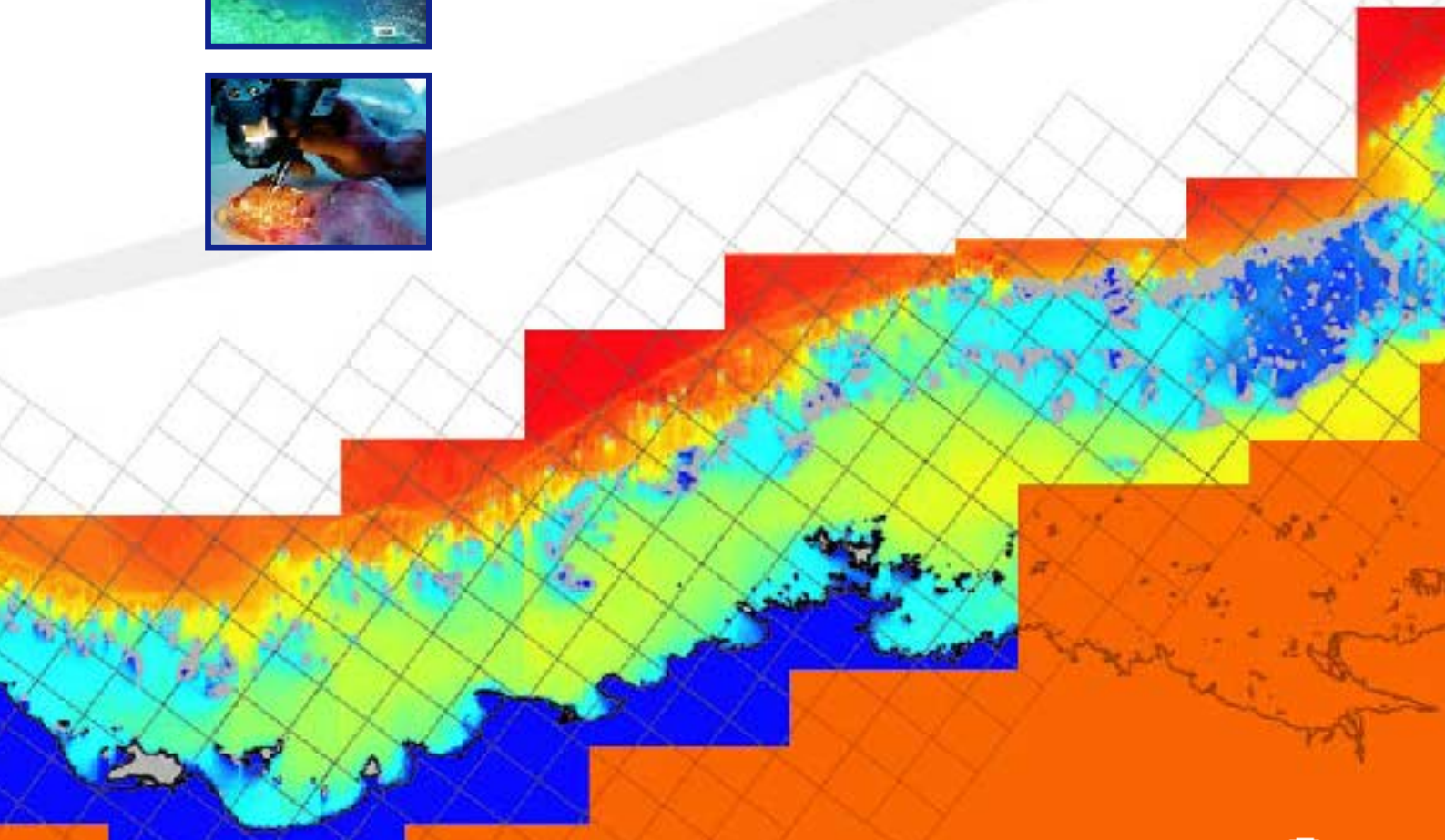




Annual Report 2001–2002



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

Program A. Conserving World Heritage values

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

- For the first time, CRC Reef PhD student Mr Guido Parra has collected information on the ecology and behaviour of coastal dolphins in Australia. He has found substantial populations of these animals in the Great Barrier Reef region.

PROGRAM B. Sustainable industries

To provide critical information for and about the operations of the key uses of the GBRWHA necessary for the management of those activities.

- CRC Reef researchers, Assoc. Prof. Tom Hardy, Mr Luciano Mason and Mr Jason McConochie were awarded the Kevin Stark Memorial Medal for Excellence in Coastal and Ocean Engineering, by the National Committee on Coastal and Ocean Engineering for their work on the Cyclone Wave Atlas. The atlas is already being used with Pontoon Guidelines by GBRMPA and the tourism industry to achieve world's best practice in optimising construction and mooring of offshore structures in the GBRWHA.

PROGRAM C. Maintaining ecosystem quality

To generate critical information, relevant products and useful advice that will assist users, the community, industry and managers to know the status and trends of marine systems in the GBRWHA by developing benchmarks and performance indicators.

- CRC Reef researcher Dr Rob Coles co-edited a book on Global Seagrass Research Methods which brings together 51 authors from around the world to provide a useful and comprehensive set of research methods for scientists and the community monitoring of seagrass.

PROGRAM D. Reef futures

To provide infrastructure and assistance in information management for researchers to achieve their research and technology goals; to facilitate outcome-oriented integration and synthesis of information; and to promote transparency of parameters, performance indicators and policy advice to resource managers.

- CRC Reef researchers contributed expert advice and powerful decision making tools to support GBRMPA's Representative Areas Program.

PROGRAM E. Education and communication

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.

- To summarise the state of knowledge on key issues in the GBRWHA, CRC Reef produced a series of four colour brochures about coral bleaching, land use, dugongs and dwarf minke whales.

PROGRAM F. Commercial and international

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.

- IMPAC (International Marine Project Activities Centre), a CRC Reef subsidiary, attracted its first two participants with the opening of the first Australian offices of the International Ocean Institute and of the International Marinelifelife Alliance.

CRC Reef Research Centre (ABN 62 089 499 034) is a company limited by guarantee with the following members: 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 graphics by: John Barnett, GBRMPA; Peter Nagle; FantaSea Cruises; Rob Parsons and Marine Modelling Unit, JCU.

Great Barrier Reef World Heritage Area



The Great Barrier Reef World Heritage Area (GBRWHA) 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. The CRC Reef Research Centre provides scientific research to ensure the sustainable use of the GBRWHA.

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CONTENTS

1. EXECUTIVE SUMMARY



CRC Reef Chief Executive Officer,
Professor Russell Reichelt, and Chairman,
Sir Sydney Schubert.

Photo: Rob Parsons

Chairman and CEO's Report

In 2001-02, CRC Reef consolidated its strong beginning as an incorporated entity in September 1999. The Board found that the Directors' focus and responsibility, created by incorporation, was a strong positive influence in assisting CRC Reef achieve its goals.

The Board is influenced strongly by the principal users of the research results, and this has been reflected in the priority setting and research task approvals over the past year.

Second-Year Review

CRC Reef was reviewed in considerable detail this year – its second-year review by the CRC Program. The reviews of the science, management and strategic direction found that CRC Reef is progressing well. The panel noted several successful initiatives, including:

- Revision and expansion of CRC Reef's Task Associate Program which puts users in closer touch with the direction and outcomes of research tasks;
- Redevelopment of the Communication and Extension Strategy which includes a sophisticated website and better use of publications and media; and a revised corporate image.
- Effective integration of research programs which enabled linkage across scientific disciplines (bioscience, engineering, social science) in tasks related to ports and shipping, tourism and fisheries.

Although the review was positive overall, the panel did find some areas where CRC Reef can either improve its performance or expand its scope, namely

- Intellectual property (IP) management – by implementing a register of IP and by clarifying the issues of IP generated by students at universities;
- Enhancing collaboration with organisations studying water quality and runoff from the land into the coastal zone to ensure the effects of runoff are included in catchment management plans.

The Board accepted the panel's recommendations and is moving to implement these in the coming year. In particular, the Board recognises the need to provide scientific support for groups developing and implementing plans to halt the decline in coastal water quality at the scale of whole catchments.

Research results making a difference to the reef

In the past year, CRC Reef played a significant role in helping to clarify the state of knowledge of water quality in the coastal regions of the Great Barrier Reef through reports that highlighted the current areas of consensus and also areas of disagreement among coastal zone researchers in the field. CRC Reef's 'State of Knowledge' brochure series has proven popular, and in the past year the first one on crown-of-thorns starfish was supplemented by four new ones, all of which are available at CRC Reef's website:

- Land Use and the Great Barrier Reef World Heritage Area
- Coral bleaching and global climate change
- Dugongs in the Great Barrier Reef
- Dwarf minke whales in the Great Barrier Reef.

CRC Reef's support for the research on dwarf minke whales has helped the production of a Code of Conduct for ecotourism operators that provide an opportunity for visitors to swim near whales.

The production of guidelines for pontoon design are already assisting the Great Barrier Reef Marine Park Authority in policy developments aimed at helping industry and regulators ensure that appropriately engineered structures are safely moored on reefs.

CRC Reef's research relating to ports and shipping has expanded in the past year, particularly the work on baseline surveys which are needed to assess marine biodiversity in the regions' ports. This baseline information is part of the national effort to minimise the risk of establishment of invasive, harmful exotic species that may arrive in ships' ballast water or attached the hulls of vessels. Work is underway to integrate the ecological surveys on shipping lanes and approaches to harbours, the exotic species surveys and the oceanographic simulations of water and particle movements caused by winds and tides. In the hands of environmental managers and port authorities, this integrated information will help develop responses to pollution accidents and species invasions.

Staff

Associate Professor Vicki Harriott will be returning to her position at Southern Cross University after successfully leading the Education and Communication Program for CRC Reef. The Board is grateful for her strong contribution in program management and the valuable results she has delivered in a range of products, including the review of the first CRC Reef and reports about the coral harvest fishery, and impacts of tourism on the Great Barrier Reef.

International links further developed

During the past year, IMPAC (International Marine Project Activities Centre Ltd) was established and has begun attracting both sponsorship and early tenants. The Queensland and Commonwealth Governments have committed seed funds, and the private sector has also contributed support through the Great Barrier Reef Research Foundation. IMPAC's first tenants are the International Ocean Institute – Australia, and the International Marinelifelife Alliance.

The International Ocean Institute (IOI) – Australia is the IOI's first regional office and was opened by the Hon Joseph Warioba and the Hon Wilson Tuckey, Minister for Regional Services. The first Director, Prof Robin South, retains his strong links to the University of South Pacific and IMPAC hopes his office will help to build stronger regional collaborations.

New collaborations

CRC Reef is committed to fostering new partnerships and stronger collaborations among reef researchers. This was emphasised in the second-year review and will be an increasingly important feature of the CRC Reef's operations in future.

A cooperative approach with the Rainforest CRC will help CRC Reef's members and collaborators make a significant contribution to developing more efficient water quality monitoring methods, and detecting the changes in coastal ecosystems affected by runoff from the land while those changes are still slight and reversible. The Centre places a high value on achieving better results through collaborations among the best research providers for any particular task.

In the coming year, CRC Reef aims to build on current partnerships through new research and development opportunities in the Great Barrier Reef World Heritage Area and in coral reef ecosystems of Australia's regional neighbours.

Sir Sydney Schubert, Chairman
Prof Russell Reichelt, CEO

2. STRUCTURE AND MANAGEMENT



The CRC Reef secretariat (left to right): Ms Mary Nash, administrative assistant; Ms Michelle Warrington, executive officer; Ms Dawn Birch, executive assistant; Dr David Williams, Deputy CEO (Research); Ms Kylie Smith, administrative trainee and Professor Russell Reichelt, CEO.

Photo: CRC Reef.

The Cooperative Research Centre for the Great Barrier Reef World Heritage Area (CRC Reef Research Centre) is an incorporated cooperative joint venture established in 1999 by an Agreement between CRC Reef members:

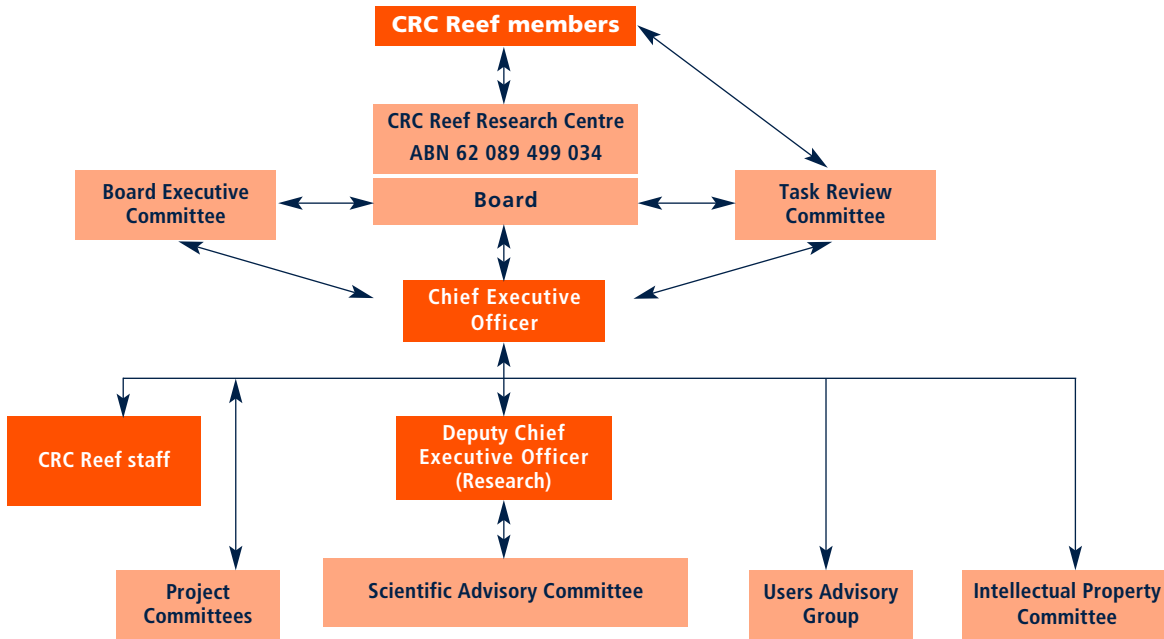
- Association of Marine Park Tourism Operators (AMPTO)
- Australian Institute of Marine Science (AIMS)
- Great Barrier Reef Marine Park Authority (GBRMPA)
- James Cook University (JCU)
- Queensland Seafood Industry Association (QSIA)
- The State of Queensland through its Department of Primary Industries (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 Chief Executive Officer (CEO), supported by a Secretariat dealing with administrative and financial activities. The Board is advised by advisory groups and committees, and a Centre Visitor.

MANAGEMENT STRUCTURE OF CRC REEF



MEMBERSHIP AND ROLES OF ADVISORY GROUPS AND COMMITTEES

The Board comprises an independent Chair and ten Directors. Board membership at 30 June 2002 was:

Sir Sydney Schubert	Chair
Dr Peter Isdale	AIMS
Mr David Hutchen	AMPTO
Mr David Windsor	AMPTO
(to December 2001)	
Mr David Windsor	GBRRF (December 2001 onwards)
Mr Bob Thomas	AMPTO (December 2001 – May 2002)
The Hon Virginia Chadwick	GBRMPA
Mr Matt Pope	GBRMPA
Professor Norman Palmer	JCU
Mr Ted Loveday	QSIA (to November 2001)
Mr Duncan Souter	QSIA (November 2001 onwards)
Mr Peter Neville	QDPI
Mr Bill Sawynok	SUNFISH

Alternate Board members through the reporting period were: Mr Bob Thomas (AMPTO), Mr Adrian Pelt (AMPTO), Mr Duncan Souter (QSIA) and Dr Alison Green (GBRMPA).

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 Chief Executive Officer (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:

- Board Executive Committee (BEC)
- Task Review Committee (TRC)
- Scientific Advisory Committee (SAC)
- Users Advisory Group (UAG, until disbanded in February 2002)

The Board Executive Committee provides guidance to management between quarterly full Board meetings; undertakes the role of Audit Committee; reviews remuneration and performance of the CEO; reviews Board performance and operations including remuneration matters; examines funding opportunities; and advises the Board on the above matters. The Committee met five times during the year and membership at 30 June 2002 was:

Sir Sydney SchubertChair, CRC Reef
 Dr Peter IsdaleAIMS
 Mr David WindsorGBRRF
 Professor Norman PalmerJCU
 The Hon Virginia ChadwickGBRMPA

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 2002 follows:

Prof R Reichelt (CEO)
 Dr D Williams (DCEO)
 Program Leaders
 Social Science Representative
 Mr D Windsor (GBRRF)
 Dr A Green (GBRMPA)
 Postgraduate Student

The **Intellectual Property Committee** re-evaluated its focus and membership during 2001-02. The membership as at June 2002 is Prof R Reichelt (CEO), Dr J Carstairs (JCU), Dr P Isdale (AIMS) and Ms F McDonald (GBRMPA).

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 on three occasions and membership at 30 June 2002 is listed below.

Sir S Schubert (Chair)
 Prof R Reichelt (CEO)
 Dr D Williams (DCEO)
 Program Leaders
 Dr A Green (GBRMPA)
 Mr V Veitch (SUNFISH)
 Mr D Souter (QSIA)
 Mr D Windsor (GBRRF)
 Dr P Isdale (AIMS)
 Dr R Coles (QDPI)
 Prof N Palmer (JCU)

The **Users Advisory Group** (UAG) was established to consider issues and knowledge required by major user groups, reviews research tasks and outputs and assists in implementation towards effective use of research. The role of the Group was reviewed in 2001-02 and the Board decided that the UAG be disbanded and that alternative means of engaging with non-partner groups, including Indigenous and conservation interests, be adopted. The UAG met on one occasion. Membership before the UAG was disbanded was:

Prof R Reichelt (CEO)
 Dr D Williams (DCEO)
 Ms B Barnett (Extension)
 Assoc Prof V Harriott (Program Leader)
 Mr M Turner (EPA/QPWS)
 Mr D Windsor (GBRRF)
 Dr A Green (GBRMPA)
 Mr C Wilson (QPA)
 Mr D Bateman (SUNFISH)
 Ms R Lea (QFS)
 Ms J Daylight-Baker (ATSIC)
 Mr D Souter (QSIA)
 Mr P Comben (Conservation)
 Prof O Hoegh-Guldberg (NTMN)

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

Since its formation in 1999, the Board has addressed corporate governance arrangements and responsibilities under Corporations Law. The Board has adopted clear definitions of responsibilities for the CEO and Board Directors and has undertaken training in the responsibilities of Company Directors. Accountability is achieved through reports to Board meetings on Key Performance Indicators including budget and financial management, compliance, CEO performance, education and business activities.

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 then 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).



CRC Reef researchers are assessing the impact of runoff from the land on the Great Barrier Reef.

Photo: GBRMPA

3. COOPERATIVE LINKAGES



Seagrass adventures on the CRC Reef website developed by Bentley Park College in conjunction with scientists from DPI.

Visit <http://www.reef.crc.org.au/seagrass/index.html>

Objective:

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

Highlights:

- Collaboration between CRC Reef, QDPI and EPA to present the Asian green mussel workshop in Cairns, to review status of the marine pest, and management options.
- Delivery of workshop for local control of crown-of-thorns starfish in the Whitsundays region, in collaboration with the tourism industry and community.
- Collation of coastal seagrass mapping data across different regions and localities in Queensland, working with local authorities, stage agencies and community groups.
- Integration of ports research to present a comprehensive picture to Port Authorities of biological and physical dynamics of Queensland ports.
- International Workshop on Satellite Oceanography and Coral Bleaching convened by AIMS in collaboration with NOAA, and development of a Bleaching Response Strategy by AIMS, outlining when and how to respond to future bleaching events.
- Launch of CRC Reef Seagrass website, developed by Bentley Park College students with QDPI and CRC Reef, at the first International Seagrass-Watch Volunteers Forum in Hervey Bay.

