CRC Reef Research Centre

Annual Report 2002 - 2003

Cooperative Research Centre for the Great Barrier Reef World Heritage Area

CRC AUSTRALIA

Established and supported under the Australian Government's Cooperative Research Centres Program

Mission

World-leading science for the sustainable use and conservation of the Great Barrier Reef World Heritage Area.

Objectives	Major Achievements
Conserving World Heritage values (Program A)	
To enable policy makers and environmental managers to use all relevant information in decision making for the use and conservation of the GBR region in accordance with its World Heritage values.	• Improved method of estimating dugong abundance developed which is of use in conserving the species. • Development of optimal Indigenous co-management of the GBRWHA models commenced. • Development of models of critical dolphin habitat.
Sustainable industries (Program B)	
To provide critical information for and about the operations of the key uses of the GBRWHA that are needed to manage those activities.	• High resolution hydrodynamic circulation model for the entire GBR and Torres Strait completed. • Project started to develop techniques for disinfecting ballast water. • Winning the right to host the Third International Symposium on Fish Otolith Research and Application.
Maintaining ecosystem quality (Program C)	
To generate critical information, relevant products and useful advice that will assist users, interested members of the Australian public, industry operators and natural resource managers to know the status and trends of marine ecosystems within the GBRWHA through development of benchmarks and performance indicators.	• Publication of Catchments and Corals: Terrestrial Runoff to the Great Barrier Reef, which provides data invaluable for conserving the GBR ecosystem. • Significant contribution to the State and Commonwealth governments' Water Quality Protection Plan for the GBR. • Environmental assessment of a sponge aquaculture industry for Palm Island Indigenous community.
Reef Futures (Program D)	
To improve the management and use of information within CRC Reef, to catalyse and participate in integrative projects, and to facilitate knowledge transfer among CRC Reef's partners, and between CRC Reef and its key client groups.	• Exploration of the impacts of different climate scenarios for the 21st Century for coral reefs using satellite sea-temperature data. • Assistance in developing software tools used to prepare GBRMPA's Representative Areas Program zoning plan.
Education (Program E)	
To provide scholarships and research funding for students and exciting and innovative education and training programs for these future leaders in research, industry and management in Australia and overseas.	• Four postgraduate students supported by CRC Reef scholarships submitted or completed their theses. • Postgraduate scholarships supported 25 students. • The number of postgraduate students employed exceeded the target set for the life of the Agreement.
Commercial and international (Program F)	
To provide training and advisory services, establish international education links, research and advisory contracts relevant to the aims of CRC Reef, and to generate income from these activities.	• The International Marine Project Activities Centre, a CRC Reef subsidiary, attracted new participants including the first Australian office of The Nature Conservancy and an office of WWF. • First course in international fisheries instruments held with participants from across Australia and overseas. • A total of $1,052,000 was raised by CRC Reef in additional revenue of which $840,154 was from commercial contracts (an increase of 300% since 1999-2000).
Communication and extension (Program E)	
To facilitate effective communication of research results, enhance collaboration between participating organisations and increase the application of strategic knowledge by users.	• SBS TV documentary Muddy Waters, featuring CRC Reef researcher, from AIMS, Dr Katharina Fabricius, aired. • Production of user-friendly brochures about line fishing, land use and marine tourism on the GBR. • Indigenous Working Group established to advise on communication protocols. • 37 papers published in professional journals.

CRC Reef Research Centre (ABN 62 089 499 034) is a company limited by guarantee. Its members are Association of Marine Park Tourism Operators, Australian Institute of Marine Science, Great Barrier Reef Marine Park Authority, Great Barrier Reef Research Foundation, James Cook University, Queensland Department of Primary Industries, Queensland Seafood Industries Association and Sunfish Queensland Inc.

Cover photo by Stephanie Schneider, JCU.

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Great Barrier Reef World Heritage Area

The Great Barrier Reef World Heritage Area is an area of unique national and international significance. It reaches from the Queensland coast to beyond the outer Great Barrier Reef and comprises the world's largest and healthiest collection of coral reefs. The GBRWHA also includes mangroves, rocky reefs, sandflats, open ocean and the deep sea floor.

Because of its unique natural value, the GBRWHA is listed under the World Heritage Convention. The use and conservation of resources in the GBRWHA is managed by several management systems including the world's largest, multiple-use marine parks system.

Commercial and recreational fisheries, tourism, shipping and ports operate in the GBRWHA. These industries are economically important both for the state of Queensland and for Australia. Major export ports and shipping channels are located in, or adjacent to, the area. Reef-based tourism is estimated to be worth about $1 billion a year and commercial fisheries worth about $400 million annually.

These industries depend on a healthy ecosystem for sustainable success. CRC Reef Research Centre provides scientific research to ensure the sustainable use of the GBRWHA.

Contents

1. Performance

During 2002-03, CRC Reef Research Centre was able to provide government and industry with vital scientific information on which to base management plans addressing some of the major issues confronting the Great Barrier Reef – issues such as coral death associated with warming of the ocean, a continuing major outbreak of crown-of-thorns starfish, declines in the quality of coastal waters and habitats and increases in fishing effort.

Top:
Professor Russell Reichelt, CEO, Mr Peter Lindsay, Member for Herbert, Dr Miles Furnas, author, and Professor Stephen Hall from AIMS, launch the book 'Catchments and Corals: Terrestrial Runoff to the Great Barrier Reef'.

Photo by CRC Reef.

Bottom:
Dr Miles Furnas taking water samples from the Burdekin River.

Photo by AIMS.

Delivering applied research results

Water quality in the Great Barrier Reef (GBR) has been a high priority research issue since the Centre opened. This year, Dr Miles Furnas, a CRC Reef researcher at the Australian Institute of Marine Science (AIMS), published a major review of river runoff into the GBR in the form of a book - **Catchments and Corals: Terrestrial Runoff to the Great Barrier Reef**. This important reference work provides the scientific evidence to demonstrate that the quality of water entering the Great Barrier Reef World Heritage Area (GBRWHA) is declining and that the Reef is at risk if this decline is not halted.

CRC Reef's research on water quality has contributed significantly to the scientific base of support for the Queensland and Commonwealth Governments' Water Quality Protection Plan for the GBR. This plan, in draft form, is now available for public consultation.

A further emerging problem for the GBR is the threat of exotic species being introduced. Alien species can be introduced unintentionally by way of bulk carrier vessels that arrive in ports around the world with ballast water that carries unknown quantities of foreign organisms. Once alien species are introduced, there is a real risk of catastrophic changes to the marine environment. During the year, CRC Reef responded to this risk by **initiating a project to develop techniques for disinfecting ballast water** as it is taken on board vessels. CRC Reef researchers based at James Cook University (JCU) in collaboration with Amiad Australia and Modular Solutions Technologies, and supported by Environment Australia and industry partners, have begun testing their first pilot treatment plant using a range of technologies and testing methods. Project Manager, Mr Steve Hillman, was invited to report on progress to the International Maritime Organisation in July 2003. The project will continue in 2003-04.

As the volume of data from research and monitoring increases, there is a growing need for **better data management and short accessible synthesis reports that consolidate the state of scientific knowledge.** CRC Reef's program, Reef Futures, is servicing this need with a steadily growing list of short reports on Land Use and the GBR, Marine Tourism and the GBR, and Line Fishing and the GBR. During the year, the Reef Futures team completed the framework for a web-based, map-based reporting system using the knowledge of coral bleaching in the prototype system. Other topics will be introduced in the coming year.

International links – ensuring the future of the world's coral reefs

To ensure that the science and engineering skills developed for the GBR make global contributions, CRC Reef has, since 2002, been developing a strategy of building its international linkages.

One result of this strategy has been the **International Marine Project Activities Centre** (IMPAC), a wholly owned subsidiary of CRC Reef with support from the Great Barrier Reef Research Foundation, and the Queensland and Commonwealth Governments. IMPAC was established to take advantage of one of the essential driving forces of the science profession - people skills and the building of teams and networks – clusters of capability. The Townsville-Cairns region has one of the largest assemblages of tropical

marine scientists in the world, and it was to build on this cluster that CRC Reef established IMPAC.

By providing serviced offices, high-speed internet and assistance with meetings and networks, IMPAC has now attracted both international and national organisations. The International Ocean Institute (IOI) (based in Malta) has established its first regional office in IMPAC and completed its first training course on international fisheries instruments in June.

Another international agency supported by CRC Reef, the **Arafura and Timor Seas Expert Forum** continued to gain momentum in 2002-03. The Forum's goal is to support sustainable use of the marine and coastal resources of the Arafura and Timor Seas through co-operation with the coastal States – Australia, East Timor and Indonesia. The Forum – which is also supported by the Australian Institute of Marine Science (AIMS) and the Australian National University through the Australian Marine Science Consortium (AMSC) - has met on five occasions, with CRC Reef serving as either Chair or Co-Chair on all occasions. A major science conference is planned for 2004.

The experience of CRC Reef's staff in international marine research policy and planning has led to invitations to participate in numerous international meetings, and to serve as Chair of conferences on Oceans Policy in Thailand and on Ecosystem Based Management of the Oceans.

CRC Reef researchers at Queensland Dept of Primary Industries (QDPI) are **world-leaders in monitoring and managing seagrass habitats**, and their work has led to the establishment of international monitoring programs and major technical publications supported by major philanthropic organisations such as the David and Lucille Packard Foundation.

Training future researchers

CRC Reef is concerned not only with getting the best teams of researchers onto the job, but to help train our future science and engineering leaders. During 2002-03, CRC Reef provided full scholarships for 12 postgraduate students and part scholarships for nine students. In total, 107 students received support from CRC Reef. Most came from our university member, JCU, where CRC Reef students represent approximately 12% of their research postgraduates.

Looking forward

CRC Reef works hard to ensure its research projects target high priority areas, and build sound administration systems to ensure that efforts are conducted in an open, transparent and accountable way. While conformance to regulations and good corporate governance are essential, the Centre puts considerable effort into exploration of new boundaries, new partnerships and better scientific performance.

During 2002-03, two supplementary programs of research, scheduled to start in 2003-04 won funding approval. Both involve new partnerships and innovative additions to CRC Reef.

The Catchment to Reef program was established jointly with Rainforest CRC. This three-year program will develop the scientific and technical toolkit for land and coastal managers implementing the GBR Water Quality Protection Plan. The Plan calls for improved monitoring and reporting systems for water quality flowing into the World Heritage Area. The joint program will play an important role in this. Partnerships between the Catchment to Reef research projects and others such as Queensland Government, the Great Barrier Reef Marine Park Authority and CSIRO are high on the agenda.

The second program of research is the **Torres Strait Program**. It will provide scientific and engineering support for sustainable use of the marine resources of Torres Strait. As with all CRC Reef activity, the Torres Strait Program will put a strong emphasis on education and communication as well as on science and engineering. The Torres Strait Program is an extension of CRC Reef, but has so many new partners that it will be managed as a separate entity with a strong, user-focussed Board of directors.

Whether it is working in Torres Strait or the GBR, CRC Reef is working to improve the level of engagement with Traditional Owners. CRC Reef's Indigenous Working Group began work in 2002-03, and will be further developed next year.

While actively pursuing its public good goals of providing support to the monitoring and management for sustainable use of the GBR, CRC Reef encourages entrepreneurial adoption of research results to assist industry development. To this end, CRC Reef will explore options for commercialising the results of the ballast water treatment pilot plant in the coming year.

With links between researchers in the GBR, Torres Strait and the Arafura and Timor Seas, the prospects for greater collaboration, cooperation and coordination are steadily growing. CRC Reef will continue to pursue both public good research and transfer of results to industry in 2003-04.

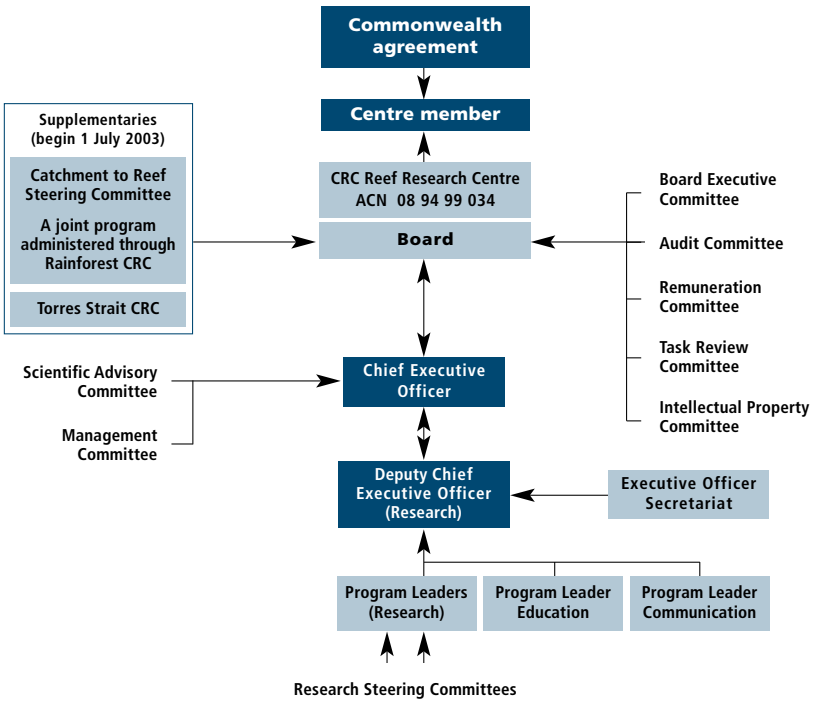
Sir Sydney Schubert, Chairman

Prof Russell Reichelt, CEO

2. Corporate Governance

Highlights

- CRC Reef's Company Secretary completed Postgraduate Diploma in Company Secretarial Practice.
- Chairman of CRC Reef will be appointed to be Chairman of the new company, CRC Torres Strait, and CEO of CRC Reef will become Director of the new company.
- AIMS Director, Professor Stephen Hall, appointed to the Board of CRC Reef.
- Industry Task Associates assigned to all research tasks to ensure enhanced performance of research tasks.
- CRC Reef Research Centre Ltd reviews its corporate governance manual.
- Annual review of satisfaction of members survey reports high level of satisfaction by members.
- CRC Reef Research Centre Ltd is now reporting against ASX Corporate Governance principles.The CRC Reef Research Centre management structures, policies and procedures adhere to good corporate governance practices and guidelines.



The Cooperative Research Centre for the Great Barrier Reef World Heritage Area (CRC Reef Research Centre Limited) is an incorporated cooperative joint venture established in 1999 by an Agreement between CRC Reef members: Association of Marine Park Tourism Operators (AMPTO); Australian Institute of Marine Science (AIMS); Great Barrier Reef Marine Park Authority (GBRMPA); James Cook University (JCU); Queensland Seafood Industry Association (QSIA); The State of Queensland through its Department of Primary Industries (QDPI); SUNFISH Queensland Inc; and an Agreement with the Commonwealth of Australia. The Great Barrier Reef Research Foundation (GBRRF) became a member in 2001-02. The management structure consists of the Board and the CEO, supported by a Secretariat dealing with administrative and financial activities. The Board is advised by Advisory Groups and Committees, and a Centre Visitor.

See Appendix 2 for membership and roles of advisory groups and committees.

The Australian Stock Exchange (ASX) Corporate Governance Council's 'Principles of Good Corporate Governance and Best Practice Recommendations, March 2003' outline 10 principles and the Centre's adherence to these are outlined in Appendix 2.

The Centre is implemented through a company limited by guarantee – a not-for-profit company, CRC Reef Research Centre Ltd. Directors work in the interests of the company, rather than the particular member who may have nominated them, and make proper and immediate disclosure of any conflict of interest. The Board plays a strong role in setting strategic directions for the Company, including reviews of the full research program every six months and strategic direction annually.

The Company Board has adopted a governance charter and a code of conduct that applies to all directors and staff, who are expected to observe the highest standards of behaviour and act with integrity, striving at all times to enhance the reputation and performance of the company.

The Board receives comprehensive business reports at each meeting to enable it to assess company performance, financial status and conformance to all requirements of the company, whether they come from legislation or obligation to members and stakeholders. An audit committee reviews the external audit reports once per year and advises the Board accordingly.

A procedure exists for disclosure and recording of conflict of interest (see Appendix 2).

The Board evaluates its own performance and that of management through an annual survey.

3. New ventures

Highlights

- $2.25 million over three years awarded for new cooperative research to improve water quality in the Great Barrier Reef World Heritage Area.
- $3 million over three years won for new research initiative in the Torres Strait.
- An Indigenous Engagement Strategy initiated to enhance linkages between Traditional Owners and researchers.

Catchment to Reef

In 2002, CRC Reef and Rainforest CRC were awarded a joint Supplementary Grant from the CRC Program for three years to develop new protocols and tools to identify, mitigate water quality problems and to assess the health of aquatic ecosystems in the Wet Tropics and Great Barrier Reef World Heritage Areas. This integrated catchment-to-reef approach aims to minimise the downstream effects of agriculture and improve the ecosystem health of the GBR lagoon and its feeder catchments. This additional project (which will become Project C7 within Program C) will provide the tools needed by landholders, industry and other stakeholders to monitor the effects of land use changes and restoration on water quality.

This project dovetails well with the core themes of the Natural Heritage Trust Mark 2 (NHT2) - biodiversity, sustainable use of land and water, and capacity-building – and matches the needs of the regional body responsible for developing the regional plan for natural resource management in the Wet Tropics, the Natural Resource Management Board (Wet Tropics) Inc. (NRM Board).

Aims

To provide critical information of relevance to industry and management in relation to the following problems:

- The export of nutrients, sediments and other contaminants into near coastal waters and the GBR lagoon, the world's largest reef system, has increased massively since European settlement, severely impacting on the viability and condition of these ecosystems and the industries that depend on them. Approximately 200 nearshore reefs in the Wet Tropics and Whitsundays are under immediate, direct pressure.
- Runoff of excess nutrients, sediments and agricultural chemicals is also severely impacting the river catchments and wetland ecosystems that feed into the GBR lagoon and threatens the ecology of these systems, their biodiversity and their capacity to cleanse water entering the sea.
- This problem of water quality from catchment to reef, is widely recognised as one of Australia's most pressing and challenging environmental issues.
- The Commonwealth Government has established long-term targets for improving water quality in the GBR lagoon and will need effective tools for monitoring the status and trends of water quality entering the GBRWHA.
- While new institutional arrangements and policy frameworks are required to bring about effective changes in coastal and marine ecosystems, it is imperative that tools be developed immediately to both improve the quality and ecological integrity of terrestrial and aquatic systems and monitor the effectiveness of those changes.

The Catchment to Reef Steering Committee will be established to manage the Catchment to Reef project. This will comprise the CEOs of both CRCs and management level representatives from stakeholder organisations including Griffith University, JCU, AIMS, Wet Tropics Management Authority (WTMA), GBRMPA and the Natural Resource Management (NRM) Board. The Steering Committee will be chaired at alternate meetings by the two CEOs. Coastal CRC and Tropical Savanna CRC, and CSIRO will be invited to send observers.

CRC Reef will work on a joint project with Rainforest CRC to develop tools to monitor river health.

Photo by Richard Pearson, JCU.

Strategic guidance will be provided by the Governing Boards of Reef and Rainforest CRCs. This will be facilitated by organising back-to-back Board Meetings at least once a year.

Torres Strait Program

CRC Reef has received support from the Commonwealth ($3 million over three years) to establish a new research, education and extension program in Torres Strait. The program brings together the main resource management agencies, research institutions and stakeholders in Torres Strait as well as the Torres Strait Regional Authority (TSRA), representing the Torres Strait community.

The participants bring substantial resources (over $13 million over three years) to the Program as well as scientific and management expertise and have agreed to combine their current efforts into a single, integrated, multi-disciplinary research, education and communication program, directed towards the identified needs of stakeholders and end-users. Their expertise derives from considerable experience in Torres Strait and the adjacent GBRWHA. The core participants are AFMA, AIMS, CSIRO Marine, CRC Reef, GeoScience Australia, JCU, National Oceans Office (NOO), QDPI and the TSRA. Supporting participants include GBRMPA, GBRRF and QSIA. Environment Australia, the Papua New Guinea National Fisheries Authority and AFFA have supported in principle the establishment of the Program.

CRC Reef has a well-established record of delivering quality research results to end-users and stakeholders. The researchers involved are world class and highly regarded by their peers. This program offers a unique opportunity to bring efficiencies and synergies to the current research effort to improve the delivery of information needed for sustainable development of Torres Strait and peoples and to add considerably to the value of current research and extension efforts. The result is an integrated, multi-disciplinary applied program of research far beyond that which could be done previously or by any of the participants acting independently.

Research will be directed in three key areas: Harvested Marine Resources, Biophysical Processes, and Marine Systems Management Evaluations and Risks. These areas respond to stakeholder and end-user priorities. Education and training will offer postgraduate scholarships as well as secondary or undergraduate and community level training for Torres Strait peoples. Training for researchers, stakeholders and communities will focus on improving the understanding and uptake of research results. Research will be conducted using culturally sensitive research protocols and procedures.

The aim and objectives of the Torres Strait Research Program to meet identified end-user needs are listed below:

Aims

The establishment of a coordinated and integrated research program to:

- support the sustainable development of marine resources and minimise impacts of resource use in Torres Strait;
- enhance the conservation of the marine environment and the social, cultural and economic well being of all stakeholders, in particular the Torres Strait peoples; and
- contribute to effective policy formulation and management decision making.

Objectives

- To provide information on key ecological processes in Torres Strait that will improve understanding of the sustainability of the Torres Strait marine ecosystem and conservation of threatened marine species.
- To provide information on status and trends of fisheries and other economically and culturally important natural resources of Torres Strait necessary for effective coordinated and integrated natural resource management.
- To assist in the development and implementation of marine strategies for Torres Strait.
- To provide information to support regional marine planning in Torres Strait and northern Australia.
- To assess the impacts of resource exploitation on the Torres Strait marine environment.

CRC Reef's Indigenous Working Group meets with CRC Reef Board (from L to R) Ms Melissa Nursey-Bray (CRC Reef/JCU), Ms Bryony Barnett (CRC Reef), Sir Sydney Schubert (CRC Reef Chairman), Ms Sandra Pannell (Rainforest CRC), Prof Russell Reichelt (CRC Reef), Ms Melissa George (Burdekin Dry Tropics), Ms Linda Craig (EPA), Prof Stephen Hall (AIMS) and Mr Chicka Turner (GBRMPA).

Photo by CRC Reef.

- To provide tools for the evaluation of the consequences of alternative management strategies on Torres Strait stakeholders, marine resources, communities and cultural values.
- To create innovative systems to make available to Torres Strait peoples and other end-users data and information, either existing or generated by the program.
- To identify candidate species for new aquaculture from the natural resources of Torres Strait that are compatible with the aspirations and lifestyles of Torres Strait peoples, and to develop the technology and knowledge base to support sustainable production in new Torres Strait based aquaculture industries.
- To develop education and extension programs to enhance the involvement of Torres Strait peoples in research and development opportunities in Torres Strait.
- To improve the capacity of Torres Strait communities to understand and utilise research results for enhanced economic and social development.
- To improve the capacity of researchers to engage with Torres Strait communities in the design and conduct of research and in the transfer of research results.

Indigenous engagement

Indigenous engagement by CRC Reef researchers has been limited previously to a few tasks which related directly to cultural issues, such as co-management, Indigenous use of marine resources, and cultural values. In consultation with Rainforest CRC, CRC Reef is developing an Indigenous Engagement Strategy to increase the level of engagement by other researchers working on sea country, where the research is of interest to the local Traditional Owners and Indigenous communities.

An Indigenous Working Group (IWG), with a majority of Indigenous representatives, was established to advise CRC Reef on developing and implementing the Strategy. The IWG members at June 30 were Ms B Barnett (Extension Manager, CRC Reef), Ms L Craig (Indigenous Conservation Coordination Unit, EPA); Ms M George (Burdekin Dry Tropics Group), Mr V Jose (National Secretariat of Torres Strait Islander Organisations), Ms M Nursey-Bray (CRC Reef researcher), Dr S Pannell (Program Manager, Rainforest CRC), Mr P Rist (Girringun Aboriginal Corporation), Mr C Turner (Indigenous Policy Liaison Unit, GBRMPA).

The IWG met twice during the year and has advised on appropriate communication channels and the development of protocols for CRC Reef researchers engaging with Indigenous people. A process for identifying priority research tasks for improved engagement was discussed between the IWG and the Board Executive Committee in April 2003 and is being implemented, with a focus on inshore monitoring and research tasks.

CRC Reef is establishing communication with relevant Traditional Owner groups and representative bodies to provide a framework for future engagement by researchers. The Strategy also aims to increase opportunities for raising cultural awareness in researchers, through seminars, workshops and extension activities. It will also focus on developing communication products which are culturally appropriate for the transfer of research outcomes. This will link with proposed extension and communication activities of the Torres Strait Program.

Several researchers worked closely with Traditional Owners of sea country where their research was based. CRC Reef postgraduate student **Ms Melissa Nursey-Bray** established a Cultural Reference Group through the Hopevale Community to oversee aspects of her PhD thesis on the social and economic values associated with Indigenous use of marine resources, in particular on cooperative management of Indigenous hunting. A synopsis of relevant photo archives found during the research was also compiled for the Hopevale Community.

Photo by Russell Reichelt.

Case study demonstrating successful technology transfer

Wildlife studies

CRC Reef's Species Conservation project provides essential information for the conservation of marine wildlife. A comprehensive study into the interactions between prawn trawling and sea turtles indicated that regulations that require trawlers to use Turtle Exclusion Devices (TEDs) are warranted. A strategy for monitoring the compliance of the use of TEDs and the meeting of bycatch reduction targets has been provided to the GBRMPA.

Surveys of dugong using a camera mounted on a helium balloon ('blimp–cam') indicated that animals are particularly vulnerable to boat strikes if boats were travelling at high speeds. The research supports speed limits for boats in important dugong habitats because dugongs do not seem to learn to avoid dangerous boat traffic.

CRC Reef research has also identified areas of critical habitat for rare inshore dolphins. The Irawaddy and humpback dolphins prefer estuarine and coastal waters that, even in remote areas of the GBRWHA, are subject to human use and coastal development.

Research users: GBRMPA, QPWS, Commonwealth and state government departments.

CRC Reef postgraduate student Ms Rachel Pears from JCU, is studying the biology of cod and gropers and has conducted underwater surveys of their abundance and distribution on the Reef.

Photo by Stephanie Schneider, JCU.

Collaborative research led by **Professor Helen Ross** (UQ) and **Mr James Innes** (GBRMPA) into cooperative management in the GBRWHA, by GBRMPA and Indigenous peoples, included case studies base on management issues at four different communities, with support from Sea Forum as members of the Steering Committee. A workshop evaluation of the task was hosted and facilitated by the Girringun Aboriginal Corporation in Cardwell.

CRC Reef contributed funds to produce interpretive videos on dugong research, for both Aboriginal and Torres Strait Islander audiences. JCU researchers **Prof Helene Marsh**, **Dr Donna Kwan** and **Dr Ivan Lawler** collaborated with representatives from Cape York Land Council, TSRA, AFMA, GBRMPA, Hopevale Community and the Mabuiag Island Community on the project.

AIMS research by **Dr Chris Battershill** into sponge aquaculture for Indigenous communities relies on collaboration with Traditional Owners and members of the Indigenous Palm Island community. The feasibility study is complete, and continuing discussions within the community are required before developing a commercialisation plan with all stakeholders. A similar research task is planned for the Torres Strait Program.

