



**AUSTRALIAN MUSEUM
LIZARD ISLAND
RESEARCH STATION**
2015 Report



LIZARD ISLAND RESEARCH STATION 2015 Report

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LIZARD ISLAND RESEARCH STATION

Located on the northern Great Barrier Reef, the Lizard Island Research Station is a world-leading facility for coral reef research and education and is one of the outstanding research facilities of the Australian Museum Research Institute.

Researchers from around the world access this unique on-reef research station, making a substantial contribution to coral reef science. In the past year:

WELCOME



The Lizard Island Research Station (LIRS) is a cornerstone of the Australian Museum Research Institute (AMRI)'s science.

As the Australian Museum (AM)'s outpost on the Great Barrier Reef, LIRS has provided researchers the world over with access to the facilities and knowledge required to understand,

manage and conserve one of our nation's treasured ecosystems for more than 40 years.

2015 was one of the most eventful in both the history of LIRS, and for the Australian Museum.

There were many successes to celebrate during the year, such as the discovery at LIRS of new methods to combat the invasive Crown of Thorns Starfish, along with evidence of ongoing Reef regeneration. Another key highlight of the work at LIRS was the discovery of 91 new species of Polychaetes on the Reef, identified by an international team of scientists led by AMRI's Dr Pat Hutchings and Dr Elena Kupriyanova.

These critical successes also continued at the AM in Sydney, with the liberation of new gallery spaces on the historic site. This included the opening of Wild Planet — an exhibition that celebrates AMRI's leading research in biodiversity conservation, and highlights for museum visitors the incredible work of researchers both in the lab and in the field, as seen at LIRS.

The year also has had many challenges, with the LIRS facing another category four cyclone that temporarily disrupted outpost operations for the second year running.

Led by our skilled and stalwart LIRS Directors, Dr Anne Hoggett and Dr Lyle Vail, the station was successfully evacuated, the damage has now been restored, and we continue to welcome researchers from around the world.

LIRS is a jewel in the crown of AMRI's scientific arsenal, and its inception and continuing operation would not have been possible without the generous support of the Lizard Island Reef Research Foundation (LIRRF). This dedicated group of individuals have secured funding for the scientific opportunities that an active research facility on the World-Heritage listed Great Barrier Reef can provide. On behalf of the team at AM and LIRS, I'd like to thank them and our donors for their support.

Kim McKay AO,
Australian Museum Executive Director and CEO

140
SCIENTISTS
 CONDUCTED RESEARCH AT LIRS

91
NEW SPECIES
 OF POLYCHAETE WORMS
 DESCRIBED FROM
 LIZARD ISLAND

111
NEW PUBLICATIONS
 BASED ON LIRS RESEARCH

1300
SPECIES
 DOCUMENTED
 IN LIZARD ISLAND
 FIELD GUIDE



ANOTHER YEAR, ANOTHER CYCLONE

Less than a year after the first category four cyclone hit Lizard Island in living memory, Cyclone Nathan caused major disruption when it struck in the early hours of 20 March 2015, also at category four. Nathan was in the area for about two weeks, passing at a distance of 90 km at category two on 12 March before intensifying and returning to make an almost-direct hit on Lizard Island eight days later. The GBR Ocean Observing System array in the Lizard Island lagoon recorded environmental conditions throughout both events. With wind speed up to 181 km per hour and air pressure of 965 hPa, Nathan was slightly stronger than Cyclone Ita the year before. While winds of more than 100 km per hour battered the island for more than 12 hours during Cyclone Ita, they lasted only six hours during Nathan.

As with Ita in 2014, an enormous number of trees came down and exposed reefs were pummelled. The LIRS buildings proved themselves again, suffering no major damage. However, there was lots of minor damage and the amount of sand that was hurled around was amazing, literally

sandblasting many surfaces. Again, LIRS had to evacuate, which impacted ongoing and imminent research enormously. Visiting researchers were again extremely helpful and calm as LIRS prepared for the cyclone and the evacuation.

The aftermath was different this time around. Flights and barge services resumed much more quickly and this greatly enhanced the recovery. LIRS staff were back on the island by sunset on the day of the cyclone, rather than four days later as was the case the year before. We were able to prevent further damage that would have occurred had there been a greater delay, such as saving experiments and food supplies by restoring power to areas where circuit breakers had tripped. Selected researchers were able to return within a few days to salvage what they could of ongoing experiments.

There are still plenty of lovely reefs in the beautiful Lizard Island lagoon because it was largely protected by the reef surrounding it, but the perimeter of the island group has been badly impacted.



OPPOSITE: LIRS after Cyclone Nathan.

TOP LEFT: Exposed reefs were badly impacted.

TOP RIGHT: Sharing information with worried researchers as Nathan approached.

ABOVE: BELOW: Lyle Vail and Anne Hoggett.

Several research teams are monitoring the damage and recovery. One interesting finding is that a huge number of very small coral colonies survived the cyclones and they are an important part of the regenerating reef at Lizard Island. Despite the disruption caused by Cyclone Nathan, LIRS has hosted a record number of scientists and hosted ground-breaking research in areas like COTS and impacts of climate change.

Monitoring by the Australian Institute of Marine Science has shown that reefs further south that were badly damaged by two severe cyclones (Larry in 2006, Yasi in 2011) had largely recovered by 2015. In fact, some of them now have higher coral cover than at any time since monitoring began in 1986. Reefs can recover remarkably quickly if the conditions are right. Research has shown that such resilience depends on good water quality and intact ecosystems. Our challenge is to improve and maintain those things.

Anne Hoggett AM & Lyle Vail AM, AMLIRS Directors



FELLOWSHIPS

Five new Fellowships were awarded in 2015 by the Australian Museum for PhD students and early-career researchers to conduct field-intensive research at LIRS, commencing in March 2016.

The Fellowships program is fully supported by the Lizard Island Reef Research Foundation and its donors.

Details of the conditions and selection criteria can be found in the Lizard Island Research Station section of the Australian Museum's web site. Applications close in August or September each year for funding that becomes available in March of the following year.



Zoe Loffler

2016 Ian Potter Doctoral Fellow
ARC CoE Coral Reef Studies, James Cook University

> Canopy-forming macroalgae on coral reefs: how does it affect key ecosystem processes?

Coral reefs are impacted by many stressors that reduce the coverage of live coral. While some reefs recover from such impacts, others are overgrown by fleshy macroalgae (seaweed). Once established, seaweed-dominated states are difficult to reverse. It has been suggested recently that cyclones and storms may remove seaweed from the reef and thereby provide a 'window of opportunity' for the settlement and recovery of coral populations. We know that storms and cyclones can break the thallus (leafy part) from the holdfast of shallow-water seaweeds such as *Sargassum*, but the long-term effects of such removal are unknown.

Two category four cyclones impacted the Lizard Island region in the past two years and Zoe's supervisor, Dr Andrew Hoey, has long-term data sets on seaweed communities in those areas.

Zoe will use this unique set of circumstances to test the hypothesis that cyclones can provide an opportunity for corals to re-establish by removing seaweed.

RIGHT: Polyps of the coral *Turbinaria peltata*.

OPPOSITE LEFT: Fanworm *Megalomma interrupta* showing radiolar eyes. Image: Alexander Semenov.

OPPOSITE RIGHT: Healthy reef flat with a Doublebar Goatfish, *Parupeneus crassilabris*.



Jamie McWilliam

2016 Lizard Island Doctoral Fellow
Centre for Marine Science and Technology, Curtin University

> The pulse of a coral reef: Using acoustic survey as a tool for monitoring coral reef ecosystems in a changing climate

Marine ecosystems face a challenging future with the growing pressures of climate change and industrial development. In order to develop effective management measures, efficient long-term monitoring programs are required. One area with untapped potential for effective monitoring is underwater sound.