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 etc;
- a highly inclusive and representative committee structure;
- strong links between the education program and industry; and
- an extension strategy built around industry information needs and the matching of research to those needs.

Communication and extension activities have focused on collaboration, in line with the key objectives of the CRC Reef Communication and Extension Strategy (2000):

- promote a distinctive and positive image of CRC Reef and the Cooperative Research Centres 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.

During 2001, the CRC Reef Communication and Extension Strategy was reviewed, with progress evaluated and strategies updated.

Internal links with participating organisations

Links between researchers and partner organisations has been 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. Fifty personnel from the Great Barrier Marine Park Authority (GBRMPA), the Association of Marine Park Tourism Operators (AMPTO), Queensland Seafood Industry Association

(QSIA), SUNFISH, the Environmental Protection Agency (EPA), Australian Fisheries Management Agency (AFMA), Queensland Department of Primary Industries (QDPI), Sea Forum, Queensland ports, and private industry are assigned as Task Associates to 82 tasks. Predominantly positive Task Associate comments on annual task reports indicate that this process is working effectively and facilitating communication of research findings.

The Users Advisory Group met once during the year with representatives from AMPTO, GBRMPA, QSIA, QDPI, EPA, SUNFISH, Ports Corporation of Queensland and the National Tropical Marine Research Network. The role of the group was reviewed in 2001-02 and the Board decided to disband it and adopt alternative means of engaging with non-partner groups, including Indigenous and conservation interests. Options for improved Indigenous engagement by CRC Reef, across a range of activities, are being developed in consultation with Indigenous associates and partners.

There has been significant uptake of data from the Fishing and Fisheries project by Queensland Fisheries Service, in developing the reef line fishery management plan. Much of the research being undertaken in the project relies on the support of community members – recreational and commercial fishers, seafood processors and fish tackle shops who supply samples.

Other collaborative research projects with members include:

- a joint project between James Cook University (JCU) School of Engineering and United Water International to pilot methods for treatment of ballast water;
- a review of the eastern Torres Strait reef line fishery (management, available data, and research needs) in collaboration with fisheries management agencies and policy makers – Queensland Fisheries Service, AFMA, National Oceans Office, Torres Strait Fisheries Scientific Advisory Committee and Torres Strait Fisheries Management Committee;
- a project on cooperative management of the GBRWHA by GBRMPA and Indigenous people to develop a structure and process for co-management, suited to Indigenous management, working with Sea Forum and Cape York Development Corporation;
- CRC Reef/CSIRO collaborative research led by Dr Bruce Mapstone on modelling of multiple-species fisheries, jointly funded by CRC Reef and the Fisheries Research and Development Corporation (FRDC);
- AIMS/GBRMPA collaboration on monitoring the 2002 coral bleaching event, and developing the ReefState predictive model on the ecological state of coral communities under different scenarios;

- Minke whale research and development of an industry Code of Conduct, led by Dr Alastair Birtles (JCU) in collaboration with tourism industry members from the Cod Hole and Ribbon Reef Operators Association (CHARROA), in particular *Undersea Explorer*, and management agencies (GBRMPA, Environment Australia (EA) and Queensland Environmental Protection Agency).

Stakeholder linkages were also enhanced by:

- extensive email information networks between staff, students and associates;
- publishing scientific results in newsletters, reports, brochures and in the media;
- regular seminars, workshops and briefings to industry and regional resource management agency staff;
- extension and research presentations to tourism industry members in Cairns, Whitsundays and Mackay;
- formal representation of industry and management on various committees, such as the Effects of Line Fishing Steering Committee, 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, national and international groups so that research results can be utilised directly in management outcomes by member agencies.

EXTERNAL LINKAGES

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

The Ports and Shipping research program has been strengthened with a move of the baseline survey projects to QDPI in Cairns, providing greater opportunity for integrating research activities and developing cooperative links between private industry (ports and shipping), managers, researchers and stakeholder groups. Industry has funded ports' baseline surveys and monitoring of critical habitat in Cairns, Gove, Weipa, Karumba, Skardon River, Townsville and Cape Flattery. The information has assisted Port Authorities in managing impacts on the environment and monitoring for introduced pests. The integrated approach has also led to successful joint tenders for externally funded projects in Cairns, Thursday Island and Ashmore Reef. QDPI researchers have collaborated with postgraduate students based at JCU School of Engineering to develop an integrated hydrodynamic model for Cairns Port Authority.

In February 2002, CRC Reef sponsored a workshop in Cairns to review the status of the introduced pest, the Asian green mussel, in Trinity Inlet, and assess management options. The QDPI Ports and Shipping team coordinated the workshop which was attended by representatives from the Queensland state government agencies that play a role in marine pest management – Environmental Protection Agency, QDPI, Queensland Transport – with input from the Northern Territory Museum, CRC Reef, Cairns Port Authority, Queensland Ports Association, GBRMPA, Australian Quarantine Inspection Service, and the Commonwealth Consultative Committee on Introduced Marine Pest Emergencies (CCIMPE). The subsequent response was coordinated by the Environmental Protection Agency, and included distribution of a public information brochure developed in collaboration with CRC Reef.



CRC Reef researchers have helped to develop a Code of Practice for swimming with minke whales.

Photo: Alastair Birtles, CRC Reef.

Australian Institute of Marine Science (AIMS) researcher Dr Janice Lough and team (Regional Dynamics in the Marine Climate) are collaborating with the National Oceanic and Atmospheric Administration (NOAA) to investigate causes and consequences of the 1998 coral bleaching event and to establish an early warning system for coral bleaching.

Working with local authorities, state agencies and community groups, information from the QDPI seagrass program, led by Dr Rob Coles, has enhanced understanding of impacts of dredging, sewage, and management of Dugong Protection Areas.

The associated monitoring program Seagrass-Watch, continues to be well supported by community groups who have conducted surveys throughout coastal Queensland. QDPI coordinated the first International Seagrass-Watch Volunteers Forum in Hervey Bay in October 2001. The Seagrass website, developed by Bentley Park College students working with QDPI and CRC Reef, was launched at the Forum.

A number of postgraduate projects are being enhanced through external collaboration, including work with the WA Department of Conservation and Land Management (CALM) - Mr Ben Radford; Commonwealth Scientific and Industrial Research Organisation (CSIRO) and the Australian National University (ANU) - Ms Vimoksalehi Lukoschek; and the Seychelles Fishing Authority - Ms Rachel Pears.

The Chairman, CEO and Centre Visitor represented CRC Reef at the CRC Association national conference in Sydney in May 2002.

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.

During 2001–2002, CRC Reef was associated with more than 143 organisations, including the following:

Australian universities and TAFE colleges

Australian National University
Edith Cowan University
James Cook University

Northern Territory University
Southern Cross University
University of Queensland

University of Western Australia
University of Central Queensland
University of Tasmania

CRCs and other research organisations

AIMS
Centre for Research on Introduced
Marine Pests
CRC Coastal Zone, Estuary and
Waterway Management
CRC Catchment Hydrology
CRC Aquaculture

CRC Freshwater Ecology
CRC Tropical Savannas Management
CRC for Sustainable Sugar Production
CRC for Sustainable Tourism
CRC for Tropical Rainforest Ecology
and Management
CSIRO Antarctic Division

CSIRO Atmospheric Research
CSIRO Land and Water
CSIRO Marine Research, Cleveland
and Hobart
CSIRO Sustainable Ecosystems
Hydrozoan Research Laboratories

Government departments and corporations

Australian Bureau of Meteorology
Australian Bureau of Tourism Research
Australian Maritime Safety Authority
Agriculture, Fisheries and Forestry -
Australia
Australian Fisheries Management
Authority
Australian Institute of Aboriginal and
Torres Strait Islander Studies
Australian Heritage Commission
Australian Museum
Conservation and Land Management
(CALM) WA
Consultative Committee on Introduced
Marine Pest Emergencies
EcoFish
Environment Australia
GBRMPA

Museum and Art Gallery of Northern
Territory
Museum of Tropical Queensland
Museum of Victoria
National Oceans Office
National Ocean and
Atmospheric Administration
Northern Territory Department of
Environment and Heritage
Northern Territory Fisheries Division
Ports Corporation Queensland
Prime Minister and Cabinet
Queensland Department of Business,
Industry and Resource Development
Queensland Department of Transport -
Maritime Services
QDPI – Southern Fisheries Centre and
Northern Fisheries Centre

Queensland Department of Natural
Resource Management
Queensland Department of State
Development
Queensland Environmental Protection
Agency
Queensland Fisheries Service
Queensland Museum
Queensland Parks and Wildlife Service
Queensland Ports Association
QSIA
Torres Strait Fisheries Scientific Advisory
Committee
Torres Strait Fisheries Management
Committee
Western Australian Fisheries
Western Australian Museum
Wet Tropics Management Authority

Local government and consultative organisations

Cairns City Council
Cairns Esplanade Redevelopment
Scientific Advisory Committee
Cairns Port Authority

Gladstone Port Authority
Mackay Port Authority
Torres Strait Regional Authority
Townsville Port Authority

Townsville City Council
Trinity Inlet Management Program
Weipa Catchment Coordinating Group

Community organisations

AUSTAG
Australian Coral Reef Society
Australian Marine Science Association
Australian National Sportsfishing
Association
Cape York Land Council
Cape York Development Corporation

Fisheries Management Advisory
Committees
Hopevale Community Council
National Tropical Marine Network
Northern Land Council
Order of Underwater Coral
Heroes (OUCH)

Local Marine Resource Advisory
Committees (Cooktown, Port
Douglas, Townsville, Cairns, Airlie
Beach, Rockhampton)
Sea Forum Working Group
SUNFISH
SUNTAG
Zonal Advisory Committees

Private companies

Australian Underwater Technologies
BHP Cannington
BIOZ
Cairns Dive Centre
Cairns Marine Aquarium Fish
Cape Flattery Silica Mine
Captain Cook Cruises, Cairns
Comalco Minerals and Alumina
Cumberland Yacht Charters
Digital Dimensions
Down Under Dive
Dunk Island Ferry and Cruises
FantaSea Cruises
Great Adventures
Hamilton Island Resort
Hayman Island Resort
Kangaroo Cruises

Lady Elliott Resort
Lady Musgrave Barrier Reef Cruises
Mantaray Reef Charters
Maxi Action
Mike Ball Dive Expeditions
MIM Holdings
Mission Beach Dive Charters
Modular Solution Technologies
Nabalco Pty Ltd
National System Resources, Melbourne
Nimrod Explorer
Ozsail
Pacific Marine Group
Prodiver Cairns
Prosail
Queensland Aquarium Supply Divers
Association Incorporated

Queensland Nickel
Queensland Yacht Charters
Quicksilver Connections
Reef and Island Cruises
Southern Cross Sailing Adventures
Sunlover Cruises
Sinclair Knight Merz
Taka Dive
Tangalooma Wildlife Dolphin Resort
Undersea Explorer
URS, Perth
Whitehaven Express
Whitsunday All Over
Whitsunday Escape
Whitsunday Rent-A-Yacht
Yothu Yindi Foundation

Industry associations

AMPTO
Cod Hole and Ribbon Reef Operators
Association

Dive Queensland
Great Barrier Reef Charter Association
Townsville Enterprise Ltd

Whitsunday Bareboat Operators
Association

INTERNATIONAL LINKS

CRC Reef's strategy for international linkages 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 in relation to assisting developing countries, to develop export industries, and to generate income for CRC Reef. A report on the Commercial and International Program is provided in Section 6. International links by current research programs are presented below.



CRC Reef researchers have been instrumental in developing SeagrassNet, an international seagrass monitoring program in the western Pacific.

Photo: DPI.

During the year, CRC Reef established the International Marine Project Activities Centre (IMPAC) to promote international collaboration, and to provide facilities for international agencies working in the marine tropics within the United Nations system, eg. UNESCO, Food and Agriculture Organization (FAO), United Nations Environment Programme (UNEP); development banks, eg. World Bank; international NGOs, eg. IOI, World Conservation Union (IUCN), World Wide Fund for Nature (WWF); and major foundations, eg. Packard Foundation. IMPAC will be a coordinating centre for existing international bodies requiring access to facilities in the tropical Indo-Pacific.

An international seagrass monitoring program SeagrassNet, focusing on eight countries in the western Pacific was established in January 2002 as a collaborative program between QDPI, University of New Hampshire, University of Maryland and organisations in Micronesia, Fiji, Malaysia, Palau, Papua New Guinea, and the Philippines. Field training programs have been delivered by **Dr Rob Coles** and team, and an interactive website (www.SeagrassNet.org) established as a resource for researchers and community members.

CRC Reef collaborated with Agriculture, Fisheries and Forestry - Australia (AFFA) who funded the development of a proposal to establish a cooperative research centre in the Asia-Pacific Economic Cooperation (APEC) region. The proposed Cooperative Regional Research Centre (CRRCC) would be established as a partnership between CRC Reef and AFFA, to allow governments, industry and NGOs to invest in research to better manage marine and coastal resources, and sustainable marine aquaculture in the APEC region. The concept has been reviewed positively and work to implement the network will continue in 2002-03.

Prof Howard Choat (JCU) is working with fisheries managers in the Seychelles, Cocos Keeling, American Samoa and the Solomon Islands in the underwater visual census (UVS) surveys of large fish species, with good information on local distribution on Maori wrasse in the Pacific and Indian Oceans.

The AIMS team working on regional dynamics in the marine climate of the GBRWHA, are collaborating with the Naval Research Laboratory at Stennis Space Center in Mississippi Sound (USA) to map river plumes and coastal buoyancy jets in Mississippi Sound and the northern Gulf of Mexico. The data are being compared with Australian studies of plume evolution and dynamics.

A simple, cost-effective method to examine sediment stress from gold mining on massive *Porites* corals on Lihir Island, Papua New Guinea, is being developed. With support from National System Resources in Melbourne, Lihir Mining Company, BHP, AIMS and JCU, postgraduate student **Ms Sea Rotmann** is using changes in thickness of the coral tissue layer as an indicator of sediment levels.

AIMS researcher **Dr Katharina Fabricius** established a long-term monitoring program for the Palau International Coral Reef Centre, which included delivery of field training in Palau.

JCU PhD student **Ms Vimoksalehi Lukoschek** is working with international sea snake expert Prof Harold Heatwole (North Carolina State University) and Dr Harold Voris (Field Museum of Natural History, Chicago) who are providing tissue samples from overseas species of sea snake, for comparison with material obtained from ANU and the Australian Museum.

Postgraduate student, **Mr Geoffrey Muldoon** (JCU), is working with the International Marinelifelife Alliance (IMA) at the new regional field office at IMPAC, Townsville, to develop a Code of Conduct of Best Practices for the live reef food fish trade in the Asia-Pacific Region.

There has been extensive collaboration between CRC Reef researchers and staff and international organisations and agencies, including:

Organisations and programs

Arafura Timor Seas Experts Forum	International Ocean Institute	Parks Australia, Cocos Keeling
BHP Indonesia	IUCN – Fisheries Group	Seagrass Net
Department of Marine and Wildlife Resources, American Samoan Government	Lihir Mining Company	Seychelles Fisheries Authority
Fish and Wildlife, American Samoa	Ministry of State for Environment, Indonesia	The Nature Conservancy
Food and Agriculture Organisation (FAO)	Minnesota Sea Grant College Program	Trophia, New Zealand
Hong Kong Harbour Authority	National Oceanic and Atmospheric Administration	United Water International
International Marinelife Alliance, Hawaii	Packard Foundation	World Intellectual Property Organisation
		World Wide Fund for Nature

Universities and research institutions

Bermuda Marine Biological Laboratory	Kosrae Development Review Commission	University of New Hampshire, USA
Coral Reef Research Foundation, Palau	North Carolina State University	University of Malaysia Sabah
Department of Agriculture, Land and Fisheries, Kosrae	Palau International Coral Reef Centre	University of Miami (Rosentheil School of Marine and Atmospheric Science)
East West Centre and Ocean Policies Institute	Purdue University, USA	University of Philippines
Field Museum of Natural History, Chicago	Smithsonian Institution	University of Rhode Island
Finnish Game and Fisheries Research Institute	Simon Bolivar University, Venezuela	University of South Florida
Fisheries PNG	Stanford University, USA	University of the South Pacific
Iceland Department of Fisheries	Stennis Space Center, USA	University of Washington
Kasetsart University (Bangkok, Thailand)	Sultan Qaboos University, Oman	University of Windsor
	Texas A & M University	US Fish and Wildlife Service
	The Nature Conservancy (FSM, Palau, PNG)	World Conservation Monitoring Centre
	University of Capetown, South Africa	
	University of Guam	

4. RESEARCH

RESEARCH



CRC Reef scientists are surveying ports for introduced pests, including the Asian green mussel.

Photo: Michael Rasheed, DPI.

Highlights

- CRC Reef researchers convened a workshop responding to the presence of an introduced pest, the Asian green mussel, in Cairns harbour. The workshop included Queensland Ports, EPA, QDPI, AQIS, CCIMPE and the Northern Territory Museum.
- For the first time, CRC Reef PhD student Mr Guido Parra has assessed populations of coastal dolphins in Australia. He was invited to present his results to the International Whaling Commission in Japan and to a conference in the Philippines on the conservation of marine mammals in SE Asia.
- CRC Reef researchers, Assoc Prof Tom Hardy, Mr Luciano Mason and Mr Jason McConochie were awarded the Kevin Stark Memorial Medal for Excellence in Coastal and Ocean Engineering, by the National Committee on Coastal and Ocean Engineering for their work on the Cyclone Wave Atlas. The atlas is already being used with Pontoon Guidelines by GBRMPA and the tourism industry to achieve world's best practice in optimising construction and mooring of offshore structures in the GBRWHA.
- CRC Reef researcher Dr Rob Coles co-edited a book on Global Seagrass Research Methods that brings together 51 authors from around the world to provide a useful and comprehensive set of research methods for scientists and the community monitoring of seagrass.
- CRC Reef researchers contributed expert advice and powerful decision making tools to support GBRMPA's Representative Areas Program.

Program A. Conserving World Heritage values

Program Leader: Professor Helene Marsh, JCU

OBJECTIVE



PhD student Vimoksalehi Lukoschek is investigating the genetics of sea snakes.

Photo: Emma Hutchinson

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 traditional focus of natural resource management in Australia is broadening from the biological and physical aspects of natural resources to incorporate social, cultural and economic factors into the policy, planning and design processes. Research in this program will document the social, cultural and economic values of the World Heritage Area. Threatened species are a key component of the reasons why the region was listed as a World Heritage Area. This program will provide critical information of relevance to industry and management with respect to the conservation values of threatened species.

During 2001–02, Program A, formerly called Management For Sustainability, was reorganised into a new program - Conserving World Heritage Values. CRC Reef's Board approved the program restructure in November 2001 and the changes were implemented immediately with regard to program management. Full implementation with respect to financial reporting was postponed until the start of the 2002–2003 financial year to minimise complexity in the end-of-year accounts.

The new program has two projects: Use and Value of the World Heritage Area (A3) (which contains most of the tasks from the former program, Management for Sustainability); and Species Conservation (A4) (which includes marine wildlife projects from Project C1, Biodiversity: status and trends).

We report here against the revised objectives resulting from the new structural arrangements.

Project A3. Use and value of the World Heritage Area

Project Leader: Professor Stephen Crook, JCU

Dr Mark Fenton and Ms Nadine Marshall studied the social and economic links between Queensland's commercial fishing resource and communities along the coast. With the help of a team of trained interviewers, the researchers spoke by telephone with 1,544 fishers living between Karumba and Southport. The fishers provided information about the fishing business, the location of homeports, years of operation in business, number and size of boats and type of timing of fishing activities. They answered questions about their number of employees, and about business spending as well as about their families and household spending. This study provides a snapshot of how Queensland coastal communities use and depend on Queensland's seafood industries and can be used to: (1) assess the net economic and

social benefits to commercial fishing; and (2) develop measures which will enhance the sustainability of managed resources while minimising negative social and economic impacts of management decision-making on commercial fishers.

