CRC Reef Research Centre

Cooperative Research Centre for
the Great Barrier Reef World Heritage Area

ANNUAL REPORT 1999/2000

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

Mission

To support and promote the ecologically sustainable development and management of the Great Barrier Reef World Heritage Area (GBRWHA) and tropical reef ecosystems.

Centre Objectives

PROGRAM A: Management for Sustainability

To use innovative systems to assist policy-makers and environmental managers in decision-making for the use and conservation of the GBRWHA.

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.

PROGRAM C: Maintaining Ecosystem Quality

To generate critical information that will assist users, the community, industry and managers to know the status and trends of marine systems in the GBRWHA.

PROGRAM D: Information Systems & Synthesis

To ensure that technology and knowledge developed by CRC REEF is utilized by industry, managers and community to ensure that the Great Barrier Reef is maintained for future generations.

PROGRAM E: Education & Communication

To provide exciting and innovative education and training programs for the future leaders in research, industry and management in Australia and overseas.

PROGRAM F: Commercial and International

To provide training and advisory services, international education links, research and advisory contracts relevant to the aims of the Centre, and to generate income from these activities.

Major Achievements

- Research on dugong and turtles was instrumental in developing the Hopevale community turtle and dugong hunting management plan which received the Prime Minister's Award for Community Leadership.
- Cyclone Wave Atlas and Pontoon Guidelines will assist GBRMPA and the tourism industry to achieve world's best practice in optimising construction and mooring of offshore structures in the GBRWHA.
- The Seagrass-Watch Community Monitoring Program received a Prime Minister's Environment Award. Computer simulation of tropical river plume discharge allows risk analysis of the impacts of flood events.
- CRC researchers provided major contributions to GBRMPA Representative Areas Program ensuring that examples of major habitat types are protected within the Marine Park.
- Seven postgraduate students on CRC scholarships completed their degrees and seven new students were awarded scholarships. Ten former students were employed in related industries.
- External grants exceeded projected income. International collaborative research on reef fishes resulted from a Queensland Government agreement with the Smithsonian Institute.

CRC Reef Research Centre (ABN 62 089 499 034) is a company limited by guarantee with the following

AMPTO Association of Marine Park Tourism Operators

Australian Institute of Marine Science

DPI Queensland Department of Primary Industries (on behalf of the Qld Government)

QCFO Queensland Commercial Fishermen's Organisation

Great Barrier Reef Marine Park Authority

JCU James Cook University

Sunfish

with the Commonwealth's Cooperative Research Centres Program

Cover: **Photos: Dr David Wachenfeld, Triggerfish@bigpond.com**
Pictured: Dr Annabel Jones
Thanks to Jason Brown and crew at Diving Dreams, Townsville, for use of equipment and pool facility
Cyclone Wind Model supplied by A/Prof Tom Hardy, Mr Lou Mason and Mr Jason McConochie

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Photo: Robert Parsons

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EXECUTIVE SUMMARY

1. EXECUTIVE SUMMARY

Chairman and CEO's Report

The year in review has been one of enormous change for the CRC Reef Research Centre *(CRC Reef)*. The first *CRC Reef* (CRC for the Ecologically Sustainable Development of the Great Barrier Reef) was established in 1993 and operated until September 1999 when the new 'CRC for the Great Barrier Reef World Heritage Area' came into existence. The *CRC Reef* is now a public not-for-profit company formed to carry out the business of the Centre, with new programs, a new Board, a new CEO and Centre Visitor.

The first *CRC Reef* was successful in adding value to the research activities of its members and in delivering outcomes for those using research results in reef management, tourism and fishing industries. Much of that success was due to the former Chairman of the Board, Sir Sydney Williams, and his outstanding leadership, guiding the first CRC to its position as one of the best in Australia. Sir Sydney retired as Chairman in September 1999.

The recently retired CEO, Simon Woodley, made an invaluable contribution leading the *CRC Reef* through a re-orientation of its research programs and the successful bid to the Commonwealth CRC Program for a further six years of funding support. As part of this process, Dr David Williams (Deputy CEO (Research) and the Centre's Program and Project Leaders have led an extensive round of consultation with research users.

The *CRC Reef* members continued to exhibit a high degree of cooperation in Board Committee operations, research program preparation and delivery, media activity, participation in public meetings and financial management. In the May 2000 Review of Tropical Marine Science, the Chief Scientist, Dr Robin Batterham, identified *CRC Reef* and its partners as a model for the provision of excellent applied collaborative research of relevance to Australia.

Significant research outcomes for 1999–2000 include:

- Completion of fine-scale surveys and extension training activities for crown-of-thorns starfish.
- Successful completion of the second round of manipulations in the Effects of Line Fishing Experiment.
- Completion of the *Atlas of Cyclone Waves and Water Levels in the GBR*.
- Completion of the draft guidelines for the building of reef-based tourist infrastructure.
- Completion of the Hopevale Dugong and Turtle Hunting Management Plan.
- Provision of expert advice to GBRMPA in the development of the Representative Areas Program for the Great Barrier Reef Marine Park.
- Social impact assessment studies of commercial fishing communities.
- Initiation of collaborative research between *CRC Reef* and the Smithsonian Institute on coral reef fish ecology in the Caribbean and Great Barrier Reef.

Collaborative initiatives with other CRCs and organisations have been pursued during the year. *CRC Reef* has joined the CRC Greenhouse Gas Alliance, due to its particular interest and expertise in the monitoring of sea surface temperatures and coral bleaching in the GBRWHA. The *CRC Reef* initiated collaboration between researchers from *CRC Reef*, James Cook University, Australian Venom Research Unit (University of Melbourne) and Surf Life Saving Australia to integrate research on the Irukandji Jellyfish Syndrome.

CRC Reef members from the Australian Institute of Marine Science (AIMS) and the Great Barrier Reef Marine Park Authority (GBRMPA) have collaborative links with the National Oceanic and Atmospheric Administration in the USA modelling sea surface temperatures. The *CRC Reef*, through Dr Terry Done (AIMS), has played a major role in the organisation of the

From left *CRC Reef* Chairman Sir Sydney Schubert, incoming Chief Executive Officer Dr Russell Reichelt and past CEO Mr Simon Woodley.

Photos: CRC Reef

forthcoming 9th International Coral Reef Symposium to be held in Bali in October 2000.

Links with industry continue to be strengthened. Task Associates from industry and management agencies have been assigned to each research task, aiming to enhance mutual understanding and ownership of each research task. A collaborative monitoring project with the tourism industry 'Eye on the Reef' has been broadened to include monitoring of identified indicators of reef health. The Users Advisory Group has been reconstituted to include broad representation of community, government, industry and conservation interests. In late 1999 and early 2000, a series of specific public briefings by key researchers on coral bleaching and global warming were held in Cairns, Airlie Beach, Brisbane and Gladstone at the request of the tourism industry and other community interest groups.

The *CRC Reef* Education Program continued its dynamic and supportive role for students. Seven PhD students from the first *CRC Reef* completed their degrees in 1999/00 and were employed in relevant fields. A further four are expected to complete by the end of 2000. The first cohort of seven new post-graduate students for the new Centre were appointed and inducted. CRC students participated in a CRC Career Development and Leadership course. In November 1999 *CRC Reef* initiated the proposal to host the course in north Queensland in conjunction with other tropical CRCs.

Within the next few years it is intended to position the *CRC Reef* with a more diverse revenue base with strategies already in place to find new members and generate new income.

The late Professor Michael Pitman, former Centre Visitor, was an invaluable source of advice to the Board and CEO, as well as being an essential link to the CRC Program. Professor Peter Andrews (Co-Director of the Institute of Molecular Biosciences) is the new Centre Visitor.

The outgoing CEO, Mr Simon Woodley, together with Centre staff has ensured that the transition from the old CRC to the new one has been done efficiently and effectively in a very short time span. The Directors of the *CRC Reef* Board have continued their commitment in supporting the Centre through their guidance and expertise.

CRC Reef's goal is to build on existing partnerships and develop new ones, especially with other CRCs. The strategy is outward-looking and staff and members look forward to the coming years, which promise to be an exciting period of growth for *CRC Reef*.

Sir Sydney Schubert, Chairman
Dr Russell Reichelt, CEO (June 2000)

(Note: Simon Woodley was the CEO for 11 of the 12 months covered by this report)

A note from Simon Woodley

I have been privileged to organise and lead the CRC Reef Research Centre to undertake the transition from the CRC for the Ecologically Sustainable Development of the Great Barrier Reef to the CRC for the Great Barrier Reef World Heritage Area. In doing so, I thank the Board for their guidance, CRC staff for their support and the many people from the *CRC Reef* participants whose expertise and capability has built the outstanding reputation of the CRC.

The new CRC has maintained the momentum of research, education and other activities from the previous Centre while at the same time establishing new directions, programs and governance arrangements. This has been highlighted in the report of the First Year Visit to the Centre by the Chairman of the CRC Committee and Panel members. The Panel commented positively on the successful transition to the new CRC, on strategies for self-sufficiency, high quality research programs, well-defined objectives and sophisticated evaluation processes.

As I leave the Centre for new challenges, I would like to acknowledge the unique body of researchers, managers, educators, industry people and stakeholders who have collectively worked so hard towards the goal of ecologically sustainable use of the Great Barrier Reef World Heritage Area.

I wish the new CEO, Dr Russell Reichelt, the Board and staff of the Centre and all associated personnel well for the future.

Simon Woodley

STRUCTURE AND MANAGEMENT

The *CRC Reef* Secretariat.
Back row: Deputy CEO (Research) Dr David Williams, Administrative Assistant Ms Amanda Norman.
Front row: CEO Dr Russell Reichelt, Executive Officer Ms Anne Tucker and Executive Assistant Mrs Lisa Arnell.

Photo: Robert Parsons

2. STRUCTURE AND MANAGEMENT

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 the Centre participants:

- 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 Commercial Fishermen's Organisation (QCFO);
- The State of Queensland through its Department of Primary Industries (QDPI); and
- SUNFISH Queensland Inc.

and an Agreement with the Commonwealth of Australia.

The CRC has formed a public not-for-profit company CRC Reef Research Centre (ABN 62 089 499 034) to conduct the business of the Centre. These arrangements were incorporated into the Centre and Commonwealth Agreements signed in September 1999. Income tax exemption has been granted for the new company.

The management structure consists of the Board and the CEO. The Board and CEO are advised by Advisory Groups and Committees and supported by a Secretariat dealing with administrative and financial activities.

The Board comprises an independent Chair and nine Directors.

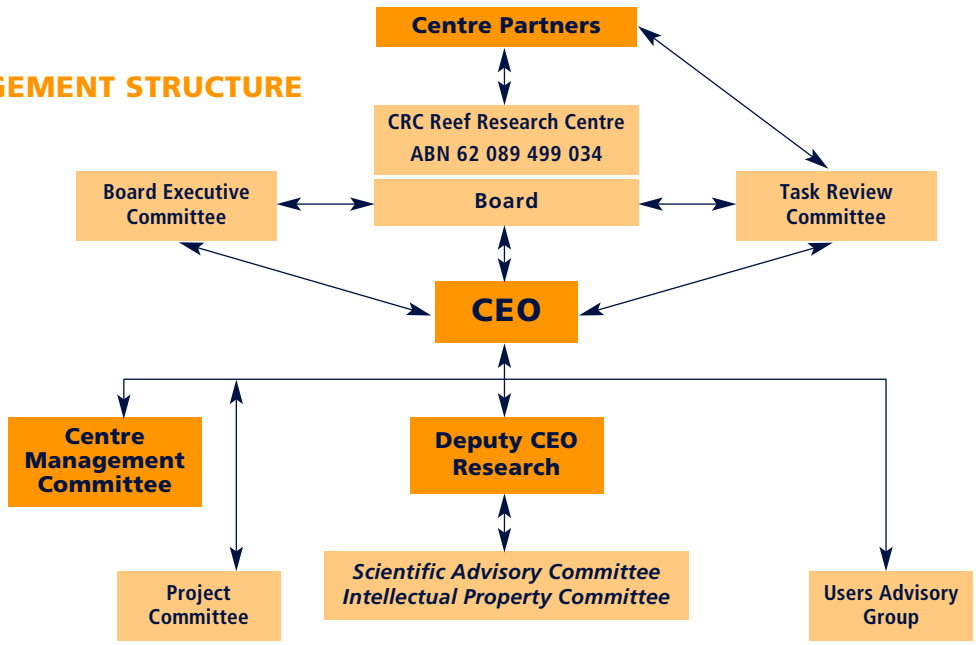
Board membership at 30 June 2000 was:

Sir Sydney Schubert	Chairman
Dr Peter Isdale	AIMS
Mr David Hutchen	AMPTO
Mr David Windsor	AMPTO
Hon. Virginia Chadwick	GBRMPA
Mr Matt Pope	GBRMPA
Prof Norman Palmer	JCU
Mr Ted Loveday	QCFO
Mr Peter Neville	QDPI
Mr Bill Sawynok	SUNFISH

Other Board Members through the reporting period were:

Sir Sydney Williams	Chairman (to 5 November 1999)
Dr Russell Reichelt	AIMS (to 20 April 2000)
Mr Mike Burgess	AMPTO (to 28 July 1999)
Mr Tony Briggs	AMPTO (to 27 August 1999)
Mr Richard Kenchington	GBRMPA (to 26 November 1999)
Dr Barry Pollock	QDPI (to 22 May 2000)
Mr Alan Turnbull	SUNFISH (to 5 August 1999)

MANAGEMENT STRUCTURE



The Board regulates all operations of the Centre including monitoring and determining strategic development, reporting to the participants and the Commonwealth, approving Centre Programs, the Annual Budget, financial arrangements and commercialisation of Centre intellectual property, and appointing the Chief Executive Officer and Program Leaders. The Board met six times during the year.

The Centre Visitor, Prof Peter Andrews, provides a strong link between the Centre and the CRC Program. Prof 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 the Centre. 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.

The Board has approved the establishment of a set of standing committees to advise the Board and assist Centre management:

- Board Executive Committee
- Task Review Committee
- Scientific Advisory Committee
- User Advisory Group
- Intellectual Property Committee
- Centre Management Committee

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; advises the Board on the above matters. The Committee has met on two occasions and membership at 30 June 2000 included:

Sir Sydney Schubert	Chair, CRC
Dr Peter Isdale	AIMS
Mr David Windsor	AMPTO
Prof Norman Palmer	JCU
Hon. Virginia Chadwick	GBRMPA

The Centre Management Committee comprises staff of the *CRC Reef* and meets weekly. The Users Advisory Group considers issues and knowledge required by major user groups, reviews research tasks and outputs and assists in implementation towards effective use of research. The Scientific Advisory Committee (SAC) and Intellectual Property Committee (IPC) provide scientific and technical advice to the Board through the CEO and Task Review Committee on the research, technology transfer and IP aspects of the Centre's programs. The Task Review Committee reviews tasks and policy proposals on behalf of the participants in the Centre and advises and makes recommendations to the Board on such matters. The committees have met on three occasions and membership at 30 June 2000 included:

Users Advisory Group
Dr R Reichelt (CEO)
Dr D Williams (DCEO)
Mr M Turner (EPA/QPWS)
Mr S Hillman (Ports)
Mr D Windsor (AMPTO)
Dr A Green (GBRMPA)
Ms C Anderson (QPAA)
Mr D Bateman (SUNFISH)
Ms R Lea (QFMA)
Mr D Souter (QCFO)
Mr P Comben (Conservation)
Prof M McManus (NTMN)
Mr A Nolan (ATSIC)

SAC/IPC
Dr R Reichelt (CEO)
Dr D Williams (DCEO)
Program Leaders
Social Science Representative
Mr D Windsor (AMPTO)
Dr A Green (GBRMPA)
Postgraduate Coordinator
Postgraduate Student

Task Review Committee
Sir S Schubert (Chair)
Mr D Windsor (AMPTO)
Dr A Green (GBRMPA)
Mr J Robinson (SUNFISH)
Mr D McPhee (QCFO)
Prof N Palmer (JCU)
Dr P Isdale (AIMS)
Mr P Finglas (QDPI)

In addition, task or issue specific Committees (Effects of Fishing Steering Committee, Engineering Guidelines Steering Committee, Performance Indicators Steering Committee) have been established to assist cooperation and integration in research programs and tasks.

