

An underwater photograph showing a large number of jellyfish swimming in the water. The water is clear and blue. In the foreground, there are some coral structures and rocks. The overall scene is a vibrant marine ecosystem.

**LIZARD ISLAND  
RESEARCH STATION**

**NEWSLETTER 1996/97**

Sponsored by the Lizard Island Reef Research Foundation



## **LIZARD ISLAND REEF RESEARCH FOUNDATION**

The Lizard Island Reef Research Foundation is an independent trust established to raise funds for the Station and to support research on the Great Barrier Reef. Its major commitments are to the Doctoral Fellowships program and to capital development of the Station. Donations to the Foundation are tax deductible within Australia and attract a partial subsidy from the NSW State Government through the Australian Museum Trust. Over \$1.5 million has been raised by the Foundation since its inception in 1978.

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**Donors who have provided support in the current year are acknowledged and thanked in the body of the newsletter.**



# LIZARD ISLAND RESEARCH STATION NEWSLETTER 1996/97

Dr Anne Hoggett and Dr Lyle Vail, Directors  
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All photos by Lyle Vail or Anne  
Hoggett unless otherwise indicated.  
Cover photo: John Cooper

Sponsored by the Lizard Island Reef Research Foundation

## Beneficial toxins from venomous cone shells

Highly prized by collectors for their beautiful and varied shell patterns, species of the genus *Conus* have recently attracted the attention of researchers because their venoms provide chemical templates for the design of new drugs of value in a number of medical conditions. Of the 500 species of *Conus* worldwide, over 80 are found on the Great Barrier Reef and about 50 of these occur in the waters around Lizard Island. While the venoms of several species have caused human fatalities, toxins in some other species show potential as novel drugs for use in pain management, epilepsy and the prevention of stroke.

A group from the Department of Biochemistry and Molecular Biology at the University of Melbourne is studying the venoms of cone shells found at Lizard Island. The group is led by Associate Professor Bruce Livett and Dr John Down and they are funded by the Australian Research Council. The group collects specimens of *Conus* for isolation of toxins and screening of biological activity. Interesting new toxins in the venoms are purified, characterised and synthesised in collaboration with Dr Paul Alewood's group at the Centre for Drug Design and Development at the University of Queensland. The synthetic toxins provide workable quantities for subsequent research, obviating the need for further collection of cone shells.

Research is presently focusing on the alpha-conotoxins which target the nicotinic receptors responsible for muscle movement and brain functions. Results show that alpha-toxins from different species of *Conus* show selectivity towards either muscle or brain receptors. These toxins are useful tools for examining the molecular nature of diseases such as Alzheimer's disease, Parkinson's disease and epilepsy, in which the function of nicotinic receptors in the brain is known to be impaired.

Thus far, only a few species of *Conus* have been analysed for their novel toxins. With over twenty different toxins in each species, the fifty species of *Conus* on the reefs around Lizard Island provide a treasure trove of potential novel compounds.



The cone shell venom research team from the University of Melbourne

## RESEARCH AND EDUCATION

### Making it easy

As Directors of the Lizard Island Research Station, we take seriously the Station's reason for being: to facilitate research and education on the Great Barrier Reef. We strive to make it easy for scientists, students and leaders of educational groups to achieve the goals of their field trips. Merely providing access to the environment through the usual research station infrastructure (accommodation, laboratories, aquaria, boats, diving gear etc) is not enough, although it is a necessary prerequisite. 'Making it easy' involves consultation, planning and management at many levels.

On the broadest and most long-term scale, we are actively involved in government processes that affect the Station's operations.

- By providing input into science policy, we can ensure that the nation's leaders are aware of the scale and value of Australia's vast marine resources and of the pre-eminence of Australian scientists in this field. Increasing our understanding of coral reefs and their conservation is a goal that can be achieved through improved funding for research, education and infrastructure.
- By contributing to the resolution of management issues in the Great Barrier Reef Marine Park and in the Lizard Island National Park, we can assist in conserving the natural environment that is so important to the Research Station's users. Also, we can work with the managing agencies to streamline research permit arrangements which are widely acknowledged as unwieldy.
- By providing input into proposed diving and boating legislation, we attempt to maintain operational feasibility while achieving the highest possible safety standards. A legislative nightmare which will stifle marine science is a real possibility in the absence of effective lobbying from the marine science community.

Planning field trips is an important area in which we help to 'make it easy' for research station users.

- First-time users need detailed information on the available facilities, accessibility of possible research sites, permit requirements, operational regulations, provisioning arrangements, weather patterns and many other things. It can seem daunting, especially for researchers and educational groups coming from overseas. We go to considerable lengths to ensure that first-time users are well informed and that they are provided with everything they need to organise their trip.
- Repeat and regular users know what to expect and what they need to do to plan a trip. However,

we make things easier for them by reminding them well in advance them if dive medicals are due and to check that their permits are valid for the intended work. These are small things but they can make the difference between a successful trip and an awkward one.

- Virtually all visitors need to have food, equipment and permits on the island at the time they arrive. Before their trip, we provide all users with a food list from which they can select items, let them know exactly when the order must be with the suppliers, and when the food will arrive by barge at Lizard Island. We further assist overseas visitors by placing their food orders with the suppliers at the correct time. We also keep tabs on permits and consigned freight, and inform the visitor if any problems develop.

We do our best to 'make it easy' for users on a day-to-day basis at the Station, too.

- All staff are available virtually round the clock, 365 days a year. Far from resulting in frazzled staff, we find that most users respect this level of service and make calls on our time after hours only when necessary. Staff are always readily accessible during the working day.
- Maintenance of equipment has a high priority, and things can be relied upon to work or to be fixed as quickly as possible in the event of a breakdown.
- Access to the field is excellent, with convenient proximity of the dive shed to the boat moorings and sufficient boats to avoid the need for sharing between research teams.
- The Station's diving and boating regulations are as flexible as is consistent with safety considerations and legislation, and allow for field work to be conducted outside normal working hours when necessary.
- Most users find that working at the Lizard Island Research Station is enjoyable. The magnificent setting and excellent facilities contribute to this, but we believe the main factor is the way in which people interact.

The wide range of research projects carried out at the Station this year demonstrates just how much there is to learn about the coral reef ecosystem. The Lizard Island Research Station makes a significant contribution to this knowledge each year by making it easy for scientists to learn about coral reefs and for educators to pass on this knowledge.

*Anne Hoggett and Lyle Vail, Directors*

## Why Are Coral Reefs Colourful?

A team of scientists investigating the reason for colour on coral reefs has made numerous visits to the Station over the past four years. The team is led by Dr Justin Marshall (currently at the University of Queensland, formerly at the University of Sussex), Dr Tom Cronin (University of Maryland) and Professor Roy Caldwell (University of California, Berkeley).

