

Australian Museum

Lizard Island Research Station Upgrade

1 July 2010 to 30 June 2011

21 November 2011

nature culture **discover**



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Highlights

- The Upgrade Project is on track with almost \$4.5 million spent at the end of June 2011. Projects completed or underway in 2010/11 were:
 - A 30 kW solar power system was built between October 2010 and February 2011 (photos in Appendix 6). It began production in late February 2011, works brilliantly and saves about 65% of diesel used for generating electricity and hence of carbon emissions.
 - Two new dinghies were delivered during the year, the 8th and 9th purchased under this program (*Primrose* and *Mary Ida*; photo in Appendix 6).
 - Funding for a 10th new dinghy was donated by the Trust Company. It will be ordered in 2011/12.
 - The existing catamaran, *Kirsty K*, was fully refurbished by its builder in Cairns. This included minor repairs and adjustments, rewiring and repainting, and fitting new electronic equipment and twin 90 hp 4-stroke motors.
 - Staged purchase of laboratory equipment continued.
 - Additional improvements to the diving and workshop facilities were made.
- Research and operational highlights during 2010/11 were:
 - LIRS was well-used by Australian and international researchers (projects are listed in Appendix 1; institutional affiliations of researchers are summarised in Table 1). Their research is a major contribution to knowledge of coral reef biology and ecology.
 - At least 80 scientific papers dated 2010 were published (Appendix 3).
 - LIRS had record usage in 2010/11 (7,790 person nights excluding staff), including record usage by researchers (5,596 person nights; Appendix 2). The majority of the remaining person nights were attributable to student groups.
 - Six new fellowships and one special grant were awarded to start in March 2011: three fellowships to PhD students, three fellowships to early career researchers and the special grant to an early career researcher (Table 2).
 - Funding of up to \$65,000 is available to award five additional fellowships to start in March 2012.
 - Funding of \$30,000 is available to award a grant in 2012 that will improve the sustainability of the recreational reef fishery (Peter Teakle Sustainable Fishing Grant).
 - The Lizard Island Reef Research Foundation has recognised the need to support ongoing maintenance of LIRS. It has started a new program of Life Membership in which donors contribute a substantial sum to a capital fund, the income of which will be used for maintenance at LIRS. Three Life Members have already joined the program that started in September 2010.

Difficulties

- National harmonisation of state-based workplace health and safety regulations is underway with implications for both boating and diving that could adversely affect operations at LIRS (and other field stations). LIRS has been active in both processes to press the case for reef science and a practical approach to facilitating field work by visiting scientists.

Research and research training

Representatives of 45 institutions from 13 countries conducted research at LIRS during 2010/11, comprising 136 researchers in total (Table 1) who conducted 101 research projects (Appendix 1). The year saw a record level of research usage, including research training (Appendix 2).

Table 1: Source and academic level of research users during 2010/11 DONE

Country	Institution	Senior Researchers	Student Researchers				Total
			PhD	MSc	Honors	U/grad	
Australia	Australian Institute of Marine Science	3					3
	Australian Museum	3					3
	Australian National University	4	3		3		10
	CSIRO	1					1
	Flinders University	3					3
	James Cook University	11	20	8	1		40
	Macquarie University	1					1
	Maritime Safety Qld	1					1
	Museum of Tropical Queensland	1					1
	Northern Territory Museum	1					1
	Queensland Museum	4					4
	Southern Cross University	1					1
	State Herbarium of SA	1					1
	University of Adelaide	2					2
	University of Melbourne	1					1
	University of Sydney	1					1
	University of Tasmania	1					1
	University of Technology Sydney	1					1
University of Queensland	7	6				13	
Canada	University of Saskatchewan	1					1
Czech Republic	University of Ostrava	1					1
Germany	Ruhr University Bochum	1		1			2
	University of Tuebingen	1	1	2			4
Italy	Consiglio Nazionale delle Ricerche	1					1
Japan	University of the Ryukyus	1	1				2
New Zealand	Archaeology Solutions P/L	1					1
	Auckland University of Technology	1					1
	University of Auckland	2	3				5
Norway	Norwegian U. of Science & Technology	3					3
	University of Oslo	1					1
Portugal	Instituto Superior de Psicologia Lisbon	1		1			2
Russia	A.N. Severtzov Institute of Ecology and Evolution	1					1
	University of Moscow	1					1

Switzerland	University of Basel		1			1
	University of Neuchatel	3	2	2		7
	University of Zurich			1		1
UK	University of Cambridge		1			1
	University of St Andrews	1				1
	Zoological Society of London	1				1
USA	Cornell University	1				1
	Ocean Genome Legacy	1				1
	School for International Training				5	5
	University of California Davis	1				1
	University of California Santa Barbara	1				1
TOTAL		74	38	15	4	5

Support for research

The Lizard Island Reef Research Foundation continued to support field research at Lizard Island in 2010/11 in two ways: by providing fellowships and grants awarded to researchers by the Australian Museum, and by providing funds for development and maintenance of LIRS.

Fellowships and grants current in 2010/11 are shown in Table 2.

Table 2: Fellowships and grants current in 2010/11

Fellowship/Grant name	Year of Award	Duration	Fellow	Institution	Value of Award
Lizard Island Doctoral Fellowship	2008	3 years	Jacob Johansen	James Cook University	\$21,000
	2010	2 years	Chris Goatley	James Cook University	\$14,000
	2011	2 years	F. Joseph Pollock	James Cook University	\$16,000
Ian Potter Doctoral Fellowship at Lizard Island	2009	2 years	Alicia Crawley	University of Queensland	\$14,000
	2010	2 years	Darren Coker	James Cook University	\$14,000
	2011	2 years	Sandra Binning	Australian National University	\$16,000
Isobel Bennett Marine Biology Fellowship	2011	1 year	Dr Stefan Walker	James Cook University	\$11,000
John & Laurine Proud Fellowship	2010	1 year	Dr Nichola Raihani	Zoological Society of London	\$8,000
	2011	1 year	Dr Tracy Ainsworth	James Cook University	\$11,000
Yulgilbar Foundation Fellowship	2010	1 year	Dr Maud Ferrari	University of California Davis	\$7,100
	2011	1 year	Dr Chris Fulton	James Cook University	\$11,000
	2011	1 year	Jessica Stella	James Cook University	\$8,000
Special Grant	2011	1 year	Sarah Hamylton	University of Wollongong	\$6,800

Funding is also available through the LIRRF to continue supporting research in 2011/12, as follows:

- Five new fellowships in existing programs to start in 2012, valued at up to \$81,000.
- A new grant, the Peter Teakle Sustainable Fishing Grant, to start in 2012 and valued at up to \$30,000.
- Field work by ten existing Fellows to the value of \$84,800 between April 2011 and March 2012.