Since its formation in September 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 the Centre through project management systems incorporating rigorous processes undertaken in the development and approval of research tasks including both research and user scrutiny. The tasks are then approved by the Board on advice from the Scientific Advisory Committee and Task Review Committee. All research tasks are reviewed in December (checking progress), and June (full review of progress and achievements against milestones).

3. COOPERATIVE LINKAGES

Seagrass monitoring at Cockle Bay, Magnetic Island. From left CRC Researcher Dr Vicki Hall, Research Assistant Ms Michelle Boyle, Postgraduate Student Jane Mellors and Assistant Chris Parker. *Photo: Alison Moore*

Objective:

To continue and extend the collaborative and cooperative culture created by the first CRC Reef Research Centre between researchers, industry, stakeholders and resource managers.

Highlights:

- Review of Communication and Extension project and implementation of recommendations to enhance internal and external links.
- Establishment of Tourism Research Advisory Group to facilitate exchanges between researchers, industry and management.
- Establishment of Users Advisory Group with broad representation of research users to increase networks and dissemination of research results.
- The 'Eye on the Reef' industry-based monitoring program has received strong support from the marine tourism industry in the Cairns region.

Cooperative linkages between the Centre's member organisations and with external agencies are vital. The new CRC GBRWHA has built on linkages established under the previous ***CRC Reef***, intending to enhance those links, as well as creating new cooperative arrangements.

The strategies to achieve strong linkages are:

- a well-developed communication strategy, supported by its members;
- excellent internal communication, with personal contacts, paper-based and electronic tools;
- strong support for multi-agency research tasks;
- provision of opportunities for CRC researchers and stakeholders to meet in workshops, meetings and advisory committees etc.;
- 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.

INTERNAL LINKS WITH PARTICIPATING ORGANISATIONS

During 1999, GBRMPA reviewed its information needs, with support from *CRC Reef*, aiming to identify research priorities. The process involved extensive consultation between the CRC and GBRMPA staff. The resulting report was used to guide decisions on the funding priorities for CRC research, and will be published in 2000.

A review of the extension and communication practices of *CRC Reef*, which involved consultation with all *CRC Reef* member organisations, identified areas where internal communication between members of the CRC could be improved. Implementation of the recommendations of the review, including development of agreed practices for identifying the contribution of Centre participants, enhancement of the CRC corporate image, improvements in communication practices, and revision of the CRC communication strategy in 2000.

The Centre has further developed its Task Associate program to increase liaison between CRC researchers, resource managers and private operators. The role of the Associate is to improve the relevance and application of strategic research, facilitate information transfer and help develop public policy and better industry practices. A large number of staff from GBRMPA, QDPI, QPWS, QFMA and the tourism industry continued to help develop new CRC tasks, identify management needs, support projects and review results as an integral part of Centre activities during the year.

To further enhance linkages between researchers, industry and management in the marine tourism sector, the Centre has established a Tourism Research Advisory Group, which will meet twice annually. The group will exchange views on research needs of significance to the marine tourism industry, and assist in the dissemination of research findings.

In the planning phase of the large multi-agency research project on Seabed Diversity in the GBRWHA, meetings of stakeholders and participants were held in Townsville in April 2000. This process allowed input to the development of the project, roles of participants, and agreement on objectives and output.

The Users Advisory Group also helps facilitate links throughout the CRC. This group was expanded in 2000 to be more representative of the wider group of research users and includes representatives from AMPTO, GBRMPA, QCFO, QDPI, QPWS and Ports Corporation of Queensland, conservation agencies, the network of marine research stations, and indigenous interests. Much of the committee's work involves reviewing research directions and results, and the dissemination of the results through their organisational links, to more effectively use knowledge emerging from the CRC.

Stakeholder linkages were also enhanced by:

- extensive e-mail information networks between staff, students and associates;
- publishing scientific results in a range of newsletters, reports, brochures and in the media;
- re-establishment of a two-day *CRC Reef* conference presenting research findings to stakeholders;
- regular seminars, workshops and briefings to industry and regional resource management agency staff;
- formal representation of industry and management on various committees, such as the Effects of Line Fishing Steering Committee and the Eye on the Reef Steering Committee to provide information for management plans, fisheries proposals, tourism policy and ports and shipping codes of practice;
- participation of CRC researchers and staff on a wide range of working parties, state government Advisory Committees, national and international groups etc. where research results can be utilised directly in management outcomes by partner agencies;
- regular movement of researchers, staff and students across positions in CRC member agencies, enhancing the appreciation of the role of the CRC in collaborative, applied research; and
- the use of technology such as video-conferencing to facilitate meetings of steering groups.

EXTERNAL LINKAGES

Briefings about the application of the Centre's research programs were given to Federal and State Parliamentarians, senior national and international policy-makers and industry leaders. In June 2000, a presentation supported by *CRC Reef* in collaboration with AMPTO was made to the Queensland's country state cabinet meeting in Cairns on the status of the crown-of-thorns starfish and its effects on the marine tourism industry.

A large contingent of *CRC Reef* staff, the Board Chair and CEO attended the CRC Association national conference in Brisbane in May 2000, facilitating the maintenance of linkages with other CRCs and the national CRC program. Dr Vicki Hall was co-convenor for a CRC Association workshop on education at the conference.

In Cairns, 11 reef tourist operators joined with GBRMPA and the CRC to fund the 'Eye on the Reef' program in Cairns. This industry-based monitoring program collects information about the health of reef sites, water temperatures and unusual changes

Industry involvement has been critical to the successful development of the *CRC Reef* Ports and Shipping project. Pictured at the Townsville Port are Port of Townsville Environmental Services Manager Ms Caryn Anderson, BHP Cannington Safety, Environment and External Affairs Manager Mr Mick Roche and Project Leader Dr Rob Coles.

Photo: Robert Parsons

in marine life. The initiative has been welcomed by the marine tourism industry.

Both at the Board and the project management level, there have been significant discussions between the CRC and Queensland's ports industries to discuss extending the involvement of ports in the CRC program, and to develop research proposals supported by the ports and shipping industry.

A collaboration of three CRCs plus the Cairns Port Authority, Cairns City Council and Tourism Tropical North Queensland established a joint cooperative research unit in Cairns. The new unit has been in operation from August 1999, with an aim to provide strategic research information and decision support to the regional tourism industry. The activities of the Centre will be reviewed by the Board in August 2000.

Strong links have continued with other CRCs, particularly those in the environment sector. An alliance of CRCs with an interest in tropical environmental issues (Sustainable Sugar Production, Sustainable Development of Tropical Savannas, Tropical Rainforest Ecology and Management, and Sustainable Tourism) maintained close contract when dealing with common issues. A number of staff training, education and public awareness activities have been conducted jointly by CRCs based geographically in North Queensland.

Discussions are continuing about the development of a proposed node of the *CRC Reef* in Western Australia, including Murdoch University, University of Western Australia and CALM for research and education collaboration. One PhD student is working with UWA and CALM on a research project.

The Centre provides information and products to more than 1000 small to medium enterprises (SME's) in tourism, fishing, ports, shipping and engineering industries, mostly through peak associations such as AMPTO and QCFO (now QSIA). Many operators are directly involved with research, and support staff by assisting with logistical aspects of field work, such as provision of ship-time. In addition, an extension program continued in the Cairns region by CRC researcher, Mr Udo Engelhardt, to brief tourism operators about the status of crown-of-thorns starfish. Training was provided to 30 operators about monitoring and control programs.

During 1999–2000, the Centre was associated with more than 130 organisations, including the following:

Australian Universities and TAFE Colleges

- James Cook University
- Australian National University
- University of New South Wales
- Flinders University
- Melbourne University
- University of Tasmania
- University of Western Australia
- Central Queensland University
- Monash University
- University of Wollongong
- University of NSW
- Curtin University

CRCs and Australian Research Organisations

- Australian Institute of Marine Science
- CRC for the Antarctic and Southern Ocean Environment
- CRC for Aquaculture
- CRC for Sustainable Tourism
- CRC for Tropical Rainforest Ecology and Management
- CRC for the Sustainable Development of Tropical Savannas
- CRC for Sustainable Sugar Production
- CRC for Greenhouse Gas Alliance
- Lizard Island Research Station
- The Australian Museum
- Airborne Research Australia
- Thyne-Reid Education Trust
- AUSCORE
- CSIRO Land and Water
- CSIRO Marine Research, Hobart

Government Departments and Corporations

- Great Barrier Reef Marine Park Authority
- Qld Dept of Primary Industries
- Qld Fisheries Management Authority
- Ports Corporation of Queensland
- Qld Sugar Corporation
- Qld Dept of Natural Resources
- Qld Dept of Transport
- Qld Dept of State Development
- Qld Dept of Main Roads
- Tourism Queensland
- WA Dept of Conservation and Land Management
- Northern Territory Museum
- Queensland Museum
- Qld Environmental Protection Agency
- Qld Parks and Wildlife Service
- Bureau of Sugar Experimental Stations
- Museum of Victoria
- Museum of Tropical North Queensland
- Australian Centre for International Agricultural Research
- Australian Marine Science and Technology Ltd
- Environment Australia
- Tasmania Dept of Primary Industries
- Fisheries Research and Development Corporation

Local Government and Consultative Organisations

- Townsville City Council
- Cairns City Council
- Bundaberg City Council
- Hervey Bay City Council
- Gladstone Port Authority
- Cairns Port Authority
- Mackay Port Authority
- Townsville Port Authority
- Trinity Inlet Management Program
- Strand Scientific Advisory Group
- Mackay Tourism and Development Bureau
- Pioneer Valley Water Board

Community Organisations

- SUNFISH
- Zonal Advisory Committees
- Regional Marine Resource Advisory Committees (Cooktown, Port Douglas, Townsville, Cairns, Airlie Beach, Rockhampton)
- Hopevale Community Council
- Australian Rotary Health Foundation
- Surf Life Saving Australia
- North Queensland Conservation Council
- Johnstone River Catchment Management Group
- Herbert River Catchment Management Centre
- Townsville-Thuringowa Landcare Group
- Mitchell River Watershed Management Group
- Australian Coral Reef Society
- Australian Marine Science Association
- Australian National Sportsfishing Association
- Burdekin Dry Tropics Regional Strategy Group
- National Tropical Marine Network

Private Companies

- Frankland Island Cruises
- Great Adventures
- Pure Pleasure Cruises
- Quicksilver Connections
- Quicksilver Diving Services
- Sunlover Cruises
- Undersea Explorer
- Friendship Cruises
- Haba Dive
- Ocean Spirit Cruises
- Passions of Paradise
- Poseidon Outer Reef Cruises
- Quickcat Cruises
- Taka Dive
- Hitchhiker Reef Trips
- Down Under Dive
- Cairns Dive Centre
- Big Cat Cruises
- Rob Benn Cruises
- Hamilton Island
- Hayman Island Resort
- BHP Cannington
- Lizard Island Resort
- Dunk Island Resort
- Hamilton Island Resort
- Great Keppel Island
- Dive Queensland
- Econnect Pty Ltd
- Flamingo Bay Research
- Sinclair Knight Merz
- Fisheries Research Consultants
- Gutteridge Haskins Davey Pty Ltd
- Pacific Marine Group
- North Marine Services
- Digital Dimensions
- Calypso Video Productions
- Sea Research
- Reefwatch Australia
- GIS Australasia
- Peri Pty Ltd.
- Bundaberg Canegrowers
- Innisfail Canegrowers
- Mackay Canegrowers

Industry Associations

- AMPTO
- QCFO (now QSIA)
- Queensland Canegrowers
- Nth Qld Engineers Association
- Dive Queensland
- Interpretation Australia Assoc
- Tourism Tropical North Qld
- Townsville Enterprise
- Queensland Farmers Federation
- Tourism Council of Australia

INTERNATIONAL LINKS

The Centre strategy for international linkages is directed towards the contracting of expertise in the conduct and development of research, ecologically sustainable marine industries and management of tropical marine ecosystems. The aims are to enhance the national objectives of Australia in relation to external assistance to developing countries, to develop export industries, and to generate income for the Centre. A report on the Commercial and International Program is provided in Section 6. International links related to current research programs are presented below.

CRC Reef has played a significant role in the agreement signed between the Queensland Government and the Smithsonian Institute (USA). The agreement supports initiatives in research and education, including a joint USA/*CRC Reef* project led by Prof Howard Choat on the population biology of tropical fishes.

Dr Terry Done, a *CRC Reef* Program Leader (AIMS), was elected President of the International Coral Reef Society, the peak international body for coral reef science. During his term, he has also had responsibility for the organisation of the International Coral Reef Symposium to be held in Bali in October 2000.

Dr Zena Dinesen (GBRMPA) has been invited to become a member of the IUCN Management Effectiveness Task Force, in conjunction with NOAA. This working group is developing internationally recognised practices to identity performance indicators which will enable the evaluation of different management practices, in line with research funded by the *CRC Reef*.

Results of research by Dr Alistair Birtles and Dr Peter Arnold on Minke Whales were included in a report to the International Whaling Commission (IWC) on research into the Southern Pacific Sanctuary in 2000, and the researchers were invited to participate in workshops associated with the IWC meeting.

Prof Helene Marsh, Program Leader (JCU), has continued collaboration with IUCN, with support from a Pew Fellowship, to produce a dugong action plan.

Prof Philip Pearce, Project Leader (Program B), is a member of the Education Council of the World Tourism Organisation and is involved in the development of training programs for tourism development in the Asia-Pacific region.

Mr Ray Berkelmans is coordinator of a research project on long-term temperature monitoring which involves collaboration between AIMS, GBRMPA, CSIRO, and NOAA. Since 1996, water temperature has been monitored at up to 46 sites on the GBR. The collaboration with NOAA is to determine the relationship between water temperature and coral bleaching, which has been a dominant science and management issue globally in the last two decades, and which may be related to climate change.

Large numbers of papers have been published in the international scientific literature, especially in prestigious journals. Full details of international papers are in Section 8.

Internationally, the Centre was associated with:

Organisations and Programs

- National Oceanic and Atmospheric Administration, USA
- International Panel on Climate Change
- Land-Ocean Interactions in the Coastal Zone, The Netherlands
- European Space Agency
- World Conservation Monitoring Centre
- Environmental Defence, USA
- Plymouth Marine Laboratories
- Resource Analysis, Netherlands
- IRD, Noumea
- Organisation for Tropical Studies
- Tropical Biology Association
- International Coral Reef Society
- IUCN – Management Effectiveness Task Force
- IUCN – Coral Reef Initiative
- IUCN – Sirenia Specialist Group
- CITES
- Scientific Steering Committee, Institutional Dimensions of Global Environmental Change
- Harvard Medical School
- SWIRE Marine Institute, Hong Kong
- World Tourism Organisation
- World Wildlife Fund, Japan
- Alfred-Wegener Institute of Polar and Marine Research, Germany
- Palau International Coral Reef Center
- FAO – Fisheries Research Institute
- New England Aquarium, Boston
- Corial, Hawaii
- Pew Foundation

Universities and research institutions

Purdue University, USA
University of New Hampshire, USA
University of Hawaii
East-West Center, Hawaii
University of Southern Florida
University of Illinois, USA
Berkeley University, USA
University of British Columbia, Canada
University of the Philippines Kasetsart University, Bangkok
Hasanuddin University, Indonesia
University of Waikato, New Zealand
University of Auckland
Victoria University, Wellington
Free University of Amsterdam
Université Joseph Foutier
Utrecht University, Netherlands
University of East Anglia, UK
University of Genova, Italy

VISITORS TO CENTRE

CRC Reef hosted a number of visitors to the Centre, including delegations of eight people from the Mexican Parliament, four from Japanese research institutes, and seven from the Smithsonian Institute (USA). Other important visitors included Dr Robin Batterham, Australia's Chief Scientist, and visitors from CSIRO.

Many tourism operators such as dive and charter boats are directly involved with research. Here a dive boat leaves Cairns for another reef adventure.