Dr Helen Ross and **Mr James Innes** and their co-workers established an arrangement with the Indigenous group Sea Forum to co-manage their research project which aims to provide information and support for GBRMPA and Indigenous traditional owners in developing a process and structure for cooperative management of areas and natural resources within the World Heritage Area. Indigenous groups are developing case studies to record Indigenous and partnership experience relating to co-management and Indigenous views on how co-management could evolve. These matters have been discussed at several conferences including the Indigenous voices conference organised by the Rainforest CRC and a follow-up meeting organised by CRC Reef.

Ms Melissa Nursey-Bray has used her recent experience as a Churchill Fellow studying the abalone fishery in South Africa to inform her PhD research on Indigenous hunting in the GBRWHA, which uses Hope Vale and Yarrabah communities as case studies. Ms Nursey-Bray has documented Indigenous and western perspectives on Indigenous hunting and planning with a view to understanding their implications for co-management regimes in the Great Barrier Reef (GBR) region. Her thesis is that co-management must incorporate the entire cultural perspectives of both parties, not just the charismatic aspects. For example, some Indigenous hunters believe that turtles must be butchered alive and on the beach to ensure their right to life. These hunters believe that is only through live butchering that the turtle's spirit, through its blood, can be returned to the ancestors and the sea. Such beliefs represent considerable challenges for decision makers and other stakeholders working within western cultural paradigms.

Dr Merrilyn Wasson's research aims to make available to the partners of the CRC Reef accessible information on the changes to the legal and institutional frameworks affecting the intellectual property associated with the biodiversity of the GBRWHA. Dr Wasson convened and organised an international symposium to coincide with a preparatory meeting for the United Nations World Sustainable Development Summit in Bali in June 2002.

Professor Malcolm Waters recently assumed leadership of this project as a result of the serious illness of Professor Crook.

Project A4. Species conservation

Project Leader: Professor Helene Marsh, JCU

The outcomes of this project are having significant policy influence in international forums as well as on the revision of zoning presently underway within the Great Barrier Reef Marine Park (GBRMP). The Dugong Status Report and Action Plans for Countries and Territories produced with support from CRC Reef, the United Nations Environment Program, the World Conservation Union and its Species Survival Commission, the World Conservation and Monitoring Centre and JCU was launched at a meeting of the world's environment ministers in February 2002. This document, which reviews knowledge of dugong biology and conservation throughout its range in 37 countries, formed the basis for a review of the status of the dugong at an international symposium and workshop on the Marine Mammals of south-east Asia and will form the basis for a parallel review in Japan in September 2002.

Mr Guido Parra's work on coastal dolphins in the GBRWHA informed the deliberations of the International Whaling Commission's Small Cetacean Sub-Committee in Japan as well as a meeting on the conservation of marine mammals in SE Asia held in the Philippines. Mr Parra has found substantial populations of coastal dolphins in the Great Barrier Reef region. This is the first information on the ecology and behaviour of these animals in coastal waters.

Space-age technology is being used to overcome the challenge of studying the biology of cryptic marine mammals, particularly dugongs. One of the primary issues for dugong conservation is their relationship with their food supply, seagrass. There has been considerable research on dugong feeding ecology, with their preference for pioneer species of seagrasses well established. However, little is known about how dugongs use sub-areas within their home ranges. There is no information about the movements and foraging of dugongs over short times and small distances so it has been impossible to build an accurate model of dugong foraging. To understand dugong foraging, several fixes per hour with accuracy of the order of a few metres are needed. Previous satellite tracking technology in the GBRWHA could not achieve this resolution so it was impossible to determine whether dugongs move between bays using definite corridors. This information is needed to develop rules for the attendance of commercial gill netters at nets outside Dugong Protection Areas. Dugongs are now being tracked using tags that incorporate Geographic Positioning System (GPS) technology so that their movements can be recorded continuously, at scales never before possible. Coupled with timed depth recorders this will make it possible to accurately locate animals, and identify the nature of their behaviour. This resolution is essential to describe, at an appropriate scale, the foraging of dugongs on a spatially and temporally variable resource such as seagrass.

PhD student **Ms Amanda Hodgson** has developed a 'blimp cam' to overcome some of the problems of watching cryptic marine mammals. The 'blimp-cam' is a remote-controlled video camera that is suspended from a helium-filled aerostat balloon tethered to a vessel by a 50 m cable. This arrangement has allowed her to obtain footage of the detailed behaviour of individual dugongs and dugong herds, including their reaction to boat traffic. Her research shows that dugongs react to boats only at the last minute, which explains their susceptibility to boat strikes.



PhD student Amanda Hodgson is using a video camera mounted on a balloon to track the movements of dugongs.

Photo: Helene Marsh, CRC Reef.

Summary of tasks

Project A3. Use and value of the World Heritage Area

Spatial allocation of Great Barrier Reef use (Phase 2)	.Ms B Breen (JCU)
Towards cooperative management of Indigenous hunting by a remote community in the GBRWHA	.Ms M Nursey-Bray (JCU)
A conceptual and operational understanding of resource dependency	.Ms N Marshall (JCU)
Cultural heritage of the GBRWHA	.Dr D Roe, Ms C Pocock (JCU)
Cultural heritage management of two World Heritage communities	.Ms J Harrington (JCU)
Supporting development of co-management by GBRMPA with indigenous and other stakeholders	.Prof H Ross (UQ)
Genetic resource ownership issues in the GBRWHA	.Dr M Wasson (ANU)

Project A4. Species conservation

Conservation genetics of sea snakes in Australian waters, with emphasis on the GBRWHA	.Ms V Lukoschek (JCU)
Seabird management in the GBRWHA - management and monitoring	.Dr E Gyuris (JCU)
Seabird management in the GBRWHA - population genetics of roseate terns	.Ms A Lashko (JCU)
Role of environmental factors in distribution of breeding seabird populations in the GBR	.Mr D Grover (JCU)
An ecological basis for managing dugong and green turtles in the GBRWHA	.Prof H Marsh (JCU)
The impacts of anthropogenic noise on coastal marine mammals: dugongs and dolphins	.Ms A Hodgson (JCU)
Dugong management and satellite tracking	.Mr J Sheppard (JCU)
Workshop: stranded marine mammals and turtles on urban coast of Queensland	.Prof H Marsh (JCU)
Ecology and conservation biology of coastal dolphins	.Mr G Parra (JCU)

Program B. Sustainable industries

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.

The Great Barrier Reef World Heritage Area (GBRWHA) and Marine Park is a multiple use system within which the biophysical properties of the GBR are central to its World Heritage Status. Balancing the benefits of development against its threats to nature is often difficult and sometimes controversial. Successful management hinges on the appropriate regulation of human use, and assumes that the biophysical system will 'look after 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 seek to provide sufficient information about the uses of the GBRWHA for regulation and best practice to be put in place so that those uses do not threaten the key World Heritage Values of the region and remain both economically and socially viable.

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

As part of the restructure of programs, several of the projects have been re-named (Program B2, Sustainable Tourism has become Tourism, and Program B3, Innovative Engineering has become Engineering and Environmental Control).

Project B1. Ports and shipping

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 (WHA) annually, often carrying cargoes that we would not want released in an accident. These activities are vital to the normal social and economic function of Queensland but pose obvious potential risks to the environment.

There has been considerable consolidation of the Ports and Shipping project in the last year. The team working on exotic pests has relocated to Cairns to join forces with the habitat survey team. This has improved coordination across project activities, and efficiency in project management and fieldwork. Shortly after the move, the aggressively invasive Asian green mussel was discovered in Cairns harbour and the CRC Reef Ports and Shipping team took the lead in coordinating a response to the incident. A workshop of major stakeholders

convened by CRC Reef resulted in a national response to the discovery and a concerted effort to eliminate the mussel from Cairns harbour.

Close engagement with industry has been a feature of the Ports and Shipping project since its establishment two years ago; the research team now enjoys widespread support with ports authorities and other industry sectors throughout tropical Australia. Work has been initiated or completed during 2001-02 in several ports, including Trinity Inlet, Mackay, Townsville and Thursday Island.

CRC Reef's work on invasive pests has received international recognition through invitations for **Dr Kerry Neil** and **Mr Oliver Floerl** to attend specialist international working groups on the issues of marine species translocations. In particular, Mr Floerl's PhD thesis on the potential for pest introductions and appropriate mitigation measures in small coastal recreational marinas has provided new insights into risks associated with coastal shipping activities.

The Ports and Shipping project is a good model of integration of research activities across disciplines, with new initiatives being taken to integrate port surveys for native habitats, surveys for introduced pests and modelling of water movements and sediment transport in and around ports. The modelling work arising from the Engineering and Environmental Control team provides tools that allow prediction of the fate of pollutants, exotic pest larvae and sediments that might be released as a result of accidents in ports. This predictive capacity proved particularly useful in devising response to the discovery of Asian green mussels in the Cairns Port. Linking the hydrodynamic and sediment transport models with knowledge of habitats around ports will be a great aid to planning port development and response to potential mishaps.

Project B2. Tourism

Project Leader: Dr Gianna Moscardo, JCU

Three themes dominated the research activities of the Tourism project this year. The first was the completion and consolidation of a tourism data web. The second was the use of this tourism data web to explore longer-term strategic planning issues for GBR tourism, and the third was the use of reliable research evidence to develop specific tourism products and services.

Substantial progress was made in 2001-02 in consolidating a set of databases that describe different aspects of tourism in the GBRWHA. Some activities that provided inputs for the databases included the completion of a major survey of reef visitors, surveys of reef tourism personnel, audits of media coverage of the GBR and competitor destinations, and surveys of regional visitors who do not go to the GBR. The completion of several data collection exercises meant that the tourism data web was active and available to respond to user requests.

The last year has been a challenging one for Australian tourism with major and unanticipated declines in international travel in general and disruptions to airline services as a result of terrorist activity and the collapse of Ansett Airlines. Such events highlight the need for a sound, accurate and detailed understanding of how various factors influence the patterns of tourism that are found in the GBRWHA. Many reef tourism operators found themselves in a new marketplace with different constraints and opportunities. This precipitated an increased need to understand the nature of their markets. The researchers were able to use the tourism data web to respond to dozens of operator requests for such market information.



CRC Reef researchers are working with industry to survey reef tourists to find out how they use the reef and their satisfaction with their experience.

Photo: Rob Parsons.

The changing patterns of reef tourism are of concern to the operators and the public sector managers responsible for this aspect of the GBRWHA. Several of the research activities this year focused on answering requests from the GBRMPA about the nature of tourism use of the GBR. In addition to answering immediate requests for descriptive information, the tourism data web was also used to conduct more strategic and longer-term analyses. In particular, considerable effort was given to identifying and explaining patterns of change in reef tourism to develop predictive models that support longer term, more proactive tourism planning.

Finally, several tasks were involved in developing more specific tourism products and services to support sustainable reef tourism. These included research into reef personnel reviews on training needs and the development of interpretive resources and products to improve interaction between visitors and reef wildlife, especially dwarf minke whales along the ribbon reefs of the far northern GBR.

Project B3. Engineering and environmental control

Project Leader: Associate Professor Tom Hardy, JCU

The project team realised a number of important milestones in 2001–02. In particular, **Associate Professor Tom Hardy, Mr Jason McConochie and Mr Luciano Mason** were awarded the Kevin Stark Memorial Medal for Excellence in Coastal and Ocean Engineering, by the National Committee on Coastal and Ocean Engineering for the Atlas of Cyclone Waves in the Great Barrier Reef. This was a significant achievement for these three researchers, as well as for CRC Reef.

The Atlas of Cyclone Waves received much positive media attention including: local and national newspapers (Cairns Post, Townsville Bulletin, Courier Mail, The Australian); local and regional TV (WIN TV, WIN Gold Coast news); national and international radio (ABC, German) and international print (New Scientist).

The Atlas is an important input to written guidelines for reef infrastructure (Reef Infrastructure Guidelines: Tourist Pontoons), substantial parts of which have already been incorporated into new policies by GBRMPA.

A computer program has been developed to analyse historical wind data during tropical cyclones. This tool provides capability to develop wind statistics from available wind data which can be used to help understand the quality of synthetic cyclone wind statistics. Unlike historical data, available at a limited number of unevenly spaced weather observation stations, the synthetic cyclone statistics being developed provide data over the entire GBR. Simulations of winds during approximately 20,000 simulated tropical cyclones have been completed and the results are being incorporated into the Atlas of Cyclone Waves. Wave modelling capabilities are being further enhanced by developing fine-scale modelling that has biological, engineering and management applications. To date, the models can reproduce wave data measured during tropical cyclones inside the GBR matrix as well as inside the lagoon of a single reef. We believe that continued development will produce a world-class solution to the problem of predicting waves in the complex reef matrix of the GBR.

The wave models and expertise developed in the Engineering and Environmental Control project are being used to represent the nearshore wave climate for the *Tropical Cyclone Wave Impacts* task.

Fine-scale current modelling is being extended to include the entire GBRWHA. A challenging aspect of this work that has been completed is the capability to model the East Australian Current (EAC) and its influences on GBR circulation. The EAC is important for understanding many water-borne processes in the GBR, including larval and pollutant transport.

Several Honours projects have been completed or are ongoing. In *An Audit of Mooring Designs of Tourist Pontoons in the Great Barrier Reef*, an audit system for tourist pontoon infrastructure was developed and tested. Audits of three pontoons were conducted with the assistance of GBRMPA staff and with logistics support from the operators. Other Honours projects include *Modelling Shallow Water Waves in Coral Reef Regions*, developing computer analysis tools to aid in the design of mooring systems for reef pontoons, *Modelling Super Cyclones at Curacao Island*.

Project B4. Fishing and fisheries

*Project Leader: Dr Bruce Mapstone, JCU
CRC Reef*

This year, there has been consolidation of existing directions and the broadening of research in the Fishing and Fisheries project. Consolidation included progress with reports on two major existing projects (Effects of Line Fishing Project and research on red-throat emperor), successful completion of another set of annual surveys in the Effects of Line Fishing (ELF) Experiment, and review of progress on monitoring and assessment work on a range of inshore and nearshore fisheries.

Expansion of the scope of the Fishing and Fisheries project included the start of two new projects funded jointly by CRC Reef and the Fisheries Research & Development Corporation (FRDC). The first of these projects will gain better understanding of the status and biology of Spanish mackerel stocks along the east coast of Queensland. The project involves considerable assistance from recreational and commercial fishers from the Gold Coast to Innisfail, as well as the help of various seafood processors and tackle shop owners who act as collection points for samples. The second project involves modelling how fishing fleets respond to changes in the species composition of their catches. The project will improve our ability to predict how

management strategies influence fishing behaviour and, ultimately, impacts on fish stocks. Of special note this year also is the employment of a fisheries modeller, **Dr Ian Montgomery**, with the Fishing and Fisheries team. Dr Montgomery brings considerable experience in fisheries modelling, training and research from NSW and Victoria.

Several postgraduate students from the Fishing and Fisheries project graduated last year, having made significant contributions to our understanding of harvested species and fisheries on the GBR. **Drs Jake Kritzer, Jacobus Mosse** and **John Kung** graduated with PhDs and **Mr David Welch** gained an MSc after research into aspects of the GBR reef line and aquarium fish fisheries. These and other students working in the Fishing and Fisheries project have provided research that has made important contributions to the development of management arrangements for the Reef Line fishery on the GBR, especially in establishing appropriate legal size limits for harvested species.

As in previous years, engagement with stakeholders continued to be a critical aspect of the Fishing and Fisheries project, with close associations being maintained between project staff and fishers, managers and other stakeholder groups along the east coast and in the Torres Strait. CRC Reef expertise was recognised by invitations to staff to participate in invitation-only international fisheries symposia in the United States and Scotland, workshops on the assessment of spotted and Spanish mackerel stocks, finfish and rock lobster working groups in the Torres Strait, and by-catch action planning for the net fisheries in the Gulf of Carpentaria.

Summary of tasks

Project B1. Ports and shipping

Baseline surveys – Cairns, Weipa, Karumba, Townsville, Port of Cape Flattery and Port of Gove . . . . .	.Dr K Neil (QDPI)
Port surveys . . . . .	.Dr K Neil (QDPI)
The potential of recreational vessels and boating marinas spreading marine fouling organisms . . . . .	.Mr O Floerl (JCU)
Hydrodynamic modelling of coastal ports . . . . .	.Assoc Prof T Hardy (JCU)
Identification and monitoring of habitats critical to the GBRWHA in or adjacent to shipping	
lanes and coastal ports . . . . .	.Dr M Rasheed (QDPI)
Ballast water treatment pilot study . . . . .	.Dr P Schneider (JCU)

Project B2. Tourism

Understanding tourist use of the GBRWHA . . . . .	.Dr G Moscardo (JCU)
Great Barrier Reef: destination image and competitiveness . . . . .	.Prof P Pearce (JCU)
Visitor strategic response project . . . . .	.Dr G Moscardo (JCU)
Improving the sustainability of visitor-wildlife interaction . . . . .	.Dr G Moscardo (JCU)
Reef industry personnel: information, training and career needs . . . . .	.Prof P Pearce (JCU)
Analysis of Environmental Management Charge (EMC) returns . . . . .	.Mr B Lee (GBRMPA)
Towards ecologically sustainable dwarf minke whale tourism . . . . .	.Dr A Birtles (JCU)



CRC Reef researchers are working with fishers to gather information to help management of Queensland's fishing resources.

Photo: CRC Reef.

Summary of tasks *(continued)*

Project B3. Engineering and environmental control

Influence of groundwater and surface water in GBR water quality	Assoc Prof T Hardy (JCU)
Engineering guidelines	Assoc Prof T Hardy (JCU)
Interactive atlas of winds and waves of the GBRWHA	Assoc Prof T Hardy (JCU)
Fine-scale wave modelling	Assoc Prof T Hardy (JCU)
Best-practice mooring and pontoon design	Assoc Prof T Hardy (JCU)
Extension of fine-scale circulation models from the Cairns Section to the whole GBR	Dr L Bode (JCU)

Project B4. Fishing and fisheries

Effect of two-tiered management regime on catch characteristics of recreational and commercial charter line fisheries in tropical estuaries	Ms R Partridge (JCU)
Stock structure of commercially important serranid species in the GBR and adjacent reef systems	Prof H Choat (JCU)
Population biology of red bass	Mr R Marriott (JCU)
Exploitation dynamics and biological characteristics of east coast Spanish mackerel harvested by recreational and commercial sectors	Dr A Tobin (JCU)
Predator-prey dynamics in coral reef fish	Mr A Abdulla (JCU)
Proposal to establish a cooperative regional research centre in the APEC region	Dr B Kerrigan (JCU)
Implementation of fishing and fisheries research	Dr B Mapstone (JCU)
Regional differences in coral trout reproductive biology	Ms S Adams (JCU)
Proper biology	Ms R Pears (JCU)
The effects of line fishing on the GBR	Dr B Mapstone (JCU)
Population dynamics and stock structure of the red-throat emperor and other targets of the Queensland tropical coral reef line fishery	Dr C Davies (NOO)
Abundance estimates of large mobile and sedentary fish	Prof H Choat (JCU)
Modelling multi-species fishery dynamics	Dr B Mapstone (JCU)
Modelling multi-species targeting of fishing effort in the Queensland coral reef finfish fishery	Dr B Mapstone (JCU)
Coastal fisheries resource monitoring and stock assessment in the GBRWHA	Mr R Garrett (QDPI)
Liaison and information management for fishing and fisheries research	Drs B Mapstone, A Jones (JCU)
Measurement uncertainty and post-capture changes in size of coral trout in the live reef fish fishery	Mr C Lunow (QDPI)
Review of reef line fishing in eastern Torres Strait	Dr B Mapstone (JCU)
Reef fish dispersal	Ms R Fisher (JCU)
Otolith based tests of connectivity	Ms M Bergenius (JCU)
Larval ecology and connectivity	Ms J Eagle (JCU)
An ecological economics approach to fisheries where latent effort exists	Mr G Muldoon (JCU)
Spatial variation in population dynamics of red-throat emperor	Mr A Williams (JCU)



CRC Reef researchers are
investigating the effects of
line fishing on the reef.

