



# COTS COMMS



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Response to COTS COMMS hasn't exactly been overwhelming, but the encouragement from a few respondents to the request for project summaries has been enough to go for a second issue. Project summaries that I have received are included in this issue and hopefully others will trickle in when I get a chance to do a bit of hassling follow-up.

The list of reports available from GBRMPA and AIMS printed in Issue #1 proved to be a success and the offer still stands. Additions to the list will be included in future issues of COTS COMMS.

So welcome to COTS COMMS Issue #2. Don't forget, ideas, comments, cartoons and literary contributions would be appreciated. If you know someone who missed getting a copy of the newsletter let me know.

## Review Reviewed

In mid-March the Minister for the Arts, Sport, the Environment, Tourism and Territories (DASETT), Senator Graham Richardson, released the review into crown of thorns starfish research and management conducted by Professor Don Anderson.

Major findings and recommendations of Anderson's review were:

1. The current management policy of the Great Barrier Reef Marine Park Authority for crown of thorns starfish control is soundly based and takes account of current knowledge of crown of thorns starfish populations on the Great Barrier Reef. The policy could be applied more extensively only if special funds were made available for this purpose.

2. The Great Barrier Reef Marine Park Authority has promoted appropriate research into crown of thorns management under the COTSAC research program and has fully evaluated the results of this research in relation to its current management policy. The causes of outbreaks of crown of thorns starfish are still unknown.

3. Ecological research and management-

related research under the COTSAC program both support the view that local control techniques are available and could be effective, even though expensive, but large scale control or eradication is impracticable and unaffordable.

4. The COTSAC research program indicates that population fluctuations of the crown of thorns starfish have occurred in the past, but the scale of such fluctuations cannot be analysed in detail. The present phenomenon appears to have a long history.

5. The COTSAC research program has been defined, reviewed and operated in an efficient and productive manner, within the limits allowed by annual funding. A high degree of dedication is evident among the research workers and research managers involved in the program.

6. The provision of Federal funds for the COTSAC program on an annual basis has disadvantaged the program in various ways, primarily through the imposition of a need for rapid decision making and the corollary that the review committee for the program (COTSARC) has been unduly constrained by time considerations. Despite this, COTSARC has carried out its task as effectively as possible.

7. The COTSAC research program has led to significant advances in the understanding of the ecology of the crown of thorns starfish. As a result of this program, opportunities have now been created to investigate the broadscale ecology of the species in the Great Barrier Reef more deeply, and to better analyse its reproduction, dispersal, settlement and recruitment processes. Understanding of the causes and management of the crown of thorns starfish depends critically on the outcome of this research. Areas of future research should include:

- \* predation at all levels;
- \* population dynamics;
- \* effects of human activities, including agricultural run-off and fisheries; and
- \* biological control.

8. The research would benefit from an injection of supplementary research workers with suitable skills, especially in experimental biology. This could be obtained through 4-5

suitable post-doctoral appointments guaranteed for 3 years, and is critical to progress in the investigation of predation and population dynamics.

9. The crown of thorns starfish research program on the Great Barrier Reef should be continued for another 3-5 years at a dedicated and committed funding level of at least \$A1 million a year.

10. For the GBRMPA to run the program effectively, it needs the support of a review committee that could be active in determining the initial funding and annual renewal of all projects. Composition of the committee should include Professor Swan, 2 experts from GBRMPA, 2 experts from AIMS and 3 external (Australian-based) experts.

11. The review committee should meet at least 3 times each year, to review applications for funds, to receive and deliberate upon the reports of assessors on these applications, and to review progress of the program before the next round of applications.

12. In order to maintain a flow of information about the program to the wider community, Professor Swan should also be asked to chair a coordinating committee. This committee, meeting annually, could be informed about the progress of the program with a view to allowing input of views from other interested groups (e.g. tourism and state government). If comprised of 2 members of the scientific review committee and 4 members chosen from the Great Barrier Reef Consultative Committee (GBRCC), the coordinating committee could report to the GBRCC annually on the research program.