Photo: CRC Reef

RESEARCH

4. RESEARCH

PhD student Mr Jamaluddin Jompa and Task Leader Dr Laurence McCook inspect coral and algal settlement plates used in an experiment to test the effects of seaweed overgrowth on the recovery of coral populations following the mass coral bleaching in 1998.

Photo: Robert Parsons

Highlights:

- Four new research programs including 12 new projects were successfully established in 1999/2000.
- Development of a world-first Cyclone Wave Atlas integrated with Pontoon Guidelines assisted GBRMPA and the Tourism industry to achieve world's best practice in optimising construction and mooring practices of offshore bases for tourism to minimise environmental risk in the most cost-effective way.
- CRC researchers provided a major contribution to GBRMPA's Representative Areas Program through expert opinion and application and development of software programs to delineate major bioregions of the GBRWHA.
- Research on dugongs and turtles was instrumental in the development and launching of the Hopevale community's turtle and dugong hunting management plan that won a Prime Minister's Environmental Award for Community Leadership.

2 inset photos: Katharina Fabricius, Alison Moore

Program A. Management for Sustainability

(Program Leader: Prof Helene Marsh, JCU)

OBJECTIVE:

To use innovative systems which are transparent to industry and management to enable policy makers and environmental managers to use all relevant information, including the different values and perceptions of risk of various stakeholder groups, in decision-making for the use and conservation of the GBRWHA.

Natural resource management in Australia is broadening its traditional focus 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 Program A will document the social, cultural and economic values of the World Heritage Area, and will develop performance indicators for specific management objectives, and methods to optimise resource usage, coordination, information-sharing, decision making and decision implementation.

Program A is organised in three projects. Only two of the eight tasks in these projects started in 1999/2000. Most of the remaining tasks will start in 2000/2001. Other tasks in the Program were completed from the previous CRC.

Project A1: Social, Cultural and Economic Values

(Project Leader: Dr Mark Fenton, JCU)

A tool for identifying the Social Impacts on the Commercial Fishing Industry of GBR Management (*Dr Mark Fenton, JCU*) There is an increasing emphasis towards understanding the impacts that might occur as a result of changes in resource policy, with attention being given to the social distribution of impacts – who benefits, and who pays. The social assessment process is designed to enhance the decision-making process, obtain greater acceptance of decisions by all parties and minimise the influence of politics. This task is developing an assessment of the socio-economic characteristics of the commercial fishing industry in Queensland. Commercial fishing is the fifth largest primary industry in Queensland with a gross value of production of $361 million per year and an associated capital investment of over $250 million. The industry consists of 2000 vessels and directly employs over 6,000 people (DPI 1997).

This research task focuses on understanding and predicting the social and economic impacts associated with potential changes in fisheries policy and management. Social assessment methodology is being used to identify the socio-economic links between the fisheries resource, fishing businesses and the broader community. Baseline information has been collected through structured telephone interviews. Fishers were asked questions relating to their business structure and fishing practices, personal demographics and the location of their business and personal expenditure.

The response rate was remarkable. For those fishers that could be contacted, over 92% completed the interview (unless they were latent license holders). A report summarising the results of the survey will be made widely available in November, and it is anticipated that the web-based GIS database of the results will be available in early 2001.

An assessment of the socio-economic characteristics of the Queensland fishing industry is the major theme of a *CRC Reef* project led by Dr Mark Fenton. Pictured is Task Researcher Ms Nadine Marshall.

Photo: Robert Parsons

Towards integrating social, cultural and economic concerns into management of the GBRMPA *(Dr Leanne Fernandes, JCU/CRC)* The social, economic, ecological and cultural management objectives held by people who use and manage the GBR Marine Park need to be identified to evaluate management options. As a result of this task, which involved interviewing over 220 people, GBRMPA now has a clearer view of its objectives from the perspectives of their staff and all major stakeholder groups including the general public resident on the coast adjacent to the region, as well as Brisbane and Sydney. Stakeholders prioritised their main objectives to enable managers to explicitly consider the likely impact of their decisions on different groups. A user-friendly decision support system combines this information on objectives and priorities to help staff at GBRMPA conduct structured, systematic assessments of the likely impacts of any decision.

Project A2: Decision Support for Managers

(Project Leader: Dr Stephen Crook, JCU)

Performance indicators for the GBRWHA *(Dr Zena Dinesen, GBRMPA/CRC)* The development of indicators to measure the effectiveness of natural resource management is an emerging area of international interest as managers are required to be more accountable for their decisions. Dr Zena Dinesen is developing protocols on performance for the GBRWHA. She is testing a combination of relevant features of the management effectiveness evaluation framework developed by IUCN/WCPA for protected areas management evaluation, as well as methodologies used in State of the Environment Reporting and for developing indicators for ecologically sustainable fishing. All these indicators are still being tested, refined and adapted by the relevant agencies. Indicators for the GBRWHA are being developed and tested using two case studies identified by the GBRMPA: its Representative Areas Biodiversity Conservation Program and the Whitsunday Plan of Management.

Two components of the latter include evaluations of the Whitsundays Reef Protection Program conducted by Elizabeth Dinsdale, a research student at JCU, and the visitor education strategies used in the Whitsundays conducted by Elizabeth Potter, a visiting Fulbright Scholar from the USA. The research has identified requirements for planning processes in the GBRWHA:

- To have clear, specific objectives (and preferably agreed targets) against which to evaluate progress and success.
- To disaggregate broad, high-level goals or objectives and to divide them into clear measurable objectives.
- To involve stakeholders as well as managers of natural resources in identifying what should be monitored and evaluated.

Program B. Sustainable Industries

(Program Leader: Dr Bruce Mapstone, JCU/CRC)

OBJECTIVE:

To provide critical information for and about the operations of the key uses of the GBRWHA necessary for the management of 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 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 in this environment is often difficult and sometimes controversial. Successful management hinges on the appropriate regulation of human use, under the assumption that the bio-physical system will satisfactorily 'look after itself' provided that the impacts of use are sufficiently small. A thorough understanding of the industries, their needs, and their impacts is critical to achieving this balance. In Program B, we seek to provide sufficient information about the uses of the GBRWHA for regulation and best practice to be put in place such that those uses do not threaten the key World Heritage Values of the region but 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.

Charter boat operators throughout Queensland continue to provide valuable assistance to *CRC Reef* projects.

Photo: Sally Troy

Project B1: Ports and Shipping

(Project Leader: Dr Rob Coles, QDPI)

Objective: To provide better information for risk management of port and shipping activities in the GBRWHA through:

- Documenting the locations and properties of critical habitats associated with high-risk locations on GBR shipping lanes.
- Identifying at a fine-scale marine habitat areas in or adjacent to major ports which contribute to fisheries production or conservation values
- Reviewing existing knowledge of environmental impacts on marine ecosystems of disposal of dredge material at sea and on coastal land.
- Developing hydrodynamic models of selected Queensland ports.

The ports and shipping focus is an exciting new area for the CRC in its second lease of life. Many major and minor ports and marinas operate in or adjacent to the GBRWHA and thousands of ships traverse the waters of the WHA annually, often carrying cargos that we would not want released in an accident. These activities are vital to the normal social and economic function of Queensland, but do pose some obvious potential risks to the environment.

In this project we focus on three main themes. First, we will detail those habitats nearest to the ports and major shipping lanes so that the environmental risks or impacts of port or shipping activities or mishaps can be best managed to minimise environmental impacts. Second we are developing and applying hydrodynamic models of the major ports to allow better understanding and management of activities such as docking large vessels and dredging of ports and shipping lanes. This work also will provide new insights to the fate of chemicals or sediments in the water column associated with the normal port operations. Third, we are working with the ports industry to monitor the composition of biological communities in ports in the interests of detecting any introduced species. This work is resulting in an unprecedented catalogue of species distribution data for inshore environments in tropical Australia. In the same vein, we are working with ports and other industry sectors to examine the feasibility of developing a novel process for treating the ballast water of international ships to ensure that no exotic species are introduced to the WHA in that ballast water.

Being a start-up project in 1999–2000, we have been working hard with the industry stakeholders defining the overlap between the desires and needs for research of the major stakeholder groups, such as Ports Corporations and Australian Maritime Safety Authority. In addition, we have begun preliminary modelling work. The modelling work builds on strong existing ties between the Marine Modelling Unit at JCU and some of the Ports Corporations and is a good example of the sort of close collaboration between industry and research providers we look for in Program B.

A major step in setting the scope of the Ports and Shipping Project has been a workshop among all the main stakeholders and project staff in October 1999. This workshop provided a valuable chance to discuss the range of research needs and begin setting the main directions for the project in the short term. As with all projects in Program B, stakeholder engagement will be crucial to the application of our research and this year has set the Ports and Shipping Project on a good footing for the future.

Project B2 – Sustainable Tourism

(Project Leader: Dr Gianna Moscardo, JCU)

Objective: To provide reliable, accurate and relevant information on tourism in the GBR region to support both public and private sector managers to plan for and develop sustainable tourism in the GBRWHA.

Tourism research builds on the foundation established in the previous CRC, and is a major on-going project in the new *CRC Reef*. Research in this project in 1999–2000 has mostly involved wrapping-up existing work and planning the transition of tasks from the past to future.

One of the strengths of the project is the continuation of monitoring the perceptions, origins and destination preferences of visitors to the GBR and evaluations of their needs from tourism operators. This work provides a unique long-term perspective of eco-tourism on the GBR and important insights into how industry and management might need to adjust their activities to cater for ever-changing visitor expectations. Other research in the project provides detailed analysis of feedback from tourists about their satisfaction with trips to the GBR, and what factors determine whether they have a good or a bad trip. One of the new starters in this Project involves documenting how the GBR is portrayed in national and international media, and an evaluation of how this might influence the choices intending tourists make about where they ultimately visit. Again, this information should provide useful feedback to industry operators about how best to market their business and feedback to managers about issues that are being portrayed about the status of the GBRWHA.

Another new task in the Sustainable Tourism Project is looking at the interactions between divers and a new species of Minke Whale that visits the northern GBR seasonally. The predictable presence of these whales in the GBR Region has been targeted by some tourist operators to give their clients very special experiences, allowing them to get into the water with the whales. With funding from the National Heritage Trust program, administered through the CRC and JCU, we have been working with the operators to devise best-practice ways of allowing the activity to continue, but on the whales' terms.

Project B3: Innovative Engineering

(Project Leader: A/Prof Tom Hardy, JCU)

Objective: To provide design inputs and design techniques that will reduce environmental impacts and improve the economics and structural integrity of reef structures.

The Innovative Engineering Project continues the ground-breaking research begun in the Engineering Program of the previous CRC. Accordingly, 1999–2000 was predominantly a year of task completion and planning for new directions. Some impressive outputs for the project this year include a completed paper, an atlas of wave conditions expected under cyclonic conditions for the entire GBR, a prototype CD-ROM based interactive version of the wave atlas and the wrapping-up of a set of guidelines for the development and installation of tourist pontoons in GBR waters. Both of these outputs should aid both managers and industry considerably in the choice of where to place pontoons and the streamlining of their installation.

Another task completed this year involved extensive modelling and field studies of the feasibility of using island resort wastewater as irrigation to reduce the flow of wastewater nitrogen from islands into surrounding GBR waters. The results show that waste-water irrigation can reduce substantially nitrogen discharges into reef environments, though the amount of reduction depends on the soil and water table characteristics of each island. Again, this a great example of good research pointing the way to efficient and environmentally friendly solutions to potential problems arising from human use of the GBRWHA.

Ground-breaking research continues within the Innovative Engineering Project. Pictured are Project Leader A/Professor Tom Hardy, Research Engineer Mr Lou Mason and Research Officer Mr Jason McConochie.

Photo: Robert Parsons

Project B4: Fishing and Fisheries

(Project Leader: Dr Bruce Mapstone, JCU/CRC)

Objectives:

- To provide assessments of key fin-fish stocks in reef and inshore habitats of the GBRWHA.
- To describe the dynamics of fishing fleets both within and across fisheries in the GBRWHA.
- To synthesise information on the likely operational consequences of alternative management strategies, their social and economic impacts, and their effects on the environmental impacts of fishing in the GBRWHA.
- To provide management strategy evaluations for management of fisheries in the GBRWHA, taking into consideration the multi-sector, multi-fishery impacts of management strategies in each fishery.

From a solid grounding of research into the reef line fishery over the past six years, the new CRC is broadening its fisheries research to include work on both reef and inshore fisheries. Our attention will continue to be focused mainly on finfish, although by value-adding to QDPI's history of research on mud crabs and prawn fisheries, we will be diversifying in those directions as well. The new directions have been in the planning stages in 1999–2000, but are now set to go in the coming years.

This year was another big year for the Effects of Line Fishing (ELF) Project, which commenced in 1995. This year we completed the second round of manipulations of fishing pressure and reef closures that are central to the Effects of Line Fishing Experiment. This means that we are now into the final stage of the experiment – monitoring exactly how stocks of reef fish re-build after the impacts of fishing. The ELF team also has been working closely with all stakeholders this year to refine the details of stakeholders' objectives for the reef line fishery in the medium-long term, and to discuss a range of potential strategies for management of the fishery. This information is central to our evaluations of the strengths and weaknesses of potential management strategies that will provide a common currency with which stakeholders can discuss how well those strategies will meet their (sometimes conflicting) objectives.

Engagement with stakeholders and the management of the reef line fishery continues to be a key element of the Fishing and Fisheries Project. This year we produced another four newsletters, contributed to the refinement of the Coral Reef Fin Fish and Tropical Fin Fish draft Management plans, and continued our active contact with charter boat operators, commercial fishers and recreational fishers.

The Great Barrier Reef World Heritage Area is host to a vast array of diverse marine species.

Photo: David Wachenfeld

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 indicate the status of the ecosystem and/or its sub-components. The detection of 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 which will anchor the public debate on the status of the GBRWHA. It will also give early warning of any systematic trends in status and condition within this large and complex ecosystem.

Project C1: Conserving Biodiversity

(Project Leader: Dr P Doherty, AIMS)

In this transition year, the project includes numerous research tasks that are contributing to regional marine planning. The project team is assisting GBRMPA to develop and evaluate the performance of its Representative Areas Program, and it is monitoring the status of critical habitats (coral reefs, seagrass beds) and stocks of sensitive marine wildlife (dugongs, cetaceans, and seabirds).

In 1999–2000, researchers from this project formed the core of a GBRMPA-led Representative Areas project team. The Representative Areas system is required to protect a viable sample of all the biological diversity of the GBRWHA. The first stage involved the identification of 'bioregions', and the second will be the selection of representative and special biological communities for protection within those bioregions. Bioregions are defined as regions that are relatively homogeneous with respect to the range of environments, habitats and biological communities that they contain. The team delineated 64 contiguous 'bioregions', mostly bands of reefs and sea-floor running parallel to the coast. By ensuring that a substantial sample of all habitats in each of the bioregions is protected from human impacts, the system will make an important contribution to protecting the Area's entire complement of biological diversity and ecosystem processes.

The biological survey data for the Representative Areas Program were relatively sparse, especially for the sea floor, and new spatial statistics and interpolation approaches combined with expert opinion were used to delineate bioregion boundaries. In order to resolve a serious data deficiency for sea-floor biodiversity, planning was undertaken by Centre researchers and fishery partners for a major new task to commence in 2001–2002. In addition to broad scale biodiversity mapping, objectives and outcomes related to the fishing industry (e.g. bycatch sustainability and trawl impacts on sessile fauna) were also identified as very high priority.

The project's existing reef monitoring tasks were extremely valuable in assessing the impact of coral bleaching and crown-of-thorns starfish. Detailed monitoring of 48 reefs distributed over 10 degrees of latitude showed that several reefs had a net

Measuring coral populations is an important part of broad scale biodiversity mapping with particular reference to the status of marine habitats.

