



Lizard Island Research Station

Newsletter 1997/98

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Research Foundation

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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. More than \$1.6 million has been raised by the Foundation since its inception in 1978.

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Lizard Island Research Station

PMB 37 Cairns QLD 4871 Australia

Tel: + 61 (0)7 4060-3977

Fax: + 61 (0)7 4060-3055

Email: lizard@amsg.austmus.gov.au

www.austmus.gov.au/science/projects/lizard/index.htm

Directors

Dr Anne Hoggett and Dr Lyle Vail

All photographs by Anne Hoggett or Lyle Vail unless otherwise indicated.

The Station is 25 years old...

This year marks the 25th anniversary of the Station's operations so it is an appropriate time to review its history and achievements. In the early 1970s, Dr Frank Talbot, then Director of the Australian Museum, was approached by US philanthropists Henry and Jacqueline Loomis who wanted to establish a new coral reef research facility. Because the southern end of the reef was already well served by research stations at Heron Island and One Tree Island, Frank's thoughts turned north. In 1971, he and Henry visited several likely islands in the area before selecting Lizard, where plans for establishment of an airstrip and fishing lodge were also in progress. A 25 year lease over part of the Lizard Island National Park was negotiated in 1973.

The Station's first Director was Steve Domm, who reported in 1974 that two temporary buildings had been constructed (an air-conditioned lab and a staff house), two generators had been installed, and that up to 6 visiting researchers could be accommodated in tents. Bench fees were \$30 per week per person! By mid-1975, a maintenance engineer had been appointed, two staff houses and the visitor's house now known as Talbot had been built, a temporary aquarium system was functioning, field equipment comprised four boats, two scuba compressors and 14 scuba tanks, the temporary lab was outfitted with microscopes and balances, and plans for a permanent laboratory block were being finalised. Researchers had started to make use of the facility, mostly for basic biological survey work. This rate of development was an amazing achievement considering the isolation and lack of communications facilities at the time. Steve resigned in November 1976 and was replaced as Director by Dr Barry Goldman. At about the same time, Dr Des Griffin became Director of the Australian Museum, beginning a long and fruitful association with the Research Station.

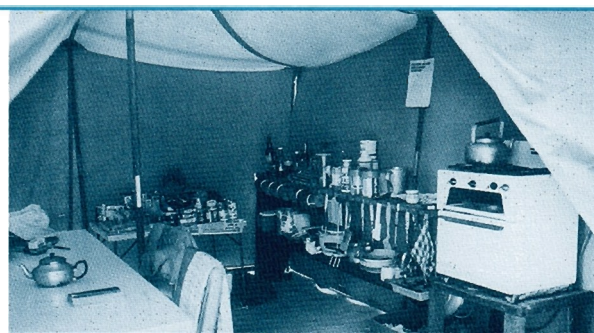
Under the direction of Barry and with the creative assistance of his then wife, Lois Wilson, the Station flourished over the next nine and a half years. The first permanent laboratory block was built in 1977 and the library collection was started.

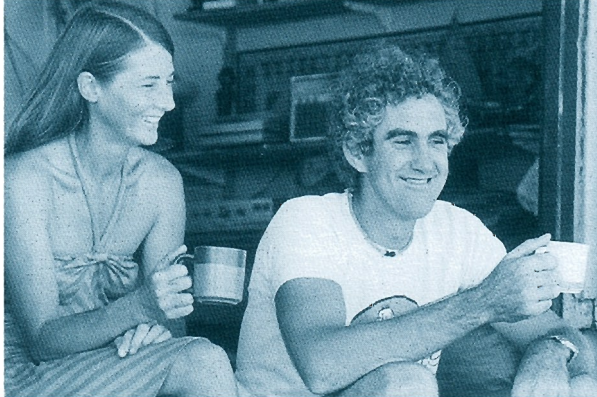
The original aquarium system, including an enclosed aquarium room, was built in 1978, as was the generator shed. In that year, a reliable source of groundwater was found so collection of rainwater in tanks was no longer necessary. An important landmark in the Station's history was the establishment in 1978 of the Lizard Island Reef Research Foundation with the late Sir John Proud as its committed and enthusiastic founding chairman. Over the ensuing twenty years, the Foundation has provided the funds that have enabled the Station to rise above the ordinary.

Laboratory and field equipment continued to increase in variety and sophistication throughout Lois and Barry's tenure. By 1979, a great boost to communications had occurred: outgoing telephone calls could be made through the Royal Flying Doctor Service by HF radio, although incoming messages were restricted to telegrams. Incoming radphone calls were possible by 1981 but communications remained awkward. The first regular barge service operated every two weeks from 1981, but only during the dry season.

The early eighties saw a period of major development. The tent era ended in 1982 when three new visitor houses were completed, now known as Suntory, Kirby and Loomis houses. The first annual Lizard Island Doctoral Fellowship was awarded in 1983 with funds provided by the Lizard Island Reef Research Foundation. Over the years, the Fellowship has increased in value from \$4,000 to \$6,000 per annum for three years. It continues to be one of the most valuable sources of funding for doctoral students on the Great Barrier Reef. Also in 1983, a 14 metre sailing catamaran *RV Sunbird* began operations from the Station as a research vessel capable of extended trips to remote locations and as a supply vessel. The block building that currently houses the office, library and dry laboratory was constructed in 1984, and the workshop was extended to provide a large undercover space in 1985. In April 1986, Barry and Lois resigned and were replaced by Dr Barbara Kojis and Dr Norman Quinn as Directors.

Cooking tent in the early eighties.
(Photographer unknown)





Lois Wilson and Dr Barry Goldman in the early eighties. (Photographer unknown)

The pace of development slowed during the late eighties. A telephone was installed in 1988 making communications much easier and several additions were made to the fleet of small boats. *RV Sunbird* was well used, conducting research along the entire Great Barrier Reef as well as in the Torres Strait and Papua New Guinea. In August 1990, Barb and Norm were replaced as Directors by Dr Lyle Vail and Dr Anne Hoggett.

The early nineties saw a period of consolidation, upgrading of existing facilities, and planning and fundraising for the next major stage of development. A decision was made not to pursue improving analytical facilities because of the cost and logistics of maintaining such equipment at Lizard Island. The Station's policy now is to provide basic equipment that enables researchers to process their samples to a stage suitable for transport to more sophisticated laboratory facilities.

The Raymond E. Purves Laboratory was constructed in 1992, providing spacious wet lab facilities for the first time at the Station. The *RV Sunbird* was sold in 1993 to concentrate resources on the Station itself. In 1995, the original aquarium system was replaced with the new Sir John Proud Aquarium. This important facility has three times the seawater capacity, occupies twice the area of the original system, and includes an area for the culture of algae and other microscopic life. The two largest visitor houses, Kirby and Suntory, were extended in 1995 with each gaining an extra bedroom, an enlarged kitchen and verandah, and two new bathrooms. Also in 1995, an airconditioned room was added to complete the Raymond E. Purves Laboratory. In 1997, the Warman House was built to replace one of the original staff houses. Between 1995 and 1997, the old pit toilets were phased out and replaced with excellent dry composting systems: only one pit toilet remains and this is scheduled for upgrading soon. The Station now has thirteen small boats and more than 50 scuba tanks.