Our oceans contain a rich and diverse array of underwater sounds, which are used by many animals to navigate, forage and communicate. Hundreds of fish species are known to produce sound and fish choruses that are prominent throughout Australian waters are often associated with feeding or spawning activities. Local soundscapes may play a key role in the life processes of marine organisms, including fish.

There has been limited work developing and applying appropriate acoustic monitoring techniques to investigate any relationship between a marine soundscape and fish communities at appropriate scales. Jamie aims to develop a methodology for monitoring the condition of coral reefs using underwater soundscape recordings.

Soundscape science is still at a very early stage of development, and intensive monitoring of the kind proposed by Jamie is what is required to take things forward.





Dr Michael Bok

2016 John and Laurine Proud Postdoctoral Fellow
Lund University, Sweden

> Seeing with gills: The evolution of branchial photoreceptors in fan worms

Marine fan worms possess some of the strangest eyes in nature. Their 'fans' are composed of two sets of radiolar tentacles that project up out of the worm's protective tube. Primarily used for respiration and feeding, these radioles are also often involved in detecting light. They express a surprising diversity of eyelets of varying levels of sophistication, ranging from scattered single ocelli to compound eyes with up to 1,000 facets. These photoreceptors are probably a relatively recent evolutionary development to cope with a sessile, tube-dwelling lifestyle. They appear to function as visual burglar alarms for detecting the silhouettes of looming predators and eliciting a startle response for the worm to rapidly retreat within its fortified tube.

Considering the unusual and apparently recently-evolved nature of fan worm 'eyes', these animals are an excellent case for examining the emergence of novel visual systems and may inform our understanding of how the first eyes evolved. Lizard Island is the ideal location to carry out such a study due to the recent, thorough census of polychaete species there (funded by LIRRF in 2013). Lizard Island now has the best described and broadest taxonomic range of fan worms known, comprising 75 species. Mike's study will involve collaborators: Dr Megan Porter, University of Hawaii at Manoa; Dr Maria Capa, Museum of Natural History & Archaeology, Norway.



Dr Rebecca Fox & Dr Jennifer Donelson

2015 Isobel Bennett Marine Biology Fellowship, University of Technology, Sydney

> Exploring the nexus between behaviour and physiology of coral reef fishes in a warming world

Our ability to forecast outcomes for ecological communities under conditions of global change is reliant on knowledge of species' sensitivity to environmental temperatures and investigation of their latent capacity to cope with higher temperatures. This latent capacity can be expressed in the form of both behavioural and physiological plasticity. In most research to date the two mechanisms have been considered independently, but an important nexus may exist between the two, which may have the potential to lead to an over or under-estimation of the temperature-related extinction risks faced by individual species.

The study that will be conducted by Rebecca and Jennifer is the first to test the combined capacity for behavioural and physiological plasticity in reef fish species, with the goal of being able to more accurately predict who will be the winners and losers in a warmer future.

The project's significance lies in the fact that it will examine the combination of behavioural and physiological plasticity exhibited by mobile reef fishes using surgeonfishes as a model. It will also be the first time that thermoregulation behaviour has been specifically tested for in coral reef fishes in situ. The outcomes will advance our understanding of how tropical marine ectotherms will respond to environmental warming.





Dr Sandra Binning & Dr Dominique Roche

2016 Yulgilbar Postdoctoral Fellows
The University of Neuchâtel, Switzerland

> Cooperation, conflict and cognition in marine cleaning mutualisms

Mutualism is a relationship between two species in which both benefit from the association. Mutualisms play an integral role in maintaining the diversity and stability of ecosystems, including coral reefs. For example, cleaning organisms, which include a variety of fish and crustacean species, remove ectoparasites from the surfaces of so-called clients. Cleaners are ubiquitous on coral reefs and have important effects on reef community structure. These positive interactions are likely maintained through trade-offs among potential costs, benefits and risks associated with cooperating and a variety of partner control strategies by all participants. Knowledge of the benefits derived by participants and traits related to partner control are therefore critical to understand the evolution and maintenance of mutualisms and consequently coral reef community structure and stability.

Sandra and Dom will use one of the most abundant cleaners in the Indo-Pacific, the Bluestreak Cleaner Wrasse, to explore factors contributing to the persistence of cleaning mutualisms on coral reefs, building on the wealth of knowledge available on this species and its interactions with client reef fishes around Lizard Island. In this system, client fishes visit cleaners to have their ectoparasites removed. Conflicts of interest arise because cleaners prefer to eat the client's protective mucus rather than ectoparasites. As fishes rely on this protective coating for defence against infections, mucus feeding by cleaners constitutes cheating. Therefore, cleaners must feed against their preference in order to provide a net benefit, or good service, to the clients.

Interestingly, not all clients are treated equally; there is dramatic variation in the rates of cheating among species. Why are some species treated so poorly by the cleaners? Identifying the underlying causes of this variation in service quality is critical for advancing cooperation theory.



COTS Control Grants

The Great Barrier Reef lost half its coral cover in the 27 years to 2012. Cyclones and predation by the Crown of Thorns Starfish (COTS) are estimated to be responsible for 90% of that loss and, in the absence of COTS, coral cover would actually have increased marginally despite ongoing losses from other causes (D'eath et al, 2012, PNAS).

In 2014, the Ian Potter Foundation provided funding to the Lizard Island Reef Research Foundation under its 50th Anniversary Commemorative Grants program for research that improves control methods and/or mitigates the effects of COTS outbreaks. With this funding, the Australian Museum awarded five grants in 2015 to researchers from ARC Centre of Excellence for Coral Reef Studies at James Cook University, College of William and Mary (USA), Southern Cross University and the University of Sydney.

Much of the funded research aims to resolve deficiencies in our knowledge of COTS biology that could point to potential interventions for management of outbreaks. Topics include the behaviour of COTS larvae, the role of predation in controlling both adult and larval COTS populations, and COTS reproduction and larval dispersal. Much of this research was done near the end of 2015 to coincide with the known breeding season of COTS and data are still being analysed.

One of the funded projects was carried out in early 2015 and it has already provided reef managers with an additional one-shot injection method for controlling COTS outbreaks (Publication 12 in this report). Lisa Boström-Einarsson from James Cook University tested



household vinegar for its effectiveness in controlling COTS by injection. The first one-shot injection method was developed at LIRS in recent years using oxbile. Oxbile is still the chemical of choice for managers controlling large numbers of COTS since only 4 ml needs to be injected to ensure 100% mortality. However, oxbile is often not available in remote locations, it can be expensive and there can be issues with importation and quarantine due to its bovid origin. Lisa wanted to test the effectiveness of household vinegar since it is cheap and generally readily available, even in remote Pacific island countries.

In the LIRS aquarium, Lisa injected COTS with different strengths and volumes of vinegar. She found that a single injection of 25 ml of vinegar from a small bore needle at the base of one arm induced functional mortality in 24 hours and 100% mortality in 48 hours. She then tested whether COTS injected with vinegar had any negative impacts on other animals, such as pufferfish and triggerfish that are known to feed on dying COTS, or on corals and other invertebrates that would come into contact with injected COTS. She tested 32 species of fish and invertebrates and found no negative effects. The method has since been successfully adopted in the Maldives, Seychelles, Bali, PNG and Fiji. Permits and funding have been obtained for field trials to be undertaken during 2016 to satisfy GBRMPA requirements for listing vinegar as an approved chemical for killing COTS on the Great Barrier Reef.

Additional grants in the COTS Control program will be made in 2016 and 2017.

Profile of a former fellow



Dr Ilona Stobutzki

Ilona Stobutzki was the 1995 Lizard Island Doctoral Fellow. Her entire tertiary education was completed at James Cook University, culminating in a PhD under the supervision of Dr David Bellwood. Ilona's PhD research focused on the swimming abilities

and orientation behaviour of pre-settlement reef fish. She was the first to demonstrate the ability of larval fishes to actively control their dispersal and settlement on reefs. This revelation has had a major impact on the management of reef fish since she demonstrated that they were not like passive particles that are at the mercy of the wind and tides.