Photo: CRC Reef.

Program C. Maintaining ecosystem quality

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 quality and well-being of the reef ecosystem. However, there is generally a lack of historical benchmarks against which to measure change, and few agreed performance indicators to assess the status of the ecosystem and/or its sub-components. Detecting anthropogenic impact in ecosystems is often challenging because it takes place in a highly variable natural environment. Besides the obvious potential for local depletions and pollution due to inappropriate uses within the zone, coastal marine ecosystems are affected by climate change and impacts from both the landward and seaward margins.

This program is a balanced package of mapping, monitoring and strategic process-oriented research that aims to establish benchmarks and performance indicators that will 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 across critical issues in the areas of biodiversity, water quality, and coral bleaching (details below). It was a year of solid achievements backed by 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 a number of community-based monitoring projects.

Program restructuring resulted in tasks on vertebrates (dugong, sea turtles, sea birds, sea snakes) being transferred to a new project on Species Conservation in Program A. A new project for crown-of-thorns starfish (COTS) was created in the program although it has had only one active task (reconciliation of results from fine- and broad-scale monitoring). Two bids were made to the CRC Secretariat for supplementary funding to support a new program of research for the Torres Strait, and to support joint work with CRC Rainforest aimed at improving water quality in coastal areas of the GBRWHA. Recent deaths of two tourists to the GBR from the irukandji syndrome has brought a lot of focus on marine stingers and offers of new funding.

Project C1. Biodiversity: status and trends

Project Leader: Dr Peter Doherty, AIMS

With the transfer of the marine vertebrates task to Program A, this project retains three main elements: seafloor biodiversity, coral reefs and marine plants.

Phase 1 of the seafloor task was concluded during the year with the production of two technical reports. The major report, authored by staff from three research providers (CSIRO, AIMS, QDPI) canvassed the technical challenges of sampling fixed and motile biodiversity over 210,000 km² of seafloor within the GBRMP. The analysis was based on a comprehensive analysis of the lessons learned from past investments, such as the GBRMPA/CSIRO/QDPI study into the effects of trawling and the

CRC Reef/QDPI surveys of deep-water seagrass habitats. New research was commissioned to compare the performance of video with traditional sampling methods such as small otter trawls, recognising the need to use non-extractive methods in highly protected zones. Both reports were exposed and discussed in a stakeholder workshop. Their results will guide the design of an effective and efficient program of mapping seafloor communities aimed at identifying biodiversity hotspots and habitats critical to the conservation of unique biodiversity.

The long-term monitoring team (LTMT) at AIMS completed its 10th consecutive survey of coral reef health across the GBR. A third wave of crown-of-thorns starfish moving through the central GBR represented the major disturbance to coral and fish communities. While the cycles in coral cover look increasingly like fire-induced changes to terrestrial landscapes, starfish outbreaks can bring a serious additional cost to tourist

operations dependent on access to seascapes with high visual amenity. During the year, the LTM team assisted AMPTO, one of CRC Reef's industry partners, to obtain relief funding from the Queensland and Commonwealth Governments for hand-control programs of starfish around key sites with heavy tourist visitation, by certifying the efficacy of such operations. The additional funding allowed another CRC Reef partner (GBRRF) to purchase a small research vessel, MV Foundation One. In addition to servicing the COTS control program, this vessel will provide CRC Reef with additional, cost-effective access to the entire GBR for other research and management issues.



CRC Reef supported the marine tourism industry in its successful bid for financial assistance to support control of crown-of-thorns starfish at key tourism sites on the Great Barrier Reef.

Photo: GBRMPA.

During the year, the LTMT published its fifth report on the status of the GBR in paper and electronic form. The publication covers monitoring surveys until 2000 with more recent work available on the internet. Currently, primary results from each research cruise are available within six weeks of returning from sea as electronic posts on the AIMS website www.aims.gov.au. The utility of this reporting about the condition and trend in near real-time is invaluable for managers as revealed in the comment by the Task Associate "GBRMPA staff use the site on a daily basis."

The Marine Plants Group (MPG) based in QDPI's Northern Fisheries Centre continued its enviable record of producing results used immediately by others. Last year, the MPG finished collating and validating maps of seagrass communities for the coast of Queensland. These maps were distributed on CD and will be available on the QDPI website. Already such maps have been used by GBRMPA and Queensland Environmental Protection Agency (QEPA) to designate Dugong Protection Areas.

Repeated surveys in some areas have revealed the ephemeral but resilient nature of seagrass meadows. Much of this information was derived from community-based monitoring. The MPG supports volunteer groups in seven regions between

Cairns and Moreton Bay. This influence was obvious at the last Hervey Bay Seafood Festival, with the theme: Seagrass – Sustainable Fisheries Habitat. Alongside the festival, the MPG held an international Seagrass-Watch Forum, attracting 120 scientists, community volunteers and natural resource managers. Students from Bentley Park College in Cairns completed the Seagrass WebSite on the CRC Reef website which was launched at the forum.

Reaching beyond Queensland, the MPG convened an international conference in the Philippines in partnership with the University of New Hampshire. Supported by funds from the David and Lucille Packard philanthropic foundation, the MPG produced a landmark book on seagrass monitoring which will do much to ensure a uniform approach to global assessments of condition and trends in seagrass communities. After the workshop, standardised monitoring programs began in seven countries.

Project C2. Water quality

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.

Water sampling and related analytical work to estimate nutrient exports from a range of river catchments has been completed, providing comprehensive estimates of inputs of nutrients from the land to the GBRWHA. Annual exports of important forms of nitrogen and phosphorus from wet and dry catchments are strongly correlated with annual discharge volume. Discharges from dry catchments carry most of the sediment and nutrients reaching the reef. Estimates of total sediment, nitrogen and phosphorus inputs to the GBRWHA derived from these results have provided a solid foundation to GBRMPA's Water Quality Action Plan (www.gbrmpa.gov.au) which has set targets for reducing sediment and nutrient loads leaving coastal rivers. Because of the social and economic implications arising from the need for changed land use to meet the targets, one scientist was seconded to GBRMPA for six months to assist communication about runoff issues.

A landmark was achieved during the year with the project leader, **Dr Miles Furnas**, producing a draft of a book, *Catchment to Corals*, which will give the community and natural resource managers a comprehensive description of the GBR catchment and terrestrial runoff to the GBR. This book will be published in 2002–03.

A second book is planned which focuses on the Herbert River in far north Queensland. The book will integrate the rich knowledge about one of the most intensively studied systems in northern Queensland. The book will transmit the best available scientific understanding of land-sea issues to land-holders and natural resource managers. It brings together contributors from many research providers (AIMS, ANU, CSIRO, JCU, Queensland Department of Natural Resources (QDNR)) and CRC Reef and CRC Sugar. A comprehensive technical monograph was drafted but, following extensive public consultation, the authors proposed a more accessible document which highlights the key results and their implications for land management in the Herbert Catchment. A meeting of stakeholders strongly endorsed this direction, and subsequent actions have been discussed with the Sugar R&D Corporation and the CaneGrowers organisation.

A two-year field program to describe and compare coral reef communities on nearshore islands adjacent to agricultural catchments in the wet tropics and relatively pristine catchments adjacent to Cape York Peninsula was completed. Nearshore reefs in the northern study area (13°S) were found to have higher coral cover, coral diversity, coral recruitment and recruit survival than reefs adjacent to the wet tropics (17°-18°S). These factors directly affect the capacity of reef systems to recover from natural and human disturbances. Macro-algal populations are seasonally abundant on reefs at both sites. During the summer of 2001–02, significant bleaching was observed on both sets of reefs. Continued monitoring of these reefs will provide a unique opportunity to observe reef responses to disturbance events in environments that are characterised by high and low levels of human-influenced runoff.

Computer simulation models of shelf-scale plume dynamics of the Burdekin River were expanded to include runoff inputs from all major rivers between the Burdekin (20°S) and Normanby (16°S) Rivers between 1966–2000. The simulated plume distributions were used to estimate return-periods for reef exposure to lower-salinity waters on the shelf between Townsville and Cairns. An important finding is that during “large” wet seasons, most of the central GBR shelf can be influenced by runoff for several weeks.

In Papua New Guinea, **Ms Sea Rotmann**, a postgraduate student supported by CRC Reef, has established that tissue thickness in massive corals may provide a cost-effective tool for detecting sub-lethal stress arising from environmental impacts. Ms Rotmann has been studying the impacts from disposal of mine tailings into the sea. The support of the industry partner, Lihir Mining Company, BHP-Billiton, is acknowledged.

Project C4. Climate change and coral bleaching

Project Leader: Dr Janice Lough, AIMS

The enhanced Greenhouse effect is warming global and regional temperatures. Rising sea surface temperatures (SST) increase the probability that the local threshold for coral bleaching will be exceeded. Mass coral bleaching was observed on the GBR in the summer of 1998 (arising from the 1997-98 El Nino Southern Oscillation (ENSO)) and again in the summer of 2002. Coral reefs are clearly sensitive to climate change and were highlighted as a “unique and threatened ecosystem” in the recent Intergovernmental Panel on Climate Change (IPCC) Third Assessment Report. Increasing frequency of bleaching on the GBR is likely to alter the makeup of the ecosystem because the vulnerability and adaptive capacity varies with coral species and location.

This project integrates high-resolution monitoring of the physical environment of the GBRWHA with experimental studies into the potential for corals to adapt and/or acclimate to climate change. High-resolution data are provided by satellite records that are validated by an extensive network of loggers (45 sites, 7.1 million records) and oceanographic moorings which measure currents, tides and sea level. Integration highlights the role played by water column mixing as a local factor influencing the regional severity of coral bleaching within the global trend. A preliminary “risk” map for bleaching, based on the 1998 event, is now being refined.

The logger program has enabled the development of bleaching and mortality curves for various reef locations. Worryingly, experimental studies, including reciprocal transplant experiments, have provided no evidence to suggest that corals can adapt or acclimate to rapid temperature changes. Observational studies have also highlighted highly species-specific differences in sensitivity and mortality due to coral bleaching.

The integration of biological and environmental information in this project was fundamental to the implementation of a bleaching response strategy by GBRMPA in early 2002. By early January, daily monitoring of water temperatures combined with “hotspot” information from NOAA satellites indicated that thresholds for coral bleaching were being exceeded on the GBR. In response to this real-time alert, GBRMPA funded aerial surveys of the Marine Park, which means that the 2002 bleaching in the GBRWHA was probably the best-monitored event in both space and time. Unfortunately, 2002 was also the worst recorded bleaching episode on the GBR, with more widespread effects. All users of the GBR must now be concerned about its immediate future. The following extract from the GBRMPA website summarises the current situation:

“Unusually warm water experienced over the summer of 2001/2002 has led to a mass-bleaching event on the GBR. This is the second mass-bleaching event to affect the GBR in five years. While most reefs have escaped without extensive death of corals, the extent of bleaching indicates that the majority of reefs within the GBRMP were exposed to stressful conditions. The potential for bleaching to cause severe ecological damage to entire coral reef ecosystems was seen during the 1998 bleaching event at several locations worldwide, including the Maldives, Tanzania and Sri Lanka. In both recent bleaching events (1998, 2002), the GBR has been fortunate to escape with extensive mortality of corals seen at only a few inshore reefs. The spatial extent of bleaching this year, combined with the mass death of corals seen at the worst affected reefs, provides a vivid warning of the potential for widespread and severe ecological damage should warm water events increase in severity, duration or frequency in the future.”



Surveys of coral bleaching on the Great Barrier Reef by researchers from CRC Reef, AIMS and GBRMPA found that bleaching in 2002 was the worst on record.

Photo: Ray Berkelmans, GBRMPA.

Summary of tasks

Project C1. Biodiversity: status and trends

Measuring the success of conservation strategies to protect scleractinian corals on the GBR	.Ms E Dinsdale (JCU)
Seabed biodiversity in the GBRWHA	.Dr R Pitcher (CSIRO), Dr P Doherty (AIMS)
Long-term monitoring of coral reefs within the GBRWHA	.Dr H Sweatman (AIMS)
Identifying critical marine plant habitats within the GBRWHA	.Mr L McKenzie (QDPI)
Population biology and biogeography of Caribbean and Indo-Pacific reef fishes	.Prof H Choat (JCU)
Seagrass monitoring of the western Pacific	.Dr R Coles (QDPI)

Project C2. Water quality

Nutrient inputs and coastal water quality	.Dr D Alongi (AIMS)
Water quality in undeveloped and pristine areas of the GBR catchment	.Mr J Brodie (JCU)
Impacts of terrestrial run-off on coastal reef communities	.Dr K Fabricius (AIMS)
Physiological tolerances of hard corals	.Ms S Anthony (JCU)
Terrestrial run-off into the GBRWHA - a synthesis	.Dr M Furnas (AIMS)
The movement of sediment and its biological impacts on reef corals	.Ms S Rotmann (JCU)
Herbert River integration study	.Dr D Williams (CRC)

Project C4. Climate change and coral bleaching

Regional dynamics in the marine climate of the GBRWHA	.Dr J Lough (AIMS)
Long-term monitoring of sea temperatures at PCQ ports	.Dr R Berkelmans (AIMS)

Project C5. Crown-of-thorns starfish

Fine-scale surveys of crown-of-thorns starfish in the Cairns Section of the GBRMP	.Mr U Engelhardt (Reefwatch)
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Program D. Reef Futures

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 the CRC Reef and its key client groups.

The program has been in a transition stage in 2001-02 and is now called the Reef Futures program. The name reflects one of CRC Reef's prime purposes of forward-looking analysis of the consequences of environmental change, use and management within the vast Great Barrier Reef World Heritage Area that is characterised by diverse geography, environmental gradients and patchiness, and variable natural disturbance regimes. In this first year with a full team, the program made excellent progress in developing systems and addressing priority issues for CRC Reef. The change in focus of the program has resulted in a revision of the program objectives, the new version of which are reported above.

Project D3. Knowledge exchange

While individual tasks across CRC Reef build knowledge transfer into their mode of operation and collaboration with particular client groups, this project acts as a forum for knowledge compilation, integration and transfer that operates across research tasks. This project, working in close cooperation with the Communication and Education section and the Exploring Reef Futures team, contributed several significant deliverables. These include: a major revision of the CRC Reef's web design and content to improve its functionality; a review of the outcomes and achievements of the seven years of the CRC for the Ecologically Sustainable Development of the GBR; an analysis and report on the GBR's coral harvest fishery that directly influenced policy development by the Commonwealth Government; updating and release of web-pages and brochure on water quality, climate change and coral bleaching, and marine mammals; leadership in a scientific response to deaths caused by the marine stinger irukandji; preparation of information for review of biophysical monitoring on the GBR; and facilitation of a major study to estimate the spatial patterns and return periods for river flood waters entering the GBR waters. Through this project, CRC Reef provided major sponsorship for the Conference 'Sustaining Aquatic Environments', which aimed to provide solutions to coastal water quality issues in Queensland, in association with the National Land and Water Audit and the Queensland Government's Department of Natural Resources and Mines. An innovative web-based task reporting system was also developed as part of this project.

Project D4. Exploring Reef Futures

One component of this project addresses a need to store and manage CRC Reef's scientific information resources, and to enhance the access by CRC Reef partners to those resources. Spatial data were given priority – both those generated within research projects and those acquired from external sources. A warehouse of spatial data was established, a suite of internet mapping and interrogation tools assembled, and introductory training seminars presented. One of the first major integrative applications to use the GIS was an investigation of the nature and causes of geographic patchiness of coral bleaching following the heat wave in summer 2002. Daily satellite sea-surface temperatures received by the AIMS receiving station were incorporated into the GIS and when juxtaposed on the coral reef map, helped to identify anomalous hot and cool areas for ecological investigation of coral bleaching impacts. The project also contributed to the mapping and analysis of changing land-use patterns in the GBR catchment, part of the large runoff and water quality project in Program C. A database and GIS of the many monitoring projects on the GBR was created in preparation for a major review of monitoring by CRC Reef and its member organisations.

Environmetrics is the name given to statistics, analysis and modelling of environmental and ecological data. Work in this project provided outcomes in three areas: software tools and support for the design, evaluation and monitoring of the Representative Areas Program; development of tools within research teams to address complex environmental and ecological issues; and enhanced statistical input into the design and analysis of CRC Reef projects. All these outcomes have enhanced the quality of advice that CRC Reef researchers can provide to partners in management and industry. The TRADER

software system was developed to complement existing MARXAN software and to develop zoning maps for the ongoing Representative Areas Program (RAP) being undertaken by GBRMPA. The maps must conform to strict design principles of place, size and replication, yet be able to be generated on a laptop computer with the speed and flexibility that allow exploration of any number of options that meet the principles while maximising accommodation of user wishes for access. GBRMPA's use and involvement in the development of TRADER is a good example of collaboration and uptake of a product of the project by one of CRC Reef's key partners.

The task on spatial decision support assembled information and developed prototype modelling tools that will allow us to explore future scenarios for coral reef appearance and ecology in the GBR. In an initial case study, we explored the consequences of predicted climate change on the frequency and severity of coral bleaching and death for three reefs for which bleaching temperature threshold curves were available. The 20–50 year outlooks of the model runs were generally pessimistic in terms of reef appearance and ecology, assuming there is negligible capacity for adaptation in the coral system. The capacity for natural system adaptation is very uncertain, and is being studied elsewhere in CRC Reef. Decisions will usually have to be made in the absence of certainty, so the project began to develop tools to accommodate the uncertainty. Three elements are included: 1. hazard mapping (likelihood functions for the future risks-of-exposure to damage from bleaching, cyclones, crown-of-thorns starfish and freshwater flood plumes);

2. disturbance-recovery modelling for coral reef communities to investigate the influence of water quality and abundance of reef grazers on recovery potential (i.e. system resilience); 3. scenario generation, to estimate the most likely consequence of future impacts (both anthropogenic and natural) on places of interest, such as recreational dive sites, mass tourism sites, highly protected areas or known fish spawning areas.



CRC Reef has published several brochures highlighting the state of knowledge about issues that are critical to the Great Barrier Reef.

Summary of tasks

Project D3. Knowledge exchange

Working groups and synthesis Assoc Prof V Harriott (JCU)
 Book: Geoscience on the Great Barrier Reef Dr P Larcombe (JCU)

Project D4. Exploring Reef Futures

Information management system Mr S Kininmonth (AIMS)
 Environmetrics and data mining Dr G De'ath (AIMS)
 Effects of water quality on the distribution of corals on coastal reefs: developing tools
 for environmental assessment and risk management Mr B Radford (JCU)
 Spatial decision support Dr S Wooldridge (AIMS)

5. EDUCATION AND TRAINING



CRC Reef PhD student Renae Partridge is checking whether there are differences between the number and type of fish caught in estuaries that are open and closed to commercial fishing.

Photo: Andrew Tobin, CRC Reef.

Program E. Education and Communication

Program Leader: Assoc Professor Vicki Harriott, JCU and CRC Reef

Objective

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

The Education and Communication Program in CRC Reef 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.

Highlights

- The second-year review by the CRC program praised CRC Reef students and their contribution to the research and education programs.
- Four postgraduate students supported by CRC Reef scholarships completed or submitted their theses.
- Five new postgraduate students were awarded scholarships and recruited into research programs for 2002, with a total of 22 students receiving CRC Reef stipends during 2001–2002.
- The Augmentative Grant Scheme was revised to focus on PhD and Masters students, providing research support for three Honours students and 10 postgraduate students.
- Student training including an innovative statistical support scheme, and short courses on intellectual property, presentation skills and scientific writing, was strongly supported by students.

