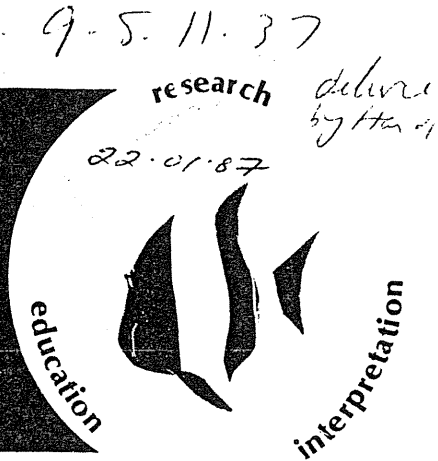


B. Kettle 1987a

9-5-11-37

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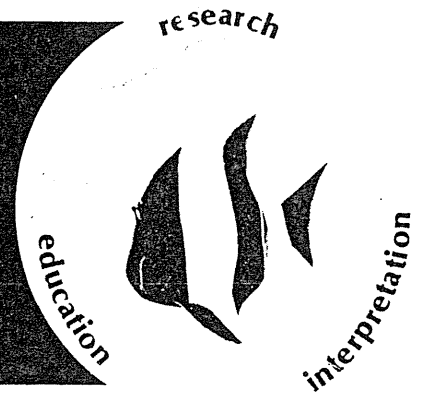
PRESURVEY OF JOHN BREWER REEF  
20/01/87 - 21/01/87

An exercise to determine crown-of-thorns starfish  
distribution prior to a joint GBRMPA / RAN  
eradication program.

Conducted by Brett Kettle for  
MARINE BIO LOGIC

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22.01.1987

PRESURVEY OF *ACANTHASTER* ON JOHN BREWER REEF  
MARINE BIO LOGIC 20/01/1987 TO 21/01/1987

**AIMS:**

To establish the status of the crown-of-thorns starfish (*Acanthaster planci*) infestation of John Brewer Reef prior to a starfish control exercise by the Great Barrier Reef Marine Park Authority and the Royal Australian Navy. *Viz.* to chart the position and density of adult populations and to suggest a dive strategy to promote efficient and thorough removal of starfish adults by SCUBA divers using the copper sulphate injection technique. In addition, to survey selected sites to determine the current juvenile populations on the reef and their likely impact on existing and transplanted coral.

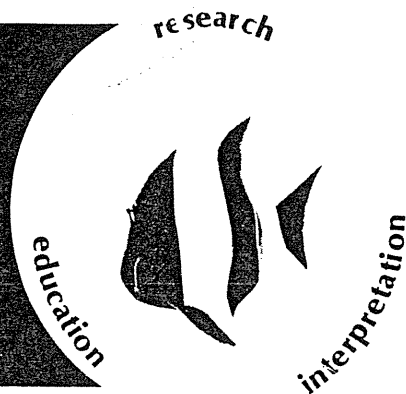
**Methods:**

A modified manta tow technique was used to survey most of the perimeter of John Brewer Reef and two long-reef transects. The technique used was similar in most respects to the currently popular two minute manta tow method, with the exception that no board was used. Instead the towing rope was tied to the rear of the observer's (the author's) weight belt. Recent trials have suggested that this method affords greater manouverability and comfort to observers, thus reducing fatigue and enhancing the reliability of the observations. During these tows the driver/observer (GBRMMPA staff member K. Weaver) noted observations communicated from the observer at two minute intervals. These transects are marked on the accompanying reef outline, FIGURE 1, as transects A to C. Dan bouys and numbered net floats were placed at significant locations to aid in the later task of mapping the starfish populations.

Four sites were surveyed after nightfall to estimate the current status of nocturnally active juvenile populations. These sites (sites 1 to 4) were positioned as shown in FIGURE 1. The sites were marked with an anchored, illuminated dan bouy. Four twenty-one metre long belt transects were laid out at each site, radiating at right angles to each other. The area examined was a two metre wide

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belt, extending for one metre either side of the tape, between the one metre and twenty-one metre markings. Thus each replicate covered 40 m<sup>2</sup> and each site covered 160 m<sup>2</sup> in total.