In 2010/11, the LIRRF provided the following contributions for development and maintenance of LIRS:

- \$480,000 for the Upgrade Project, substantially more than the agreed Donor Contribution of \$260,000.
- \$62,200 to support additional developments at LIRS outside the scope of the Upgrade Project.

Education

The research station provides an opportunity for students to experience and begin to understand the complexities of the coral reef environment. The educational program is usually conducted by teachers or lecturers from the students' own institution although some engage consultants to provide expert knowledge. Ten student groups from nine institutions used the station's facilities in 2010/11, as follows:

Ascham School
 Barker College
 Brighton Grammar School
 Geelong College
 Haileybury College
 Trinity Anglican School
 RMIT University
 School for International Training (2 groups)
 University of Maryland

Intellectual Property

No LIRS Intellectual Property of potential commercial value was developed during 2010/11.

Performance

Key performance indicators for the LIRS Upgrade Project are detailed at Item 8, Schedule A of the Head Agreement. Performance in 2010/11 is assessed against those indicators here. All except one of the benchmarks were met, and in many areas were far exceeded. The exception was timing of the power upgrade, which was achieved 14 months behind schedule as explained in last year's report.

KPI	Result
<u>Education and skills development</u> : access for research and education to at least 15 postgraduate students in 2010/11	57 students (Table 1 and Appendix 1) – KPI achieved
<u>Collaboration</u> : usage by 15 research institutions in 2010/11	42 institutions (Table 1) – KPI achieved
<u>Collaboration</u> : facilitate research visits by 30 visiting scientists in 2010/11	74 non-student researchers (Table 1 and Appendix 2) – KPI achieved
<u>Collaboration</u> : enter into eight new research, industry or business collaborations by the end of the 10 th year from	ISPA Portugal and the Teakle Foundation became the 8 th and 9 th new collaborators since 2006 –

practical completion	KPI achieved
<u>Research and development excellence</u> : 55 scientific publications dated 2010	80 publications (Appendix 3) – KPI achieved
<u>Technology transfer</u> : establishment of information-sharing activities	Summer seminar series continued; information about LIRS activities continue to be posted on AM web site; Lizard Island blog established on AM web site – KPI achieved
<u>Investment in research</u> : best endeavours by AM to continue its association with, and to receive support from, the Lizard Island Reef Research Foundation and others for LIRS	See section above, Support for Research – KPI achieved
<u>Investment in research</u> : earn enough from activities at LIRS to cover salaries, fuel, maintenance and reimbursable expenses	See Appendix 5 – KPI achieved
<u>Construction</u> : Complete construction project as planned	All construction works now complete, all on time and within the overall budget except for the solar power system 14 months behind schedule – KPI largely achieved
<u>Other projects</u> : Complete other projects as planned	
<ul style="list-style-type: none"> - New boats (<i>Note 1</i>) - Replace existing boats (<i>Note 2</i>) - Upgrade laboratory equipment - Replace tractor - Upgrade diving facilities - Improve bulk fuel facilities - Improve waste disposal facilities - Upgrade access track 	<p>Complete</p> <p>Complete (more than planned)</p> <p>Half budget remaining</p> <p>Done twice, 6 years apart</p> <p>Mostly done</p> <p>Mostly done</p> <p>Mostly done</p> <p>Partly done</p> <p>- KPI largely achieved</p>

Note 1. The original plan was to purchase an additional high-speed catamaran. However, the two new “people mover” boats have been so successful that this is no longer considered necessary. Instead, the existing high-speed catamaran was refitted in 2011.

Note 2: The plan was to replace five dinghies. By 2010/11, nine old dinghies had been replaced and a tenth will be ordered in 2012.

Commercialisation

As required in Clause 4 of the Proceeds of Commercialisation Agreement, the following information is provided:

4.2 (a) None of the events listed in Clause 3.1 occurred in 2010/11, so the AM did not make any notifications to the Department.

(b) Two research projects involving current and former Australian Museum staff were carried out in 2010/11. Dr Jim Specht (retired) continued his work on an archaeological project led by Dr Matt Felgate of the University of Auckland in September 2010. Current staff, Dr Pat Hutchings and Dr Maria Capa Corrales, contributed to the CReefs Census of Marine Life project in August and September 2010.

(c) Two Australian Museum staff are currently known (as at November 2011) to be conducting research at LIRS during 2011/12. Dr Zoe Richards made a research visit in September 2011. Dr Jeff Leis will lead a multi-institutional team on research visits in late 2011 and early 2012.

(d) Entities involved in conducting research at LIRS in 2010/11 are listed in Table 1 and Appendix 1.

(e) Entities that propose to use LIRS in 2011/12, as known at November 2011, are:

Research

Auckland University of Technology
Australian Institute of Marine Science
Australian Museum
Australian National University
Cornell University
Instituto Superior Psicologia Lisbon
James Cook University
Macquarie University
Norwegian University of Science and Technology
School for International Training
Southern Cross University
University of Auckland
University of Basel
University of Bochum
University of Bristol
University of California Berkeley
University of Cambridge
University of Maryland Baltimore County
University of Neuchâtel
University of Oslo
University of Queensland
University of Technology Sydney
University of Tuebingen
University of Western Australia
University of Wollongong
Washington University St Louis

Student groups

Barker College
Brighton Grammar School
Geelong College Preparatory School
RMIT University
School for International Training
Trinity Anglican School

University of Texas Austin

(f) No commercialisation activities were undertaken during 2010/11.

(g) It is unlikely that any commercialisation activities will be undertaken in 2011/12.

(h) One former and two current AM employees were engaged in Research at LIRS during 2010/11. No AM employees were engaged in Commercialisation activities during 2010/11. [Refer 4.2 (b) above]

(i) Financial and in-kind contributions made by AM to LIRS are shown in Appendix 5.

(j) Not applicable for 2010/11.

(k) Not applicable for 2010/11.