CRC Reef also contributed funds towards the Burdekin Traditional Owner Land Management Forum in August 2002.

CRC Reef researchers **Prof Helene Marsh** and **Dr Ivan Lawler** and PhD students, **Mr James Sheppard** and **Ms Amanda Hodgson**, researching aspects of dugong behaviour, were closely involved with Traditional Owners at Hervey Bay, Shoalwater Bay and Stradbroke Island where they are doing their research.

A research agreement was signed with the Cardwell-based Girringun Aboriginal Corporation to enable social surveys of Indigenous recreational fishers by JCU Honours student **Ms Kara Dew**.

The QDPI Seagrass-Watch Program, coordinated by **Dr Stuart Campbell**, contributed to the TAFE Caring for Country Program, training a group of Indigenous students to monitor seagrasses at Yule Point, Cairns. Opportunities for further involvement of Indigenous volunteers in the Seagrass-Watch Program are being explored in Cooktown and Bowen.

Extensive consultation occurred with the Torres Strait Regional Authority (TSRA), Island Council Chairs and community fishers in the collation and review of commercial catch history in the Eastern Torres Strait Reef Line Fishery task undertaken by Fishing and Fisheries Program researchers.

CRC Reef contributed funds to Indigenous Working Group members **Mr Phil Rist** and **Ms Melissa George** to attend the World Parks Congress in Durban, South Africa, in September 2003. A theme of the Congress is Indigenous Peoples, Local Communities and Equity in Protected Areas.

Photo by QDPI.

Case study demonstrating successful technology transfer

Introduced marine pests

In Australia, introduced marine organisms are threatening the ecological and economic value of our unique coastal marine ecosystems. Most Non-Indigenous Species (NIS) are believed to be unintentional introductions associated with shipping and mariculture activities. To assist in detecting, preventing and managing NIS introductions, CRC Reef researchers are undertaking surveys of Australian ports at high risk of marine pest introductions. The introduced Asian green mussel was discovered in Cairns during a baseline survey, and subsequent diving surveys determined the spatial extent of the infestation. Studies of the biology and ecology of the Asian green mussel have been used to develop the eradication response to the pest and have helped to determine the likelihood of its translocation during routine port activities such as dredging. CRC Reef student research projects on ship fouling organisms, modelling of port hydrodynamics and larval settlement patterns contribute to an understanding of the causes and movement of introduced marine pests. Information from these studies and from other surveys at Ashmore Reef, Thursday Island, Gove, Karumba and Townsville is being used by various port authorities to better manage their impact on the environment and by state, national and international agencies to help develop standards to detect, monitor and manage NIS.

Research users: Ports industry, shipping industry, Australian Quarantine and Inspection Service (AQIS), EPA, QDPI, GBRMPA, CSIRO, IMO GloBallast.

4. Research

Highlights in priority research areas

WATER QUALITY

- CRC Reef research into the impacts of terrestrial runoff on inshore reefs contributed significantly to the Commonwealth Productivity Commission's study on industries in the GBR catchment, to the Report on GBR water quality by the GBR Protection Interdepartmental Committee Science Panel, and to the formulation of the Reef Water Quality Protection Plan - a joint initiative of the Commonwealth and Queensland Governments to halt and reverse the decline in water quality entering the reef within 10 years.
- CRC Reef researchers also developed new methods based on those that linked smoking with lung cancer to demonstrate that terrestrial runoff has affected coastal reefs in the Wet Tropics. This work contributed to the instigation of the Reef Water Quality Protection Plan by the Commonwealth and Queensland governments.
- In addition, CRC Reef researcher **Dr Miles Furnas** based at AIMS published the book, Catchments and Corals: Terrestrial Runoff to the Great Barrier Reef. The book is the first comprehensive description of the state of the GBR catchment, modern levels of runoff to the reef and the influence of runoff on coastal reef ecosystems. This essential reference book is crucial to the debate.
- CRC Reef researchers found ecological gradients in coral and algal communities corresponding to water quality gradients. This will allow to predict future changes in reef communities in case the water quality should deteriorate in future due to human activities.

CORAL BLEACHING

- The **Reef Futures** team collaborated with climate modellers at CSIRO to explore the consequences of different climate scenarios for the 21st Century. Their studies suggested that achieving lower rates of global warming would improve the outlook for coral reefs as a result of less frequent and less severe impacts of coral bleaching. The team discovered areas with relatively lower risk of coral bleaching by combining data from ecological assessments following the 2002 bleaching event on the GBR, with AIMS' satellite sea-temperature database, produced with assistance from CRC Reef.

CROWN-OF-THORNS STARFISH

- The Long-term Monitoring Team completed their eleventh year of reef surveys. Their recent surveys indicated an increased incidence of coral disease on the GBR, albeit at low levels compared with other parts of the world. The team also documented the continued southward progression of the third recorded wave of crown-of-thorns starfish outbreaks.

ENVIRONMENTAL SUSTAINABILITY OF PORTS AND SHIPPING

- CRC Reef's port habitat mapping and monitoring work continues to be well utilised by industry and government in planning and decision making about port development and maintenance.

CRC Reef's research into impacts of runoff from the land is supporting government initiatives to halt the decline in water quality entering the Reef.

Photo by Katharina Fabricius, AIMS.

USE AND CONSERVATION OF BIODIVERSITY

- CRC Reef researchers developed a method to estimate the absolute abundance of dugongs from aerial survey data using mathematical modelling, the dive profiles of wild dugongs fitted with timed depth recorders, and data from experiments to determine the visibility from an aircraft of model dugongs in water of varying turbidity. Managers can now use this information to assess the sustainability of dugong mortality from all causes in various regions of the GBRWHA.
- CRC Reef researchers assisted GBRMPA develop the draft zoning plan for the Marine Park by producing software that allowed modification of configurations while continuing to meet specified criteria for biodiversity conservation.
- **Dr Julie Robin's** work on the overlaps between sea turtle feeding grounds and trawl activity will inform the design of cost-effective programs to enforce the use of turtle excluder devices by east coast trawl fishers.
- CRC Reef postgraduate student **Ms Amanda Hodgson** has shown that the major effect of boats on dugongs is mortality rather than habitat displacement.
- Community (**Seagrass-Watch**) and government monitoring programs supported by CRC Reef continued to monitor the condition of seagrass resources in the GBRWHA. The seagrasses at most locations were in a stable condition, with some improving and some declining. In an extension of this project to include the Western Pacific, SeagrassNet, more than 1,400 people have attended seagrass training seminars and nearly 400 people have participated in seagrass monitoring field training exercises. An interactive website has been developed for data entry and retrieval.
- CRC Reef researchers discovered deep, relict mangrove forest material nearly 7,600 years old in paleochannels close to inner shelf reefs of the GBRWHA. The mangrove material is still slowly decomposing and may influence modern day nutrient flows.

SUSTAINABLE INDUSTRIES

- The Fishing and Fisheries project has made important contributions to the Strategic Environmental Assessments for Commonwealth-managed fisheries, which are required by Environment Australia under the Environment Protection and Biodiversity Conservation Act 1999.
- CRC Reef researchers published an atlas of 10 years of sea surface temperatures with resolutions which are around 10 times higher than maps that were previously available. The maps of sea surface temperatures will be correlated with ocean colour to better link productivity hot spots with other oceanographic features such as currents and upwelling regions.
- CRC Reef research into the attitudes of recreational fishers to compliance will inform the design of Communication and Education programs when the new GBRMPA zoning comes into effect.

Photo by CRC Reef

Case study demonstrating successful technology transfer

Fishing and fisheries

CRC Reef's Fishing and Fisheries (F&F) Project involves a number of interrelated research tasks focusing on the fisheries of the GBR and Torres Strait. Data and information from these tasks have been used in the development of the Queensland Government's draft Coral Reef Fin Fish and Spanish Mackerel Fisheries Management Plans; stock assessment by Queensland Fisheries Services and EA Sustainability Reporting requirements for east coast shark, barramundi and mud crab; the GBRMPA Representative Areas Program; and Environment Australia's draft Management Plan for Elizabeth and Middleton Reefs Marine National Nature Reserve. F&F researchers continue to expand the breadth and scope of the Project's research directions, collaborations and liaison activities.

Research users: GBRMPA, QDPI, commercial fishing, recreational fishing, conservation groups.

Conserving World Heritage values (Program A)

Program Leader: Professor Helene Marsh, JCU

Objective

To enable policy makers and environmental managers to use all relevant information, including the different values of various stakeholder groups, in decision making for the use and conservation of the Great Barrier Reef region in accordance with its World Heritage Values.

The focus of natural resource management in Australia has traditionally been on the biological and physical aspects of natural resources. This focus is now broadening to incorporate social, cultural and economic factors into the policy, planning and design processes. This program will assist in natural resource management by documenting the social, cultural and economic values of the World Heritage Area.

Threatened species are a key component of the listing of the World Heritage Area. This program will provide critical information of relevance to industry and management with respect to the conservation values of threatened species.

The changes to financial reporting of Program A to reflect the change in management structure (Sept 2001) were implemented from the start of 2002-03 financial year.

Use and value of the World Heritage Area (Project A3)

Project Leader:
Professor Malcolm Waters, JCU

Professor Stephen Crook, former leader of this project, died in 2002 after a long illness. Professor Malcolm Walters now leads this project.

Dr Cheryl Hercus interviewed 88 recreational anglers from Cairns, Townsville and Agnes Waters/Town of 1770 to determine their perceptions, experiences and actions towards compliance and management issues. The participants value recreational fishing as a cultural practice. Their love of fishing shapes their perceptions of issues of communication, protection and enforcement. Most participants are positively oriented towards fishing regulations, even though they might be critical of certain regulations. Most recreational anglers recognise the importance of conservation but they want the social and recreational importance of recreational fishing recognised. Most fishers considered the enforcement of Marine Park and fishing regulations was inadequate and they wanted to see stronger enforcement measures for the minority who break the rules so that the majority who comply can continue to enjoy fishing. This research will be very useful to GBRMPA's Communication and Education Program particularly in relations to communications of the new zoning. The social characteristics of Queensland's recreational anglers are being further studied by **Dr Stephen Sutton**.

Using a case study approach, **Professor Helen Ross**, **Mr James Innes** and **Ms Melissa George** have worked with Indigenous communities to provide information and support mutual learning, towards the best possible design and implementation of future co-management arrangements between Indigenous peoples and the managers of the GBRWHA. They conclude that the opportunities for solving both Indigenous and non-Indigenous management and access desires in the GBRWHA probably lie in some combination of area, species and multi-purpose agreements. A co-management arrangement starts, rather than finishes, when the agreement is reached. The parties therefore need to keep goodwill in working together, and to work hard at resolving problems as they arise. This can be helped by: shared goals; shared commitment and a belief that cooperation offers better prospects than political or legal conflict; a fair and efficient decision-making structure and processes, adequate resourcing, sense of progress, through successful implementation via a series of steps, maintaining positive personal relationships and regular reviews to check how the arrangements are working (both in terms of process and outcomes). This research will be used to help develop co-management arrangements in the GBRWHA.

Through an analysis of historic and contemporary materials, CRC Reef student **Ms Celmara Pocock** has reconstructed the ways in which visitors have experienced the Reef in the past and present. Her research suggests that while native vegetation of the islands stimulated sounds, smells and sights that reef visitors in the early 20th Century also wanted an idealised tropical island. Therefore, contemporary tourists are provided with a tropical landscape that buffers them

Left:
CRC Reef postgraduate student Ms Celmara Pocock from JCU is using historic photographs to interpret past visitor experiences.

Photo courtesy of National Archives of Australia.

Right:
CRC Reef researchers are asking communities about cultural heritage values of the reef.

Photo by CRC Reef.

from the abundance of native flora on reef islands. At the same time, however, modern technologies have opened new experiences to reef visitors. Earliest visitors could only peer at the living reef through the water surface and were unable to participate as modern divers and snorkellers do. Instead early visitors emulated the scientists who they accompanied. They touched, prodded and collected a vast array of marine life, producing numerous tactile and odorous sensations. Collections also helped to convey the Reef in an age when photography was unable to communicate colour and underwater life. Many of these experiences are now conveyed through sophisticated photographic equipment and access is similar for both visitors and distant observers.

Species conservation (Project A4)

Project Leader:
Professor Helene Marsh, JCU

Dr Julie Robins contributed to the sustainable management of sea turtle by-catch in prawn trawls in the GBRWHA by developing a comprehensive approach to understanding the interaction between prawn trawling and sea turtles. She estimated of the number and species composition of sea turtles caught and killed in the Queensland East Coast Trawl Fishery, which combined with estimates from other trawl fisheries in northern Australia, indicates that the regulations requiring trawlers to use Turtle Excluder Devices (TEDs) are warranted. Ms Robins predicted the relative density of sea turtles in waters adjacent to the Queensland east coast to generate quantitative broad scale maps of the relative density of sea turtles, based on the relationship between sea turtle density, water-depth and benthic species trawled. Ms Robins also developed a spatially explicit strategy for monitoring the compliance of fishers to the regulations about the use of TEDs and their effectiveness in meeting by-catch reduction targets by integrating predicted sea turtle density and fishing effort. The results of her work have been provided to GBRMPA for use in the re-zoning of the Marine Park and to fisheries managers to assist in designing cost-effective programs to monitor the use of TEDS by trawler skippers.

CRC Reef postgraduate student **Ms Amanda Hodgson** used a video camera mounted on a blimp tethered to a vessel to study the responses of dugongs to boats. To assess the potential risk of boat disturbance and boat strikes, Ms Hodgson studied the behaviour of the dugongs while recreational boats used the area as well as during experimental trials. Observations of boats passing opportunistically at different speeds showed that dugongs have a delayed response to boats and are particularly vulnerable to being hit by boats travelling fast. During the experiments, an aluminium dinghy with a 20 HP engine was driven past the edge of a dugong herd at the regulated speed limit, either once or five times to determine whether repeated passes caused a higher level of disturbance. There was no link between the distance of the boat from the focal animal and the duration, distance or direction of its subsurface behaviour. The percentage of time spent feeding and travelling by dugongs was unaffected by the boat's passing, the number of passes made, or the focal dugong's position in the herd relative to these two factors. Therefore, any response to the boat was delayed and short. These results support the use of speed restrictions for boats in important dugong areas.

CRC Reef associate student **Mr Guido Parra** used vessel-based line transect surveys to study Irrawaddy and Indo-Pacific humpback dolphins in the Hinchinbrook and Princess Charlotte Bay areas in the GBRWHA. He showed that the distribution of both these dolphins is influenced by their proximity to the mainland coast or islands, proximity to river mouths, and water depth. Both species have similar and overlapping spatial distributions. The preference of both species for coastal, estuarine waters has important implications for their conservation. Coastal and estuarine waters are often the focus of human settlement. Even in areas of low human density such as the Far Northern Section of the GBRWHA, threatening activities such as gill netting tend to be concentrated in estuaries and in inshore waters close to the coast. Mr Parra's spatial analysis has identified potential areas of critical habitat for both species in the GBRWHA.

CRC Reef researchers are tracking dugong using satellite tags.

Photo by Tom Stevens, JCU.

Conserving World Heritage values (Program A) – list of tasks

TITLE	TASK LEADER	TASK ASSOCIATE
Use and value of the World Heritage Area (A3)	**Prof Malcolm Waters (JCU)**	
Spatial allocation of GBR use, phase 2 (2.1.6/2)	Ms B Breen (JCU)	Mr J Innes (GBRMPA), Dr L Fernandes (GBRMPA)
Towards cooperative management of Indigenous hunting by a remote community in the GBRWHA (A1.2.2S)	PGS Ms M Nursey-Bray (JCU)	Mr J Innes (GBRMPA)
Social assessment of recreational fishing in the GBR region (A1.2.3a)	Dr S Sutton (JCU)	Mr J Innes (GBRMPA), Mr C McKenzie (AMPTO), Mr V Veitch (SUNFISH), Mr D Souter (QSIA)
A conceptual and operational understanding of resource dependency (A1.2.4S)	PGS Ms N Marshall (JCU)	Mr J Innes (GBRMPA)
Cultural heritage of the GBRWHA (A1.3.1)	Dr S Greer (JCU)	Mr J Innes (GBRMPA), Mr C McKenzie (AMPTO)
Cultural heritage of the GBRWHA (A1.3.1S)	PGS Ms C Pocock (JCU)	Mr J Innes (GBRMPA), Mr C McKenzie (AMPTO)
Cultural heritage management of two World Heritage communities (A1.3.2S)	PGS Ms J Harrington (JCU)	
Determinants of stakeholder compliance and non-compliance in the GBRWHA - Part A (A2.2a)	Dr C Hercus (JCU)	Mr V Veitch (SUNFISH), Mr B Duncan (GBRMPA) Mr J Innes (GBRMPA)
Supporting development of co-operative management in the GBRWHA, by GBRMPA and Indigenous peoples (A3.3)	Prof H Ross (UQ)	Steering Committee
Species Conservation (A4)	**Prof H Marsh (JCU)**	
Survivorship of sea turtles after capture in trawls (2.5.3)	Ms J Robins (QDPI)	
Conservation genetics of sea snakes in Australian waters, with emphasis on the GBRWHA (C1.4.1S)	PGS Ms V Lukoschek (JCU)	Dr L Fernandes (GBRMPA)
Population genetic structure of roseate tern populations in Australia, and an investigation of genetic relationships among roseate tern subspecies (C1.4.2.1S)	PGS Ms A Lashko (JCU)	Mr A Stokes (GBRMPA), Mr P O'Neill (QPWS)
The role of environmental factors in the distribution of breeding seabird populations in the GBRWHA (C1.4.2.2S)	PGS Mr D Grover (JCU)	Mr M Turner (Marine Parks Management Coordination)
Enhancing the ecological basis for managing dugongs in the GBRWHA (C1.4.3.1a)	Dr I Lawler (JCU)	Mr A Stokes (GBRMPA)
The impacts of anthropogenic noise on coastal marine mammals: dugongs and dolphins (C1.4.3.1S)	PGS Ms A Hodgson (JCU)	Mr A Stokes (GBRMPA)
Enhancing the ecological basis for conservation management of dugongs using innovative satellite tracking technologies (C1.4.3.2S)	PGS Mr J Sheppard (JCU)	Mr A Stokes (GBRMPA)
Review and refinement of the Queensland marine mammal and turtle strandings and mortality program focussed in the GBRWHA (C1.4.4a)	Mr A Stokes (GBRMPA)	Steering Committee
Ecology and conservation biology of coastal dolphins (C1.4.5S)	PGS Mr G Parra (JCU)	

PGS - Postgraduate student

Sustainable industries (Program B)

Program Leader: Dr Bruce Mapstone, JCU/CRC Reef

Objective

To provide critical information for and about the operations of the key uses of the GBRWHA that are needed to manage those activities.

The program will:

- provide key industry-level information for management of the GBRWHA;
- assess the key operational characteristics, needs, constraints and potential impacts of the major industry sectors in the GBRWHA;
- where appropriate, seek innovative technologies to allow ecologically and economically sustainable development (ESD); and
- develop tools to reduce uncertainty in the management of key uses for their ecologically sustainable development.

It is often difficult and sometimes controversial to balance the benefits of development with its threats to nature. Successful management hinges on the appropriate regulation of human use, and assumes that the biophysical system will repair itself provided that the impacts of use are small. A thorough understanding of the industries, their needs and their impacts is critical to achieving this balance.

In this program, we aim to provide information about uses of the GBRWHA so that regulation and best practice can be achieved, and so that these uses do not threaten key World Heritage Values of the region and the industries can remain economically and socially viable.

Our focus is on two major industries that rely on the GBRWHA (tourism and fisheries) and one industry that must co-exist with it (port and shipping activities) to provide services to a multitude of land-based industries. We complement this industry focus with a program of engineering and environmental modelling research to provide innovative ways of assisting best-practice, minimum-risk industry development.

Ports and shipping (Project B1)

Project Leader:
Dr Rob Coles, QDPI

Many major and minor ports and marinas operate in or adjacent to the GBRWHA and thousands of ships traverse the waters of the World Heritage Area annually, often carrying cargoes that would threaten the environment if released in an accident. These activities are vital to the normal social and economic function of Queensland but pose potential risks to the environment.

The Ports and Shipping project has continued to grow over the last year, especially through strengthened engagement with ports corporations along the coast. Close engagement with industry has been a feature of the Ports and Shipping project since its establishment three years ago. The research team has surveyed all major ports in tropical Queensland to map natural habitats and search for exotic pests. In some cases, surveys now span 10 years and provide a solid base from which to develop long-term monitoring programs to assess the sustainability status of habitats around ports.

CRC Reef's work on invasive pests has continued to receive international recognition through invitations for **Dr Kerry Neil** to attend specialist international working groups and advise on the detection of introduced pests in tropical waters. Dr Neil is also leading the development of tests to detect exotic pests based on biochemical or genetic signals rather than labour-intensive visual searches. If successful, these methods will increase the efficiency and reliability of pest detection.

The Ports and Shipping project is a good model of integration across disciplines, with integration of port surveys for native habitats, surveys for introduced pests and modelling of water movements and sediment transport in and around ports. This integration proved particularly useful in designing ongoing monitoring for the Asian green mussels in Cairns harbour based on predictions from hydrodynamic models of the likely dispersal of larvae released by mussels already discovered at specific locations.

In order to prevent the introduction of exotic marine species, CRC Reef, together with joint venture partners, is taking steps to develop an efficient method of 'cleaning' ship board

Photo by FantaSea Cruises.

Case study demonstrating successful technology transfer

Waves and pontoons

The Wave Atlas produced by CRC Reef researchers based at JCU contains results from the simulation of winds and waves during 10,000 synthetic tropical cyclones. The Atlas is being extended to include non-cyclonic waves. The data have been applied directly to the design of several tourism pontoons off Cairns, and for the design of a major new shipping channel in the far northern section of the reef. The Atlas also contributes to the technical report, Reef Infrastructure Guidelines: Tourist Pontoons, which presents engineering best-practice for construction of offshore structures in the GBRWHA. These guidelines have been adopted by GBRMPA as the basis for their policy for reef structures. The Atlas is available online and, in 2002, the guidelines were published on CD for ease of access for industry and management.

Research users: GBRMPA, marine engineering and design companies, tourism industry.

Photo by Rob Parsons.

Case study demonstrating successful technology transfer

Tourism surveys

As a result of user requests, a number of specific reef tourism market reports were completed and disseminated during the year. In addition, a second major visitor survey was completed with data collected from reef visitors at sites between the Whitsundays and Cairns. This second survey allowed for a comparison of reef tourism markets and reef tourist travel patterns before and after September 2001. Tour operators specifically requested the comparisons and the analyses revealed some significant and substantial changes in the nature of domestic reef tourism markets. Further analyses are being conducted to explore the emergence of new reef tourism markets with very different profiles to previous tourist groups. This will allow more effective tourism marketing and management and will assist the tourism industry in its future planning.

Research users: Tourism industry, community, tourists, and environmental managers.

ballast water to remove or kill all larvae in the ballast water so that they will not be released into Australian seas. A portable pilot plant for treatment has been developed and is being trialled with a variety of organisms under controlled conditions. It will soon be field-tested with actual ballast water from active vessels. This technology has the potential to provide world-leading bio-security to the international shipping industry and significantly reduce the risks of exotic pest introductions via ballast water.

Tourism (Project B2)

Project Leader:
Dr Gianna Moscardo, JCU

Tourism research in the last year focused on consolidating long-running research programs, with an emphasis on integrating existing information. Over the last year, a significant change was detected in the expectations of many tourists visiting the GBRWHA. These analyses focussed on changes in patterns pre- and post-September 2001. Preliminary analyses indicate that previous trends in repeat visitation are continuing and new Australian markets are emerging. These new markets appear to be very different from those in previous years. Fewer tourists sought interactions with wildlife, solitude and 'wilderness' experiences compared with those that sought more social, experiential activities such as diving and 'resort style' holidays. This shift in expectations may reflect a change in the demographics of tourists visiting the GBR, with many tourists who would previously have visited international resorts in south east Asia choosing tropical Australian holidays in the wake of terrorist threats overseas. The development of new and significantly different market segments raises a number of management implications that require further attention.

The tourism research team also changed focus this year, conducting a telephone survey of more than 1,200 residents of the coastal regions adjacent to the GBR to investigate patterns of independent recreational use by local people. This work will add valuable insights to the 'home-based' recreational visitors to the GBR to complement the well-documented profile of visitors from interstate and overseas.

Research has continued to address the needs of wildlife tourism, with two projects focussing on the expectations, perceptions and behaviours of visitors on live-aboard dive charter vessels and visitors seeking interactions with dwarf minke whales off the northern GBR. This work has resulted in the engagement of CRC Reef researchers with the International Whaling Commission, where draft sustainability indicators for dwarf minke whales were discussed. In addition, an information and training kit was developed to aid operators and others in the provision of interpretive guided tours of GBR destinations.

Engineering and environmental control (Project B3)

Project Leader:
Associate Professor Tom Hardy, JCU

During the year, there has been increasing recognition of and demand for the outstanding expertise of the Engineering and Environmental Control Team in modelling hydrodynamic and environmental conditions on the GBR and their effects along the coast of tropical Queensland. The group has fulfilled major contracts by providing extensive storm-surge predictions for the Harvey Bay and Sunshine Coast regions and advice on the wave and wind conditions expected during cyclones at various places on the GBR to assist in the design of shipping channels and placements of pontoons.

Important milestones were achieved in representing wave and hydrodynamic conditions at fine scales. The group completed a hydrodynamic circulation model for the entire GBR and Torres Strait that operates at a 1.5km grid-scale, allowing the detailed modelling of water flows around individual reefs and representation of the effects of the complex reef matrix on transport of water-borne particles. This work will provide critical information for assessing the connectivity of marine populations between reefs and, hence, the likely effectiveness of closure regimes as refuges from which populations elsewhere can be replenished.

The capacity to model waves and associated forces around reefs was refined considerably this year, with wave and current models for individual reefs resolved at a scale of 70m. These models enhance our capacity to explore biological and engineering questions at fine scales around reef structures.

The team has collaborated with the Ports and Shipping team, providing the expertise to develop detailed circulation and sediment transport models for major ports. These models were used to explore the likely infestation pathways for Asian green mussels in Cairns Port. They will also be used to explore the major risks from accidental spills in ports, and the most efficient designs for port dredging and development works.

Fishing and fisheries (Project B4)

Project Leader:
Dr Bruce Mapstone, JCU/CRC Reef

The Fishing and Fisheries (F&F) team has continued to expand and broaden its focus in the last year, while maintaining long-running research initiatives such as the Effects of Line Fishing (ELF) project. New projects included a revision of management plans for Elizabeth and Middleton Reefs (under contract to EA), collection of important catch and effort data for community-based commercial fishing operations in the Torres Strait (funded by AFMA) and a review of the information for assessments of spotted Mackerel stocks along the Queensland Coast.

A major achievement for the F&F Team this year was winning the right to host the Third International Symposium on Fish Otolith Research and Application, to be held in Townsville in July 2004. This conference will bring leading fisheries scientists from around the world to Townsville and provide a great opportunity to showcase the wealth of expertise in tropical fisheries in north Queensland.