Developments planned over the next ten years include replacement of the second staff house, replacement of the oldest visitor house (Talbot), extension of Loomis house, replacement of the original laboratory building, replacement of the original part of the workshop, construction of a large storage shed, and construction

of a visitors' centre comprising a library, seminar room, meeting room, shop and offices. Regular replacement of outboard motors, vehicles, generators and boats combined with diligent maintenance is the most cost-effective way of ensuring equipment that works, and this policy will be continued.

The Station's contributions to coral reef science may be inferred from the quantity and quality of publications produced by visiting researchers. A collection exists of 530 references to work done at the Station, but this is by no means complete. The majority is made up of peer-reviewed papers in international scientific journals, but it also includes postgraduate theses, books, book chapters and papers published in conference proceedings. The published record shows that the early years were dominated by descriptive work on the fauna, flora and physical environment. In the eighties, biological work expanded into areas such as functional morphology, reproductive cycles, population dynamics, feeding strategies and processes including nutrient cycling, bioerosion and cyclone disturbance. Two important lines of scientific enquiry began at Lizard in the early eighties: the significance of herbivory in the coral reef ecosystem and the role of the larval phase in the life cycle of reef fishes. Both lines of enquiry are still being followed today at Lizard Island and elsewhere, and have far-reaching implications for the management of coral reefs. In the late eighties and nineties, research extended further into topics such as sex change in fishes, aging of fish populations, recruitment of larvae into adult populations, parasitism, symbiotic associations, the effects of people on coral reefs, and the search for useful bioactive chemicals, to name just a few. Outside the marine field, the archaeology of Lizard Island was studied for the first time in the nineties, and geologists and terrestrial botanists have also made contributions.

Collectively, this work is piecing together a story about how coral reefs work. The story may never be fully told because each part that we learn leads to more questions, but it is always interesting and often surprising. The surface has just been scratched: what will be discovered in the next 25 years?

Anne Hoggett and Lyle Vail, Directors



Sleeping tent in the early eighties. (Photographer unknown)

Research & Education

Cleaning up

Cleaning is one of the most common behaviours on coral reefs. The pretty, blue and white banded cleaner wrasse is a coral reef fish that spends most of the daytime hours cleaning parasites from other fish. This is assumed to benefit both the cleaner and the client fish, yet we know very little about what drives this behaviour. The cleaner wrasse establishes a cleaning station then does a bobbing and gyrating dance to show that it is ready to begin cleaning. Fish living in the area make frequent visits to the cleaning station to be groomed. Client fish turn off their predatory instincts while being cleaned and allow the cleaner fish to remove parasites from all over their bodies, including inside the mouth and around the gill chambers. The benefit to the cleaner wrasse is clear: it gets a meal of parasites. However, the significance of cleaning behaviour to the client fish is not clear, although it has been suggested that the health of client fish will deteriorate in the absence of cleaners.

Dr Lexa Grutter, a former Lizard Island Doctoral Fellow and now at the University of Queensland, is conducting a series of field and aquarium experiments at Lizard Island to test whether client fish benefit from the attentions of cleaner wrasse. Lexa has demonstrated that particular parasites (gnathiid isopods), are the main food source of cleaner fish and that they eat them in large numbers (about 1,200 gnathiids per cleaner per day). She also found that the abundance of gnathiids on fish decreases between dawn and sunset, which is the time when cleaner fish are active. To test whether this decline in abundance was due to predation by cleaner fish, she placed caged fish on reefs with and without cleaner fish at sunset and sampled the fish the following dawn and sunset. At dawn, she found that gnathiid abundance did not differ between reefs with and without cleaner fish. However, by sunset, fish on reefs without cleaner fish had four times as many gnathiids as fish on reefs with cleaner fish. This suggests that cleaner fish predation may be so high it causes the daily decline in parasites observed on fish. However, little is known about the effects of different parasite loads on fish. Consequently, Lexa is now conducting an aquarium-based experiment at the Station to investigate whether client fish suffer decreased "health" when infected with different densities of gnathiid parasites.

Microscopic Life

The skeletons of single-celled animals known as forams (Order Foraminiferida) make up a large component of some beaches around Lizard Island. Forams are extremely diverse and their skeletons are often beautifully sculpted, but most are so small that a microscope is needed to appreciate them. Almost half the Earth's sedimentary rocks are composed of the calcareous skeletons of forams and these assemblages are used extensively by palaeontologists to date sedimentary strata.

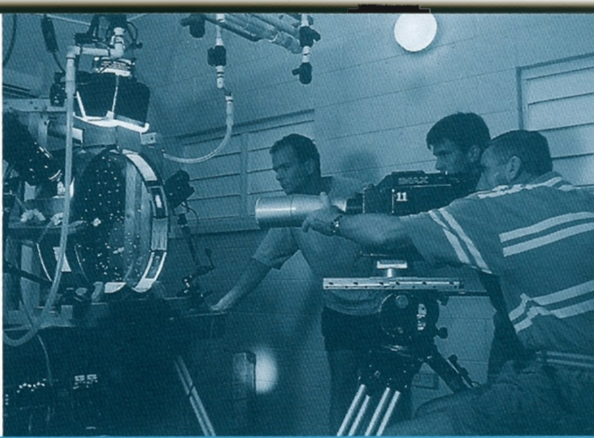
The rich and abundant foram fauna of Lizard Island attracted many foram specialists during the year. Dr Kate Darling from the University of Edinburgh and colleagues Dr Dick Kroon and Dr Chris Wade collected planktonic forams from around the island and from outside the nearby outer barrier reefs. Many species were "grown out" in the Station's culture room and samples were taken back to Scotland for DNA sequencing.

The researchers aim to determine the evolutionary relationships between species of forams, thus providing a base from which they can begin to build a global picture of foram populations.

A workshop on forams was held at the Station in July 1997. Led by Prof. John Lee of City College New York, the workshop was attended by 20 scientists from 7 countries - surprisingly, this did not include any scientists from Australia. A portion of each day was spent collecting forams from around the island with the remainder devoted to seminars and demonstrations concerning identification and biochemistry. Participants regarded the workshop as highly successful and the Station was pleased to be able to support such a dedicated and enthusiastic group of specialists.

Dr Kate Darling and Dr Dick Kroon used Condor Cat to collect planktonic forms.





The Image Quest team filming in IMAX format in the Sir John Proud Aquarium. (Photo: Image Quest)

On the big screen and small

An unprecedented number of film makers used the Station's facilities to make documentaries this year. Such activities are supported by the Station because it contributes to education about coral reefs, often reaching a very large audience.

Image Quest 3-D has been visiting the Station for many years to film marine life. This year Peter Parks and his team spent two months filming jellyfish and other planktonic animals in Imax format. This will be used in a feature film about sharks to be shown in Imax theatres worldwide: Image Quest's contribution will show the beginning of the food chain on which the shark ultimately depends. All filming was conducted in the Sir John Proud Aquarium. The ability to supply filtered seawater to his purpose built aquaria was a tremendous benefit to this work.

Four other teams also used the Station for making documentaries. Richard Smith of ABC TV visited twice during the year to obtain footage for a *Quantum* programme on the management of reef fisheries. Wild Visuals of Sydney is producing a documentary about weapons used by animals. While at Lizard, they concentrated on stomatopods, since the aggressive clubbing and spearing mechanisms possessed by this group of marine crustaceans is legendary. Klaus Toft of the ABC Natural History Unit made two visits to get underwater and terrestrial footage for a film on the climatic phenomenon, La Niña. Lastly, a Czech team made their second visit in two years for a series of TV shows highlighting conservation issues. Most of these groups timed their visits to coincide with those of particular researchers so that they could draw upon their expertise.