After completing her PhD, Ilona worked for CSIRO on bycatch in northern Australian fisheries and the broader ecosystem impacts of fishing. She was involved in developing risk assessment approaches and during this time started collaborations with researchers in Indonesia. In 2002, she moved to the WorldFish Center in Malaysia to lead work on coastal fisheries in South and South-east Asia. During that period, she became interested in working at the interface between fisheries science and policy. Since 2006, she has worked for the Federal Government within the Australian Bureau of Agricultural and Resource Economics and Science. Ilona has held various roles in science leadership and management related to Commonwealth fisheries, and undertakes research to assist management and policy development. Currently, she leads the Fisheries, Forestry and Quantitative Sciences Branch with teams of scientific and economic researchers who work on issues relating to fisheries, forestry and biosecurity. Her involvement in Asian fisheries research continues.



LIZARD ISLAND REEF RESEARCH FOUNDATION

FOUNDER

Sir John Proud¹

PATRONS

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 Dr Des Griffin AM
 Mr Raymond Kirby AO
 Mrs Jacqueline Loomis
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 Mr Robert Purves AM
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 Ms Helen Wellings

¹ Deceased

² Retired as active Trustee in 2015

SCIENCE COMMITTEE

Dr Penny Berents (Chair)
 Dr Rebecca Johnson
 Dr Lyle Vail AM
 Dr Anne Hoggett AM



LIRS is the only research station on the Great Barrier Reef supported by a dedicated Foundation.

The Lizard Island Reef Research Foundation's focus is to provide resources to support excellent coral reef research at LIRS. This takes two major forms: 1) providing high quality research infrastructure, and 2) providing funds for research and for the communication of that research.

The Lizard Island Reef Research Foundation has provided the funds for all capital development of the Station since the Foundation's inception in 1978 and for the Fellowships program since 1984. More recently, it has funded an increasing number of other projects.

Projects and equipment funded by LIRRF in 2015

- The LIRS Fellowships and Grants programs outlined previously.
- New tractor with hydraulic frame, through generous donations from the John Villiers Trust and the Raymond E. Purves Foundation
- Refurbishment of the Raymond E. Purves Laboratory, thanks to the Raymond E. Purves Foundation
- New research dinghy *Marie Elisabeth*, thanks to a donation by long-term LIRRF members Geoff and Lis Haddy
- Replacement of other equipment, including a generator, two 90 hp outboard motors for *Kirsty K*, and new air conditioners for the aquarium system
- Online Lizard Island Field Guide (lifr.australianmuseum.net.au) and associated mobile applications, outlined on page 12
- Social media engagement through an intern based at the Australian Museum and the website lirrf.org, thanks to David and Daniela Shannon
- Satellite tags to record long-distance movements of marlin, thanks to the Teakle Foundation

ABOVE: Australian Museum Trustees and staff at LIRS.



LEFT: Deploying equipment to study ocean acidification.
 TOP: Drones are becoming useful tools for coral reef research.
 ABOVE: Repairing the aquarium pump pit after Cyclone Nathan.

Board changes

Ken Coles AM has been a Trustee since 1991, was Chairman from 1994 to 2012, and with his wife Rowena Danziger AM, is one of the initial Life Members of the Foundation. As he is approaching 90 years, Ken decided this year to retire from active engagement with the Trust. To recognise his outstanding contributions, the Trust resolved to recognise him as an Emeritus Trustee.

Social media

The Foundation’s web site, lirrf.org, was greatly expanded during 2015 through the efforts of two part-time interns based at the Australian Museum, Teresa Horsley and Megan Deveson. Through regular phone interviews with scientists at LIRS, they have produced a series of posts that capture the diversity and importance of the research conducted there.

Subscription to the site is free and all subscribers have the opportunity to win a 3-night stay for two at Lizard Island Resort, donated by Delaware North Australia Parks and Resorts.

Members and Friends

LIRRF Members donate \$1,000 or more in a 12 month period and Friends give a lower amount. Donations of \$2 or more are tax deductible in Australia. Life Members donate at least \$100,000 which may be spread over several years. Please see page 24 for this year’s Members.

LIRS is able to provide a world-class coral reef research station in an isolated location due to the regular stream of annual donations from Members and Friends. This income source enables multi-year planning and provides the base from which LIRRF is able to attract special grants from other philanthropic organisations. The very substantial donation from Life Members is critical for long-term maintenance of Station’s infrastructure in a harsh environment.

Our corporate members provide valuable in-kind contributions.

- Delaware North Australia Parks and Resorts is the major supporter of the Members program through its donation of an annual ‘Members Draw’ prize of a 3-night stay for two people at the Resort. In 2015 the prize was extended to Friends as well as Members and was won by Nikki Weston. Delaware North also provides valuable logistic support to LIRS, including access to its chartered barge and passenger flights.
- Apollo Sports Company has supported the Station’s extensive inventory of dive equipment for many years.
- Hungerford Hill Wines contributes wines for the annual Foundation dinner.



Events

Each year, the LIRRF hosts a dinner in Sydney and a luncheon in Melbourne for Members. This year, the Sydney event was held on the Terrace at the Australian Museum on 12 August with about 100 people attending, and the luncheon was at the Athenaeum Club on 6 May with 23 people.

The guest speaker at both functions was Dr Peter Macreadie, a senior lecturer in marine ecology at Deakin University. He gave engaging talks on the extraordinary carbon-storing abilities of Australia's coastal ecosystems. Peter along with colleague Dr Paul York (James Cook University) were awarded the 2014 Isobel Bennett Marine Biology Fellowship to study the carbon sequestration capacity of deep water seagrass meadows in the vicinity of Lizard Island.

In Melbourne, LIRS Director Dr Anne Hoggett also spoke about impacts and recovery from Cyclones Nathan and Ita. At the Sydney function, Australian Museum Director & CEO Kim McKay welcomed those present and provided an update on the program and developments at the Museum. Dr Pat Hutchings (AM Senior Principal Research Scientist) reported on the imminent publication of the outcomes of the Polychaete Workshop that was sponsored by the LIRRF in 2013, and Dr Rebecca Johnson (Director, Australian Museum Research Institute) gave an update about Station activities during the past year as neither of the LIRS Directors were able to attend.

The latest addition to the LIRS research fleet, *Marie Elisabeth*, was launched on 9 November at LIRS with donors Geoff and Lis Haddy as the guests of honour. The dinghy is named for Lis and it generously commemorates one of her milestone birthdays. It is the first of the LIRS dinghies with a 4-stroke motor and is already very popular among researchers.

Visitors

The following Members and Trustees visited LIRS during 2015:

- Inaugural Life Member Peter Teakle, with family and guests
- David and Megan Armstrong
- Belinda Gibson with Jim Murphy and friends
- Charlie and Sandy Shuetrim
- Janet Hirst, Avalee Weir and Nicole McLeod of the Ian Potter Foundation
- Geoff and Lis Haddy
- Mike and Lou Hamshere

ABOVE: Lis and Geoff Haddy at the launch of *Marie Elisabeth*.



FOR THE RECORD

Trips to Lizard island

The Australian Museum organised two trips to Lizard Island through its partnership with travel group Adventure World.

One was a five-night stay at LIRS in October, led by Australian Museum scientist and LIRRF Trustee Dr Penny Berents. The eleven participants learned much about the reef and issues facing it through talks by Penny and interactions with researchers. They snorkelled daily, climbed Cook's Look and took a day trip to the outer reef.

The other was a four-night stay at the Lizard Island Resort in November. The seven guests were welcomed to the island by LIRS Directors Dr Anne Hoggett and Dr Lyle Vail and enjoyed substantial interaction with researchers on a tour of LIRS and while snorkelling, walking on the island, and visiting the outer reef.