Many reef animals appear to have well developed colour vision which is vastly superior to that of humans. The reason for this is not clear and the team of investigators has decided to investigate two marine groups to examine this problem; stomatopods (mantis shrimp) and fishes. Stomatopods were selected because they possess the world's most complex retina having 16 types of photoreceptors (12 for colour analysis compared to 3 in humans), colour filters and many polarisation receptors (humans have none). Fish were chosen because they too possess multiple photoreceptors, although not as many as stomatopods but again more than humans. Both of these groups often use dazzling body colour patterns for display, communication or camouflage.

The research is designed to understand colour communication amongst marine animals and how different visual systems coordinate this fascinating behaviour. This study is the first attempt to determine what marine animals really see when they look at food, rivals, and predators. Another challenge for the team is how to present the colourful world of marine animals to humans, with our vastly inferior visual system.



## DOCTORAL FELLOWSHIPS

Each year, a Lizard Island Doctoral Fellowship is awarded to a PhD candidate conducting significant long-term field studies in a scientific discipline relevant to the Great Barrier Reef. Tenable for up to three years, the Fellowship is worth up to \$6,000 per year. The Doctoral Fellowship program is fully funded by the Lizard Island Reef Research Foundation and is awarded by the Australian Museum. Applications close on or about 1 October each year. For further information about the Fellowship, contact the Research Station or see our web site: [www.austmus.gov.au/science/projects/lizard/lizfello.htm](http://www.austmus.gov.au/science/projects/lizard/lizfello.htm).

The 1997 Doctoral Fellowship was awarded jointly to Andrew Baker (University of Miami) and Phil Munday (James Cook University). Andrew used

### Diversity of coral symbionts

Single-celled plants known as zooxanthellae live symbiotically within coral polyps and provide nourishment to the polyps through photosynthesis. They are so critical to corals that their loss leads to 'bleaching' (loss of colour) and eventual death of the coral. Bleaching occurs in response to environmental stress, including high water temperature and increased UV radiation. Global warming and ozone depletion may thus have significant impacts on coral reefs.

Zooxanthellae found in stony corals on the Great Barrier Reef exhibit less genetic diversity than those found in Caribbean

corals, according to Andrew Baker (University of Miami, joint 1997 Doctoral Fellow). This is surprising since the Caribbean has only about 50 species of corals compared to about 400 species on the Great Barrier Reef. Andrew's work at Lizard Island has also shown that a single species of coral can host more than one species of zooxanthella, whose distributions are determined by the light levels they experience. This is similar to the situation found by Andrew and other workers in the Caribbean, and it is interesting because it suggests that the biology of the coral hosts can only be fully understood by appreciating the range of symbionts with which they interact. A recent paper in *Nature* by Andrew and co-workers links the pattern of zooxanthella diversity with patchiness in coral bleaching in the Caribbean.



Andrew Baker and assistant Cathie Page

the 1997 funds to make a single month-long trip to Lizard in April 1997. Phil's project commenced in 1997 and he will have Fellowship funds in 1998 with the opportunity for further funding in 1999.

Bryce Stewart (1996 Doctoral Fellow; James Cook University) completed field work in April 1997 for his project on the role of piscivorous (fish-eating) fishes on coral reefs. Most of the fish targeted by recreational and commercial fishers in the Great Barrier Reef are fish-eaters, but relatively little is known about the ecology of such species. For effective management of piscivorous fishes, information on the interaction between predator and prey species is required and Bryce's project has provided valuable data and conclusions.

Ilona Stobutzki (1995 Doctoral Fellow, James Cook University) completed her field work a year ahead of schedule in January 1996 and submitted her thesis in early 1997. Her groundbreaking work on the swimming and direction-finding abilities of pre-settlement reef fishes has attracted considerable publicity in the scientific and popular press. Ilona has shown that far from being inert particles at the mercy of water currents, the larvae of reef fishes are strong swimmers that can detect reefs well beyond the range of vision. This work has enormous implications for management of coral reefs and reef-based fisheries.

### Habitat specialised fishes

Many coral reef fishes have specialised habitat requirements: coral-gobies, for example, only live within the branches of particular kinds of coral. The availability of such habitats could help determine the distribution and abundance of these fish species. If suitable habitats are in short supply, different fish species that require similar habitats may have to compete for space. Whether or not competition for space occurs among coral reef fishes is one of the longest standing controversies in coral reef ecology.

To help resolve this controversy, Phil Munday (James Cook University, joint 1997 Doctoral Fellow) is studying a group of species of coral-gobies, because they are among the most habitat-specialised fishes on the Reef. He will investigate the influence of coral type, coral availability and competition between goby species on the settlement, growth and survivorship of coral-gobies.



Phil Munday

## MONITORING

An important role of the Research Station is to maintain long-term data sets of environmental and other parameters. The Station continued the following monitoring projects during the year.

### Weather

An automatic weather data logger was installed in December 1996 which records air temperature, wind speed and direction, rainfall, air pressure and humidity every hour. Manually collected records for daily rainfall go back to 1979 and daily temperature maxima and minima are available from 1989. It is intended to maintain the manual data collection program as a partial backup for the electronic system.

### Crown of thorns starfish

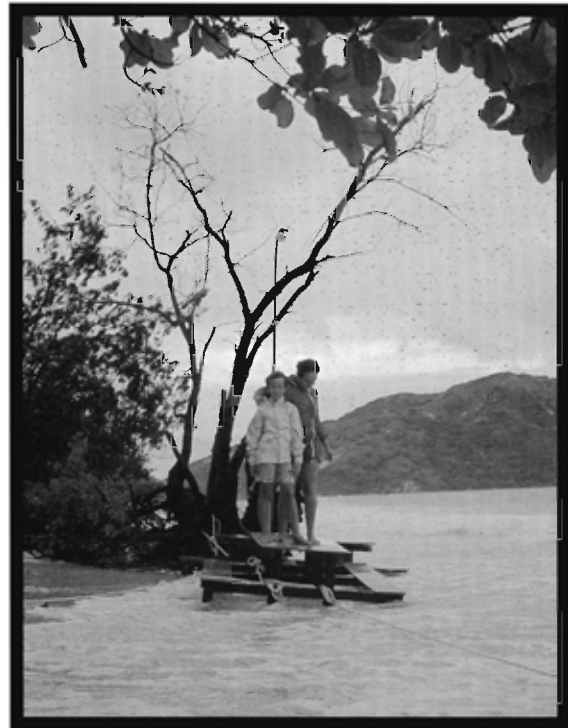
A log of the number of crown of thorns starfish (COTS) observed casually by Research Station divers has been maintained since October 1993, when starfish numbers were noticed to be on the increase. The log shows high and relatively stable numbers of COTS around Lizard Island and other nearby midshelf reefs over the past few years, but almost no COTS on the outer barrier reefs between Hicks Reef and Number 10 Ribbon Reef.