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 Lizard Island Doctoral Fellowship program is fully funded by the Lizard Island Reef Research Foundation and is awarded by the Australian Museum. Applications for the 1999 Doctoral Fellowship close on 1 October 1998. For further information about the Fellowship, see our web site.

The 1998 Doctoral Fellowship was awarded to Nick Gust of James Cook University for his project on factors influencing sex change in parrotfishes. Nick began his study in mid-1996 and is eligible for two years of Fellowship funding.

Continuing his work this year under the 1997 Doctoral Fellowship is Phil Munday, also of James Cook University. Phil's project is on the relationship between coral gobies and their habitats, and he will be eligible for another year of Fellowship funding in 1999.

Augmentative Grant

This year, funds were available to award the first Lizard Island Augmentative Grant to a highly commended applicant for the Doctoral Fellowship. This grant comprises a Student Voucher for 100 person days at the Station, worth \$2,200. It was awarded to Melany Puglisi of the University of Mississippi, USA, for her work on the chemical ecology of gorgonian corals. Melany will visit the Station early in 1999.



Doctoral Fellow Phil Munday at work in the Sir John Proud Aquarium.

Activities

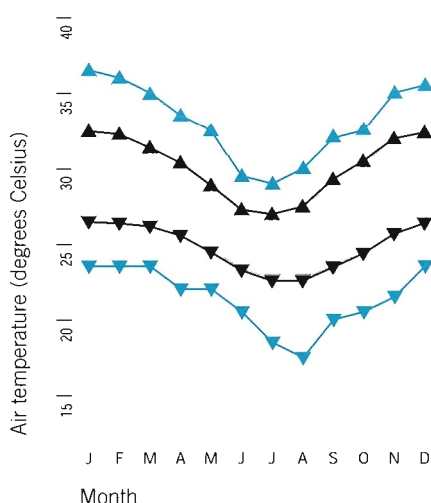
The Station frequently contributes to community and management-oriented issues in its sphere of interest. This year, we have been involved in production of the Cairns Area Plan of Management, management plans for the island national parks in the Lizard Island area, rezoning the Far Northern Section of the Great Barrier Reef Marine Park and debate about the ethics of conducting research in protected areas.

An important role of the Research Station is to maintain long-term data sets of environmental and other parameters. We do not monitor coral populations formally, but it is interesting to note that the major coral bleaching episode that impacted many areas of the Great Barrier Reef early in 1998 did not affect Lizard Island at all. A very small proportion of corals were observed to have bleached partially in about March 1998, but these recovered quickly.

The Station continued the following monitoring projects during the year.

Weather

Weather data (air temperature, wind speed and direction, rainfall and air pressure) has been logged automatically every hour since December 1996, although there are some gaps in the record due to technical problems. Manually collected records for daily rainfall go back to 1979 and daily air temperature maxima and minima are available from 1989.



Water quality

The Station has sampled a 40 nautical mile transect centred on Lizard Island each month from 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 are at least one nautical mile from the nearest reef. This transect forms part of the Authority's Reef-wide water quality monitoring program.

Crown of thorns starfish

A log of crown of thorns starfish (COTS) numbers has been kept at the Station since October 1993. This record cannot be used to calculate densities because it is based on casual observations of the number of COTS noticed by research divers as they conduct their other activities; the only estimate of area is whether or not the divers swam more than 50 metres. Despite these limitations, the log does provide many observations over a long period of time and appears to show trends. The log was started when COTS numbers had already started to rise; in 1992, COTS were rarely seen around Lizard at all.

Considering only those dives where observers swam more than 50m, from a mean of 0.8 per dive (s.d.=2.03, n=458) in the last three months of 1993, COTS numbers increased to 4.6 per dive (s.d.=7.4, n=1096) in 1996. The numbers then declined, reaching a mean of 1.8 COTS per dive (s.d.=3.06, n=325) in the first 7 months of 1998. A similar pattern is seen for the proportion of dives on which no COTS were seen. In 1993, no COTS were observed on 70% of dives on which the observers swam more than 50 m. This value decreased to a low of 31% in 1996, and increased to 49% in the first 7 months of 1998.

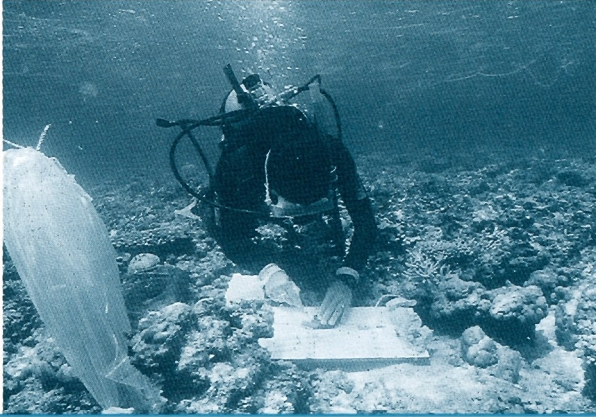
Dr Jeff Leis with a light trap used to catch larval fish.

Lizard Island Air Temperature

Based on daily maxima and minima, 1990 - 1997.

- ▲ Maximum daily maximum temperature
- ▲ Mean daily maximum temperature
- ▼ Mean daily minimum temperature
- ▼ Min daily minimum temperature





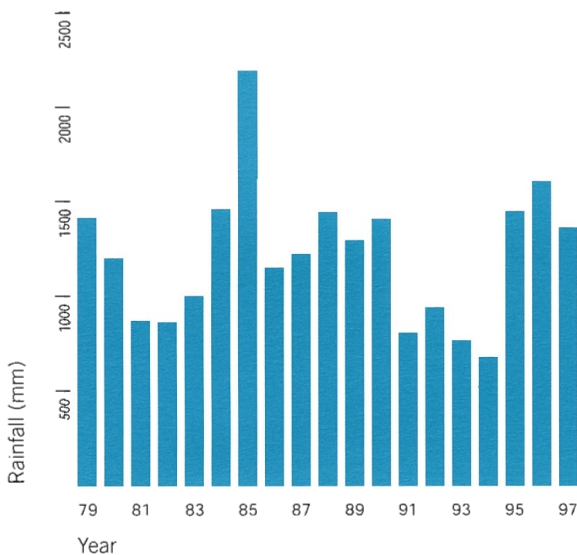
The reefs remain the Station's main 'laboratories'.
(Photo: Mark A. Johnson)

According to this data set, the recent outbreak seems to be waning at Lizard Island. However, small starfish are still common so it may be some years before COTS become rare once again at Lizard Island. Despite this, areas that have suffered severe coral mortality due to the COTS outbreak, such as Mermaid Cove, are now showing signs of recovery due to recolonisation by corals.