Appendix 1

Research projects and project leaders 2010/11

Endoparasites of coral reef fishes

Dr Rob Adlard, Queensland Museum

The effects of acidification on predator/prey interactions

Bridie Allan (Masters student), James Cook University

Coral reef fish coloration: sexual selection, diversity and speciation

Prof Trond Amundsen and Dr Elisabet Forsgren, Norwegian University of Science and Technology

GBR Ocean Observing System

Scott Bainbridge, Australian Institute of Marine Science

Testing the adaptive capacity of corals to climate change: a demographic approach

Dr Andrew Baird, James Cook University

Long term effect of cleaner fish presence on fish herbivory rates

Dr Sonia Bejarano Chavarro (field leader for Dr Alexandra Grutter), University of Queensland

Quantifying the effect of cleaner fish removal on grazing intensity on patch reefs

Dr Sonia Bejarano Chavarro, University of Queensland

CReefs - Census of Marine Life

Dr Julian Caley and Shawn Smith, Australian Institute of Marine Science

Dr Rob Adlard, Dr Merrick Ekins, Dr Terrence Miller and Monika Schlacher, Queensland Museum

Lynda Avery, Dr Phil Bock, Museum Victoria

Gareth Belton and Maria Marklund, University of Adelaide

Dr Ian Beveridge, University of Melbourne

Chad Buxton, Museum of Tropical Queensland

Dr Maria Corrales Capa and Dr Pat Hutchings, Australian Museum

Dr Zdenek Duris, University of Ostrava

Takuma Fujii (PhD student) and Dr James Reimer, University of the Ryukyus

Abby Fusaro, Ocean Genome Legacy

Dr Fred Gurgel, State Herbarium of SA

Holly Heiniger (PhD student), University of Queensland

Dr Viacheslav Ivanenko, University of Moscow

Dr Ivan Marin, A.N. Severtzov Institute of Ecology and Evolution

Charlotte Watson, Northern Territory Museum

Shape up or ship out: can coral reef fish change their shape to suit their environment?

Sandra Ann Binning (PhD student), Australian National University

Competition and coexistence in the butterflyfish community

Shane Blowes (PhD student) and Prof Sean Connolly (supervisor) James Cook University

Microbial nitrogen fixation in the hindgut of marine herbivorous fishes

Lilly Bojarski (PhD student), University of Auckland

Investigating temporal foraging patterns of coral reef predators and their effect on prey
Yoland Bosiger (Honours student), James Cook University

Effect of diet on corallivore condition and reproduction
Rohan Brooker (PhD student), James Cook University

Cooperative and cognitive aspects of cleaning symbiosis
Prof Redouan Bshary, University of Neuchatel

Anemone distribution and toxicity analysis
Karen Burke da Silva, Assoc Prof John Edwards and Dr Jeanne Young, Flinders University

Colour vision thresholds in marine fish
Conor Champ (PhD student), University of Queensland

Evolution of aposematic (warning) colouration in marine opisthobranchs
Dr Karen Cheney, University of Queensland

How did coral trout get its spots?
Dr Karen Cheney, University of Queensland

The role of hindgut symbionts in protein uptake and recycling in marine herbivorous fishes
Dr Kendall Clements, University of Auckland
Ass Prof Esther Angert, Cornell University
Prof Howard Choat, James Cook University
Dr Lindsey White, Auckland University of Technology

Evaluation of protection zones - case studies in Australia and the Solomon Islands
Pip Cohen (PhD student), James Cook University

Effects of coral bleaching on coral-dwelling fishes
Darren Coker (PhD student), James Cook University

Effect of chronic fish predation on reef building corals
Andrew Cole, (PhD student), James Cook University

Biodiversity of coral assemblages
Prof Sean Connolly, James Cook University

Colour adaptation in *Pseudochromis fuscus*
Fabio Cortesi (PhD student), University of Basel

Assessing the risk of ocean acidification for the Great Barrier Reef
Alicia Crawley (PhD student), University of Queensland

Ecological energetics of butterflyfishes
Christopher Cvitanovic (PhD student), Australian National University

Climate change impacts through changes in topographic complexity
Jaclyn Davies (Masters student), James Cook University

Ecological and evolutionary genomics of marine invertebrates

Prof Bernie Degnan and Dr Sandie Degnan, University of Queensland

Hormonal correlates of interspecific social behaviour

Alizee Derendinger (Masters student) and Dr Albert Ros (supervisor), University of Neuchatel

Effects of ocean acidification on homing behaviour in cardinalfishes

Brynn Devine (Masters student), James Cook University

Determine cause of ocean acidification effects: pH or CO₂?

Danielle Dixson (PhD student), James Cook University

Explaining coral species abundances: linking morphology to demography

Dr Maria Dornelas, University of St Andrews

A biodiversity baseline for the northern Great Barrier Reef using Reef Life Survey protocols

Dr Graham Edgar, University of Tasmania

Distribution, abundance and diversity of the Lapita cultural complex on the GBR coastline of Australia

Dr Matthew Felgate, University of Auckland

Prof Wal Ambrose, Australian National University

Dr Hans Bader, Archaeology Solutions Pty Ltd

Dr Jim Specht, Australian Museum

The effect of ocean acidification on predator-prey interactions

Dr Maud Ferrari, University of California Davis

Prof Doug Chivers, University of Saskatchewan

Energetics of locomotion in coral reef fishes

Dr Christopher Fulton, Australian National University

The ecological role of sediments on coral reefs

Christopher Goatley (PhD student) and Prof David Bellwood (supervisor), James Cook University

Partner novelty and reproductive fitness in the simultaneously hermaphroditic sea slug *Chelidonura sandrana*

Carolyn Groves (undergraduate student), School for International Training

Behavioural flexibility as a phenotypic response to environmental change by coral reef fishes

Siobhan Heatwole (Honours student), Australian National University

Identification and diversity of Myxosporean parasites in apogonids

Holly Heiniger (PhD student), University of Queensland

Energetics of habitat choice in planktivorous coral reef fishes

Jacob Johansen (PhD student), James Cook University

Underwater hyperspectral imaging of coral habitats

Dr Geir Johnsen, Norwegian University of Science and Technology

Ultrastructure and function of the hindgut in marine herbivorous fishes

Kate Johnson (PhD student), University of Auckland

An investigation of coral morphology and fish association

James Kerry (Masters student), James Cook University

GBR endocrine disruption

Dr Frederieke Kroon, CSIRO

Impacts of tourism on coral disease prevalence

Joleah Lamb (PhD student), James Cook University

Sexual reciprocity and traumatic mating in hermaphrodite sea slugs

Rolanda Lange (PhD student), University of Tuebingen

What are the costs of locomotion during daily foraging in coral reef fish?

Cayne Layton (Honours student) and Dr Christopher Fulton (supervisor), Australian National University

Ecology of cryptobenthic fishes on the Great Barrier Reef

Carine Lefevre (PhD student), James Cook University

Spatial & temporal patterns of coral reef connectivity

Libby Liggins (PhD student), University of Queensland

Behavioural responses of varanid lizards (goannas) to cane toads

John Llewelyn (PhD student), James Cook University

Predator-prey interactions and the importance of sensory cues in a changing world

Oona Lonnstedt (PhD student), James Cook University

Environmental constraints on mangrove performance

Prof Catherine Lovelock and Dr Ruth Reef, University of Queensland
Prof Marilyn Ball and Dr Nele Schmitz, Australian National University

Seascape genetics of broadcast spawning reef building corals

Dr Vimoksalehi Lukoschek, James Cook University

Indirect effects of cleaner wrasses

Dr Elizabeth Madin, University of Technology Sydney
Prof Robert Warner, University of California Santa Barbara

Hydrodynamic disturbances on coral reefs

Dr Joshua Madin, Macquarie University

Long term effect of cleaner fish presence on fish herbivory rates

Gay Marsden (field leader for Dr Alexandra Grutter), University of Queensland

How did coral trout get its spots?