Photo CRC Reef

loss of coral cover that could be attributed to a major coral bleaching event in 1998. Rapid synoptic surveys over the same area indicated that the presence and impact of crown-of-thorns starfish were mainly confined to reefs in the Cooktown to Townsville section of the Great Barrier Reef. Within this sector, finescale surveys revealed high numbers of cryptic juvenile starfish likely to grow into destructive adult populations, and this early warning has allowed tourism operators to protect prime sites using protocols developed at the Centre.

Marine plants are a critical yet poorly understood component of the Great Barrier Reef ecosystem. Whereas the importance of seagrass as food for dugongs and turtles, and food and shelter for fish and invertebrate production and biodiversity are well known, we have limited capacity to advise on how to protect and manage them. In 1999–2000, extensive surveys that were completed at a number of locations filled major gaps in our knowledge of the distribution of sea-grass communities and species in deep waters, intertidal areas and coral reefs along and across the Great Barrier Reef. Daily productivity rates were correlated to the composition of mud in the sediments and suspended in the water, and the amount of available phosphorus. One species, which is prime food for the dugong, had high below-ground productivity, allowing it to recover quickly following dugong grazing or physical disturbance. Information from these studies will be used in setting guidelines for water quality and seagrass conservation management in the Marine Park. Our Marine Plant Ecology Group received a Prime Minister's Environmental Award for their Seagrass-Watch community based monitoring program.

Significant populations of threatened vertebrates inhabit the GBRWHA – dugongs, turtles, whales, dolphins and seabirds. In 1999, this project's work was instrumental in the development and launching of the Hopevale turtle and dugong hunting management plan that won a Prime Minister's Environmental Award for Community Leadership. New work on bridled terns confirmed an earlier counterintuitive result that suggested that populations of this sea bird nesting on small islands can habituate to benign human presence. This finding has implications for the management of tourism visitation to sea-bird islands and will be further investigated.

Project C2: Assessing land-based threats and impacts

(Project Leader: Dr Miles Furnas, AIMS)

This project focuses on understanding and measuring the impacts of terrestrial runoff from catchments modified by human activities on the GBRWHA. Enhanced nutrient runoff into the sea can have a range of deleterious impacts. The project relies on comparative studies of catchment and ecosystem responses in the sea adjacent to more and less developed sections of the Queensland coast. A particular focus is the biological responses of inshore coral reefs to elevated silts and nutrients, and a search for useful 'bioindicators' of the degree of land-based pollution in different habitats. This work will be complemented by satellite remote-sensed data that will be used to establish the levels of primary production in the coastal seas and to interrogate archival records for any evidence of eutrophication (nutrient pollution) of the coastal lagoon during the last 20 years.

Data collected from several rivers through the 1998–99 wet season showed an apparent 5 to 10-fold range amount of fine sediment exported per litre of water discharged. This finding demonstrates that care must be taken in extrapolating from one river to another, and to that end, the relationship between N and P exports to total water discharge from several rivers was determined for the first time. For two catchments (Herbert, Tully), most of the inorganic N exported was in the form of nitrate (NO_3) that mostly comes from the lower catchment. In the Burdekin, by contrast, its primary source appears to be the upper catchments. In dry catchments, the amount of fine suspended sediment (that can be monitored automatically) was shown to be well correlated with nutrient concentrations (that cannot). In wet tropical rivers, it was not so well correlated because of regional differences in soil types.

A computer simulation model and risk assessment software were developed to better quantify the area under the influence of river plumes under current and future catchment management and water allocation regimes. Maps of return periods based on analysis of simulations of Burdekin River floods for the period 1966–1995 – (see AIMS website) show the risk of exposure to Burdekin River water at a range of dilutions and durations for any point in the WHA between Ayr and Cairns. Frequent fresh water exposure precludes reefs, occasional fresh water kills corals, and occasional brackish water causes some types to lay down a band of skeleton that glows under ultra-violet light. We used this fact to cross-check the accuracy of the simulated flood-plumes and found that the timing and intensity of this luminescence in AIMS' coral colony collection (>240 corals from 30 reefs) cross-correlated well in times and places reached by the simulated flood plumes.

Studies on other effects of runoff on coral reefs focused on hard corals, soft corals and algae. Under nutrient-enriched conditions, sediments became coagulated by microbial growths into a sticky 'marine snow' that smothered juvenile corals, in contrast to 'clean' sediments, that were relatively innocuous to corals, and 'nutritional' sediments, that were consumed by some coral species. Biodiversity of soft corals was found to be strongly related to water clarity, with generic richness being depressed in turbid water. This study thus suggests that soft coral biodiversity may be a useful indicator of increased turbidity caused by expanding land use, and that taxonomic composition is a better bioindicator than total hard or soft coral cover. The project produced a major atlas for soft corals on the Web and a book version to be published in 2000–2001.

Algae (seaweed) responses to sediments and nutrients in land runoff were also clarified. It was shown there is no simple cause and effect relationship between land runoff and increased algal overgrowth of established corals on nearshore coral reefs. Although enhanced nutrients can increase daily algae growth, it does not do so if the algae are already nutrient-replete, and where daily growth increases, total biomass may remain the same because new growth is consumed by herbivores as rapidly as it is produced. Lastly, there is little or no tendency for algae to overgrow established corals in many reef situations. The work cautions against taking the view that a high abundance of seaweeds is necessarily symptomatic of a nutrient 'problem'. Management responses might be more appropriately directed at causes of depletion of herbivorous fishes, snails or sea-urchins than the control of nutrient runoff into a bay.

Research has shown that rising water temperatures or reductions in water quality will act to reduce the corals resistance and increase the virulence of microbes. *CRC Reef* PhD student Mr Andrew Baird studies signs of disease.

Photo: Paul Marshall

Project C3: Predicting the Physical Environment

(Project Leader: Dr Janice Lough, AIMS)

Much of the ecology of the Great Barrier Reef, and how we can access and use its resources, is strongly determined by the physical environment. This project includes a range of research tasks on the role of the physical environment and the impacts of changing oceanographic conditions upon the marine ecosystem of the GBRWHA.

There are major concerns that increasing global temperatures and atmospheric CO_2 due to burning of fossil fuels and land clearing, is threatening coral reefs in a number of ways. One study used temperature records to show that the unusually warm sea surface temperatures that caused coral bleaching on the GBR in early 1998 were associated with reduced wind speed due to high atmospheric pressure that was part of a large-scale ocean circulation anomaly. The summer of l997–1998 was shown to be the warmest of the past century of instrumental records, to be linked to an unusually strong El Nino-Southern Oscillation (ENSO) event, and to be possibly enhanced by global warming. Satellite technology is also being used in this study – to map spatial and temporal patterns in sea temperature with a view to scenario modelling and risk assessment of future episodes of coral bleaching and death. Our research on records in skeleton cores collected in 1980 suggests that so far there had been no impact on the fundamental process of coral calcification. To that date, calcification rates had actually increased with the increased average sea temperatures, more than counteracting any declines caused by changing ocean chemistry brought about by rising CO_2 levels in the atmosphere. Analysis of more recent coral growth will determine whether this trend has continued to the end of the century.

Another major thread in this project concerned use of oceanographic data and models to estimate the year-to-year reliability of replenishment of populations of corals, fish and other creatures. The study supported the conventional wisdom (and the basis for marine protected area planning) that most juveniles arrive from distant 'source' reefs, with a much smaller proportion settling on the same reef as their parents. This result was based on model runs of hydrodynamics and particle transport over 20 years for the Cairns section of the Great Barrier Reef. The project worked to better understand how the larvae-bearing currents of the Great Barrier Reef are driven by the oceanic currents of the Coral Sea. This work included the comparison of results of oceanographic instruments with regional circulation derived from satellites. The circulation shows features that may be related to ENSO and coral bleaching events, and it appears that variations in the position of a gyre and the presence of eddies in the Coral Sea may strongly influence flows at the GBR continental margin, and hence larval transport among the reefs.

Program D. Information Systems and Synthesis

(Program Leader: Dr Terry Done, AIMS)

OBJECTIVE:

To ensure that technology and knowledge developed under *CRC Reef* and all other relevant programs is utilised by industry, managers and the community to ensure benefits available from the Great Barrier Reef are maintained for current and future generations.

Research Program D is closely linked to the Extension and Communication Project, since it includes elements of innovation in information management and analysis, decision support and expert consideration of policy-related issues. The Program is planned to go into full operation in 2000–2001. Two Projects have been established, each of which incorporates two research tasks.

Project D1: Information Systems

(Project Leader: Dr Jamie Oliver, GBRMPA)

Information Management Systems *(Dr Adam Lewis, JCU/GBRMPA)* In 1999–2000, the concept for this task was developed through consultation with members and the Centre's task review process. A web-page portal will provide direct access to the visions, goals, philosophies and organisational structures of the Centre and its members, with links to their homepages for more detailed information. There will be a graphical user interface to provide access to information available for different places in the GBRWHA, and an 'issues' interface leading to discussion papers, titles and contacts for relevant projects, and bibliographies. For members of the CRC, links facilitating further access to meta-data will be provided. Some key information to be included in the system was finalised, including a Geographic Information System (on CD ROM) and a full database and project management system for Centre tasks.

Environmetrics and Data Mining *(Dr Glenn De'ath, JCU/CRC)* This research task made a major contribution to the Representative Areas Program (RAP) of the Great Barrier Reef Marine Park Authority (see C1). This task applied and further developed spatial and statistical models to delineate about 64 bioregions ('reef' and 'non-reef'), based on surveys of fauna, flora, depth and sediments undertaken by CRC researchers and external collaborators. Patterns of soft coral biodiversity have been related to water turbidity, and factors affecting the spatial distribution of coralline algae have also been related to physical variables, such as sediment. These findings are relevant to land management practices. The task continues its contribution to the RAP through participation in a working group that will select and optimise for biodiversity conservation, the size and distribution of protected areas within the bioregions, taking into account the current and anticipated patterns of human use in the Area.

Project D2: Information Synthesis

(Project Leader: Dr Terry Done, AIMS)

Spatial Decision Support: This task will come into full operation in 2000–2001, following appointment of a Task Leader. It will develop and apply spatial tools to evaluate social and environmental impacts and implications of various policy options such as 1) use and protection of the Area's habitats and resources and 2) use of land and water, leading to changes in the extent and nature of impacts of runoff of water, sediments, nutrients and/or contaminants. It is intended that the Project will both make generic advances and support specific needs of Centre parties through the following task and links with other relevant projects across the Centre. In 1999–2000, concept development was progressed through the Centre's consultation and review processes, and through an international workshop on information management and decision support held at AIMS and funded by the United Nations Environment Program. The position of Project Leader will be re-advertised following an unsuccessful attempt to recruit during 1999–2000.

Working Groups and Synthesis *(Dr Terry Done, AIMS)* This research task facilitates the Centre's role as a broker of knowledge that informs public debate and matters of policy. The project brings together clients (e.g. representatives from industries and their regulators) with experts from within and beyond the Centre to work through issues. The nature of the outputs will vary, including discussion papers intended to inform decision makers in industry, management and policy, as well as provide outreach material directed towards the Centre's web site and communication Program. In May 1999 a workshop on impacts of terrestrial run-off on the GBRWHA was held to review an issues paper prepared by the CRC summarising current scientific understanding of the complex issues. The purpose of this document is to raise the level of the public debate and to identify the priority areas for future research. Several issues were identified as potential subjects for the attention of future working groups. The revised document following from the

Fixing coral settlement plates onto a section of the reef.

Photo: Ken Anthony

workshop will be regularly updated on the CRC web site. Protection of tourism sites from damage by aggregations of crown-of-thorns starfish is currently proving very costly to the tourism industry, and a working group is proposed to clarify ecological and socio-economic issues and to consider solutions to the operators' problems and their broader ecological and social implications. Small businesses that service aquarium and curio trades are seeking to modify the regulations governing their access to coral resources, and a working group is planned to analyse the issues from ecological and socio-economic perspectives. The Project will come into full operation in 2000–2001.

EDUCATION

5. EDUCATION

All student projects associated with ***CRC Reef*** research tasks now have task associates, ensuring an ongoing link with industry. ***CRC Reef*** PhD students Ms Amanda Hodgson and Ms Anna Lashko on campus at James Cook University.

Photo: Robert Parsons

Objective:

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

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

Highlights:

- Seven postgraduate students supported by CRC scholarships completed their degrees.
- Seven new postgraduate students were awarded scholarships and were recruited into research programs for 2000, with a total of 26 students receiving CRC stipends.
- Seven students received travel grants of $1200 to present at the International Coral Reef Symposium in 2000.
- Two students completed successful Industry Sponsored Placement Programs.
- Student training opportunities included a CRC Career Development and Leadership Course run in Townsville, as well as short courses for GIS, conflict resolution, social assessment and scientific writing.

Program E. Education and Communication

(Program Leader: A/Prof Vicki Harriott, JCU/CRC)

The National Perspective

The publication of the Department of Education, Training & Youth Affairs' White paper on education and research training has raised many issues of significance both to universities and CRCs. These include the potential decrease in funded postgraduate student places, increased pressure on student completion times, and the need to include the development of generic skills to meet the needs of future employers in postgraduate training. The challenge facing the CRC is to include in students' training a component on industry-accepted skills and experience, while at the same time reducing completion times.

Commitment to Education and Training

The *CRC Reef* has increased its commitment to Education and Training by initiating a 50% appointment of a Program Leader, Education and Communication. The Centre thanks Prof Howard Choat, the previous Education Program Leader, for his leadership within the *CRC Reef* over many years. A/Prof Vicki Harriott was appointed as Program Leader in February 2000.

The value and achievements of the Education and Training Project was also recognised by the extension of the appointment of the Project Leader for Postgraduate Education, Dr Vicki Hall, for a further three years. Dr Hall was the joint organiser of an Education Workshop at the CRCA Conference in Brisbane in May 2000, and presented a paper on education policy at the workshop.

In collaboration with the Deputy CEO (Research), a strategy and budget to plan for stipends and research support for postgraduate students throughout the life of the CRC was developed, to ensure that the goals and milestones of the CRC are met. The importance of maintaining links with our industry and management partners has received greater emphasis this year by ensuring that all student projects associated with research tasks have an assigned Task Associate.

Innovative Approaches to Education and Training

The day to day management of the student body is provided by the Project Leader for Postgraduate Education to ensure that students are actively involved in all the Centre's activities and have access to resources necessary to complete their degrees. Mentoring is provided for project management and communication through performance reviews, tutoring and training courses.

After recognising a gap in the availability of statistical advice to CRC students, arrangements have been made to provide statistical support on a shared financial arrangement with James Cook University.

As part of a major review of the *CRC Reef* web-site, its use as a tool for student recruitment and providing information useful for current and prospective students has been recognised. Development of Education web-pages has begun, and should be complete by late 2000.

Opportunities for training identified for the forthcoming two years are: media training; commercialisation of research and its intellectual property implications; negotiation skills; multivariate analysis; the relationship between policy development and science.

Student Employment

The CRC continues to produce well-rounded graduates that are highly sought after in the work place. Ten current and recently graduated students have been employed by national and international agencies in the fields of research, academia, management and industry during 1999–2000.

Employment History of Students (1999–2000)

CRC Postgraduates	Place of Employment
N Crosbie	Austrian Academy of Science
M Dommisse	University of Alaska
A Heap	Australian Geological Survey Organisation
P Marshall	Great Barrier Reef Marine Park Authority
K Michalek-Wagner	Great Barrier Reef Marine Park Authority
J Mellors	Queensland Department of Primary Industries
D Oemcke	United Water, South Australia
A Orpin	National Institute of Water and Atmospheric Research, New Zealand.
M Samoilys	McGill University, Canada
D Welch	Great Barrier Reef Marine Park Authority

Postgraduate Education

(Project Leader: Dr Vicki Hall, JCU/CRC)

There was a focus on assisting students from the former CRC in completing their degrees, recruiting new students into the exciting research programs of the current CRC, and maintaining the balance between tertiary and industry training. The highlights of the year included hosting the CRC Career Development and Leadership Workshop in Townsville in collaboration with CRC Rainforest, CRC Sugar and CRC Savannas, coordinating the CRCA Education Mini-symposium in collaboration with Dr Anne Campbell, and introducing an induction program for new students.