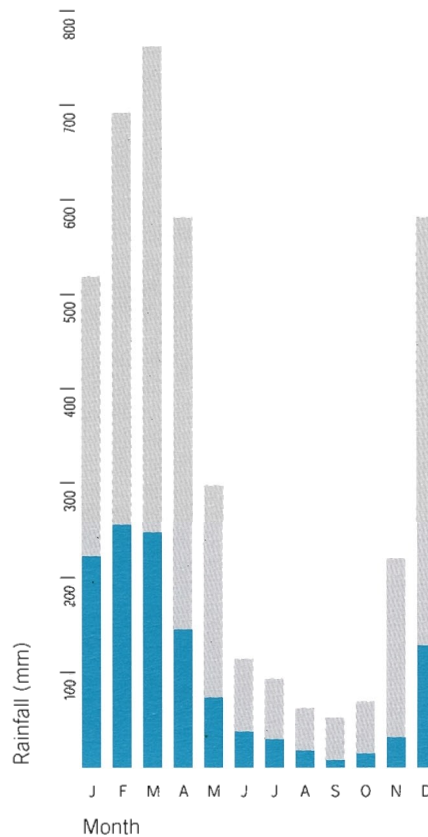
The outbreak of COTS in the vicinity of Lizard Island during the past five years appears to be common to all mid-shelf reefs in the area, but the outer reefs escaped this impact. During the five year period, only seven COTS were recorded during 386 dives on the outer barrier reefs stretching from Hicks Reef to Ribbon Reef Number 10. Of these, six were observed in 1994 and one in 1995. In addition, the Lizard Island Lodge recorded only one COTS during 523 visits to the Cod Hole on Ribbon Reef Number 10 between April 1992 and April 1997.

Potato cod

Monitoring of the potato cod population and human activities at the Cod Hole continued this year with the cooperation of Lizard Island Charters. The main attraction of this internationally-famous dive site is the resident potato cod population, but numbers of these fish have been decreasing since the survey began in 1992. In the first 12 months of the survey, a mean of 12 and a maximum of 26 potato cod were seen per dive, but by the year to April 1997, the mean was 6 and the maximum was 13 potato cod per dive. It is not known whether the fish have died, moved elsewhere, or are still present in the area but fewer are seen at any one time. Neither is it known whether the decline is being caused or exacerbated by the level of human usage of the area. A report has been submitted to the Great Barrier Reef Marine Park Authority.



Lizard Island Annual Rainfall 1979 - 1997



Lizard Island Monthly Rainfall 1979 - 1997

■ monthly maximum
■ monthly minimum

Donations in 1997/98 - thank you!

We warmly thank the following individuals and companies who have generously supported the Station through the Lizard Island Reef Research Foundation in 1997/98. This year, cash donations have enabled us to purchase items including a new 4.9m dinghy with 25hp motor, a set of thirty wetsuits for hire, some new furniture and whitegoods for the visitor houses, and an overhead projector and screen. They have also enabled the Station to continue the program of regular replacement of outboard motors and the 4WD vehicle, and to continue to support promising young scientists through the Doctoral Fellowship program and the inaugural Augmentative Grant. As well, some donated funds are being put aside towards construction of a second new house for staff. Special donors to the staff housing project are indicated with an asterisk (*) and gifts in kind are indicated with a plus sign (+).

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and many anonymous donors

Vale Sir John Proud

The founding chairman of the Lizard Island Reef Research Foundation died in October 1997 at the age of 90, but he will long be remembered at the Station. It was Sir John Proud's enthusiasm, generosity and persistence that saw the establishment and success of the Foundation that has contributed so greatly to the Station's development and to coral reef research. His interests and philanthropic activities extended well beyond coral reefs. A mining engineer by profession, he was an astute businessman with keen environmental interests who led an active and highly productive life. He famously survived an air crash in which five people died on Queensland's Lamington Plateau in 1937; after lying for nine days in dense rainforest with a badly broken leg, Sir John and one other survivor were finally rescued. He went on to develop one of Australia's major mining companies, establish various engineering research foundations, and to serve on the Australian Museum Trust and the University of Sydney Senate.

Sir John Proud lived to see his vision for the Station realised: it is recognised internationally as an excellent facility for coral reef research. The Station's seawater aquarium system was rebuilt in 1995 and was named in his honour. Sir John left a generous bequest to the Station and Lady Proud continues to support us.



Experiments are conducted in the John Proud Aquarium.
(Photo: Mark A. Johnson)

Foundation Members' News

The annual members' dinner was held at the Australian Museum's Rooftop on 5 November 1997 and the guest speaker was former NSW Premier Neville Wran. The function was a great success thanks to the interest of our Members in supporting it and to the efforts of the organisers, Ken Coles, Rowena Danziger and Anders Ousback. Wine for the dinner was generously donated by Universal Wines and Fesq & Company.

The Members' prizes this year were won by Dick and Pip Smith and the Takahashi family. Dick and Pip Smith chose to donate their prize back to the Foundation. The four night cruise for two to Lizard Island on the luxurious Reef Endeavour with airfares to Cairns was then raffled, resulting in additional funds for the Station. The raffle was won by Mr and Mrs Neil Balnaves. Two members of the Takahashi family will take up their prize of a four night stay at the five star Lizard Island Lodge with airfares from Sydney in November 1998. The Members' prizes were generously sponsored by Captain Cook Cruises and Australian Resorts.

Several Foundation members visited the Station this year. Chris and Katy Joscelyne made a brief visit in October 1997 from a cruise aboard Reef Endeavour. Charlie and Sandy Shuetrim were staying at the Lodge during the coral spawning period in November 1997. They made two night trips to a nearby reef with Station staff and researchers to observe the event.

Developments

As reported in last year's newsletter, the first of two new staff houses was completed in July 1997; the Warman House is occupied by the Directors. The next major development will be a new house for the maintenance staff and funds are being accumulated for this purpose. Other developments achieved this year include:

* A bunded area for storage of up to 32 fuel drums was constructed in October 1997. As well as protecting the environment from the effects of any leaks from fuel drums, the new raised slab makes handling drums much easier than in the past.

* The Apollo Sports Company made a second large donation of dive gear in April 1998 to replace items that had worn out from its original donation in 1991 and to expand the Station's range of gear. In addition, the Station purchased a set of thirty short wetsuits in February 1998. The Station now has sufficient gear of excellent quality to fully outfit up to twenty snorkellers and six scuba divers. It is only through the generous donation of this expensive equipment that the Station is able to hire it out at very reasonable rates to researchers and educational groups.

* A new video about the Station and its work was produced in May 1998. Using video footage generously provided by Richard Smith (ABC TV), Justin Peach (Image Quest) and David Hannan (Coral Sea Images), the video was written and produced by Anne Hoggett, narrated by Richard Smith, and edited by Lile Judickas (ABC TV) at the Gunpowder studios in Sydney. The video is used mainly to show to island visitors during twice-weekly tours of the Station, but it is also sent to intending educational groups and used for fundraising.

* In accordance with the Station's policy of replacing important items of equipment on a regular basis, the two year old Toyota Landcruiser was replaced in May 1998 and the two-yearly replacement program for the Station's twelve outboard motors proceeded as planned.

For the record...

Staff

Lyle Vail and Anne Hoggett continued as the Station's Directors this year, and were made permanent members of the Australian Museum staff in 1997 after more than seven years of contract work.

An exciting change in the Station's two full-time maintenance positions occurred this year. Lance and Marianne Pearce, who have occupied the positions since 1988, needed more time to care for their developing tropical fruit orchard near Innisfail but did not want to leave their jobs permanently. Bob and Tania Lamb, who have worked at the Station as relief maintenance staff over the past few years, were keen for longer term employment here. Each couple will now work for six months of each year, with the changeover occurring in April and October. Bob and Tania will be here during the winter period, and they started their first six months in April 1998. The Station will benefit from the wide range of expertise and interests brought by the two couples. Lance and Marianne were made permanent members of the Australian Museum staff in January 1998 after nearly 10 years of contract work. Bob and Tania are working on a two-year contract.