### Water quality

The Station has sampled a 40 nautical mile transect centred on Lizard Island each month since January 1993, under contract to the Great Barrier Reef Marine Park Authority. Data collected are wind direction and speed, swell direction and height, cloud cover, water temperature profiles, salinity profiles and surface-water chlorophyll concentrations. Four sampling stations are close to Lizard Island and the other four span much of the continental shelf. This transect forms part of the Authority's Reef-wide water quality monitoring program.

### Potato cod

With the co-operation of Lizard Island Charters, monitoring of an internationally famous dive site on the outer reef near Lizard Island has continued this year. The Cod Hole is renowned for its resident population of large potato cod that tolerate the approach of divers. Since April 1992 when monitoring commenced, the number of potato cod at the Cod Hole has declined



Cyclone Justin approached Lizard Island twice in March 1997. Anne Hoggett and Alex Vail inspect the rearranged beach from the picnic table.

significantly and the frequency of injuries visible on the fish appears to be increasing. In addition to the number and condition of cod, the monitoring program collects data on human usage of the Cod Hole, weather data, information on other fish species and instances of obvious environmental damage. We thank Julie Ryan for collecting data during her regular and frequent visits to the Cod Hole this year.



Injuries to potato cod are becoming increasingly frequent at the Cod Hole. Photo: Dave Dickson

## DONATIONS IN 1996/97 - THANK YOU!

We warmly thank the following donors who have generously supported the Station through the Lizard Island Reef Research Foundation in 1996/97. This year, donations have enabled us to construct the Warman House, to continue the program of regular replacement of outboard motors, and to continue to support promising young scientists through the Doctoral Fellowship program. Members contribute \$1,000 or more per year, Friends contribute up to \$1,000. Special donors to the staff housing project are indicated with an asterisk (\*).

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and many anonymous donors



## LIZARD ISLAND REEF RESEARCH FOUNDATION MEMBERS NEWS



Members' Dinner at the Australian Museum. Photo: Ken Coles

The Members' event of the year was a sell-out, with 111 guests attending a Rooftop dinner at the Australian Museum on 16 October 1996. This function provides a wonderful opportunity for interaction between members of the Lizard Island Reef Research Foundation and staff of the Research Station and of the Museum. Guest of honour and speaker at the dinner was the Federal Minister for the Environment and Leader of the Government in the Senate, Senator the Honourable Robert Hill. Professor Derek Anderson, Deputy Vice-Chancellor of the University of Sydney also spoke about the importance of coral reef research. Special thanks are due to Mr Ken Coles, Mrs Rowena Danziger and Mr Anders Ousback for organising the dinner, and to Mr Hill-Smith and Mr Mark Fesq for donating the wine.

There were two Members' prizes this year. A four night stay for two at the Lizard Island Lodge with business class air travel was won by Michael Dowe and Louise Nettleton, who plan to visit during July 1997. Chris and Katy Joscelyne won a four night cruise on the *Reef Endeavour* to Lizard Island, with business class air travel to Cairns. These excellent prizes were sponsored by Australian Resorts Ltd, Captain Cook Cruises and the Suncorp Group.

Ken Coles and Rowena Danziger were welcome guests at the Station in June 1997, when they toured the facility and were able to see the recently completed Warman House. Ken and Rowena are Special Donors to the staff housing project, and as the Foundation's chairman, Ken has worked hard to ensure the house could be built this year. Other members and their guests who visited the Station during the year included Anders Ousback with Dov Sokoni, and Margaret and Jenny Creer.



Ken Coles and Rowena Danziger inspect the Sir John Proud Aquarium with Anne Hoggett.

## INAUGURAL DONORS VISIT - 26 YEARS ON!

With remarkable foresight and generosity, Henry and Jacqueline Loomis of the USA provided the seed capital to start the Lizard Island Research Station in the early 1970s. Henry Loomis and the then Director of the Australian Museum, Dr Frank Talbot, together searched the northern Great Barrier Reef in 1971 for a suitable island on which to locate the proposed Research Station. Their choice of Lizard Island has proved to be an excellent one.

Henry and Jacqueline visited the Station for a few days in January 1997 for the first time since Henry's exploratory trip. They were frankly amazed at the substantial and well-used facility that exists today, and which would not be here at all without their vision and funding. They were particularly pleased to see that their giving had provided the impetus for many others to support coral reef research. During their visit, Henry and Jacqueline pledged additional funds



Henry and Jacqueline Loomis

to purchase a new boat and motor for the Station. The Loomises are patrons of the Lizard Island Reef Research Foundation. Loomis House, a favourite among researchers, and nearby Loomis Beach have long been named after Jacqueline and Henry in recognition of their timely and substantial support

### SUPPORT THE LIZARD ISLAND RESEARCH STATION

Become a Member or a Friend of the Lizard Island Reef Research Foundation.

I wish to become a Member (donations of \$1,000 or more)

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Title: \_\_\_\_\_ Name: \_\_\_\_\_

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I enclose a cheque for \$ \_\_\_\_\_ payable to the Lizard Island Reef Research Foundation

Please charge \$ \_\_\_\_\_ to my Mastercard / Visa / Bankcard

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Please tick this box if you wish your donation to remain anonymous

Please mail to:               The Secretary/ Treasurer  
Lizard Island Reef Research Foundation  
Australian Museum  
6 College Street  
SYDNEY NSW 2000

For further information, please contact the Directors of the Research Station at Lizard Island (07 4060-3977) or Gail McCarthy at the Australian Museum (02 9320-6110)

## DEVELOPMENTS

### Warman House constructed

The major capital development at the Station this year was construction of the Warman House, named in honour of Charles Warman, AM. Mr Warman is a Patron of the Foundation, has been a Trustee since the Foundation's inception in 1978, and he has given generously to the Station over many years.

The Warman House is built on the site of the Maintenance Officers' old house and will be occupied by the Directors. The Maintenance Officer and Accommodation Officer will occupy the Directors' old house, resulting in more space and better accommodation for all staff. When funds become available, the Directors' old house will also be demolished and replaced.

Construction of the Warman House commenced in April and was completed in June 1997. It has three bedrooms, kitchen, dining room and living room, two verandahs, high ceilings, timber floors, lots of built-in storage and an external bathroom with a composting toilet system. All indications are that it will be an excellent house for the tropical environment.