Site 1 was examined both during the day and during the night. This site was wholly within the viewing area of the Reef Link submarine, an area of enhanced coral cover. Within this area a single twenty metre tape was laid out on each of four adjacent bommie tops. Again a belt two metres wide, extending one metre either side of the tape was examined.

The habitat surveyed by belt transects and manta tows was restricted to the depth range zero to five metres. Juvenile sites were chosen on reef flat areas as this corresponds to areas of highest juvenile density in the past. At sites 1 and 4 this occurred on the top of consolidated back-reef bommies. At sites 2 and 3 it occurred high on the leeward slope of the front-reef crest.

Examination of all belt and manta transects paid particular attention to patches of recently dead coral, including determinations as to the true cause of these "feeding scars". Scars attributable to the feeding activities of *Drupella*, to mechanical damage from crinoids and from unknown coral ailments were not recorded as "feeding scars".

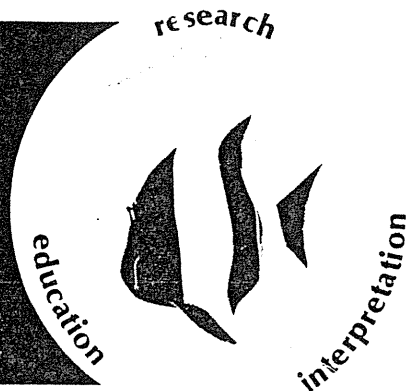
All field data (and the text of this report) were transcribed onto computer (copies available as ASCII files on request). It was intended to analyse data from the replicated juvenile belt transects by nested G-tests to determine intra-site and inter-site variations, however the data gathered needed no statistical testing.

#### RESULTS:

On the perimeter tow (tow "A") of John Brewer Reef there were no adult starfish seen. Two juveniles (84/85 recruitment, currently 2 years old) were seen in the northern quadrant of reef (each within c.400 m of the prominent "spur"), along with a small number (<10) of juvenile feeding scars (see FIG 1) in the same area. In addition there were feeding scars of similar sized (12 to 20

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cm) juveniles in *Acropora* thickets at a depth of c.5 m in the runoff channels of the southern half of the back-reef.

On the second tow (tow "B") adult starfish (size range 18 to c.40 cm diameter) were found in the eastern quadrant of the reef (see FIG 1). Two minute counts were low (typically 0 to 2) at the northern end of this belt and the maximum starfish density (17 in a two minute tow) was encountered at the southern end of the belt, a position approximately half of the way along the reef front. These starfish were feeding within an area of moderate (10%) coral cover. This was within the region which was best described as the zone where reef flat gives way to dispersed coral isolates on an otherwise sandy substrate. This belt was bounded on the seaward side by the shallow, consolidated reef crest (filamentous and macro-algae dominated).

The third tow (tow "C") was designed to determine the extent of penetration of starfish into the lagoonal area of the reef. It closely followed the 4 m isobath in the zone of transition from numerous patchy bommies to almost continuous open sand. On this tow only two starfish were seen, these in the vicinity of the greatest manta tow counts of transect "B".

#### INCIDENTAL MANTA TOW OBSERVATIONS:

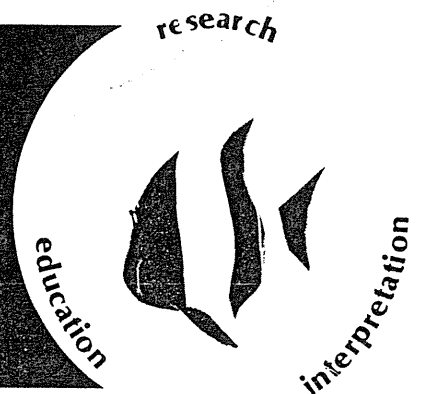
Isolated areas of high (unpredated) coral cover were found on extreme crest of the north-eastern extremity of the reef. The eastern section of the front edge of the reef possessed a belt of similarly high coral cover, extending from the reef crest to about 3 m depth on the seaward reef slope. A similar condition occurred very patchily on the remainder of the reef front. Moderate coral cover existed in the areas containing adult crown-of-thorns. Moderate cover also existed in small, isolated patches on the southern-most extremity of fore-reef flat, in a depth of c. 4m.