As in previous years, research from the F&F team continued to contribute significantly to policy development, with contributions to the development of the Draft Coral Reef Finfish Management Plan and revision of assessments and regulations for the Queensland Spanish Mackerel fishery.

Engagement with stakeholders continued to be a critical aspect of the F&F project, with close associations between project staff and fishers, managers and other stakeholder groups along the east coast and in the Torres Strait.

Sustainable industries (Program B) – list of tasks

TITLE	TASK LEADER	TASK ASSOCIATE
Ports & Shipping (B1)	**Dr R Coles (QDPI)**	
Ports and shipping implementation (B1.0.2)	Dr R Coles (DPI)	Dr B Mapstone (JCU), Ms A Clarke (QDPI)
Port surveys (B1.0.3)	Dr K Neil (QDPI)	Dr B Mapstone (JCU), Dr R Coles (QDPI), Ms S Trimarchi (PCQ), Ms K Kelleher (Cairns Port Authority)
Port baseline surveys for introduced marine species - Cairns (B1.11), Port of Gove (B1.12), Townsville (B1.8), Karumba (B1.6),Port of Cape Flattery (B1.9)	Dr K Neil (QDPI)	3rd Party Contract
Marine flora, fauna and marine pest surveys - Cairns Port (B1.11a)	Dr K Neil (QDPI)	3rd Party Contract
Port of Gladstone (Port Curtis) and Rodds Bay Dugong Protected Area baseline seagrass monitoring surveys (B1.13)	Dr M Rasheed (QDPI)	3rd Party Contract
Modelling of the dispersal of the Asian green mussel in the Cairns area (B1.14)	Assoc Prof T Hardy (JCU)	3rd Party Contract
Long-term monitoring of Port of Mourilyan seagrass (B1.15)	Dr M Rasheed (QDPI)	3rd Party Contract
Cairns harbour and Trinity Inlet seagrass monitoring (B1.16)	Dr M Rasheed (QDPI)	3rd Party Contract
Molecular diagnostic techniques for Asian green mussel (B1.17)	Dr K Neil (QDPI)	3rd Party Contract
Hydrodynamic, sediment and dredge modelling of ports (B1.2)	Assoc Prof T Hardy (JCU)	Mr C Wilson (TPA), Ms K Kelleher (Cairns Port Authority)
Identification and monitoring of habitats critical to the GBRWHA in or adjacent to shipping lanes & coastal ports (B1.3)	Dr M Rasheed (QDPI)	Ms S Trimarchi (PCQ)
Ballast water treatment pilot study (B1.5)	Dr P Schneider (JCU)	Prof R Reichelt (CRC Reef)

PGS - Postgraduate student

Sustainable industries (Program B) – list of tasks *(continued)*

TITLE	TASK LEADER	TASK ASSOCIATE
Sustainable Tourism (B2)	**Dr G Moscardo (JCU)**	
Understanding tourist use of the GBRWHA (B2.1.1)	Dr G Moscardo (JCU)	Mr J Innes (GBRMPA), Mr C McKenzie (AMPTO)
GBR: destination image and competitiveness (B2.1.2)	Prof P Pearce (JCU)	Mr J Innes (GBRMPA), Mr C McKenzie (AMPTO)
Visitor strategic response project (B2.2)	Dr G Moscardo (JCU)	Mr J Innes (GBRMPA), Mr C McKenzie (AMPTO)
Improving the sustainability of human - reef wildlife interactions (B2.3)	Dr G Moscardo (JCU)	Mr J Innes (GBRMPA), Mr D Morgans (Tourism Queensland)
Scoping study reef interpretation centre - Deepwater National Park (B2.6)	TBD	Mr J Innes (GBRMPA), Mr D Windsor (GBRRF)
Presentation and management of Environment Management Charge (EMC) data (B2.7)	Mr J Innes (GBRMPA)	Dr G Moscardo (JCU), Mr C McKenzie (AMPTO)
Towards ecologically sustainable dwarf minke whale tourism (B2.8)	Dr A Birtles (JCU)	Mr S Kielbaska (Mike Ball Dive Expeditions)
Towards sustainable environmental experiences for the live-aboard diving industry on the GBR (B2.9S)	PGS Mr D Miller (JCU)	Mr C McKenzie (AMPTO), Ms K Gorman (GBRMPA)
Engineering and Environmental Control (B3)	**Assoc Prof Tom Hardy (JCU)**	
Influence of groundwater and surfacewater in GBR water quality (3.2)	Assoc Prof T Hardy (JCU)	Mr J Brodie (JCU)
Interactive atlas of winds and waves of GBRWHA (B3.1)	Assoc Prof T Hardy (JCU)	Mr M Gledhill (Pacific Marine Group)
Fine-scale wave modelling in coral reef regions (B3.2)	Assoc Prof T Hardy (JCU)	Mr M Allen (EPA), Mr M Gledhill (Pacific Marine Group)
Best-practice mooring and pontoon design (B3.3)	Assoc Prof T Hardy (JCU)	Mr M Gledhill (Pacific Marine Group), Mr A Costen (EPA)
Extension of fine-scale circulation modelling to the entire GBR region (B3.4)	Dr L Bode (JCU)	Dr P Doherty (AIMS)
Tropical cyclone wave impacts: Caloundra - Maroochy and Hervey Bay (EPA) (B3.5)	Assoc Prof T Hardy (JCU)	3rd Party Contract
Modelling and ocean discharge - Guthalungra Prawn Farm (B3.6)	Mr L Mason (JCU)	3rd Party Contract
Fairway Channel wave analysis (B3.7)	Assoc Prof T Hardy (JCU)	3rd Party Contract
Fishing & Fisheries (B4)	**Dr G Begg (JCU)**	
Connectivity between coastal/estuarine and reefal fish assemblages (2.4.22)	Mr R Garrett (QDPI)	
Perceived and actual differences in recreational line catch trends in estuaries open and closed to commercial fishing in north Queensland (B4.10S)	PGS Ms R Tobin (JCU)	Mr D Cameron (GBRMPA), Dr D McPhee (UQ)
Stock structure of commercially important serranid species in the GBR and adjacent reef systems (B4.11)	Prof H Choat (JCU)	Mr D Souter (QSIA)
Forecasting fishing impacts on the population biology of the red bass *Lutjanus bohar* (B4.12S)	PGS Mr R Marriott (JCU)	Mr M Bishop (GBRMPA), Mr M Elmer (QFS)
Exploitation dynamics and biological characteristics of east coast Spanish mackerel harvested by the recreational and commercial sectors (B4.13)	Dr A Tobin (JCU)	Mr M Elmer (QFS)
Predator-prey dynamics in coral reef fish: potential implications of predator removal by fishing (B4.14S)	PGS Mr A Abdulla (JCU)	Dr B Mapstone (JCU)
Review and assessment of the Australian east coast spotted mackerel stock (B4.16)	Dr G Begg (JCU)	Mr D Cameron (GBRMPA), Mr M Lightowler (QFS)

PGS - Postgraduate student
TBD - To be decided

Sustainable industries (Program B) – list of tasks *(continued)*

TITLE	TASK LEADER	TASK ASSOCIATE
Fishing & Fisheries (B4) (contd)	**Dr G Begg (JCU)**	
Otoliths in the tropics - theory and methods (B4.17)	Ms B Green (JCU)	Mr M Bishop (GBRMPA)
Preliminary development of a management plan for Elizabeth and Middleton Reefs Marine National Nature Reserve (B4.18)	Dr G Begg (JCU)	3rd Party Contract
Collation and review of Islander commercial catch history in the Eastern Torres Strait reef line Fishery (B4.19)	Dr G Begg (JCU)	3rd Party Contract
Serranid biology (B4.20S)	PGS Ms R Pears (JCU)	Mr M Bishop (GBRMPA)
Third International Symposium on Fish Otolith Research and Application (B4.21)	Dr G Begg (JCU)	Dr D Williams (CRC Reef)
Driving innovation in environmental performance in the Queensland fishing industry (B4.22)	Mr T Dempster (QSIA)	3rd Party Contract
The effects of line fishing on the GBR (B4.2a)	Dr B Mapstone (JCU)	Steering Committee, Mr M Bishop (GBRMPA), Mr M Elmer (QFS)
Population dynamics and stock structure of red throat emperor and others (B4.3.1)	Dr C Davies (NOO)	Mr M Bishop (GBRMPA), Mr D Souter (QSIA)
Abundance estimates of large and sedentary fishes (B4.3.2)	Prof H Choat (JCU)	Mr M Bishop (GBRMPA), Mr D Souter (QSIA)
Modelling multi-species fishery dynamics (B4.4)	Dr B Mapstone (JCU)	Mr M Bishop (GBRMPA), Mr D Souter (QSIA)
Modelling multi-species targeting of fishing effort in the Queensland coral reef finfish fishery (B4.4a)	Dr B Mapstone (JCU)	3rd Party Contract
Coastal fisheries resource monitoring in the GBRWHA (B4.5)	Mr R Garrett (QDPI)	Mr D Cameron (GBRMPA), Mr M Doohan (QFS)
Liaison and information management for Fishing & Fisheries research (B4.6)	Dr A Jones (JCU)	Steering Committee
Measurement uncertainty and post-capture changes in sizes of coral trout (B4.8)	Mr C Lunow (QDPI)	Mr R Grimley (QBFP)
A review of reef line fishing in the eastern Torres Strait (B4.9)	Dr B Mapstone (JCU)	Ms K Bennetts (AFMA)
Stock structure of common coral trout *Plectropomus leopardus* in the GBRWHA (C3.4S)	PGS Ms M Bergenius (JCU)	Mr M Bishop (GBRMPA)
The accumulation of larvae by oceanographic features: do they cause recruitment and biodiversity hotspots? (C3.5S)	PGS Ms J Eagle (JCU)	Dr P Doherty (AIMS)
Determining optimal capacity where latent effort exists (E 2.1.16/1S)	PGS Mr G Muldoon (JCU)	Mr M Bishop (GBRMPA)
Spatial variation in population dynamics of red throat emperor (E 2.4.21S)	PGS Mr A Williams (JCU)	Mr M Bishop (GBRMPA)

PGS - Postgraduate student

Left:
CRC Reef researcher Mr Amos Mapleston based at JCU is studying the catch characteristics of Spanish mackerel caught by recreational and commercial fishers.

Photo by CRC Reef.

Right:
CRC Reef postgraduate student Ms Renae Tobin from JCU is asking recreational fishers their opinions about perceived differences in catch between estuaries which are open and closed to commercial fishing.

Photo courtesy of Ayr Advocate.

Crown-of-thorns starfish continue to have major impacts on reefs, including many valuable tourism sites. The Reef Futures team have developed models that show that small increases in survival of COTS larvae increases the frequency of outbreaks. Although the link has not yet been established, larval survival could be improved by the increase in coastal productivity due to the rise in runoff from the land.

Photo by David Wachenfeld.

Maintaining ecosystem quality (Program C)

Program Leader: Dr Peter Doherty, AIMS

Objective

To generate critical information, relevant products and useful advice that will assist users, interested members of the Australian public, industry operators, and natural resource managers to know the status and trends of marine ecosystems within the GBRWHA, through development of benchmarks and performance indicators.

Public debate and policy development for use and protection of the GBRWHA should be well informed about the status and trends of ecosystems. However, there are few historical benchmarks against which to measure change and few agreed performance indicators of system health. Detecting anthropogenic impact in this situation is also challenging because it takes place in a highly variable natural environment. Besides the potential for local impacts in the ocean, coastal marine ecosystems are affected by land-based pollution and global weather patterns.

This program is a balanced package of mapping, monitoring and strategic process-oriented research that aims to establish benchmarks and performance indicators to anchor public debate on the status of the GBRWHA. It will also give early warning of any systematic trends in status and condition in this large and complex ecosystem.

During the year, the program continued to make good progress in the areas of biodiversity, water quality, and climate change. It was a productive year with many significant outputs, including resource books, training manuals, technical reports and integrative studies. Information from the program was distributed in many formats: verbal, paper reports, CDs and websites. Outreach was achieved through print and electronic media, technical and industry workshops, public presentations, stakeholder consultations and community-based monitoring projects.

Biodiversity: status and trends (Project C1)

Project Leader:
Dr Peter Doherty, AIMS

Following the completion of a major desktop planning study, the CRC Reef Board has committed $1 million over the next three years to the operational phase of the GBR Seabed Biodiversity task, which will map seafloor habitats, fauna and flora within the GBRWHA. This commitment has been matched by additional funding from the Fisheries Research Development Corporation (FRDC) and the National Oceans Office (NOO), in expectation that this large task will also deliver risk-assessments for trawl fisheries in the Marine Park (required under the Commonwealth Environment Protection and Biodiversity Conservation Act) and baseline information required for regional marine planning (part of implementing Australia's Oceans Policy). The four research providers (AIMS, CSIRO, QDPI, Queensland Museum) will contribute $4 million to achieve these goals, making the total value of the task more than $6 million. Sampling will begin in September 2003 and progress will be reported regularly through a website accessible from the CRC Reef home page.

The Long-Term Monitoring Team (LTMT) at AIMS completed its 11th consecutive survey of coral reef health throughout the GBR. The team recorded a rising incidence of diseased corals in some sections of the GBR, although the general health of reefs remains good compared with reefs in other countries. This information formed an important part of the State of the Reef report (2003) which was launched by GBRMPA at an international Reef Summit in Townsville in July 2003. The LTMT also continued to monitor the progress of a third wave of crown-of-thorns starfish moving south along the length of the GBR, reporting that current outbreaks are now concentrated on reefs adjacent to Townsville. In addition, CRC Reef was contracted by EA to report on the status of reefs in the Coral Sea, which were found to have very low coral cover following recent bleaching episodes. Subsequently, CRC Reef was commissioned to provide an affordable strategy for monitoring all marine parks administered by EA.

Botanical specialists from QDPI continued their studies of tropical seagrass meadows in the GBRWHA and internationally. Seagrass communities in Queensland have remained relatively stable in recent years, possibly because low rainfall associated with the El-Nino weather pattern has meant low discharge of sediment-laden freshwater from coastal drainages. During 2002-03, the researchers also found that intertidal seagrasses had recovered after major losses caused by flooding in 1999 indicating that seagrass beds can regenerate over large areas within three years. Community-based monitoring (Seagrass-Watch) was maintained at seven locations between Cairns and Brisbane, and eight countries in the Western Pacific. CRC Reef researchers wrote and published a methods manual to support these volunteer groups as well as contributing chapters to a Global Atlas of seagrasses scheduled for publication next year. The David and Lucille Packard Foundation (USA) has committed new funds to continue the international monitoring task.

Photo by GBRMPA.

Case study demonstrating successful technology transfer

Water quality

CRC Reef staff and researchers have continued to play pivotal roles in the debate on inshore water quality in the GBR lagoon. The book by Dr Miles Furnas (Catchments and Corals: Terrestrial Runoff to the Great Barrier Reef) published during the year has already been used to set water quality guidelines in a Queensland Government committee. CEO of CRC Reef, Prof Russell Reichelt is a member of the Reef Protection Science Panel responsible for advising the Queensland Government on water targets. The issue of inshore water quality has attracted a great deal of attention from conservationists, government agencies and the media in the last year, with CRC Reef and AIMS research central to the debate. CRC Reef research featured in the documentary Muddy Waters, which was broadcast on SBS TV in May 2003. During the year, CRC Reef also released a revised and updated edition of the Land Use and the GBR brochure. An ongoing multidisciplinary study comparing tropical coral reefs close to and distant from areas of river runoff will provide insight into the way that nutrients and sediments washed off the land affect reefs.

Research users: GBRMPA, agriculture industry, government agencies, conservation groups.

The Project started several other new tasks during the year related to the conservation, management and use of tropical biodiversity. Financial support from the GBRRF was crucial in three cases. In the first, a three-volume scientific treatise on reef coral taxonomy produced by **Dr John Veron** (AIMS) was translated into an interactive tool distributed on CD. This will enable a range of users (scientists, managers, and border control agents) to identify species in this very complex group. In the second, researchers from AIMS and JCU completed pilot trials and an environmental assessment on behalf of the Indigenous community of Palm Island showing the feasibility of a sponge aquaculture industry. Negotiations are ongoing with Traditional Owners about scaling up to a small commercial enterprise. In the third development, the Commonwealth science minister, Hon. Peter McGauran, provided $100,000 to the GBRRF for research into irukandji jellyfish following the deaths of two tourists in north Queensland. These seed funds attracted another $150,000 of donations, which were then allocated to three projects by an Irukandji Taskforce acting for the Queensland Government. In addition, the recent Queensland State budget allocated another $550,000 over the next four years for additional research into these deadly stingers.

Water quality (Project C2)

Project Leader:
Dr Miles Furnas, AIMS

The increase in runoff of sediment and nutrients following European development of the land is one of the greatest human impacts on the GBR. Most of this increase is due to land clearing and intensive agriculture in catchments adjoining the GBR. Heightened awareness of the transfers from land to sea has generated significant community and policy debate.

During the year, **Dr Miles Furnas** published a book which synthesises 15 years of research and details the sources and processes of terrestrial runoff. This resource book is aimed at a wide audience ranging from natural resource managers to informed laypersons. Prior to publication, this information was fed into State and Commonwealth processes resulting in the new Reef Water Quality Protection Plan. This is a major outcome for the Project.

Two further reports are anticipated. **Mr Jon Brodie** from JCU is finalising a study into the nutrient exports from 'pristine' catchments, which have little land clearing and human development, to provide an essential benchmark against which to judge the rehabilitation of modified catchments. These data were also fed into the Reef Protection Plan, ahead of their publication. Another planned output, the Herbert River Integration Study, was put on the backburner because key personnel were heavily committed to the development of the business plan for the CSIRO Flagship Program: Healthy Country. Meanwhile several contributing studies were finalised showing that hill slope erosion in the upper catchment is the main source of sediments in the river, while canelands in the lower catchment provide most of the excess nitrogen. Scenario models show that increasing ground cover and reducing fertiliser use should reduce the delivery of excess sediments and nutrients to coastal seas.

Research continued into the transport and transformation of these materials once they reach the marine environment. The data show that most of the terrestrial exports are deposited in a band within 20km of the coast, indicating that runoff is mainly a problem for inshore communities. Sediment bacteria degrade the organic matter that falls to

CRC Reef researcher Dr Katharina Fabricius from AIMS is studying the impact of terrestrial runoff on coastal reefs and ecosystems.

Photos by Katharina Fabricius, AIMS.

the seabed in this zone and release nitrogen as dissolved gas that eventually makes its way back to the atmosphere. New work on cross-shelf mixing rates was identified as a critical step towards creating balanced nutrient budgets for the GBRWHA, which will be concluded in the lifetime of CRC Reef.

A comparative study of the condition of inshore coral reefs adjacent to agricultural catchments in the Wet Tropics and relatively pristine catchments on Cape York continued. Key results from this study are that coral biodiversity and recruitment decreases, and macro-algal cover increases, along water quality gradients within and between the two regions. These results were presented to many audiences (managers, politicians, public) in many formats including a television documentary (Muddy Waters) that screened nationally. This study has provided the most definitive view of the scope of land-based pollution in the GBRWHA and influenced the agenda for action.

As reported elsewhere, a major response will be delivered over the next three years through a new joint venture between two CRCs (Rainforest and Reef). This project - Catchments to Reef - will develop new tools for monitoring the health of rivers and coastal communities, and establish baselines against which to measure progress towards a cleaner environment. In addition to nutrients, the research will broaden its focus to include organic contaminants following research that has shown corals to be very sensitive to a wide range of such chemicals. For example, **Dr Andrew Negri** from AIMS showed that the photosynthesis of zooxanthellae, which provide corals with a major source of energy, is inhibited by the herbicide diuron at environmental levels of just 1 microgram per litre of seawater.

Climate change and coral bleaching (Project C4)

Project Leader:
Dr Janice Lough, AIMS

The enhanced greenhouse effect is warming global and regional temperatures in the air, on the land, and in the sea. Reef-building corals are very sensitive to changes in their thermal environment and will lose their algal symbionts and bleach with a one-degree rise in the maximum sea temperature. As a result, coral reefs were highlighted as a 'unique and threatened ecosystem' in the recent Intergovernmental Panel on Climate Change (IPCC) Third Assessment Report.

There was widespread coral bleaching on the GBR in the summers of 1998 and 2002. Most bleached corals survived these events except in some inshore areas that experienced the most extreme and/or prolonged temperature anomalies. Therefore, there is potential for more widespread loss of corals with repeated bleaching episodes. In response, CRC Reef researchers with others e.g. AIMS, NOAA, have created an early warning system for GBRMPA to detect sea temperatures conducive to bleaching, while continuing experiments into the potential for corals to adapt and/or acclimate to climate change.

High-resolution monitoring of the physical environment of the GBRWHA is being achieved through real-time satellite remote sensing, validated by an extensive network of in-situ temperature loggers, oceanographic moorings, and the AIMS automated weather station network. A key result obtained from the two recent bleaching episodes is the importance of water column mixing as a local factor influencing the regional severity of coral bleaching. Using this knowledge, researchers are working with international partners (NOAA) to refine bleaching risk maps for the GBR.

Laboratory studies on the physiology and biochemistry of coral-algal symbioses have been supplemented by careful and limited transplantation of reef corals between parts of the GBR to forecast how they will respond to warmer temperatures. So far, the results have been mixed but the most exciting result was observed last summer in corals transplanted from the Keppel Islands (23ºS) to Magnetic Island (19ºS). These corals bleached after being relocated to the warmer waters off Townsville but later recovered. During this process, the surviving corals were found to have lost their original strain of symbionts (Clade C) and to have been repopulated by the local strain (Clade D). This change of partners gave the corals from the Keppels the same thermal properties as native corals from Magnetic Island. This is the first time that such acclimatisation has been demonstrated and provides some hope that coral reefs may be able to adapt to climate change.

Maintaining ecosystem quality (Program C) – list of tasks

TITLE	TASK LEADER	TASK ASSOCIATE
Biodiversity: Status & Trends (C1)	**Dr P Doherty (AIMS)**	
Measuring the success of conservation strategies to protect scleractinian corals on the GBR (A2.1.3S)	PGS Ms E Dinsdale (JCU)	Dr P Marshall (GBRMPA)
Coral ID project (C1.10)	Dr C Veron (AIMS)	3rd Party Contract
Sponge aquaculture for Indigenous communities (C1.11)	Dr C Battershill (AIMS)	3rd Party Contract
Research and monitoring initiative for Commonwealth Marine Protected Areas (C1.12)		3rd Party Contract
Research & monitoring initiative for Commonwealth Marine Protected Areas - Coringa - Herald (C1.12a)	Mr W Oxley (AIMS)	3rd Party Contract
Long-term monitoring of coral reefs of the GBRWHA (C1.2)	Dr H Sweatman (AIMS)	Dr D Wachenfeld (GBRMPA)
Identifying critical marine plant habitats in the GBRWHA (C1.3)	Mr L McKenzie (QDPI)	Mr A Stokes (GBRMPA), Dr D Haynes (GBRMPA)
Population biology and biogeography of Caribbean and Indo-Pacific reef fishes (C1.6)	Prof H Choat (JCU)	3rd Party Contract
Western Pacific Seagrass Project - Packard Foundation (C1.8)	Dr R Coles (QDPI)	3rd Party Contract
Water Quality (C2)	**Dr M Furnas (AIMS)**	
Effects of experimentally enhanced nutrients on inshore seagrass beds in the GBR region (1.4.4)	PGS Ms J Mellors (JCU)	Dr R Coles (QDPI)
Assessing land-based threats and impacts: nutrient supply fluxes (C2.1)	Dr D Alongi (AIMS)	Dr D Haynes (GBRMPA), Mr V Veitch (SUNFISH)
Water quality in undeveloped and pristine areas of the GBR catchment (C2.10)	Mr J Brodie (JCU)	Dr D Haynes (GBRMPA)
Assessing impacts of terrestrial runoff on inshore reefs (C2.2)	Dr K Fabricius (AIMS)	Dr D Haynes (GBRMPA), Mr V Veitch (SUNFISH)
Factors affecting coral fitness in an experimental reef mesocosm (C2.3S)	PGS Ms S Anthony (JCU)	Mr J Hoey (GBRMPA)
The physical movement of sediment and its biological impact on reef corals (Lihir) (C2.5)	Ms S Rotmann (AIMS)	3rd Party Contract
Herbert River integration study (C2.6)	Dr D Williams (CRC Reef)	
Long-term chlorophyll monitoring of GBR waters (C2.8a)	Dr M Furnas (AIMS)	Dr D Haynes (GBRMPA)
Assessing the effects of the herbicide diuron on inshore coral (C2.9)	Dr A Negri (AIMS)	Dr D Haynes (GBRMPA)
Climate Change & Coral Bleaching (C4)	**Dr J Lough (AIMS)**	
Regional dynamics in the marine climate GBRWHA (C3.1)	Dr J Lough (AIMS)	Dr P Marshall (GBRMPA)
Long-term monitoring of sea temp at PCQ ports (C3.1.1)	Dr R Berkelmans (AIMS)	Ms S Trimarchi (PCQ)
Climatic and oceanographic change from high-resolution records in large fossil *Porites*, Magnetic Island, Qld (C4.1S)	PGS Mr S Lewis (JCU)	Dr J Lough (AIMS)
Irukandji Research (C6)		
Identification of Cubomedusae responsible for Irukandji syndrome using molecular and morphological characters (C6.1)	Ms M Van Oppen (AIMS)	3rd Party Contract

PGS - Postgraduate student

Reef Futures (Program D)

Program Leader: Dr Terry Done, AIMS

Objective

To improve the management and use of information within CRC Reef, to catalyse and participate in integrative projects, and to facilitate knowledge transfer among CRC Reef's partners, and between CRC Reef and its key client groups.

Knowledge exchange (Project D3)

Project Leader:
Dr Terry Done, AIMS

This project acts as a forum for knowledge compilation, integration and transfer which operates across research tasks and works in close cooperation with the Communication section and the Exploring Reef Futures team. Its major achievement for the year was the completion of the first three stages of a major review of monitoring programs on the GBR. The first stage was the design, building and compilation of a database and Geographic Information System that described and mapped the locations of the monitoring projects. This system was populated with information based on a survey of CRC Reef and other researchers. The second stage was a workshop of key respondents, to elaborate and clarify the information in the system. The third stage was a workshop that focused on land-based sources of pollution and water quality issues. The meetings catalysed a number of potential new monitoring tasks and improved integration among formerly disconnected tasks. The team also produced syntheses of current state of knowledge in the CRC Reef brochure series: Line Fishing on the GBR, Marine Tourism on the GBR, and an updated edition of Land Use and the GBR. The achievements of Project Team are commendable in light of the departure of the former project leader **Assoc Prof Vicki Harriott** in August 2002, and thanks to the efforts of **Dr Louise Goggin** who led the project along with the Communications and Education Program, until the appointment of **Dr Britta Schaffelke** to this project in May 2003.

Exploring Reef Futures (Project D4)

Project Leader:
Dr Terry Done, AIMS

The team made major progress in advancing understanding of CRC Reef's priority issues of climate change and coral bleaching, biodiversity conservation, terrestrial runoff and water quality, and crown-of-thorns starfish. It also greatly advanced the development of a state-of-the-art information management system, and achieved international recognition for its work.