Prof Justin Marshall and Dr Karen Cheney, University of Queensland

Polarised light underwater

Prof Justin Marshall, University of Queensland

Stomatopod vision and signals

Prof Justin Marshall, University of Queensland

Predatory ecology of *Pseudochromis fuscus*

Prof Mark McCormick, James Cook University

Annual fish census at six sites at Lizard Island

Prof Mark McCormick, James Cook University

Impact of acidification on fish survival

Prof Mark McCormick, James Cook University

Dr Paolo Domenici, Consiglio Nazionale delle Ricerche

Evolution, adaptation and acclimatization: the vulnerability of scleractinian corals to mass bleaching events

Dominique McCowan (PhD student), James Cook University

Effects of climate change on the connectivity of coral reef fish populations

Ian McLeod (PhD student), James Cook University

Protein uptake in marine herbivorous fishes

Selena McMillan (PhD student), University of Auckland

Impact of acidification on fish survival

Dr Mark Meekan, Australian Institute of Marine Science

Recording Aboriginal sites on Lizard Island

Robynne Mills, University of Sydney

Chemical cues: the role of chemical alarm cues in coral reef fish

Mathew Mitchell (PhD student), James Cook University

Effects of ocean acidification on behaviour of reef fishes

Prof Phil Munday, James Cook University

Prof Goran Nilsson, University of Oslo

Secondary predator attractants of naïve *Pseudochromis fuscus*

Shannon Odell (undergraduate student), School for International Training

Ecological significance of coral disease on the Great Barrier Reef

Allison Paley (PhD student), James Cook University

Post settlement events influence on coral population dynamics

Dr Lucie Penin, James Cook University

Monitoring tidal movements

Rafe Penington, Maritime Safety Queensland

Interspecific social competence and audience effects in cleaner wrasses *Labroides dimidiatus*

Ana Pinto (PhD student), University of Neuchatel

Coordination abilities in cleaner wrasse pairs

Ana Pinto (PhD student), University of Neuchatel

Effect of coral bleaching on feeding behaviour in butterflyfishes

Chiara Pisapia (Masters student), James Cook University

Understanding White Syndrome in the Indo-Pacific

F. Joseph Pollock (PhD student), James Cook University

Development of novel tagging and marking methods to study movement, growth and age of holothurians

Dr Steve Purcell, Southern Cross University

The evolution of punishment and cooperation in nature

Dr Nichola Raihani, Institute of Zoology, Zoological Society of London

Comparative analysis of Siphopteron mating strategies and their genital morphology

Verena Reichel (Masters student), University of Tuebingen

The bio-physical coupling of predator-prey interactions in coral reef fishes

Dominique Roche (PhD student), Australian National University

Niche segregation in coral reef damselfishes

Rosaella Sheb'a (Honours student), Australian National University

The effect of predator influence on color change in two distinct morphs of the marine fish *Pseudochromis fuscus*

Megan Sherman (undergraduate student), School for International Training

Identifying Apogonidae from larval to juvenile phases based on morphological differences

Rebecca Shopiro (undergraduate student), School for International Training

Interspecies comparison in the brain's distribution of the arginine vasotocin (AVT) of species varying on their cooperative behaviour

Dr Marta Soares and Ana Rute Martins de Mendonca (Masters student), Instituto Superior de Psicologia Lisbon

Diversity of coral ectosymbionts

Jessica Stella (PhD student), James Cook University

The ecological effects of parasites in fish after settlement

Derek Sun (PhD student), University of Queensland

The impact of ocean acidification on the reproduction and growth of scleractinian corals

Dr Ralph Tollrian and Sebastian Striewski (Masters student), Ruhr-University Bochum

Impact of herbivorous fish on coral recruit survival

Melanie Trapon (PhD student) and Dr Morgan Pratchett (supervisor), James Cook University

Cooperative hunting between groupers, moray eels and octopus

Alex Vail (PhD student), University of Cambridge

Molecular mechanisms of coral immunity and the influence of environmental factors on coral immunity

Jeroen van de Water (PhD student), James Cook University

Environmental determinants of growth & mortality of reef fishes in the GBR

Cecilia Villacorta Rath (Masters student), James Cook University

Hormone correlates of social behaviour: does social androgen modulation differ in intra- and interspecific contexts?

Philippe Vulliod (Masters student) and Dr Albert Ros (supervisor), University of Neuchatel

The evolution of badges of status and signal-receiver behaviour

Dr Stefan Walker and Dr Vanessa Messmer, James Cook University

How pH changes fish behaviour

Megan Welch (undergraduate student), School for International Training

The effects of sedimentation on damselfish

Amelia Wenger (Masters student), James Cook University

Coolidge effect - how partner identity influences the sexual motivation of hermaphroditic sea slugs

Johanna Werminghausen (Masters student) and Dr Nils Anthes (supervisor), University of Tuebingen