13. A full time coordinator of the program should be appointed. This person would need to be ex officio a member of the scientific review committee and the coordinating committee. In anticipation of a continuation of a major part of the research program at AIMS, and the obvious need for coordination of this component within AIMS, the GBRMPA appointed coordinator would need to work closely with the responsible staff member(s) at AIMS.

14. The facilities and expertise of the Australian Institute of Marine Science are

essential to the completion of the ecological research now required, but control of the program should remain with the Great Barrier Reef Marine Park Authority.

15. All projects funded under the cots research program should carry contractual obligations, including strict identification of the application of the funds within the project and an annual report of progress to the GBRMPA.

Senator Richardson has asked his department and GBRMPA to report back to him as soon as possible about implementation of all of Prof. Anderson's recommendations. Sen. Richardson said he would be personally taking up with the Prime Minister the need to act on the recommendation that Federal funding for the cots program be maintained for another 3 to 5 years at a minimum level of \$1 million per year.

Certainly the additional funds are needed. The current level of just over \$500,000 is barely sufficient to maintain existing research, let alone allow for any new initiatives such as the predation issue. Last financial year GBRMPA chipped in around \$70,000 of its own funds towards the COTSAC research program. AIMS has also made substantial financial and logistical contributions each year of the program. These additional funds shouldn't be counted on in future years. GBRMPA has also submitted to the Federal Government a new policy proposal for additional funding to support research into cots predators and the issue of whether human intervention has affected predator control.

GBRMPA is planning to convene a meeting of the new stream-lined, more technically-oriented COTSARC on 24 April 1989 to consider the Anderson Review and get the ball rolling.

Copies of Anderson's Review are available from GBRMPA through Brian Lassig or Leon Zann.

### AIMS Broadscale Surveys

The AIMS Survey Team is nearing completion of its third year of broadscale surveys of the distribution and abundance of cots and corals on the GBR. During February 33 reefs in the Cairns and Innisfail sectors were surveyed. Surveys in the Whitsunday and Pompey sectors (approx. between latitudes 19.5° and 21° S) will be conducted over the period April 19th to May 6th.

The team would be very interested to hear from anyone who:

\* would like current information on the

distribution of cots outbreaks in particular areas;

\* has information about cots in the Whitsunday and Pompey sectors; or

\* may be able to benefit from their visits to particular reefs in the Whitsunday/Pompey sectors during their forthcoming cruise.

Although they have a tight schedule, they may be able to help in some way.

If you fit any of these criteria, please contact David Johnson, Bruce Miller-Smith, Johnston Davidson or Craig Munday at AIMS [Telephone (077) 78-9211].

### Effects of Fishing Mega-Study

A scientific workshop was held in February under the auspices of the Advisory Committee on Research on Fishing in the Great Barrier Reef Region to discuss and recommend a research program on the effects of fishing, particularly trawling, in the GBR Region. The workshop was attended by about 30 invited scientists with representatives from GBRMPA, Queensland Department of Primary Industries, CSIRO, Australian Institute of Marine Science, James Cook University, Griffith University, Queensland Museum, West Australian Marine Research Laboratories and Queensland National Parks & Wildlife Service.

One of the main objectives of the workshop was to recommend future research that is required to plug gaps in information necessary to understand the effects of trawling in the region. It was clear that a trawler could be driven sideways through existing gaps in our knowledge in this area.

The grand plan formulated to provide the necessary information involves experimental manipulation of trawling and line fishing effort in reefal and inter-reefal areas through GBR Marine Park zoning. Within each of three Marine Park sections (Cairns, Townsville and Mackay/Capricorn-Bunker) two locations encompassing at least 5 reefs would be selected. Two of these reefs will remain open to line fishing, two will be closed to fishing and half of the remaining reef will be closed and half open to fishing. One of the two locations in each Marine Park section will be closed to prawn trawling with the closure extending about 5km into the GBR lagoon. After 3-5 years, the treatments will be swapped.

During the experiment a coordinated multi-agency program of research and monitoring would be undertaken to assess the closures and measure the significance of any interactions between fishing and the reef community. Workshop participants identified a number of variables (including cots and potential cots predators) to be monitored in each of the paired clusters of reefs.