In relation to climate change and coral bleaching, the team integrated several data sets, generated by AIMS and JCU with CRC Reef support. Spatial correlation in patterns of heat stress and bleaching impacts were defined at a much finer level of spatial resolution (1km) than has been possible previously. However, patterns of heat stress alone were far from complete predictors of distribution and severity of bleaching impact. Through application of advanced analytical tools (including boosted trees, Bayesian neural networks, and graphical models), progress was made in determining the importance of local environmental and ecological factors in improving our understanding of the phenomenon. Projections that compared two Intergovernmental Panel on Climate Change (IPCC) scenarios for 2050 highlighted potential benefits for coral communities of lower rates of global warming.

A major goal for GBRMPA in the conservation of biodiversity is the implementation of an effective configuration of representative protected areas across the World Heritage Area. To this end, the team provided

Photo by R. Berkelmans, AIMS.

Case study demonstrating successful technology transfer

Coral bleaching and climate change

Several CRC Reef research tasks have contributed to a greater understanding of the physical and biological conditions that trigger coral bleaching on the GBR. Correlation of heat stress and coral bleaching are now possible at a very fine level of spatial resolution. It is now clear that heat stress alone predicts only part of the observed bleaching impact and that local environmental and ecological factors are important as well. Incorporating climate change scenarios into predictions of coral bleaching substantiated the threat of global warming to the health of the GBRWHA. Bleaching risk maps have been refined in collaboration with international partners (NOAA). High-resolution monitoring of sea temperatures by satellites and an extensive network of temperature loggers and weather stations along the GBRWHA have led to the development of an early warning system to detect temperatures that are likely to lead to bleaching and to provide this information to the media, resource managers, government and tourism operations. First results of physiological studies provide some hope that corals may be able to adapt to climate change. Access to spatial data and summary information on coral bleaching will be available soon on the Reef Futures website.

Research users: International community, Australian government agencies, and the community.

Case study demonstrating successful technology transfer

Knowledge exchange

This task aims to enhance the role of CRC Reef as a knowledge broker, to facilitate the provision of information about coral reefs to CRC Reef member organisations and the community, and to undertake research reviews on request. An example from 2002-03 is the release of a brochure that summarises the impacts of marine tourism on the GBR. The brochure is based on a scientific review by Associate Professor Vicki Harriott, which was published as a CRC Reef technical report. This long-awaited synthesis concludes that, in contrast to popular opinion, scientific evidence indicates that the footprint of marine tourism on the Reef is small and localised.

Research users: GBRMPA, QPWS, federal and state government departments, community, and the media.

assistance in developing and applying software tools that were used by GBRMPA to develop the draft zoning plan for the GBR that went to public review in mid-2003. The software was one of the tools that assisted GBRMPA generate configurations that met specified criteria for representation and replication across bioregions whose borders had previously been defined with assistance from researchers across CRC Reef and its members.

The team made an important contribution to the emerging scientific consensus about the detrimental impacts of land-based runoff into GBR waters. New methods for attributing causality to environmental change were developed, and they were used to argue that terrestrial runoff has affected coastal benthic communities of the wet tropics. This work was the basis of presentations to government inquiries that have led to the instigation of the Reef Protection Plan.

The year saw continued serious impacts by crown-of-thorns starfish on reefs, including many valuable tourism sites. The team developed new models that showed that relatively small increases in larval survival can increase the frequency of outbreaks and reduce the recovery of coral cover. Such an increase in larval survival is consistent with increases in coastal productivity from increased runoff of silt and nutrients in recent decades, but this linkage has not yet been established, nor has the potential ameliorating effects of predation on various stages of the juvenile and adult starfish.

Continual improvement in the management and dissemination of data and information to CRC Reef partners and the public remains an ongoing goal for the team. The information management system is a geospatial data warehouse with metadata structures to underpin it. The team developed web-based access to around 20 different maps and 100 metadata sets, as well as geospatial tools for viewing and basic interrogation. Major progress has been made in system design and in developing full functionality within AIMS, and in developing mirror sites that will be accessible to all CRC Reef partners through the CRC Reef home page.

The team's work gained major exposure nationally and internationally, highlighted by publications in prestigious journals, invited keynote and plenary addresses, and participation of its members in various regional, state and international working groups.

Reef Futures (Program D) – list of tasks

TITLE	TASK LEADER	TASK ASSOCIATE
Information Synthesis (D2)	**Dr T Done (AIMS)**	
Effects of water quality on the distribution of corals on coral reefs (D2.1.1S)	PGS Mr B Radford (JCU)	TBD
Book: Geoscience of the Great Barrier Reef (D2.2b)	Dr P Larcombe (Centre for Environment, Fisheries and Aquaculture Science)	Mr A Costen (EPA)
Knowledge Exchange (D3)	**Dr Terry Done (AIMS)**	
Knowledge Exchange (D3.1)	Assoc Prof V Harriott (CRC Reef), Dr B Schaffelke (CRC Reef)	
Exploring Reef Futures (D4)	**Dr T Done (AIMS)**	
Ownership of genetic resources in the GBRWHA, its ecotone and the EEZ (A3.1)	Dr M Wasson (ANU)	Dr C Battershill (AIMS)
Information Management System (D1.1)	Dr B Schaffelke (CRC Reef)	Mr A Chin (GBRMPA)
Knowledge Management System (D4.1)	Mr S Kininmonth (AIMS)	Ms S Davies (GBRMPA)
Exploring Reef Futures (D4.2)	Dr S Wooldridge (AIMS)	Dr P Marshall (GBRMPA)
Data and information analysis (D4.3)	Dr G De'ath (AIMS)	Dr D Williams (CRC Reef)

PGS - Postgraduate student
TBD - To Be Decided

5. Cooperative linkages

Top:
CRC Reef researcher Dr Lance Bode and his team based at James Cook University are developing models to understand the connectivity between reefs and predict the movement of fish larvae.

Photo courtesy of Townsville Bulletin.

Bottom:
CRC Reef postgraduate student Mr Dean Miller, based at JCU is studying the sustainable use of ecologically important natural resources by the tourism industry.

Photo by Gareth Stephens, Undersea Explorer.

Highlights

- Collaboration of CRC Reef researchers, management agencies, industry and international interests in the design and development of a portable ballast water treatment plant, currently being tested in Townsville.
- Contribution towards establishment of the Australian Marine Invertebrate Taxonomist Network (AMIT) as an outcome of the Asian green mussel eradication response.
- Collaboration on coral bleaching by AIMS and NOAA scientists to develop satellite products for risk assessment on the GBR, and early detection of bleaching.
- Enhanced understanding of the effects of runoff on coastal systems, including identifying ecological gradients along water quality gradients by AIMS scientists.
- Extension of existing hydrodynamic and transport models of the Cairns Section to the entire GBR, as well as parts of the Torres Strait and the Gulf of Papua.
- Expansion of the Global Seagrass Monitoring Program to develop collaborative partnerships between science and community-based teams in the countries of the western Pacific.
- Establishment of a CRC Reef Indigenous Working Group to advise on the development and implementation of an Indigenous Engagement Strategy.

Objective

To continue and extend the collaboration and cooperation between researchers, industry, stakeholders and resource managers.

Cooperative linkages between CRC Reef's members and with external agencies are vital to the operations and future of the Centre. CRC Reef has enhanced collaborations among members established under the previous CRC Reef, and established new cooperative arrangements. The strategies used by CRC Reef to achieve and maintain strong cooperative linkages are:

- a strategic approach to communication and extension, which is supported by its members;
- strong support for multi-agency research tasks and integration of research;
- provision of opportunities for CRC Reef researchers and stakeholders to meet in workshops, meetings, steering and advisory committees;
- a highly inclusive and representative committee structure;
- strong links between the education program and industry; and
- a communication and extension strategy built around information needs of industry and the matching of research to those needs.

CRC Reef is supporting research to better understand the number and spread of jellyfish species that cause irukandji syndrome.

Photo by Lisa Ann Gershwin, JCU.

Internal links with member organisations

Links between researchers and member organisations are strengthened through the Task Associate Program. The role of the Task Associate is to improve the relevance and application of strategic research, facilitate information transfer and help develop public policy and better industry practices. Forty one personnel from AFMA, AIMS, AMPTO, GBRMPA, GBRRF, JCU, Ports Corporation Queensland (PCQ), QSIA, SUNFISH, the Environmental Protection Agency (EPA), QDPI, Sea Forum and private industry are assigned as associates to more than 80 tasks. A review of the Task Associate Program was undertaken in 2002 which resulted in improved reporting by Task Associates in 2003.

Close association of research providers with other member organisations has produced positive research outcomes for all parties. Water quality research by **Dr Katharina Fabricius** based at AIMS has significantly advanced our understanding of the effects of runoff on coastal systems, identifying ecological gradients which relate to water quality gradients. The findings will allow predictions of change in reef communities in response to changes in water quality, contributing also to the GBRMPA Water Quality Protection Plan.

Integration of QDPI biota surveys for introduced marine organisms in the Cairns Trinity Inlet, with modelling of dispersal of the Asian green mussel by JCU's Marine Modelling Unit, contributed to a better understanding of the problem by the Queensland EPA.

Members of the tourism industry partner, AMPTO, have supported surveys by CRC Reef social researcher **Dr Gianna Moscardo** based at JCU, providing access on different operations.

Stakeholder linkages were also enhanced by:

- extensive email information networks between staff, students and associates;
- publishing scientific results in newsletters, reports, brochures, the media and on the website;
- regular seminars, workshops and briefings to industry and regional resource management agency staff;
- extension and research presentations to tourism industry members in Cairns and the Whitsundays;
- formal representation of industry and management on various committees, to provide information for management plans, fisheries proposals and tourism policy; and
- participation of CRC Reef researchers and staff on numerous working parties, state government Advisory Committees, GBRMPA advisory committees, national and international groups so that research results can be utilised directly in management outcomes by member agencies.

External linkages

CRC Reef maintains external linkages through research projects and through education and extension activities.

A collaboration of management agencies (EPA, Qld Dept of Transport - DOT, EA, GBRMPA), policy makers (Queensland Port,), industry (Shipping Industry Modular Solution Technologies, AMIAD) and research agencies (AIMS, JCU), non-government agencies (GBRRF) and international interests has resulted in the design and development of a portable ballast water treatment plant, currently undergoing pilot tests at a Townsville sewage treatment plant. The project aims to produce a plant capable of economical treatment of ships' ballast water in tropical, subtropical and temperate waters, with a view to future commercial applications.

CRC Reef researchers from QDPI were supported by AFFA, Cairns Port Authority (CPA), CSIRO Centre for Research on Introduced Marine Pests (CRIMP), Commonwealth Consultative Committee on Introduced Marine Pest Emergencies (CCIMPE), EA, DOT and Queensland EPA, in continued surveys and research on the introduced marine pest in Cairns Port, the Asian green mussel. An additional outcome of the Asian green mussel eradication response was the establishment of the Australian Marine Invertebrate Taxonomist Network (AMIT), a collaboration between taxonomists from research establishments

including the QDPI, Australian Museum, JCU, Museum of Tropical Queensland (MTQ), Poore Museum Victoria and Queensland Museum.

External collaboration has also resulted in the following research task activities and outcomes:

- Extension of hydrodynamic and transport models to the entire GBR, as well as parts of the Torres Strait and the Gulf of Papua was enabled through collaboration with the Australian Bureau of Meteorology who supplied wind information. The connectivity modelling has been of value to GBRMPA for the Representative Areas Program.
- Improved understanding of the potential impacts of diuron, found in certain herbicides, on corals and their symbiotic algae, based on active collaboration between water quality researchers from AIMS and University of Queensland.
- A review of water quality in developed and undeveloped and pristine areas of the GBR by JCU researcher **Mr Jon Brodie**, with links to DNR&M, EPA and CSIRO Land and Water, used in risk assessment analysis for the Reef Protection Plan.
- Long-term monitoring of sea temperature at PCQ ports, undertaken by AIMS scientists in collaboration with the Solitary Islands Marine Park Authority and Environment Australia, who provided data and funding for data loggers.
- Mapping of port habitats by the QDPI Marine Ecology Group for Port Authorities, and in consultation with Technical Advisory Committees, in Cairns, Gladstone, Karumba, Mackay, Mourilyan and Weipa.
- Continued involvement by CRC Reef scientist based at AIMS, **Dr Scott Wooldridge**, with the Decision Support Working Group for the World Bank/Global Environment Fund (GEF) Target for Resource Assignment from the Core (CORE TRAC) Project, towards development of a Dynamic Decision Support System, targeting reefs in America, Australia and the Philippines.
- CRC Reef-funded extension activities in conjunction with research by **Dr Alastair Birtles** (JCU) and **Dr Peter Arnold** (MTQ) on swim-with-whale activities on the northern GBR. The tourism industry contributed significantly to the research program and participated in two pre-season workshops held in Cairns in April and May 2003.
- Production of interpretive videos on dugong research, for both Aboriginal and Torres Strait Islander audiences, by JCU researchers, **Prof Helene Marsh**, **Dr Donna Kwan** and **Dr Ivan Lawler**, in collaboration with representatives from Cape York Land Council, TSRA, AFMA, GBRMPA, Hopevale Community and the Mabuiag Island Community.

Postgraduate students have also benefited from external and international collaborations:

- CRC Reef postgraduate student **Ms Amanda Hodgson** based at JCU received support in analysis of dugong vocalisations from the Sonar and Undersea Environment Group, Maritime Operations Division, Defence, Science and Technology Organisation.
- QPWS assisted in dugong and dolphin research by CRC Reef postgraduate students **Mr James Sheppard** and **Mr Guido Parra** from JCU, by providing boat and staff support.
- CRC Reef postgraduate student **Ms Renae Tobin** from JCU was supported by QFS, members of recreational fishing clubs and Sunfish, and the Australian Sportsfishing Association (ANSA) for data in her study of recreational line fishing trends in north Queensland estuaries open and closed to commercial fishing.
- CRC Reef postgraduate students **Mr Ross Marriott** and **Ms Rachel Pears** from JCU have both benefited from collaboration with the Seychelles Fishing Authority in their fisheries population studies.

Photo by Lyle Vail.

Students in the spotlight

Understanding impacts of line fishing

Understanding the interactions between predators, such as coral trout, and their prey is essential to manage the potential effects of reef fishing on the reef ecosystem. CRC Reef Student Associate Mr Ameer Abdulla from James Cook University used a system of artificial reefs and cages in the Lizard Island lagoon to simulate the effect of removing local large predators by overfishing. He found an increase in foraging and growth of the prey used in the trials, the tropical damselfish *Pomacentrus moluccensis*, on reefs where predators were excluded. The results suggest that if predator abundance or diversity declines sharply due to overfishing of piscivores, some prey species may grow and reproduce at levels that may out-compete other prey species and reduce total prey diversity.

Case study demonstrating successful technology transfer

Photo by PCQ.

Critical habitats and shipping

CRC Reef's program of seagrass and benthic habitat surveys for Queensland ports has continued to expand and now includes eight ports - Mourilyan, Cairns, Thursday Island, Mackay, Karumba, Weipa, Skardon River and Gladstone. The surveys were developed in close consultation with the relevant port authorities and have received significant financial contributions from port management agencies including Ports Corporation of Queensland, Mackay Port Authority, Trinity Inlet Waterways, Gladstone Port Authority and Cairns Port Authority.

Port authorities have used results of the monitoring programs extensively in planning and reviewing their port activities. The number and geographic spread of Queensland sites now being monitored has enabled the researchers to determine regional scale changes in abundance and distribution of seagrass. This has assisted in distinguishing broader climatic causes of change from local human-induced changes.

The team has developed an excellent reputation in the ports and shipping industry for producing high quality and relevant research and monitoring. This reputation has led to port agencies approaching them to design and implement baseline surveys and monitoring programs for their ports. The team has continued working closely with other tasks in CRC Reef including those of the Introduced Pest Species team on joint projects designed to further strengthen our position as a leader in port habitat monitoring for Queensland. The team is also working with port authorities to achieve a longer-term funding commitment.

Research users: Ports industry, shipping industry, AQIS, GBRMPA.

Consultancies and third party projects

There has been an expansion in the number of third party funded research tasks and consultancies conducted by CRC Reef researchers. Several tasks in the Sustainable Industries Program (Fishing and Fisheries Project, Ports and Shipping Project) were funded by external sources, including:

- An examination of the exploitation dynamics and biological characteristics of east coast Spanish mackerel (funded by FRDC);
- Development of a draft management plan for Elizabeth and Middleton Reefs Marine National Nature Reserve (funded by Environment Australia);
- Collation and review of Islander commercial catch history in the eastern Torres Strait reef line fishery (funded by AFMA);
- Baseline surveys and monitoring program development by QDPI researchers for the Ports of Cairns and Gladstone (funded by Cairns Port Authority, Gladstone Port Authority);
- Development of molecular diagnostic techniques for the Asian green mussel to rapidly identify introduced pests. The work will contribute to the collaborative management strategy being developed by Cairns Port Authority, AFFA, CCIMPE, CRIMP, EPA and QDPI (funded by AFFA);
- Modelling of design wave conditions for the proposed Fairway Shipping Channel in far north Queensland (based on the Atlas of Tropical Cyclone Waves on the GBR), undertaken by the JCU Marine Modelling Unit for Coastal Engineering Solutions;
- A coastal flooding and frequency study conducted by the JCU Marine Modelling Unit for EPA and the Australian Bureau of Meteorology;
- Collation and review of Islander commercial catch history in the Eastern Torres Strait Reef Line Fishery (funded by TSRA and AFMA).

CRC Reef provides information and products to more than 1,000 small-to-medium enterprises in tourism, fishing, ports, shipping and engineering industries, mostly through peak associations such as AMPTO and QSIA. Many operators are directly involved with research, some as Task Associates, and support staff by assisting with logistical aspects of fieldwork, such as provision of ship-time and supply of fisheries material.

International links

CRC Reef's strategy for international links is directed towards contracting expertise to conduct and develop research and ecologically sustainable marine industries, and to manage tropical marine ecosystems. The aims are to enhance Australia's objectives to assist developing countries, to develop export industries, and to generate income for CRC Reef. By building on existing collaborations, and developing new working arrangements, CRC Reef continues to broaden its international profile.

CRC Reef Fishing and Fisheries researchers have conducted consultancies for the Department of Marine and Wildlife Resources, American Samoa, the Division of Fish and Wildlife, Commonwealth of the Northern Mariana Islands, and the Marine Research Institute, Iceland. These tasks continue to broaden the international profile of CRC Reef.

CRC Reef will co-host the Third International Symposium on Fish Otolith Research and Application in Townsville in July 2004, which is already attracting significant national and international attention. International and local steering committees have been appointed to assist with preparation. Sponsorships from several Commonwealth, State and international research and management agencies have been secured.

Left:
The Global Seagrass Monitoring Program has developed a successful collaborative partnership between science and community-based teams in the western Pacific.

Photo by QDPI.

Right:
Seagrass Watch involves communities in monitoring seagrass throughout Queensland.

Photo by CRC Reef.

The Global Seagrass Monitoring Program has developed a successful collaborative partnership between science and community-based teams in countries of the western Pacific. Monitoring sites have been established in the Federated States of Micronesia, Republic of Palau, the Philippines, East Malaysia, Indonesia, Papua New Guinea Australia and Fiji. The program includes the use of science-based protocols at two levels, one for organisations with appropriate expertise, and a simpler level for community groups and schools (Seagrass-Watch). This project is funded through the David and Lucille Packard Foundation administered by the University of New Hampshire.

CRC Reef researcher **Dr Kerry Neil** based at QDPI was sponsored by the Australian Association of Port and Marine Authorities (AAPMA) and the Australian Shipowners Association (ASA) to present her work at the First International Workshop on Guidelines and Standards for Invasive Aquatic Species Surveys and Monitoring in Brazil. Collaborative links with the International Maritime Organisation (IMO) GloBallast Group and National Institute of Water and Atmospheric Research (NIWA, New Zealand) were developed through the workshop.

Other international collaborations by CRC Reef researchers include:

- Fine-scale wave modelling by visiting scholar **Dr Katuya Hirayama** from the Marine Environment and Engineering Division of the Port and Airport Research Institute, Yoosuka, Japan, working with **Assoc Prof Tom Hardy** at JCU School of Engineering
- Contributions to marine biotechnology workshops by AIMS scientist **Dr Chris Battershill**, with Universities in the Netherlands and in China, as a result of interest in the work on sponge aquaculture for Indigenous communities.
- Collaboration on coral bleaching by AIMS and NOAA scientists to develop satellite products for risk assessment on the GBR, and early detection of bleaching.
- Membership on the NOAA/National Environmental Satellite, Data and Information Service (NESDIS) Sea Surface Temperature calibration/validation committee by AIMS scientist **Dr William Skirving**.

Examples of industries and other organisations which are end-users of CRC Reef research

Core participants including AMPTO, AIMS, QDPI, GBRMPA, QSIA and SUNFISH.

National research agencies including CSIRO.

Queensland local government including Townsville City Council and Cairns City Council.

Queensland ports and shipping industry including Ports Corporation of Queensland, Mackay Port Authority, Trinity Inlet Waterways, Gladstone Port Authority, Cairns Port Authority, Lucinda Port Authority, Mourilyan/Abbot Point Ports, Weipa Port, Townsville Port Authority.

Tourism and dive operators including Undersea Explorer, Port Douglas; Quicksilver Cruises, Port Douglas; Great Adventures, Cairns; Deep Sea Divers Den, Cairns; Friendship Cruises, Mission Beach.

Queensland island resorts including Hayman Island, Lizard Island, Dunk Island, Hamilton Island and Great Keppel Island.

Tourism industry including Tourism Queensland and regional tourism members (Whitsundays, Townsville, Gladstone, Cairns).

Fishing organisations including Fisheries Management Advisory Committees, Australian National Sportfishing Association, and commercial and recreational fishers.

State government departments and agencies including EPA (Qld); QPWS; Queensland Dept of Natural Resources, Department of Health

Industry organisations including the Bureau of Sugar Experimental Stations; Canegrowers Association; Queensland Farmer's Federation; Australian Marine and Offshore Group.

Marine engineering companies including Stewart Marine Design, Pacific Marine Group, North Marine Services.

Environmental consulting companies including Fisheries Research Consultants.

Conservation and community groups including Hopevale Community Council; North Queensland Conservation Council; Trinity Inlet Management Program; Catchment Management Groups.

International conservation and research agencies including IUCN and NOAA (USA).

6. Education and training (Program E)

Program Leader: Assoc Professor Vicki Harriott, JCU and CRC Reef (until August 2002); Professor Helene Marsh, JCU (from April 2003)

Highlights

- Four students supported by CRC Reef scholarships completed or submitted their theses.
- A total of 21 students received CRC Reef scholarships during 2002-2003.
- Augmentative Grants were awarded to four Honours students and 11 MSc or PhD students.
- Student training including an innovative statistical support scheme, and short courses on Geographic Information Systems (GIS), Media Skills, and Writing Grant Proposals.
- Research results of CRC Reef Scholarship Students and Student Associates were published in 21 publications (see Appendix 5).

CRC Reef student Mr Guido Parra based at JCU is studying inshore dolphins in Australia to help ensure their long-term survival.

Photo courtesy of Townsville Bulletin.

Objective

To provide scholarships, funding, training and a supportive educational environment for postgraduate students within an integrated research program.

CRC Reef's Education Program has three goals: to maintain standards of scientific excellence in education; to guide students to employment; and to enable students to contribute to the strategic development of Australian and international marine sciences.

Professor Helene Marsh became leader of the program after **Associate Professor Vicki Harriott** returned to Southern Cross University.

Student Induction Program

A comprehensive student induction program, including a CRC Reef student handbook, was offered in September 2002 and June 2003 and was well-received by students starting their studies with CRC Reef.

Current Student Status

No new scholarships were awarded in 2002-03. The total number of CRC Reef Scholarship students was 29, of which 21 received CRC Reef scholarships this year. Four of these students submitted their theses during the year. CRC Reef also had 78 Student Associates i.e. they had an association with CRC Reef through their project or supervisor or through the receipt of financial support. Of these, 24 submitted or graduated during the year. Student Associates are eligible to apply for training opportunities and travel awards.

CRC Reef students in 2002 - 03 comprised:

Degree	Scholarship Students*	Student Associates
PhD	27	44
MSc/ MEngSc etc	2	16
Honours	0	18
Total	**29**	**78**

(Table includes students who submitted or graduated during 2002-03)

** includes students who have received scholarships in the past but have not yet submitted.*

Grants and Awards

CRC Reef continued to support student attendance at conferences. Nine students were supported with grants totalling approximately $6,000 to attend both national and international conferences.

CRC Reef Augmentative Grants support postgraduate research in areas of core as well as strategic interest to CRC Reef.

Student	Place of Employment
Scholarship students	
Dr Rebecca Fisher	Postdoctoral researcher, University of California, Santa Cruz, USA
Mr John Robertson	Program Leader (Aquaculture), Agency for Food and Fibre Sciences, Australia
Student associates	
Dr Carolina Bastidas	Lecturer, Universidad Simón Bolívar, Venezuela
Dr Ray Berkelmans	Research scientist, AIMS, Townsville, Australia
Dr Jo Cavanagh	Environmental scientist, Landcare Research, Christchuch, New Zealand
Dr Guillermo Diaz-Pulido	Lecturer, Universidad del Magdalena, Colombia
Dr Greg Doherty	Superintendent, Safety Health & Environment, Roseberry Mine, Tasmania, Australia
Dr Jamal Jompa	Lecturer, Hasunddin University, Indonesia
Dr Jacob Mosse	Christian University of Artha Wacana Kupang, West Timor
Dr Julie Robins	Research scientist, QDPI, Brisbane

Grants totalling $10,000 were awarded to four Honours students and 11 MSc or PhD students, who become CRC Reef Student Associates.

The Ken Woolfe scholarship of $3,000 was awarded to a JCU Earth Sciences PhD student, **Mr Stephen Lewis**, to support his CRC Reef-funded research into records of climatic and oceanographic change in fossil and recent corals.

Training

Postgraduate students receive training in generic skills useful to industry, and work closely with industry and CRC Reef partners via the Task Associate scheme.

A statistical support service for CRC Reef students was initiated in July 2001 and continued into 2003. The service operates in conjunction with JCU and provides both individual consultation time with a statistical advisor and several short courses in topics of interest. The scheme has been well supported by students and is currently being reviewed to further improve its delivery.

Other student training opportunities included a short course in Writing Grant Proposals, and Media Skills. A training course on the use of Geographic Information Systems (GIS) was held in May 2003 for students and staff of the Fishing and Fisheries Project (Program B). CRC Reef's training program has been discussed with CRC Reef Postgraduate Students and Student Associates to ensure ongoing relevance.

Student employment

CRC Reef graduates are sought after by industry and research partners which facilitates the transfer of relevant expertise. In the past 12 months, the following CRC Reef students have been employed in positions relevant to their training with CRC Reef.

Photo by JCU.

Student in the spotlight

Unravelling the life of sea snakes

Little is known about the status and biology of sea snake populations in Australian waters. CRC Reef Scholarship student Ms Vimoksalehi Lukoschek based at JCU is studying the population genetics of the olive and spine-bellied sea snakes in Australian waters to help fill the gaps in our knowledge. Preliminary results suggest that olive sea snakes in the GBR are genetically distinct from those in northern and western Australia. Olive sea snakes from Western Australia and the GBR also look different, which suggests that these two groups are reproductively isolated and need to be managed carefully. Ms Lukoschek's study is helping to protect and conserve these mysterious and highly inquisitive sea creatures.