Recruitment of Students

Seven PhD scholarships were awarded in early 2000 in the fields of Environmental Studies, Marine Biology and Anthropology and Archaeology. A half-day induction program for new postgraduate students was successfully completed in June 2000 to introduce new students to the benefits and responsibilities of belonging to a CRC.

An additional 19 students received support in the form of continuing stipends or write-up scholarships to complete postgraduate projects initiated under the previous CRC. The Centre also has 52 students registered as *CRC Reef* student associates, ie. have an association with the *CRC Reef* through their project, supervisor or through the receipt of financial support. All these students are eligible to apply for training opportunities and travel awards.

Involvement of industry with postgraduate students is strongly encouraged. Of the 28 postgraduate students receiving stipend support in the last year, eight had supervision from outside the university (from AIMS, GBRMPA and QDPI). Of student associates of the CRC, 18 have external supervision (AIMS, CSIRO, QDPI, GBRMPA, UQ).

Scholarships and Awards

Policies for recruitment of postgraduate students into the new CRC were developed in 1999, and revised in 2000 to streamline the selection process. Student induction materials, including the CRC Postgraduate Information Booklet, were revised.

The Centre continued to support student representation at conferences. Following a competitive selection process, seven students were supported with grants of $1200 to attend the 9th International Coral Reef Symposium in Bali in October 2000.

The Centre provided opportunities for student involvement at the undergraduate level through augmentative grants and graduation prizes. Six Honours Augmentative Grants were awarded to assist students with the funding of their research projects of significance to the GBR World Heritage Area. The average value of grants awarded was $900.

Ms Line Bay received the CRC Reef Research Centre Prize for demonstrating the best overall ability in Honours level studies for a research thesis relevant to the Great Barrier Reef World Heritage Area. This prize was organised by a *CRC Reef* Participant, AMPTO, and was sponsored by Sundial, Airlie Beach.

The Kelleher Prize of $3,000 was awarded to Bronwyn Grigg, an Environmental Engineering student for best academic performance in the third year of a Bachelor of Engineering degree.

Successful Student Completions

Seven CRC scholarship postgraduate students completed their degrees in 1999–2000. Five of these students graduated at the James Cook University ceremony in April 2000. At the same ceremony, the former Director of the Centre, Professor Chris Crossland was awarded an Honorary DSc. Two students (Ken Anthony and Kirsten Michalek-Wagner) graduated with distinction. A further three scholarship students have submitted their theses and are awaiting examiners' reports.

New Initiatives in the Management of Students

The academic and mentoring support provided by the Project Leader to CRC students has been of great benefit to students particularly in areas of project management, seminar presentations and scientific writing. In conjunction with university supervisory staff, performance reviews were completed for students identified as being at risk of not completing their degrees within a reasonable time-frame. These students were encouraged to develop realistic project management timelines and were monitored regularly. Four students completed performance reviews in the last year.

Training for Industry

Two students completed placements under the Industry Sponsored Placement Program, which was further developed during 1999–2000. Jacob Kritzer was sponsored by the CRC and gained international experience during a two-month placement with Environmental Defence, an international conservation organisation in California (USA). Excellent reviews were received on the placement of Tim Smith with the Townsville EPA. Limitations have been placed on the future of this program by the increased pressure for students to complete within a three year time-frame. Most students will now be encouraged to undertake industry placements during the period while their thesis is being examined.

A CRC Career Development and Leadership Workshop run by Assoc Prof Bob Marshall and Professor Leon Mann was completed in November 1999 in collaboration with other CRCs. *CRC Reef* sponsored four postgraduate students and one postdoctoral student. Greg Doherty received a Business and Higher Education Roundtable Scholarship to attend this workshop, based on his outstanding potential for a career in research and development. A further two students were awarded grants to travel to Melbourne to complete the CRC Career Development and Leadership course in May 2000. All students reported that they received extremely valuable outcomes from course participation in terms of their career development.

Student support and training was provided by a three day GIS course and a short course in Conflict Resolution Skills (VETEC accredited). Students were sponsored to attend a scientific writing course and a Social Assessment Workshop: Achieving Project Objectives through Social Research Methods.

Centre 1999/2000 students are grouped as follows:

PhD students	50
Masters level students	10
Honours level students	18
(inc. 6 current Augmentative Grant students)	
TOTAL	**78**

New PhDs from *CRC Reef*.
From left Dr Kirsten Michalek-Wagner,
Dr Ken Anthony, Inaugural Director
Dr Chris Crossland (HonDSci), Dr Darren
Oemcke, Dr Alan Orpin.

Photo: David Stone

POSTGRADUATE SCHOLARSHIPS

The following students have CRC Scholarships or a combination of CRC Scholarship and an Australian Postgraduate Research Award (APRA):

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 *Plectropomus leopardus* and *P. laevis* populations on the GBR	01.03.97	Prof H Choat & Dr B Molony (JCU) Dr B Mapstone (CRC)	Current	CRC/APA
K Anthony	PhD	JCU/Task 5.5.1	The role of suspended sediment in coral energy budgets	30.03.95	Dr B Willis (JCU)	Completed	CRC
B Breen	PhD	JCU/Task 2.1.6/2	Decision Support System for the Cairns Section of the GBRMP	28.02.94	Prof H Marsh (JCU)	Suspended	CRC
N Crosbie	PhD	JCU/Task 1.1.1	Environmental and ecological controls on *in situ* population growth rates of Great Barrier Reef phytoplankton	01.09.94	Prof D Griffiths (JCU) Dr M Furnas (AIMS)	Completed	CRC
G De'ath	PhD	JCU/Task 5.5.5	Modelling spatial and temporal change in benthic reef communities	15.08.96	A/Prof D Coomans & Prof H Marsh (JCU) Dr T Done (AIMS)	Completed	CRC
M Dommisse	PhD	JCU/Task 1.1.1	Detritus and its influences on water quality in the Great Barrier Reef: quality and quantity	01.09.95	A/Prof C Alexander (JCU) Dr M Furnas (AIMS)	Submitted	CRC
R Fisher	PhD	JCU/Task C 3.3	The behavioural capabilities of tropical reef fish larvae: implications for dispersal during the pelagic phase	28.06.99	Dr D Bellwood (JCU)	Current	CRC/APA
A Heap	PhD	JCU/Task 1.3.1	Sedimentology of the Whitsundays	17.02.97	Drs K Woolfe, P Larcombe & G Dickens (JCU)	Current (Part-time)	CRC
J Higgs	PhD	JCU/Task 2.4.14	Distribution of recreational boating activities in the Townsville region	01.02.95	Dr B Mapstone (CRC) A/Prof G Russ (JCU)	Suspended	CRC
A Hodgson	PhD	JCU/Task C 1.4.3	Impacts of underwater noise on dugongs and coastal dolphins	27.03.00	Prof H Marsh (JCU)	Current	CRC/APA
J Kritzer	PhD	JCU/Task 5.5.6	Spatial and temporal variation in the population dynamics and life history traits of the tropical snapper, *Lutjanis carponotatus*, on the GBR	31.03.98	Prof H Choat (JCU) Dr C Davies (CRC)	Current	CRC
L Lambeck	MSc	JCU/Task 1.3.1	Sphere of influence of northern rivers	01.01.98	Drs K Woolfe, P Larcombe & S Abbott (JCU)	Submitted	CRC
A Lashko	PhD	JCU/Task C 1.4.2	Genetic diversity in the relationship between nesting and feeding aggregations of seabirds in the Great Barrier Reef World Heritage Area	31.03.00	Drs E Gyuris & M Waycott (JCU)	Current	CRC
V Lukoschek	PhD	JCU/Task C 1.4.1	Distribution and abundance of inshore dolphins in the Great Barrier Reef World Heritage Area	07.02.00	Dr P Corkeron & Prof H Marsh (JCU)	Current	CRC/APA

Name	Degree	Institution Enrolled/ Task Affiliation	Thesis Title	Commencement Date	Supervisor	Status of Study	Source of Funding
P Marshall	PhD	JCU/Task 2.1.5/2	Physical impacts to corals: implications for community structure and management	30.03.95	Dr G Inglis (JCU) Dr J Oliver (GBRMPA)	Submitted	CRC
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 & Mr C Davies (CRC) Mr G De'ath (JCU)	Current (Part-time)	CRC/APA
K Michalek-Wagner	PhD	JCU/Task 5.5.3	The chemical ecology of the soft coral *zooxanthellae* interaction	01.01.96	Drs B Willis & B Bowden (JCU)	Completed	CRC
G Muldoon	PhD	JCU/Task 2.1.16	An ecological economic approach to determining optimal capacity where latent effort exists	01.07.97	Dr L Fernandes & A/Prof O Stanley (JCU) Dr C Davies (CRC)	Current	CRC
D Oemcke	PhD	JCU/Task 3.4.2/2	The treatment of ballast water discharges to ports in the Great Barrier Reef region	01.07.95	Prof J Patterson (JCU) & Prof H van Leeuwen (UNE)	Completed	CRC
A Orpin	PhD	JCU/Task 1.3.1	Fate of riverine sediment entering the GBR lagoon from the Burdekin Delta	28.02.94	Drs K Woolfe & R Carter (JCU)	Completed	CRC
R Pears	PhD	JCU/Task B 4.8	Comparative demography and life history features of serranid fishes: implications for fisheries and conservation management	01.04.00	Prof H Choat (JCU) Dr C Davies (CRC)	Current	CRC/JCU
C Pocock	PhD	JCU/Task A 1.3	Management of cultural heritage values in the Great Barrier Reef World Heritage Area	27.03.00	Dr D Roe (JCU)	Current	CRC
B Radford	PhD	JCU/Task D 2.2	Spatial risk assessment and decision support for coral reefs Dr B Willis (JCU)	31.03.00	Dr T Done (AIMS)	Current	CRC
M Rasheed	PhD	JCU/Task 1.4.2	Investigations of recovery and succession in North Queensland tropical seagrass communities	30.06.95	Dr R Coles (QDPI) & Dr G Inglis (JCU)	Completed	CRC
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 & Mr Rodney Beard (UQ) Dr B Mapstone (CRC)	Current	CRC
S Rotmann	PhD	JCU/Task C 2.5	Assessment of the use of coral tissue thickness as a monitor of ref health and performance	22.04.00	Dr S Smithers (JCU) Dr D Barnes (AIMS)	Current	CRC
D Welch	MSc	JCU/Task 2.412/5	Development of techniques which minimise size selectivity for sampling populations of the common coral trout, *Plectropomus leopardus*, for age structure analysis	01.01.95	A/Prof G Russ (JCU) Drs B Mapstone & C Davies (CRC)	Current	CRC
A Williams	PhD	JCU/Task 2.4.12/2	Population structure of the *Lethrinus miniatus* on the GBR	31.03.98	Dr C Davies (CRC) A/Prof G Russ (JCU)	Current	CRC/APRA

POSTGRADUATE ASSOCIATES

The following students have links to the CRC through research support or supervision:

Name	Degree	Institution Enrolled/ Task Affiliation	Thesis Title	Commencement Date	Supervisor	Status of Study	Source of Funding
B Abubukar	PhD	JCU/Task 2.2.1	Assessing environment settings and design	31.01.99	Prof P Pearce	Withdrawn	CRC
J Ahn	MSc	JCU/Task 2.2.3	Chinese and Japanese reef tourists' understanding of safety and environmental messages	01.02.99	Drs E Kim & G Moscardo (JCU)	Current	CRC
N Aragones	PhD	JCU/Task 2.1.8	Techniques for the restoration of tropical seagrass beds	27.02.95	Dr G Inglis (JCU)	Suspended	CRC
P Armsworth	PhD	JCU/Task 1.2.1	The mathematical ecology of reef fishes	01.02.98	Dr L Bode & A/Prof D Bellwood (JCU)	Submitted	CRC
W Bailey	Hons	JCU/Task B1.2	Modelling flushing of contaminates in the port of Townsville	01.03.00	A/Prof T Hardy	Current	CRC
A Baird	PhD	JCU/Task 5.5.2	Coral settlement patterns and the behaviour and ecology of coral larvae	01.07.95	Dr T Hughes (JCU)	Current	CRC
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) Dr B Willis (JCU)	Current	CRC
R Berkelmans	PhD	JCU/Task 1.1.4	Upper thermal tolerance limits for acclimation of reef corals	01.08.96	Dr B Willis (JCU) Dr J Oliver (GBRMPA)	Current (part-time)	CRC
S Bryce	PhD	JCU/Task 1.3.1	Sediment transport in mangrove creek systems of North Queensland	01.01.95	Drs P Larcombe & R Carter (JCU)	Withdrawn	CRC
J Bunt	PhD	JCU/Task 1.3.1	Sediment transport in mangrove systems and causes of turbidity	20.02.97	Drs P Larcombe & P Ridd (JCU)	Current	CRC
B Carroll	Hons	JCU/Task 5.1.3	Effects of herbivory on the distribution and abundance of macroalgae	01.09.98	A Prof T Hughes (JCU)	Completed	CRC Hons Augmentative 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	Drs K Burns & G Brunskill (AIMS) A/Prof R Coventry (JCU)	Current	CRC
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)	Current	CRC
G Doherty	PhD	JCU/Task 1.3.5	Trace element geochemistry of the intertidal zone of Cleveland Bay, Queensland	01.10.97	Dr G Brunskill (AIMS)	Current	CRC

Name	Degree	Institution Enrolled/ Task Affiliation	Thesis Title	Commencement Date	Supervisor	Status of Study	Source of Funding
S Fletcher	Hons	UQ/Task E5.1	Historical evolution of Low Isles, northern Great Barrier Reef	02.02.99	Dr T Frank (UQ)	Current	CRC Hons Augmentative Grant
M Fowler-Walker	MSc Qual	JCU/Task 1.1.5	Diversity of fouling species	01.06.99	Drs J Collins & M Sheaves (JCU)	Completed	CRC
M Gallagher	MSc	UQ/Task 3.2.0	Significance of groundwater and surface water discharges from the Great Barrier Reef Lagoon	01.01.96	Prof R Volker (UQ)	Current	CRC
D Gibson	Hons	JCU/Task E5.1	Cross-shelf distributions of tropical plankton on the Central Great Barrier Reef	06.09.99	A/Prof C Alexander & Dr M McCormick (JCU)	Current	CRC Hons Augmentative Grant
B Grigg	Hons	JCU/Task 3.3	Optimising pontoon mooring design in the Great Barrier Reef World Heritage Area	01.03.00	A/Prof T Hardy	Current	CRC
J Guinotte	PhD	JCU/Task 1.5.2	Coral reef habitat suitability	15.07.99	Dr A Lewis (GBRMPA/JCU) Dr T Done (AIMS)	Current	CRC
A Hoey	Hons	JCU/Task 5.1.3	Early post settlement mortality in two coral reef fishes (Pomacentridae: *Pomacentrus amboiensis* and *P. nagasakiensis)*	01.09.98	Dr M McCormick (JCU)	Completed	CRC Hons Augmentative Grant
J Jompa	PhD	JCU/Task 1.4.1	Coral algal interactions and their roles in reef degradation	01.07.97	Dr L McCook (AIMS) & Prof H Choat (JCU)	Current	CRC
M Kospartov	Hons	JCU/Task E5.1	A multi-scale investigation of the size structure of coral populations	02.02.00	A/Prof T Hughes (JCU)	Current	CRC Hons Augmentative Grant
J Kung	PhD	JCU/Task 2.4.20	Economic management of multispecies fisheries and the commercial collection of aquarium fishes on the Great Barrier Reef	01.03.95	Dr B Mapstone (CRC) A/Prof O Stanley (JCU)	Current	CRC
B Lukoschek	Hons	JCU/Task 5.1.3	Foraging dynamics of benthic carnivorous fishes on tropical soft bottom sediments around Lizard Island	01.09.98	Dr M McCormick (JCU)	Completed	CRC Hons Augmentative Grant
J Madin	Hons	JCU/Task 5.1.3	Biomechanics and susceptibility to breakage of branching corals	01.09.98	A/Prof T Hughes (JCU)	Completed	CRC Hons Augmentative Grant
A Maltby	Hons	JCU/Task 3.3	Determining wind loads on tourist pontoons	01.03.00	A/Prof T Hardy & Dr J Ginger (JCU)	Current	CRC

