventually discovered that the starfish could be killed, without harming the oysters, by "top-dressing" the oyster beds with granulated slaked lime spread from an aircraft. The total cost was something like \$250 a hectare.

Harvey got hold of a bag of lime from a sugar mill near Innisfail and found that one pea-sized lump placed on the back of an adult crown of thorns starfish killed it in a matter of hours.

The lime is just as lethal under water, as he demonstrated for us.

We found a small hommie (coral head) near Beaver Cay in about three metres of water, with 30 or 40 starfish feeding on it. From a boat immediately over it, Harvey scattered about four handfuls of slaked lime on the surface.

The grains sank through the clear water and settled on the starfish where they were trapped by the forest

of spikes. Some grains also settled on branches of staghorn coral but most sank to the sandy bottom.

Next day, we found an extraordinary scene around the bommie. Virtually every starfish was dead. The grains of lime had burned angry red cavities into the mucuous-covered skin. Some starfish were already disintegrating. The coral showed small white spots where the lime had settled but appeared otherwise unharmed. (On a return visit a month later, even these blemishes had disappeared.)

"I told the marine park authority about my experiments," said Harvey, "but, although they said they would come out and see me about it, they never have."

Not all tourist operators share Harvey's conviction that the only way to tackle the starfish problem is to talk about it, in the hope of provoking some official intervention. Doug Tarca, who runs a highly successful reef-viewing business out of Townsville, has maintained for years that the starfish threat is non-existent.

We could see why Tarca says this when he invited us to make the trip to the outer reef in his big, luxurious, 30-knot catamaran *Sea Link*.

In the aircraft-type lounge, being served by tanned hostesses, the 100 or so passengers watched videos of underwater movies as their craft — commanded by Tarca in immaculate whites, zoomed out 75km to Brewer Reef, not far from the Outer Barrier.

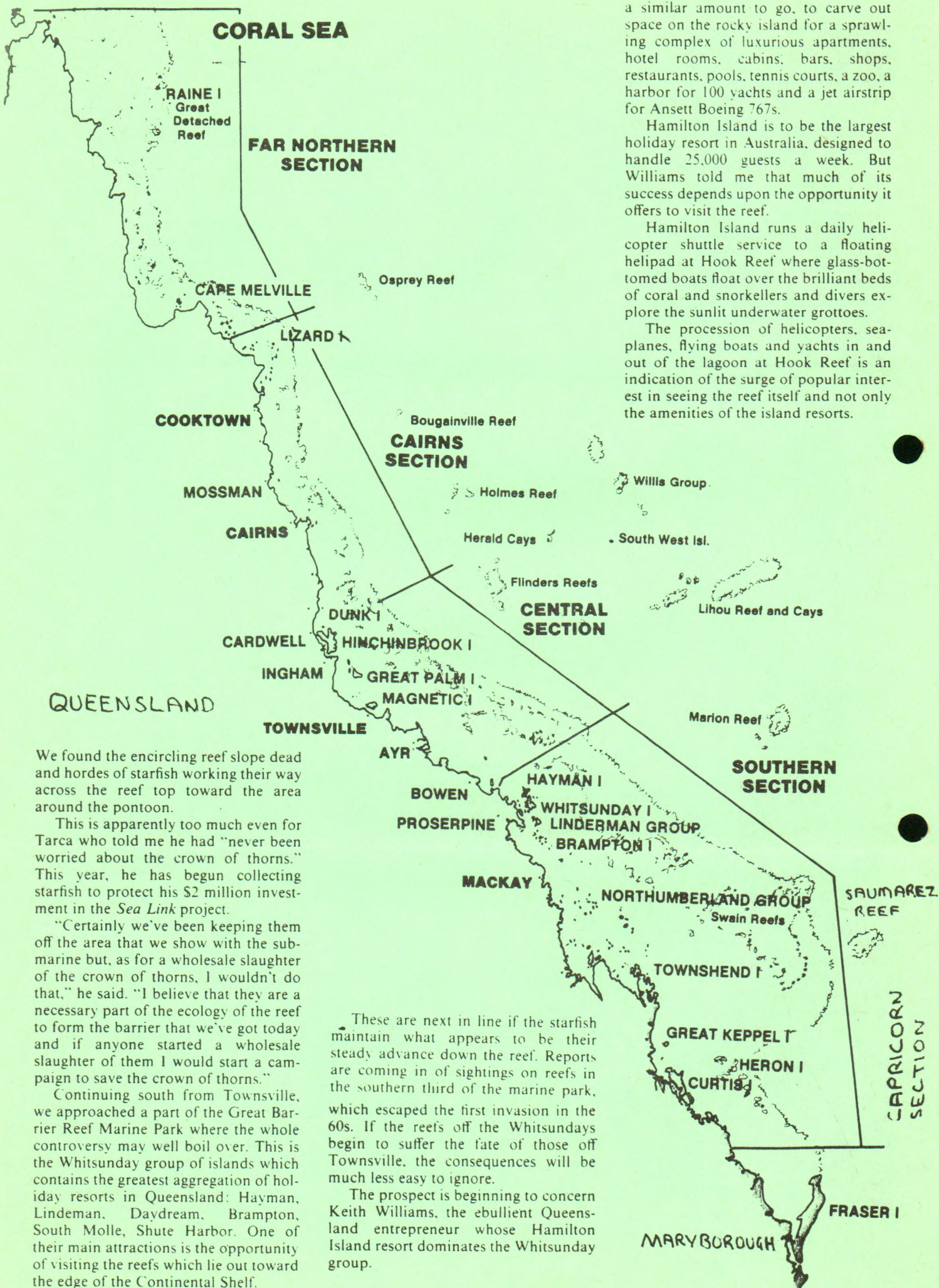
There the *Sea Link* was moored at a very large pontoon, anchored in the lee of the reef. The pontoon carried picnic tables and chairs, colored umbrellas, shower cubicles and palm trees in tubs. Soon, according to Tarca, it will be covered with white sand.