As volunteers, Renie Hood and Snow Amos very capably filled in while Lance and Marianne were on leave in January 1998. Heather Read was Alex Vail's home tutor in 1997, and Sophie Stojic filled the position in 1998.

Usage

Overall usage of the Station this year was at a similar level to 1996/97, but a change in the proportions of user groups is apparent. While usage by PhD level researchers was similar to previous years, the number of days occupied by postgraduate student researchers was very low. In contrast, the number of days occupied by educational groups was the greatest ever recorded. These facts are not unrelated. Fostering education about coral reefs is part of the Station's mission, but facilitating research remains its primary purpose. A larger number of educational groups was accepted this year because it was clear that the number of postgraduate students making regular use of the Station had fallen. The introduction of bench fee vouchers this year was aimed, in part, at attracting additional postgraduate students by providing substantial discounts for high volume users.

Diving

Due to lower research usage this year, especially by postgraduate students, diving activity was reduced compared to previous years. Only 2,753 dives, representing 2,997 person hours underwater, were logged this year. As usual, most diving took place in very shallow water: 30% of this year's dives were to 5m or less, 48% were between 6 and 10m, 17% were from 11 to 15m and the remaining 4% were between 16 and 30m.

Bench fees

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.

In 1997/98, 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. For visits longer than 28 consecutive days, a 10% discount applies to the whole period.

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 1998/99.

A new bench fee voucher system is being trialed from March to December 1998 in which substantial discounts are offered to high volume users. Researcher Vouchers cost \$3,250 for 50 person nights and Student Vouchers cost \$2,200 for 100 person nights. Vouchers must be used within a year of purchase and other conditions apply.

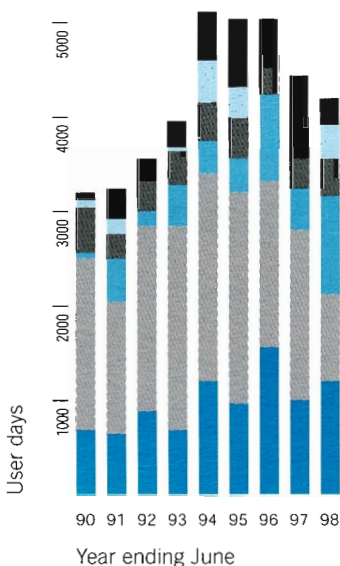
Other costs involved in conducting research at Lizard Island include airfares between Cairns and Lizard Island (currently \$403 return), barge freight for food and other supplies from Cairns (\$9 per grocery carton) and food (the supermarket bill plus a small cartage fee for delivery to the barge depot). Use of most laboratory and aquarium facilities is included in the bench fee although extra charges may be incurred for use of equipment that draws a lot of power or uses additional fuel. Use of a small boat is included in the bench fee to competent and qualified users, 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 \$50 per hour. Scuba tanks, air fills and weights are included in the bench fee for divers qualified according to the Station's regulations. High quality snorkelling gear, wetsuits, regulators and BCDs are available for hire at reasonable rates.

Volunteer program

The Station's volunteer program offers free accommodation in exchange for four hours manual work per day. The work is 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. Visit our web site for more details about the volunteer program.

Tours

Tours of the Station continued to be conducted on Monday and Friday mornings for island visitors. A special tour was given on 20 May 1998 for the Board of the CRC Reef Research Centre and its Acting Director, Dr Terry Done.



Lizard Island Research Station Usage

- Researchers
- Post Graduates
- Education Groups
- Volunteers
- Commercial
- Others

Research Projects and Participants

The following research projects were carried out during the year. Project leaders who are postgraduate students are indicated with an asterisk (*).

Water quality monitoring program (November 1997)

David Haynes and Michelle Devlin (Great Barrier Reef Marine Park Authority, Townsville)

Ammonium affinity of sediments at Lizard Island (July/August 1997)

Prof. John Bishop (University of Richmond, USA) assisted by Ariele Levin

Colour vision and colour communication on the Great Barrier Reef (August 1997)

Dr Justin Marshall (University of Queensland, Brisbane), Dr Tom Cronin and Chuan-Chin Chen* (University of Maryland at Baltimore, USA), Prof Roy Caldwell (University of California at Berkeley, USA) and Christine Harling* (University of Sussex, UK), accompanied by Roz, Elena and Ian Cronin and Michael Caldwell

Molecular analysis and ecology of the green alga *Halimeda* (April/May 1998)

Dr Llewellya Hillis (Smithsonian Tropical Research Institute, Panama) assisted by Dr Paul Colinvaux

Reproductive strategy in fragmented populations of *Pemphis acidula* (December 1997)

Prof. Jacques de Sloover (Catholic University of Louvain, Belgium) assisted by Dr Marc Dufrêne

Collection and culture of planktic and benthic foraminifers for DNA analysis (September 1997)

Dr Kate Darling, Dr Dick Kroon and Dr Chris Wade (University of Edinburgh, Scotland)

Molecular phylogeny of the protistan phylum Haplosporidia (July 1997)

Prof. Eugene Burreson (Virginia Institute of Marine Science, USA) assisted by Nancy Stokes and accompanied by Susan Burreson

Foraminiferan workshop - various projects on reef foraminifera (July 1997)

Prof. John Lee (City College of New York, USA) - Convenor

Dr Joan Bernhard (New York State Department of Health, Albany, USA)

Dr Sam Bowser (New York State Department of Health, Albany, USA)

Dr Maria Jose Correia (City College of New York, USA) accompanied by Sergio Correia

Dr Jean-Pierre Debenay (University of Angers, France)

Dr Ivo Duijnsteer (University of Utrecht, The Netherlands)

Dr Susan Goldstein (University of Georgia, Athens, USA)

Dr Pamela Hallock Muller (University of South Florida, USA)

Prof. Dr. Christoph Hemleben (Institute and Museum for Geology and Palaeontology, Tübingen, Germany)

Dr Johann Hohenegger (University of Vienna, Austria)

Prof Dr Lukas Hottinger (Museum of Natural History, Basel, Switzerland)

Dr Natasja Jannink (University of Utrecht, The Netherlands)

Dr Hiroshi Kitazato (Shizuoka University, Japan)

Dr Martin Langer (Institute and Museum for Geology and Palaeontology, Tübingen, Germany)

Dr Jere Lipps (University of California at Berkeley, USA)

Dr Jan Pawlowski (Museum of Natural History, Geneva, Switzerland)

Dr Beth Richardson (University of Georgia, Athens, USA)

Helen Talge (University of South Florida, USA)

Dr Masashi Tsuchiya (Shizuoka University, Japan)

Monostyloid (monogenean) parasites of elasmobranchs (June 1998)

Dr Leslie Chisolm and Dr Ian Whittington (University of Queensland, Brisbane)

Re-collection of sponges for taxonomic and pharmaceutical research (January 1998)

Dr John Hooper (Queensland Museum), Dr Russell Hill (Australian Institute of Marine Science), Dr Mark Butler and Dr Priscilla Leone (Queensland Pharmaceutical Institute) assisted by John Kennedy, Sue List-Armitage, Kirsteen Kennedy and Shane Armitage