It would not have been possible to build the house this year without the support of the Lizard Island Reef Research Foundation. In particular, some Members of the Foundation enabled fast-tracking of this development by becoming Special Donors to the staff housing project, giving \$5,000 each per year for three years, and we acknowledge their contributions with thanks. Special donors this year are:

Lord and Lady Catto of Cairncatto  
Kenneth Coles and Rowena Danziger  
Graham and Glynn O'Niell  
Sir John Proud  
Raymond E. Purves Foundation  
Charles Warman  
Brian Wiesener  
and one anonymous donor



The Warman House

### Other developments

The final stage of the Sir John Proud Aquarium was completed in July 1996 with the installation of a second saltwater intake line and a large new saltwater pump. This stage was completed so long after the majority of the project because a permit for locating the intake line in the Great Barrier Reef Marine Park had to be negotiated, and extremely low tides were required for the installation. However, it is an integral part of the new system and its purpose is to abolish water supply problems by duplicating critical parts of the system. Heavy usage of the Sir John Proud Aquarium over summer put the system to the test, and it passed easily.

An automatic weather logging device was installed at the Station in December 1996. It records air temperature, wind speed and direction, rainfall, air pressure and humidity. The data are available to researchers as needed.

The Station's need for additional stereomicroscopes and light sources was partially met with the generous donation of an Olympus stereomicroscope by Faulding Ltd, the distributor of this brand in Australia. Mr Zoli Florian of James Cook University was instrumental in securing the donation and we thank both he and Mr Brendan Nicholls of Faulding for their support.

The oldest visitor house at the Station, Talbot House, was revamped this year. The old bathroom has been converted into a store-room, which means there is much more space in the dining area. A new external bathroom with a composting toilet system has been built. Most light fittings were replaced, the electrical wiring was improved, and the interior of the house was painted. All visitor houses now have composting toilets and the only pit toilet remaining on the Station is at the Directors' old house.

There are now four telephone lines servicing the Station. One is the main line for all incoming calls, both phone and fax: it's new 8-digit number is (07) 4060-3977. A Telstra cardphone replaced the old coin-phone this year on another of the lines. The third line is used for the Station's e-mail connection with it's node at the Australian Museum, and the last is waiting for the day when there is sufficient bandwidth to access the internet through a commercial service provider. When this happens, e-mail facilities for researchers will be made available.

## FOR THE RECORD ...

### Staff

The Station's full-time staff of four people was unchanged for yet another year. Lyle Vail and Anne Hoggett are the Directors, Lance Pearce is the Maintenance Officer and Marianne Pearce is the Accommodation Officer. Bob and Tania Lamb filled in while Lance and Marianne were on leave in May and June 1997. Liri Latimore was Alex Vail's home tutor in 1996, and Heather Read filled the position in 1997.

### Usage

Usage of the Station was slightly lower this year than in any of the past three years. Researchers and educational groups spent 3,343 user days at the Station during 1996/97, compared with last year's record high of 4,477 user days. Total usage was also down, with 4,458 user days this year, compared with 5,074 last year. Volunteers, official guests of the Station (including builders), and family accompanying researchers are not included in the research and educational category but they are included in total usage.

### Diving

Due to lower research usage this year, diving activity was reduced in comparison with previous years. Only 3,634 dives, representing 4,238 person hours underwater, were logged this year compared to 4,842 dives last year. Most diving is done in very shallow water at Lizard Island: 28% of this year's dives were to less than 5 m, 55% were between 6 and 10 m, 10% were from 11 to 15 m and the remaining 7% were between 16 and 30 m.

### Tours

Tours of the Station continued to be conducted this year on Mondays and Fridays between 9.30 and 11.00 am for island visitors including Lodge guests, campers and yachties. During tour times, a staff member is available to discuss the Station's work and current research projects, and to answer questions. At other times, visitors are welcome to call into the Research Station and view the Sir John Proud Aquarium and the verandah display.

### Bench fees and other research costs

Visiting researchers are charged a bench fee that covers self-catering shared accommodation, use of a small boat, most laboratory and aquarium facilities, and scuba tanks and air fills to qualified divers. The fee is subsidised by the Australian Museum Trust. For visits longer than 28 consecutive days, a 10% discount applies to the whole period.

In 1996/97, the bench fee was \$75 per day for the principal scientist (non-student projects) and \$65 per day for each assistant. For postgraduate student projects, the fee was \$29 per day for the student and \$25 per day for each assistant. Attractive rates are offered to groups of school and university students undertaking course work directed by teachers or lecturers from their own institutions. Bench fees have been held at these levels for many years, and they will remain the same in 1997/98. However, it is likely that there will be a small increase in 1998/99.

Other costs involved in conducting research at Lizard Island include airfares between Cairns and Lizard Island (currently \$390 return), barge freight for food and other supplies from Cairns (\$9 per grocery carton) and food (the supermarket bill plus a small cartage fee for delivery to the barge depot). Use of most laboratory and aquarium facilities is included in the bench fee, but an extra charge is made for use of any equipment that requires a larger-than-usual generator to be run. This includes the freeze-dryer, the aquarium room air conditioner, the large seawater filter and any other powerful equipment brought by researchers. Use of a small boat is included in the bench fee, but if a larger boat is needed, the additional fuel cost is recouped on a distance basis and it may be necessary to hire a boat driver at \$45 per hour. High quality snorkelling gear and a small number of regs and BCDs are available for hire at reasonable rates.



Use of a small boat is included in the bench fee for competent and qualified users.

## Volunteer program

The Station's volunteer program offers free accommodation in exchange for four hours manual work per day. The work is usually maintenance, not research, but many volunteers are recently-qualified biologists keen to experience the coral reef environment and to mix with researchers. Only two volunteers are accepted at any one time, and opportunities are greatest during the Australian winter. Contact the Station for more details about the volunteer program.

## Sssshhhhhh .....

Generator noise has long been a problem at nearby houses. This year, the last of the old air-cooled generators was replaced with a water-cooled one of similar size (27 kVA). All three of the Station's generators are now water-cooled, which means they can be enclosed and thus quietened.

The 60 kVA generator, purchased about two years ago, is housed in an integral sound-attenuating box. While this is still audible from some houses due to its large engine size, it is usually run only while scuba tanks are being filled so it doesn't present much of a problem. The two smaller generators (27 and 15 kVA) are located in the old generator shed which has now been fully enclosed and insulated, with the engines being aspirated and vented through sound-attenuating baffles. The reduction in sound level is remarkable.

## RESEARCH PROJECTS AND PARTICIPANTS

The following research projects were carried out during the year. Postgraduate student project leaders are indicated with an asterisk (\*).

### "Eye on the Reef" monitoring

Benjamin Kahn (Port Douglas), Tony Hill, Gwen Higgins, Leon Pasternak, Susan Pasternak, Phil Sharratt, Liz Sharratt, Ian Clare, Loris Clare and Susan Parker (Sydney) (September 1996)

### Fine sediment transport on coral reef flats

Dr Eric Wolanski (Australian Institute of Marine Science) assisted by Isabella Louw and Nichol Louw, and accompanied by Terri, Phillip and Tim Wolanski, Lloyd and Nichola (Kiliki) Louw (December 1996).