Holothurians, *Bohadschia geographi*, were observed along the entire reef front. One was observed spawning (postured but not releasing gametes) at c. 1750 hrs on 20/01/1987.

An unusually large clam, *Tridacna gigas*, was found on the southern end of the reef-front. This was measured at 1.25 m in length. The site was bouyed and is marked on FIGURE 1.

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#### JUVENILE SURVEYS:

So few juveniles were seen that it is not worth tabling the results of each transect.

The examination of site 1 by day (the only juvenile site examined by day) yielded no crown-of-thorns juveniles in any of the four replicates, although two juveniles were observed outside of the transects (a- c.14 cm, cryptic, quiescent. b- c. 14 cm, exposed, activity not recorded).

The only site at which juveniles were found at night was site 4. At this site two replicates contained no starfish, one replicate contained one starfish (juvenile, 12 cm, cryptic, quiescent) and one replicate contained two starfish (both - juveniles, c.12-14 cm, exposed, feeding - massive hard coral). This site was within the area where juvenile feeding scars were observed during manta towing.

#### DISCUSSION:

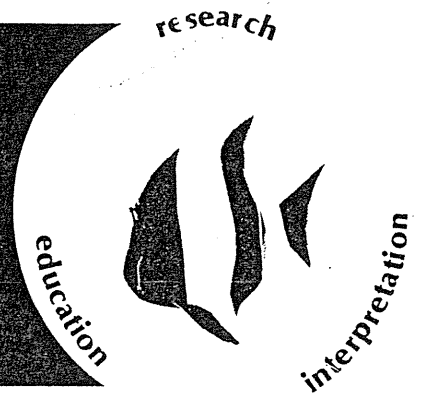
##### 1) ADULT POPULATIONS:

From the manta tow data collected on transects "B" and "C" it would appear that there is a small population (c.200 - 300 starfish) of crown-of-thorns dispersed in a narrow (c.150 m wide) belt on the leeward side of the front reef crest on the northern end of John Brewer Reef. These starfish are feeding on the belt of live coral in the same region. This patch of coral represents the only significant area of live hard coral that is a) in a sheltered environment and b) not patrolled and/or controlled regularly by Reef Link staff.

Given the starfish density and coral cover within the belt, and considering the external appearances of ill health (probably by gradual starvation) in the population, it is likely that without diver intervention this population would gradually dwindle over the next year. This remnant population might prove to be a nuisance for coral transplanting work planned by Doug Tarca and the Four Seasons Hotel Group. However the belt-like orientation of the population, and their relatively static nature (the

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population has been in this vicinity for at least 6 months) enhances the chances for a successful eradication attempt.

## 2) JUVENILE POPULATIONS:

According to the replicated belt transects the highest numbers of juvenile are to be found on the northern end of the consolidated back-reef of John Brewer Reef. This is supported by manta tow observations of juvenile feeding scars in the same area. The only other evidence of juveniles is in small, isolated patches of *Acropora* thicket, lying in runoff channels on the southern end of the otherwise consolidated back-reef of John Brewer Reef.

Reports by MARINE BIO LOGIC snorkelling guides suggest that there are low but significant numbers of juveniles in the submarine viewing area. These are still being killed as Reef Link staff encounter them. These observations are not at odds with the survey data as the starfish density is very low.

Juveniles do not appear to pose a threat to the current or planned tourist ventures on John Brewer Reef.