Lizard Island Field Guide

This guide to the life of the Lizard Island area has been in development for many years at LIRS, initially as a database of names maintained by LIRS Director Anne Hoggett and now as a data-rich, well-illustrated online resource thanks to a partnership with Geoff Shuetrim and his Gaia Guide Association. The Guide is at lifg.australianmuseum.net.au/Hierarchy.html and free mobile applications are available for Apple and Android platforms.

The LIFG captures information about local species, marine and terrestrial, in an accessible format to build research capacity and engage with the community. As well as published and museum records, it draws from the 'grey' knowledge generated by the researchers who pass through LIRS which would otherwise be lost, and also includes well-substantiated reports from interested members of the public. Many of the common and some of the not-so-common species are now illustrated. At the end of 2015 there were 1,300 species in the Guide, including 430 fishes, 104 corals, 150 echinoderms, and 96 birds. The background database includes more than 6,500 species known to exist in the area but that is a gross underestimate of the true number. For example, there is a rich insect fauna on the island but it is largely unstudied. Thanks go to the many experts who have provided or confirmed identifications of photographed animals and plants, and to the people who have contributed photos and information.

The LIRRF has supported this initiative since it went online. The project received a great boost at the end of 2015 with a grant from the Ian Potter Foundation that will speed the entry of new data, including the results of the 2013 Polychaete Workshop that were published this year.

ABOVE: No Name Reef before Cyclone Nathan.



Crown-of-Thorns Starfish (COTS) Outbreaks

The number of COTS in the Lizard Island area decreased dramatically during 2015. This marks the end (at Lizard Island) of the fourth documented outbreak of these coral-eating starfish on the Great Barrier Reef and conforms to the pattern noted in the previous outbreak at Lizard Island and elsewhere, i.e. the sudden onset of large numbers of visible starfish, outbreak levels persist for about five years, followed by a sudden crash in numbers.

The two most recent outbreaks have been witnessed by the current LIRS Directors at Lizard Island and there is data from LIRS dive logs to support their timing. The third outbreak started at Lizard Island in 1993 and finished in 1998, and the fourth started in 2010 and finished in 2015. There is no data from Lizard Island for the first two GBR outbreaks.

CLOCKWISE FROM TOP LEFT:

PhD student Steve Doo studies foram carbonate production.
New maintenance staff, John Williamson and Marianne Dwyer.
Alex Buck and Zara-Louise Cowan were part of a large team from JCU studying behaviour of COTS larvae.
Regular volunteers, Snow and Renie Amos.

Australian Museum Science Festival

For the first time, LIRS took part in the Australian Museum's Science Festival held during National Science Week in August, the AM's 'Month of Science'. LIRS had a booth at the Festival, the content of which was provided by LIRS and the Marine Invertebrates section at the AM. Many wonderful volunteers with LIRS experience interacted with visitors during the event, who were estimated to total nearly 10,000 over the two weeks the event was held.

Cyclone Issues

Representatives of the Local Disaster Management Group from Cook Shire Council visited LIRS in July along with Paul Ryan and Paul Flemons of the Australian Museum to inspect the facilities and to discuss how to best link the Station's cyclone plan with the Cook Shire Council Disaster Management network. Discussions were also held about a dedicated cyclone shelter for LIRS.



Flights To Lizard Island

Hinterland Aviation commenced Regular Passenger Transport services to Lizard Island in late 2014. Those flights operated daily during 2015. In 2016, the service will operate three days per week, on Tuesdays, Thursdays and Sundays.

Staff

Lyle Vail and Anne Hoggett completed 25 years as joint Directors in August 2015.

Bruce Stewart and Cassy Thompson resigned from their roles as maintenance staff in January and April 2015, respectively. They were a great asset to the station for more than a year.

Marianne Dwyer and John Williamson are the new maintenance staff. They started in March 2015 when LIRS was still undergoing significant clean up and repairs in the wake of Cyclone Nathan, a challenge they rose to brilliantly.

Former staff Lance and Marianne Pearce returned twice during 2015 to fill in during staff leave periods.

Short-term staff during the year were Alex Vail, Sean Jenkinson and Louise Debono.

Postgraduate Student Interns

The internship program provides extended access to field and aquarium facilities for postgraduate students who assist LIRS staff for 12 hours each week in lieu of bench fees. Internships are for three months. To ensure familiarity with LIRS facilities and procedures, interns must have been to LIRS within the past five years. They must also have a project that can be done effectively without an assistant. Interested postgraduate students who fit that profile are invited to contact LIRS at any time to discuss.

In 2015, three interns made excellent contributions to LIRS while progressing their own PhD research:

- Steve Doo (University of Sydney) – January to April
- Tory Chase (James Cook University) – May to August
- Jamie McWilliam (Curtin University) – September to December

Volunteers

The volunteer program is essential to the effective operations of LIRS. Volunteers pay their own way to the island and provide four hours of work each day, usually assisting maintenance staff. Accommodation is provided at LIRS free of charge to enable them to do that.

We thank our regular and long-term volunteers for their continuing contributions: Renie and Snow Amos, Lois Wilson and Terry Ford.

Our gratitude also goes to the following new volunteers during 2015: Bailey Marshall, Michele Marshall and Kerry Sackett.

In addition, we thank Charlie Makray who continues to provide first aid training for all LIRS staff, tailored to our needs, on a voluntary basis.

Bench Fees

Per person per night, Including GST	2015	2016
Researcher	\$136	\$139
Researcher's assistant	\$121	\$124
Postgrad student (own project)	\$53	\$54
Postgrad's assistant	\$48	\$49
School or university group	\$86	\$88

Tours

Regular tours of LIRS for resort guests re-started as soon as the Resort re-opened in July 2015 following cyclone repairs. These tours must be booked through the Resort. LIRS staff or interns conduct a tour on Tuesday mornings and additional tours are led by the Resort’s naturalist at other times.

A weekly tour for other island visitors, mainly campers and yachties, is conducted between May and October when there is sufficient demand. Cyclone Nathan did not cause any disruption to these tours, which in 2015 were on Mondays at 10 am. At other times, visitors are welcome to call into the Station to view the Sir John Proud Aquarium and courtyard displays but guided tours are not available.