### Zooxanthella diversity in scleractinian corals

\*Andrew Baker (University of Miami, USA) assisted by Cathie Page (March/ April 1997)

### Re-collection of sponges and ascidians for marine natural products research

Dr John Hooper (Queensland Museum, Brisbane) assisted by Dr Sue Paton (January 1997)

### Origin and evolution of Porifera

\*Allen Collins (University of California Berkeley, USA) (October 1996)

### Large-scale recruitment patterns in corals

Dr Terry Hughes (James Cook University, Townsville) assisted by Liz and Brett Dinsdale (October 1996); by Andrew Baird, Mary Jo Boyle, Dr Natalie Moltschaniwskyj and Cameron Murchie (November 1996); by Liz and Brett Dinsdale (accompanied by Jenny and Emma Dinsdale; December 1996) and by Andrew Baird, John McKinlay and Dr Natalie Moltschaniwskyj (January 1997).

### Coral ecology

Dr Terry Hughes (James Cook University, Townsville) assisted by Dr Jim Bence and Mary Jo Boyle, and accompanied by Sue and Sarah Bence, Connor, Paula, Brenda and Paddy Hughes (July 1996)

**Coral spawning studies: sperm activation, larval rearing and settlement.**

Dr Andrew Heyward, Dr Andrew Negri & Dr Dan Ryan (Australian Institute of Marine Science, Dampier and Townsville), Dr Bob Seamarck (CRC for Advanced Reproductive Technologies), assisted by Polly O'Neill (November/ December 1996)

**Coral skeletons as monitors of sea surface temperature**

Dr Linda Ayliffe (Australian National University, Canberra) assisted by David Awwiller (November/ December 1996)

**Coral reef restoration**

\*Rohan Pratt (James Cook University, Townsville) assisted by Mary Wakeford and Nahora Galvis (July/ August 1996); by Cathy King and Geoffrey Lun (October/ November 1996); and by Brian Dance (April 1997)

**Parasites and non-indigenous species at Lizard Island**

Dr Greg Ruiz (Smithsonian Environmental Research Center, USA) accompanied by Cathy Lundmark and Trevor Ruiz (April 1997)

**Comparison of fish parasites between Heron Island and Lizard Island**

Dr Tom Cribb (University of Queensland, Brisbane), Dr Rob Adlard (Queensland Museum, Brisbane) and Dr Rod Bray (British Museum of Natural History) (April/ May 1997)

**Gyrodactylidae (Monogenea) of the Great Barrier Reef**

\*Ingo Ernst (University of Queensland, Brisbane) assisted by Mal Bryant (May/ June 1997)

**Neurotoxins of *Conus* as therapeutic agents**

Dr Bruce Livett, Dr John Down, Dr David Satchell, Kirsty Rolls, Lydia Lye, Eva Birgenson, Natalie Braxton (University of Melbourne) assisted by Max Rolls, Dr Tony Klein and Suzanne Klein (May/ June 1997)

**Bioactive molecules from marine molluscs**

Dr Denise Adams, Trudy Bond, Marion Loughnan and Bronwyn Garnham (Centre for Drug Design and Development, University of Queensland) (October 1996)

**Phylogenetic systematics of cowries and their evolutionary ecology**

\*Chris Meyer (University of California Berkeley, USA) (October 1996)

**Taxonomy of Pacific leptognathiid crustaceans**

\*Kim Larsen (Australian Museum, Sydney) (March/ April 1997)

**Gnathostomulida and other interstitial sand fauna**

Dr Wolfgang Sterrer (Bermuda Natural History Museum) assisted by Susan Young (August/ September 1996)

**Soft bottom invertebrate communities and the influence of fish foraging**

\*Gabriel Codina (James Cook University, Townsville) assisted by Renae Partridge (February 1997)

**Reproductive potential of crown-of-thorns starfish and factors regulating its variations**

Dr Tenshi Ayukai (Australian Institute of Marine Science, Townsville) (December 1996) and assisted by Cassie Ryan (August 1996)

**Local control strategies for crown-of-thorns starfish**

David Fisk (Reef Research and Information Services, Lismore) assisted by Mary Portefaix (August 1996)

**Local control strategies and movements of adult crown-of-thorns starfish**

Dr Lyle Vail and Dr Anne Hoggett (Lizard Island Research Station) assisted by Bob Lamb, Marianne Pearce and Lance Pearce (June/ July 1996)

**Chronic damage to corals by crown-of-thorns starfish**

\*Morgan Pratchett (James Cook University, Townsville) assisted by Kerry Neil and David Pratchett (October 1996); by Stuart Watson (December 1996); by Matthew Gordon and Melissa Schulz (February/ March 1997); and by David Pratchett and Shaun Wilson (June 1997)

**Nutrient cycling by holothurians**

\*Sven Uthicke (Australian Institute of Marine Science, Townsville) assisted by Dr Britta Schaffelke (June 1997)

**Colour, colour communication, vision and eye movements on coral reefs**

Dr Justin Marshall and Dr Jack Pettigrew assisted by Kerstin Fritsches (Vision, Touch and Hearing Research Centre, University of Queensland); Dr Tom Cronin and Chuan-Chin Chiao (University of Maryland Baltimore, USA) (October 1996)

**Larval fish behaviour**

Dr Jeff Leis (Australian Museum, Sydney) assisted by Brooke Carson Ewart, Mike Emslie, Amanda Hay and Ryan Kelly (October to December 1996).

**Trophic diversification and the evolution of reef fishes**

Dr David Bellwood (James Cook University, Townsville), Dr L. Sorbini (Museo Civico di Storia Naturale di Verona, Italy) and Dr W. Landini (Italy), assisted by Michael Marnane and accompanied by family members (August 1996)

**Ecology of herbivorous fishes**

Prof. Howard Choat (James Cook University, Townsville) assisted by Will Robbins and Linda Flores (August/ September 1996); and by Will Robbins, David Crossman and Linda Flores (December 1996).