Predatory ecology of Moon Wrasse

James White (Masters student), James Cook University

Generalization in adult cleaner wrasse

Sharon Wismer (PhD student), University of Neuchatel

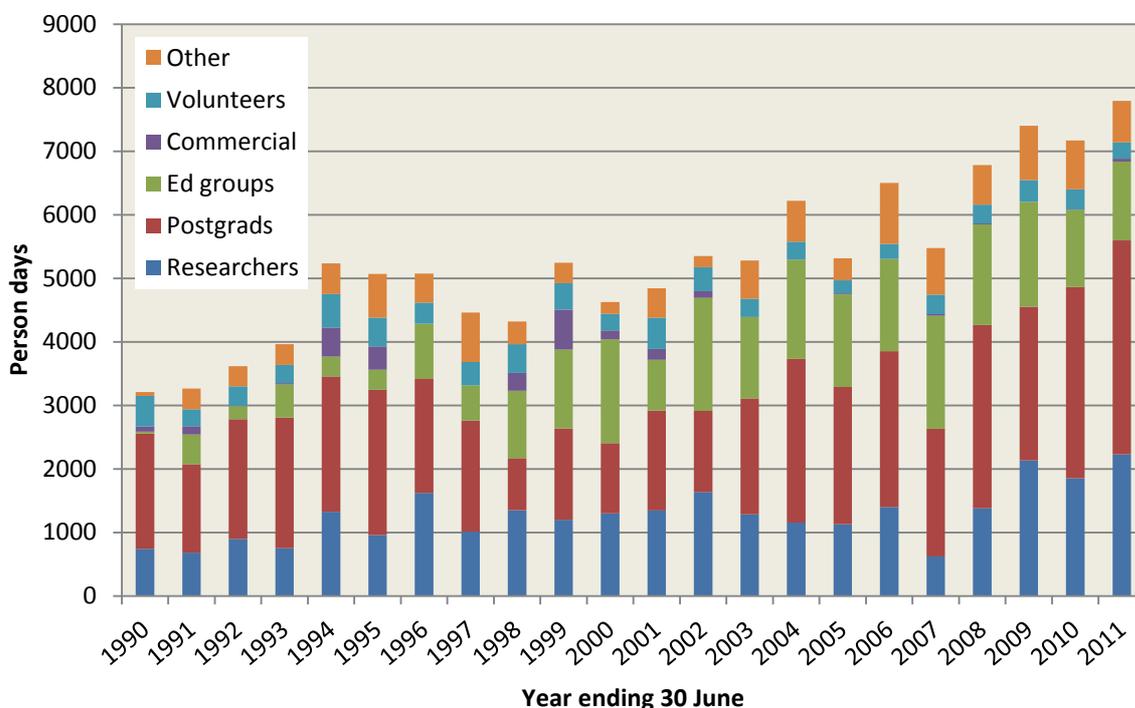
The effect of age class and habitat on cleaner wrasse behaviour

Sharon Wismer (Masters student), University of Zurich

Appendix 2

Personnel

The graph below shows participation in LIRS Activities by various user groups.



Appendix 1 lists the names and institutional affiliations of all research project leaders who participated in LIRS activities between 1 July 2010 and 30 June 2011.

LIRS staff in 2010/11 were:

- Dr Lyle Vail (Director)
- Dr Anne Hoggett (Director)
- Bob Lamb (Maintenance)
- Tania Lamb (Maintenance)
- Lance Pearce (Maintenance)
- Marianne Pearce (Maintenance)
- Tane Sinclair-Taylor (Temporary, Maintenance)
- Alex Vail (Temporary, Maintenance)

A film crew from BBC and Digital Dimensions Pty Ltd used LIRS for commercial purposes in 2010/11. Participants were:

- Nikki Melton
- Rory McGuinness
- Cam McGrath
- Bess Manley
- Monty Halls
- Richard Fitzpatrick
- Mary Clark
- Rachel Butler

James Bricknell

Student groups from six Australian high schools, one Australian University and two US universities used LIRS for educational purposes in 2010/11, as follows:

Ascham School
Barker College
Brighton Grammar School
Geelong College Preparatory School
Haileybury College
Trinity Anglican School
RMIT University
School for International Training
University of Maryland

Appendix 3

Publications dated 2010 based on work at LIRS

1. **Ang, T.Z., 2010.** Social conflict resolution in groups of the angelfish *Centropyge bicolor*. PhD thesis, University of Cambridge.
2. **Ang, T.Z. and A. Manica, 2010.** Aggression, segregation and stability in a dominance hierarchy. *Proceedings of the Royal Society B*, 277: 1337-1343.
3. **Ang, T.Z. and A. Manica, 2010.** Unavoidable limits on group size in a body size-based linear hierarchy. *Behavioural Ecology*, doi:10.1093/beheco/arq062
4. **Ang, T.Z. and A. Manica, 2010.** Benefits and costs of dominance in the angelfish *Centropyge bicolor*. *Ethology*, 116: 1-11.
5. **Anker, A., 2010.** New findings of rare or little-known alpheid shrimp genera (Crustacea, Decapoda) in Moorea, French Polynesia. *Zootaxa*, 2403: 23-41.
6. **Barnett, L.J., T.L. Miller and T.H. Cribb, 2010.** Two new *Stephanostomum*-like cercariae (Digenea: Acanthocolpidae) from *Nassarius dorsatus* and *N. olivaceus* (Gastropoda: Nassariidae) in central Queensland, Australia. *Zootaxa*, 2445: 35-52.
7. **Biro, P.A., C. Beckmann and J.A. Sharp, 2010.** Small within-day increases in temperature affects boldness and alters personality in coral reef fish. *Proceedings of the Royal Society B*, 277: 71-77.
8. **Bonaldo, R.M and D.R. Bellwood, 2010.** Parrotfish predation on massive *Porites* on the Great Barrier Reef. *Coral Reefs*, doi 10.1007/s00338-010-0669-3.
9. **Bongaerts, P., C. Riginos, T. Ridgway, E. Sampayo, M. J. H. van Oppen, N. Englebort, F. Vermeulen and O. Hoegh-Guldberg, 2010.** Genetic divergence across habitats in the widespread coral *Seriatopora hystrix* and its associated *Symbiodinium*. *PLoS One*, 5: e10871
10. **Bray, R.A., T.H. Cribb and J.-L. Justine, 2010.** *Multitestis* Manter 1931 (Digenea: Lepocreadiidae) in ephippid and chaetodontid fishes (Perciformes) in the south-western Pacific Ocean and the Indian Ocean off Western Australia. *Zootaxa*, 2427: 36-46.
11. **Bray, R.A., T.H. Cribb and J.-L. Justine, 2010.** *Diploproctodaeum* spp. (Digenea, Lepocreadiidae) in Australian and New Caledonian waters including two new species from Tetraodontiformes and new records of related species. *Acta Parasitologica*, 55: 313-326.
12. **Burger, M.A.A. and R.D. Adlard, 2010.** Phenotypic variation in a significant spore character in *Kudoa* (Myxosporea: Multivalvulida) species infecting brain tissue. *Parasitology*, 137: 1759-1772.
13. **Burger, M.A.A. and R.D. Adlard, 2010.** Four new species of *Kudoa* Meglitsch, 1947 (Myxosporea: Multivalvulida) from Australia with recommendations for species descriptions in the Kudoidae. *Parasitology*, 137: 793-814.