Starting in the Northern section, the program would cost an estimated \$1 million per annum per cluster of reefs. Though the design is still in its infancy, there is clearly great potential for "piggy-backing" aspects of this mega-study with the COTSAC program.

The Advisory Committee should be approaching the Federal Government with a proposal and recommendation for funding of the program in its entirety.

For further information contact Dr Wendy Craik of the GBRMPA [Telephone (077) 81-8811].

### COTS Handbook that Bounces?

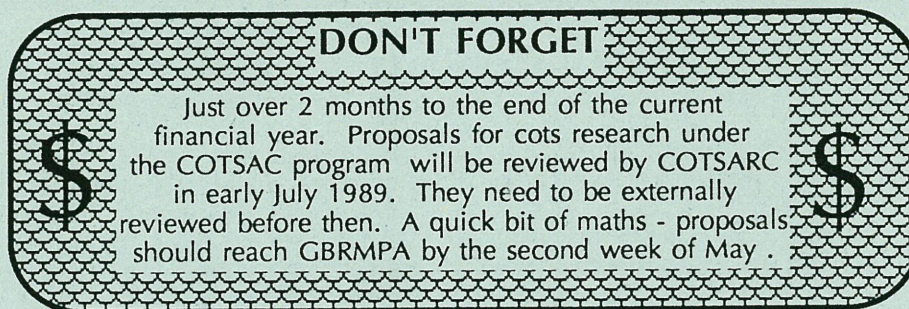
Some years ago, Chuck Birkeland of the University of Guam and John Lucas of James Cook University signed a contract with CRC Press (Chemical Rubber Company Press) to produce a handbook on cots. The concept of this handbook is to be a source book for researchers and other persons interested in obtaining practical information on *Acanthaster*. CB is covering field aspects, JL is addressing the life cycle and laboratory aspects. It is more than a review, intending to answer questions such as: How do we control cots? How do we rear the larvae? etc.

With the large amount of new information coming out on *Acanthaster* in recent years, the submission of the handbook manuscript has been put off on several occasions. However, it is now to be submitted in the middle of this year.

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COTS COMMS is edited by Brian Lassig. Views expressed are not necessarily those of the Great Barrier Reef Marine Park Authority.

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## COTS RESEARCH PROJECTS: PART I

This is the first of a continuing series aimed at updating interested parties on who's doing what in cots research. Additions will be made as new projects are initiated and researchers find the time to send me the necessary information for subsequent issues. My thanks to those who responded for this issue.

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**Title:** Numerical models of the hydrodynamic regime around schematised and actual reefs.

**Leaders:** Dr Kerry Black & Dr John Andrews; (KB) Victorian Institute of Marine Sciences, 14 Parliament Place, Melbourne VIC 3003 (03) 651-1998

**Objectives:** To use numerical models of hydrodynamics which include wind, tidal and low-frequency coastal currents to examine reef-scale circulation and to supplement this with numerical simulations of larval dispersal over periods of days to weeks.

**Rationale:** Computer simulation of hydrodynamics and advection/dispersion provides a sophisticated procedure to utilise and greatly extend the information contained in existing field measurements. With the overview of the modelling, the complex circulation and dispersal on and around coral reefs can be more properly assessed.

**Achievements:** Much new knowledge has been gained. Flow patterns have been specified for a wide variety of morphologies, while the general dynamics are now understood. The dispersal modelling has shown that larvae have a much longer residence time on reefs than has previously been considered possible. An analytical solution to predict residence times has been developed. There is correspondence between the sites of relatively high retention on individual reefs and the locations where primary outbreaks of starfish first occurred.

**Current Status:** Some housework is still being undertaken.

**Future Directions:** Several matters should be addressed. Among these is the need to examine larval transport in a cluster of reefs, the influence of waves on retention time, the influence of non-linear interaction on retention time, the influence of wind boundary layers on retention time, the need for large multi-disciplinary dispersion experiments with well-mixed tracers (not coral), the linking of large scale and reef scale modelling, specification of fine scale and reef scale modelling, specification of fine scale influences within metres of the starfish, three-dimensional circulation, stratification in the lagoons and predation.