**Growth rates of reef fishes**

Prof. Howard Choat (James Cook University, Townsville) assisted by Will Robbins (February 1997)

**Interaction of hormones and reproductive behaviour in *Acanthochromis polyacanthus***

Prof. Ned Pankhurst (University of Tasmania, Launceston) assisted by Polly Butler (July 1996); and by Carolyn Barnett, Polly Butler and Dr Tish Pankhurst (October/ November 1996)

**Batesian mimicry in reef fishes**

Dr Julian Caley (James Cook University, Townsville) and Dr Dolph Schluter (Canada), assisted by Leonie Valentine and accompanied by Andrea and Maggie Schluter (February/ March 1997)

**Life history plasticity in tropical reef fishes**

Dr Julian Caley and Dr Geoff Jones (James Cook University, Townsville) assisted by Vicki Johnson, Srisakul Piyomvaragorn and Stephanie Slade (February 1997); and by Kate Buckley and Lynne Van Herwerden (June 1997)

**Preliminary survey for telemetry studies on marine organisms**

Dr George Jackson and Dr Dirk Zeller (James Cook University, Townsville), Dr Ron O'Dor (Dalhousie University, Canada) and Dr Peter Doyle (University of Aberdeen, Scotland) (August 1996)

**Quantification of flux rates of adult fishes across the boundaries of fisheries reserves - telemetry**

Dr Garry Russ and Dr Dirk Zeller (James Cook University, Townsville) assisted by Sarah Omundsen and Glen Ewels (April/ May 1997)

**Habitat selection in rare fish species**

Dr Geoff Jones (James Cook University, Townsville) assisted by Stephanie Slade, Srisakul Piyomvaragorn and Vicki Johnson (February 1997)

**Growth, condition at settlement, effects of hormones on development, and hormone changes during metamorphosis of larval and juvenile fishes**

Dr Mark McCormick (James Cook University, Townsville) assisted by Gabriel Codina and Renae Partridge (November/December 1996)

**Effects of line fishing - baseline visual surveys**

Dr Tony Ayling (Sea Research, Daintree) assisted by Dr Avril Ayling, Warren Nott and Chris Ryan, and accompanied by Bliss and Xenica Ayling (September 1996)

**Capture efficiency of light traps**

Dr Mark Meekan (Australian Institute of Marine Science, Townsville) and \*Lessie White (US student) (December 1996)

**Quantification of flux rates of adult fishes across the boundaries of fisheries reserves - trapping**

\*Charles Hatcher (James Cook University, Townsville) assisted by Dr Garry Russ, Sarah Omundsen and Glen Ewels (April 1997)

**Demography of lethrinid and lutjanid fishes in the lagoon**

\*Vincent Hilomen (James Cook University) assisted by Charles Hatcher and accompanied by Aaron, Judith and Thea Hilomen (July/ August 1996)

### **Ecology of anemonefishes**

\*Michael Arvedlund (James Cook University, Townsville) (March/ April 1997)

### **Piscivory in coral reef fishes**

\*Bryce Stewart (James Cook University, Townsville) assisted by Nick Gust (August 1996); by Justin Chidlow, Mike Emslie and Nick Gust (October/ November 1996); by Jo Beukers (February/ March 1997); and by Ruth Adams (April 1997)

### **Population ecology of habitat specialised fishes**

\*Phil Munday (James Cook University, Townsville) assisted by Janelle Eagle, Rob Sirocco and Shaun Wilson (November/ December 1996); and by Shaun Wilson (March 1997)

### **Morphological and colour pattern changes in juvenile parrotfishes**

\*Anne Crook (James Cook University, Townsville) assisted by Jess Morgan (November 1996) and by Doug Maskell (December 1996)

### **Development of the digestive system in parrotfishes**

\*Li-Shu Chen (James Cook University, Townsville) assisted by Will Robbins and Linda Flores (August/ September 1996); and by Jake Kritzer and John Ackerman (November / December 1996)

### **Rarity in coral reef fish communities**

\*Peter Nangle (James Cook University, Townsville) assisted by Mike Emslie and Maya Srinivasan (October 1996); by Roisin O'Reilly (December 1996); and by Jens Knauer (January 1997)

### **Fish ecology** (Honours project)

\*Maya Srinivasan (James Cook University, Townsville) assisted by Stephanie Slade (February 1997); and by Brandt Foster (April 1997)

### **Fish ecology** (Honours project)

\*Aurelie Morriseau (James Cook University, Townsville) assisted by Dr Geoff Jones (April 1997)

### **Fish ecology** (Honours project)

\*Janelle Eagle (James Cook University, Townsville) (June 1997) assisted by Srisakul Pironvaragorn (February 1997); and by Michael Marnane (April 1997)

### **Fish ecology** (Honours project)

\*Line Bay (James Cook University, Townsville) assisted by Vicki Johnson (February 1997)

### **Factors influencing sex change in parrotfishes**

\*Nick Gust (James Cook University, Townsville) assisted by Mark Thomas and David Brown (November 1996); by Stuart Watson (February 1997); and by Juliet Corley and Bryce Miller (April 1997)

### **Maternal influences on larval survivorship in reef fishes**

Dr Brigid Kerrigan (James Cook University, Townsville) assisted by Vanessa Craig and Janelle Eagle (June 1997)

### **Pollen flow and fertility in populations of *Pemphis acidula*, a distylous species**

\*Gregory Mahy and Prof. Jacques de Sloover (Catholic University of Louvain, Belgium) (January/ February 1997)

### **Anthropogenic impacts on seabirds (transfer to Rocky Islets study site)**

Dr Emma Gyuris (James Cook University, Townsville) assisted by Dr Barry Goldman (accompanied by Ayla Goldman), Adam Felton and Emily Bolitho (December 1996); and by Adam Felton, Jasmine Foxlee, Alessandra M. and Bill Smith (January 1997)

### **Television documentary filming**

Dr Pavel Bezouska, Dr Zbynek Fiala and Lumir Krouzecky (Czech Television) (January 1997)

### **Management of Lizard Island National Park**

Ross Brown (Department of Environment, Cairns) (January 1997)



## GROUP VISITS

- Students from Ascham School, Sydney; Lisa Adams, Sarah Alderson, Nicky Armstrong, Josephine Chau, Amy Colquhoun, Alex Evans, Katie Graham, Amy Gray, Sheila Jayader, Jessica Johns, Charlotte Lemech, Nicky Willcocks and Sascha Yim, led by Jane and Jol Valentine, Jill and Peter Lumsdaine and Helen Warren and accompanied by Ben and Tess Lumsdaine (July 1996)
- Members of The Australian Museum Society, Sydney: Jan Burke, Peter Burke, Melanie Bruce, Nicholas Bruce, Warwick Bruce, Felicity Carter, Heather Edgely, Fred Finlay Jones, Kate Finlay Jones, David Foster, Margaret Foster, Julie Jenkins, Leona Geeves, Roslyn Newton and Robyn Sym, led by Dr Penny Berents, Peter Berents and Anna Murray and accompanied by Natalie Berents (March 1997)
- Under the auspices of the School for International Training, Cairns, students from various US universities: Kyle Apigian, Michael Burke, Amy Cameron, Amanda Cote, Karen de Angelis, Beth Delisle, Alison Drew, Beth Gattin, Curt Gervich, Kristen Greco, Ann Gutierrez, Mirei Isaka, Lynn McHugh, Sarah Nichols, Laura Perry, Luke Reasser, Tara Schroeder, Amanda Stason, Ron Sutherland, Jen Tsao, Marian Wampler and Carrie Zimpritch, led by Dr Andrew Lewis, Laura Brennan and Peter Brennan and accompanied by Danni Ceccarelli and Tai Lewis (March / April 1997)
- Students from University of Guelph, Canada: Anita Budiman, Cole Burton, Kelly Cavanagh, Alison Derry, Sarah Filsinger, Elizabeth Godwin, Craig Hyndman, Jennie Knopp, Kristin Macey, Roland Planeta, Colleen Prince, Meaghan Rachich, Miranda Robinson, Tracey Skagsfield, Sarah Slater, Arthur Whiting and Judith Wilson; led by Prof. Paul Hebert, Prof Jim Ballantyne, Dr Chris Wilson and Liz Straszynski (May 1997)