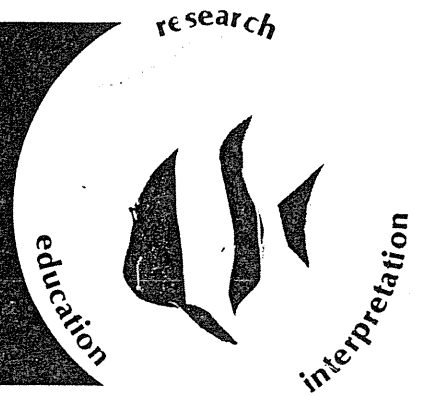
## 3) NAVY BRIEFING AND DIVE STRATEGY:

Navy personnel were provided with a copy of a sketch outline of John Brewer Reef. This figure resembled FIGURE 1 except that information regarding juveniles was deleted.

In view of the belt-like nature of the adult starfish distribution it was recommended that divers commence at one end and progress slowly along the reef crest to the other end of the starfish distribution. In order to let the divers familiarise themselves with starfish it was recommended that they start at the southern extremity of the distribution (where the population density is highest) and work northwards. To facilitate effective coverage of the area it was recommended that a series of float markers be used to mark the end of each dive. This idea was modified when K. Weaver (GBRMPA) suggested the use of two 100 m long bouyed lines as delimiters. Navy supervisors were requested to allow divers at either extremity of the transect to swim wide of the line searching for starfish higher on the reef crest or further into the lagoonal area.

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#### REPORT SUMMARY

Juveniles appear to pose no threat to current or future tourist ventures on John Brewer Reef as they occur only at low densities and are restricted to only the back-reef area.

A remnant population of c. 200 - 300 <sup>1000!</sup> starfish were located on the reef-front. These formed a narrow belt on the northern half of the front. The belt encompasses the last remaining area of significant coral cover. This belt is limited at its shallow extremity by the algal dominated consolidated pavement of the reef flat. At its deepest extremity it is limited by the transition to sparse *Millepora* and branching *Porites* covered bommies on otherwise predominantly sandy substrates.

All characteristics of the population distribution make it a very viable proposition to achieve a high kill rate. Navy supervisors were advised on a number of techniques to enhance their search effectiveness.

SUBMITTED 4PM 22/01/1987.

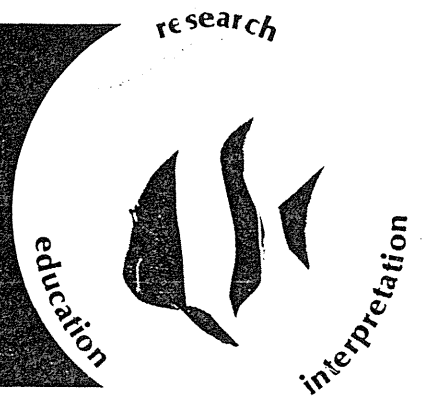
*Brett Kettle*

BRETT KETTLE  
MARINE BIO LOGIC

p.s. Thanks very much Karen for your help with the field work.

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### SUMMARY OF HOURS

#### MONDAY 19/01/87

0900-0945 (45m)	funnel and filter paper to Karen, Food from Big W.
1130-1255 (85m)	fuel tanks from GBRMPA, filled, Energiser batteries from K-Mart.
1330-1350 (20m)	pack dive gear
1400-1700 (3h)	write aims and methods of report to detail outline for Karen, schedule tasks for trip.

#### TUESDAY 20/01/87

0900-1430 (5h30m)	draft w/proof copies of maps, assemble floats, prepare for survey site 1/day, lay transects, do replicates.
1500-1830 (3h30m)	load Zodiac, do perimeter tow placing markers as required.
2000-2400 (4h)	prepare boat & slates, load gear, begin snorkel assessment of replicated belt transects.

#### WEDNESDAY 21/01/87

0000-0100 (1h)	complete snorkelling of sites
0630-0930 (3h)	load zodiac, tow manta transect "B" and "C"
0930-1330 (4h)	meet navy, collect sample, brief divers, return to Reef Link.
2000-2230 (2h30m)	report write-up

#### THURSDAY 22/01/87

1030-1400 (3h30m)	complete report.
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TOTAL HOURS 32:30

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FIGURE 1. JOHN BREWER REEF