**Problems & Needs:** Funding

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**Title:** Dynamics of recruitment and the densities of juvenile crown of thorns starfish between 15°S and 20°S on the GBR.

**Leader:** Dr Peter Doherty; Australian Environmental Studies, Griffith University, Nathan QLD 4111 (07) 275-7408

- Objectives:**
1. To measure the densities of small *A. planci* on 16 coral reefs south of Townsville
  2. To indicate habitat preferences in terms of exposure, depth and substratum
  3. To establish baseline data for juvenile densities in the vicinity and downstream of breeding aggregations
  4. To hindcast the relative abundance (spatial and temporal) of larval settlement
  5. To test the hypothesis that "outbreaks" are the result of greater-than-average settlement.

**Rationale:** To provide the first systematic, extensive surveys of juvenile abundance; to identify settlement as the proximate cause of outbreaks; to target reefs suitable for field programmes on the ecology of juveniles.

**Achievements:** 384 transects (each 10x1m) spread systematically over 16 coral reefs have been sampled for all asteroids in each of three successive years (1986-88) to satisfy objective 1. One cohort of greater-than-average recruitment was detected during the period of monitoring. These data have satisfied most other objectives as well as demonstrating larval transport downstream of source populations.

**Current Status:** Three years of field sampling completed; final year of data to be analysed. Preliminary results reported to 6th International Coral Reef Symposium.

**Future Directions:** No extension planned at this stage. Intermediate results suggest the desirability of limited tactical sampling at the end of 1989 (2/3 reefs only) to establish whether another period of elevated settlement has resulted from the 1989 spawnings.

**Problems & Needs:** The surveys confirm (1) that juvenile *A. planci* are rare animals in non-outbreak populations, and (2) that recruitment variations leading to subsequent outbreaks of adults are rare events. Both characteristics increase the difficulty and expense of monitoring juvenile abundance at regional scales.

**Title:** Hard coral -- cots interaction study at Green Island

**Leader:** Mr Dave Fisk; P.O. Box 5348, Townsville M.C., QLD 4810  
(077) 72-6519

**Objectives:** Characterise the pattern of hard-coral regeneration. Regularly survey cots population around whole reef (adults). Survey rubble over wide range of habitats for 0+ cots.

**Rationale:** Green Island has been an early detection reef for observing cots outbreaks in the central GBR during the last two major outbreaks. Hard coral cover was very low following both outbreaks -- the effect on hard coral communities therefore was severe. The resultant impact of the outbreaks in the longer term for Green Island needs to be monitored.

**Achievements:** A low and declining population of cots was evident from 1986 to the present. Hard coral regeneration is very patchy and appears to be dependent on larval transport from other reefs. Green Island appears to receive more recruits than two other nearby reefs.

**Current Status:** Cots surveys are proposed to be continued; hard coral regeneration monitoring is ongoing.

**Future Directions:** Both aspects are linked in the one program with overlapping specific questions re the distribution of recruits being addressed.

**Problems & Needs:** Expansion of the program to address new questions arising from current data from Green Island and from other external projects (especially with respect to hydrodynamic modelling) requires reassessment of funding levels or a re-evaluation of the scope of the current program.

**Title:** Search for evidence within surface and subsurface sediments for the occurrence of previous aggregations of crown of thorns starfish on the GBR.

**Leaders:** Dr P.G. Flood; Geology, University of New England, Armidale, NSW 2351  
Dr E. Frankel; Applied Geology, University of Technology, Sydney, NSW 2007  
PGF: (067) 73-2862

**Objectives:** To collect surface sediment samples and to recover subsurface sediment samples using vibrocores (7m penetration capacity) to visually search for and  $C^{14}$  date cots spines.

**Rationale:** Cots skeletal fragments are readily recognisable in carbonate sands (Walbran, 1984). Examine subsurface sediments for previous record of cots fragments; test is % occurrence in normal population; aggregation or infestation by comparison of number of cots/kg in recent settings.