- 14. Byrne, M., F. Rowe and S. Uthicke, 2010.** Molecular taxonomy, phylogeny and evolution in the family Stichopodidae (Aspidochirota: Holothuroidea) based on COI and 16S mitochondrial DNA. *Molecular Phylogenetics and Evolution*, doi: 10.1016/j.ympev.2010.04.013
- 15. Cheney, K.L., 2010.** Multiple selective pressures apply to a coral reef fish mimic: a case of Batesian-aggressive mimicry. *Proceedings of the Royal Society B*, doi 10.1098/rspb.2009.2218
- 16. Cole, A.J., R.J. Lawton, M.S. Pratchett and S.K. Wilson, 2010.** Chronic coral consumption by butterflyfishes. *Coral Reefs*, doi 1007/s00338-010-0674-6.
- 17. Cole, K.S., 2010.** Gonad development in hermaphroditic gobies. Chapter 6 in "Reproduction and sexuality in marine fishes. K.S. Cole (Ed.). University of California Press, Berkeley.
- 18. Cole, K.S., 2010.** Gonad morphology in hermaphroditic gobies. Chapter 5 in "Reproduction and sexuality in marine fishes. K.S. Cole (Ed.). University of California Press, Berkeley.
- 19. Cortesi, F. and K.L. Cheney, 2010.** Conspicuousness is correlated with toxicity in marine opisthobranchs. *Journal of Evolutionary Biology*, 23: 1509-1518.
- 20. Deveney, M.R. and I.D. Whittington, 2010.** Three new species of *Benedenia* Diesing, 1858 from the Great Barrier Reef, Australia with a key to species of the genus. *Zootaxa*, 2348: 1-22.
- 21. Fabricius, K.E., K. Okaji and G. D'earth, 2010.** Three lines of evidence to link outbreaks of the crown-of-thorns seastar *Acanthaster planci* to the release of larval food limitation. *Coral Reefs*, 29: 593-605.
- 22. Farnsworth, C.A., D.R. Bellwood and L. van Herwerden, 2010.** Genetic structure across the GBR: evidence from short-lived gobies. *Marine Biology*, 157: 945-953.
- 23. Ferreira, M.L., N.J. Smit and A.J. Davies, 2010.** *Gnathia grutterae* sp. nov. (Crustacea, Isopoda, Nathiidae) parasitising representatives of the Balistidae, Labridae and Tetraodontidae from Lizard Island, Great Barrier Reef, Australia. *Zootaxa*, 2718:39-50.
- 24. Fisher, R. and J.M. Leis, 2010.** Swimming speeds in larval fishes: from escaping predators to the potential for long distance migration. Chapter 11 (pp. 333-373) in: Fish locomotion: an eco-ethological perspective. Eds.: P. Domenici and B.G. Kapoor. Science Publishers: Enfield, NH, USA.
- 25. Fuiman, LA., M.G. Meekan and M.I. McCormick, 2010.** Maladaptive behavior reinforces a recruitment bottleneck in newly settled fishes. *Oecologia*, 164: 99-108.
- 26. Fulton, C.J., 2010.** The role of swimming in reef fish ecology. Chapter 12 (pp. 374-406) in: Fish locomotion: an eco-ethological perspective. Eds.: P. Domenici and B.G. Kapoor. Science Publishers: Enfield, NH, USA.
- 27. Gagliano, M., M.I. McCormick, J.A. Moore and M. Depczynski, 2010.** The basics of acidification: baseline variability of pH on Australian coral reefs. *Marine Biology*, 157: 1849-1856.
- 28. Gaither, M.R., R.J. Toonen, D.R. Robertson, S. Planes and B.W. Bowden, 2010.** Genetic evaluation of marine biogeographical barriers: perspectives from two widespread Indo-Pacific snappers (*Lutjanus kasmira* and *Lutjanus fulvus*). *Journal of Biogeography*, 37: 133-147.

- 29. Gardiner, N.M. and G.P. Jones, 2010.** Synergistic effects of habitat preference and gregarious behaviour on habitat use in coral reef cardinalfish. *Coral Reefs*, 29: 845-856.
- 30. Gardiner, N.M., P.L. Munday and G.E. Nilsson, 2010.** Counter-gradient variation in respiratory performance of coral reef fishes at elevated temperatures. *PLoS One*, 5: e13299
- 31. Goatley, C.H.R and D.R. Bellwood, 2010.** Biologically mediated sediment fluxes on coral reefs: sediment removal and off-reef transportation by the surgeonfish *Ctenochaetus striatus*. *Marine Ecology Progress Series*, 415: 237-245.
- 32. Greenfield, D.W. and J.E. Randall, 2010.** *Eviota karaspila*, a new gobiid fish from Fiji (Teleostei: Gobiidae). *Zootaxa*, 2672: 61-68.
- 33. Grutter, A.S., J.G. Rumney, T. Sinclair-Taylor, P. Waldie and C.E. Franklin, 2010.** Fish mucous cocoons: the 'mosquito nets' of the sea. *Biology Letters*, doi: 10.1098/rsbl.2010.0916
- 34. Grutter, A.S., 2010.** Cleaner fish. *Current Biology*, 20: R547-R549.
- 35. Grutter, A.S., A.J. Crean, L.M. Curtis, A.M. Kuris, R.R. Warner and M.I. McCormick, 2010.** Indirect effects of an ectoparasite reduce successful establishment of a damselfish at settlement. *Functional Ecology*, doi: 10.1111/j.1365-2435.2010.01798.x
- 36. Gunter, N.L., M.A.A. Burger and R.D. Adlard, 2010.** Morphometric and molecular characterisation of four new *Ceratomyxa* species (Myxosporea: Bivalvulida: Ceratomyxidae) from fishes off Lizard Island, Australia. *Folia Parasitologica*, 57: 1-10.
- 37. Haendeler, K., H. Waegele, U. Wahrmund, M. Ruedinger and V. Knoop, 2010.** Slugs' last meals: molecular identification of sequestered chloroplasts from different algal origins in *Sacoglossa* (Opisthobranchia, Gastropoda). *Molecular Ecology Resources*, doi: 10.1111/j.1755-0998.2010.02853.x
- 38. Heenan, A., 2010.** The behaviour of settling coral reef fishes and supplementary management tools. PhD thesis, University of Edinburgh
- 39. Hellstrom, M., K.D. Kavanagh and J.A.H. Benzie, 2010.** Multiple spawning events and sexual reproduction in the octocoral *Sarcophyton elegans* (Cnidaria: Alcyonacea) on Lizard Island, Great Barrier Reef. *Marine Biology*, 157: 383-392.
- 40. Heron, S.F., B.L. Willis, W.J. Skirving, C.M. Eakin, C.A. Page and I.R. Miller, 2010.** Summer hot snaps and winter conditions: modelling white syndrome outbreaks on Great Barrier Reef corals. *PLoS One*, 5(8): e12210. doi:10.1371/journal.pone.0012210
- 41. Hoey, A.S., 2010.** The ecosystem role of macroalgal browsing fishes on coral reefs. PhD thesis, James Cook University.
- 42. Hoey, A.S. and D.R. Bellwood, 2010.** Damselfish territories as a refuge for macroalgae on coral reefs. *Coral Reefs*, 29: 107-118.
- 43. Hoey, A.S. and D.R. Bellwood, 2010.** Cross-shelf variation in browsing intensity on the Great Barrier Reef. *Coral Reefs*, 29: 499-508.