Second-Year Review

Postgraduate students made a major contribution to the second-year review of CRC Reef. Following a summary presentation on the education program by **Assoc Prof Vicki Harriott**, three students made formal presentations and the panel met with a group of students for informal discussions. Panel comments on the education program included: "The involvement of graduate students in the program is a very notable feature of the CRC and their motivation by real world problems a very strong endorsement of the CRC's planning and education strategies" and "All aspects of the postgraduate program would seem to be outstandingly successful."

The panel was particularly impressed with the student/stakeholder fishing and fisheries research project workshop, which was organised and presented entirely by the graduate student group. The panel also commented favourably on the level of research and training support provided by CRC Reef for its students.

Student Induction Program

A comprehensive student induction program was offered in May 2002 and was very well-received by students starting their studies with CRC Reef. The postgraduate student orientation handbook was comprehensively revised and updated. It includes information about intellectual property, training and grant opportunities, and guidelines for funding student proposals.

Recruitment of Students

Five new PhD scholarships were awarded in 2001-2002 in the fields of environmental studies, marine biology and social science, bringing the total number of current scholarships awarded by CRC Reef to 22. The Centre also has 66 students registered as student associates i.e. they have an association with CRC Reef through their project or supervisor or through the receipt of financial support. These students are eligible to apply for training opportunities and travel awards.

Grants and Awards

CRC Reef continued to support student attendance at conferences. Seven students were supported with grants totalling \$7180 to attend both national and international conferences.

CRC Reef provided opportunities for student involvement at the undergraduate level through augmentative grants to support research costs. Augmentative Grants were awarded to three Honours students and 10 postgraduate students who become CRC Reef student associates.

Training

Students said that assistance with statistical analyses was their top priority for training support. Therefore, a statistical support service was initiated in July 2001 and continued into 2002. The service operates in conjunction with James Cook University and provides both individual consultation time with a statistical advisor and several short courses in topics of interest. The scheme has been very well supported by students and has received positive feedback.

Other student training opportunities included short courses in scientific writing, intellectual property and presentation skills. A one-day course in cross-cultural awareness was also available to students.

Successful Student Completions

Three CRC Reef scholarship postgraduate students completed their degrees in 2001-02, and another student submitted her thesis for examination. Completions and submissions by student associates are listed in the following tables.

Student Employment

The following current and recently completed students have been employed in positions relevant to their training with CRC Reef in the last 12 months.



CRC Reef PhD student Rachel Pears is investigating the life histories of gropers and cods.

Photo: Russell Kelley.

Employment History of Students (2001-02)

CRC Reef Postgraduate Scholarship students **Place of Employment**

Ms Elizabeth Dinsdale	GBRMPA, tourism management
Dr Jake Kritzer	Postdoctoral Fellow, University of Windsor
Mr Andrew Heap	Geoscience Australia, University of Tasmania
Mr David Welch	Queensland Department of Primary Industries
Mr Geoffrey Muldoon	International Marinelife Alliance, IMPAC, Townsville
Mr Alex Lambeck	Geoscience Australia, Canberra

Student associates

Mr Mark Gallagher	Executive Engineer, Water Studies Pty Ltd.
Mr Oliver Floerl	Postdoctoral Fellow, NIWA, New Zealand.
Ms Marji Puotinen	Lecturer, James Cook University
Ms Christine Schoenberg	Researcher, University of Queensland

CRC Reef students in 2001–02 comprise:

	Scholarship students*	Student associates
PhD student	28	39
MSc/ MSc qual. students	4	8
Honours level students	0	19
TOTAL	32	66

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

POSTGRADUATE STUDENTS

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	Commencement date	Supervisor	Status of study	Source of funding
S Adams	PhD	JCU/Task 5.5.7	Effects of fishing and regional variation on the sexual structure of <i>Plectropomus leopardus</i> and <i>P. laevis</i> populations on the GBR.	01.03.97	Prof H Choat (JCU) Dr B Molony (JCU) Dr B Mapstone (JCU)	Submitted	CRC Reef/ APA
S Anthony	PhD	JCU/ Task C2.3	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 P Southgate (JCU) Dr K Michalek-Wagner (GBRMPA)	Current	CRC Reef/ JCU
W Bailey	MEngSc	JCU/Task B1.2	Numerical modelling of the sediment transport in the GBR region.	02.01.01	Assoc Prof T Hardy (JCU) Prof J Patterson (JCU)	Current	CRC Reef/ APA
M Bergenius	PhD	JCU/Program B4.18S	Stock structure of common coral trout in the GBR.	18.06.01	Dr Gavin Begg (JCU) Dr B Mapstone (JCU) Assoc Prof G Russ (JCU)	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 A2.1.3	Measuring the success of conservation strategies to protect scleractinian corals on the GBR.	01.01.01	Assoc Prof V Harriott (JCU) Dr M Fenton (JCU) Mr P Valentine (JCU)	Current	CRC Reef
J Eagle	PhD	JCU/Program E	Larval accumulation areas: a tool for predicting reef fish population dynamics and connectivity.	30.06.01	Prof M Kingsford (JCU) Dr G Jones (JCU)	Current	CRC Reef/ APA
R Fisher	PhD	JCU/Task C3.3	The behavioural capabilities of tropical reef fish larvae: implications for dispersal during the pelagic phase.	28.06.99	Assoc Prof D Bellwood (JCU)	Current	CRC Reef/ APA
D Grover	MSc	JCU/Task C1.4.2.2	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	CRC Reef
J Harrington	PhD	JCU/Task 1.3.2S	Valuing a place; how do communities identify cultural heritage significance? A comparative study in two World Heritage areas.	29.03.99	Dr S Greer (JCU) Dr D Miles (JCU)	Current	CRC Reef/ APA
A Heap	PhD	JCU/Task 1.3.1	Sedimentology of the Whitsundays.	17.02.97	Dr P Larcombe (JCU) Dr G Dickens (JCU)	Completed	CRC Reef

Name	Degree	Institution enrolled/ task affiliation	Thesis title	Commencement date	Supervisor	Status of study	Source of funding
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	Impacts of anthropogenic noise on dugongs and coastal dolphins.	27.03.00	Prof H Marsh (JCU) Dr L Chilvers (JCU)	Current	CRC Reef/ APA
J Kritzer	PhD	JCU/Task 1.3.1	Spatial and temporal variation in the population dynamics and life history traits of the tropical snapper <i>Lutjanus carponotatus</i> on the GBR.	01.03.98	Prof H Choat (JCU) Dr C Davies (NOO)	Completed	CRC Reef/ IPRS
A Lashko	PhD	JCU/Task C1.4.2.1	Genetic diversity in the relationship between nesting and feeding aggregations of seabirds in the GBRWHA.	31.03.00	Dr E Gyuris (JCU) Dr M Waycott (JCU)	Current	CRC Reef
S Lewis	PhD	JCU/Task C4.1	Climatic and Oceanographic change from high-resolution records in large fossil <i>Porrites</i> coral heads, Magnetic Island, Queensland.	31.03.01	Dr P Hearty (JCU) Dr G Shields (JCU) Dr Janice Lough (AIMS)	Current	CRC Reef/ JCU Earth Science Schol.
V Lukoschek	PhD	JCU/Task C1.4.1	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	Msc	JCU/Task B4.2	An investigation into aspects of reproduction and regional variation in growth for populations of red bass, <i>Lutjanus bohar</i> .	30.03.01	Dr B Mapstone (JCU) Prof H Choat (JCU)	Current	CRC Reef
N Marshall	PhD	JCU/Task 1.2.1	Social resilience and resource-dependency in Queensland's commercial fishing industry.	01.07.01	Dr DM 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 (NOO) Dr G De'ath (JCU)	Current (part-time)	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 2.1.16	An ecological economic approach to determining optimal capacity where latent effort exists.	15.07.97	Dr L Fernandes (GBRMPPA) Assoc Prof O Stanley (JCU) Dr B Mapstone (JCU) Dr C Davies (NOO)	Current	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	CRC Reef

Name	Degree	Institution enrolled/ task affiliation	Thesis title	Commencement date	Supervisor	Status of study	Source of funding
R Partridge	PhD	JCU/Task B4.10	The effects of a two-tiered management regime on the catch characteristics of recreational and charter line fisheries operating in tropical estuarine systems.	12.03.01	Dr B Mapstone (JCU) Dr M Sheaves (JCU)	Current	CRC Reef
R Pears	PhD	JCU/Task B4.20	Comparative demography and life history features of cods and groper: 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 Pockock	PhD	JCU/Task A1.3.1S	Management of cultural heritage values in the GBRWHA.	27.03.00	Dr D Roe (JCU) Dr S Greer (JCU) Dr D Collett (EA)	Current	CRC Reef
B Radford	PhD	JCU/Task D2.2	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 A Lewis (GBRMPA) Dr J Delaney (UWA)	Current	CRC Reef
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)	Current	CRC Reef
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
S Rotmann	PhD	JCU/Task C2.5	Assessment of the use of coral tissue thickness as a monitor of reef health and performance.	22.05.00	Dr S Smithers (JCU) Dr D Barnes (AIMS)	Current	CRC Reef/ Lihir Mining
D Welch	MSc	JCU/Task 2.4.12/5	Development of techniques that minimise size selectivity for sampling populations of the common coral trout <i>Plectropomus leopardus</i> for age structure analysis.	01.01.95	Assoc Prof G Russ (JCU) Dr B Mapstone (JCU) Dr C Davies (NOO)	Completed	CRC Reef
A Williams	PhD	JCU/Task 2.4.12/2	Population structure of <i>Lethrinus miniatus</i> on the GBR.	31.03.98	Dr B Mapstone (JCU) Dr C Davies (NOO) Assoc Prof G Russ (JCU)	Current	CRC Reef/ APA

POSTGRADUATE ASSOCIATES

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

Name	Degree	Institution enrolled/ task affiliation	Thesis title	Commencement date	Supervisor	Status of study	Source of funding
A Abdulla	PhD	JCU/Program B	Multi-species interactions in coral reef fish: implications of predator removal by fishing.	01.03.00	Dr B Mapstone (JCU) Dr J Caley (JCU) Dr S Connelly (JCU)	Current	CRC Reef/ IPRS
N Aragones	PhD	JCU/Task 2.1.8	Techniques for the restoration of tropical seagrass beds.	27.02.95	Dr G Inglis (NIWA)	Suspended	CRC Reef/ AusAID
R Arthur	PhD	JCU/Task D1.1	Coral competition and recovery in reefs affected by a coral mass mortality.	30.06.99	Assoc Prof V Harriott (JCU) Dr T Done (AIMS)	Current	IPRS/ Diversitas
A Astorquia	Hons	JCU/Task B3.2	Small-scale wave modelling at John Brewer Reef.	01.03.01	Assoc Prof T Hardy (JCU)	Completed	CRC Reef
J Aumend	PhD	JCU/Program E	Trace element analysis of otoliths as a technique for identifying the coastal nursery grounds of tropical snapper (<i>Lutjanus</i> spp.) from the GBR.	28.09.98	Dr M Sheaves (JCU)	Current (part-time)	CRC Reef Aug Grant
A Baird	PhD	JCU/Task 5.5.2	Coral settlement patterns and the behaviour and ecology of coral larvae.	01.07.95	Prof T Hughes (JCU)	Completed	CRC Reef
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)	Current	CRC Reef Aug Grant
J Ballard	Hons	JCU/Program E	Modelling of prehistoric super-cyclones at Curacao Island.	10.01.02	Assoc Prof T Hardy (JCU)	Current	CRC Reef Kelleher Prize
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)	Submitted	CRC Reef
L Bay	PhD	JCU/Program E	Gene flow and local thermal adaptation in coral reef fishes.	01.06.01	Dr J Caley (JCU) Dr G Jones (JCU) Prof R Crozier (JCU)	Current	CRC Reef Aug Grant
R Berkelmans	PhD	JCU/Task 1.1.4	Upper thermal tolerance limits for acclimation of reef corals.	01.08.96	Assoc Prof B Willis (JCU) Dr J Oliver (GBRMPA)	Completed	CRC Reef
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)	Current	CRC Reef Aug Grant
S Bray	Hons	JCU/Program E	Latitudinal trends in the age structure and life history of the damselfish <i>Pomacentrus moluccensis</i> .	01.03.01	Dr G Jones (JCU) Dr J Caley (JCU)	Completed	CRC Reef Hons Aug Grant

Name	Degree	Institution enrolled/ task affiliation	Thesis title	Commencement date	Supervisor	Status of study	Source of funding
S Byce	PhD	JCU/Task 1.3.1	Sediment transport in mangrove creek systems of North Queensland.	01.01.95	Dr P Larcombe (JCU) Dr R Carter (JCU)	Completed	CRC Reef
J Bunt	PhD	JCU/Task 1.3.1	Sediment transport in mangrove systems and causes of turbidity.	20.02.97	Dr P Larcombe (JCU) Dr P Ridd (JCU)	Completed	CRC/ IPRS
L Burgess	Hons	UQ/Program E	The influence of incubation temperature on hatching morphology and swimming performance of green sea turtle hatchlings <i>Chelonia mydas</i> in the GBR.	01.03.01	Dr J Lanyon (UQ) Dr D Booth (UQ)	Current	CRC Reef Hons Aug Grant
J Cavanagh	PhD	JCU/Task 1.3.5	Organochlorine pesticide residues in near-shore marine sediment cores of the Herbert and Burdekin regions and their relationship to historical agricultural activities.	01.07.96	Dr K Burns (AIMS) Dr G Brunskill (AIMS) Assoc Prof R Coventry (JCU)	Completed	CRC Reef
D Ceccarelli	PhD	JCU/Task C 2.2	Effects of territorial damsel fish on community structure of coral reefs.	01.02.01	Dr K Fabricius (AIMS) Dr G Jones (JCU) Dr L McCook (AIMS)	Current	CRC Reef
C Clarke	MSc	JCU/Program E	Are sea hares an appropriate agent for the control of algal outbreaks?	30.07.01	Ms G Brodie (JCU) Dr A Klusmann-Kolb (Aimz)	Current	CRC Reef Aug Grant
T Clarke	Hons	JCU/Task B1.3	Application of hydrodynamic modelling in Cairns Port to introduced mussel spread; integration of hydrodynamic, habitat and biological information.	01.03.02	Assoc Prof T Hardy (JCU)	Current	CRC Reef
M Depczynski	Hons	JCU/Program E	Reef biodiversity and the role of fishes in coral reef ecosystems.	01.03.01	Assoc Prof D Bellwood (JCU)	Completed	CRC Reef Hons 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 Monaghan (JCU)	Current (part-time)	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)	Submitted	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)	Submitted	CRC Reef
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
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)	Submitted	CRC Reef/ IPRS

Name	Degree	Institution enrolled/ task affiliation	Thesis title	Commencement date	Supervisor	Status of study	Source of funding
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)	Current (part-time)	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)	Current	CRC Reef Hons Aug Grant
J Guinotte	PhD	U Kansas, NCAR/ Task D2.1a	A spatial index and modelling of coral bleaching thresholds in the GBR.	15.07.99	Prof D Gillieson (JCU) Dr T Done (AIMS) Dr W Buddemeier (U Kansas) Dr J Kleypas (NCAR)	Current	CRC Reef/ IPRS/ TESAG schol
L Harrington	PhD	JCU/Task C2.2	Role and significance of coralline algae on coastal reefs in areas of terrestrial runoff.	01.01.01	Dr K Fabricius (AIMS) Dr J Collins (JCU) Dr R Steneck (Maine)	Current	CRC Reef/ IPRS
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)	Submitted	CRC Reef/ AusAID
J Kung	PhD	JCU/Task 2.4.20	Economic management of multi-species fisheries and the commercial collection of aquarium fishes on the GBR.	01.03.95	Dr B Mapstone (JCU) Assoc Prof O Stanley (JCU)	Completed	CRC Reef
S Leuzinger	Hons	JCU/Program E	Effects of stress and resource limitation on energy allocation in reef corals.	01.03.01	Dr K Anthony (JCU) Assoc Prof B Willis (JCU)	Completed	CRC Reef Hons Aug Grant
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)	Current	CRC Reef
J McConochie	MEng	JCU/Task 3.1	Establishing the frequency of wave energy in the GBR.	30.03.99	Assoc Prof T Hardy (JCU) Prof J Patterson (JCU)	Current (part-time)	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	Nutrient effects on inshore seagrass of the GBR/WHA.	03.07.92	Dr R Coles (QDPI) Prof H Marsh (JCU)	Current (part-time)	CRC Reef
J Mosse	PhD	JCU/Task 2.4.12	Regional variation age, growth and reproductive biology of the blue spot rock cod, <i>Cephalopholis cyanostigma</i> (Serranidae) on the GBR.	03.03.97	Prof H Choat (JCU) Dr C Davies (NOO)	Submitted	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)	Current	CRC Woolfe Scholarship

Name	Degree	Institution enrolled/ task affiliation	Thesis title	Commencement date	Supervisor	Status of study	Source of funding
G Parra	Phd	JCU/Task C1.4.55	Ecology and conservation biology of Irawaddy, <i>Orcaella brevirostris</i> , and Indo-Pacific humpback, <i>Sousa chinensis</i> , dolphins in the Central Section of the GBR Marine Park	01.01.01	Prof H Marsh (JCU) Dr P Arnold (MTQ) Dr P Corkeron (NIFA)	Current	CRC Reef
H Patterson	PhD	JCU/Program E	Isotopes, early life history and potential self-recruitment of coral reef fish	01.03.01	Prof M Kingsford (JCU)	Current	CRC Reef Aug Grant
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 Penny	Hons	JCU/Program E	The effects of fishing on mud crab <i>Scylla serrata</i> in north Queensland: incidence and effect of damage on sub-legal and female crabs.	01.03.01	Dr M Sheaves (JCU)	Completed	CRC Reef Hons Aug Grant
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) Dr A Lewis (GBRMPA) Prof D Gillieson (JCU)	Current	CRC Reef
P Riolo	MAppSc	JCU/Task 1.5.2	Sea surface temperature interpolation.	02.08.99	Mr J Monaghan (JCU) Dr W Skirving (AIMS)	Completed	CRC Reef
J Robins	PhD	JCU/Task 2.5.3	The impact of trawling on sea turtles.	01.03.98	Prof H Marsh (JCU) Dr D Die (CSIRO)	Current	CRC Reef
W Robbins	PhD	JCU/Program E	Growth, demography and stock culture of Queensland reef sharks.	01.02.01	Prof H Choat (JCU)	Current	CRC Reef Aug Grant
L Santana	Hons	JCU/Task C 2.2	Effects of territorial damselfish on coral recruitment and survival.	01.03.01	Dr K Fabricius (AIMS)	Completed	CRC Reef
C Schoenberg	PhD	Uni. Oldenberg/ Task 1.4.1	Ecology of bioeroding sponges on the GBR.	01.01.96	Dr C Wilkinson (IMPAC) Dr L McCook (AIMS) Dr K Fabricius (AIMS)	Completed	CRC Reef
J Scott	Hons	JCU/Program E	Genetic analysis of the population structure of the red throat emperor (<i>Lethrinus miniatius</i>) using microsatellite DNA variation.	01.03.01	Dr L van Herweden (JCU) Prof H Choat (JCU)	Completed	CRC Reef Hons Aug Grant
L Smith	MSc	JCU/Task 2.2.4	Developing dwarf minke whale tourism interpretation.	28.02.00	Dr A Birtles (JCU)	Completed	CRC Reef
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 C 3.2	A modelling investigation of the pathways of biota in the Southern GBR.	01.03.97	Dr L Bode (JCU)	Current (part-time)	CRC Reef
S Thomas	PhD	JCU/Task C 2.5	Sediment deposit instrument development on Lihir Island, PNG.	31.07.99	Dr P Ridd (JCU) Prof M Heron (JCU)	Current	CRC/IPRS

Name	Degree	Institution enrolled/ task affiliation	Thesis title	Commencement date	Supervisor	Status of study	Source of funding
P Tudman	Hons	JCU/Task D 2.1	Modelling the trophic effects of fishery closures and cross-shelf variation on coral reefs of the Central GBR.	01.03.01	Assoc Prof G Russ (JCU) Dr T Done (AIMS)	Completed	CRC Reef Hons Aug Grant
P Tudman	PhD	JCU/Program E	Modelling the trophic effects of fishing on the coral reefs of the Central GBR.	18.03.02	Assoc Prof G Russ (JCU)	Current	CRC Reef
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)	Current	CRC Reef Aug Grant
C Ware	PhD	JCU/Task 2.2.1	Understanding travel decision making and patterns.	15.02.99	Prof P Pearce (JCU) Dr L Murphy (JCU)	Current (part-time)	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)	Current	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)	Current	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)	Submitted	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)	Current	CRC Reef
C Yagi	PhD	JCU/Task 2.2.1	Tourist perceptions of other tourists.	02.08.99	Prof P Pearce (JCU) Dr G Moscardo (JCU)	Current	CRC Reef
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)	Current	CRC Reef Aug Grant
J True	PhD	JCU/Task 1.3.7	Massive scleractinian corals as indicators of environmental change.	01.01.97	Assoc Prof B Willis (JCU) Dr D Barnes (AIMS)	Suspended	CRC Reef

APA = Australian Postgraduate Award
 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

UTILISATION AND APPLICATION OF THE RESEARCH, COMMERCIALISATION, LINKS WITH USERS

6. UTILISATION AND APPLICATION OF THE RESEARCH, COMMERCIALISATION, LINKS WITH USERS



Guidelines for pontoon design by CRC Reef researchers have formed the basis of management policy on structures in the Great Barrier Reef Marine Park.
Photo: FantaSea Cruises.