## OTHER VISITORS

Inaugural donors Henry and Jacqueline Loomis visited the Station for a few days in January 1997, accompanied by David and Lisa Williams, Charlie Williams, Dale and Tammy Tuttle, and Sue Wood.

The following people stayed at the Research

Station either as supporters or as future researchers or group leaders:

- Brian Wingett and Marti Jane Anderson (Sydney)
- Prof. Hartmut Michel (Max Planck Institute, Germany)
- Dr Lane McDonald (Miracosta College, USA) and Dr Tim Herrlinger (University of California at Davis, USA) accompanied by family members
- Erik, Karen and Peter Rasmussen (USA)

The building team for construction of the Warman House was on the island from April to June 1997 and included: Geoff Salvestro (contractor), Neil Taylor, Matthew Evans, David Peard, Jason Stehn, James Robb, Jamie McLean Tucket, Kerry McCarty, Tom Long, Terry Lowcock, Brian Saddler, Garry, Tom, John, Shane, Troy and one other (April to June 1997)

## VOLUNTEERS

Our heartfelt thanks to the following volunteers who contributed to the Station's maintenance and operation during the year.

Felicity Bennett  
Kirsten Bodtker  
Rosie Bomford  
Geoff Brennan  
Jordana Cohen  
Rachelle Cohen  
Jannine Cowan  
Lee-Anne Elms  
Anda Fellows  
Michel Grasyan  
Nick Heath  
Alicia Hidden  
David Hidden  
Teresa Hilomen  
Liz Holland  
Renie Hood  
Martin How  
Tammy Kawa  
Giselle Kolti  
Paul Maxwell  
Anne Mitchell  
Chris Mitchell  
Marian O'Dwyer  
Belinda Peters  
David Priddle  
Andrew Robinson  
Ralf Schön  
Michael Stahmann  
Chiqui Totañes  
Soren

## PUBLICATIONS

The following publications, based in whole or in part on work carried out at the Lizard Island Research Station, were received into the Station's collection during the year. There are now almost 500 reprints, theses and books in the collection. All visiting scientists are urged to send two copies of papers resulting from their work at the Station for inclusion.