Tissue thickness variation in massive *Porites* corals in response to environmental changes (October 1997)

James True* (James Cook University, Townsville) assisted by Mary Bursey

Coral recruitment (November 1997; January 1998)

Andrew Baird* (James Cook University, Townsville)

Recruitment processes influencing larval settlement of corals (November/December 1997)

Dr Andrew Heyward, Dr Andrew Negri (Australian Institute of Marine Science, Karratha), Dr Russell Hill (Australian Institute of Marine Science, Townsville) and Dr Bob Seamark (CRC for Advanced Reproductive Technologies, Adelaide), assisted by Tina Negri

Many experiments are conducted underwater. (Photo Mark A. Johnson)

Long-term monitoring of coral communities (January 1998)

Liz Dinsdale (for Dr Terry Hughes, James Cook University, Townsville) and Brett Dinsdale, accompanied by Emma and Jenny Dinsdale

Coral diseases (January/February 1998)

Dr Arnfried Antonius (University of Vienna, Austria)

Behavioural and ecological aspects of the symbiosis between two free-living corals and a worm (May 1998)

Sea Rotmann* (James Cook University, Townsville) assisted by Dr Jason Tanner

Hypodermic insemination in flatworms (January 1998)

Dr Nicolaas Michiels (Max Planck Institute, Germany) assisted by Julie Zeitlinger, Dr Ralph Tollrian and Anne Peters

Adaptive significance of body pattern changes in cephalopods (October/November 1997)

Dr Shelley Adamo (Dalhousie University, Canada) assisted by Kathy Weichelt

Long-term monitoring of giant clam populations (December 1997/January 1998)

Dr David Phillips (Fenviron, UK) assisted by Jackie Robinson

Nutrient cycling by holothurians (July 1997)

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

Effectiveness of a long-term program of crown-of-thorns starfish eradication on patch reefs (all year)

Dr Lyle Vail and Dr Anne Hoggett (Lizard Island Research Station) assisted by Lance Pearce, Marianne Pearce, Bob Lamb, Caroline Wallenberg, Ben Milne, Paul Johnson and many other volunteers

The crown-of-thorns starfish story (desk study) (July 1997)

Amy Hinks* and Emily Hardman (University of Newcastle-upon-Tyne, England)

Chronic damage to corals by crown-of-thorns starfish (November 1997; February/March 1998)

Morgan Pratchett* (James Cook University, Townsville) assisted by Jason Pratchett, Gillian Goby and Ben Carroll

Monitoring fish populations and human usage of the Cod Hole (all year)

Dr Lyle Vail and Dr Anne Hoggett (Lizard Island Research Station) assisted by Julie Ryan, Paula Ryan, Sharon Watson and Trevor Clarke

Interaction of hormones and reproductive behaviour in the spiny damselfish, *Acanthochromis polyacanthus* (July 1997; December 1997)

Prof. Ned Pankhurst and Dr Tish Pankhurst assisted by Polly Butler, Andrea Hobby and Mark Hilder (University of Tasmania, Launceston) and accompanied by Sam and Mike Pankhurst



Relationship of fish morphology to diet, feeding mode and microhabitat (July/August 1997; October 1997; December 1997)

Dr David Bellwood and Selma Klanten (James Cook University, Townsville) assisted by Jason Elliott

Growth rates and longevities in exploited reef fishes (July/August 1997; December 1997; March 1998)

Prof Howard Choat (James Cook University, Townsville) assisted by Will Robbins, Samantha Adams, Selma Klanten and Dr Kendall Clements

Effects of fishing on the sexual structure of protogynous serranids on the Great Barrier Reef

Samantha Adams* (James Cook University, Townsville) (July/ August 1997)

Quantification of flux rates of adult fishes across the boundaries of fisheries reserves - telemetry (August 1997; October 1997; February 1998)

Dr Dirk Zeller and Dr Garry Russ (James Cook University, Townsville) assisted by Carole Eros, Ashley Frisch and Sarah Omundsen

Quantification of flux rates of adult fishes across the boundaries of fisheries reserves - trapping (August 1997; October 1997; February 1998; June 1998)

Charles Hatcher* (James Cook University, Townsville) assisted by Ashley Frisch and Sarah Omundsen

Population ecology of habitat specialised fishes (August/September 1997; January 1998; April/ May 1998)

Phil Munday* (James Cook University, Townsville) assisted by Annika Persson, Gillian Goby and Tsai Sin

Systematics of Indo-Pacific shrimp gobies (September/October 1997)

Mark Mohlman* (University of Hawaii, USA) assisted by Ilsa Kuffner

Reproduction and growth of *Lethrinus nebulosus* (October 1997)

Edwin Grandcourt* (James Cook University, Townsville) assisted by Mary Burse

Life history, reproductive biology and population dynamics of *Lutjanus carponotatus* (October 1997)

Jake Kritzer* (James Cook University, Townsville) assisted by Mary Burse

Effects of line fishing - baseline visual surveys (October 1997)

Dr Tony Ayling (Sea Research, Daintree) assisted by Dr Avril Ayling, Warren Nott and Parrish Robbins, and accompanied by Bliss and Xenica Ayling, Jo and baby.

An evaluation of herbivory in the Blennidae (October 1997; March 1998)

Shaun Wilson* (James Cook University, Townsville)

The importance of short-lived fishes to the nutrient dynamics of coral reefs (October 1997)

Michael Marnane* (James Cook University, Townsville)

Larval fish behaviour (November/December 1997)

Dr Jeff Leis, Brooke Carson Ewart and Di Bray (Australian Museum)

Factors influencing egg production rates in reef fishes (November 1997 to January 1998)

Dr Brigid Kerrigan (James Cook University, Townsville) assisted by Renae Partridge

Maternal and environmental factors controlling larval quality and survivorship (November 1997 to January 1998)

Dr Brigid Kerrigan (James Cook University, Townsville) assisted by Renae Partridge and accompanied by Greg Suosaari and Jeff Lane

Metabolism of reef fishes and squid (November/December 1997)

Dr Mark McCormick and Dr Natalie Moltschanivskyj (James Cook University, Townsville) assisted by Bridget Green and Ross Thomas

Factors influencing sex change in parrotfishes (November 1997; February/March 1998)

Nick Gust* (James Cook University, Townsville) assisted by Jason Pratchett, Gillian Goby, Stuart Watson and Barbara Lukoschek

Ecology of anemonefishes (November 1997)

Michael Arvedlund* (James Cook University, Townsville) assisted by Lars Olsson and Ingvar Jensen

Diet evaluation of herbivorous reef fish (December 1997)

David Crossman* (University of Auckland, New Zealand) assisted by Dr Kendall Clements

Do cleaner fish 'farm' parasites? (December 1997 to February 1998; May 1998)

Dr Lexa Grutter (University of Queensland, Brisbane) assisted by Mark Johnson, Carley Bansemmer and Maya Srinivasan

Condition and persistence of recruit damselfishes (January/February 1998)

Dr David Booth (University of Technology, Sydney) assisted by Giglia Beretta

Role of herbivory and hydrodynamics in determining abundance and metabolism of algae (January 1998; February 1998; March 1998)

Dr Robert Carpenter (California State University Northridge, USA) assisted by Hedy Carpenter and Megan Liddelow

Functional morphology and ecology of feeding and locomotion in labrid fishes (February 1998; April 1998)