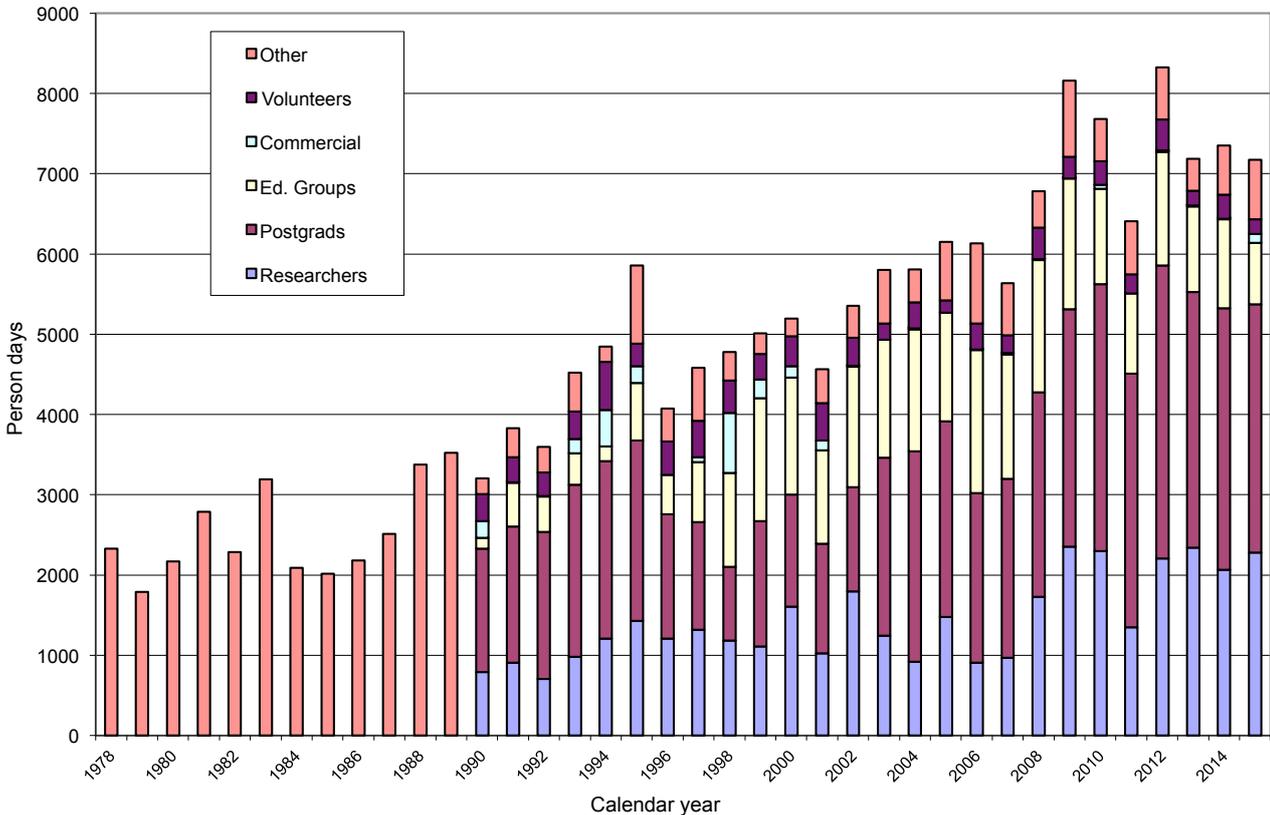


Usage

LIRS continues to operate at or near its designed capacity of 7000 user nights per year. The research focus is clear, with researchers (including postgraduate research students) comprising 75% of total usage in 2015.



TOP: Dr Bridie Allan examines larval fishes in the aquarium.
 RIGHT: Dr Shelby Temple explains his work on vision to island visitors.



VISITORS IN 2015

Scientists from 38 institutions in 10 countries conducted 149 research projects at Lizard Island in 2015 comprising: 74 senior scientists or postdocs, 49 PhD candidates, 9 MSc candidates, 3 Honours candidates and 5 undergraduate research students. The researchers are listed here with their project titles and institutional affiliations.

Institutions

Australian

- 1 ARC Centre of Excellence for Coral Reef Studies
- 2 Australian Institute of Marine Science
- 3 Australian Museum
- 4 Curtin University
- 5 Griffith University
- 6 James Cook University
- 7 Macquarie University
- 8 RMIT University
- 9 Southern Cross University
- 10 University of Queensland
- 11 University of Sydney
- 12 University of Technology Sydney
- 13 University of Western Australia
- 14 University of Wollongong

International

- 15 College of William and Mary, USA
- 16 Instituto Superior de Psicologia Aplicada, Portugal
- 17 Lund University, Sweden
- 18 Natural History Museum, UK
- 19 Norwegian University of Science and Technology, Norway
- 20 School for International Training, USA
- 21 University of Arizona, USA
- 22 University of Auckland, New Zealand
- 23 University of Bristol, UK
- 24 University of California Berkeley, USA
- 25 University of Copenhagen, Denmark
- 26 University of Exeter, UK
- 27 University of Glasgow, UK
- 28 University of Hawaii, USA
- 29 University of Lisbon, Portugal
- 30 University of Maryland Baltimore County, USA
- 31 University of Maryland College Park, USA
- 32 University of Miami, USA
- 33 University of Neuchatel, Switzerland
- 34 University of Oslo, Norway
- 35 University of Saskatchewan, Canada
- 36 University of St Andrews, UK
- 37 Uppsala University, Sweden
- 38 Washington University St Louis, USA

Senior scientists and postdocs

Trond Amundsen¹⁹
Sebastian Wacker¹⁹
CORALFISH: Reef Fish Coloration

Andrew Baird^{1,6}
Sean Connolly^{1,6}
Maria Dornelas³⁶
Coral demography

David Bellwood^{1,6}
Shelter use on coral reefs:
an acoustic study

Sandra Binning³³
Do parasites affect the cognitive
abilities of their fish hosts?

Michael Bok¹⁷
The behavioural basis of UV vision
in mantis shrimp

Redouan Bshary³³
Cooperative and cognitive aspects
of cleaning symbiosis

Maria Byrne¹¹
The lifespan and behavioural
repertoire of *Acanthaster planci* larvae,
responses to haloclines, food patches,
temperature and predator cues. Does
A. planci produce eternal larvae?

Roy Caldwell²⁴
Stomatopod behaviour

Katie Chartrand⁶
Jaclyn Davies⁶
Emma Scott⁶
Alysha Sozou⁶
Paul York⁶
Seagrass monitoring

Karen Cheney¹⁰
Colour and chemical diversity
in nudibranchs

Howard Choat⁶
Functional anatomy of feeding in
parrotfish and surgeonfish

Christofer Clemente¹⁰
Movement of *Varanus panoptes*
using accelerometry

Fabio Cortesi¹⁰
Colour vision in coral reef fishes:
from molecule to behaviour

Thomas Cribb¹⁰
Rod Bray¹⁸
Scott Cutmore¹⁰
Trematode parasites of Great Barrier
Reef fishes

Maria Dornelas³⁶
Mia Hoogenboom⁶
Corals in space: mapping spatial
distribution of coral species

Symon Dworjanyn⁹
Halocline boundaries defining
Crown-of-Thorns Starfish larval
migration and movement

Kate Feller²³
Photonic structures in the eyes
of stomatopod larvae

Renata Ferrari Legorreta¹¹
3D models of table corals:
quantifying growth and erosion

Rebecca Fox¹²
Understanding the movements
of marine fishes for management

Yakir Gagnon¹⁰
1) Circular polarisation behaviour
2) Polarimetry of stomatopods

Martin Grosell³²
Linking physiological effects of high
CO₂ to animal behaviour

Viktor Gruev³⁸
High speed colour polarisation cameras
for underwater behavioural studies

Alexandra Grutter¹⁰
What happens to reefs without
cleaner fish?

Andrew Hoey^{1,6}
1) Reproductive behaviour of
Crown-of-Thorns Starfish
2) Effect of sediment and algae
on coral settlement

Emma Kennedy⁵
Crustose coralline algae as indicators
of ocean acidification

Shaun Killen²⁷
Schooling of coral reef fish

Sjannie Lefevre Nilsson³⁴
Kristian Gunderson³⁴
Goran Nilsson³⁴

Physiology of jumping snails

Chan Lin³⁰
Neuroanatomy of stomatopods

Oona Lonnstedt³⁷
1) Predatory ecology of lionfish
2) Effects of microplastic pollution
on larval fish ecology