- Baccaert, J., 1987. Distribution patterns and taxonomy of benthic foraminifera in the Lizard Island reef complex, northern Great Barrier Reef, Australia. Vol. 1: Distribution patterns, 146 pp + plates; Vol. 2: Taxonomy, 290 pp; Vol. 3: Atlas of foraminifera, 225 pp, 109 plates; Vol. 4: Annexe 1; Vol. 5: Annexes 2-5. PhD thesis, Université de Liege, Belgium.
- Bellwood, D.R., 1995. Direct estimate of bioerosion by two parrotfish species, *Chlorurus gibbus* and *C. sordidus*, on the Great Barrier Reef, Australia. *Marine Biology*, 121:419-429.
- Bellwood, D.R., 1995. Carbonate transport and within-reef patterns of bioerosion and sediment release by parrotfishes (family Scaridae) on the Great Barrier Reef. *Marine Ecology Progress Series*, 117:127-136.
- Bellwood, D.R., 1996. Production and reworking of sediment by parrotfishes (family Scaridae) on the Great Barrier Reef, Australia. *Marine Biology*, 125:795-800.
- Bellwood, D.R., 1996. The Eocene fishes of Monte Bolca: the earliest coral reef fish assemblage. *Coral Reefs*, 15:11-19.
- Bergbauer, M., R. Lange and J. Reitner, 1996. Characterization of organic matrix proteins enclosed in high Mg-calcite crystals of the coralline sponge *Spirastrella (Acanthochaetetes) wellsi*. In: "Global and Regional Controls on Biogenic Sedimentation. I. Reef Evolution. Research reports." (Eds. J. Reitner, F. Neuweiler and F. Gunkel.) *Göttinger Arbeiten zur Geologie und Palaeontologie*, Sb2:9-12.
- Beukers, J.S., 1996. The relative roles of recruitment and post-recruitment processes in the regulation of a coral reef damselfish population. PhD thesis, James Cook University, Townsville.
- Bray, R.A., T.H. Cribb and S.C. Barker, 1993. Hemirhamphidae (Digenea) from marine fishes of the Great Barrier Reef, Queensland, Australia. *Systematic Parasitology*, 25:37-62.
- Bray, R.A. and T.H. Cribb, 1996. *Preptetos* and *Neopreptetos* (Digenea: Lepocreadiidae) from Australian marine fishes. *Folia Parasitologica*, 43:209-226.
- Caley, M.J. and J. St John, 1996. Refuge availability structures assemblages of tropical reef fishes. *Journal of Animal Ecology*, 65:414-428.
- Child, C.A., 1990. Pycnogonida of the western Pacific Islands, VIII. Recent collections from islands of the Great Barrier Reef, Australia. *Proceedings of the Biological Society, Washington*, 103(2): 311-335.
- Choat, J.H. and L.M. Axe, 1996. Growth and longevity in acanthurid fishes; an analysis of otolith increments. *Marine Ecology Progress Series*, 134:15-26.
- Clements, K.D. and J.E. Randall, 1996. Four new records of surgeonfishes (Perciformes: Acanthuridae) from the Great Barrier Reef. *Memoirs of the Queensland Museum*, 39(2): 339-342.
- Clements, K.D., 1997. Fermentation and gastrointestinal microorganisms in fishes. In: "Gastrointestinal microbiology" Vol. 1: Gastrointestinal ecosystems and fermentations (eds. R.I. Mackie and B.A. White). Chapman and Hall, New York, pp. 156-198.
- Clements, K.D. and J.H. Choat, 1997. Comparison of herbivory in the closely-related marine fish genera *Girella* and *Kyphosus*. *Marine Biology*, 127: 579-586.
- Cumming, R.L., 1996. The corallivorous gastropods *Drupella cornus*, *D. fragum* and *D. rugosa*: ecology and impact on coral communities at Lizard Island, Great Barrier Reef. PhD thesis, James Cook University, Townsville.
- Davies, C.R., 1995. Patterns of movement of three species of coral reef fish on the Great Barrier Reef. PhD thesis, James Cook University, Qld.
- Fisk, D., L. Vail and A. Hoggett, 1997. Cost-effective small-scale crown-of-thorns starfish eradication procedures using acid injections. Pp 79-85 in 'The Great Barrier Reef, science, use and management: a national conference: proceedings', Great Barrier Reef Marine Park Authority, Townsville.
- Green, A.L., 1996. Spatial, temporal and ontogenetic patterns of habitat use by coral reef fishes (Family Labridae). *Marine Ecology Progress Series*, 133: 1-11.
- Hall, V.R. and T.P. Hughes, 1996. Reproductive strategies of modular organisms: comparative studies of reef-building corals. *Ecology*, 77:950-963.
- Karlson, R.H., T.P. Hughes and Susan R. Karlson, 1996. Density-dependent dynamics of soft coral aggregations: the significance of clonal growth and form. *Ecology*, 77(5):1592-1599.
- Kleeman, K., 1996. Coral communities at Lizard Island, Great Barrier Reef, Australia. *Beitraege zur Palaeontologie*, 21: 57-67.
- Leis, J.M., H.P.A. Sweatman and S.E. Reader, 1996. What the pelagic stages of coral reef fishes are doing out in blue water: daytime field observations of larval behavioural capabilities. *Marine and Freshwater Research*, 47:401-411.
- McKenzie, L.J., W.J. Lee Long and E.J. Bradshaw, 1997. Distribution of seagrasses in the Lizard Island Group - a reconnaissance survey, October 1995. CRC Reef Research Centre Technical Report No. 14. CRC Reef Research Centre, Townsville, 26 pp.
- Meischner, D. 1996. Sealevel oscillations and growth history of the Great Barrier Reef. In: Reitner, J., F. Neuweiler and F. Gunkel (eds.), "Global and regional controls on biogenic sedimentation. I. Reef Evolution." Research reports. - *Göttinger Arbeiten zur Geologie und Palaeontologie*, Sb2: 71-76.
- Müller, R.-W. B., 1995. Rezente Corallinaceae in Riff-Höhlen des Grossen Barriere-Riff Queensland, Australien. Diploma thesis, Institut für Geologie und Palaeontologie der Universität Stuttgart, Germany.
- Musso, B., 1994. Internal bioerosion of *in situ* living and dead corals on the Great Barrier Reef. PhD thesis, James Cook University, Townsville.
- Newman, L.J. and L.R.G. Cannon, 1996. *Bulaceros*, new genus, and *Tythosoceros*, new genus (Platyhelminthes: Polycladida) from the Great Barrier Reef, Australia, and Papua New Guinea. *The Raffles Bulletin of Zoology*, 44(2):479-492.
- Pratchett, M.S., 1995. Spatial distribution, abundance and diet selection of butterflyfish (Pisces: Chaetodontidae). Honours thesis, James Cook University, Townsville.
- Purcell, S.W., 1997. Quantifying organic content of material from coral reefs. Pp 61-66 in 'The Great Barrier Reef, science, use and management: a national conference: proceedings', Great Barrier Reef Marine Park Authority, Townsville.
- Reader, S.E., & J.M. Leis, 1996. Larval development in the lutjanid subfamily Caesioninae (Pisces): the genera *Caesio*, *Dipterygonotus* and *Pterocaesio*. *Bulletin of Marine Science*, 59:310-369.
- Reitner, J., G. Wörheide, V. Thiel and P. Gautret, 1996. Reef caves and cryptic habitats of Indo-Pacific reefs - distribution patterns of coralline sponges and microbialites. In: "Global and regional controls on biogenic sedimentation. I. Reef evolution. Research Reports." (Eds. J. Reitner, F. Neuweiler and F. Gunkel.) *Göttinger Arbeiten zur Geologie und Palaeontologie*, Sb2:91-100.
- Shashar, N., T.W. Cronin, G. Johnson and L.B. Wolff, 1995. Designs for submersible imaging polarimeters. In "Ultraviolet Radiation and Coral Reefs", Eds. D. Gulko and P.L. Jokiel. HIMB Technical Report 41.
- Stobutzki, I.C. and D.R. Bellwood, 1994. An analysis of the sustained swimming abilities of pre- and post-settlement coral reef fishes. *Journal of Experimental Marine Biology and Ecology*, 175:275-286.
- Stobutzki, I.C., 1997. Swimming abilities and orientation behaviour of pre-settlement coral reef fishes. PhD thesis, James Cook University, Townsville.
- Stump, R., 1996. An investigation to describe the population dynamics of *Acanthaster planci* (L.) around Lizard Island, Cairns Section, Great Barrier Reef Marine Park. CRC Reef Research Centre Technical report No. 10. CRC Reef Research Centre, Townsville, 56 pp.
- Thiel, V., J. Reitner and W. Michaelis, 1996. Biogeochemistry of modern Porifera and microbialites from Lizard Island (Great Barrier Reef, Australia) and fossil analogues. In: "Global and regional controls on biogenic sedimentation. I. Reef evolution. Research reports." (Eds. J. Reitner, F. Neuweiler and F. Gunkel.) *Göttinger Arbeiten zur Geologie und Palaeontologie*, Sb2: 129-132.
- Wilson, D.T., 1995. The formation and ultrastructure of otolith settlement marks within a number of reef fish species. Honours thesis, James Cook University, Qld.
- Whittington, I.D. and M.A. Horton, 1996. A revision of *Neobenedenia* Yamaguti, 1963 (*Monogenea*: Capsalidae) including a redescription of *N. melleni* (MacCallum, 1927) Yamaguti, 1963. *Journal of Natural History*, 30: 1113-1156.
- Wörheide, G., J. Reitner and P. Gautret, 1996. Biocalcification processes in three coralline sponges from the Lizard Island section (Great Barrier Reef, Australia): the stromatoporoid *Astrosciera*, the chaetetid *Spirastrella (Acanthochaetetes)* and the sphinctozoid *Vaceletia* (Demospongiae). In: "Global and regional controls on biogenic sedimentation. I. Reef evolution. Research Reports." (Eds. J. Reitner, F. Neuweiler and F. Gunkel.) *Göttinger Arbeiten zur Geologie und Palaeontologie*, Sb2:149-154.

The Research Station  
needs your help to continue its work.

Become a Member or Friend  
of the Lizard Island Reef Research Foundation

See page 8 or contact  
the Research Station for information.