CRC Reef is working on a pilot plant to sterilise ballast water and protect our ports from invasion by introduced marine species that can become pests.

Photo by John Barnett.

7. Commercial and international (Program F)

Highlights

- A total of $1,052,000 was raised by CRC Reef in additional revenue of which $840,154 (an increase of 300% since 1999-2000) was from commercial contracts.
- The Australian Ballast Water Treatment Consortium began testing a prototype to sterilise ballast water in Townsville.
- Two new associates were attracted to work in IMPAC – The Nature Conservancy and the World Wide Fund for Nature established offices in the centre.
- The **Hon Joseph Warioba**, President of the International Ocean Institute (IOI) officially opened the world's first regional centre for IOI in Townsville. He also opened the Elisabeth Mann Borgese Training Centre in IMPAC which will be used by IOI-Australia and by the UN Division of Ocean Affairs and Law of the Sea TRAIN-SEA-COAST program to train participants from Asia and the Pacific Islands.
- The first training course in international fisheries regulations and instruments was run at IMPAC - attracting participants from across Australia and overseas.
- Status of Coral Reefs of the World: 2002 was produced by the Global Coral Reef Monitoring Network which highlights that the rate of damage to coral reef resources worldwide is increasing.
- The administrative centre for IOI virtual university was established in the IMPAC offices in Townsville.

Objective

CRC Reef's commercial and international program will:

- provide training and advisory services in coastal zone management, marine protected area management, monitoring and research techniques, extension and education techniques and related ecologically sustainable uses to governments and donor agencies in developing countries;
- establish international education links to foster recruitment of students and trainees to Centre related activities, to undertake research, training, and advisory contracts relevant to the aims of the Centre;
- generate income from the above activities; and
- support the primary objectives of the Centre by developing a solid basis of additional funding from a variety of sources including contract research, other consulting, sponsorship and donations, new members and associate members and from external granting bodies.

The Commercial and International Program aims to promote the capabilities of its members to increase the level of research sponsored by non-CRC Reef members, that is, increase cooperation and collaboration and at the same time increase the amount of research funded and managed through CRC Reef. This strategy is intended to place CRC Reef in a strong financial position in the coming years.

Through the partnership of AIMS, JCU and QDPI, combined with new collaborations with other major Australian R&D providers, CRC Reef is becoming the preferred supplier of tropical marine expertise in research, education and training for the national and international markets.

Photo by QDPI.

Student in the spotlight

How seagrass respond to stress

Intertidal seagrass meadows in the central region of the GBRWHA are characterised by small species and, despite being in the tropics, are substantially influenced by seasonal cues. CRC Reef Student Associate Ms Jane Mellors found that the environmental and geographical history of a seagrass meadow was the most important factor in determining their environmental response. This was highlighted by a nutrient enrichment experiment, in which two different meadows on Magnetic Island near Townsville had opposing patterns of nutrient limitation despite their proximity. Ms Mellors' results suggest that a broad-brush management approach to the research and management of seagrass habitats in this dynamic and environmentally variable region is inappropriate. Her results will be particularly useful to QDPI, which has statutory responsibility for seagrasses in Queensland.

The level of commercial contracts has increased from approximately $250,000 in the 1999-00 financial year to $840,154 in the 2002-03 financial year. Included in these commercial contracts are benthic surveys of introduced marine pests in Queensland ports. There is potential for even better products in this area through collaboration of JCU's hydrodynamic modellers with QDPI marine ecology expertise.

The Ballast Water Treatment Pilot Plant project met a major milestone this year with the installation of the plant at JCU in Townsville and first trials are underway. The project aims to develop the technology to treat ships' ballast water for introduced marine pests. Project managers **Dr Phil Schneider** and **Mr Steve Hillman** have reported positive results in the early tests, and the effort now is to continue the fund raising needed to complete the tests next year. This project flows directly from the doctoral research of a recently completed CRC Reef student funded by the Ports Corporation of Queensland, and has very strong support from the Coasts and Clean Seas Program of Environment Australia. CRC Reef intends to commercialise the results of the pilot plant project.

CRC Reef has continued its support of the Great Barrier Reef Research Foundation, a philanthropic organisation with the goals of generating research funding for the GBRWHA and for coral reefs worldwide. The CEO **Prof Russell Reichelt** chairs the Scientific Assessment Panel evaluating applications for research grants from the Foundation and provides advice to its Board of Directors.

CRC Reef co-chaired several meetings of a new partnership called the Arafura and Timor Seas Expert Forum which is emerging between Australia, East Timor, Indonesia and PNG. On the Australian side the key contributors to date have been AIMS, CRC Reef and ANU. The marine consortium has been supported by Environment Australia and the National Oceans Office.

Photo by Laurence McCook, AIMS.

Student in the spotlight

The role of seaweeds in recovering reefs

Degraded and disturbed coral reefs are dominated by benthic algae but need coral recruitment for recovery. Thus, the effects of algae on coral recruitment are critical to reef recovery. CRC Reef Student Associate Mr Chico Birrell explored influences of algae on coral recruitment. In surveys of coral recruit-algae associations on inshore reefs of the GBR, he identified key algae potentially influencing either coral settlement or post-settlement survival. Filamentous algal turfs can reduce settlement of the coral *Acropora millepora*, either alone or in combination with sediments in the turf. Water-soluble influences from *Lobophora variegata* enhanced settlement, whereas the green alga *Chlorodesmis fastigiata* hindered settlement. Surprisingly, assemblages of fleshy algae favoured survival and growth of recruits for four months following settlement. Thus, algae always influence coral recruitment, but the outcome depends on the species involved and whether the influence is directed at either coral larvae or recruits.

The international links of the Centre continued to expand in 2002-03. The CEO was invited to chair a panel in Thailand assisting in the development of the first Thai Oceans Policy, and meetings with Indonesian colleagues from the Ministry of Marine Affairs and Fisheries sought advice on oceans policy development for Indonesia.

International Marine Project Activities Centre

The International Marine Project Activities Centre Ltd. (IMPAC) was established by the CRC Reef Research Centre Ltd. to export internationally the marine science and management expertise that is concentrated in Townsville by attracting international agencies to co-locate in Townsville.

IMPAC was established as a partnership to improve collaboration between international project agencies operating in the marine tropics, especially those assisting developing countries with sustainable development and conservation of coral reefs, mangrove forests and seagrass beds and their associated fisheries. The agencies accommodated at IMPAC in 2002-03 were:

- International Ocean Institute (IOI) – Australia. Regional Centre for Australia and the Western Pacific;
- Global Coral Reef Monitoring Network (GCRMN) – Global Coordination (co-hosted by the Australian Institute of Marine Science);
- Great Barrier Reef Research Foundation – Townsville office and International Science Advisory Committee.
- The Nature Conservancy (TNC) Science Coordinator for the Asia-Pacific & California Marine Protected Area program;
- World Wide Fund for Nature (WWF), specifically the Great Barrier Reef Campaign.

IMPAC was established as a not-for-profit subsidiary of CRC Reef under the Chair of **Sir Sydney Schubert**, with representatives of CRC Reef, IOI (Australia) and GBRRF on the governing board. IMPAC has received financial support from the Queensland and Commonwealth Governments and the GBRRF to outfit the offices and stimulate international interactions through workshops and training courses. In addition the Australian Government Departments of Foreign Affairs and Trade; Regional Services, Territories and Local Government; Industry, Science and Resources; and Environment and Heritage, have provided support and also those in the Queensland State Government, and the Councils of the cities of Townsville and Thuringowa. IMPAC is also supported by Townsville Enterprise Limited. CRC Reef oversees administration and accounting.

The IMPAC objective is to provide international agencies with the ideal office arrangement to permit better collaboration as well as assist in project formulation, in addition to running training courses and workshops on oceans governance. Thus IMPAC and IOI (Australia) hosted a successful workshop 'Issues and Instruments on Responsible Fisheries Policy' which included the major UN Conventions and Agreements for fisheries management. Another course on UN Environmental Conventions and Instruments is planned for late 2003. IMPAC also hosted a regional workshop for IOI (Australia) for participants from the Asia Pacific region to plan an operational strategy. This has led to IMPAC and CRC Reef being invited to assist in the development of National Oceans Policies in Thailand and Indonesia. Another workshop in August 2002 with participants from seven countries aimed to develop policies and protocols for the Live Reef Fish Trade in association with the Marine Aquarium Council.

The Coordinator of the Global Coral Reef Monitoring Network (GCRMN), **Dr Clive Wilkinson**, also acts as the IMPAC Coordinator under an arrangement with AIMS. The GCRMN brings into IMPAC a network of people in over 80 countries who are monitoring coral reefs for global reporting. During the past year, the GCRMN produced the Status of Coral Reefs of the World: 2002 that was released internationally to audiences concerned about coral reef conservation. This latest report shows that reefs around the world are still being damaged by human impacts of pollution and over fishing, but that also the rate of coral reef conservation is improving, including increasing recovery from the massive losses of corals in 1998 due to global coral bleaching. The best recovery is now being seen in either remote reefs or ones that are under active and successful management.

Dr Alison Green is the chief scientific advisor for The Nature Conservancy program to establish improved Marine Protected Areas (MPAs) in the Asia-Pacific region. The principal goal is to improve the management of existing MPAs and establish new ones that will have built in resilience to disturbance, especially climate change related coral bleaching. This process is part of major eco-regional planning in association with WWF (USA) and Conservation International to establish a series of larger MPAs to conserve the world's hot spot of biodiversity that includes Philippines, Eastern Indonesia, PNG and nearby islands.

The GBRRF has established a part-time office in IMPAC, with a particular emphasis on the management of the Foundation's International Science Advisory Committee, chaired by the CEO of CRC Reef. IMPAC is assisting the Foundation with introductions into international NGOs and in determining the major problems facing coral reefs in the waters around Australia.

Top:
CRC Reef researchers from AIMS Dr Thomas Stieglitz and Mr Craig Steinberg preparing instruments to monitor mixing and sea temperature. This information is used to identify productivity hotspots and validate satellite sea surface temperature and ocean productivity imagery.

Bottom:
CRC Reef researcher, Mr Cary Mclean from AIMS, servicing a tide gauge used in a long-term study of the East Australian Current.

Photos by AIMS.

8. Communication and extension (Program E)

Program Leader: Assoc Prof Vicki Harriott (until August 2002), Dr Louise Goggin, CRC Reef (from April 2003)

Highlights

- The documentary Muddy Waters which screened on SBS TV in May featured work of CRC Reef researcher, **Dr Katharina Fabricius** based at AIMS, and contributed to awareness of the impact of runoff on the GBR.
- **Professor Helene Marsh** and **Mr Guido Parra** were invited to report on the status of dugongs and coastal dolphins in tropical Australia at an international workshop in the Philippines in August 2002.
- **Dr Alastair Birtles**, CRC Reef researcher based at JCU, advised the International Whaling Commission on the code of practice that has been developed collaboratively by managers, researchers and the tourism industry for the swim-with-whales industry in the GBRWHA in June 2003.
- **Dr Kerry Neil**, CRC Reef Project Leader, was invited to attend the First International workshop on Guidelines and Standards for Invasive Aquatic Species Surveys and Monitoring at he International Maritime Organisation Global Ballast Water Management Programme in Brazil in April 2003.
- Research from the Fishing and Fisheries Team was presented in nine oral presentations at the International Symposium on Aquatic Protected Areas in Cairns in August 2002.

CRC Reef postgraduate student, Ms Anna Lashko from James Cook University, was invited to present details of her work on roseate tern genetics at a Roseate Tern Conference in Ireland.

Photo by Kiyoaki Ozaki.

Objective

To facilitate effective communication of research results, enhance collaboration between participating organisations and increase the application of strategic knowledge by users.

Communication and extension activities have focused on collaboration, in line with the key objectives of the CRC Reef Communication and Extension Strategy (2003):

- promote a distinctive and positive image of CRC Reef and the National CRC Program;
- promote understanding of the objectives, role and procedures of CRC Reef, both internally and externally;
- ensure the relevance of CRC Reef research;
- communicate research outcomes to CRC Reef members, stakeholders and interested parties, and;
- increase the uptake and application of CRC Reef research.

Significant conference and seminar presentations

CRC Reef researchers are very active in presenting research findings at conferences and seminars to the scientific and broader community. Researchers presented at seminars (68), workshops and regional conferences (63 presentations), national (19 presentations) and international conferences (47 presentations), with a total of 197 presentations based on work supported by CRC Reef. They included:

CRC Reef postgraduate student **Mr Ashley Williams** was awarded the best senior oral presentation at the World Congress on Aquatic Protected Areas and Australian Society for Fish Biology joint conference by the Australian Society for Fish Biology ($350).

CRC Reef expertise was recognised by invitations to participate in invitation-only international fisheries symposia. **Dr Bruce**

Mapstone, CRC Reef Program Leader, gave the plenary address at the UNESCO international conference on World Heritage 2002 in Venice, Italy in November 2002. **Dr Gavin Begg** was invited to the European Union Funded Cod Metapopulation Working Group in Reykjavik, Iceland in May 2003.

Dr Katharina Fabricius, CRC Reef task leader, presented the plenary lecture at the International Society for Reef Studies Conference in Cambridge, United Kingdom in September 2002.

Professor Helene Marsh, CRC Reef Program Leader, was the plenary speaker at an international symposium on dugong in Japan in October 2002.

CRC Reef task leader, **Dr Alastair Birtles**, presented a paper on dwarf minke whale research and management at the International Ecotourism Conference in Cairns in October 2002.

Many CRC Reef researchers have provided expert advice to Management Advisory Committees (ReefMAC and Harvest MAC), Research Advisory Committees (Fisheries RAC, Water Quality RAC) or working groups including **Dr Bruce Mapstone** (coral reef fin fish fishery, Torres Strait finfish working group, Torres Strait rock lobster working group), **Mr Cameron Murchie** (Torres Strait finfish working group), **Dr Gavin Begg** (spotted mackerel), **Dr Andrew Tobin**, **Dr Gavin Begg** (Spanish mackerel stocks), **Dr Peter Doherty** (harvest fisheries), **Dr Katharina Fabricius** (water quality), **Dr Miles Furnas** (water quality) and **Dr David Williams** (water quality, coral reef fin fish fishery). **Drs Michael Rasheed** and **Rob Coles**, are members of the dredging Technical Advisory Consultative Committees (TACC) for the ports of Weipa, Karumba and Mackay and provide advice on dredging programs for these ports that will ensure port activities will have minimal impacts on sensitive marine environments. This ensures that CRC Reef's results are used to provide a positive management outcome for the environment.

Extension activities

Links with users are enhanced and technology transfer facilitated by involving users at all levels of research and communication. Industry-based Task Associates have been assigned to each research task with responsibilities to provide research direction and to disseminate research results.

Public displays

The Effects of Line Fishing team from CRC Reef exhibited at the Townsville Sportfishing Clubs, Fishing and Outdoor Expo 2003 in March.

Radio broadcasts

Research by CRC Reef and other science organisations is being broadcast to thousands of listeners in north Queensland. In collaboration with AIMS, QDPI, GBRMPA, JCU, Museum of Tropical Queensland, Tropical Savannas CRC, CRC for Predictive Mineral Discovery, CRC Sugar, CRC Reef is coordinating weekly interviews with scientists on local ABC radio.

Industry liaison

The Effects of Line Fishing (ELF) project has continued its extensive extension program which involves a regular newsletter, representation at trade shows, publication of articles in fishing magazines, and fishing industry conferences, to promote the results of their research project.

CRC Reef has maintained its Task Associate Program, with 41 Task Associates assigned to more than 80 research tasks, to increase liaison between CRC Reef researchers, resource managers, industry and private operators (see Section 5).

The 'Eye on the Reef' project is a three-year industry-based monitoring program in which volunteers from the marine tourism industry in the Port Douglas/Cairns area collect information about reef health at 25 regularly visited sites. The project is jointly supported by GBRMPA and CRC Reef. Collection of data has continued in 2002-03, and a database is being developed and made web accessible by CRC Reef. The project will be undergoing operational testing and review in 2003-04 and opportunities and benefits of expanding the program will be explored.

Dr Gianna Moscardo presented research data to tourism industry members in Cairns and the Whitsundays to increase their understanding of tourist use in their region.

CRC Reef supported two minke whale workshops in Cairns, in April and May 2003, to update researchers, managers and tourism industry representatives on results of previous work, to provide information about research during the coming field season and to discuss the new permit system covering swim-with-whales activities that will operate for the first time in 2003.

CRC Reef Education Manager, **Mr Tim Harvey** and Extension Manager, **Ms Bryony Barnett** attended the Earthwatch Institute Strategy Planning Meeting, hosted by CSIRO at Atherton in March. **Prof Helene Marsh**, a member of the Earthwatch International Advisory Council, also attended the workshop.

CRC Reef Extension Manager **Ms Bryony Barnett** represented CRC Reef at the Seaforum VII workshop in Townsville, on invitation from the Gurang Aboriginal Council, and gave a presentation on CRC Reef research and aspirations for Indigenous engagement.

Indigenous liaison

An Indigenous Working Group (IWG) has been established to advise CRC Reef on protocols and communication strategies for Indigenous engagement. The IWG met twice during the year and advised on appropriate protocols for researchers working with Indigenous people and on relevant contacts. CRC Reef is currently identifying suitable research tasks to provide a focus for improved engagement with Traditional Owners (See Section 3).

CRC Reef Marine Science Journalism Prize

The CRC Reef Marine Science Journalism Prize was offered to students from Australian tertiary institutions for a factual story about marine science in the GBRWHA. In September 2002,

the $1000 prize was presented at the Australian Science Festival by the Minister for Science The Hon Peter McGauran to **Ms Vanessa Woods**, a postgraduate student from the Australian National University. She wrote a story about coral bleaching on the GBR. The $250 Dorothy Paramore Highly Commended Award was presented jointly to **Mr Daniel Bateman** and **Ms Kellie Lobb**, both students from JCU in Townsville. Ms Lobb's story was about the threat of runoff to inshore reefs and Mr Bateman wrote about the difficulty of finding employment as a marine scientist in Australia. All stories were published in Australasian Science in September.

Communication products

CRC Reef produces technical documents as well as communication products that explain research results in plain language so results are accessible to the broader community. These are highly regarded by users. There is continuing emphasis on shifting from paper products to electronic and face-to-face communication.

Newsletters

Two issues of CRC Reef News were produced in 2002-03 with a broad coverage of research news and staff updates and were circulated to 1200 people and organisations. Five newsletters from the Effects of Line Fishing (ELF) project were also produced. These newsletters target fishers, management authorities and researchers and have been a very successful medium to keep industry in touch with the project.

Technical reports

In 2002-03, five technical reports were printed and/or published on the CRC Reef website. Most CRC Reef technical reports will be produced electronically in the future.

Brochures

Two six-page brochures about line fishing and marine tourism on the Great Barrier Reef were produced to supplement the CRC Reef series of brochures about the state of knowledge of major issues that are relevant to the GBRWHA. The brochure on Land Use was also revised and updated. The brochures were distributed with the CRC Reef newsletter and delivered to reef tourism operators for distribution to passengers, and to GBRMPA for distribution with education packs. There has been a very positive response to the brochures which summarise important research in an attractive and accessible format.

Website

The CRC Reef website is designed to make information about CRC Reef and its activities, as well as more general information about the GBR, more accessible to the scientific and general community. The website features downloadable files of CRC Reef publications including CRC Reef technical reports, brochures and newsletters.

Media

A media skills training course was offered in April for CRC Reef students, with five students and two staff from CRC Reef and two staff members from GBRMPA and one staff member from WWF attending.

Media coverage since July 2002 is listed below. The effect of runoff on the GBR received considerable coverage both locally and nationally. Other topics which have attracted media attention include coral bleaching, sea surface temperature atlas, crown-of-thorns starfish and introduced marine pests.

	Local	State/National	Internat.
Print	61	9	5
Radio	33	4	-
Television	9	-	-
Online	NA	NA	8

Left:
Ms Vanessa Woods from ANU won the 2002 CRC Reef Marine Science Journalism Prize which was presented by the Hon Peter McGauran at the Australian Science Festival.

Photo by Australian Science Festival.

Right:
CRC Reef CEO Professor Russell Reichelt congratulates Mr Daniel Bateman from JCU on winning the Dorothy Paramore Highly Commended Award.

Photo by CRC Reef.

Appendix 1.
Performance indicators

Objectives of CRC Reef

Performance Indicator	Target over life of Agreement	Measure 1999-2000	Measure 2000-01	Measure 2001-02	Measure 2002-03
Total resources	$75.4m total resources	$10.5m	$11.7m	$11.8m	$12.1m
Cash resources	$40.4m cash resources	$4.9m	$6.0m	$5.9m	$6.2m
CRC Reef publications transferring research outcomes and technology to industry	70 Centre reports	5	19	36	18
Industry seminars	50 seminars	32	67	61	68

Other indicators:

Benefit to CRC Reef. Building intellectual capital. An additional 49.2 professional positions (excluding in-kind staff) have been added among the partners as a result of CRC Reef.

Benefit to user core participants. Dissemination of CRC Reef IP to parties. CRC Reef has facilitated dissemination of Centre IP among the partners. Examples are Representative Areas Program (GBRMPA) and Long-Term Monitoring Program (AIMS).

Benefit to Australia. Actual or future potential benefits. Protection of the values of the GBRWHA, support for sustainable industries, risk analysis for global climate changes affects on coral reefs, evaluation of land-based impacts on GBRWHA (See Section 4).

Other benefit. Public good identified benefit. Support for recreational use of the GBR through recreational fishing programs, tourism industry support.

Program/Project management. Adoption of project management approach. Quarterly financial reporting; six-monthly and annual task reviews. Task reviews by scientists and research users. Integrated finance and project management system.

Quality and relevance of research program

Performance Indicator	Target over life of Agreement	Measure 1999-2000	Measure 2000-01	Measure 2001-02	Measure 2002-03
Research program resources	$53.34m total cash and in-kind resources on research program	$8.3m	$9.9m	$9.7m	$10.07m
Advisory groups and steering committees	10 advisory groups and steering committees for research	6	4	5	5
External publications	15 publications p.a. in refereed journals	33	35	28	37
	10 papers p.a. in international conferences	10	8	7	7
	20 papers p.a. in national conferences	2	6	7	3
	5 book chapters	3	5	13	10
	3 invitations to deliver plenary addresses p.a.	3	4	6	3

Other indicators:

Scientific status and user satisfaction.

Demonstrated research quality: All progress in research tasks is reviewed by the Scientific Advisory Committee (SAC), Task Review Committee (TRC) and Board and proposals are peer-reviewed by at least two researchers external to CRC Reef.

Enhanced research reputation: Honours and awards for researchers; see Appendix 4.

Election to key positions in scientific bodies: See Sections 4, 5 and 8.

Demonstrated user satisfaction: User input to planned projects occurs via SAC, TRC and Task Associates. Survey of satisfaction of partners showed high level of satisfaction.

Involvement of research users in deciding and conducting research: User input to planned projects is via SAC, TRC, Task Associates and steering committees.

Strategy for utilisation and application of research outputs

Performance Indicator	Target over life of Agreement	Measure 1999-2000	Measure 2000-01	Measure 2001-02	Measure 2002-03
Resources devoted to communication and tech transfer	Minimum $2.5m cash and in-kind on communication and tech. transfer	$327,000	$325,000	$473,000	$388,000
Centre products	Newsletter 4 p.a.	7	5	5	7
	Major update of Centre website every 2 years	Major upgrade initiated	Major upgrade completed	Minor upgrade revision	Maintenance
	Tech reports 10 p.a.	5	2	7	5
	Targeted short courses 3 p.a.	4	1	5	3
Commercial contracts for CRC expertise	Increasing over life of CRC (Total $2.35m)	$252,000	$459,000	$600,000	$840,154

Other indicators:

Application by industry of CRC Reef products. Applications include briefings to industry and environmental groups and publications. These include workshops on crown-of-thorns starfish, tourism research and dwarf minke whales, collaboration with industry and management on moorings and pontoon design, and close communication with Representative Areas Program.

Recognition by general public and stakeholder groups. High public profile and understanding of CRC Reef and CRC Program; see Section 5, 8. Increased exposure via local radio programs. Production of user-friendly colour brochure series.

Implementation by national and international agencies of CRC Reef products. See Sections 4, 5.

Communication and implementation of CRC Reef research outcomes and technology. The CRC Reef Communication Strategy was updated. Each research proposal includes strategy and budget for communication; appointment of Task Associates to each task. See Sections 4, 5, 8.

Education and training

Performance Indicator	Target over life of Agreement	Measure 1999-2000	Measure 2000-01	Measure 2001-02	Measure 2002-03
Training and equipping postgraduate as leaders in research and management	35 postgraduates employed	10	7 scholarship students 4 student associates	6 scholarship students 4 student associates	2 scholarship students 8 student associates
	30 postgraduates employed in user or related industry	10	11	10	10
Increase in knowledge and skill base available	Workshops and short courses attended by 10 industry and user persons p.a.	See Section 9	See Section 9	See Section 9	See Section 8
Program resources	$2.7m cash and in-kind resources	$443,000	$477,000	$514,000	$522,000
Postgraduate program	30 scholarships	28	21	22	25
	15 additional students supported	54	63	66	58

Other indicators:

Industry training. All new students underwent induction including opportunities for industry collaborations in Sept 2002 and June 2003. Short courses in GIS, writing grant proposals, and media skills offered.

Student performance management. All students are reviewed annually by JCU; and six-monthly and annually as part of CRC Reef task reviews.

Collaborative arrangements

Performance Indicator	Target over life of Agreement	Measure 1999-2000	Measure 2000-01	Measure 2001-02	Measure 2002-03
Cooperation in research in Australia and overseas and more efficient use of resources	20 collaborative arrangements	See Section 3	See Section 3	See Section 3	See Section 5
Research providers contributing resources	$32.1m total cash and in-kind	$4.9m	$5.3m	$5.5m	$5.7m
Research providers FTEs in-kind	18.56 FTE in-kind	34.72	22.67	22.76	21.6
Collaboration between researchers	80% projects involve 2 or	82%	67%	82%	100% (all tasks except third party contracts have industry associates)
	Participants workshop 4 p.a.	6	8	16	6
	Shared supervision of students 5 p.a.	9 stipend students	8 stipend students	29 stipend students	24 scholarship students 31 associate students
Collaboration between researchers and research users	University and non-university supervisors for 25% of postgraduate students	25%	38%	40%	40% scholarship students 29% associate students
Collaboration with other research institutions	25 projects p.a.	26 institutions	22 institutions	24	35
International collaboration	Centre researchers involved in 25 international collaborations per year	45 institutions	48 institutions	56	67
	5 visitors p.a.	27	10 visitors/ delegations	12 visitors	6 delegations
	Formal arrangements with intl organisations- 1 p.a.	4	1	1	6
	3 postgrad students to present at intl conferences	1	6	5	14
Associate membership program	4 p.a. associate members	2	NA	NA	NA
Secondments of industry staff to research providers	1 secondment to research provider p.a.	1	1	0	0
Secondments of research provider staff to industry	3 secondments to industry p.a.	2	0	1	0

Other indicators:

Collaboration with other CRCs. Annual meetings for planning- CEOs, Business Managers at CRC Association conference.