Name	Degree	Institution Enrolled/ Task Affiliation	Thesis Title	Commencement Date	Supervisor	Status of Study	Source of Funding
S Mandagi	MAppSc	JCU/Task 2.1.8	The relationship between shoot age and heavy metal accumulation in seagrasses	02.03.98	Dr G Inglis (JCU)	Completed	CRC
R Marriott	MSc Qual	JCU/Task 2.4.12/2	Age-growth and reproductive biology characteristics of the Red Bass *Lutjanus bohar* (Lutjanidae) from the Great Barrier Reef	01.10.00	Drs C Davies & B Mapstone (CRC) Prof H Choat (JCU)	Current	CRC
J McConochie	MSc	JCU/Task 3.1	Establishing the frequency of wave energy in the Great Barrier Reef	30.03.99	A/Prof T Hardy (JCU)	Current	CRC
J Mellors	PhD	JCU/Task 1.4.4	Nutrient effects on inshore seagrasses of the GBRMPWHA	03.07.92	Dr R Coles (QDPI) & Prof H Marsh (JCU)	Current (part-time)	CRC
K Messer	Hons	JCU/Task B1.2	Modelling flushing of contaminates in the port of Townsville	01.03.00	A/Prof T Hardy	Current	CRC
J Mosse	PhD	JCU/Task 2.4.12	Regional variation age, growth and reproductive biology of the Blue spot rockcod, *Cephalopholis cyanostigma* (Serranidae) on the Great Barrier Reef	03.03.97	Prof H Choat (JCU) & Dr C Davies (CRC)	Current	CRC
S Muloin	PhD	JCU/Task 2.2.1	The psychological benefits experienced from human/animal interactions	29.03.94	Prof P Pearce (JCU)	Current (part-time)	CRC
C Page	Hons	JCU/Task 5.1.3	Patterns of reproduction and recruitment: Split spawning and bleaching	01.09.98	Dr B Willis (JCU)	Completed	CRC Hons Augmentative Grant
B Palmqvist	Hons	JCU/Task E5.1	Nineteenth century guano mining industry on the Great Barrier Reef	02.02.00	Dr M Gibbs (JCU)	Current	CRC Hons Augmentative Grant
R Pratt	PhD	JCU/Task 2.3.2	Coral reef restoration, ecology and techniques	01.01.95	Dr U Kaly (JCU) A/Prof T Hughes (JCU)	Current (part-time)	CRC
T Preitz	Hons	JCU/Task 2.2.1	An investigation of cruise passenger markets and satisfaction with cruising in the Townsville region	01.02.00	Dr G Moscardo (JCU)	Current	CRC
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 C Skelly (JCU) & Dr T Done (AIMS)	Suspended	CRC
P Riolo	MSc	JCU/Task 1.5.2	Sea surface temperature interpolation	02.08.99	Dr A Lewis (GBRMPA/JCU) Dr W Skirving (AIMS)	Current	CRC
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 (part-time)	CRC

Name	Degree	Institution Enrolled/ Task Affiliation	Thesis Title	Commencement Date	Supervisor	Status of Study	Source of Funding
C Ryan	MSc Qual	JCU/Task 2.1.19	The effect of turbidy and shading on seagrasses: a comparative study of field and aquarium results	31.03.00	Dr V Hall (CRC)	Current	CRC
M Samoilys	PhD	JCU/Task 2.4.2	Reproductive strategies of the common coral trout on the northern Great Barrier Reef	01.06.92	Prof JH Choat (JCU) & Dr P Doherty (AIMS)	Submitted	CRC
C Schoenberg	PhD	Uni. Oldenberg/ Task 1.4.1	Ecology of bioeroding sponges on the Great Barrier Reef	01.01.96	Drs C Wilkinson, L McCook & K Fabricius (AIMS)	Current	CRC
B Smith	Hons	JCU/Task 3.3	A computer design tool for designing moorings in the Great Barrier Reef	01.03.00	A/Prof T Hardy & Mr M Matheson (JCU)	Current	CRC
L Smith	MSc	JCU/Task 2.2.4	Developing dwarf minke whale tourism interpretation	28.02.00	Dr A Birtles (JCU)	Current	CRC
A Straton	Hons	UQ/Task 5.1.3	Assessing the applicability of choice modelling to the management of the GBRMP	01.03.99	Drs R Brown & J Asafu-Adjaye (UQ)	Completed	CRC Hons Augmentative Grant
J True	PhD	JCU/Task 1.3.7	Massive scleractinian corals as indicators of environmental change	31.03.97	Dr B Willis (JCU) Dr D Barnes (AIMS)	Current	CRC
C Van der Geest	Hons	JCU/Task E5.1	The effectiveness of a bycatch reduction device in a multispecies tropical trawl fishery	02.02.00	A/Prof G Russ (JCU)	Current	CRC Hons Augmentative Grant
J Vaughan	Hons	JCU/Task 1.5.2	Interpreting satellite sea surface maps of the GBR	01.03.99	Dr A Lewis (JCU)	Withdrawn	CRC Hons Augmentative Grant
M Wakeford	MSc Qual	JCU/Task 1.4.1	Crown of thorns starfish and reef-building communities	01.03.99	Dr J Collins (JCU) Dr T Done (AIMS)	Current	CRC
C Ware	PhD	JCU/Task 2.2.1	Understanding travel decision making and patterns	15.02.99	Prof P Pearce & Dr L Murphy (JCU)	Current (Part-time)	CRC
C Wegscheidl	Hons	UQ/Task E5.1	The effects of dugong grazing on biodiversity in seagrass systems	02.02.99	Drs J Lanyon & G Skilleter (UQ)	Current	CRC Hons Augmentative Grant
B Woods	PhD	JCU/Task 2.2.3	The interpretive and educational dimensions of wildlife tourism	01.05.98	Dr G Moscardo & Prof P Pearce (JCU)	Current	CRC
C Yagi	PhD	JCU/Task 2.2.1	Tourist perceptions of other tourists	02.08.99	Prof P Pearce & Dr G Moscardo (JCU)	Current	CRC

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

Biological samples collected during research surveys provide valuable information about the status of the Great Barrier Reef fishery. Pictured Researchers Mr Cameron Murchie (obscured) and Mr Dongchun Lou and Postgraduate Student Mr David Welch.

Photo: CRC Reef

Objective:

The *CRC Reef* will function as a knowledge broker by facilitating the successful application of targeted research for industries and management agencies.

Highlights:

- The achievements of the Seagrass Watch community monitoring program were recognised with the awarding of a Prime Minister's Environment Award.
- Research on minke whales has produced guidelines for human-whale interactions for the tourism industry and provided interpretive material for industry operators.
- Research on Irukandji jellyfish has been used by Surf Life Saving Australia to develop policies to reduce jellyfish stings in north Queensland.

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

***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.

Mechanisms to enhance links with users and to facilitate technology transfer include the involvement of users at all levels of research and communication. Examples include the establishment of a broad-based User Advisory Group, and the assignment of industry-based Task Associates to each research task with responsibilities both to provide research direction and to disseminate research results.

Technology transfer through the education program is another important component of the strategy (See section 5). Post-graduate 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 successful employment of a large percentage of graduates with industry also facilitates transfer of research results.

CRC Reef researchers are very active in presenting research findings at conferences and seminars (See section 9). To further enhance technology transfer, two CRC Research Days are planned for 2000, to highlight the major outcomes of the first six years of the CRC Reef Research Centre and plans for the new research program. Industry and community representation at the conference is encouraged by advertising the conference widely to industry.

The *CRC Reef* produces a set of communication products aimed at explaining research results in plain language and to make them accessible to the broader community. These are highly regarded by users. All Technical Reports include a plain language summary contributed by the relevant industry Task Associate.

The restructuring of the Extension and Communication section of the CRC has emphasised the significance of face-to-face communication among the *CRC Reef* members, and between researchers and research-users. The re-establishment of the Research Days, introduction of an Induction Session for researchers and Task Associates, and establishment of an industry and management Tourism Research Advisory Group are examples of this increased emphasis.

Case Studies demonstrating successful Technology Transfer practices

i. Wave Atlas

A prototype of a CD-based user interface which displays wave data derived from cyclones has been developed from the simulation of 6,000 tropical cyclones, and has been demonstrated to management, industry and engineering designers. The data provides probability relationships for wave heights from cyclonic storms at thousands of points throughout the GBR. The Wave Atlas will be a readily accessible tool to resolve the difficult issue of determining wave energy for tourist pontoons on the Great Barrier Reef.

Research Users: GBRMPA, marine engineering and design companies

ii. Guidelines for infrastructure development for tourist pontoons

A highly successful workshop on 'Setting Appropriate Design Criteria for the Great Barrier Reef World Heritage Area' was organised as part of this project in January 2000, attended by representatives from industry, management agencies, marine designers and engineers. A set of design criteria has been developed and agreed to by industry which relate to best-practice in planning, design and implementation of construction of tourist pontoons. These criteria have been incorporated in a set of guidelines developed by the CRC and will be used by the tourism industry to plan pontoon installations, by engineers to design pontoon installations and by GBRMPA to make informed decisions on the licensing and renewal of permits for pontoons moored on the GBR.

Research Users: GBRMPA, marine engineering and design companies

iii. Effect of Line Fishing Project

CRC Reef research staff have direct input into the Queensland Government Fisheries Management Advisory Committees on issues relevant to the draft management plan for the Reef Line Fishery. This includes advice on the implications of closures to fishing of fish spawning grounds and development of performance indicators for management plans. Results of the biological studies associated with fisheries research tasks have been used to revise and implement management regulations, for example, on minimum size limits in the Queensland draft management plan for the fishery. Research findings are communicated directly to commercial and recreational fishers via a dedicated newsletter and extension program. The development of a model (Management Strategy Evaluation model) incorporating information on the biology of recreational and commercial target fisheries, along with socio-economic information of the fisheries, will allow testing of the effect of different management regimes on both the fisheries resource and on the fishers.

Research Users: QFMA, GBRMPA, recreational and commercial fishers

iv. Dugong Research

Research on dugongs based at James Cook University has determined population trends from aerial surveillance and tracked dugong using satellite transmitters. CRC Program Leader Prof Helene Marsh's work has had major influence on the development of policy on dugong conservation in Queensland, as well as on gill-netting practices. Her research is also influencing indigenous hunting practices in Queensland aboriginal communities, while it contributes to the education of fishers. Her international expertise in this field has been recognised by the award of a prestigious Pew Fellowship and additional funding from ARC and GBRMPA.

Research Users: GBRMPA, QPWS, EA, community (particularly the indigenous community), national and international conservation agencies

v. Irukandji Jellyfish Research

Stings from Irukandji jellyfish in tropical Queensland, which are potentially fatal, are causing increasing concern to the tourism industry and the life saving movement. Sampling supported by the *CRC Reef* has provided 250 jellyfish for research in analysis of jellyfish venom and population genetics. As a result of information collected during the sampling period, a new policy for prevention of Irukandji stings has been implemented by the surf lifesaving association. These practices will reduce the incidence of jellyfish stings for beach users.

Research users: Surf Lifesaving Australia, medical practitioners, community.

vi. Minke Whale research

A project developing ecologically sustainable practices in the minke whale tourism industry has collated observations from hundreds of encounters with minke whales to reveal patterns of distribution and social structure. The project has successfully developed and tested guidelines for interactions between tourists and whales. A wide range of interpretative material has been provided by researchers to the industry and its clients, and confidential reports were made available to industry operators on ways to improve the ecological sustainability of their operations.

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

vii. Crown-of-thorns starfish

Both the Long Term Monitoring Program based at AIMS, and the study of fine-scale distribution of crown-of-thorns starfish have provided information on the status of starfish outbreaks in the Cairns section of the reef. This information has been vital to the management agencies and the tourism industry. Early warning of the starfish outbreaks has meant that control measures could be implemented early to control populations locally. The *CRC Reef* has provided support for the marine tourism industry in its representations to the Queensland Government about the current outbreak. The crown-of-thorns starfish extension program has provided spot-checks on starfish populations at sites of commercial interest, and has provided information on research results directly to marine tourism research operators. Two training workshops on techniques for starfish control were held in Cairns.

Research Users: Queensland tourism industry, community, GBRMPA

viii. Seagrass Research

The CRC Seagrass Watch monitoring program has expanded in collaboration with community groups and QPWS. The success of the plan was recognised in the awarding of a Prime Minister's Environment Award in the category of rural and regional leadership. The program was initiated in Hervey Bay and the Whitsundays, with plans to expand to the Townsville region. In other research projects, information on seagrass distribution is making a significant contribution to the management of Dugong Protection Areas and planning for the GBRMPA Representative Areas Program.

Research Users: Community, QPWS, GBRMPA, Regional City Councils

The Effects of Line Fishing team. Back row: Mr Ashley Williams and Dr Campbell Davies. Second row: Mr Geoffrey Muldoon, Mr Ross Marriott, Program Leader Dr Bruce Mapstone, Mr Gary Carlos and Mr Jake Kritzer. Third row: Dr Annabel Jones, Ms Renae Partridge and Mr Dongchun Lou. Front row: Mr Cameron Murchie, Ms Kyi Bean and Mr John Kung.

Photo: Robert Parsons

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

Core participants including GBRMPA, JCU, DPI, AIMS, QCFO, SUNFISH, and AMPTO

National research agencies including CSIRO and the Australian Venom Research Unit

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; Great Keppel Island.

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

QFMA, Fisheries Management Advisory Committees, Australian National Sportfishing Association, and commercial and recreational fishers.

State Government departments and agencies including EPA, Qld; QPWS; Qld Dept of Natural Resources.

Industry organisations including the Bureau of Sugar Experimental Stations; Canegrowers Association; Queensland Farmers' 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; Environment Australia; North Qld Conservation Council; Trinity Inlet Management Program; Catchment Management Groups.

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

Commercial and International Program

The establishment of a specific Commercial and International Program is a deliberate strategy of the CRC to place it in a strong financial position in the next few years to ensure its long-term viability. The Centre has set out to become the preferred supplier of tropical marine expertise in research, education and training for the national and international markets. The Centre 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.
- 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.

Milestones for 1999/00 have been achieved and exceeded. Capability statements have been prepared for prospective international and local clients. External grants for the year totalled $252,000, an increase on the projected additional income of $220,000 in 1999/00. Commercial contracts have been awarded for benthic surveys of introduced marine pests in Queensland ports; for coral and sediment studies on Lihir Island, Papua New Guinea; for seagrass surveys of Townsville Strand redevelopment; and for collaborative studies of coral reef fish ecology in the Caribbean and GBR.

A consortium of partners from industry, research and government has been established 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.

The CRC has been closely involved in the establishment of the Great Barrier Reef Research Foundation, a philanthropic organisation with the goals of generating research funding for the Great Barrier Reef World Heritage Area. The new CEO Dr Russell Reichelt will chair the Scientific Assessment Panel evaluating applications for research grants from the Foundation.

7. STAFFING AND ADMINISTRATION

There were amendments to the Specified Personnel list during 1999/00 which were approved by the CRC Program.
No major equipment items were purchased over the year.