- 44. Holcomb, M., 2010.** Coral calcification: insights from inorganic experiments and coral responses to environmental variables. PhD thesis, Massachusetts Institute of Technology and Woods Hole Oceanographic Institution.
- 45. Holmes, T.H. & M.I. McCormick, 2010.** Smell, learn and live: The role of chemical alarm cues in predator learning during early life history in a marine fish. *Behavioural Processes*, 83: 299-305.
- 46. Holmes, T.H. and M.I. McCormick, 2010.** Response across a gradient: behavioural reactions of newly settled fish to predation cues. *Animal Behaviour*, doi: 10.1016/j.anbehav.2010.11.019
- 47. Holmes, T.H. and M.I. McCormick, 2010.** Size-selectivity of predatory reef fish on juvenile prey. *Marine Ecology Progress Series*, 399: 273-283.
- 48. Huffard, C.L., N. Saarman, H. Hamilton and W.B. Simpson, 2010.** The evolution of conspicuous facultative mimicry in octopuses: an example of secondary adaptation? *Biological Journal of the Linnean Society*, 101: 68-77.
- 49. Hunter, J.A., E. Ingram, R.D. Adlard, R.A. Bray and T.H. Cribb, 2010.** A cryptic complex of *Transversotrema* species (Digenea: Transversotrematidae) on labroid, haemulid and lethinid fishes in the Indo-West Pacific region, including the description of three new species. *Zootaxa*, 2652: 17-32.
- 50. Ilagen, R.P, E. Rhoades, D.F. Gruber, H.-T. Kao, V.A. Pieribone and L. Regan, 2010.** A new bright green-emitting fluorescent protein - engineered monomeric and dimeric forms. *FEBS Journal*, 277: 1967-1978.
- 51. Jones, D.B., D.R. Jerry, M.I. McCormick and L.K. Bay, 2010.** The population genetic structure of a common tropical damselfish on the Great Barrier Reef and eastern Papua New Guinea. *Coral Reefs*, 29: 455-467.
- 52. Lawton, R.J., M.S. Pratchett and L.K. Bay, 2010.** Cross-species amplification of 44 microsatellite loci developed for *Chaetodon trifascialis*, *C. lunulatus* and *C. vagabundus* in 22 related butterflyfish species. *Molecular Ecology Resources*, doi: 10.1111/j.1755-0998.2010.02919.x
- 53. Lawton, R.J., M.S. Pratchett and L.K. Bay, 2010.** Isolation and characterization of 29 microsatellite loci for studies of population connectivity in the butterflyfishes *Chaetodon trifascialis* and *Chaetodon lunulatus*. *Conservation Genetics Resources*, 2: 209-213.
- 54. Leis, J.M., 2010.** Ontogeny of behaviour in larvae of marine demersal fishes. *Ichthyological Research*, DOI 10.1007/s10228-010-0177-z
- 55. Lowry, J.K. and R. Peart, 2010.** The genus *Microrchestia* (Amphipoda: Talitridae) in eastern Australia. *Zootaxa*, 2349: 21-38.
- 56. McCormick, M.I. and M.G. Meekan, 2010.** The importance of attitude: the influence of behaviour on survival at an ontogenetic boundary. *Marine Ecology Progress Series*, 407: 173-185.
- 57. McCormick, M.I., C.A. Ryen, P.L. Munday and S.P.W. Walker, 2010.** Differing mechanisms underlie sexual size-dimorphism in two populations of a sex-changing fish. *PLoS One*, 5: e10616
- 58. McCormick, M.I., J.A.Y. Moore and P.L. Munday, 2010.** Influence of habitat degradation on fish replenishment. *Coral Reefs*, doi 10.1007/s00338-010-0620-7

- 59. Meekan, M.G., C. von Kuerthy, M.I. McCormick and B. Radford, 2010.** Behavioural mediation of the costs and benefits of fast growth in a marine fish. *Animal Behaviour*, 79: 803-809.
- 60. Messmer, V., 2010.** From genes to ecosystems: patterns, processes and consequences of declining biodiversity in coral reef fish communities. PhD thesis, James Cook University.
- 61. Miller, T.L., R.D. Adlard, R.A. Bray, 2010.** Cryptic species of *Euryakaina* n. g. (Digenea: Cryptogonimidae) from sympatric lutjanids in the Indo-West Pacific. *Systematic Parasitology*, 77: 185-204.
- 62. Munday, P.L., D.L. Dixon, M.I. McCormick, M. Meekan, M.C.O. Ferrari and D.P. Chivers, 2010.** Replenishment of fish populations is threatened by ocean acidification. *Proceedings of the National Academy of Sciences*, doi 10.1073/pnas.1004519107
- 63. Nilsson, G.E and D.J. Randall, 2010.** Adaptations to hypoxia in fishes. Chapter 5 in "Respiratory physiology of vertebrates: life with and without oxygen", ed. G.E. Nilsson. Cambridge University Press.
- 64. Nilsson, G.E., S. Ostlund-Nilsson and P.L. Munday, 2010.** Effects of elevated temperature on coral reef fishes: loss of hypoxia tolerance and inability to acclimate. *Comparative Biochemistry and Physiology, Part A*, 156: 389-393.
- 65. Pratchett, M.S., 2010.** Changes in coral assemblages during an outbreak of *Acanthaster planci* at Lizard Island, northern Great Barrier Reef (1995-1999). *Coral Reefs*, 29: 717-725.
- 66. Quere, G. and J.M. Leis, 2010.** Settlement behaviour of larvae of the stripey snapper, *Lutjanus carponotatus* (Teleostei: Lutjanidae). *Environmental Biology of Fishes*, 88: 227-238.
- 67. Raihani, N.J., A.S. Grutter and R. Bshary, 2010.** Punishers benefit from third-party punishment in fish. *Science*, 327: 171.
- 68. Siebeck, U.E., A.N. Parker, D. Sprenger, L.M. Maethger and G. Wallis, 2010.** A species of reef fish that uses ultraviolet patterns for covert face recognition. *Current Biology*, 20: 407-410.
- 69. Simpson, S.D., M.G. Meekan, N.J. Larsen, R.D. McCauley and A. Jeffs, 2010.** Behavioral plasticity in larval reef fish: orientation is influenced by recent acoustic experiences. *Behavioral Ecology*, 21: 1098-1105.
- 70. Sprenger, D., R. Lange, N.K. Michiels and N. Anthes, 2010.** Sources of phenotypic variance in egg and larval traits in a marine invertebrate. *Evolutionary Ecology*, 24: 185-194.
- 71. Stanley, J.A., C.A. Radford, and A.G. Jeffs, 2010.** Induction of settlement in crab megalopae by ambient underwater reef sound. *Behavioural Ecology*, 21: 113-120.
- 72. Stella, J.S., G.P. Jones and M.S. Pratchett, 2010.** Variation in the structure of epifaunal invertebrate assemblages among coral hosts. *Coral Reefs*, doi 10.1007/s00338-010-0648-8
- 73. Thacker, C.E., A.R. Thompson, T.C. Adam and J.-P. Chen, 2010.** Phylogeny and character evolution in the Indo-Pacific genus *Ctenogobiops* (Gobiiformes: Gobiidae). *Ichthyological Research*, 57: 231-239.