**Achievements:** No cots fragments have been observed in 622 subsurface samples from 23 cores from Heron or Fitzroy Reefs; no fragments in surface sediments from Lady Musgrave Reef.  $C^{14}$  record to 4000 year B.P.

**Current Status:** Project in southern GBR completed; 1989 field area designated northern GBR.

**Future Directions:** Consultation with AIMS, GBRMPA, BMR, JCU etc.

**Problems & Needs:** Some debate (6th International Coral Reef Symposium) as to what no./kg of cots fragments represent normal population, aggregation, infestation etc; and the difficulty of bioturbation altering the stratigraphic record.

**Title:** Feeding rates of *Acanthaster* in the field.

**Leader:** Mr John Keesing; AIMS, PMB No. 3, Townsville MC, QLD 4810.  
(077) 78-9211

**Objectives:** 1. Investigate daily and seasonal behaviour patterns in *A. planci*.  
2. Measure daily and seasonal rates of feeding of *A. planci* in the field.

**Rationale:** 1. Conjecture over diel behaviour patterns in *A. planci*  
2. No quantitative data on behaviour at population level  
3. No population field studies on feeding rates  
4. No feeding rate information in terms of biomass or energy.

**Achievements:** 1. Size and time of day dependent behaviour pattern established.  
2. Seasonal variation and behaviour and feeding rate established.  
3. Biologically and ecologically useful measurements of feeding rate recorded.

**Current Status:** Analysis and writing (Ph.D.)

**Future Directions:** Studies on foraging behaviour and energetics of *A. planci* at individual and population level desirable; as well as studies on juveniles.

**Problems & Needs:** Just the usual -- remote field sites and #@!\* weather.

**Title:** Ecophysiological studies of *Acanthaster*.

**Leader:** Assoc. Prof. John S. Lucas; Zoology Dept; James Cook University; Townsville;  
QLD 4811.  
(077) 81-4412

**Objectives:** These have changed over the long duration of this research. Currently working on methods for ageing *Acanthaster*.

**Rationale:** Two major problems with field studies of *Acanthaster* have been the inability to tag or age them.

**Achievements:** Investigation of age pigments; seasonal lines in skeletal parts; spine-length/general body size.

**Current Status:** This research is an M.Sc. thesis study pursued by Mr Richard Stump (see later entry).

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**Title:** Macro-scale studies of the distribution and abundance of *Acanthaster planci* and corals of the GBR.

**Leader:** Dr P. Moran; J. Davidson; D. Johnson; B. Miller-Smith & C. Mundy; AIMS, PMB No. 3, Townsville M.C., QLD 4810 (077) 78-9211

**Objectives:** To conduct broadscale, synoptic reef surveys for cots and coral (from all areas of the GBR - south of Princess Charlotte Bay) on an annual basis.

**Rationale:** This project not only extends the database which was produced in 1985/86 by the CCEP COT study, but also introduces a more extensive temporal dimension to the data.

**Achievements:** Surveys have been conducted on over 100 reefs annually since 1985/86; clearly documenting the broadscale changes in cots distribution and abundance over the past three years.

**Current Status:** 1986/87 - 107 reefs surveyed  
1987/88 - 139 reefs surveyed  
1988/89 - 96 reefs surveyed to date with one 18-day cruise remaining

**Future Directions:** Project completion date 30 June 1989, but continuation of long-term broadscale monitoring beyond this date is planned.

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**Title:** Growth, longevity and age determination in *Acanthaster planci* (Linn.)

**Leader:** Mr Richard Stump; Zoology Department, James Cook University, Townsville, QLD 4811. (077) 82-4883

**Objectives:** To develop a reliable technique for age determination of *Acanthaster*, and to assess differences in physiological and chronological age in populations of high and low densities.

**Rationale:** Age determination is important to both population dynamics and in application to all physiological studies.

**Achievements:** Pigment rings have been found on many skeletal elements and are best developed in the aboral spines. A tetracycline antibiotic has been used as a skeletal marker to determine the periodicity of these rings. An autofluorescent pigment found in the pyloric caeca is also being tested for its ageing capabilities.