Management structure and arrangement

Performance Indicator	Target over life of Agreement	Measure 1999-2000	Measure 2000-01	Measure 2001-02	Measure 2002-03
Total cash and in-kind resources in general administration	$5.8m cash and in-kind	$856,000	$1.0m	$1.08m	$1.13m
Additional revenue raised	$5.8m	$270,000	$637,000	$629,000	$1.05 m
New partners	2	Discussions with parties well-advanced	GBRRF will become a partner in July 2001	No new partners	No new partners
Management skills	All program/project leaders to attend one course	4/5 Program Leaders	1 Program Leader	All previously completed	1 new Program Leader to complete

Other indicators:

Continuity of long-term partnerships and research effort. Satisfaction of partners survey completed in 2003.

Governance. Nominees for each party on Board. Majority of user and independent members on Board (7/10).

Financial management. Programs and projects within budget. Monthly, quarterly and annual report on time. All financial reporting obligations were met in a timely fashion.

Performance evaluation

Performance Indicator	Target over life of Agreement	Measure 1999-2000	Measure 2000-01	Measure 2001-02	Measure 2002-03
Annual task reviews	Six-month and annual	Six-month and annual	Six-month and annual	Six-month and annual	Six-month and annual
External audit	Annual	Annual	Annual	Annual	Annual
Audit committee	Quarterly meetings	Board Exec meetings	Board Exec meetings.	Board Exec meetings.	Board exec meetings.
Annual Board scrutiny of task performance and budget	Quarterly meetings	Quarterly meetings	Quarterly meetings	Quarterly meetings	Quarterly meetings
Reports to Board and CRC Program	Monthly, quarterly and annual reports to Board and CRC Program	Target reached	Target reached	Target reached	Target reached

Other indicators:

Efficient and effective performance. Satisfaction of parties survey undertaken in 2003. High level of support from members.

International consultant advice. See section 7.

Annual report. Reports made and submitted on time.

Appendix 2.
Corporate governance, structure and management

CRC Reef Research Centre's structures, policies and procedures have been developed with due recognition to the importance in adhering to good corporate governance practice and guidelines. The Company has documented this in a Corporate Governance Charter that is approved by the Board.

The ASX Corporate Governance Council published best practice guidelines on 31 March 2003, and the CRC Reef Board accepts these as best practice benchmarks for assessing its performance in those areas generic to all companies. The statement following outlines those core principles adopted by the Council that are relevant to a not-for-profit company limited by guarantee (non-listed) and the Centre's response to the guidelines.

Principle 1: Lay solid foundations for management and oversight

CRC Reef's Corporate Governance Charter clearly delineates the role of the Board and management in relation to the Centre. The Board has also developed and implemented policies and practices that ensure the company complies with the guidelines. The Centre also recognises that in a small and dynamic organisation the relationships among directors, the Chairman and the CEO should be reviewed and updated regularly.

Principle 2: Structure the Board to add value

During the financial year the Board comprised of 10 non-executive directors (including the Chairman). The names and details of the directors in office at 30 June 2003 are listed below.

Each director has the right at the Company's expense to seek independent professional advice in relation to the execution of the Board responsibilities. Prior approval of the Chairman, which will not be unreasonably withheld, is required.

The Board considers that all directors work in the interests of the Company. There are established policies in place to ensure conflicts of interest are fully disclosed and the disclosure is recorded in the minutes of the meeting. Where appropriate the director is excluded from all discussions and considerations of the matter by the Board, and Declaration of Interests is a standing agenda item for all Board Meetings.

The Chairman of the Centre is an independent director, and the role of the Chairman and the CEO are not exercised by the same person.

The Board does not have a nomination committee in relation to the appointment of new directors. The nature of the Centre by virtue of the governing Commonwealth and centre agreements and the requirements of Constitution does not provide for the discretion of the Board to elect new directors. However, there are provisions for the Board to make appointments of Associate Directors but in these cases the Board itself would act as the nomination committee.

Principle 3: Promote ethical and responsible decision making

The Centre has established a code of conduct which is signed off by all employees. All directors, managers and employees of the Centre are expected to observe the highest standards of behaviour and act with integrity, striving at all times to enhance the reputation and performance of the Company.

Principle 4: Safeguard integrity in financial reporting

The CEO states to the Board in writing that the Company's financial reports present a true and fair view in all material respects of the company's financial condition and operational results are in accordance with relevant accounting standards. This has been an established practice since the inception of the Company.

The Company has an Audit Committee meeting which meets once a year to consider the performance of the Company and review external audit reports on the Centre's finances. The committee comprises of five non-executive directors. The Chairman of the Committee is also the Chairman of the Board. The CEO, Deputy CEO and Executive Officer also attend the meetings. Minutes of all committee meetings are provided to the Board.

Principle 5: Make timely and balanced disclosures

As a company limited by guarantee ('not for profit'), the Centre does not report to shareholders through the ASX. The Company makes quarterly reports of its financial status to the Commonwealth government, and more detailed business reports are provided to Directors at each Board meeting.

Principle 6: Respect the rights of shareholders

The Centre has members rather than shareholders. The Company keeps the members informed of the Company's performance and all major developments in an ongoing manner. Information is communicated to members through its publications: annual financial report –distributed to all members; annual CRC Reef report – distributed to all members; CRC Reef newsletters, brochures and technical reports – wide circulation among members and others.

The Members are also required to attend the Annual General Meeting to ensure a high level of accountability and to inform the members of performance against established strategic goals of the company.

The external auditor is required to attend the annual general meeting and be available to answer member questions in relation to the audit of the company's affairs. The Chairman advised the members of this at the commencement of each AGM.

Principle 7: Recognise and manage risk

The Company reviews its priorities and overall strategies at least once per year. The Company has established policies and operational procedures for its administration and funding of research. Research work is conducted under individual contracts with research providers, where the contract conditions make detailed provisions for management of intellectual property, health and safety, expenditure, ethical conduct and publications.

Principle 8: Encourage enhanced performance

The Board undertakes an annual review of its performance and that of the Company's executive management through a Board Satisfaction survey.

The Company has established a Task Associate system where users of research results are invited to comment on progress of individual research tasks twice per year. The scientific products of the Centre are peer-reviewed, and the research providers are encouraged to publish their results where appropriate in leading scientific journals.

The Centre provides an induction package to new directors and has provisions for access to independent professional advice, access to the company secretary, access to the CEO and the provision of information on request. The Company Secretary attends all Board Meetings.

Training programs for key management staff are designed and implemented under the supervision of the CEO and Deputy CEO.

Principle 9: Remunerate fairly and responsibly

In accordance with the not-for-profit nature of the company, the constitution provides that no remuneration will be payable to directors other than the Chairman. The remuneration of the Chairman is determined by the members of the Company. The Company has established a remuneration committee to review the emoluments of the Chairman and to make recommendations to the members of the Company for consideration at a meeting of the members.

The Remuneration Committee is also charged with the responsibility of reviewing the compensation arrangements for the CEO. The Committee assesses the appropriateness of the nature an amount of remuneration on an annual basis by reference to relevant employment market conditions (giving due consideration to the surveys conducted by the CRC Program).

The Remuneration Committee comprises of three non executive directors (the Chairman of the Board is not a member of the Committee). The Chairman of the Committee reports to the Board on the proposed recommendations in relation to the CEO's remuneration.

Remuneration of other employees is determined by the CEO, who makes an annual review of both performance and remuneration.

Principle 10: Recognise the legitimate interests of stakeholders

The Company recognises the interests of its employees and the public in its Code of Conduct. The Company places strong emphasis on both training and health and safety in the workplace. The Company products are scientific reports and those with a public good component are made widely available through print and internet.

MEMBERSHIP AND ROLES OF ADVISORY GROUPS AND COMMITTEES

The **Board** comprises an independent Chairman and 10 Directors. Board members at 30 June 2003 were:

- Sir S Schubert, BE, BA, GDip (Highways & Traffic), GDip (Bus Admin), independent Chairman
- Mr M Burgess, Deputy Chairman, AMPTO
- Hon V Chadwick, BA, DipEd, Chair, GBRMPA
- Professor S Hall, PhD, Director, AIMS
- Mr D Hutchen, Chair, AMPTO
- Mr P Neville, Deputy Director General, Queensland Fisheries Service
- Professor N Palmer, BSc (Hons), PhD, Pro Vice Chancellor (Research & International), JCU
- Mr M Pope, LLB
- Mr W Sawynok, Assoc Dip Land Surveying, Research Officer, SUNFISH
- Mr D Souter, BSc (Hons), Chief Executive Officer, QSIA
- Mr D Windsor, BCom, Executive Director, GBRRF

The Alternate Board members as at June 2003 were Mr P Willers (AIMS), Mr I Gordon (AMPTO), Mr C McKenzie (AMPTO), Mr A Pelt (AMPTO), Dr D Wachenfeld (GBRMPA), Dr P Isdale (GBRRF), Prof H Marsh (JCU), Mr C Bishop (QDPI) and Mr V Veitch (SUNFISH).

The Board regulates all operations of CRC Reef including: monitoring and determining strategic development; reporting to the members and the Commonwealth; approving CRC Reef programs; the Annual Budget; financial arrangements and commercialisation of CRC Reef intellectual property; and appointing the CEO and Program Leaders. The Board met four times during the year.

The **Centre Visitor**, Professor Peter Andrews, provides a strong link between CRC Reef and the CRC Program. Professor Andrews is actively involved in Centre governance, providing advice in strategic direction and participating in review processes.

The CEO attends all meetings of the Board and is responsible to the Board for the operational management of CRC Reef. Dr David Williams, Deputy CEO (Research) advises the CEO on the development and direction of the scientific research programs and has a major role in external research advisory forums.

A set of standing committees advises the Board and assists CRC Reef management. These are the Board Executive Committee (BEC); Task Review Committee (TRC); Audit Committee; Intellectual Property Committee; and Scientific Advisory Committee (SAC).

The Board Executive Committee provides guidance to management between quarterly full Board meetings; undertakes the role of Audit Committee; reviews Board performance and operations including remuneration matters; examines funding opportunities; and advises the Board on the above matters. The Committee met three times during the year. Membership at 30 June 2003 was Sir S Schubert (Chairman), Prof S Hall (AIMS), The Hon V Chadwick (GBRMPA), Mr D Windsor (GBRRF) and Prof N Palmer (JCU).

The Scientific Advisory Committee (SAC) provides scientific and technical advice to the Board through the CEO and Task Review Committee on the research and technology transfer aspects of CRC Reef's programs. The committee met on four occasions and membership as at 30 June 2003 was Dr D Williams (Chairman), Prof R Reichelt (CEO); Program Leaders, Social Science Representative, Postgraduate Student, Mr C McKenzie (AMPTO), Dr D Wachenfeld (GBRMPA) and Mr D Windsor (GBRRF).

The Task Review Committee reviews tasks and policy proposals on behalf of members of CRC Reef and advises and makes recommendations to the Board on such matters. The committee met twice and membership at 30 June 2003 was Sir S Schubert (Chairman), Prof S Hall (AIMS), Mr C McKenzie (AMPTO), Dr D Wachenfeld (GBRMPA), Mr D Windsor (GBRRF), Prof N Palmer (JCU), Ms A Clarke (QDPI), Mr D Souter (QSIA) and Mr V Veitch (SUNFISH).

The Intellectual Property Committee provides advice to the Board through the CEO and membership as at 30 June 2003 was Prof R Reichelt (Chairman), Ms S Riding (AIMS), Ms F McDonald (GBRMPA), Mr J Taylor (JCU) and Dr P Isdale (UQ).

In addition, task or issue specific Committees (Effects of Fishing Steering Committee) have assisted cooperation and integration in research programs and tasks.

The Board has adopted effective management controls of the contributed resources to CRC Reef through project management systems incorporating rigorous processes undertaken in the development and approval of research tasks including both research and user scrutiny. The Board approves the tasks after advice from the Scientific Advisory Committee and Task Review Committee. All research tasks are reviewed in December (checking progress) and June/July (full review of progress and achievements against milestones).

Lionfish

Photo by Dean Miller, JCU.

Appendix 3.
CRC Reef postgraduate students

SCHOLARSHIP STUDENTS WHO SUBMITTED DURING 2002-03

The following students had CRC Reef Scholarships or a combination of CRC Reef Scholarship and other awards eg. an Australian Postgraduate Award (APA).

Name	Degree	Institution Enrolled/ Task Affiliation	Thesis Title	Commenced	Supervisor	Source of Funding
S Adams	PhD	JCU/Task 5.5.7	The reproductive biology of three species of *Plectropomus* (Serranidae) and responses to fishing.	01.03.97	Prof H Choat (JCU) Dr B Molony (JCU) Dr B Mapstone (JCU)	CRC Reef/APA
W Bailey	MEngSc	JCU/Task B 1.2	Development of a lagrangian sediment transport model for application to the marine environment.	02.01.01	Assoc Prof T Hardy (JCU) Prof J Patterson (JCU)	CRC Reef/APA
R Fisher	PhD	JCU/Task C 3.3	The functional capabilities of reef fish larvae: implications for dispersal during the pelagic phase.	28.06.99	Assoc Prof D Bellwood (JCU)	CRC Reef/APA
J Robertson	PhD	UQ/Task 2.4.16	Ecological and economic implications of conservation management strategies intended to minimise the impacts of fishing on the GBR.	01.01.94	Dr H Campbell (UQ) Mr R Beard (UQ) Dr B Mapstone (JCU)	CRC Reef

SCHOLARSHIP STUDENTS – AT JULY 2003

The following students have CRC Reef Scholarships or a combination of CRC Reef Scholarship and other awards eg. Australian Postgraduate Award (APA) or James Cook University Scholarship (JCU).

Name	Degree	Institution Enrolled/Task Affiliation	Thesis Title	Commenced	Supervisor	Status of Study	Source of Funding
S Anthony	PhD	JCU/Task C2.3S	Physiological tolerances, growth limiting factors, and sources of stress for corals in a large-scale aquarium.	01.03.02	Assoc Prof B Willis (JCU) Dr K Michalek-Wagner (GBRMPA) Assoc Prof R de Nys (JCU)	Current	CRC Reef/ JCU
M Bergenius	PhD	JCU/Task C3.4S	Consequences of spatial patterns in life history characteristics of a coral reef fish subject to different harvest strategies.	18.06.01	Dr G Begg (JCU) Dr B Mapstone (JCU) Assoc Prof G Russ (JCU) Dr R Little (CSIRO)	Current	CRC Reef
B Breen	PhD	JCU/Task 2.1.6/2	Spatial allocation of resource use in the Cairns Section of the GBRMP.	28.02.94	Prof H Marsh (JCU) Dr S Shafer (Texas A&M) Mr A Williams (QPWS)	Current (part-time)	CRC Reef
E Dinsdale	PhD	JCU/Task A2.1.3S	Measuring the success of conservation strategies to protect scleractinian corals on the GBR.	01.01.01	Assoc Prof V Harriott (SCU) Dr M Fenton (JCU) Mr P Valentine (JCU)	Current	CRC Reef
J Eagle	PhD	JCU/Task C3.5S	The influence of local scale hydrodynamics on larval and food supply to coral reef assemblages.	30.06.01	Prof M Kingsford (JCU) Dr G Jones (JCU)	Current	CRC Reef/APA
D Grover	MSc	JCU/ Task C1.4.2.2S	The role of environmental factors in the distribution of breeding seabird populations in the GBRWHA.	01.01.01	Dr E Gyuris (JCU) Mr J Monaghan (JCU)	Current (part-time)	CRC Reef

AusAID = Australian Agency for International Development
CRC Reef Aug Grant = CRC Reef Augmentative Grant
CRC Reef Hons Aug Grant = CRC Reef Honours Augmentative Grant
IPRS = International Postgraduate Research Scholarship

SCHOLARSHIP STUDENTS – AT JULY 2003 *(continued)*

Name	Degree	Institution Enrolled/Task Affiliation	Thesis Title	Commenced	Supervisor	Status of Study	Source of Funding
J Harrington	PhD	JCU/Task A1.3.2S	Cultural heritage and communities: a comparative study of three World Heritage areas – the GBR (Australia); Ayutthaya (Thailand); and Avebury (United Kingdom).	29.03.99	Dr S Greer (JCU) Dr R Henry (JCU)	Current	CRC Reef/APA
J Higgs	PhD	JCU/Task 2.4.14	Distribution of recreational boating activities in the Townsville region.	01.02.95	Dr B Mapstone (JCU) Assoc Prof G Russ (JCU)	Suspended	CRC Reef
A Hodgson	PhD	JCU/Task C1.4.3.1S	Dugong behaviour and the effects of boats and pingers.	27.03.00	Prof H Marsh (JCU) Dr L Chilvers (Canterbury)	Current	CRC Reef/APA
A Lashko	PhD	JCU/Task C1.4.2.1S	Population genetic structure of roseate tern *Sterna dougallii* populations in Australia and surrounding regions and a preliminary investigation of the relationships among subspecies.	31.03.00	Dr E Gyuris (JCU) Dr M Waycott (JCU)	Current	CRC Reef
S Lewis	PhD	JCU/Task C4.1S	Climatic and oceanographic change from high-resolution records in large fossil *Porites* coral heads, Magnetic Island, Queensland.	31.03.01	Dr G Shields (JCU) Dr J Lough (AIMS)	Current	CRC Reef/ JCU Earth Science Schol.
V Lukoschek	PhD	JCU/Task C1.4.1S	Conservation genetics of sea snakes (Hydrophiidae) in Australian waters, with emphasis on the GBRWHA.	07.02.00	Prof H Marsh (JCU) Dr M Waycott (JCU) Dr S Keogh (ANU)	Current	CRC Reef/APA
R Marriott	PhD	JCU/Task B4.12S	Forecasting fishing impacts on the population biology of the red bass, *Lutjanus bohar.*	30.03.01	Dr B Mapstone (JCU) Prof H Choat (JCU)	Current	CRC Reef
N Marshall	PhD	JCU/Task A1.2.4S	A conceptual and operational understanding of resource-dependency	01.07.01	Dr M Fenton (JCU)	Current	CRC Reef
J McKinlay	PhD	JCU/Task 2.4.17	A spatial and temporal analysis of the Queensland multi-species commercial line fishery from fishers' logbook data.	01.01.97	Dr B Mapstone (JCU) Dr C Davies (AAD) Dr G De'ath (AIMS)	Suspended	CRC Reef/APA
D Miller	PhD	JCU/Task B2.9S	Towards sustainable use of ecologically important natural resources by an economically important tourism industry in the GBRMP.	30.03.02	Dr A Birtles (JCU) Prof D Gillieson (JCU)	Current	CRC Reef/ JCU
G Muldoon	PhD	JCU/Task E2.1.16/1S	Innovation and fisheries investment where latent effort exists: sustainability implications for the GBR Reef-Line Fishery.	15.07.97	Dr L Fernandes (GBRMPA) Assoc Prof O Stanley (JCU) Dr B Mapstone (JCU) Dr C Davies (AAD)	Current (part-time)	CRC Reef
M Nursey-Bray	PhD	JCU/Task A1.2.2S	Conflict, co-operation or co-management: eating our words? Towards Indigenous hunting management in north Queensland.	01.10.00	Prof H Marsh (JCU) Assoc Prof S Turton (JCU) Prof H Ross (UQ)	Current (part-time)	CRC Reef
R Pears	PhD	JCU/Task B4.20S	Comparative demography and life history features of cods and gropers: implications for fisheries and conservation management.	01.05.00	Prof H Choat (JCU) Dr B Mapstone (JCU) Dr G Begg (JCU)	Current	CRC Reef/JCU
C Pocock	PhD	JCU/Task A1.3.1S	Sensational reef: visitors' sensuous experiences of the GBR.	27.03.00	Dr D Roe (JCU) Dr S Greer (JCU) Dr D Collett (EA)	Current	CRC Reef
B Radford	PhD	JCU/Task D2.1.1S	Effects of water quality on the distribution of corals on coastal reefs: development of tools for environmental assessment and risk management.	31.03.00	Dr T Done (AIMS) Assoc Prof B Willis (JCU) Dr K Anthony (JCU) Dr K van Neill (UWA)	Current	CRC Reef
S Rotmann	PhD	JCU/Task C2.5	Tissue thickness as a method to measure coral response to sediment stress on Lihir Island, PNG.	22.05.00	Dr S Smithers (JCU) Dr D Barnes (AIMS)	Current	CRC Reef/ Lihir Mining
J Sheppard	PhD	JCU/Task C1.4.3.2S	Enhancing the ecological basis for conservation management of dugongs, using innovative satellite tracking technologies.	01.01.02	Prof H Marsh (JCU) Dr I Lawler (JCU)	Current	CRC Reef/ JCU
R Tobin	PhD	JCU/Task B4.10S	The perceived and actual differences in recreational line catch trends in estuaries open and closed to commercial gillnet fishing in north Queensland.	12.03.01	Dr B Mapstone (JCU) Dr M Sheaves (JCU)	Current	CRC Reef
A Williams	PhD	JCU/Task E2.4.21S	Spatial patterns in population biology of a large coral reef fish: what role can movement play?	31.03.98	Dr B Mapstone (JCU) Dr C Davies (AAD) Assoc Prof G Russ (JCU)	Current	CRC Reef/APA

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CRC Reef Hons Aug Grant = CRC Reef Honours Augmentative Grant, IPRS = International Postgraduate Research Scholarship

STUDENT ASSOCIATES WHO SUBMITTED OR GRADUATED IN 2002-03.

The following students had links to CRC Reef through research support.

Name	Degree	Institution Enrolled/Task Affiliation	Thesis Title	Commence-ment Date	Supervisor	Status of Study	Source of Funding
L Barnes	Hons	JCU/Program E	The role of clear-water mangroves in the ecology of reef fishes on the GBR.	08.01.02	Assoc Prof D Bellwood (JCU) Dr M Sheaves (JCU)	Completed	CRC Reef Aug Grant
J Ballard	Hons	JCU/Program E	Modelling of prehistoric super-cyclones at Curacoa Island.	10.01.02	Assoc Prof T Hardy (JCU)	Completed	CRC Reef Kelleher Prize
R Bannister	Hons	JCU/Task C1.11	Feeding ecology of dictyoceratid sponges.	01.07.02	Assoc Prof R de Nys (JCU)	Submitted	CRC Reef
C Bastidas	PhD	JCU/Task 1.4.1	The importance of life history for determining patterns in the distribution and abundance of soft corals.	01.07.98	Dr K Fabricius (AIMS) Assoc Prof B Willis (JCU)	Completed	CRC Reef
L Burgess	Hons	UQ/Program E	The influence of incubation temperature on hatching morphology and swimming performance of green sea turtle hatchlings *Chelonia mydas* in the GBR.	01.03.01	Dr J Lanyon (UQ) Dr D Booth (UQ)	Completed	CRC Reef Hons Aug Grant
T Clarke	Hons	JCU/Task B1.3	Modelling the movement of introduced species in the Port of Cairns.	01.03.02	Assoc Prof T Hardy (JCU)	Completed	CRC Reef
G Diaz-Pulido	PhD	JCU/Task 1.4.1	Roles of reproduction and recruitment in determining macroalgal abundance and interactions with corals.	01.02.98	Dr L McCook (AIMS) Dr J Holtum (JCU)	Completed	CRC Reef
G Doherty	PhD	JCU/Task 1.3.5	Trace element geochemistry of the intertidal zone of Cleveland Bay, Queensland.	01.01.98	Dr G Brunskill (AIMS) Dr M Ridd (JCU)	Completed	CRC Reef
O Floerl	PhD	JCU/Task B1.10	Marinas as reservoirs for marine fouling organisms.	12.01.99	Prof H Marsh (JCU) Dr C Battershill (AIMS) Dr G Inglis (NIWA)	Completed	CRC Reef/IPRS
M Gallagher	MSc	UQ/Task 3.2.0	Significance of groundwater and surface water discharges from the GBR Lagoon	01.01.96	Prof R Volker (UQ)	Completed	CRC Reef
C Gralton	Hons	JCU/Program E	An evaluation of the role of recruitment in the recovery of inshore coral assemblages in the Palm Island group following the 1998 bleaching event.	01.03.01	Assoc Prof B Willis (JCU)	Completed	CRC Reef Hons Aug Grant
J Jompa	PhD	JCU/Task 1.4.1	Coral algal interactions and their roles in reef degradation.	04.07.97	Dr L McCook (AIMS) Prof H Choat (JCU)	Completed	CRC Reef/ AusAID
C McCall	Hons	JCU/Task B3.3	An audit of mooring designs of tourist pontoons in the GBR.	01.03.01	Assoc Prof T Hardy (JCU)	Completed	CRC Reef
J Mosse	PhD	JCU/Task 2.4.12	Population biology of *Cephalopholis cyanostigma* (Serranidae) on the GBR.	03.03.97	Prof H Choat (JCU) Dr C Davies (AAD)	Completed	CRC Reef
H Patterson	PhD	JCU/Program E	Otolith chemistry, early life history, and potential self-recruitment of coral reef fishes.	01.03.01	Prof M Kingsford (JCU)	Submitted	CRC Reef Aug Grant
J Robins	PhD	JCU/Task 2.5.3	A scientific basis for a comprehensive approach to managing sea turtle by-catch: the Queensland east coast as a case study.	01.03.98	Prof H Marsh (JCU) Dr D Die (CSIRO)	Completed	CRC Reef
S Thomas	PhD	JCU/Task C2.5	An underwater sediment accumulation sensor and its application to sediment transport processes at Lihir Island, PNG.	31.07.99	Dr P Ridd (JCU) Prof M Heron (JCU)	Completed	CRC/IPRS
K Thompson	Hons	JCU/Program E	Molecular sexing techniques as a means of analysing dugong populations.	08.01.02	Dr D Blair (JCU) Dr M Waycott (JCU)	Completed	CRC Reef Aug Grant
M Varoy	Hons	JCU/Program E	The adaptive significance of coral morphology on inshore turbid reefs.	08.01.02	Dr K Anthony (JCU) Prof T Hughes (JCU)	Completed	CRC Reef Aug Grant
M Weber	MSc	Bremen/Task C2.2	Effects of various types of sediments on the photophysiological health of scleractinian corals.	20.09.02	Dr K Fabricius (AIMS) Dr M Wolff (University of Bremen)	Submitted	CRC Reef
S Wilbraham	Hons	UQ/Program E	Remote-sensing based classification and monitoring of Low Isles.	01.03.01	Assoc Prof J Jell (UQ)	Completed	CRC Reef Hons Aug Grant
R Williams	Hons	UQ/Task B4.13	Movement of narrow-barred Spanish mackerel in southern Queensland waters as indicated by parasites.	18.02.02	Prof R Lester (UQ) Dr A Tobin (QDPI)	Completed	CRC Reef
B Woods	PhD	JCU/Task 2.2.3	The interpretive and educational dimensions of wildlife tourism.	15.03.98	Dr G Moscardo (JCU) Prof P Pearce (JCU)	Completed	CRC Reef
C Wood	Hons	JCU/Task B3.3	Testing and implementation of pontoon mooring design guidelines.	01.03.02	Assoc Prof T Hardy (JCU)	Completed	CRC Reef
C Yagi	PhD	JCU/Task 2.2.1	Tourist encounters with other tourists.	02.08.99	Prof P Pearce (JCU)	Submitted	CRC Reef

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STUDENT ASSOCIATES – STATUS AT JULY 2003

The following students have links to CRC Reef through research support.