Objective

CRC Reef will be a knowledge broker and facilitate the successful application of targeted research for industries and management agencies.

Highlights

- The Ports and Shipping project has been instrumental in finding the Asian green mussel, an introduced pest which was detected in Queensland Ports in the last year. The port pest surveys allow improved risk assessment for introduced pests in Queensland.
- Research on patterns of coral bleaching allowed rapid management response to the most severe bleaching ever recorded on the Great Barrier Reef in summer 2002.
- Reviews of water quality in the GBRWHA have been used to establish water quality guidelines for coastal Queensland.
- Completed guidelines on pontoon design have formed the basis of management policy on structures in the Great Barrier Reef Marine Park.

CRC Reef strategies for technology transfer include:

- an extensive extension and communication program;
- collaboration and cooperation in research;
- input to public policy and legislation;
- education and training; and
- provision of consulting, training and advisory services.

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.

The education program is another important component of the strategy (see section 5). Postgraduate students receive training in generic skills useful to industry, may undertake industry placement during their training, and work closely with industry via the Task Associate scheme. The employment of a large percentage of graduates with industry and research partners also facilitates transfer of research results.

CRC Reef researchers are very active in presenting research findings at conferences and seminars (see section 9). The 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.

Case studies demonstrating successful technology transfer practices

Introduced marine pests

The introduction of exotic marine organisms into Australian waters as a result of ballast water pumping or shipping movements is of growing concern. A key component of the Decision Support System used in Australia to manage introduced pest species is a baseline survey of all ports, to determine existing biodiversity in ports. Diving surveys in Cairns Port determined the spatial extent of the introduced Asian green mussel in Cairns Harbour. CRC Reef and QDPI staff convened a workshop with management agencies to develop a response to the pest's presence. The port also detected the introduced Caribbean tube worm, which can pose a threat to local biodiversity. CRC Reef student research projects on ship fouling organisms and modelling of port hydrodynamics contribute to an understanding of the causes and movement of

introduced marine pests. Baseline surveys in other ports such as Townsville, Cape Flattery, Gove and Karumba are used by Port Authorities to manage their impact on the environment and for monitoring for introduced pest species.

Research users: Ports industry, shipping industry, Australian Quarantine and Inspection Service (AQIS), GBRMPA.

Critical habitats and shipping

Baseline surveys of seagrass mangrove and benthic macro-invertebrate communities were completed for the Queensland Ports of Mourilyan Harbour, Mackay, Cairns, Karumba, Weipa, Thursday Island and Skardon River. The seagrass and mangrove communities in the high-risk shipping lane adjacent to Margaret and Shellburne Bays were also surveyed. Large areas of intertidal seagrass, mangroves and reef communities that would be susceptible to oil and fuel spills from shipping accidents were mapped in the areas. These baseline surveys led to the development of long-term monitoring strategies for several ports. There has been a substantial uptake and application of research by the ports and shipping industry. Critical habitat information collected within ports in this task has been utilised in dredge management plans for Weipa, Karumba, Cairns and Mackay. The Mackay Port Authority and the Ports Corporation of Queensland are using information from the GIS of critical habitats for ports in planning future port expansion and development that will have minimal effects on the marine environment. The commitment of project supervisors to maintain the relevance of the research has led to a high level of industry support, with new project approaches often being initiated by port authorities.

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

Fishing and fisheries

The Fishing and Fisheries project involves a series of interrelated research tasks, including student projects. These have been extensively used in developing the Queensland Government's draft Reef Line Fishery Management Plan. The contributions include: the revision of legal size limits for the harvest of blue-spot coral trout; revision of harvest limits on species of small cods; expert advice on the sustainability of reef finfish stocks under current and revised management arrangements; analysis of fishery logbook catch and effort data. Advice has also been provided to EA concerning by-catch in the commercial and charter line fishery and on sustainability issues; and to the GBRMPA Representative Areas Program on the effectiveness of marine protected areas in ameliorating the impacts of line

fishing. Researchers have also worked closely with fisheries managers in the Torres Strait to develop strategies to enhance the involvement of Torres Strait islanders in the local line fishery.

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

Water quality

CRC Reef staff and researchers have played 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) has been used to set water quality guidelines in a Queensland Government committee. **Dr David Williams** chaired a panel and authored a consensus statement synthesising knowledge on the issue of water quality and catchments in Queensland. **Prof Russell Reichelt** is a member of the Reef Protection Science Panel responsible for advising the Queensland Government on water targets. CRC Reef was also a major sponsor of the 'Sustaining Aquatic Environments' conference in November 2001, with a focus on implementing solutions to the impacts of terrestrial runoff. 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. An ongoing multidisciplinary study comparing tropical coral reefs close to and distant from areas of river run-off will provide insight into the way terrestrially-derived nutrients and sediments will affect reefs.

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

Waves and pontoons

The Wave Atlas produced by CRC Reef researchers based at JCU simulates the passing of 20,000 cyclones. The atlas has recently been extended to include non-cyclonic conditions. The data have been applied directly in design inputs for a helicopter pontoon off Cairns, and also contributed to the technical report, Reef Infrastructure Guidelines: Tourist Pontoons, which presents engineering best-practice for construction of offshore structures in the GBRWHA. These guidelines were adopted by GBRMPA during 2002 as the basis for their policy for reef structures. The atlas is available online and the guidelines will be available on CD for ease of access for industry and management.

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

Coral bleaching and climate change

Several research tasks at AIMS and JCU have contributed to a greater understanding of the physical conditions that trigger coral bleaching on the GBR. These tasks include satellite imagery, in situ monitoring of sea water temperature, modelling of large scale and small scale water circulation in the Coral Sea and around reefs, large-scale surveys of the distribution of bleached corals, and experimental studies of coral bleaching thresholds. As a result of integration of these study results, **Drs Ray Berkelmans** and **Paul Marshall** produced a draft "Bleaching response strategy" to guide management actions following reports of bleaching. The strategy was tested immediately in summer 2002 when severe bleaching was recorded on the GBR. CRC Reef scientists from AIMS and GBRMPA were able to predict and follow the bleaching episode, and provide information to the media, resource managers, government and tourism operations. The information is currently being synthesised into a risk analysis of coral bleaching and as the major issue on the Reef Futures website.

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

Tourism surveys

A major visitor survey was completed with data collected from 2,200 reef visitors at sites between the Whitsundays and Cairns. Results of the surveys about factors which influence tourism patterns of travel and activity participation were presented at a series of industry workshops in Cairns and the Whitsundays. These workshops generated many requests for specific analyses of the dataset to provide information of interest to individual tourism operations. The information was provided by the researchers, in addition to summary reports. The requests include information on backpackers, the youth-travel market, dive tourism, domestic tourism and other specific market sectors. In a second major project, JCU researcher have been asked by industry to identify factors that are contributing to regional downturns in visitor numbers. This will allow more effective tourism marketing and promotional activities, and will assist the tourism industry in its future planning.

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



CRC Reef researcher based at DPI, Dr Kerry Neil, is surveying tropical ports for introduced marine pests.

Photo: Rob Parsons.

Sustainability of the coral harvest fishery

The report on the sustainability produced as a report to Harvest MAC (the management advisory groups to the Queensland government on the harvest fisheries) was produced as a CRC Reef Technical Report, and a version has been accepted as a refereed journal article. The reports have been used to inform debate among industry, resource managers and politicians concerning the future of the fishery. At the direction of the Prime Minister, GBRMPA established an expert panel, with **Assoc Prof Vicki Harriott** representing CRC Reef, to make recommendations about the management of the fishery. The panel's report was submitted in March 2002.

Research users: Queensland Fisheries Service (QFS), coral harvest and aquarium industry, GBRMPA, Queensland Parks and Wildlife Service (QPWS), federal and state government departments.

Wildlife studies

During data collection of genetic analysis of sea snakes, CRC Reef PhD student **Ms Vimoksalehi Lukoschek** repeated surveys from previous decades and found a significant decline in the number of sea snakes in the offshore Swains Reefs. This information is of interest to GBRMPA and QPWS, because few dedicated sea snake surveys are available to examine population variations and distribution. Another PhD student, **Ms Amanda Hodgson**, has used innovative technology ("blimp-cam" - aerial videography from a helium balloon) to determine whether boat movement affects the behaviour or survival of protected dugong species. Preliminary findings are being used to determine policy with respect to small boat movements in marine protected areas.

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

Knowledge exchange

The CRC Reef has recently revised its program structure to include a new task in Knowledge Exchange. The purpose of this task is 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 followed the deaths of two tourists stung by irukandji jellyfish, when there was a demand for information on the jellyfish from media, the community and government agencies. **Dr Louise Goggin** prepared a summary document from technical papers

and in consultation with expert scientists. This was posted in a printer-friendly form on the CRC Reef website, and more than 11,000 hits were recorded on the irukandji webpage in April 2002. CRC Reef staff also helped to coordinate scientific response to the issue with health professionals, the tourism industry, government and researchers.

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

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, Queensland; Lucinda Port Authority; Mourilyan/Abbot Point Ports; Weipa Port; Townsville Port Authority; Cairns Port Authority.

Tourism and dive operators including Undersea Explorer, Port Douglas; Quicksilver Cruises, Port Douglas; Great Adventures, Cairns; Pure Pleasure Cruises, Townsville; 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, North Marine Services.

Environmental consulting companies including Sinclair Knight Merz, 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).

Commercial and International Program

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 three 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.

CRC Reef has set the following objectives for its commercial and international program:

- to 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;
- to 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;
- to generate income from the above activities; and to
- 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 level of external grants and commercial contracts has increased from approximately \$100,000 in the 1999–00 financial year to \$600,000 in the 2001–02 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 Consortium began work on a major project to develop the technology for the treatment of ship's ballast water for introduced marine pests. This flows directly from the doctoral research of a recently completed CRC student funded by the Ports Corporation of Queensland, and has very strong support from the Coasts and Clean Seas Program of Environment Australia.

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



A major CRC Reef project is developing technology for the treatment of ballast water to prevent the introduction of marine pests.

Photo: John Barnett, GBRMPA.

7. STAFFING AND ADMINISTRATION

There were amendments to the Specified Personnel list during 2001–02 which were approved by the CRC Program. No major equipment items were purchased over the year.

Specified personnel

Name	Organisation	% Time with CRC Reef	Role
Prof Russell Reichelt	CRC Reef	100	Chief Executive Officer
Dr David Williams	AIMS	75	Deputy CEO (Research)
Assoc Prof Vicki Harriott	JCU	100	Program Leader, Education & Communication
Dr Bruce Mapstone	JCU/ CRC Reef	100	Leader, Program B
Dr Terry Done	AIMS	60	Leader, Program D
Dr Miles Furnas	AIMS	60	Project Leader
Dr Gianna Moscardo	JCU	60	Project Leader
Dr Peter Doherty	AIMS	50	Leader, Program C
Dr Robert Coles	QDPI	50	Project Leader
Professor Helene Marsh	JCU	50	Leader, Program A
Assoc Prof Tom Hardy	JCU	30	Project Leader
Professor Philip Pearce	JCU	30	Project Leader
Dr Roland Pitcher	CSIRO	5	Research Staff
Dr Alison Green	GBRMPA	20	Research Staff



Assoc Prof Vicki Harriott looks very happy to be returning to her position at Southern Cross University after successfully leading the Education and Communication Program for CRC Reef.

Photo: Louise Goggin, CRC Reef.

PROFESSIONAL STAFF CONTRIBUTIONS 2001–02

Name	Role	Total % of time	% Spent on research					% Education	% Communication	% Administration
			A	B	Program C	D	Total			
Australian Institute of Marine Science										
Dr A Mitchell	R	38			38		38			
Dr C Steinberg	R	62			62		62			
Dr D Alongi	R	6			6		6			
Dr D McKinnon	R	28			28		28			
Dr D Williams	A	45					0			45
Ms E Howlett	A	0.05			0.05		0.05			
Mr L Trott	R	33			33		33			
Mr M Cappel	R	61			61		61			
Mr M Devereux	R	12			12		12			
Dr M Furnas	R	100			100		100			
Mr O Dalhaus	R	73			73		73			
Mr P Dixon	R	17			17		17			
Dr P Doherty	A	34					0			34
Mr P Speare	R	12			12		12			
Ms S Duggan	R	10			10		10			
Dr T Done	R	65				65	65			
Dr W Skirving	R	50			50		50			
Mr A Cheal	R	20			20		20			
Ms R Ninio	R	5			5		5			
Mr I Miller	R	20			20		20			
Ms K Page	R	20			20		20			
Mr B Fitzpatrick	R	8			8		8			
Ms K Osborne	R	14			14		14			
Mr A Thompson	R	20			20		20			
Dr H Sweatman	R	30			30		30			
Dr P Isdale	A	3					0			3
Dr J Lough	R	10			10		10			
TOTAL (Person Years)		796	0	0	649	65	714	0	0	82
Department of Primary Industries										
Ms A Clarke	A	10					0			10
Dr S Campbell	R	50		50			50			
Mr R Yoshida	R	55		55			55			
Mr C Lunow	R	3		3			3			
Mr A Roelofs	R	58		58			58			
Mr G Chisholm	R	2		2			2			
Mr S Kerville	R	25		25			25			
Mr R Thomas	R	88		88			88			
Mr R Garrett	R	32		32			32			
Mr P Leeson	R	5.4		5.4			5.4			
Dr N Gribble	R	35		35			35			
Ms S Helmke	R	15		15			15			
Ms J Mellors	R	85		85			85			
Ms C Roder	R	27		27			27			
Ms A Corby	C	5					0	5		
Ms B Gibbs	A	20					0			20
Ms J Bite	R	71.2		71.2			71.2			
Mr C Bishop	A	5					0			5
Mr P Neville	A	5					0			5
TOTAL (Person years)		597	0	552	0	0	552	0	5	40

A Administration C Communication R Research

STAFFING AND ADMINISTRATION

Name	Role	Total % of time	% Spent on research				Total	% Education	% Communication	% Administration
			A	B	C	D				
Great Barrier Reef Marine Park Authority										
Dr A Lewis	R	5				5	5			
Dr A Green	R	30					0			30
Dr A Smith	R	5		5			5			
Ms S Morris	R	3			3		3			
Mr E Green	R	2		2			2			
Mr M Russell	R	1		1			1			
Dr D Huber	R	2		2			2			
Mr M Bishop	R	2.2		2.2			2.2			
Dr K Dobbs	R	3		1	2		3			
Mr J Innes	R	40		40			40			
Dr P Cadwallader	R	1		1			1			
Dr D Haynes	R	10			10		10			
Mr D Cameron	R	5		5			5			
Ms T Orr	A	5					0			5
Ms J Waterhouse	R	2			2		2			
Ms H Skeat	R	5		5			5			
Mr A Chin	R	10			10		10			
Mr J Day	R	3					0			3
Mr A Skeat	R	0.5					0			0.5
Dr D Wachenfeld	R	40			40		40			
Dr K Michalek-Wagner	R	2.6			2.6		2.6			
Dr P Marshall	R	0.5	0.5				0.5			
Dr L Fernandes	A	0.2					0			0.2
Ms K Gorman	A	5.8					0			5.8
Mr T Stokes	A	5			5		5			
Hon V Chadwick	A	10					0			10
TOTAL (Person years)		199	0.5	64	75	5	144	0	0	54.5
James Cook University of North Queensland										
Assoc Prof G Russ	R	20		10			10	10		
Dr M Fenton	R	5	5				5			
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	30		10			10	20		
Dr G Moscardo	R	15		15			15			
Dr M Waycott	R	10	5				5	5		
Dr A Birtles	R	25		20			20	5		
Dr E Gyuris	R	10			5		5	5		
Mr C Linfoot	R	25		25			25			
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	20		20			20			
Prof H Marsh	R	10	5				5	5		
Mr P Osmond	R	5		5			5			
Mr V Pulella	R	5		5			5			
Mr D Thomson	R	5		5			5			
Ms K Sharp	A	5					0			5
Prof M Kingsford	R	5		5			5			
Prof D Gardner	R	5					0	5		
Dr D Lee-Ross	R	15		15			15			
Ms A Sharp	R	25		25			25			
Dr S Greer	R	10	10				10			
Prof J H Choat	R	20			10		10	10		
Dr L Murphy	R	20		15			15	5		
Dr J Collins	R	5					0	5		
Mr A Astorquia	R	13		13			13			

A Administration R Research

STAFFING AND ADMINISTRATION

Name	Role	Total % of time	% Spent on research					% Education	% Communication	% Administration
			Program				Total			
			A	B	C	D				
James Cook University of North Queensland (continued)										
Mr R Kapitzke	R	20		20						
Dr M Sheaves	R	5		5						
Ms H Penrose/ P Quayle	R	75			75					
Ms K Milanovic	A	10					0		10	
Dr J Carstairs	R	2					0		2	
Mr J Taylor	A	3					0		3	
Ms S Knight	A	5					0		5	
Prof N Palmer	A	12					0	6	6	
TOTAL (Person years)		550	35	283	105	0	348	96	0	31

OTHERS

Mr D Windsor (GBRRF)	A	10					0		10	
Mr D Hutchen (AMPTO)	A	10					0		10	
Mr R Thomas (AMPTO)	A	10					0		10	
Mr D Souter (QSIA)	A	15					0		15	
Mr B Sawynok (Sunfish)	A	10					0		10	
Sir S Schubert	A	10					0		10	
Dr R Little (CSIRO)	R	12.5		12.5			12.5			
Mr F Pantus (CSIRO)	R	2.5		2.5			2.5			
Dr A Punt (CSIRO)	R	2.5		2.5			2.5			
Dr A D Smith (CSIRO)	R	2.5		2.5			2.5			
Dr C Davies (NOO)	R	10		10			10			
Dr M Wasson (ANU)	R	15	15							
Prof H Ross (UQ)	R	15	15							
Dr P Arnold (MTQ)	R	10		10			10			
TOTAL (Person years)		135	30	40	0	0	40	0	0	65