While some passengers, donned scuba gear or snorkels, most awaited the approach of *The Yellow Submarine*, which Tarca had gone to collect from its anchorage.

Designed and built by Tarca, this extraordinary craft does not submerge. From the rows of underwater windows in its hull snug in the carpeted interior, its passengers, have a fine view of the corals and fish life as Tarca navigates slowly over the reef.

Listening to Tarca's commentary over the speaker system, few passengers would realise that what they are seeing is a protected remnant of a once-luxuriant coral landscape and that just beyond their range of vision the scene changes dramatically.

Brewer Reef is being attacked for the second time since 1962 by the starfish.



Williams has spent \$50 million with a similar amount to go, to carve out space on the rocky island for a sprawling complex of luxurious apartments, hotel rooms, cabins, bars, shops, restaurants, pools, tennis courts, a zoo, a harbor for 100 yachts and a jet airstrip for Ansett Boeing 767s.

Hamilton Island is to be the largest holiday resort in Australia, designed to handle 25,000 guests a week. But Williams told me that much of its success depends upon the opportunity it offers to visit the reef.

Hamilton Island runs a daily helicopter shuttle service to a floating helipad at Hook Reef where glass-bottomed boats float over the brilliant beds of coral and snorkellers and divers explore the sunlit underwater grottoes.

The procession of helicopters, sea-planes, flying boats and yachts in and out of the lagoon at Hook Reef is an indication of the surge of popular interest in seeing the reef itself and not only the amenities of the island resorts.

We found the encircling reef slope dead and hordes of starfish working their way across the reef top toward the area around the pontoon.

This is apparently too much even for Tarca who told me he had "never been worried about the crown of thorns." This year, he has begun collecting starfish to protect his \$2 million investment in the *Sea Link* project.

"Certainly we've been keeping them off the area that we show with the submarine but, as for a wholesale slaughter of the crown of thorns, I wouldn't do that," he said. "I believe that they are a necessary part of the ecology of the reef to form the barrier that we've got today and if anyone started a wholesale slaughter of them I would start a campaign to save the crown of thorns."

Continuing south from Townsville, we approached a part of the Great Barrier Reef Marine Park where the whole controversy may well boil over. This is the Whitsunday group of islands which contains the greatest aggregation of holiday resorts in Queensland: Hayman, Lindeman, Daydream, Brampton, South Molle, Shute Harbor. One of their main attractions is the opportunity of visiting the reefs which lie out toward the edge of the Continental Shelf.