Name	Degree	Institution Enrolled/Task Affiliation	Thesis Title	Commence-ment Date	Supervisor	Status of Study	Source of Funding
A Abdulla	PhD	JCU/Task B4.14S	Predator-prey dynamics in coral reef fish.	01.03.00	Dr B Mapstone (JCU) Dr J Caley (JCU) Dr S Connolly (JCU)	Current	CRC Reef/IPRS
J Ackerman	PhD	JCU/Task C1.6	Demography of reef fishes.	28.06.99	Prof H Choat (JCU)	Current	CRC Reef
N Aragones	PhD	JCU/Task 2.1.8	Techniques for the restoration	27.02.95	Dr G Inglis (NIWA)	Suspended	CRC Reef/ AusAID
R Arthur	PhD	JCU/Task D1.1	Reef recovery from large-scale disturbance in the Lakshadweep Islands.	30.06.99	Assoc Prof V Harriott (SCU) Prof H Marsh (JCU) Dr T Done (AIMS)	Current	IPRS/ Diversitas
J Aumend	PhD	JCU/Program E	Trace element analysis of otoliths as a technique for identifying the coastal nursery grounds of tropical snapper (*Lutjanus* spp.) from the GBR.	28.09.98	Dr M Sheaves (JCU)	Current (part-time)	CRC Reef Aug Grant
A Ballagh	Hons	JCU/Task B4.1a	Determination of growth trends in Queensland east coast Spanish mackerel *Scomberomorus commerson* using otolith back-calculations.	20.02.03	Dr A Tobin (QDPI) Dr G Begg (CRC Reef) Dr I Lawler (JCU)	Current	CRC Reef
L Bay	PhD	JCU/Program E	Local thermal adaptation and the evolution of species' borders in coral reef fishes.	01.06.01	Dr J Caley (AIMS) Dr G Jones (JCU) Prof R Crozier (JCU)	Current	CRC Reef Aug Grant
C Birrell	MSc	JCU/Program E	Influence of algae and terrestrial runoff on larval settlement and juvenile survival of corals on disturbed reefs.	01.02.01	Assoc Prof B Willis (JCU) Dr L McCook (AIMS) Dr K Anthony (JCU)	Current	CRC Reef Aug Grant
M Boyle	PhD	JCU/Program E	The ecology and migrations of post-hatchling sea turtles in Australia.	31.03.02	Dr M Waycott (JCU) Dr R Alford (JCU) Dr C Limpus (QPWS)	Current	CRC Reef Aug Grant
S Busilacchi	MSc	JCU/Task B4.1a	Assessment of the effectiveness of Minimum Legal Size in managing a multi-sector fishery, the Eastern Torres Strait reef line fishery case	1.08.02	Dr G Begg (JCU) Assoc Prof G Russ (JCU)	Current	CRC Reef
D Ceccarelli	PhD	JCU/Task C2.2	Effects of territorial herbivorous damselfish on coral reef benthic communities.	01.02.01	Dr G Jones (JCU) Dr L McCook (AIMS)	Current	CRC Reef
C Clarke	MSc	JCU/Program E	The ecology of feeding in sea hares. Are sea hares an appropriate agent for the control of algal resources?	30.07.01	Ms G Brodie (JCU) Assoc Prof R de Nys (JCU) Prof A Klussmann-Kolb (Goethe U)	Current	CRC Reef Aug Grant
M Depczynski	PhD	JCU/Program E	The functional role of cryptobenthic reef fishes in coral reef ecosystems.	05.08.02	Assoc Prof D Bellwood (JCU)	Current	CRC Reef Aug Grant
M Devlin	PhD	JCU/Task C2.2	Temporal and spatial dynamics of a wet tropics flood plume and the effects on inshore coral reef biota.	01.05.98	Dr K Fabricius (AIMS) Dr S Smithers (JCU) Mr J Brodie (ACTFR)	Current (part-time)	CRC Reef
G Dunshea	Hons	JCU/Program E	Molecular age estimation in the sirenian *Dugong dugon*: applicable tool or genetic curiosity?	03.02.03	Dr I Lawler (JCU) Dr M Waycott (JCU) Dr D Kwan (JCU)	Current	CRC Reef Aug Grant
P Ettinger-Epstein	PhD	JCU/Program E	Examination of the chemical ecology and commercial viability (biopharmaceutical) of selected GBR sponge species.	31.03.03	Assoc Prof R de Nys (JCU)	Current	CRC Reef Aug Grant
R Evans	MSc	JCU/Program E	Effect of GBRMP zoning on the reproductive potential of reef fishes.	18.03.02	Assoc Prof G Russ (JCU)	Current (part-time)	CRC Reef Aug Grant
L-A Gershwin	PhD	JCU/Task C6.1	Phylogeny and taxonomy of the Cubozoa of Australia.	31.03.03	Prof M Kingsford (JCU) Dr M van Oppen (AIMS)	Current	CRC Reef
G Ghitarina	PhD	JCU/Program E	Rapid determination of environmental stress in aquatic ecosystems.	24.02.03	Assoc Prof R de Nys (JCU) Assoc Prof P Southgate (JCU) Dr K Burns (JCU)	Current	CRC Reef Aug Grant
J Guenther	Hons	JCU/Program E	The effect of surface microtopography of *Pinctada* and *Pteria* species on the settlement of fouling organisms.	03.02.03	Assoc Prof R de Nys (JCU) Assoc Prof P Southgate (JCU)	Current	CRC Reef Aug Grant
J Guinotte	PhD	JCU/Task D2.1a	Projected climate change and potential effects on suitable coral reef habitat for the GBR.	15.07.99	Prof D Gillieson (JCU) Dr T Done (AIMS) Dr W Buddermeier (U Kansas) Dr J Kleypas (NCAR)	Current	CRC Reef/ IPRS/ TESAG Schol.
T Hancock	PhD	JCU/Task D4.3	Clustering and pattern recognition using classification and regression trees.	02.01.03	Assoc Prof D Coomans (JCU), Dr B Litow (JCU)	Current	CRC Reef
L Harrington	PhD	JCU/Task C2.2	Ecology of crustose coralline algae: interactions with scleractinian corals and responses to environmental conditions.	01.01.01	Dr K Fabricius (AIMS) Dr J Collins (JCU) Dr R Steneck (Maine)	Current	CRC Reef/ IPRS

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STUDENT ASSOCIATES – STATUS AT JULY 2003 *(continued)*

Name	Degree	Institution Enrolled/Task Affiliation	Thesis Title	Commence-ment Date	Supervisor	Status of Study	Source of Funding
J Hasling	MTourism	JCU/Task B2.8	Take a closer look: designing effective interpretation for the dwarf minke whale industry.	26.07.02	Dr A Birtles (JCU)	Current	CRC Reef
D Hawthorn	MTourism	JCU/Task B2.8	Exploring the practical application of sustainability indicators for nature-based tour operators.	11.02.03	Dr A Birtles (JCU)	Current	CRC Reef
J-P Hobbs	PhD	JCU/Program E	Regional scale analysis of processes regulating the abundance and diversity of fishes on the Great Barrier Reef.	30.03.03	Dr G Jones (JCU) Dr P Munday (JCU) Dr S Connolly (JCU)	Current	CRC Reef Aug Grant
S Kininmonth	PhD	UQ/Task D4.1	Connectivity modelling of the coral reef ecosystem.	01.05.02	Prof H Possingham (UQ) Dr G De'ath (AIMS)	Current (part-time)	CRC Reef
E Laman-Trip	MSc	JCU/Program E	An age-based analysis of sexual size dimorphism in surgeonfishes (Acanthuridae, Perciformes) from the Indo-Pacific region.	12.02.01	Prof H Choat (JCU)	Current	CRC Reef Aug Grant
D Louden	MSc	JCU/Task C1.11	The effect of depth on the survival feeding biology, growth and morphology of *Ireinia* sp (Porifera, Demospongia) and the implications for aquaculture.	24.03.03	Assoc Prof R de Nys (JCU) Dr C Battershill (AIMS) Assoc Prof P Southgate (JCU)	Current	CRC Reef
J McConochie	MEng	JCU/Task B3.1	Numerical modelling of synthetic cyclone generated waves in the GBR Region.	30.03.99	Assoc Prof T Hardy (JCU) Prof J Patterson (JCU)	Suspended	CRC Reef
J Madin	PhD	JCU/Program E	The structural integrity and spatial distribution of corals in the hydrodynamic reef environment.	31.03.00	Prof T Hughes (JCU) Dr S Connolly (JCU)	Current	CRC Reef Aug Grant
J Mellors	PhD	JCU/Task 1.4.4	Effects of nutrients on inshore seagrass beds.	03.07.92	Prof H Marsh (JCU)	Current (part-time)	CRC Reef
M Myers	PhD	UCLA/Task C1.2	A comparison of ReefCheck methods with other methods for monitoring coral reefs.	01.07.00	Prof R Ambrose (UCLA) Prof G Hodgson (UCLA)	Current	CRC Reef
M Page	PhD	JCU/Program E	Late Quaternary evolution of the north Queensland continental margin.	20.02.00	Dr G Dickens (Rice – Texas) Prof R Henderson (JCU)	Current	CRC Woolfe Scholarship
G Parra	PhD	JCU/Task C1.4.5S	Ecology and conservation biology of Irrawaddy, *Orcaella brevirostris*,and Indo-Pacific humpback, *Sousa chinensis*, dolphins at the Central Section of the GBRMP.	01.01.01	Prof H Marsh (JCU) Dr P Arnold (MTQ) Dr P Corkeron (IMR)	Current	CRC Reef
D Peck	PhD	JCU/Program E	Foraging behaviour and genetic divergence in a tropical procellariiform, the wedge-tailed shearwater.	30.03.02	Dr B Congdon (JCU)	Current	CRC Reef Aug Grant
A Pritchard	PhD	JCU/Task B4.1a	Restructuring of the Torres Strait fisheries management institutional framework to integrate islanders to participate in management of Torres Strait fisheries resources.	20.01.03	Dr G Begg (JCU) Dr B Mapstone (JCU)	Current	CRC Reef
M Puotinen	PhD	JCU/Task 1.1.3	Tropical cyclone impacts on coral reefs: modelling the disturbance regime in the GBR Region.	10.04.95	Dr T Done (AIMS) Prof D Gillieson (JCU)	Current (part-time)	CRC Reef
Z Richards	PhD	JCU/Program E	An investigation of the relative vulnerability of rare versus common corals to factors threatening the GBR.	31.03.03	Prof T Hughes (JCU) Dr C Wallace (MTQ) Dr M van Oppen (AIMS)	Current	CRC Reef Aug Grant
W Robbins	PhD	JCU/Program E	Growth, demography and genetic stock structure of Queensland reef sharks.	01.02.01	Prof H Choat (JCU)	Current	CRC Reef Aug Grant
J Ryan	Hons	JCU/Task B3.3	Evaluation of the pontoon mooring design guidelines.	01.03.03	Assoc Prof T Hardy (JCU)	Current	CRC Reef
A Scardino	PhD	JCU/Program E	Surface technologies modelled from nature.	03.03.03	Assoc Prof R de Nys (JCU)	Current	CRC Reef Aug Grant
G Sjursaether	MTourism	JCU/Task B2.8	Involving tourism operators in the ecologically sustainable management of their industry: Developing a sighting Network for the GBR minke whale ecotourism industry.	17.02.03	Dr A Birtles (JCU)	Current	CRC Reef

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STUDENT ASSOCIATES – STATUS AT JULY 2003 *(continued)*

Name	Degree	Institution Enrolled/Task Affiliation	Thesis Title	Commence-ment Date	Supervisor	Status of Study	Source of Funding
E Slaughter	Hons	JCU/Program E	Federal and State Government exploitation of GBR Islands between 1830 and 1950.	01.01.03	Dr M Gibbs (JCU)	Current	CRC Reef Aug Grant
J Sofonia	MSc	JCU/Program E	Effects of sediment characteristics on stress responses in corals.	06.09.01	Dr K Anthony (JCU) Assoc Prof B Willis (JCU)	Current	CRC Reef Aug Grant
C Steinberg	PhD	JCU/Task B3.4	Modelling the Southern GBR; circulation and implications for biological systems.	01.03.97	Dr L Bode (JCU)	Current (part-time)	CRC Reef
M Taverner	MTourism	JCU/Task B2.1.2	Understanding visitor perceptions of threatening wildlife in north Queensland.	01.01.03	Dr G Moscardo	Current	CRC Reef
N Tonkin	Hons	JCU/Program E	Ghost Ports and Harbours.	01.01.03	Dr M Gibbs (JCU)	Current	CRC Reef Aug Grant
J True	PhD	JCU/Task 1.3.7	Massive scleractinian corals as indicators of short-term environmental change.	01.01.97	Assoc Prof B Willis (JCU) Dr D Barnes (AIMS)	Current (part-time)	CRC Reef
P Tudman	PhD	JCU/Program E	Modelling the ecosystem effects of fishing on the coral reefs of the Central GBR.	18.03.02	Assoc Prof G Russ (JCU)	Current	CRC Reef Aug Grant
T Vintges	MTourism	JCU/Task B2.8	Involving tourism operators in the sustainable management of their industry towards a better understanding of the minke whale behaviour during swim encounters.	07.02.03	Dr A Birtles (JCU)	Current	CRC Reef
C Vollhardt	MSc	Ruprecht-Karls-Uni, Heidelberg/ Task C2.9	The effects of the herbicide diuron on corals.	11.11.02	Dr A Negri (AIMS) Prof T Braunbeck (Ruprecht-Karls-University Heidelberg)	Current	CRC Reef
C Ware	PhD	JCU/Task 2.2.1	An examination of the travel patterns, trip-planning strategies, and attraction hierarchy characteristics of visitors to the Cairns region.	15.02.99	Prof P Pearce (JCU) Dr L Murphy (JCU)	Current (part-time)	CRC Reef

CRC Reef Aug Grant = CRC Reef Augmentative Grant

Appendix 4. Grants and awards

Researchers (Organisation)	Title of Grant or Award	Source	Period of Grant	$
Abdulla A (CRC Reef/JCU)	Travel Award	CRC Reef		1,000
Anthony S (CRC Reef/JCU)	Science for Management Award	GBRMPA		1,000
Bay L (CRC Reef/JCU)	Travel Award	CRC Reef		500
Becker H, Fabricius K (AIMS)	Travel and Research Grant	German Academic Exchange Organisation	Jan 01 – Jun 03	4,000
Begg G (CRC Reef/JCU)	Collation and review of Islander commercial catch history in the eastern Torres Strait reef-line fishery	Australian Fisheries Management Authority	Mar 03 – Oct 03	36,599
Begg G (CRC Reef/JCU)	Evaluation of stock assessment models for data-poor pelagic fisheries	Australian Academy of Science International Collaborations Program	Jul 03 – Jun 04	11,000
Dinsdale E (CRC Reef/JCU)	Growing the Smart State PhD Funding	Queensland Government	Jan 03 – Jan 04	4,000
Eagle J (CRC Reef/JCU)	Doctoral Research Scheme	JCU	May 03 – May 04	1,250
Eagle J (CRC Reef/JCU)	Ethel-Mary Read Research Grant	Royal Zoological Society of NSW	Jun 02 – Jun 03	600
Eagle J (CRC Reef/JCU)	Joyce W. Vickery Scientific Research Award	Linnean Society of NSW		500
Eagle J (CRC Reef/JCU)	Lerner-Gray Fund for Marine Research	American Museum of Natural History	May 02 – May 03	3,510
Eagle J (CRC Reef/JCU)	Project Aware Micro Grant	PADI	Feb 02 – Feb 03	1,400
Gershwin L (CRC Reef/JCU)	Investigations on irukandji taxonomy	Robert W. King Memorial Fund	Jan 04 – Dec 04	10,000
Grover D (CRC Reef/JCU)	Travel Award	CRC Reef		637
Harrington J (CRC Reef/JCU)	Travel Award	CRC Reef		500
Jones A, Begg G (CRC Reef/JCU)	Preliminary development of a management plan for Elizabeth and Middleton Reefs Marine National Nature Reserve	Environment Australia	Jan 03 – Mar 03	17,577
Lashko A (CRC Reef/JCU)	Internal Research Award	TESAG, JCU		1,000
Lashko A (CRC Reef/JCU)	Travel Award	CRC Reef		850
Lawler I, Marsh H (JCU), Coles R (QDPI)	Quality of seagrass as a dugong food resource	ARC	Jan 02 – Jan 05	67,635
Lawler I (JCU)	Improving conservation management of dugongs using innovative tracking technologies	Ian Potter Foundation	Jan 02 – Jan 03	20,000
Lawler I (JCU)	Foraging ecology of dugongs: implications for management	Sea World Research and Rescue Foundation Inc.	Jan 02 – Jan 03	28,500
Lou DC (CRC Reef/JCU)	Tropical reef fish ageing	Dept Marine & Wildlife Resources, American Samoa	Jun 02 – Sept 02	13,250
Lou DC (CRC Reef/JCU)	Tropical reef fish ageing	Divn Fish & Wildlife, Commonwealth of Northern Mariana Islands	Apr 03 – May 03	3,890
Lou DC (CRC Reef/JCU)	Spotted mackerel ageing	QDPI Southern Fisheries Centre	Apr 03 – May 03	4,052
Lukoschek V (CRC Reef/JCU)	Travel Award	CRC Reef		500
Lukoschek V (CRC Reef/JCU)	Travel Award	Aust Coral Reef Society		545
Mapstone B (CRC Reef/JCU)	Modelling multi-species targeting of fishing effort in the Queensland coral reef finfish fishery	Fisheries Research and Development Corporation	Dec 01 – Dec 04	369,128
Marshall N (CRC Reef/JCU)	Internal Grant	TESAG, JCU	Aug 01 – Sep 02	800
Marshall N (CRC Reef/JCU)	Student Grant	CRC Reef	Jan 02 – Jan 04	10,000
Marshall N (CRC Reef/JCU)	Augmentative Research Grant	GBRMPA	Apr 02 – Apr 03	1,000
Miller D (CRC Reef/JCU)	Supplementary Scholarship	CRC Sustainable Tourism	Mar 03 – Mar 05	15,000
Moscardo G (JCU)	NIP Wildlife Project	CRC Sustainable Tourism	Oct 02 – Sep 03	30,000
Patterson H (CRC Reef/JCU)	Travel Award	CRC Reef		500
Pocock C (CRC Reef/JCU)	Doctoral Research Scholarship	JCU	Feb 03 – Nov 03	2,000
Pocock C (CRC Reef/JCU)	Travel Award	CRC Reef		1,000
Pocock C (CRC Reef/JCU)	Travel Award	CRC Reef		500
Prichard A (CRC Reef/JCU)	PhD Postgraduate Scholarship	JCU	Jan 03 – Jun 03	2,000
Radford B (CRC Reef/JCU)	Industry support	Apache Energy	Jun 01 – Nov 03	45,000
Sheppard J (CRC Reef/JCU)	Improving conservation management of dugongs using satellite telemetry	Society for Marine Mammalogy	Jan 02 – Jan 03	8,821
Tobin A (CRC Reef/QDPI)	Exploitation dynamics and biological characteristics of east coast Spanish mackerel harvested by the recreational and commercial sectors	Fisheries Research and Development Corporation	Aug 02 – May 03	163,634
Tobin R (CRC Reef/JCU)	Student Research Funding	TESAG, JCU	Nov 02 – Nov 03	1,000
Weber M, Fabricius K (AIMS)	Travel and Research Grant	German Academic Exchange Organisation	Jan 02 – Jun 03	4,000
Wooldridge S (CRC Reef/AIMS)	CSIRO-AIMS Provision of Services Agreement (Workshop)	CSIRO Sustainable Ecosystems	Jun 03 – Jun 03	4,000

Appendix 5. Publications

Refereed papers

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* Publication by CRC Reef postgraduate student or CRC Reef Student Associate.

Appendix 6. Staffing and administration

There were amendments to the Specified Personnel list during 2002-03. No major equipment items were purchased over the year.

Name	Organisation	Percent time with CRC Reef	Role
Prof Russell Reichelt	CRC Reef	100	Chief Executive Officer
Dr David Williams	AIMS	80	Deputy CEO (Research)
Professor Helene Marsh	JCU/CRC Reef	50	Leader, Program A, Program E
Dr Bruce Mapstone	JCU/CRC Reef	100	Leader, Program B
Dr Peter Doherty	AIMS	57	Leader, Program C
Dr Terry Done	AIMS	60	Leader, Program D
Assoc Prof Vicki Harriott	JCU	25	Leader, Program E
Dr Louise Goggin	CRC Reef	50	Leader, Program E
Dr Britta Schaffelke	JCU/CRC Reef	25	Manager, Education & Knowledge Exchange
Dr Robert Coles	QDPI	50	Project Leader
Dr Miles Furnas	AIMS	75	Project Leader
Assoc Prof Tom Hardy	JCU	30	Project Leader
Dr Gianna Moscardo	JCU	40	Project Leader
Professor Philip Pearce	JCU	30	Project Leader
Dr Roland Pitcher	CSIRO	5	Research Staff
Dr David Wachenfeld	GBRMPA	20	Research Staff

PROFESSIONAL STAFF CONTRIBUTIONS 2002 – 03

Name	Role	Total % of time	% Spent on Research Program					% Education	% Communication	% Administration
			A	B	C	D	Total			
Australian Institute of Marine Science										
Mr G Coleman	R	20			20		20			
Mr I Miller	R	20			20		20			
Ms D Page	R	14			0		0			14
Ms K Osborne	R	20			20		20			
Mr C Steinberg	R	33			33		33			
Dr D Alongi	R	25			25		25			
Dr D McKinnon	R	5			5		5			
Dr D Williams	A	40					0			40
Dr K Fabricius	R	80			80		80			
Mr L Trott	R	42			42		42			
Mr M Cappo	R	11			11		11			
Mr M Devereux	R	12			12		12			
Dr M Furnas	R	100			100		100			
Ms M Wakeford	R	10				10	10			
Mr P Dixon	R	21			21		21			
Dr P Doherty	A	42					0			42
Mr O Dalhaus	R	8			8		8			
Mr P Speare	R	5			5		5			
Dr T Done	R	48				48	48			
Mr A Cheal	R	20			20		20			
Mr C McLean	R	20			20		20			
Mr D Barnes	R	5			5		5			
Ms S Duggan	R	15			15		15			
Dr P Isdale	R	4					0			4
Ms S Riding	R	1					0			1
Ms V Bates	R	14			14		14			
Mr A Thompson	R	20			20		20			
Dr H Sweatman	R	30			30		30			
Dr M Van Oppen	R	3				3	3			
Dr J Lough	R	10			10		10			
Mr F Tirendi	R	5			5		5			
TOTAL (Person Years)		**703**	**0**	**0**	**541**	**61**	**602**	**0**	**0**	**101**

Name	Role	Total % of time	% Spent on Research Program					% Education	% Communication	% Administration
			A	B	C	D	Total			
Department of Primary Industries										
Ms A Clarke		8					0			8
Dr S Campbell		50			50		50			
Mr S Kerville		27			27		27			
Mr R Yoshida		23			23		23			
Mr C Lunow		45		45			45			
Mr A Roelofs		35			35		35			
Mr G Chisholm		6			6		6			
Mr W Hagedoorn		22		22			22			
Mr R Thomas		90			90		90			
Mr R Garrett		23		23			23			
Mr P Leeson		4			4		4			
Dr N Gribble		35		35			35			
Ms S Helmke		29		29			29			
Dr J Mellors		54			54		54			
Ms C Roder		27			27		27			
Ms B Gibbs		20					0			20
Mr C Bishop		8					0			8
Mr P Neville		8					0			8
TOTAL (Person years)		**514**	**0**	**154**	**316**	**0**	**470**	**0**	**0**	**44**
Great Barrier Reef Marine Park Authority										
Mr J Day	R	3	3				3			
Mr J Innes	R	30	30				30			
Dr D Wachenfeld	R	50	10	10	10	10	40			10
Dr A Green	R	18			0		0			18
Chadwick	A	10					0			10
Mr T Stokes	R	10	10				10			
Mr M Bishop	R	1		1			1			
Mr A Chin	R	7			7		7			
Dr D Haynes	R	10			10		10			
Dr L Fernandes	R	1			1		1			
Dr D Cameron	R	2		2			2			
Ms T Orr	A	20					0			20
Dr P Marshall	R	20			20		20			
Mr K Gorman	R	10			10		10			
Dr K Dobbs	R	3	3				3			
Mr G Frost	R	1					0		1	
Dr K Michalek-Wagner	R	3			3		3			
Dr A Costen	R	4			4		4			
Ms S Davies	R	1				1	1			
TOTAL (Person years)		**204**	**56**	**13**	**65**	**11**	**145**	**0**	**1**	**58**
James Cook University										
Assoc Prof G Russ	R	20		5			5	15		
Dr D Kwan	R	50	50				50			
Dr I Lawler	R	15	15				15			
Assoc Prof T Hardy	R	35		30			30	5		
Dr L Bode	R	30		30			30			
Prof P Pearce	R	25		20			20	5		
Dr G Moscardo	R	40		40			40			
Dr M Waycott	R	10	10				10			
Dr A Birtles	R	25			20		20	5		
Mr G Shields	R	5			5		5			

Name	Role	Total % of time	% Spent on Research Program					% Education	% Communication	% Administration
			A	B	C	D	Total			
James Cook University (continued)										
Dr E Gyuris	R	5	0				0	5		
Mr C Linfoot	R	20		20			20			
Mr P Valentine	R	15			10		10	5		
Dr S Smithers	R	5					0	5		
Dr D Roe	R	10	10				10			
Mr N Black	R	10		10			10			
Prof H Marsh	R	10					0	10		
Mr M Pavlichuk	R	2		2			2			
Prof H Choat	R	22			12		12	10		
Dr J Brodie	R	6			6		6			
Ms A Sharp	R	10		10			10			
Prof M Kingsford	R	5					0	5		
Ms M Gibbs	R	3	3				3			
Ms R McDermott	A	2					0			2
Ms K Sharp	A	2					0			2
Dr S Greer	R	3	3				3			
Mr R Palmer	A	1					0			1
Dr L Murphy	R	20		20			20			
Dr P Schneider	R	15		15			15			
Ms R Pears	R	70		70			70			
Mr R Kapitzke	R	2		2			2			
Dr M Sheaves	R	5		5			5			
Ms K Milanovic	A	10					0			10
Dr J Carstairs	A	3					0			3
Mr J Taylor	A	4					0			4
Prof J Patterson	R	2					0	2		
Ms S Knight	A	10					0			10
Prof N Palmer	A	10					0			10
TOTAL (Person years)		**537**	**91**	**279**	**53**	**0**	**423**	**72**	**0**	**42**
Others										
Mr D Windsor (GBRRF)	A	10					0			10
Mr D Hutchen (AMPTO)	A	10					0			10
Mr M Burgess (AMPTO)	A	5								5
Mr C McKenzie (AMPTO)	A	10					0			10
Mr D Souter (QSIA)	A	15					0			15
Mr T Dempster (QSIA)	A	5		5			5			
Mr B Sawynok (Sunfish)	A	10					0			10
Sir S Schubert	A	10					0			10
Dr R Little (CSIRO)	R	25		25			25			
Mr F Pantus (CSIRO)	R	5		5			5			
Dr A Punt (CSIRO)	R	5		5			5			
Dr A D Smith (CSIRO)	R	5		5			5			
Dr N Ellis (CSIRO)	R	17		12	5		17			
Dr CR Pitcher (CSIRO)	R	20			20		20			
Dr B Venables (CSIRO)	R	3			3		3			
Mr T Wassenberg (CSIRO)	R	3			3		3			
Mr GP Smith (CSIRO)	R	3			3		3			
Mr I McLeod (CSIRO)	R	5			5		5			
Mr M Austin (CSIRO)	R	5			5		5			
Mr S Gordon (CSIRO)	R	3			3		3			
Prof H Ross (UQ)	R	15	10				10		4	1
Dr P Arnold (MTQ)	R	10			10		10			
TOTAL (Person years)		**199**	**10**	**57**	**57**	**0**	**124**	**0**	**4**	**71**