Dr Peter Wainwright (Florida State University, USA), Dr Mark Westneat (Field Museum of Natural History, Chicago, USA), and Dr David Bellwood (James Cook University, Townsville), assisted by Jason Elliott and accompanied by Caroline, Naomi and David Wainwright

Distribution and abundance of ciliated protozoa in acanthurid fishes and ontogenetic changes in host gut physiology (March 1998)

Tamsen Byfield* (James Cook University, Townsville)

Role of caesionid fishes in the energetics of coral reefs (March 1998; April 1998)

Lesley Walker* (James Cook University, Townsville) assisted by Dr Brigid Kerrigan, Josh Madin and Sea Rotmann

Gut morphology and diet in reef fishes (April 1998)

Jason Elliott* (James Cook University, Townsville)

Anthropogenic impacts on seabirds (transfer to Rocky Islets study site) (December 1997; January 1998; February 1998)

Dr Barry Goldman (accompanied by Ayla Goldman and Rhianna Willis), Jane White, Kyi Bean, Sharon Marks and Mark Bennett (James Cook University, Townsville)

Localization and tracking of minke whales (June 1998)

*Jason Gedamke (University of California Santa Cruz, USA)

School group (July 1997)

Students of Geelong College Preparatory School (Vic), led by Stuart McCallum, Sue Scott and Chris Miller

University group (July 1997)

Students of the University of Richmond (USA; Suzanne Drake, Betsy Foster, Laura Parsells, John Rugieri) led by Prof. John Bishop

School group (September 1997)

Students of SCECGS Redlands (Sydney; Emma Allen, Hugh Anderson, Pip Begg, Rosie Colless, Nicole Cooney, Christoph Conder, Georgina Edwards, Karl Hamilton, Sophie Kouvelis, Elizabeth May, Catherine Miller, Morgan Petersen, Ian Prentice, Susanna Reed, Nicky Somerville, Claire Wellington) led by Rachel Elphick, Don Elphick, Kelli McCann, Megan Bruce, Peter Eaglen and Juliet Neve, with Lucy Elphick

University group (March/April 1998)

Students of the School for International Training (Group 1: Lisa Ahljevych, Haley Allen, Sheri Beliveau, Julie Bonner, Payton Deeks, Karri Fisher, Susan Little, Karen Murray, Wendy Rice, Brandon Swope and Becky Zinn; Group 2: Christine Ansley, Jamie Conklin, Franny Elson, Lauren Filliberto, Melissa Iwamoto, Lisa Kenny, Aimee Kocis, Adam Lavinthal, Suzanne Matwyshen, Paul Seilo) led by Heidi Freiburger and Andrew Lewis

University group (April/May 1998)

Students of the University of Guelph (Canada; Ian Clarke, Julie Comber, Jeremy Dewaard, Erin Dunlop, Drew Erjavec, Suzanne Gray, Valerie James, Randall Jamieson, Elizabeth Junco, Talena Kraus, Adriane Lam, Johanne Lewis, Stephen Mills, Jason Neil, Suzanna Ritchie, Meredith Rose, Tyler Schulz, Irene Stander and Sarah Thyref), led by Prof. Paul Hebert, Prof. Jim Ballantyne and Young Um

University group (May 1998)

Students of Presbyterian College (USA; Julie Adair, Lance Buchanan, Jason Cochcroft, Cory Dickerson, John Harris, Katie Hines, Ann Marie Lassiter, Jason McLeskey, Elizabeth Northrop, Jeff Williams), led by Prof. Jim Stidman, Prof. Jim Wetzel and Ruth Hemphill

University group (June 1998)

Students of the University of New Mexico (USA; Camille Alexander, Steven Archambault, David Edwards, Stephanie Fuchs, Anna Gahl, Josephine Graf, Jennifer Graves, Brant Jones, Roberto Lopez, Jessica Phillips, Leigh Saunders, Christy Tarleton) led by Prof. Ursula Shepherd, Lisa Ellis and Joshua Leffler, with Bill Shepherd and Chris Young

Filming for documentary on animal weapons (August 1997)

Chris Miller and Alan Toddhunter (Wild Visuals, Sydney)

Filming for documentary on larval fish behaviour (October 1997; November/December 1997)

Richard Smith (ABC Television, Sydney)

Photography for Australian Geographic book on the Great Barrier Reef (November 1997)

Mike McCoy assisted by Roger Springthorpe

Filming for documentary on La Niña (December 1997; March 1998)

Klaus Toft and Wade Fairley (ABC Natural History Unit, Melbourne) assisted by Laura Jauregui

Commercial photography (February 1998)

Duncan Sims Studio (UK) and National Underwater Marine Agencies (Port Douglas)

Filming for Imax feature film (February/March 1998)

Peter Parks, Chris Parks, Roger Steene, Peter Herring, Justin Peach and Abi Peach (Image Quest 3D, UK)

Filming for documentary on Australia (March 1998)

Dr Pavel Bezouska, Dr Zbynek Fiala and Mirek Vranek (Czech Television)



University of Guelph students at work in the Purves Laboratory. (Photo: Mark A. Johnson)

Volunteers

Jane Pawle
Val Van Nieuwkuyk
Glenda Goldberg
Chris Bown
Caroline Wallenberg
Karen Murray
Clare Wood
Justin Peach
Karen Amos
Vas Andonakis
Megan Liddelow
Renie Hood
Snow Amos
Sarah Mitchell
Maddy Le Raste
David Priddle
Jeff Lane
Darlene Nieve
Paul Johnson
Ben Milne
Lori Hosaka
John La Plante
John Bradbury
Robyn Bradbury
Renaë Renaud
Michelle Théberge
Margaret Bassett
Ron Bassett
Mark Darling
Hubert Blatterer
Catherine de Sloover
Belinda Peters
Amanda and Alastair Freeman
Kym Collins
Anne Lee
Vajra Frigerio

Other Visitors

Lizard Island Research Station management (August 1997)
Dr Des Griffin
(Australian Museum, Sydney)

First aid training for staff (October 1997)
Charlie Makray and Julie Armour

Reconnaissance for future group visit (November 1997)
Bill Turner (Denver Zoo, USA)

Special interest visit (March 1998)
Glenn Crosland, newly in charge of Orpheus Island Research Station (James Cook University, Townsville)

Transfer to research vessel (April 1998)
Dr Lance Bode (James Cook University, Townsville) accompanied by June Bode

Mosquito control (April 1998)
David Sellars
(Department of Health, Cairns)

Supporters

David Gifford, Heidi Wyle, Ariella Gifford and Claire Alexander (July 1997)

Dr Cathryn Vasseleu and Dr Debbie Fried (May/ June 1998)

Mark, Penny, Royal and Catalina Hooper (June 1998)

Publications

The following 36 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 532 reprints, theses and books in the collection. All visiting scientists are urged to send for inclusion two copies of papers resulting from their work at the Station.

Borden, W.C. 1998

Phylogeny of the unicornfishes (*Naso*, Acanthuridae) based on soft anatomy. *Copeia*, 1998(1): 104-113.

Castro, P. 1997

Trapeziid crabs (Brachyura: Xanthoidea: Trapeziidae) of New Caledonia, eastern Australia, and the Coral Sea. In: "Les fonds meubles des lagons de Nouvelle Calédonie (Sédimentologie, Benthos). Études & Thèses" (ed. Richer de Forges), volume 3:59-107, Paris: ORSTOM.