Specified Personnel

Title/Name	Organisation	% time in Centre	Role in Centre
Mr Simon Woodley	CRC	100	Chief Executive Officer
Dr Russell Reichelt	CRC	8	Chief Executive Officer
Dr David Williams	AIMS	75	Deputy CEO (Research)
Dr V Harriott	JCU	42	Leader, Program E
Dr B Mapstone	JCU	100	Leader, Program B
Dr T Done	AIMS	60	Leader, Program D
Dr M Furnas	AIMS	60	Project Leader
Dr G Moscardo	JCU	60	Project Leader
Dr P Doherty	AIMS	50	Leader, Program C
Dr R Coles	QDPI	50	Project Leader
Prof H Marsh	JCU	50	Leader, Program A
Dr T Hardy	JCU	30	Project Leader
Prof P Pearce	JCU	30	Project Leader
Dr R Pitcher	CSIRO	5	Research Staff
Dr J Oliver	GBRMPA	20	Research Staff

PROFESSIONAL STAFF CONTRIBUTIONS 1998/99

Name	Role	Total % of time	% Spent on Research					% Education	% Commercial'n	% Administration
			Program							
			A	B	C	D	Total			
Australian Institute of Marine Science										
Dr A Mitchell	R	100			100		100			
Dr W Skirving	R	80			80		80			
Dr M Furnas	R	70			65		65	5		
Dr T Done	R	52			33	4	37	5		10
Dr H Sweatman	R	35			35		35			
Dr D Williams	R	35	5	10	5	5	25			10
Dr P Doherty	R	33			18		18			15
Various Prof Staff	R	30		5	25		30			
Mr C Steinberg	R	26			26		26			
Mr A Thompson	R	25		5	20		25			
Mr A Cheal	R	20			20		20			
Mr I Miller	R	20			20		20			
Mr G Coleman	R	20			20		20			
Ms R Ninio	R	20			20		20			
Dr D Burrage	R	20			20		20			
Mr B Fitzpatrick	R	20			20		20			
Ms K Osborne	R	20			20		20			
Dr J Lough	R	20			15		15	5		
Ms C Page	R	20			20		20			
Dr D Barnes	R	10			10		10			
Dr W Oxley	R	10			5		5			5
Dr D Alongi	R	7			7		7			
Dr R Reichelt	A	10					0			10
TOTAL (Person Years)		**703**	**5**	**20**	**604**	**9**	**638**	**15**	**0**	**50**
Department of Primary Industries										
Dr S Campbell	R	67			67		67			
Mr C Lunow	R	61		61			61			
Mr A Roelofs	R	37			37		37			
Mr M Baer	R	33			33		33			
Mr R Garrett	R	30		30			30			
Mr W Lee Long	R	27			27		27			
Dr N Gribble	R	26		26			26			
Ms M Samoilys	R	25		25			25			
Ms S Helmke	R	21		21			21			
Dr M Rasheed	R	20			20		20			
Ms J Mellors	R	17			17		17			
Ms C Roder	R	16			16		16			
Dr A Tobin	R	12		12			12			
Ms A Cahill	C	5					0		5	
Ms B Gibbs	A	20					0			20
Dr B Pollock	A	13					0			13
Mr P Finglas	A	10					0			10
TOTAL (Person Years)		**440**	**0**	**175**	**217**	**0**	**392**	**0**	**5**	**43**
Great Barrier Reef Marine Park Authority										
Mr R Berkelmans	R	100			100		100			
Dr Z Dinesen	R	75	75				75			
Dr J Oliver	R	30				10	10		10	10
Mr J Innes	R	25	5	5	5	5	20			5
Various Prof Staff	R	17		8	2	5	15			2
Dr A Smith	R	10		10			10			
Mr J Brodie	R	9		2	5		7			2
Mr A Chin	R	7			3		3		4	
Dr A Lewis	R	5				5	5			
Dr D Wachenfeld	R	5			5		5			
Hon V Chadwick	A	8					0			8
TOTAL (Person Years)		**291**	**80**	**25**	**120**	**25**	**250**	**0**	**14**	**27**

A Administration C Communication R Research

Name	Role	Total % of time	% Spent on Research					% Education	% Commercial'n	% Administration
			Program A	B	C	D	Total			
James Cook University of North Queensland										
A/Prof G Russ	R	50		45			45	5		
Mr I Lawler	R	50			50		50			
A/Prof T Hardy	R	40		35			35	5		
Ms M Nursey-Bray	R	38			38		38			
Dr L Bode	R	30			30		30			
Prof P Pearce	R	30		25			25	5		
Dr G Dickens	R	25	25				25			
Dr A Birtles	R	25		25			25			
Various Prof Staff	R	22	9	4	9		22			
Dr L Murphy	R	20		20			20			
Ms F Richards	R	20		20			20			
Dr E Gyuris	R	16		16			16			
Prof R Volker	R	15		10			10	5		
Dr G Ross	R	15		15			15			
Mr P Valentine	R	15		15			15			
Mr C Linfoot	R	15		15			15			
Dr E Kim	R	15		15			15			
Dr D Roe	R	10		10			10			
Mr N Black	R	10		10			10			
Ms J Rutledge	R	10		10			10			
Prof H Marsh	R	9	5				5	4		
Dr A Lewis	R	5			5		5			
Dr B Kennedy	R	5	5				5			
Prof S Crook	R	5					0	5		
Dr P Ridd	R	5	5				5			
Prof J H Choat	E	10		2			2	8		
Prof J Patterson	E	7		2			2	5		
Dr J Collins	E	6					0	6		
Dr B Willis	E	5					0	5		
A/Prof O Stanley	E	5					0	5		
Ms J Shields	C	5					0		5	
Prof N Palmer	A	7					0			7
TOTAL (Person Years)		**545**	**49**	**294**	**132**	**0**	**475**	**58**	**5**	**7**
OTHERS										
Mr D Windsor (AMPTO)	A	20					0			20
Mr D Hutchen (AMPTO)	A	10					0			10
Mr F Pantus (CSIRO)	R	20		20			20			
Dr B McDonald (CSIRO)	R	10		10			10			
Dr A Punt (CSIRO)	R	10		10			10			
Dr A D Smith (CSIRO)	R	10		10			10			
Various Officers (QFMA)		58		58			58			
Dr M Elmer (QFMA)		15		15			15			
Sir S Schubert	A	15					0			15
Mr T Loveday (QCFO)	A	15					0			15
Dr R Little (FRDC)	R	83		83			83			
Dr S Troy (FRDC)	R	50		50			50			
Dr D Lou (FRDC)	R	100		100			100			
Dr A Jones (FRDC)	E	100		80			80		20	
TOTAL (Person Years)		**516**	**0**	**436**	**0**	**0**	**436**	**0**	**20**	**60**

A Administration **C** Communication **E** Education **R** Research

Name	Employer Org.	Role	Total % of time	% Spent on Research					% Education	% Commercial'n	% Administration
				Program A	B	C	D	Total			
CRC Funded Staff											
Dr R Reichelt	CRC	A	8								8
Ms A Norman	JCU/CRC	A	100					0			100
Ms A Tucker	JCU/CRC	A	100					0			100
Mrs L Arnell	AIMS/CRC	A	100					0			100
Ms A Moore	DNR/CRC	C	33					0		33	
Mr S Woodley	GBRMPA/CRC	A	100					0		10	90
Dr C Davies	JCU	R	100		100			100			
Dr B Mapstone	JCU	R	100		100			100			
Dr G De'ath	JCU	R	100				100	100			
Mr M Gallagher	JCU	R	100		100			100			
Mr J McConochie	JCU	R	100		100			100			
Ms N Marshall	JCU	R	100	100				100			
Dr L Stewart	JCU	R	100			100		100			
Dr L Mason	JCU	R	85		45	40		85			
Mr U Engelhardt	JCU	R	85			85		85			
Mr M Curnock	JCU	R	85		85			85			
Ms S Johnstone	JCU	R	75		75			75			
Dr G Moscardo	JCU	R	60		60			60			
Mr M Matheson	JCU	R	50		50			50			
Ms T Greenwood	JCU	R	50		45			45		5	
Mr R Kapitzke	JCU	R	50		50			50			
Mr M Hartcher	JCU	R	40			40		40			
Dr M Fenton	JCU	R	30	20				20	5		5
Dr M James	JCU	R	30			30		30			
Ms E Dinsdale	JCU	R	25	25				25			
Dr L Fernandes	JCU	R	21	21				21			
Dr G Inglis	JCU	R	20			20		20			
Dr V Hall	JCU	E	100			40		40	60		
Dr V Harriott	JCU	E	42			21		21	21		
Ms S Giffney	JCU	C	100					0		100	
Dr K Fabricius	AIMS	R	100			100		100			
Dr L McCook	AIMS	R	100			100		100			
Ms S Ghonim	AIMS	R	90			90		90			
Ms M Wright	AIMS	R	50			50		50			
Dr D Williams	AIMS	R	50	10	10	10	10	40	5		5
Mr M Mahoney	AIMS	R	33			33		33			
Mr L Devantier	AIMS	R	17			17		17			
Mr E Turak	AIMS	R	17			17		17			
Ms M Skuza	AIMS	R	10			10		10			
Dr Z Dinesen	GBRMPA	R	25	25				25			
Mr G Harris	GBRMPA	R	10				10	10			
Ms R MacGregor	GBRMPA	R	10				10	10			
Ms J Booth	GBRMPA	R	10				10	10			
Mr D Alcock	GBRMPA	C	50					0	10	40	
Mr L McKenzie	QDPI	R	100			100		100			
Mr W Lee Long	QDPI	R	50			50		50			
Ms M Samoilys	QDPI	R	50		50			50			
Dr R Coles	QDPI	R	50		30	20		50			
Dr M Rasheed	QDPI	R	10		10			10			
TOTAL (Person Years)			**2921**	**201**	**910**	**973**	**140**	**2224**	**101**	**188**	**408**

A Administration **C** Communication **E** Education **R** Research

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

Professional Staff	Total Equiv. Person Years	% Spent on Research Program A	B	C	D	Total	% Education	% Commercial'n	% Administration
Total Contributed	24.95	1.34	9.50	10.73	0.34	21.91	0.73	0.44	1.87
Total Funded by CRC	29.21	2.01	9.10	9.73	1.40	22.24	1.01	1.88	4.08
GRAND TOTAL	**54.16**	**3.35**	**18.60**	**20.46**	**1.74**	**44.15**	**1.74**	**2.32**	**5.95**
Proportion of total professional staff resources in each activity	100	6	34	38	3	82	3	4	11

Support Staff (Person Years)

(1) Contributed

Organisation	No. staff
AIMS	0.32
QDPI	2.70
GBRMPA	6.68
JCU	0.07
TOTAL	**9.77**

(2) CRC Funded

Organisation	No. staff
AIMS	0.04
QDPI	0.19
GBRMPA	0.00
JCU	1.97
TOTAL	**2.20**

8. SCIENTIFIC PUBLICATIONS

** publications cited as (in press) in previous Annual Reports.*
An additional 21 publications currently in press will be reported in the 2000–2001 report.

Refereed Papers

Aragones, L. & Marsh, H. (1999) Impact of dugong grazing and turtle cropping on tropical seagrass communities. *Pacific Conservation Biology*, 5, pp. 277-288.

Armsworth, P.R. (2000) Modelling the swimming response of late stage larval reef fish to different stimuli. *Marine Ecology Progress Series*, 195, pp. 231-247.

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Barnes, D.J. & Lough, J.M. (1999) *Porites* growth in a changed environment: Misima Island, Papua New Guinea. *Coral Reefs*, 18, pp. 213-218.

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Laursen, T., Russ, G.R., Higgs, J., & Newman, S.J. (1999) Age, growth and mortality of *Gymnocranius audleyi* (Pisces: Lethrinidae) on the Great Barrier Reef. *Asian Fisheries Science*, 12, pp. 187-200.

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Lough, J.M. & Barnes, D.J. (2000) Environmental controls on growth of the massive coral *Porites*. *J. Experimental Marine Biology & Ecology*, 245, pp. 225-243.

Lourey, M.J., Miller, I.R., & Ryan, D.A.J. (2000) Decline and recovery of Great Barrier Reef corals following damage by the Crown-of-Thorns Starfish *Acanthaster planci*. *Marine Ecology Progress Series,* 196, pp. 179-186.

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9. PUBLIC PRESENTATIONS, PUBLIC RELATIONS AND COMMUNICATION

(Project Leader: Mr Don Alcock (GBRMPA/CRC)/ Ms Alison Moore (CRC))

Queensland Commercial Fishermen's Organisation Deputy State Councillor and Port Douglas Branch Secretary Mr Peter Walsh and Effects of Line Fishing Liaison Officer Dr Annabel Jones at the Port Douglas Seafood Festival in May.

Photo: Alison Moore

Objective:

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

Highlights:

- The new CRC GBRWHA was launched by Federal Member for Herbert, Hon Peter Lindsay, in November 1999.
- Dr Peter Arnold presented results of research on Minke Whales at the International Whaling Commission Meeting and Workshop.
- Dr Terry Done as President of the International Coral Reef Society has major responsibility for the 9th International Coral Reef Symposium in Bali.
- *CRC Reef* supported tourism industry and government briefings on the courses and outcomes of coral bleaching throughout Queensland.

Seagrass Award

DPI's Marine Plant Ecology group's *Seagrass-Watch* program was recognised with the Natural Heritage Trust Award for Rural and Regional Leadership in the 2000 Prime Minister's Environment Awards. The award recognised the efforts of local community groups in Hervey Bay and the Whitsundays and will provide momentum for the community monitoring program to continue beyond current funding horizons.

Significant conference and seminar presentations

During the last year, CRC researchers and staff presented a range of research findings to the scientific and broader community. There were workshops and regional conferences (33 presentations), national conferences (20 presentations) and international conferences (35 presentations), with a total of 88 presentations based on work supported by the *CRC Reef*. They included:

Dr Terry Done, CRC Program Leader as president of the International Coral Reef Society, has had a key role in the preparations for the 9th International Coral Reef Symposium, Bali, October 2000. CRC staff, researchers and students will be attending the conference. A paper on the role of the CRC in research and education for management will be presented at a workshop on management of the Great Barrier Reef at the symposium. Dr Done was also the keynote speaker at the UNEP workshop on Information Management and Decision Support for Biodiversity Preservation and Human Welfare in Townsville in December 1999.

Dr Peter Arnold, presented results of CRC-supported work on the management of the minke-whale–human interactions to the International Whaling Commission Scientific Committee Meeting and Whale Watching Workshop in Adelaide in June 1999. Mr Alastair Cheal from AIMS, who is part of the Long-Term Monitoring Program, was invited as a speaker and resource person at the Malaysia-BOBP/FAO Regional Workshop on Marine Protected Areas and Marine Park Management in November 1999.

Dr Dave Barnes gave a Plenary Address at the XIV Pacific Science Congress, Sydney in July 1999 on environmental records derived from coral skeletons. He also gave an invited address at the National Centre for Ecological Analysis and Synthesis to the Modelling Growth and Form of Sessile Organisms working group at the University of California, USA.

Dr Vicki Hall, Postgraduate Student Coordinator was joint convenor and presented a paper at the CRC Association workshop on education. Mr Don Alcock presented papers and facilitated a workshop on media skills at the national conference of the Australian Coral Reef Society in October 1999. Dr **Laurence McCook** coordinated a three-day workshop on algal identification in conjunction with the conference. In addition, 16 papers based on research supported by *CRC Reef* were presented at the conference.

CRC researchers from James Cook University organised a workshop on setting appropriate engineering design criteria for the GBRWHA in January 2000. Attended by representatives of industry, management agencies, marine designers and engineers, the workshop resulted in wide acceptance by this group of recommendations by CRC researchers of design specifications for moorings and pontoons.

A series of **industry-government workshops** on coral bleaching was presented by CRC researchers in conjunction with representatives of AMPTO in August 1999. Workshops were held Cairns, the Whitsundays, Brisbane and Gladstone, and attended by members of the marine tourism industry, government and the general public.

CRC Reef Research Days have been re-introduced after a five year absence to showcase CRC results to research users. Planning is well underway for the next Research Days to be held in September 2000. In 1999, the Centre held a Postgraduate Research Day as an opportunity for CRC postgraduate students to present interim results and to interact with peers and researchers.

Public Relations and Communication

The Extension and Communication Project was extensively reviewed in May 2000. The review reported high levels of satisfaction with CRC communication products, but a need for improvement in some processes, and the necessity to further adopt electronic communication. The review has resulted in the following changes: the staffing structure has been modified to increase the emphasis on communication and extension between *CRC Reef* member organisations; communication protocols and strategies are being revised; design aspects of corporate image are being re-examined; updating of the web site has begun; a new *CRC Reef* display has been created and another is underway; and all CRC communication products will be reviewed in 2000/01.