**Current Status:** A number of animals are being monitored on Davies Reef (central GBR). Being low to moderate population densities, growth parameters can be measured over a long period of time without depletion of hard corals affecting growth. Preliminary samples from high density (Little Broadhurst Reef) and low density populations (Lady Musgrave Reef) have been collected. Animals collected from the former location have been maintained in an aquarium at Orpheus Island Research Station (OIRS) during 1988.

**Future Directions :** Periodic treatments of the tetracycline together with morphometric and autofluorescent pigment analyses will allow correlation of techniques and ultimate validation of the animals' age from measurements.

**Problems & Needs:** Maintaining adult starfish in aquaria has been extremely difficult. A study of tetracycline dosage requirements is needed and this will involve another collection of healthy specimens. The aquarium at OIRS will be modified to cope with water quality problems during feeding times. This study now requires repeated field trips involving around 20 days of sea time during 1989. In the absence of any known age adult specimens, it has become necessary to obtain large repeated samples from populations.

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**Title:** Numerous

**Leader:** Dr Peter Moran; AIMS, PMB No. 3, Townsville M.C., Qld 4810  
(077) 78-9334

**Projects & Status:**

1. Feeding preferences of *Acanthaster planci* in the field.  
All field work complete, data entered into database and checked. Analyses underway.
  2. Rate of decomposition of adult starfish in the field.  
Field work complete. Paper in preparation.
  3. Recovery and recolonisation of coral communities after outbreaks of *Acanthaster planci*.  
Coral identifications complete. All data entered into database and checked. Analyses underway.
  4. Mesoscale studies of the distribution and abundance of *Acanthaster planci* and corals on selected reefs.  
Field work complete. Data checked and entered into database. Preliminary qualitative patterns extracted.
  5. Mesoscale hydrodynamics and starfish dispersal and recruitment.  
(with K. Black, VIMS)  
Hydrodynamic and biological patterns extracted: paper in preparation.
  6. Analyses and models of crown of thorns starfish database.  
(with R. Bradbury and R. Reichelt, AIMS)  
Synopsis of starfish activity based on CCEP data complete, paper published. Predictive analysis of GBR database complete, paper submitted. Qualitative analysis of GBR status complete, paper submitted.
  7. Spawning success and fertilisation rates of *Acanthaster planci*.  
(with J. Benzie and P. Dixon, AIMS)  
Laboratory and field work completed. Preliminary analyses underway.
  8. Wax esterases in *Acanthaster planci*.  
(with C. Brahim-Horn, CSIRO Division of Protein Chemistry)  
Laboratory analyses completed. Paper in press.
  9. Investigation of the reliability and reproduceability of the manta tow method.  
(with Dennis Sinclair, University of Newcastle)  
Field work completed. Analyses underway, paper in preparation.
  10. Tagging of *Acanthaster planci* using micro-injectable transponders.  
Prototype version constructed. Two models being manufactured.
  11. The effect of the multi-armed condition on the energetics of *Acanthaster planci*.  
(with J. Lawrence, University of South Florida)  
First phase of field work completed. Second phase to be undertaken May 1989.
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**Title:** Information dissemination: video and magazine special.

**Leader:** Dr Leon Zann; GBRMPA, PO Box 1379, Townsville, QLD 4810  
(077) 81-8811

**Objectives:** To inform the public on the status of *A. planci* on the GBR and on the progress of the COTSAC research program.

**Rationale:** The *A. planci* phenomenon has aroused great public concern. Media reporting tends to sensationalise the issues (COTSAC Recommendation 19).

**Achievements:**

1. Video: The Crown of Thorns Story (28 mins) - 250 copies distributed.
2. Australian Science Mag Special: The Crown of Thorns Starfish - 4000 copies distributed.

**Current Status:** COTSARC recommended an update of the video and publication in late 1989.

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**Title:** Population dynamics of *A. planci* on Suva Reef, Fiji.