These are next in line if the starfish maintain what appears to be their steady advance down the reef. Reports are coming in of sightings on reefs in the southern third of the marine park, which escaped the first invasion in the 60s. If the reefs off the Whitsundays begin to suffer the fate of those off Townsville, the consequences will be much less easy to ignore.

The prospect is beginning to concern Keith Williams, the ebullient Queensland entrepreneur whose Hamilton Island resort dominates the Whitsunday group.

And this growing demand, worth hundreds of millions to Queensland and Australia, makes all the more inexplicable the air of complacency about the starfish problem. (Of 56 research projects in progress in 1982-83, supported by the authority to the tune of \$250,000 and described in the 1983 annual report, not one dealt with the current activities of the crown of thorns starfish.)

Although the authority chairman has his office in Canberra, his staff work in Townsville and it was there that I had a long interview with Richard Kenchington. He is the chief planning officer and a marine biologist.

Kenchington provided figures to support the authority's position that, of the reefs for which it has reports — about one in 10 of the total of perhaps 2500 reefs — only about 15 percent are infested with starfish.

"There's a problem there," he added. "We have very few records of areas in the northern third of the reef because there's very little traffic there and we have relatively few records from the southern third, so all our records come from that central section of the reef from Lizard Island down to Bowen. In that area we are in a situation very similar to the one that prevailed in 1969. We are seeing a second event."

I asked how many reefs had been damaged by the starfish over, say, the past 15 years. "No one has any reliable figures on that, and this is the biggest problem in this whole debate," he said and went on to speak of an assumption built up by showing "very powerful pictures of starfish destroying coral, that 'all aggregations of starfish cause damage in the region of 90 to 100 percent.'" The authority's figures do not reflect this.

Kenchington is clearly not impressed by the campaigns to control starfish numbers tried in other Pacific territories.

"The sorts of programs that have been mounted in Micronesia and Okinawa suggest that it's a great palliative exercise and you feel that you're doing something," he said. "It's an obvious PR management stunt but, in terms of its actual effect in stopping the activities of the starfish on a reef, it appears to achieve very little."

He said the authority had provided some people in Queensland with injection devices but was "not actually into the business of picking up the tab for collecting starfish." Finally Kenchington assured me that, on the basis of what happened during the last "episode" and on the basis of the data available to the authority, "we can be fairly comforted that there is not an overall catastrophe on our hands."

Graeme Kelleher, chairman of the authority was even more confident when I interviewed him in his office in Canberra. I asked first whether he still believed the statement he made this year that "there is no evidence that convinces the majority of scientists that the reef is at risk."

"Yes, I believe it more strongly because the evidence that we've obtained since I made that statement has confirmed the data that we had before" and he went on to quote the results of a recent survey of reefs in the northern section, from Lizard Island to Cape York, which showed "much lower levels of infestation there than we had anticipated."

On the question of assisting people such as Harvey financially to protect the area in which they operate, Kelleher said that it was "government policy, not just an authority policy, that where there's something required purely for a local enterprise, then it is the enterprise's responsibility to meet the cost, just as, generally speaking, it's a farmer's responsibility to keep the dingoes or the rabbits down on his property."

Kelleher agreed that Endean was "sincere" in his views about the seriousness of the situation but said that "we know that his access to sources of information is much less than ours."

Kelleher said: "The evidence of our surveys is that the whole reef is not at risk in the next year or so," he said. "If anything, the infestations appear to be in a state of equilibrium. On that basis — and recognising that government funds are limited — if we spend a million dollars, that's a million dollars not being spent on hospitals. In the absence of evidence that the reef as a whole is at threat, I don't believe that a major commitment of enormous amounts of funds is justified."

No less surprising than the lack of urgency at the authority was the general lack of interest among scientists in the reasons for the astonishing population explosions of the starfish over the past 25 years. This was even commented upon by Dr D. C. Potts, an Australian marine biologist now in the United States, reviewing the latest scientific literature: "Perhaps the most regrettable aspect of the *Acanthaster* controversy is the failure of ecologists throughout the Pacific to use a remarkable demographic phenomenon (whatever its causes) to test basic assumptions of coral reef ecology."