Name	Employer	Role	Total % of time	% Spent on research					% Education	% Communication	% Administration
				Program				Total			
				A	B	C	D				
CRC Funded Staff											
Prof R Reichelt	CRC	A	100					0		100	
Ms A Norman	CRC	A	33					0		33	
Ms M Warrington	CRC	A	100					0		100	
Ms M Nash	CRC	A	67					0		67	
Ms K Smith	CRC	A	75					0		75	
Ms D Birch	CRC	A	100					0		100	
Ms L Arnell	CRC	A	8					0		8	
Ms B Barnett	CRC	C	100					0	20	80	
Dr L Goggin	CRC	C	100					0	20	80	
Mr T Harvey	CRC	A	80					0	80		
Mr T Donovan	CRC	A	100				100	100			
Ms K Bean	JCU	R	50		50			50			
Mr R Baker	JCU	R	6		6			6			
Dr G Begg	JCU	R	100		100			100			
Ms M Bergenius	JCU	R	13		13			13			
Mr G Carlos	JCU	R	100		100			100			
Ms A Connors	JCU	R	14		14			14			
Mr M Curnock	JCU	R	50		50			50			
Dr G De'ath	JCU	R	15				15	15			
Ms C Dudgeon	JCU	R	25		25			25			

A Administration C Communication R Research

STAFFING AND ADMINISTRATION

Name	Employer	Role	Total % of time	% Spent on research					% Education	% Communication	% Administration
				Program				Total			
				A	B	C	D				
CRC Funded Staff (continued)											
Ms A Fergus	JCU	R	16		16						
Ms J Fischer	JCU	A	8							8	
Mr M Flood	JCU	R	25		25						
Ms A Galletly	JCU	R	100		100						
Dr B Goldman	JCU	R	49		49						
Ms B Green	JCU	R	20		20						
Mr D Hawksworth	JCU	R	20		20						
Ms L Hawksworth	JCU	R	100		100						
Dr M James	JCU	R	14		14						
Dr A Jones	JCU	R	100		100						
Ms W Lee	JCU	R	13		13						
Dr L Dongchun	JCU	R	100		100						
Mr F Manwa	JCU	R	12		12						
Mr L Mason	JCU	R	100		100						
Mr M Matheson	JCU	R	17		17						
Mr J McConochie	JCU	R	100		100						
Mr D Mckeagney	JCU	R	20		20						
Ms S Meikle	JCU	R	12		12						
Dr G Moscardo	JCU	R	45		45						
Mr C Murchie	JCU	R	100		100						
Ms L Okorn	JCU	R	9		9						
Mr R Pierce	JCU	R	14		14						
Ms R Saltzer	JCU	R	75		75						
Mrs J Sheaves	JCU	R	29		29						
Ms I Stewart	JCU	A	67							67	
Ms B Sweeney	JCU	A	33							33	
Mrs K Vani	JCU	R	25	25							
Ms A Wiebkin	JCU	R	70		70						
Mr A Williams	JCU	R	55		55						
Prof H Marsh	JCU	R	30	15		15					
Assoc Prof V Harriott	JCU	R	100				50	20	30		
Dr B Mapstone	JCU	R	100		100						
Dr D Williams	AIMS	R	50	10	10	10	10	5		5	
Dr K Fabricius	AIMS	R	100			100					
Dr L McCook	AIMS	R	58			58					
Ms Skuza	AIMS	R	67			67					
Mr M Wright	AIMS	R	53			53					
Mr S Kininmonth	AIMS	R	100				100				
Ms K Osborne	AIMS	R	20			20					
Mr S Delean	AIMS	R	100			100					
Ms E Potter	AIMS	R	42			42					
Dr S Wooldridge	AIMS	R	100			100					
Mr S Edgar	AIMS	R	15				15				
Dr G De'ath	AIMS	R	85				85				
Mr M Mahoney	AIMS	R	100			100					
Ms J Redgwell	GBRMPA	A	50		50						
Dr R Berkelmans	GBRMPA/ AIMS	R	100			100					
Mr S Hyland	QDPI/QFS	R	100		100						
Dr K Neil	QDPI/JCU	R	100		100						
Mr R Yoshida	QDPI	R	40			40					
Dr A Tobin	QDPI	R	100		100						
Mr L McKenzie	QDPI	R	100			100					
Mr R Thomas	QDPI	R	10		10						
Mr S Campbell	QDPI	R	50			50					
Ms C Roder	QDPI	R	70			70					
Dr R Coles	QDPI	R	50		20	30					
Dr M Rasheed	QDPI	R	100		100						
TOTAL (Person years)			4573	50	2163	1055	375	3643	145	190	596

A Administration R Research

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

Professional staff	Total Equiv. Person Years	% Spent on research					% Education	% Communication	% Administration
		Program				Total			
		A	B	C	D				
Total Contributed	22.76	0.655	9.388	8.287	0.700	19.03	0.96	0.05	2.73
Total Funded by CRC	45.73	0.50	21.63	10.55	3.75	36.43	1.45	1.90	5.96
GRAND TOTAL	68.49	1.16	31.02	18.84	4.45	55.46	2.41	1.95	8.69
Proportion of total professional staff resources in each activity	100	2	45	28	6	81	4	3	13

Support Staff (Person Years)

(1) Contributed		(2) CRC funded	
Organisation	No. staff	Organisation	No. staff
AIMS	0.39	AIMS	0.20
QDPI	0.30	QDPI	0.20
GBRMPA	0.11	GBRMPA	0.50
JCU	0.43	JCU	1.70
TOTAL	1.23	TOTAL	2.60



Mr Luciano Mason, Assoc Prof Tom Hardy and Mr Jason McConochie were delighted to be awarded the Kevin Stark Memorial Medal for Excellence in Coastal and Marine Engineering.

PUBLICATIONS

8. PUBLICATIONS

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Program Leader, Dr Bruce Mapstone (L), congratulates Dr Rob Coles on the publication of the book he co-wrote entitled *Global Seagrass Research Methods*.

Photo: Louise Goggin, CRC Reef.

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9. PUBLIC PRESENTATIONS, PUBLIC RELATIONS AND COMMUNICATION

Project Leader: Associate Professor Vicki Harriott, CRC Reef



CRC Reef researchers are actively communicating research results to the community through the media.

Photo: Andrea Corby, DPI.

PUBLIC PRESENTATIONS, PUBLIC RELATIONS AND COMMUNICATION

Objective

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

Highlights

- CRC Reef organised a science/tourism workshop about local controls for crown-of-thorns starfish in the Whitsundays in November.
- CRC Reef funded and supported the Asian green mussel workshop in Cairns in February to review the status of the introduced marine pest in Trinity Inlet and to discuss management options.
- CRC Reef organised a joint media conference with GBRMPA and AIMS about coral bleaching. The results of the survey of coral bleaching received national and international media coverage.

Significant conference and seminar presentations

During the last year, CRC Reef researchers and staff presented their research to the scientific and broader community. There were seminars (61), workshops and regional conferences (40 presentations), national conferences (39 presentations) and international conferences (26 presentations), with a total of 165 presentations based on work supported by CRC Reef. They included:

Prof Russell Reichelt, CEO of CRC Reef, gave a presentation at the CRC Association conference in Sydney in May 2002.

Dr Bruce Mapstone, Program Leader with CRC Reef, gave a plenary address to the International Conference on Scientific and Technical Bases of Sustainable Fisheries in Florida in November 2001.

Dr Rob Coles, Program Leader with CRC Reef, gave a plenary address to the International Seagrass-Watch Volunteers Forum in Hervey Bay in October 2001 and to the 16th Biennial Conference of the Estuarine Research Federation in Florida in November 2001.

Prof Russell Reichelt was a keynote speaker, and **Dr David Williams** and **Dr Miles Furnas** gave the plenary address at the 2nd National Conference on Aquatic Environments in Townsville in November 2001. CRC Reef was a platinum sponsor of the conference.

Dr Dan Alongi gave the plenary address to the Asia-Pacific Conference on Marine Science and Technology in Kuala Lumpur in May 2002.

CRC Reef PhD student, **Mr Geoffrey Muldoon**, was invited to address and participate in a workshop about the Live Reef Food Fish Trade convened by The Nature Conservancy in Hong Kong in February 2002.

Dr Bruce Mapstone (coral reef fin fish fishery), **Dr Peter Doherty** (harvest fisheries), **Dr Miles Furnas** (water quality), **Dr Vicki Harriott** (coral harvesting) and **Dr David Williams** (water quality, coral reef fin fish fishery) have provided expert advice to Management Advisory Committees (ReefMAC and Harvest MAC) and Research Advisory Committees (Fisheries RAC, Water Quality RAC).

A CRC Reef panel (including **Prof Russell Reichelt**, researchers and Indigenous associates) presented different perspectives gained in research on co-management at the Indigenous Voices Conference, Tinaroo in October 2001.

Public relations and communication

Extension activities

Public displays

The Effects of Line Fishing team from CRC Reef exhibited at the Townsville Sportfishing Clubs, Fishing and Outdoor Expo 2002 in March.

CRC Reef exhibited at the Australian Marine Science Association (AMSA) Conference in Townsville in July 2001, and collaborated with QPWS at Airlie Beach in August 2001, with a community display on dugongs.

Radio broadcasts

Research by CRC Reef and other science organisations is being broadcast to thousands of listeners in north Queensland. In collaboration with AIMS, CSIRO, QDPI, GBRMPA, JCU, Museum of Tropical Queensland and Tropical Savannas CRC, 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. ELF team members also presented research findings at the Great Barrier Reef Charter Association Forum in Mackay in March 2002.

CRC Reef has maintained its Task Associate Program, with 50 task associates assigned to different research tasks, to increase liaison between CRC Reef researchers, resource managers, industry and private operators (see Section 3).

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 funded by GBRMPA and CRC Reef. Collection of data has continued in 2001-02, and a database is being developed as a tourism industry donation to the project. It is anticipated that the database will be available online by the end of 2002.

CRC Reef organised an industry-science workshop on local control options for crown-of-thorns starfish in conjunction with representatives of AMPTO in the Whitsundays in November 2001. The workshop was attended by members of the marine tourism industry, government and the general public.

Dr Alastair Birtles presented results of CRC Reef-supported work on the management of dwarf minke whale and human interactions to the tourism industry in Cairns in June 2002, prior to the start of the minke whale season. His briefing was positively received and will aid in ensuring guidelines are adhered to by the industry.

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

Indigenous liaison

Options for increasing Indigenous engagement by CRC Reef are being reviewed in consultation with partners, Traditional Owners and researchers, and will form the basis of future CRC Reef policy. **Ms Bryony Barnett**, the CRC Reef Extension Manager attended the Giringun Land Summit at Kirrama as part of this process. A workshop, Different Ways of Knowing, coordinated by CRC Reef, GBRMPA and Traditional Owners was attended by 45 researchers, managers and Indigenous peoples in April 2002.

Marine Science Journalism Prize

The Marine Science Journalism Prize was offered to students from JCU for a factual story about marine science in the GBRWHA. In September 2001, the \$1000 prize was awarded to PhD student **Ms Bridget Green** for an article about the swimming speed of young anemone fish. The \$250 Dorothy Paramore Highly Commended Award was presented to **Ms Brenda McDonald** for her story about genetics of dugongs.

Communication Products

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 2001-02 with a broad coverage of research news and staff updates and were circulated to 1200 people and organisations. Three newsletters from the Effects of Line Fishing (ELF) project were also produced. The ELF newsletter is targeted for fishers, management authorities and researchers and has been a very successful medium to keep industry in touch with the project.

Factsheets

One issue of Exploring Reef Science fact sheet about CRC Reef research was produced. An additional fact sheet was produced in collaboration with Townsville Port Authority. These fact sheets have largely been replaced by information available on the CRC Reef website.

Technical reports

In 2001–02, seven technical reports were printed and published on the CRC Reef website. By the end of June 2002, a further six technical reports had been submitted for publication. Most CRC Reef technical reports will be produced electronically in the future.

Brochures

A DL-sized brochure about the work of CRC Reef was produced for use as a promotional document.

Four six-page colour brochures were produced about the current state of knowledge of major issues of relevance to the GBRWHA: land use (November 2001), coral bleaching (January 2002), dugongs (April 2002) and dwarf minke whales (May 2002). The brochures were delivered to reef tourism operators for distribution to passengers, and to GBRMPA for distribution with education packs. The brochures were also sent out with the CRC Reef newsletter. There has been a very positive response to the brochures which summarise important research in an attractive and accessible format.

Website

In April 2002, the CRC Reef website was given a new look. It is designed to make information about CRC Reef and its activities, as well as more general information about the Great Barrier Reef, more accessible to the scientific and general community. The website features downloadable files of CRC Reef publications with most CRC Reef technical reports to be available online-only from July 2002.

Media

A media skills training course was offered in June for executive staff, with six staff from CRC Reef and one staff member each from GBRMPA and AIMS attending.

Again, the effect of run-off on the Great Barrier Reef received considerable coverage both locally and nationally. Other topics which have attracted media attention include coral bleaching, introduced marine pests (particularly the Asian green mussel), sustainability of coral harvesting, surveys of tourists and their satisfaction with reef visits, surveys of recreational and commercial fishers, the International Marine Project Activities Centre (IMPAC), the International Ocean Institute (IOI), the wave atlas and pontoon guidelines, and irukandji jellyfish.

Media coverage since July 2001 is listed below.

	Local	State/National	International
Print	84	14	3
Radio	13	6	2
Television	-	16	1
Online	-	-	6

10. GRANTS AND AWARDS

Grants

Researcher and organisation	Title of grant	Source	Period of grant	\$
Qld Fisheries Service, QDPI	Western Pacific Project	University of New Hampshire (UNH)	Apr 2001 – Nov 2002	\$170,000
Dr R Coles and Mr L McKenzie, QDPI	SeagrassNet – Western Pacific (Region IX)	Packard Foundation, UNH	2000	\$160,000
Assoc Prof T Hardy, JCU	Tropical Cyclone Waves Impact	Bureau of Meteorology, EPA	2002	\$100,000
Mr B Radford, JCU	Industry Support Grant	Apache Energy	Jul 2001 – Jul 2002	\$45,000
Dr B Mapstone, JCU	Travel Grant (plenary address at sustainable fisheries conference)	Centre for Sustainable Fisheries	Nov – Dec 2001	\$16,000
Dr DC Lou & Mr G Carlos, JCU	Processing otoliths of selected tropical fishes	Department of Marine & Wildlife Resources, American Samoan Government	May – Dec 2002	\$13,000
Ms A Hodgson, JCU	Dugong behaviour and the effects of underwater noise	SeaWorld	2002	\$12,870
Dr M Wasson, ANU	Institutional Incentives for Sustaining Ecosystems and Species	UNDP (for WSSD Sustainable Science Award)	2002	\$7,500
Ms R Fisher, JCU	Lizard Island Doctoral Fellowship	Australian Museum	2002	\$6,000
Ms A Hodgson, JCU	Dugong behaviour and the effects of underwater noise	Capalaba Lions Club	2002	\$3,400
Mr G Muldoon, JCU	Doctoral Merit Research Scholarship	JCU	2002	\$2,500
Ms V Lukoscsek, JCU	Doctoral Merit Research Scholarship	JCU	2002	\$2,375
Ms R Fisher, JCU	Doctoral Merit Research Scholarship	JCU	2002	\$2,200
Ms C Pocock, JCU	Doctoral Merit Research Scholarship	JCU	2002	\$2,000
Mr B Radford, JCU	Travel Grant	British Conservation Society	2002	\$1,500
Ms R Fisher, JCU	Project AWARE Foundation Small Grant	PADI	2002	\$800

Awards

Researcher and organisation	Title of Award	Source
Ms J Mellors, QDPI	Environmental Excellence Awards 2002 (Industry/Business Category)	Townsville City Council (\$1,000)
Mr D Grover, JCU	Student Conference Travel Award	ACRS (\$160)
Ms A Hodgson, JCU	Augmentative Grant	GBRMPA (\$1,000)
Ms M Bergenius, JCU	Augmentative Grant	GBRMPA (\$1,000)

11. PERFORMANCE INDICATORS

Objectives of the CRC Reef

Quantitative indicators:

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

Other indicators:

Benefit to CRC Reef. Building intellectual capital. An additional 40.1 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 (See Section 3,6). Examples are Representative Areas Program (GBRMPA), 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 Sections 4, 6, 9)

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. Implementation of integrated finance and project management system.

Quality and relevance of research program

Quantitative indicators:

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

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 the CRC Reef.
- Enhanced research reputation: Honours and awards for researchers; see Section 10.
- Election to key positions in scientific bodies: See Sections 3 and 9.
- Demonstrated user satisfaction: User input to planned projects occurs via SAC, TRC and Task Associates. Survey of satisfaction of partners showed high to very high level of satisfaction (Section 3).
- 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

Quantitative indicators:

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

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 8, 9. 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 3, 8, 9, 10.

Communication and implementation of CRC Reef research outcomes and technology. The CRC Reef Communication Strategy was updated. Each research proposal now includes strategy and budget for communication; appointment of task associates to each task. See Sections 3, 6, 9.

Collaborative arrangements

Quantitative indicators:

Performance Indicator	Target over life of Agreement	Measure 1999–2000	Measure 2000–2001	Measure 2001–2002
Cooperation in research within Australia and overseas and more efficient use of resources	20 collaborative arrangements	See section 3	See section 3	See section 3
Research providers contributing resources	\$32.1m total cash and in-kind	\$4.9m	\$5.3m	\$5.5m
Research providers FTEs in-kind	18.56 FTE in-kind	34.72	22.67	22.76
Collaboration between researchers	80% projects involve 2 or more parties	82%	67%	82%
	Participants workshop 4 p.a.	6	8	16
	Shared supervision of students 5 p.a.	9 stipend students	8 stipend students have >1 supervisor	29 stipend students
Collaboration between researchers and research users	University and non-university supervisors for 25% of postgraduate students	25%	38%	40%
Collaboration with other research institutions	25 projects p.a.	26 institutions	22 institutions	24

Collaborative arrangements (continued)

Quantitative indicators:

Performance Indicator	Target over life of Agreement	Measure 1999–2000	Measure 2000–2001	Measure 2001–2002
International collaboration	Centre researchers involved in 25 international collaborations per year	45 institutions	48 institutions	56
	5 visitors p.a.	27	10 visitors or delegations	12 visitors
	Formal arrangements with international organisations- 1 p.a.	4	1	1
	3 postgraduate students to present at international conferences	1	6	5
Associate membership program	4 p.a. associate members	2	NA	NA
Secondments of industry staff to research providers	1 secondment to research provider p.a.	1	1	0
Secondments of research provider staff to industry	3 secondments to industry p.a.	2	0	1

Other indicators:

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

Education and training
Quantitative indicators:

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

Other indicators:

Industry training. All new students underwent induction including opportunities for industry collaborations in May 2002. A short course in intellectual property was offered.

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

Management structure and arrangement

Quantitative indicators:

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

Other indicators:

Continuity of long-term partnerships and research effort. Satisfaction of partners survey completed in 2001.

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

Quantitative indicators:

Performance Indicator	Target over life of Agreement	Measure 1999–2000	Measure 2000–2001	Measure 2001–2002
Annual task reviews	Six-month and annual	Six-month and annual	Six-month and annual	Six-month and annual
External audit	Annual	Annual	Annual	Annual
Audit committee	Quarterly 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
Reports to Board and CRC Program	Monthly, quarterly and annual reports to Board and CRC Program	Target reached	Target reached	Target reached

Other indicators:

Efficient and effective performance. Satisfaction of parties survey undertaken in 2001. Improved level of support from members.

International consultant advice. See commercial and international section.

Annual report. Reports made and submitted on time.