74. Uthicke, S. M. Byrne and C. Conand, 2010. Genetic barcoding of commercial beche-de-mer species (Echinodermata: Holothuroidea). *Molecular Ecology Resources*, 10: 634-646.

75. Waegele, H., K. Stemmer, I. Burghardt and K. Haendeler, 2010. Two new saccoglossan sea slug species (Opisthobranchia, Gastropoda): *Ercolania annelyleorum* sp. nov. (Limapontioidea) and *Elysia asbecki* sp. nov. (Plakobranchoidea), with notes on anatomy, histology and biology. *Zootaxa*, 2676: 1-28.

76. Waegele, H., M.J. Raupach, I. Burghardt, Y. Grzybowski and K. Haendeler, 2010. Solar powered seaslugs (Opisthobranchia, Gastropoda, Mollusca): incorporation of photosynthetic units: a key character enhancing radiation? In: M. Glaubrecht (ed.), "Evolution in Action", Springer-Verlag: Berlin. doi 10.1007/978-3-642-12425-9_13.

77. Walker, S.P.W., L. Thibault and M.I. McCormick, 2010. Density-dependent sex ratio adjustment and the Allee effect: a model and a test using a sex-changing fish. *The American Naturalist*, 176: (10 pp.)

78. Winters, K.L., L. van Herwerden, J.H. Choat and D.R. Robertson, 2010. Phylogeography of the Indo-Pacific parrotfish *Scarus psittacus*: isolation generates distinctive peripheral populations in two oceans. *Marine Biology*, doi 10.1007/s00227-010-1442-4.

79. Wong, M.Y.L., 2010. Ecological constraints and benefits of philopatry promote group-living in a social but non-cooperatively breeding fish. *Proceedings of the Royal Society B*, 277: 353-358.

80. Wright, K.J., D.M. Higgs, D.H. Cato and J.M. Leis, 2010. Auditory sensitivity in settlement-stage larvae of coral reef fishes. *Coral Reefs*, 29: 235-243.

Appendix 4

External financial support

The Lizard Island Reef Research Foundation has made the following contributions to the Australian Museum for activities at LIRS, including the Upgrade Project.

LIRR contribs	2003/04	2004/05	2005/06	2006/07	2007/08	2008/09	2009/10	2010/11	TOTAL
Upgrade project	6,000	41,000	849,000	210,000	849,000	274,000	310,000	480,000	\$3,019,000
Other capital	104,000	21,000	18,621	22,000	52,600	56,000	58,900	62,200	\$395,321
Fellowships	23,000	18,000	24,000	32,000	43,000	65,000	43,100	84,800	\$332,900
Operating	0	0	42,879	41,000	3,500	3,000	4,000	4,000	\$98,379
TOTAL	133,000	80,000	934,500	305,000	948,100	398,000	416,000	631,000	\$3,845,600

The Donor Contribution for 2010/11 is shown below in the relevant transaction report from Australian Museum, Finance Section.

Acct.	Period	Jrnl. No.	Jrnl. Line.	Trans. Date	Reference	Amount	Description
5630	2011008	27251	35	20110127	DIR DEP	-480000	LIZ ISLAND REEF RESEARCH FOUNDATION

The agreed Donor Contribution for 2010/11 was \$260,000. The LIRR provided a larger sum (\$480,000) to meet expenditure for the Upgrade Project during the year.

Substantial funding (> \$10,000) or new funding commitments were made to the LIRR between July 2010 and June 2011 by:

- Teakle Foundation
- Yulgilbar Foundation
- John Villiers Trust
- Trust Company as trustee for Fred P. Archer Charitable Trust
- Maple-Brown Family Charitable Foundation

Appendix 5

Operating revenue and expenditure at LIRS in 2010/11

*** Amounts removed for publication***

	Year ending 30/06/2010	Amount relevant to KPIs
INCOME		
Sales		
Donations (excluding donations for capital items)		
Other revenue		
Total Income		
EXPENDITURE		
Salaries and Related Costs		
Research		
Cost of Sales		
Repairs & Maintenance		
Freight		
Travel		
Fuel & Oils		
Reimbursable expenses		
General Operating Expenses		
Subtotal Expenditure		
Net cash cost of services		
Non-cash expenditure - Depreciation		
Total Expenditure		
Net cost of services including depreciation		

NOTE: The Australian Museum covers the shortfall between Income and Expenditure for LIRS. In 2010/11, the AM's cash contribution was \$59,573 which exceeds the \$55,000 cash contribution required under the SSRFF agreements.

A copy of the letter from Mr Frank Howarth, Director, Australian Museum, to the Queensland Department of State Development, certifying the cash and in-kind contributions for 2010/11, is provided on the following page.

OFFICE OF THE DIRECTOR
Mr Frank Howarth

Phone: (02) 9320 6110; Fax: (02) 9320 6074
Email: frank.howarth@austmus.gov.au



21 November 2011

Mr Brian Anker
Deputy Director-General
Science and Technology
Department of Employment, Industry Development and Innovation
PO Box 15168
Brisbane City East QLD 4002

Dear Mr Anker

Re: Smart State Research Facilities Fund Agreement

I write in relation to the Smart State Research Facilities Fund Agreement between the Queensland Department of State Development (now Department of Employment, Industry Development and Innovation) and the Australian Museum Trust.

I certify that the Australian Museum Trust received a Donor Contribution from the Lizard Island Reef Research Foundation (LIRRF) of \$480,000 during the 2010/11 financial year, exceeding the required minimum amount of \$260,000 under Schedule A of the Head Agreement.

I also certify that the Australian Museum Trust has made the Australian Museum Contribution for the 2010/11 financial year as required by Schedule A of the Head Agreement as follows:

- \$46,620 in-kind contribution to overhead expenses including human resources, IT support, finance support and some salary on-costs; and
- \$59,573 cash – exceeding the minimum required cash contribution by \$4,573.

Supporting documentation for the Donor Contribution and the Australian Museum Contribution is attached.

Yours sincerely

A handwritten signature in blue ink, appearing to read "Brian Lassig".

Brian Lassig
Acting Director

nature culture discover

Appendix 6

Photographs of upgrade projects



New dinghy *Primrose*



30 kW solar array



144 solar panels



Power control room



Battery bank