A host of questions about the starfish phenomenon have yet to be answered or even thoroughly investigated but one seems to demand attention: What is causing these tremendous fluctuations in the starfish populations?

Astonishingly, 20 years after the first large-scale outbreaks were reported

from Green Island, there is still no scientist in Australia working specifically on this question.

I asked Dr Barry Goldman, director of the Lizard Island Research Station, if any direct work had been done there on the question. "No," said Goldman. "The only thing that might be related to that is some monitoring that is taking place here under the auspices of the marine park authorities. But, to my knowledge, nobody is doing any specific work on the population dynamics of the crown of thorns."

The obvious place for such work, it seemed to me, was the Australian Institute of Marine Science. I asked the director, John Bunt, if any work had been done on the population dynamics of the starfish.

"We haven't been able to start any work on that just yet," he said, "because, to begin with, there's a technical difficulty of tagging the things. They have what one might call a plasticity which enables them to discard anything that you tie on to them and we're presently looking at a little device which we think we can implant into them which they won't discard. If we can do that, then, I think we've got some hope. But, really, there is a technical problem."

I found one scientist who had spent a considerable amount of time on this question. He is Dr John Lucas, in the department of Zoology at James Cook University in Townsville.

Lucas is an eager, dedicated researcher, and probably knows more about the reproductive activities of *Acanthaster planci* than does anyone else in Australia but even he is still not sure why some years only one or two of the 20-30 million eggs produced by each female starfish survive — just enough to maintain the population — but occasionally as many as 1000 from each female go on to reach maturity, producing a population explosion. "I looked at water temperature, salinity, food, and also predation. The most important factor I found was food. The amount of algae cells in the ocean normally is very low, not enough in normal circumstances to support the survival of the starfish larvae drifting through the water. But there may be particular circumstances, say, after a particular wet rainy season washes nutrients into the sea, where there's more food and greater survival of the larvae."

The further testing of Lucas's hypothesis will have to be done by someone else for he has switched his research to giant clams.

Endean believes that human in-

fluence may be the key factor in the population explosions of starfish, largely through the release of "predator pressure." He sees the virtual removal from the reef of the giant triton shell by collectors as an important factor.

Another contributing factor may be the drastic reduction in the numbers of large reef fish since the invention of scuba diving and spearfishing; species such as coral trout, wrasse and the various cod are all known to eat juvenile starfish.

But Endean's real concern, as we walked across Beaver Cay this year to the spot where he issued his first warning in 1969, is that this second outbreak is far worse than the first.

"The first time around, it was mostly branching corals and plate corals that were affected," he said. "This time we find that the hemispherical corals, the huge brain corals, that have taken in many cases hundreds and in some cases thousands of years to attain their present dimension — they're being killed. This is not a normal phenomenon that happens regularly. It can't be — the corals are too old!"

"I think there'll now be a succession of infestations, each one worse than the preceding one, and I think that the reef now will remain impoverished as far as I can see into the future."

He added: "We have had the opportunity to halt these infestations and not taken the opportunity. We've let a very conservative scientific establishment dictate to our governments and say that there's nothing to worry about."

"It's obvious now that those people were wrong. It's not just a passing phase: it is something which is really significant and something which is causing massive damage which may well result in permanent impoverishment of the Great Barrier Reef."

While the starfish steadily move on through the reefs, the deadlock on land at last shows signs of breaking. The Crown of Thorns Starfish Advisory Committee, re-convened this year by federal Environment minister Barry Cohen after a long hiatus in research, is painfully working its way round to admitting there is a serious situation.

Of course, it is very difficult now for many scientists and the Great Barrier Reef Marine Park Authority, to raise too much of an alarm after denying for so long that there was anything to worry about. It may take high-level political intervention from Canberra to bring this long, drawn-out conflict into the open.

If the responsible ministers do not soon begin to ask some hard questions and the starfish refuses to go away as it did before, the crown of thorns issue could become extremely uncomfortable for any government to wear. □

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