Joshua Madin⁷

Osmar Luiz⁷

Oscar Pizarro¹¹

Ariell Friedman¹¹

Mapping damage and recovery of Cyclone Ita

Joshua Madin⁷

Biodiversity and habitat complexity consequences of physical disturbance

Justin Marshall¹⁰

Fanny de Busserolles¹⁰

Polarisation on the reef

Mark McCormick^{1,6}

Bridie Allan⁶

Doug Chivers³⁵

Maud Ferrari³⁵

Mathew Mitchell³⁵

1) The influence of risk history on fish lateralisation

2) The influence of reef degradation of predator-prey interactions

Mark McCormick^{1,6}

Bridie Allan⁶

Emanuel Goncalves¹⁶

Effects of boat noise on predator-prey interactions in reef fish

Malcolm McCulloch¹³

Jim Falter^{1,13}

Sclerosponges as climate recorders

Mark Meekan²

Stephen Simpson²⁶

Alexandra Grutter¹⁰

Influence of predator models on cleaning interactions

Vanessa Messmer^{1,6}

1) Predation and regeneration of Crown-of-Thorns Starfish

2) Seasonal differences in thermal sensitivity of coral trout

Cathie Page As field leader for

Bette Willis^{1,6}

Ecological significance of coral disease on the Great Barrier Reef

Ronald Petie²⁵

Visual detection of coral reefs by the Crown-of-Thorns Starfish

Megan Porter²⁸

Neurochemistry of aggression in stomatopods

Morgan Pratchett^{1,6}

Reproductive behaviour of Crown-of-Thorns Starfish

Nick Roberts²³

Polarisation vision in fish

Elise Roberts¹⁰

Colour and polarisation vision in stomatopods

Dominique Roche³³

Patterns of activity and movement in parasitized coral reef fishes

Michael Salter²⁶

Intestinal carbonate production by fish

Sara Stieb¹⁰

Brian Dalton³¹

Vision in reef fish and stomatopods

Nick Strausfeld²¹

Comparative brain organisation in Stomatopoda and Platyhelminthes

Shelby Temple²³

Polarised vision in fish, cephalopods and crustaceans

Hanne Thoen¹⁰

Colour and polarisation vision in stomatopods

Andrea Waeschenbach¹⁰

Trematode parasites of GBR fishes

Sue-Ann Watson^{1,6}

Effects of ocean acidification on invertebrate behaviour and ecological interactions in coral reef ecosystems

Simon Wever⁶

Seasonal differences in thermal sensitivity of coral trout

Postgraduate research students

Mariana Alvarez Noriega⁶

Coexistence-promoting mechanisms in reef-coral communities (PhD)

Miguel Baptista²⁹

Will fish mucus cocoons still act as 'mosquito nets' in future seas? (PhD)

Lisa Bostrom-Einarsson^{1,6}

Using household products to control Crown-of-Thorns Starfish (PhD)

Simon Brandl^{1,6}

Niche partitioning among herbivorous reef fishes (PhD)

Alexander Buck⁶

Effects of citric acid on Crown-of-Thorns Starfish (MSc)

Ciemon Caballes^{1,6}

Crown-of-Thorns Starfish reproduction and dispersal (PhD)

Tory Chase⁶

Quantifying the effect of climate change on the fish-coral symbiosis (PhD)

Simona Colosio³³

Effects of the immune response on fish physiology, personality and learning (MSc)

Zara-Louise Cowan^{1,6}

The role of predation in population regulation of Crown-of-Thorns Starfish (PhD)

Camille Demaire³³

Does changes in the biological market of marine cleaning mutualism impact on the clients' physiology and behaviour? (MSc)

Steve Doo¹¹

Carbonate production estimates of large benthic foraminifera (PhD)

Mailie Gall¹

Crown-of-Thorns Starfish development along a thermal gradient representing the East Australian Current (PhD)

Missael Garcia³⁸

Underwater polarisation recording (PhD)

Ashley Gilbreath¹⁹

Female social and territorial behaviour in *Chrysiptera cyanea* (MSc)

Naomi Green¹⁰

Reef fish learning and generalisation of nudibranch warning signals (Hons)

Michael Hammond⁸

with supervisor **Nathan Bott**⁸
Observation and classification of bucephalid parasites from piscivorous teleosts (PhD)

Tessa Hempson⁶

Effects of future coral assemblages on associated fish communities (PhD)

Rachael Heuer³²

Linking physiological effects of high CO₂ to animal behaviour (PhD)

Martin Hing¹⁴

Evolution of sociality in coral reef associated fishes (PhD)

Daniel Huston¹⁰

Larval trematodes of the Ceritidae: use of molecular matching to solve complex life cycles (PhD)

Joanna Khan⁶

Spatial ecology and shelter use of large coral reef fishes (Hons)

Martin Luehrmann¹⁰

Visual system adaptations in apogonids (PhD)

Storm Martin¹⁰

Taxonomy, host specificity and evolutionary expansion of opecoelids in carnivorous tropical fishes (PhD)

Paloma Matis¹²

Dynamics of tropical fish interactions across latitudes: implications for range expansion (PhD)

Jamie McWilliam⁴

Pulse of a coral reef (PhD)

Laurie Mitchell²²

Breaking chromatic and achromatic camouflage by the Picasso Triggerfish (MSc)

Sara Mynott²⁶

Anti-predator colouration and behaviour in tropical marine organisms (PhD)

Lauren Nadler^{1,6}

Schooling behaviour in coral reef fish (PhD)

Danielle Nembhard⁶

Post-disturbance foraging patterns of herbivorous reef fish (MSc)

Miriam Horstad Ness¹⁹

Male-male competition and territoriality in *Chrysiptera cyanea* (MSc)

Jess Nowicki^{1,6}

Functional examination of neurochemistry of pairing in butterflyfish (PhD)

Maria Del Mar Palacios^{1,6}

Controlling mesopredators: importance of intraguild behavioural interactions in trophic cascades (PhD)

Sitara Palecanda²⁸

Retinal development in *Pullosquilla thomasini* (MSc)

Jose Paula²⁹

Cleaning stations in a changing world (PhD)

Genevieve Phillips¹⁰

The function of reef fish colour patterns: how did the coral trout get its spots? (PhD)

Davina Poulos^{1,6}

Prior residency effects and the dynamics of fish communities in a changing environment (PhD)

Samuel Powell³⁸

Development of underwater polarisation video camera (PhD)

Fausto Quattrini³³

Cognitive abilities of coral reef fishes: an evaluation of anti-predatory strategies (MSc)

Laura Richardson^{1,6}

Variation in fish assemblage and structure and function among coral habitats (PhD)

Molly Scott⁶

Mechanisms of behavioural thermoregulation in coral trout (PhD)

Robert Streit⁶

Spatial ecology and use of space in browsing herbivorous reef fishes (PhD)

Sterling Tebbett⁶

Sediment mediated suppression of herbivory on coral reefs (Hons)

Rachel Templin¹⁰

Polarisation vision in stomatopod crustaceans (PhD)

Zegni Triki³³

Linking cognition and brain physiology to marine cleaning mutualism (PhD)

Donald Warren⁶

Effects of increased temperature on competitive interactions in reef damselfish (PhD)

Megan Welch⁶

Sensitivity heritability under elevated CO₂ in a coral reef fish (PhD)

Mary Willard³⁰

With supervisor **Tom Cronin**³⁰
Extraocular photoreception in stomatopod crustaceans (PhD)

Rachael Woods⁷

Factors limiting coral larvae settlement in temperate waters (PhD)

Russell Yong Qi Yung¹⁰

Richness of blood flukes (Aporocotylidae) in tetraodontiform fishes (PhD)

Undergraduate research students

Kathryn Grazioso²⁰

Assessing the relationship between metabolic rate and preference of group size in reef fish species, *Caesio cunning*

Elizabeth Green²⁰

Effects of predation on fecundity and growth on Crown-of-Thorns Starfish

Mikayla Kelly²⁰

Understanding coordinated vigilance in rabbitfish on the GBR

Kharis Schrage¹⁵

Developmental biology of Crown-of-Thorns Starfish

Cassie Van Wynen²⁰

Satiation limits and prey preference of damselfish feeding on Crown-of-Thorns Starfish



Student groups

Barker College

Led by Sarah Cormio and Rob Paynter

Brighton Grammar School

Led by Bidy Duckham, Matthew McLennan and Reef Ecotours staff

Geelong College Preparatory School

Led by Hannah McKinnon, Benjamin Robbins, Marita Seaton and Reef Ecotours staff

RMIT University

Led by Jeff Shimeta, Gale Spring and Nathan Bott

School for International Training

Led by Tony Cummings, Vanessa Messmer and David Sellars

Other visitors

Australian Museum LIRS tour

Larry Barron
Jane Barron
Keith Fletcher
Sue Goc
Tracey Goddard
Sally Ho
Kate Kershaw
Terry Kershaw
Linda Leman
Erika Stockdale
Donna Yee