Crook, A.C. 1997

Behavioural patterns and the significance of colour patterns in reef fishes of the family Scaridae. PhD thesis, James Cook University, Townsville.

Darling, K.F., C.M. Wade, D. Kroon and A.J. Leigh Brown, 1997

Planktic foraminiferal molecular evolution and their phylogenetic origins from benthic taxa. *Marine Micropaleontology*, 30: 251-266.

De Sloover, J.R. and S. Liégeois, 1997

Eagle Island, flora and vegetation (Queensland, Australia). *Bull. Jard. Bot. Nat. Belg./Bull. Nat. Plantentuin Belg.*, 66: 347-383.

Eros, C.M. 1996.

Acoustic repertoire in the territorial and courtship behaviour of *Stegastes apicalis* (Pomacentridae). MSc thesis, James Cook University, Townsville.

Green, A.L. 1998.

Spatio-temporal patterns of recruitment of labroid fishes (Pisces: Labridae and Scaridae) to damselfish territories. *Environmental Biology of Fishes*, 51: 235-244.

Grutter, A.S. 1997

Size-selective predation by the cleaner fish *Labroides dimidiatus*. *Journal of Fish Biology*, 50: 1303-1308.

Grutter, A.S. 1997

Effect of removal of cleaner fish on the abundance and species composition of reef fish. *Oecologia*, 111: 137-143.

Grutter, A.S. 1997

Spatiotemporal variation and feeding selectivity in the diet of the cleaner fish *Labroides dimidiatus*. *Copeia*, 1997: 346-355.

Hooper, J.N.A. 1996

Revision of the Microporidae (Porifera: Poecilosclerida: Demospongiae), with description of Australian species. *Memoirs of the Queensland Museum*, 40: 1-626.

Kornicker, L.S. 1996

Ostracoda (Mydocopina) from shallow waters of the Northern Territory and Queensland, Australia. *Smithsonian Contributions to Zoology*, 578: 1-97.

Lehnert, H. and J. Reitner 1997

Lebensdauer und regeneration bei *Ceratoporella nicholsoni* (Hickson, 1911) und *Spirastrella (Acanthochaetetes) wellsi* (Hartman & Goreau, 1975). *Geol. Bl. NO-Bayern*, 47: 265-272.

Leis, J.M. and B. Carson-Ewart, 1997

In situ swimming speeds of the late pelagic larvae of some Indo-Pacific coral-reef fishes. *Marine Ecology Progress Series*, 159: 165-174.

Maida, M., J.C. Coll and P.W. Sammarco, 1994

Shedding new light on scleractinian coral recruitment. *Journal of Experimental Marine Biology and Ecology*, 180: 189-202.

Meyer, D.L. 1997

Reef crinoids as current meters: feeding responses to variable flow. *Proceedings of the Eighth International Coral Reef Symposium*, 2: 1127-1130.

Miller, R.L. 1997

Specificity of sperm chemotaxis among Great Barrier Reef shallow-water holothurians and ophiroids. *Journal of Experimental Zoology*, 279: 189-200.

Munday, P.L. and S.K. Wilson, 1997

Comparative efficacy of clove oil and other chemicals in anaesthetization of *Pomacentrus amboinensis*, a coral reef fish. *Journal of Fish Biology*, 51: 931-938.

Munday, P.L., G.P. Jones and M.J. Caley, 1997

Habitat specialisation and the distribution and abundance of coral-dwelling gobies. *Marine Ecology Progress Series*, 152: 227-239.

Öhman, M.C., P.L. Munday, G.P. Jones and M.J. Caley, 1998

Settlement strategies and distribution patterns of coral reef fishes. *Journal of Experimental Marine Biology and Ecology*, 225: 219-238.

Okaji, K., T. Ayukai and J.S. Lucas, 1997

Selective feeding by larvae of the crown-of-thorns starfish, *Acanthaster planci* (L.). *Coral Reefs*, 16: 47-50.

Pain, S. 1997

Swimming for dear life. *New Scientist*, 2099: 28-32.

Pankhurst, N.W., C.W. Barnett, P.I. Butler, P.M. Pankhurst and A.C. Hobby, 1997

Environmental disturbance, reproductive behaviour and plasma steroid levels in the spiny damselfish *Acanthochromis polyacanthus*. In 'Advances in Comparative Endocrinology' (Eds S. Kawashima and S. Kikuyama). *Proceedings of the 13th International Congress of Comparative Endocrinology, Yokohama, Japan*, pp. 1707-1713.

Reitner, J. and P. Gautret, 1996

Skeletal formation in the modern but ultraconservative chaetid sponge *Spirastrella (Acanthochaetetes) wellsi* (Demospongiae, Porifera). *Facies*, 34: 193-208.

Reitner, J., G. Wörheide, R. Lange and V. Theil, 1997

Biomining of calcified skeletons in three Pacific coralline demosponges - an approach to the evolution of basal skeletons. *Cour. Forsch.-Inst. Senckenberg*, 201: 371-383.

Stobutzki, I.C. 1997

Energetic cost of sustained swimming in the late pelagic stages of reef fishes. *Marine Ecology Progress Series*, 152: 249-259.

Stobutzki, I.C. and D.R. Bellwood, 1997

Sustained swimming abilities of the late pelagic stages of coral reef fishes. *Marine Ecology Progress Series*, 149: 35-41.

Talbot, M.S. 1997

Doxomysis acanthina, a new leptomysinid (Crustacea: Mysidacea) from the northern Great Barrier Reef, Australia, with extensions to the known distributions of *D. australiensis* W.M. Tattersall, 1940 and *D. spinata* Murano, 1990 and a key to the genus *Doxomysis*. *Proceedings of the Biological Society of Washington*, 110: 426-438.

Ten Hove, H.A. and E. Nishi, 1996

A redescription of the Indo-west Pacific *Spirobranchius corrugatus* Straughn, 1967 (Serpulidae, Polychaeta), and an alternative hypothesis on the nature of a group of middle Miocene microfossils from Poland. *Beaufortia*, 46: 83-96.

Webster, J. 1993

Siliclastic/carbonate interactions at Lizard Island in the northern Great Barrier Reef. BSc (Hons) thesis, University of Sydney, 2 volumes.

Wörheide, G. 1997

The reef cave dwelling ultraconservative coralline demosponge *Astroclera willeyana* Lister 1900 from the Indo-Pacific. PhD thesis, University of Göttingen, Germany.

Wörheide, G., J. Reitner and P. Gautret, 1997

Comparison of biocalcification processes in the two coralline demosponges *Astroclera willeyana* Lister 1900 and "*Acanthochaetetes*" *wellsii* Hartman and Goreau 1975. *Proceedings of the 8th International Coral Reef Symposium*, 2:1427-1432.

Wörheide, G., P. Gautret, J. Reitner, F. Böhm, M. Joachimski, V. Theil, W. Michaelis and M. Massault, 1997

Basal skeletal formation, role and preservation of intracrystalline organic matrices, and isotopic record in the coralline sponge *Astroclera willeyana* Lister 1900. *Bol. R. Soc. Esp. Hist. Nat. (Sec. Geol.)*, 91: 355-374.

Zeller, D.C. 1996

Patterns of movement of *Plectropomus leopardus* (Serranidae) in relation to spawning aggregations and marine protected areas, as determined by ultrasonic telemetry. PhD thesis, James Cook University.

Zeller, D.C. 1997

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