12. BUDGET

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

	Actual 1999/00	Actual 2000-01	Agr'mt 2000-01	Agr'mt 2001-02	Cumulative Total To Date		Agr'mt 2002-03	Agr'mt 2003-04	Agr'mt 2004-05	Agr'mt 2005-06	Grand Total		
					Actual	Agr'mt					Total ⁽¹⁾ 7 Yrs	Agr'mt 7 Yrs	Variance 7 Yrs
AIMS													
Salaries	517	818	756	757	1,335	1,263	757	722	650	609	4,830	4,758	72
Capital	0	0	0	0	0	0	0	0	0	0	0	0	0
Other	1,631	1,784	2,009	1,766	3,415	2,953	1,766	1,442	1,265	1207	10,861	10,399	462
TOTAL	2,147	2,602	2,765	2,523	4,749	4,216	2,523	2,164	1,915	1,816	15,690	15,157	533
AMPTO (REPRESENTING THE TOURISM INDUSTRY & OTHERS)													
Salaries	63	28	58	40	91	80	40	40	40	40	291	280	11
Capital	0	0	0	0	0	0	0	0	0	0	0	0	0
Other	57	19	95	230	76	267	230	230	230	230	1,226	1,417	(191)
TOTAL	120	47	153	270	167	347	270	270	270	270	1,517	1,697	(180)
GBRMPA													
Salaries	174	194	180	187	368	343	187	187	187	187	1,303	1,278	25
Capital	0	0	0	0	0	0	0	0	0	0	0	0	0
Other	229	242	224	233	471	427	233	233	233	233	1,636	1,592	44
TOTAL	403	436	404	420	839	770	420	420	420	420	2,939	2,870	69
JCU													
Salaries	440	406	446	405	846	845	405	405	394	394	2,849	2,848	1
Capital	0	0	0	0	0	0	0	0	0	0	0	0	0
Other	834	755	817	755	1,589	1,585	755	755	739	739	5,332	5,328	4
TOTAL	1,274	1,161	1,263	1,160	2,435	2,430	1,160	1,160	1,133	1,133	8,181	8,176	5
QSIA													
Salaries	283	62	15	13	345	306	13	13	13	13	410	371	39
Capital	0	0	0	0	0	0	0	0	0	0	0	0	0
Other	90	20	0	20	110	88	20	20	20	20	210	188	22
TOTAL	373	82	15	33	455	394	33	33	33	33	620	559	61
QDPI													
Salaries	357	314	321	311	671	473	314	314	314	314	2,237	2,039	198
Capital	0	0	0	0	0	0	0	0	0	0	0	0	0
Other	557	680	538	530	1,237	861	535	535	535	534.6	3,906	3,530	376
TOTAL	913	994	859	841	1,907	1,334	849	849	848	849	6,143	5,569	573
SUNFISH													
Salaries	67	12	10	0	79	72	0	0	0	0	79	72	7
Capital	0	0	0	0	0	0	0	0	0	0	0	0	0
Other	20	5	0	0	25	12	0	0	0	0	25	12	13
TOTAL	87	17	10	0	104	84	0	0	0	0	104	84	20
ANU/ UQ													
Salaries	0	0	37	26	0	26	26	26	26	26	130	156	(26)
Capital	0	0	0	0	0	0	0	0	0	0	0	0	0
Other	0	0	20	36	0	36	36	36	36	36	180	216	(36)
TOTAL	0	0	57	62	0	62	62	62	62	62	310	372	(62)
CSIRO MARINE													
Salaries	34	23	147	85	57	117	85	77	107	77	488	548	(60)
Capital	0	0	0	0	0	0	0	0	0	0	0	0	0
Other	57	38	13	118	95	161	118	106	147	107	690	756	(66)
TOTAL	91	61	160	203	152	278	203	183	254	184	1,179	1,304	(126)
QFS													
Salaries	50	4	4	4	54	54	4	4	4	4	76	76	0
Capital	0	0	0	0	0	0	0	0	0	0	0	0	0
Other	86	66	66	66	152	146	66	66	66	66	484	478	6
TOTAL	136	70	70	71	206	200	71	71	71	71	560	554	6
TOTAL IN-KIND CONTRIBUTIONS													
Salaries	1,985	1,861	1,974	1,828	3,846	3,579	1,831	1,788	1,735	1,664	12,693	12,426	267
Capital	0	0	0	0	0	0	0	0	0	0	0	0	0
Other	3,560	3,609	3,783	3,754	7,169	6,536	3,759	3,423	3,271	3,173	24,549	23,916	633
GRAND TOTAL IN-KIND													
	5,544	5,470	5,757	5,583	11,015	10,115	5,591	5,211	5,006	4,837	37,242	36,343	900

* Total = Cumulative Actual + Outyear 'Estimate'

TABLE 2 : CASH CONTRIBUTIONS (\$'000s)

	Actual 1999/00	Actual 2000-01	Agr'mt 2000-01	Agr'mt 2001-02	Cumulative Total To Date		Projected		Agr'mt 2004-05	Agr'mt 2005-06	Grand Total		
					Actual	Agr'mt	Agr'mt 2002-03	Agr'mt 2003-04			Total ⁽¹⁾ 7 Yrs	Agr'mt 7 Yrs	Variance 7 Yrs
PARTNERS													
AIMS	130	130	130	130	390	390	130	130	130	130	910	910	0
AMPTO #	1,102	1,240	1,240	1,240	3,582	3,582	1,240	1,240	1,240	1,240	8,542	8,542	0
GBRRF			148	100	148	100	100	100	100	100	548	500	48
GBRMPA	665	665	665	665	1,995	1,995	665	665	665	665	4,655	4,655	0
JCU	197	171	143	135	511	509	135	135	135	135	1,051	1,049	2
QSIA*	0	0	119	280	119	560	139	280	280	280	1,098	1,680	(582)
QDPI	138	138	138	138	414	414	138	138	138	138	966	966	0
SUNFISH*	0	0	30	70	30	140	60	70	70	70	300	420	(120)
QFS	0	50	0	0	50	50	0	0	0	0	50	50	0
TOTAL CASH FROM PARTICIPANTS	2,232	2,394	2,613	2,758	7,239	7,740	2,607	2,758	2,758	2,758	18,120	18,772	(652)
OTHER													
NEW MEMBERS	0	0	0	100	0	200	100	100	100	100	400	600	(200)
ASSOCIATE MEMBERS	0	0	0	100	0	150	0	100	150	200	450	700	(250)
EXTERNAL GRANTS	18	78	78	100	174	200	5	100	100	200	579	700	(121)
COMMERCIAL CONTRACTS	252	459	522	200	1,233	500	598	350	500	750	3,431	2,350	1,081
SPONSORSHIP/ DONATIONS	0	3	0	100	3	200	0	200	250	500	953	1,300	(347)
OTHER	0	97	29	0	126		0						
INTEREST	30	76	70	20	176	60	20	20	20	20	256	140	116
CRC GRANT													
	2,400	2,900	2,600	2,600	7,900	7,900	2,500	2,500	2,500	1,000	16,400	16,400	0
TOTAL CRC CONTRIBUTION													
	4,931	6,007	5,912	5,978	16,850	16,950	5,830	6,128	6,378	5,528	40,588	40,962	-374
Funds carried over from previous year													
	960	1,462	1,283										
Less unspent balance													
	1,462	1,283	1,194										
TOTAL EXPENDITURE													
	4,429	6,221	6,001	5,978	16,651	16,950					40,515	40,962	(447)
ALLOCATION OF EXPENDITURE BETWEEN HEADS OF EXPENDITURE													
SALARIES	2,411	3,374	3,264	3,753	9,049	10,666	3,615	3,848	4,004	3,470	23,986	25,741	(1,755)
CAPITAL	0	0	0		0	0	0	0	0	0	0	0	0
OTHER	2,018	2,847	2,737	2,225	7,602	6,284	2,215	2,280	2,374	2,058	16,530	15,221	1,309
TOTAL	4,429	6,221	6,001	5,978	16,651	16,950	5,830	6,128	6,378	5,528	40,515	40,962	(447)

Rep tourism industry derived from the Environment Management Charge

* Subject to FRDC funding

(1) Total = Cumulative Actual + Outyear 'Estimate'

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

	Actual 1999/00	Actual 2000-01	Agr'mt 2000-01	Agr'mt 2001-02	Cumulative Total To Date		Projected				Grand Total		
					Actual	Agr'mt	Agr'mt 2002-03	Agr'mt 2003-04	Agr'mt 2004-05	Agr'mt 2005-06	Total ⁽¹⁾ 7 Yrs	Agr'mt 7 Yrs	Variance 7 Yrs
GRAND TOTAL													
In-Kind Expenditure	5,544	5,470	5,757	5,583	16,771	15,699	5,591	5,211	5,006	4,837	42,999	36,343	6,656
Cash Expenditure	4,429	6,221	6,001	5,978	16,651	16,950	5,830	6,128	6,378	5,528	46,493	40,962	5,531
Total Resources Applied to Activities of Centre	9,974	11,691	11,758	11,561	33,422	35,010	11,421	11,339	11,384	10,365	89,492	77,305	12,187
ALLOCATION OF TOTAL RESOURCES													
Total Salaries (Cash & In-Kind)	4,396	5,234	5,238	5,581	14,868	16,074	5,446	5,636	5,739	5,134	42,404	38,167	4,237
Total Capital (Cash & In-Kind)	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Other (Cash & In-Kind)	5,578	6,456	6,520	5,979	18,554	16,574	5,975	5,703	5,645	5,231	47,087	39,137	7,949

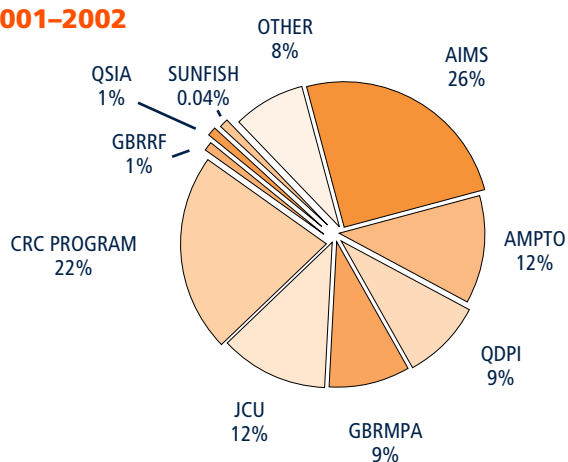
(1) Total = Cumulative Actual + Outyear 'Estimate'

TABLE 4 : ALLOCATION OF RESOURCES BETWEEN CATEGORIES OF ACTIVITIES

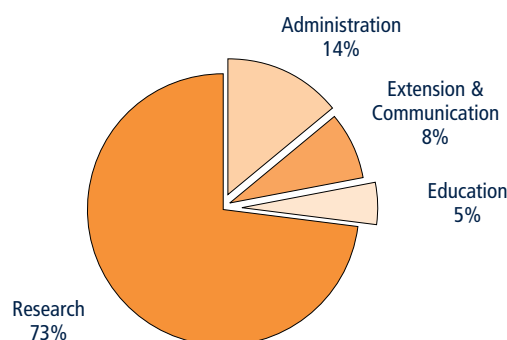
PROGRAM	\$ CASH (1) ('000s)	RESOURCE \$ IN-KIND (000's)	USAGE STAFF CONTRIBUTED (2)	STAFF FUNDED BY CRC (2)
RESEARCH	4,429	5,259	19.03	36.43
EDUCATION	271	243	0.96	1.45
EXTENSION/TRAINING	460	13	0.05	1.90
ADMINISTRATION	840	243	2.73	5.96
TOTAL	6,001	5,757	22.76	45.74

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

TOTAL CASH & IN-KIND CONTRIBUTIONS 2001-2002



APPLICATION OF CASH FUNDING 2001-2002



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 2001–02, 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

Contributions from QSIA and Sunfish through FRDC funded projects were \$119,131 and \$29,783 respectively. Funds received from JCU incorporated payments deferred from the previous financial years. CRC Reef admitted a new member, the Great Barrier Reef Research Foundation, and recorded a participant contribution of \$148,000 against a budgeted contribution of \$100,000.

Budget estimates

The Agreement projections for 2002-03 include receipt and expenditure of deferred payments of Participant contributions from 2001-02. Revisions have been made to the estimates of commercial contractual income based on existing contracts that CRC Reef has in place with external parties. In addition to this, participant contributions for QSIA/Sunfish have been revised to indicate the potential contributions from existing FRDC contracts. The Agreement projections 2003-04 to 2005-06 recorded in Tables 1, 2 and 3 are as contained in Schedule 4, Budget, of the Commonwealth Agreement.

Unexpended balance

At the end of the reporting period, CRC Reef held funds of \$1,194,463 to be allocated for expenditure in 2002-03.

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.

13. AUDIT

AUDIT

**AUDITORS REPORT TO
THE COOPERATIVE RESEARCH CENTRES SECRETARIAT,
DEPARTMENT OF INDUSTRY, SCIENCE AND RESOURCES
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 2002

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 2002 as required by clause 14(1)(f) of the Commonwealth Agreement. The parties to the CRC 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 Commonwealth.

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 include 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 as to 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 so as to present a view of the sources of funding and the application of funding of the CRC 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.

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 2002 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, 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 appears to be no material reporting of irregularities (Clause 5(1)).
3. The Researcher's allocations of the budgetary resources between Heads of Expenditure has not varied from budget by \$100,000 or 20% (whichever is the greater amount).
4. Capital Items acquired from the Grant and Researcher's Contributions are vested as provided in the Joint Venture 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

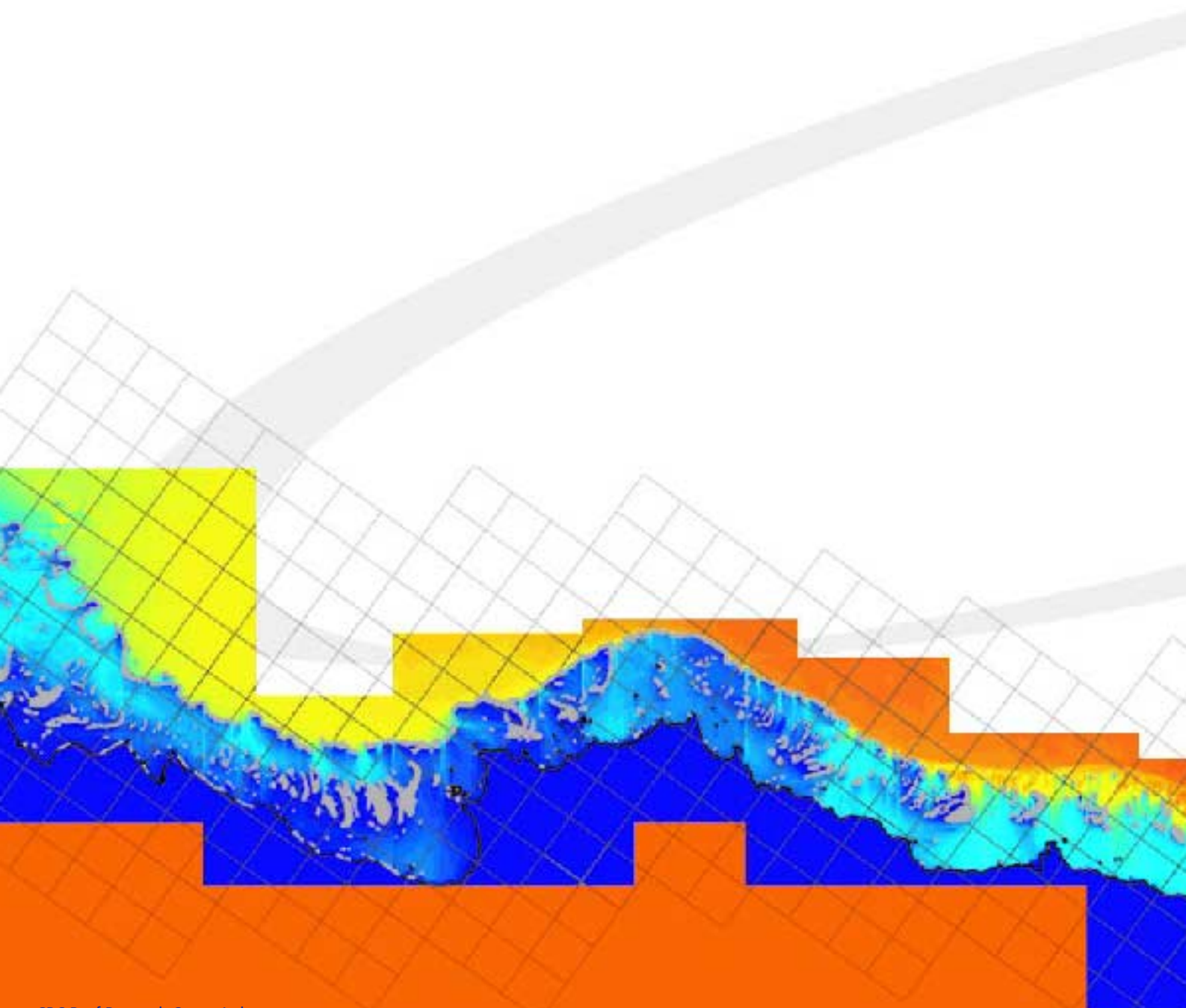
[Signature]
John Zabala
Partner

Date:

23 August 2002

List of abbreviations

ABC – Australian Broadcasting Commission	MAC – Management Advisory Committee
AIMS – Australian Institute of Marine Science	MTQ – Museum of Tropical Queensland
AMPTO – Association of Marine Park Tourism Operators	NCAR – National Center for Atmospheric Research, Boulder, Colorado
ANU – Australian National University	NGO – Non Governmental Organisation
APEC – Asia Pacific Economic Cooperation	NIFA – Norwegian Institute of Fisheries and Aquaculture
AQIS – Australian Quarantine and Inspection Service	NIWA – National Institute of Water and Atmospheric Research Ltd
AUSTAG – Australia (country wide) sportfish tagging program	NOAA – National Oceanic and Atmospheric Administration, USA
CCIMPE – Commonwealth Consultative Committee on Introduced Marine Pest Emergencies	NOO – National Oceans Office
CEO – Chief Executive Officer	PCQ – Ports Corporation Queensland
COTS – Crown-of-thorns starfish	PNG – Papua New Guinea
CRC – Cooperative Research Centre	QDPI – Queensland Department of Primary Industries
CSIRO – Commonwealth Scientific and Industrial Research Organisation	QFS – Queensland Fisheries Service
EA – Environment Australia	QPWS – Queensland Parks and Wildlife Service
ELF – Effects of Line Fishing	QSIA – Queensland Seafood Industry Association
EPA – Environmental Protection Agency	RAC – Research Advisory Committee
ESRI – Environmental Systems Research Institute	ReefMAC – Coral Reef Line Fishery Management Advisory Committee
FAO – Food and Agriculture Organization of the United Nations	SAC – Scientific Advisory Committee
FRDC – Fisheries Research and Development Corporation	SUNTAG – Queensland (state wide) sportfish tagging program
FTE – Full Time Equivalent	TAFE – Tertiary and Further Education
GBR – Great Barrier Reef	TESAG – School of Tropical Environmental Studies and Geography, JCU
GBRMP – Great Barrier Reef Marine Park	TRC – Task Review Committee
GBRMPA – Great Barrier Reef Marine Park Authority	UCLA – University of California, Los Angeles
GBRRF – Great Barrier Reef Research Foundation	UNDP – United Nations Development Programme
GBRWHA – Great Barrier Reef World Heritage Area	UNH – University of New Hampshire
GIS – Geographic Information System	UQ – University of Queensland
HarvestMAC – Harvest fisheries Management Advisory Committee	UWA – University of Western Australia
IMPAC – International Marine Project Activities Centre	WA – Western Australia
IOI – International Ocean Institute	WSSD – World Summit on Sustainable Development
IP – Intellectual Property	
IUCN – World Conservation Union	
JCU – James Cook University	



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