Led by Penny Berents and assisted by Chico Birrell and Lisa Atkinson

Australian Museum Trustees and AM staff

David Armstrong
Paul Connor, with Coco Connor
Steven Gregg
Rod Kefford
Rebecca Johnson

Tehmi Sukhla
Paul Ryan
Paul Flemons

Cook Shire Council

Peter Scott
Tim Cronin
Gary Kerr

LIRRF

Charlie Shuetrim
Sandy Shuetrim

Ian Potter Foundation

Janet Hirst
Nicole Webster
Avalae Weir

Filming for BBC series 'Ocean'

Yoland Bosiger
Rachel Butler
Alexia Graba-Landry
Roger Munns
Alex Vail

Young Ocean Explorers

Filming for NZ documentary
Steve Hathaway
Riley Hathaway
Matt Gerrand
Craig Henderson

Art installation for COP21 in Paris

Deep breathing resuscitation for the Reef
Janet Laurence, the AM's Artist-in-Residence, with Mandy Reid (AM staff member)

Australian Institute of Marine Science

GBR Ocean Observing System maintenance
Scott Bainbridge
Ray Boyes
Scott Gardner
Shaun Hahn

Former LIRS residents

Alison Rickert
Arwen Rickert

First aid training

Charlie Makray

Microscope maintenance

Allan Ross

Island maintenance

Staff of Queensland Parks and Wildlife Service

Assess damage from Cyclone Nathan

Stuart Crofton

Cyclone repairs

Abelia Cleaning
NQ Treelopping
Cairns Roofing Contractors
Bryant Constructions
Stratford Painting Contractors

PREVIOUS PAGE

LEFT: Anne Hoggett photographs a sea pen for Lizard Island Field Guide.

RIGHT: PhD student Zegni Triki at work in the aquarium.

ABOVE LEFT: New dinghy *Marie Elisabeth*
ABOVE RIGHT: Many sea fans have survived both cyclones.

PUBLICATIONS

In 2015, 111 publications based on work carried out at LIRS were received into the collection. These include 25 papers published in a single volume of *Zootaxa* that resulted from the 2013 Polychaete Workshop at Lizard Island. There are now more than 1,950 LIRS publications.

- 1. Aguado, M.T. and C.J. Glasby, 2015.** Indo-Pacific Syllidae (Annelida, Phyllodocida) share an evolutionary history. *Systematics and Biodiversity*, 13(4): 369-385.
- 2. Aguado, M.T., A. Murray and P. Hutchings, 2015.** Syllidae (Annelida: Phyllodocida) from Lizard Island, Great Barrier Reef, Australia. *Zootaxa*, 4019(1): 35-60.
- 3. Aguado, M.T., C. Helm, M. Weidhase and C. Bleidorn, 2015.** Description of a new syllid species as a model for evolutionary research of reproduction and regeneration in annelids. *Organisms, Diversity and Evolution*, 15: 1-21.
- 4. Aguado, M.T., C.J. Glasby, P.C. Schroeder, A. Weigert and C. Bleidorn, 2015.** The making of a branching annelid: an analysis of complete mitochondrial genome and ribosomal data of *Ramisyllis multicaudata*. *Scientific Reports*, 5: doi:10.1038/srep12072.
- 5. Álvarez-Campos, A. Riesgo, P. Hutchings and G. San Martín, 2015.** The genus *Syllis* Savigny in Lamarck, 1818 (Annelida, Syllidae) from Australia. Molecular analysis and re-description of some poorly-known species. *Zootaxa*, 4052(2): 297-31.
- 6. Alvestad, T. and N. Budaeva, 2015.** *Neosabellides lizae*, a new species of Ampharetidae (Annelida) from Lizard Island, Great Barrier Reef, Australia. *Zootaxa*, 4019(1): 61-69.
- 7. Baldock, T.E., A. Golshani, A. Atkinson, T. Shimamoto, S. Wua, D.P. Callaghan and P.J. Mumby, 2015.** Impact of sea-level rise on cross-shore sediment transport on fetch-limited barrier reef island beaches under modal and cyclonic conditions. *Marine Pollution Bulletin*, 97: 188-198.
- 8. Binning, S.A., A.F.H. Ros, D. Nusbaumer and D.G. Roche, 2015.** Physiological plasticity to water flow habitat in the damselfish, *Acanthochromis polyacanthus*: linking phenotype to performance. *PLOS One*, doi:10.1371/journal.pone.0121983.
- 9. Boaden, A. and M.J. Kingsford, 2015.** Predators drive community structure in coral reef fish assemblages. *Ecosphere*, 6(4): 1-33.
- 10. Boggemann, M., 2015.** Glyceriformia Fauchald, 1977 (Annelida: 'Polychaeta') from Lizard Island, Great Barrier Reef, Australia. *Zootaxa*, 4019(1): 070-097.
- 11. Bok, M.J., M.L. Porter and T.W. Cronin, 2015.** Ultraviolet filters in stomatopod crustaceans: diversity, ecology and evolution. *The Journal of Experimental Biology*, 218: 2055-2066.
- 12. Bostrom-Einarsson, L. and J. Rivera-Posada, 2015.** Controlling outbreaks of the coral-eating crown-of-thorns starfish using a single injection of common household vinegar. *Coral Reefs*, doi:10.1007/s00338-015-1351-6.
- 13. Brandl, S.J., W.D. Robbins and D.R. Bellwood, 2015.** Exploring the nature of ecological specialization in a coral reef fish community: morphology, diet and foraging microhabitat use. *Proceedings of the Royal Society B*, 282: 20151147.
- 14. Braun, C., 2015.** UV-induced DNA damage in coral reef fish: damage levels and protection mechanisms. PhD thesis, University of Queensland.
- 15. Brooker, R.M., P.L. Munday, D.P. Chivers and G.P. Jones, 2014.** You are what you eat: diet-induced chemical crypsis in a coral-feeding reef fish. *Proceedings of the Royal Society B*, 282: 20141887.
- 16. Bruce, N.L., 2015.** Joeropsididae Nordenstam, 1933 (Crustacea, Isopoda, Asellota) from the Lizard Island region of the Great Barrier Reef, Queensland, Australia. *Zookeys*, 491: 1-62.
- 17. Bruce, N.L. and R.L. Cumming, 2015.** A new genus of Stenetriidae Hansen, 1905 (Asellota: Isopoda: Crustacea) from the Great Barrier Reef, Australia and the southwestern Pacific. *Zootaxa*, 3941(4): 485-508.
- 18. Bshary, R. and R.F. Oliveira, 2015.** Cooperation in animals: toward a game theory within the framework of social competence. *Current Opinion in Behavioral Sciences*, 3: 31-37.
- 19. Callaghan, D.P., J. X. Leon and M.I. Saunders, 2015.** Wave modelling as a proxy for seagrass ecological modelling: Comparing fetch and process-based predictions for a bay and reef lagoon. *Estuarine, Coastal and Shelf Science*, 153: 108-120.
- 20. Capa, M. and A. Murray, 2015.** A taxonomic guide to the fanworms (Sabellidae, Annelida) of Lizard Island, Great Barrier Reef, Australia, including new species and new records. *Zootaxa*, 4019(1): 98-167.
- 21. Capa, M. and A. Murray, 2015.** Integrative taxonomy of Parasabella and Sabellomma (Sabellidae: Annelida) from Australia: description of new species, indication of cryptic diversity, and translocation of some species out of their natural distribution range. *Zoological Journal of the Linnean Society*, 175: 764-811.
- 22. Capa, M. and G. W. Rouse, 2015.** Sphaerodoridae (Annelida) from Lizard Island, Great Barrier Reef, Australia, including the description of two new species and reproductive notes. *Zootaxa*, 4019(1): 168-183.
- 23. Capa, M., A. Giangrande, J.M. de M. Nogueira and M.A. Tovar-Hernández, 2014.** Sabellidae Latreille, 1825, in *Handbook of Zoology: A natural history of the Phyla of the Animal Kingdom*, W. Westheide and G. Purschke (eds.), Handbook of Zoology Online.
- 24. Capa, M., Faroni-Perez, L. and P. Hutchings, 2015.** Sabellariidae from Lizard Island, Great Barrier Reef, including a new species of *Lygdamis* and notes on external morphology of the median organ. *Zootaxa*, 4019(1): 184-206.
- 25. Capa, M., M.T. Aguado and T. Bakken, 2015.** Phylogenetic hypothesis of Sphaerodoridae Malmgren, 1867 (Annelida) and its position within Phyllodocida. *Cladistics*, 2015: 1-16.
- 26. Cardoso, S.C., A.S. Grutter, J.R. Paula, G.I. André, J.P. Messias, M. Gozdowski, E. Kulczykowska and M.C. Soares, 2015.** Forebrain neuropeptide regulation of pair association and behavior in cooperating cleaner fish. *Physiology and Behavior*, 145: 1-7.