**Leader:** Dr Leon Zann; GBRMPA, PO Box 1379, Townsville, QLD 4810  
(077) 82-8811

**Objectives:** To monitor recruitment, growth and mortality of *A. planci*.

**Rationale:** Little known of post-settlement stages.

**Achievements:** Recruitment monitored 1979-89 (1975-79 deduced). Growth, mortality, migration and behaviour of cohort monitored 1984-87 (published). A disease causing a mass mortality has been described.

**Current Status:** Monitoring of recruitment continuing. Preliminary correlations (fishing pressure, rainfall etc) underway.

**Future Directions:** Monitoring to continue for as long as possible (decades?).

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**Title:** Examination of potential human causes of *A. planci* outbreaks in the South Pacific.

**Leader:** Dr Leon Zann; GBRMPA, PO Box 1379, Townsville, QLD 4810  
(077) 81-8811

**Objectives:** To establish the status and recent history of *A. planci* in widely separated areas. To identify commonalities; to specifically relate *A. planci* history to fishing effort.

**Rationale:** Widely separated island groups were chosen to reduce the chances of confounding secondary outbreaks in each area. Fishing effort is far greater in most islands in the South Pacific than on the GBR and a larger number of potential predators are taken (e.g. small species of balistids, pufferfish and wrasses). If outbreaks result exclusively (or largely) from over-fishing, an overt correlation should be evident.

**Achievements:** Detailed surveys of the Fiji Group, Vanuatu and Upolu (Western Samoa) to date. User reports from most other groups.

**Current Status:** Continuing. More detailed surveys of Samoa, Tonga, Tuvalu, Kiribati, PNG planned. Fisheries data to be examined.

**Future Directions:** Country reports to be published individually. Final correlations on completion of study.

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**Title:** Trial controls of *A. planci*.

**Leader:** Dr Leon Zann; GBRMPA, PO Box 1379, Townsville, QLD 4810.  
(077) 81-8811

**Objectives:** To test the feasibility of using service personnel for *A. planci* control. To examine the cost effectiveness of control programs.

**Rationale:** Large scale controls of *A. planci* have been urged by some sectors on the GBR but have had very doubtful success overseas. Small scale controls by tourist operators have had some success on the GBR. The use of volunteers has been suggested.

**Achievements:** Army and navy divers have been used in small scale controls on Grub, John Brewer and Holbourne Island Reefs. Results have been published (6th ICRS).

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**Title:** Physiology of high density crown-of-thorns populations.

**Leader:** Brett Kettle, (PhD student) and Assoc. Prof. John Lucas (Supervisor), James Cook University of North Queensland.

**Objectives:** To examine changes in selected physiologically related parameters of crown-of-thorns starfish through the time-course of a high density population outbreak.

**Rationale:** To date there have been very few studies that have examined any aspects of cot physiology. None have examined a broad range of physiological parameters in a systematic manner nor have any examined the variation of a suite of parameters throughout a single starfish outbreak. The repeated analysis of one population through time is a significant consideration, given that predator and prey densities fluctuate to extremes and that there is likely to be marked changes in starfish physiology in response to these changes.

**Achievements:** After a not-so-brief interlude, work has resumed on Brett's PhD on cot physiology. The thesis now looks like completion by mid-year. Whilst some results have already seen the light of day (Kettle and Lucas, 1987; effect of size on physiology) most haven't.

Some of the interesting stuff comes from an experiment conducted at Orpheus Island Research Station which looked at cots' responses to starvation. Starfish from a sample of 70 survived for up to 22 weeks without coral. The mean size of a random sample of 15, sacrificed for measurements, decreased by c. 5.5 cm but measured changes in individuals indicate net growth. The amount of growth or shrinkage was strongly related to initial size. Large starfish shrank and died quickly but small starfish grew, succumbing only late in the experiment. Even after 10 weeks of starvation 35cm cots were bigger than when the experiment began. Interestingly gonad indices increased through the period until the experiment terminated (due to mortality) in November.

Other information from the Helix and Keeper Reef study populations draws upon the size and starvation related trends observed in the above two studies and highlights the role of resource limitation and reproductive effort in determining the ultimate fate of a high density outbreak.

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