CRC Reef Funded Staff

Name	Employer Org.	Role	Total % of time	% Spent on Research Program					% Education	% Communication	% Administration
				A	B	C	D	Total			
Prof R Reichelt	CRC	A	100					0			100
Ms A Wilson	CRC	A	75					0			75
Ms M Warrington	CRC	A	100					0			100
Ms M Nash	CRC	A	100					0			100
Mrs D Cuskelly	CRC	A	100					0			100
Mrs L Arnell	CRC	A	8					0			8
Ms B Barnett	CRC	C	80					0		80	
Dr L Goggin	CRC	C	100				10	10	10	80	
Mr T Harvey	CRC	A	80					0	80		
Mr T Donovan	CRC	A	100				100	100			
Ms R Anderson	JCU	R	100	100				100			
Mr A Astorquia	JCU	R	50		50			50			
Mr W Bailey	JCU	R	5		5			5			
Dr G Begg	JCU	R	100		90			90	10		
Ms M Bergenius	JCU	R	20		20			20			
Mr G Carlos	JCU	R	100		100			100			
Dr B Goldman	JCU	R	100		100			100			
Mr A Williams	JCU	R	17		17			17			
Dr D Lou	JCU	R	100		100			100			
Dr S Mcintyre-Tamwoy	JCU	R	67	67				67			
Mr I Montgomery	JCU	A	67		67			67			
Dr S Sutton	JCU	R	50	50				50			
Mr S Hillman	JCU	R	100		100			100			
Dr B Schaffelke	JCU/CRC	R	25				15	15	10		
Assoc Prof V Harriott	JCU/CRC	R	25				15	15	5	5	
Dr B Mapstone	JCU	R	100		90			90	10		
Prof H Marsh	JCU	R	30	30				30			
Ms A Galletly	JCU	R	100		70			70		20	10
Ms J Atkinson	JCU	R	17		17			17			
Dr A Jones	JCU	R	100		100			100			
Mr J Aumend	JCU	R	7		7			7			
Mr A Burke	JCU	R	100		100			100			
Mr M Curnock	JCU	R	14		14			14			
Mr M Depczynski	JCU	R	4		4			4			
Ms J Dinsdale	JCU	R	5	5				5			
Mr J McConochie	JCU	R	75		75			75			
Ms A Fergus	JCU	R	5		5			5			
Ms M Lewis	JCU	R	4		4			4			
Ms A McCoy	JCU	R	100		70			70		10	20
Ms R Tobin	JCU	R	4		4			4			
Mr A Mapleston	JCU	R	17		17			17			
Ms S Meikle	JCU	R	12		12			12			
Mr C Murchie	JCU	R	20		20			20			
Ms I Stewart	JCU	A	100					0		30	70
Ms A Wiebkin	JCU	R	17		17			17			
Mr A Williams	JCU	R	42		42			42			
Mr A Anderson	JCU	R	22		22			22			
Ms L Hawksworth	JCU	A	100		60			60		10	30
Ms A Norris	JCU	R	100		100			100			
Ms R Saltzer	JCU	R	100		80			80		20	
Ms C Dudgeon	JCU	R	67		67			67			
Ms B Green	JCU	R	10		10			10			
Mr T Harvey	JCU	R	17	17				17			
Dr F Hoedt	JCU	R	35		35			35			
Mr E McPhee	JCU	R	25	25				25			
Ms K Owens	JCU	R	25	25				25			
Ms S Thomas	JCU	R	8				8	8			

CRC Reef Funded Staff *(continued)*

Name	Employer Org.	Role	Total % of time	% Spent on Research Program					% Education	% Communication	% Administration
				A	B	C	D	Total			
Ms E Zanetti	JCU	R	8		8			8			
Dr C McKeagney	JCU	R	25				25	25			
Dr D Williams	AIMS	R	50	10	10	10	10	40	5		5
Dr L McCook	AIMS	R	88			88		88			
Ms E Madin	AIMS	R	28			28		28			
Ms M Wright	AIMS	R	52			52		52			
Mr C Glasson	AIMS	R	28			28		28			
Mr S Kininmonth	AIMS	R	100				100	100			
Ms K Osborne	AIMS	R	21			21		21			
Mr S Delean	AIMS	R	100			100		100			
Dr S Wooldridge	AIMS	R	100			100		100			
Mr S Edgar	AIMS	R	100				100	100			
Dr G De'ath	AIMS	R	100				100	100			
Mr M Mahoney	AIMS	R	100			100		100			
Dr R Berkelmans	AIMS	R	100			100		100			
Ms J Redgwell	GBRMPA	A	50		50			50			
Mr S Hyland	QDPI/QFS	R	100		100			100			
Dr K Neil	QDPI/JCU	R	100		100			100			
Mr R Yoshida	QDPI	R	40			40		40			
Dr A Tobin	QDPI	R	100		100			100			
Mr L McKenzie	QDPI	R	100			100		100			
Mr R Thomas	QDPI	R	10		10			10			
Mr S Campbell	QDPI	R	50			50		50			
Ms C Roder	QDPI	R	70			70		70			
Dr R Coles	QDPI	R	50		20	30		50			
Dr M Rasheed	QDPI	R	100		100			100			
TOTAL (Person years)			**4921**	**329**	**2189**	**917**	**483**	**3918**	**130**	**255**	**618**

Summary of Contributions in Person Years (100% = 1 Person Year)

Professional Staff	Total Equiv. Person Years	% Spent on Research Program					% Education	% Communication	% Administration
		A	B	C	D	Total			
Total Contributed	21.57	1.570	5.030	10.320	0.720	17.64	0.72	0.05	3.16
Total Funded by CRC	49.21	3.29	21.89	9.17	4.83	39.18	1.30	2.55	6.18
GRAND TOTAL	**70.78**	**4.86**	**26.92**	**19.49**	**5.55**	**56.82**	**2.02**	**2.60**	**9.34**
Proportion of total professional staff resources in each activity	100	7	38	28	8	80	3	4	13

Support Staff (Person Years)

(1) Contributed	
Organisation	No. staff
AIMS	0.39
QDPI	0.30
GBRMPA	0.11
JCU	0.43
TOTAL	**1.23**

(2) CRC Funded	
Organisation	No. staff
AIMS	0.20
QDPI	0.20
GBRMPA	0.50
JCU	1.70
TOTAL	**2.60**

Appendix 7. Budget

TABLE 1: IN-KIND CONTRIBUTIONS ($'000s)

	Actual 1999-00	Actual 2000-01	Actual 2001-02	Agr'mt 2002–03	Actual 2002-03	Cumulative Total To Date Actual	Cumulative Total To Date Agr'mt	Agr'mt 2003-04	Agr'mt 2004-05	Agr'mt 2005-06	Grand Total Total(*) 7 Yrs	Grand Total Agr'mt 7 Yrs	Grand Total Variance 7 Yrs
AIMS													
Salaries	517	818	756	757	831	2,922	2,777	722	650	609	4,903	4,758	145
Capital	0	0	0	0	0	0	0	0	0	0	0	0	0
Other	1,631	1,784	2,009	1,766	2,050	7,474	6,485	1,442	1,265	1207	11,388	10,399	989
TOTAL	2,147	2,602	2,765	2,523	2,881	10,396	9,262	2,164	1,915	1,816	16,291	15,157	1,134
AMPTO (REPRESENTING THE TOURISM INDUSTRY & OTHERS)													
Salaries	63	28	58	40	46	195	160	40	40	40	315	280	35
Capital	0	0	0	0		0	0	0	0	0	0	0	0
Other	57	19	95	110	114	285	607	110	110	110	615	937	(322)
TOTAL	120	47	153	150	160	480	767	150	150	150	930	1,217	(287)
GBRMPA													
Salaries	174	194	180	187	186	734	717	187	187	187	1,295	1,278	17
Capital	0	0	0	0		0	0	0	0	0	0	0	0
Other	229	242	224	233	231	926	893	233	233	233	1,625	1,592	33
TOTAL	403	436	404	420	417	1,660	1,610	420	420	420	2,920	2,870	50
JCU													
Salaries	440	406	446	405	420	1,712	1,655	405	394	394	2,905	2,848	57
Capital	0	0	0	0	0	0	0	0	0	0	0	0	0
Other	834	755	817	755	779	3,185	3,095	755	739	739	5,418	5,328	90
TOTAL	1,274	1,161	1,263	1,160	1,199	4,897	4,750	1,160	1,133	1,133	8,323	8,176	147
QSIA													
Salaries	283	62	15	13	18	378	332	13	13	13	417	371	46
Capital	0	0	0	0	0	0	0	0	0	0	0	0	0
Other	90	20	0	20	0	110	128	20	20	20	170	188	(18)
TOTAL	373	82	15	33	18	488	460	33	33	33	587	559	28
QDPI													
Salaries	357	314	321	314	299	1,291	1,098	314	314	314	2,233	2,040	193
Capital	0	0	0	0		0	0	0	0	0	0	0	0
Other	557	680	538	535	613	2,388	1,926	535	535	535	3,993	3,530	462
TOTAL	913	994	859	849	912	3,679	3,024	849	848	849	6,226	5,570	656
SUNFISH													
Salaries	67	12	10	0	10	99	72	0	0	0	99	72	27
Capital	0	0	0	0	0	0	0	0	0	0	0	0	0
Other	20	5	0	0	0	25	12	0	0	0	25	12	13
TOTAL	87	17	10	0	10	124	84	0	0	0	124	84	40
ANU/ UQ													
Salaries	0	0	37	26	38	75	78	26	26	26	153	156	(3)
Capital	0	0	0	0	0	0	0	0	0	0	0	0	0
Other	0	0	20	36	0	20	108	36	36	36	128	216	(88)
TOTAL	0	0	57	62	38	95	186	62	62	62	281	372	(91)
CSIRO MARINE													
Salaries	34	23	147	85	72	276	287	77	107	77	537	548	(11)
Capital	0	0	0	0	0	0	0	0	0	0	0	0	0
Other	57	38	13	118	132	240	397	106	147	107	600	756	(156)
TOTAL	91	61	160	203	204	516	684	183	254	184	1,137	1,304	(167)
QFS													
Salaries	50	4	4	4	4	62	63	4	4	4	75	76	(1)
Capital	0	0	0	0	0	0	0	0	0	0	0	0	0
Other	86	66	66	66	66	284	279	66	66	66	482	478	4
TOTAL	136	70	70	71	70	346	342	71	71	71	557	554	3
TOTAL IN-KIND CONTRIBUTIONS													
Salaries	1,985	1,861	1,974	1,831	1,924	7,743	7,239	1,788	1,735	1,664	12,931	12,426	504
Capital	0	0	0	0	0	0	0	0	0	0	0	0	0
Other	3,560	3,609	3,783	3,639	3,985	14,937	13,930	3,303	3,152	3,054	24,445	23,438	1,007
GRAND TOTAL													
IN-KIND	5,544	5,470	5,757	5,471	5,909	22,680	21,169	5,091	4,887	4,718	37,376	35,865	1,511

* Total = Cumulative Actual + Outyear 'Estimate'

TABLE 2: CASH CONTRIBUTIONS ($'000s)

	Actual 1999-00	Actual 2000-01	Actual 2001-02	Agr'mt 2002–03	Actual 2002-03	Cumulative Total To Date Actual	Cumulative Total To Date Agr'mt	Projected Agr'mt 2003-04	Agr'mt 2004-05	Agr'mt 2005-06	Grand Total Total(*) 7 Yrs	Grand Total Agr'mt 7 Yrs	Grand Total Variance 7 Yrs
PARTNERS													
AIMS	130	130	130	130	130	520	520	130	130	130	910	910	0
AMPTO	1,102	1,240	1,240	1,240	1,240	4,822	4,822	1,240	1,240	1,240	8,542	8,542	0
(REP TOURISM INDUSTRY)#											0	0	
GBRRF			148	100	142	290	200	100	100	100	590	500	90
GBRMPA	665	665	665	665	665	2,660	2,660	665	665	665	4,655	4,655	0
JCU	197	171	143	135	135	646	644	135	135	135	1,051	1,049	2
QSIA*	0	0	119	70	104	223	630	70	70	70	433	840	(407)
QDPI	138	138	138	138	138	552	552	138	138	138	966	966	0
SUNFISH*	0	0	30	30	40	70	170	30	30	30	160	260	(100)
QFS	0	50	0	0	0	50	50	0	0	0	50	50	0
# Derived from the Environment Management Charge * Subject to FRDC funding													
TOTAL CASH FROM PARTICIPANTS													
	2,232	2,394	2,613	2,508	2,594	9,833	10,248	2,508	2,508	2,508	17,357	17,772	(415)
OTHER													
NEW MEMBERS	0	0	0	100	0	0	300	100	100	100	300	600	(300)
ASSOCIATE MEMBERS	0	0	0	100	0	0	250	0	150	200	350	700	(350)
EXTERNAL GRANTS	18	78	78	100	182	356	300	204	100	200	860	700	160
COMMERCIAL CONTRACTS	252	459	522	250	840	2,073	750	1,099	500	750	4,422	2,350	2,072
SPONSORSHIP/ DONATIONS	0	3	0	150	0	3	350	0	250	500	753	1,300	(547)
OTHER	0	97	29		30	156	0	0			156	0	
INTEREST	30	76	70	20	73	249	80	45	20	20	334	140	194
CRC GRANT	2,400	2,900	2,600	2,500	2,500	10,400	10,400	2,500	2,500	1,000	16,400	16,400	0
TOTAL CRC CONTRIBUTION													
	4,931	**6,007**	**5,912**	**5,728**	**6,219**	**23,070**	**22,678**	**6,456**	**6,128**	**5,278**	**40,932**	**39,962**	**813**
FUNDS CARRIED OVER FROM PREVIOUS YEAR													
	960	1,462	1,283		1,194								
LESS UNSPENT BALANCE													
	1,462	1,283	1,194		1,205								
TOTAL EXPENDITURE													
	4,429	6,221	6,001		6,208	22,859	22,678				40,721	39,962	759
ALLOCATION OF EXPENDITURE BETWEEN HEADS OF EXPENDITURE													
SALARIES	2,411	3,374	3,264	3,609	3,664	12,713	14,288	4,067	3,861	3,272	23,913	25,124	(1,211)
CAPITAL	0	0	0	0	0	0	0	0	0	0	0	0	0
OTHER	2,018	2,847	2,737	2,119	2,544	10,146	8,390	2,389	2,267	2,006	16,808	14,838	1,970
TOTAL	4,429	6,221	6,001	5,728	6,208	22,859	22,678	6,456	6,128	5,278	40,721	39,962	759

TABLE 3: SUMMARY OF RESOURCES APPLIED TO ACTIVITIES OF THE CENTRE ($'000s)

	Actual 1999-00	Actual 2000-01	Actual 2001-02	Agr'mt 2002–03	Actual 2002-03	Cumulative Total To Date Actual	Cumulative Total To Date Agr'mt	Projected Agr'mt 2003-04	Agr'mt 2004-05	Agr'mt 2005-06	Grand Total Total(*) 7 Yrs	Grand Total Agr'mt 7 Yrs	Grand Total Variance 7 Yrs
GRAND TOTAL													
In-Kind Expenditure	5,544	5,470	5,757	5,471	5,909	22,680	21,168	5,091	4,887	4,718	37,376	35,865	1,511
Cash Expenditure	4,429	6,221	6,001	5,728	6,208	22,859	22,678	6,456	6,128	5,278	40,721	39,962	759
Total Resources Applied to Activities of Centre	9,974	11,691	11,758	11,199	12,117	45,539	43,846	11,547	11,015	9,996	78,097	75,827	2,270
ALLOCATION OF TOTAL RESOURCES													
Total Salaries (Cash & In-Kind)	4,396	5,234	5,238	5,440	5,588	20,456	21,528	5,855	5,596	4,936	36,844	37,550	(706)
Total Capital (Cash & In-Kind)	0	0	0		0	0	0	0	0	0	0	0	0
Total Other (Cash & In-Kind)	5,578	6,456	6,520	5,758	6,529	25,083	22,320	5,692	5,419	5,060	41,253	38,276	2,977

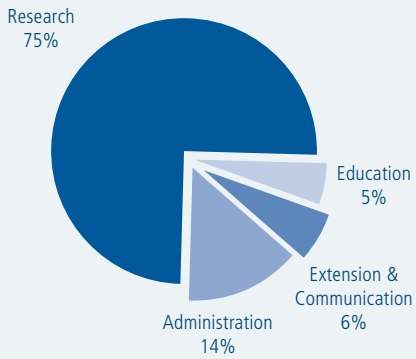
* Total = Cumulative Actual + Outyear 'Estimate'

TABLE 4: ALLOCATION OF RESOURCES BETWEEN CATEGORIES OF ACTIVITIES

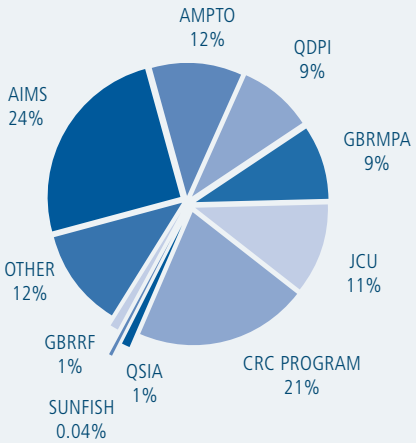
Program	$ CASH(1) ('000s)	$ IN-KIND ('000s)	Resource Usage STAFF(2) CONTRIBUTED	STAFF FUNDED BY CRC(2)
RESEARCH	4,667	5,409	17.64	39.18
EDUCATION	325	197	0.72	1.30
EXTENSION/TRAINING	374	14	0.05	2.55
ADMINISTRATION	842	288	3.16	6.18
TOTAL	**6,208**	**5,909**	**21.57**	**49.21**

(1) Cash from all sources, including CRC Program, (2) Person years, Professional staff

APPLICATION OF FUNDING 2002-03



TOTAL CASH & IN-KIND CONTRIBUTIONS 2002-03



Notes to and forming part of the Financial Statement

Basis of accounting

The Financial Statements (Tables 1-3) are a special purpose financial report prepared for the Commonwealth CRC Program for the purposes of fulfilling annual reporting obligations of CRC Participants under Clause 14(1)(f) of the Commonwealth Agreement. The information has been prepared on an accrual basis of accounting.

Capital purchases

In 2002-03, there were no capital equipment purchases.

Receipts - partners

$1,240,000 sourced from the Environmental Management Charge has been recorded as a cash contribution by AMPTO (representing the Tourism Industry).

Participant contributions to the CRC

Participant Contributions budgets for QSIA and Sunfish have been amended from 2002-03 to reflect the amounts that had the in principle approval of the CRC Program (these amounts are reflected in the variations to the Commonwealth agreements in the process of approval).

Budget estimates

The Agreement projections for 2003-04 include revisions to the amounts for commercial contractual income based on existing contracts that the Centre has in place with external parties. The Agreement projections 2004-05 to 2005-06 recorded in Tables 1, 2 and 3 are as contained in amended Schedule 4, Budget, of the Commonwealth Agreement (currently in the process of approval).

Unexpended balance

At the end of the reporting period, the CRC held funds of $1,205,392 to be allocated for expenditure in 2003-04.

Costing of in-kind contributions

The basis of institutional multipliers is as contained in Schedule 4 of the Commonwealth Agreement. In-kind contributions from AMPTO (representing the Tourism Industry), QFS, QSIA and Sunfish comprise operational support and therefore overheads have not been applied to these contributions.

Appendix 8. Audit

AUDITOR'S REPORT TO THE COOPERATIVE RESEARCH CENTRES PROGRAM, DEPARTMENT OF EDUCATION, SCIENCE AND TRAINING REPRESENTING THE COMMONWEALTH IN RESPECT OF COOPERATIVE RESEARCH CENTRE FOR THE GREAT BARRIER REEF WORLD HERITAGE AREA

FINANCIAL INFORMATION FOR THE YEAR ENDED 30 JUNE 2003

Scope

We have audited the financial information of the Cooperative Research Centre for the Great Barrier Reef World Heritage Area (CRC) as set out in Tables 1 to 3 of the Annual Report [being the tables showing in-kind and cash contributions for each party to the CRC, and cash expenditure] for the year ended 30 June 2003. The parties to the Cooperative Research Centre are responsible for the preparation and presentation of the financial information. We have conducted an independent audit of the financial information in order to express an opinion on it to the parties to the Cooperative Research Centre for the Great Barrier Reef World Heritage Area.

The financial information has been prepared for the parties to the Cooperative Research Centre for the Great Barrier Reef World Heritage Area for the purposes of fulfilling their annual reporting obligations under clause 14 (1) (f) of the Commonwealth Agreement and for distribution to the Cooperative Research Centres Program, Department of Education, Science and Training, representing the Commonwealth of Australia. We disclaim any assumption of responsibility for any reliance on this report or on the financial information to which it relates to any person other than those mentioned above, or for any purpose other than that for which it was prepared.

Our audit has been conducted in accordance with Australian Auditing Standards to provide reasonable assurance as to whether the financial information is free of material misstatement. Our procedures included examination, on a test basis, of evidence supporting the amounts and other disclosures in the financial information, and the evaluation of accounting policies and significant accounting estimates. These procedures have been undertaken to form an opinion whether, in all material respects, the financial information is presented fairly in accordance with Australian accounting concepts and standards and requirements of the Commonwealth Agreement in terms of Clauses 4 (Contributions), 5(1), 5(2), 5(3) (Application of the Grant and Contributions), 9(1), 9(5) (Intellectual Property) and 12(2) (Financial Provisions), so as to present a view of the sources of funding and the application of funding of the Cooperative Research Centre for the Great Barrier Reef World Heritage Area and the application of which is consistent with our understanding of its financial activities during the year and its financial position.

While we have not performed any audit procedures upon the estimates for the next period and do not express any opinion thereon, we ascertained that they have been formally approved by the Board of Management as required under the Centre Agreement.

The audit opinion expressed in this report has been formed on the above basis.

Audit opinion

In our opinion, the financial information presented in Tables 1 to 3 presents fairly the sources of funding, the application of funding and the financial position of the CRC for the year ended 30 June 2003 in accordance with Australian accounting concepts and applicable Accounting Standards, the CRC Secretariat's Guidelines for Auditors, and the requirements of the Commonwealth Agreement in terms of Clauses 4 (Contributions), 5(1), 5(2), 5(3) (Application of Grant and Contributions), 9(1), 9(5) (Intellectual Property) and 12(2) (Financial Provisions).

1. The multipliers adopted by the Centre to value in-kind contributions other than salary costs have a sound and reasonable basis and each partner's component of the Researcher's Contributions for the year under report has been provided at least to the value for that year committed in the Budget as specified in the Agreement, with the following exceptions:

Organisation	Amount Committed	Amount Provided
GBRMPA	$1,085,000	$1,082,000

   and the total value of all Contributions for the year under report equalled or exceeded the amount of grant paid during the year (not including advances). [Clause 4]

2. The Researcher has used the Grant and the Researcher's Contributions for the Activities of the Centre and in my professional opinion there appear to be no material reporting irregularities. [Clause 5(1)]

3. The Researcher's allocations of the budgetary resources between Heads of Expenditure has not been lower or higher than the allocation in the budget by $100 000 or 20% (whichever is the greater amount) without prior approval by the Commonwealth. [Clause 5(2)]

4. Capital Items acquired from the Grant and Researcher's Contributions are vested as provided in the Centre Agreement. [Clause 5(3)]

5. Intellectual Property in all Contract Material is vested as provided in the Centre Agreement and no Intellectual Property has been assigned or licensed without the prior approval of the Commonwealth. [Clause 9(1), 9(5)]

6. Proper accounting standards and controls have been exercised in respect of the Grant and Researcher's Contributions and income and expenditure in relation to the Activities of the Centre have been recorded separately from other transactions of the Researcher. [Clause 12(2)]

Pickard Associates

PICKARD ASSOCIATES

John Zabala

Partner

Date: 9/9/2003

List of Abbreviations

ABC – Australian Broadcasting Commission

ACTFR – Australian Centre for Tropical Freshwater Research

AFFA – Agriculture, Fisheries Forestry – Australia

AIMS - Australian Institute of Marine Science

AFMA – Australian Fisheries Management Authority

AMPTO – Association of Marine Park Tourism Operators

ANU – Australian National University

AQIS – Australian Quarantine and Inspection Service

CCIMPE – Commonwealth Consultative Committee on Introduced Marine Pest Emergencies

CEO – Chief Executive Officer

COTS – Crown-of-thorns starfish

CRC – Cooperative Research Centre

CRIMP – Centre for Research on Introduced Marine Pests

CSIRO – Commonwealth Scientific and Industrial Research Organisation

DNR&M – Dept of Natural Resources and Mines

DSS – Decision Support System

EA – Environment Australia

ELF – Effects of Line Fishing

EPA – Environmental Protection Agency

ESRI – Environmental Systems Research Institute

FAO – Food and Agriculture Organization of the United Nations

FRDC – Fisheries Research and Development Corporation

FTE – Full Time Equivalent

GBR – Great Barrier Reef

GBRMP – Great Barrier Reef Marine Park

GBRMPA – Great Barrier Reef Marine Park Authority

GBRRF – Great Barrier Reef Research Foundation

GBRWHA – Great Barrier Reef World Heritage Area

GIS – Geographic Information System

HarvestMAC – Harvest fisheries Management Advisory Committee

IMPAC – International Marine Project Activities Centre

IMR – Institute of Marine Research, Norway

IOI – International Ocean Institute

IP – Intellectual Property

IUCN – World Conservation Union

JCU – James Cook University

MAC – Management Advisory Committee

MTQ – Museum of Tropical Queensland

NCAR – National Center for Atmospheric Research, Boulder, Colorado

NGO – Non Governmental Organisation

NIFA – Norwegian Institute of Fisheries and Aquaculture

NIWA – National Institute of Water and Atmospheric Research Ltd, New Zealand

NOAA – National Oceanic and Atmospheric Administration, USA

NOO – National Oceans Office

PCQ – Ports Corporation Queensland

PNG – Papua New Guinea

QDPI – Queensland Department of Primary Industries

QFS – Queensland Fisheries Service

QPWS – Queensland Parks and Wildlife Service

QSIA – Queensland Seafood Industry Association

RAC – Research Advisory Committee

ReefMAC – Coral Reef Line Fishery Management Advisory Committee

SAC – Scientific Advisory Committee

SCU – Southern Cross University

SUNTAG – Suntag – Queensland (state wide) sportfish tagging program

TAFE – Tertiary and Further Education

TESAG – School of Tropical Environmental Studies and Geography, JCU

TRC – Task Review Committee

TSRA – Torres Strait Regional Authority

UCLA – University of California, Los Angeles

UN – United Nations

UNDP – United Nations Development Programme

UNH – University of New Hampshire

UQ – University of Queensland

UWA – University of Western Australia

WA – Western Australia

WWF – World Wide Fund for Nature

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