LEFT: Butterflyfish *Chaetodon baronessa* is common at Lizard Island.

RIGHT: A featherstar perched on a soft coral.

FAR RIGHT: Jellyfish *Netrostoma nuda* appears at Lizard Island occasionally.

FOLLOWING PAGE

LEFT: Featherstars usually cling to the bottom but sometimes they swim.

RIGHT: A pair of rabbitfish *Siganus corallinus* with a trumpetfish *Aulostomus chinensis*.

27. Casey, J.M., S.R. Connolly and T.D. Ainsworth, 2015. Coral transplantation triggers shift in microbiome and promotion of coral disease associated potential pathogens. *Scientific Reports*, 5: 11903.

28. Christa., G., K. Händeler, P. Kück, M. Vleugels, J. Franken, D. Karmeinski and H. Wägele, 2015. Phylogenetic evidence for multiple independent origins of functional kleptoplasty in Sacoglossa (Heterobranchia, Gastropoda). *Organisms, Diversity and Evolution*, 15: 23-26.

29. Coker, D.J., A.S. Hoey, S.K. Wilson, M. Depczynski, N.A.J. Graham, J.-P.A. Hobbs, T.H. Holmes and M.S.. Pratchett, 2015. Habitat selectivity and reliance on live corals for Indo-Pacific hawkfishes (Family: Cirrhitidae). *PLoS One*, doi:1371/journal.pone.0138136.

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31. Cortesi, F., W.E. Feeney, M.C.O. Ferrari, P.A. Waldie, G.A.C. Phillips, E.C. McClure, H.N. Skold, W. Salzburger, N.J. Marshall and K.L. Cheney, 2015. Phenotypic plasticity confers multiple fitness benefits to a mimic. *Current Biology*, 25: 1-6.

32. Cortesi, F., Z. Musilová, S.M. Stieb, N.S. Hart, U.E. Siebeck, M. Malmstrøm, O.K. Tørresen, S. Jentoft, K.L. Cheney, N.J. Marshall, K.L. Carleton and W.Salzburger, 2015. Ancestral duplications and highly dynamic opsin gene evolution in percomorph fishes, *PNAS*, 112(5): 1493-1498.

33. Cribb, T.H., R.A. Bray, K.A. Hall and S.C. Cutmore, 2015. A review of the genus *Antorchis* Linton, 1911 (Trematoda: Faustulidae) from Indo-Pacific fishes with the description of a new species. *Systematic Parasitology*, 92: 1-11.

34. Cronin, T.W., M.J. Bok, J.N. Marshall and R.L. Caldwell, 2014. Filtering and polychromatic vision in mantis shrimps: themes in visible and ultraviolet vision. *Philosophical Transactions of the Royal Society B*, 369: 20130032.

35. De Matos Nogueira, J.M., P. Hutchings and O. Carrerette, 2015. Terebellidae (Annelida, Terebelliformia) from Lizard Island, Great Barrier Reef, Australia. *Zootaxa*, 4019(1): 484-576.

36. De Matos Nogueira, J.M., P. Hutchings and O. Carrerette, 2015. Polycirridae (Annelida, Terebelliformia) from Lizard Island, Great Barrier Reef, Australia. *Zootaxa*, 4019(1): 437-483.

37. De Matos Nogueira, J.M., P. Hutchings and O. Carrerette, 2015. *Varanusia* nom. nov., a replacement name for *Lizardia* Nogueira, Hutchings & Carrerette, 2015 (Annelida: Terebellidae), preoccupied by *Lizardia* Pleijel & Rouse, 2005. *Zootaxa*, 4058(1): 141-141.

38. Diaz, P.E., R.A. Bray, S.C. Cutmore, S. Ward and T.H. Cribb, 2015. A complex of species related to *Paradiscogaster glebulae* (Digenea: Faustulidae) in chaetodontid fishes (Teleostei: Perciformes) of the Great Barrier Reef. *Parasitology International*, 64: 421-428.

39. Eckes, M., S. Dove, U.E. Siebeck and A.S. Grutter, 2015. Fish mucus versus parasitic gnathiid isopods as sources of energy and sunscreens for a cleaner fish. *Coral Reefs*, 34: 823-833.

40. Feller, K.D., J.H. Cohen and T.W. Cronin, 2015. Seeing double: visual physiology of double-retina eye ontogeny in stomatopod crustaceans. *Journal of Comparative Physiology A*, 201: 331-339.

41. Ferrari, M.C.O., M.I. McCormick, M.G. Meekan and D.P. Chivers, 2014. Background level of risk and the survival of predator-naive prey: can neophobia compensate for predator naivety in juvenile coral reef fishes? *Proceedings of the Royal Society B*, 282: 20142197.

42. Ferrari, M.C.O., M.I. McCormick, B.J.M. Allan, R. Choi, R.A. Ramasamy, J.L. Johansen, M.D. Mitchell and D.P. Chivers, 2015. Living in a risky world: the onset and ontogeny of an integrated antipredator phenotype in a coral reef fish. *Scientific Reports*, 5: 15537.

43. Ferrari, M.C.O., P.L. Munday, J.L.. Rummer, M.I. McCormick, K. Corkill, S.-A. Watson, B.J.M. Allan, M.G. Meekan and D.S.P. Chivers, 2015. Interactive effects of ocean acidification and rising sea temperatures alter predation rate and predator selectivity in reef fish communities. *Global Change Biology*, 21: 1848-1855.

44. Fitzhugh, K., J.M. de Matos Nogueira, O. Carerette and P. Hutchings, 2015. An assessment of the status of Polycirridae genera (Annelida: Terebelliformia) and evolutionary transformation series of characters within the family. *Zoological Journal of the Linnean Society*, doi: 10.1111/zoj.12259.



- 45. Gagliano, M., M. Depczynski and U.E. Siebeck, 2015.** Facing the environment: onset and development of UV markings in young fish. *Scientific Reports*, 5: 13193.
- 46. Gershwin, L.-A. and W. Zeidler, 2008.** Two new jellyfishes (Cnidaria: Scyphozoa) from tropical Australian waters. *Zootaxa*, 1764: 41-52.
- 47. Glasby, C. J., 2015.** Nereididae (Annelida: Phyllodocida) of Lizard Island, Great Barrier Reef, Australia. *Zootaxa*, 4019(1): 207-239.
- 48. Gunn, B.F., L. Baudouin, T. Beulé, P. Ilbert, C. Duperray, M. Crisp, A. Issali, J.-L. Konan and A. Rival, 2015.** Ploidy and domestication are associated with genome size variation in palms. *American Journal of Botany*, 102(10): 1625-1633.
- 49. Hamylton, S.M., J.D. Hedley and R.J. Beaman, 2015.** Derivation of high-resolution bathymetry from multispectral satellite imagery: a comparison of empirical and optimisation methods through geographical error analysis. *Remote Sensing*, 7(12): 16257-16273.
- 50. Hata, T., 2015.** Measuring and recreating hydrodynamic environments at biologically relevant scales. PhD thesis, Stanford University.
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