Extension activities

Public Displays

National Science Week promotes awareness of science, engineering and technology issues as they apply to our modern lives. *CRC Reef*, AIMS and JCU partnered to provide a display called 'Travelling the Blue Highway', at Melbourne's *The Great Australian Science Show* during May's national celebrations. A special Great Barrier Reef prize with sponsorship from QANTAS, Pure Pleasure Reef Cruises and Centra Hotels was awarded during the exhibition. Meanwhile Science Week in North Queensland saw *CRC Reef*, QDPI and AIMS share displays and personnel at the James Cook University Courses and Careers Day.

In a recognition of the significance of linkages between the Great Barrier Reef and catchment issues, *CRC Reef* presentations, displays and information were provided for the Burdekin-Dry Tropics Regional Strategy Group, at Ayr; at the Hinchinbrook Landcare Group meeting; at the North Queensland Landcare Conference, Ingham; the Mitchell River Watershed Management group decade celebrations at Kowanyama; at the CRC Association Conference, Brisbane; at Townsville's Annual Show; and for the Nth Qld Engineers Conference in Townsville. A display and staff were provided at the Townsville Boating and Fishing Show in April, and at the Port Douglas Seafood Festival in June 2000, featuring the Effects of Line Fishing project.

James Cook University Researcher Ms Barbara Woods surveys a traveller's experience on the reef.

Photo: CRC Tourism

Developments in Industry Liaison

A workshop, in conjunction with GBRMPA and CRC Sugar, addressed the issue of land use effects on the GBR with special reference to the sugar industry. A proposal to produce an information brochure on land-based impacts on the Great Barrier Reef has been submitted for funding by the Myer Foundation.

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

All *CRC Reef* research projects have designated Task Associates who are representatives from industry or management agencies whose role is to assist in technology transfer. A Tourism Research Advisory Group aimed at facilitating meetings between tourism researchers and industry and management representatives has also been established.

The Eye on the Reef project, a three year industry-based voluntary monitoring program which collects information on reef health, has been jointly funded by GBRMPA and *CRC Reef* in 1999–2000. The project involves training of industry-supported volunteers to monitor reef health at 25 frequently-visited reef sites. A range of supporting materials and manuals has been prepared as part of the project. Some initial design problems with the database have been addressed, and the initiative is enthusiastically supported by industry.

Communication Products

Newsletters

Four editions of the CRC Reef Research News, the primary newsletter of the *CRC Reef*, were produced in 1999–2000. There was broad coverage of research news and staff updates. Along with other communication products, the newsletter will be reviewed during 2000. The Effects of Line Fishing Newsletter was produced quarterly. This newsletter is directed to fishers, management authorities and researchers and has been a very successful medium to keep industry in touch with the project.

Exploring Reef Science Factsheets

Seven information brochures 'Exploring Reef Science' have been produced and distributed on topics of *CRC Reef* research. A brochure stand and set of factsheets has been provided for the foyer of the GBRMPA offices.

CRC Technical Reports and Tropical Topics

Five Technical Reports have been produced in 1999–2000. Copies of each have been distributed on request or by the authors. At the end of June 1999, a further eight Technical Reports have been submitted for publication, representing the ending of the funding cycle for many projects. Increasingly these reports will be produced electronically.

The book *Tropical Topics: A Compilation*, was produced as a collation of reef-related articles. Publication was sponsored by the *CRC Reef*. The book's primary audience is the tourism industry as well as environmental educators as an information source useful for reef interpretation.

Web-site redevelopment

An analysis of access to the CRC website Reef Research Online showed an average of 11,000 visits per week in Australia (46%) and overseas (54%). In late 1999, the CRC website was revised and moved to a new web address.

In June 2000, the web-site was further updated to reflect the new research programs, revision of members information and logos, addition of information about Research Days and other small changes. A move to a substantially revised web-site is planned in 2000–2001.

Media

A Media skills training courses was offered in August 1999, with 12 staff from *CRC Reef* and affiliated organisations attending. An advanced media skills course was offered in October 1999 for Program Leaders and the CEO.

In November, the CRC Marine Science Journalism Prize of $1000 was awarded to Ms Judy Dupont for an article on box jellyfish, subsequently published as an *Exploring Reef Science* note.

Media coverage in the past year has focussed on several fronts. The outbreaks of crown-of-thorns starfish received considerable coverage at both local and national levels. The CRC Report on fine-scale crown-of-thorns starfish surveys has been used to brief the media on current status of outbreaks. CRC researchers from AIMS, in conjunction with AMPTO, briefed the Queensland Cabinet in June 2000 on status of the outbreaks and its impacts on the tourism industry.

In 1999, the coral bleaching event continued to receive considerable media coverage, particularly following a Greenpeace report and an ABC documentary linking bleaching to global warming events word-wide. The research supported by the *CRC Reef*, demonstrated the localisation of the bleaching largely to inshore waters and documented the recovery of many reefs from bleaching over time. The early-warning system of reef temperature monitors has the capacity to advise industry when conditions likely to trigger coral bleaching are imminent.

The Effects of Line Fishing Program received considerable media coverage in Queensland as eight reefs were closed to fishing as part of the large-scale experiment. A media plan was put in place, including a newsletter mail-out, articles in fishing magazines and an interview program, with little adverse publicity associated with the closures.

Other topics which have attracted coverage include the long-term monitoring program, seabed modelling, seagrasses at the Townsville Strand re-development, and the Irukandji jellyfish research project.

Media publicity was at similar levels to previous years and is reflected in the table below:

	Local	State/National	International
Print	55	40	2
Radio	71	31	3
Television	20	3	2

10. GRANTS AND AWARDS

Grants

Researcher & Organisation	Title of Grant	Source	Period of Grant	$
Prof G Russ, JCU & Angel Alcala, Marine Lab. Silliman University, Philippines	Pew Fellowship in Fisheries Management – Evaluating the Role of Marine Reserves and Community-Based Management in Restoring and Maintaining Fish Populations and Marine Ecosystems	Pew Fellowship Foundation	3 years	US$150,000
Mr J Russell, QDPI	Biology, management and genetic stock structure of mangrove jack (*Lutjanus argentimaculatus*) in Australia	FRDC	3 years	$480,000
Dr C Davies, JCU	Stock structure and regional variation in population dynamics of the Red Throat Emperor and other target species of the Queensland Tropical Reef Line Fishery	FRDC	3.5 years	$388,444
Dr T Done, AIMS	Global climate change and coral bleaching on the Great Barrier Reef	DNR	3 years	$140,000
Dr T Done, AIMS	Coral reefs in the coastal seascape. Biodiversity classification and interpretation of a global network of sites	Diversitas	3 years	$130,000
Dr T Done, AIMS	Information management and decision support for biodiversity preservation and human welfare: coral reefs	UNEP	1 year	$86,207
Prof P Pearce & Dr G Moscardo, JCU	Great Barrier Reef Social Indicators Monitoring Project	GBRMPA	5 months	$38,000
Prof H Marsh, JCU	Ecologically sustainable community-based management of dugongs	ARC/GBRMPA/ Hopevale	2 years	$360,000
Prof H Marsh & Dr I Lawler, JCU	Aerial survey for dugongs on Qld coast south of Cape Bedford	GBRMPA/QPWS	1 year	$100,000
Prof M Heron, JCU & Dr D Burrage, AIMS	Microwave Sensing of Salinity in the Great Barrier Reef Lagoon	ARC	3 years	$132,000
J. Hacker, AIA, Prof M. Heron, JCU & D. Burrage, AIMS et al.	Airborne Salinity Mapping Facility	ARC	1 year	$300,000
Dr P Fenner, SLSA	First aid and pre-hospital assessment and treatment of Irukandji (jellyfish) envenomation	Australian Rotary Health Foundation	3 years	$23,280
Prof H Marsh, JCU	Seasonality of dugong distribution in Dugong Protection Areas	GBRMPA	1 year	$6,000
Prof H Marsh, JCU	Development of dugong necropsy manual	GBRMPA	1 year	$8,500
Prof H Marsh, JCU & Dr N Gribble, QDPI	Impact of shark nets on dugong by-catch	GBRMPA	1 year	$6,000
Prof H Marsh, JCU	Improving aerial survey estimates of dugong abundance	Seaworld	1 year	$12,000
Prof H Marsh, JCU	Dugong Action Plan	IUCN	1 year	$8,300
Prof H Marsh, JCU	Impact acoustic alarms on dugongs	Pew Fellowship Foundation	1 year	$16,000
Dr P Fenner, SLSA	Irukandji and drowning research	Thyne Reid Education Trust No 1.	3 years	$52,830
Dr K Fabricius, AIMS	Travel & Research Grant	Cape d'Aguilar Trust Fund	one-off	$4,500

Researcher & Organisation	Title of Grant	Source	Period of Grant	$
Dr K Fabricius, AIMS	Production of Octocoral Field Guide	Australian Biological Resources Study, Department of Environment and Heritage	1 year	$20,000
Mr G Muldoon, JCU	Augmentative Grant	GBRMPA	1 year	$1,500
Mr A Williams, JCU	Augmentative Grant	GBRMPA	9 months	$1,600
Mr J Kritzer, JCU	Terry Walker Prize	ACRS	9 months	$2,500

Awards

QDPI Seagrass-Watch Team, Northern Fisheries Centre	Prime Minister's Environmental Award in the Natural Heritage Trust Award for Rural and Regional Leadership Category	Protecting the State's Coastal Ecosystem (Seagrass-Watch Program)
Dr Neil Gribble, QDPI	Appointment as Visiting Research Scientist, University British Columbia, Fisheries Centre	

JCU divers preparing to take samples of fouling organisms from wharf piles in a crocodile protective cage, at the Port of Weipa.

Photo: Frank Hoedt

11. PERFORMANCE INDICATORS

The *CRC Reef* Agreement for the Centre includes a set of performance indicators as follows. These are likely to be revised in the near future in collaboration with the CRC Secretariat.

Objectives of the Centre

Quantitative indicators:

Performance Indicator	Target over life of Agreement	Measure-1999–2000	Previous CRC 1998–99
Total resources	$75.4m total resources	$10.5m	$8.2m
Cash resources	$40.4m cash resources	$4.9m	$3.9m
Centre Publications transferring research outcomes and technology to industry	70 Centre reports	5	NA
Industry Seminars	50 Seminars/Workshops	32	>60

Other indicators:

Benefit to Centre: Building intellectual capital. An additional 29.21 professional positions (excluding in-kind staff) have been added amongst the partners as a result of the CRC.

Benefit to user core participants: Dissemination of Centre IP to parties. The *CRC Reef* has facilitated dissemination of Centre IP amongst 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, 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; 6 monthly and annual task reviews implemented. Task reviews by scientists and research users.

Quality and Relevance of Research Program

Quantitative indicators:

Performance Indicator	Target over life of Agreement	Measure-1999–2000	Previous CRC 1998–99
Research Program resources	$53.34m total cash and in-kind resources on research program	$8.3m	$6.6m
Advisory Groups and Steering Committees	10 advisory groups and steering committees for research	6	4
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	38 9 8 7 9

Other indicators:

Scientific status and user satisfaction.

- Demonstrated research quality: All progress in research tasks is reviewed by the Scientific Advisory Committee, Task Review Committee and Board and proposals are peer-reviewed by at least two researchers external to the CRC.
- 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 UAG, SAC, TRC, and Task Associates. *CRC Reef* supported a major review of information and research needs by GBRMPA in 1999.
- Involvement of research users in deciding and conducting research: User input to planned projects is via UAG, 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	Previous CRC 1998–99
Resources devoted to communication and tech transfer	Minimum $2.5m cash and in-kind on comm. and tech. transfer	$327,000	$391,000
Centre products	Newsletter 4 p.a. Major update of Centre website every 2nd year Technical reports 10 p.a. Targeted short courses 3 p.a.	3 Reef Research 4 Fishing news Major upgrade initiated 5 4	6 Minor update 5 18
Commercial contracts for CRC expertise	Increasing over life of CRC Total $2.35m	$252,000	$130,000

Other indicators:

Application by industry of CRC Products. Applications are in the form of briefings to industry and environmental groups and publications. These include 5 seminars on coral bleaching, 1 government briefing on crown of thorns starfish, collaboration with industry and management on moorings and pontoon design.

Recognition by general public and stakeholder groups. High public profile and understanding of *CRC Reef* and CRC Program; See Section 8, 9.

Implementation by national and international agencies of CRC products; See sections 3, 8, 9, 10.

Communication and implementation of Centre research outcomes and technology Each proposal includes a TT plan; appointment of task associates to each task; UAG meetings; see Section 3, 6, 9.

Collaborative Arrangements

Quantitative indicators:

Performance Indicator	Target over life of Agreement	Measure-1999–2000	Previous CRC 1998–99
Cooperation in research within Australia and overseas and more efficient use of resources	20 collaborative arrangements	See section 3	
Research providers contributing resources	$32.1m total cash and in-kind	$4.9m	$3.3m
Research providers FTEs in-kind	18.56 FTE in-kind	34.72	28.76
Collaboration between researchers	80% projects involve 2 or more parties Participants workshop 4 p.a. Shared supervision of students 5 p.a.	82% 6 9 stipend students	NA NA 5 stipend students
Collaboration between researchers and research users	University and non-University supervisors for 25% of postgraduate students	25%	20%
Collaboration with other research institutions	25 projects p.a.	26 institutions	34 institutions
International collaboration	Centre researchers involved in 25 international collaborations per year 5 visitors p.a. Formal arrangements with international organisations – 1 p.a. 3 postgraduate students to present at international conferences	45 institutions 27 4 1	31 institutions 24 5
Associate membership program	4 p.a. Associate members	2	NA
Secondments of industry staff to research providers	1 secondment to research provider p.a.	1	NA
Secondments of research provider staff to industry	3 secondments to industry p.a.	2	NA

Other indicators:

Collaboration with other CRCs: Annual meetings for planning – CEOs, Business Managers, Communication Managers at CRC Association conference. Tropical Tourism Research Unit, Cairns, Joint organisation of CRC Career Development Course.

Education and Training

Quantitative indicators:

Performance Indicator	Target over life of Agreement	Measure-1999–2000	Previous CRC 1998–99
Training and equipping postgraduate students as future leaders in research and management	35 postgraduates employed 30 postgraduates employed in user or related industry	10 employed 10 employed	15 15
Increase in knowledge and skill base available.	Workshops and short courses attended by 10 industry and user persons p.a.	See Section 6	18
Program resources	$2.7m, cash and in-kind resources	$443,000	$543,000
Postgraduate program	35 scholarships 15 additional students supported	28 54	19 49

Other indicators:

Industry training: All new students underwent induction including opportunities for industry collaborations in June 2000. Two students completed industry placement program.

Student performance management: All students were reviewed annually by JCU; and 6 monthly and annually as part of CRC Task reviews.

Management structure and arrangement

Quantitative indicators:

Performance Indicator	Target over life of Agreement	Measure-1999–2000	Previous CRC 1998–99
Total cash and in-kind resources in general administration	$5.8m cash and in-kind	$856,000	$669,000
Additional revenue raised	$5.8m	$270,000	$247,000
New partners	2	Discussions with parties well-advanced	NA
Management skills	All program/project leaders to attend one course	4/5 Program Leaders	NA

Other indicators:

Continuity of long-term partnerships and research effort: Satisfaction of partners. Survey planned for 2000.

Governance Nominees for each party on Board
Majority of user and independent members on Board (7/10)
Annual performance review in November 1999.

Financial management: Programs and projects fully committed and within budget. Centre moved to accrual accounting system in July 2000.

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	Previous CRC 1998–99
Annual task reviews	6-monthly and annual	Yes	Yes
External audit	Annual	Annual	Annual
Audit committee	Quarterly meetings	Board Exec meetings.	No
Annual Board scrutiny of task	Quarterly meetings performance and budget	Quarterly meetings	Quarterly meetings
Reports to Board and CRC Program	Monthly, quarterly and annual reports to Board and CRC Program	Target reached	Target reached

Other indicators:

Efficient and effective performance Satisfaction of parties survey planned for 2000.

International consultant advice Not implemented in 1999–2000.

Annual report: Reports made and submitted on time.

Ms Britta Kornholt holds a high intensity light under an coral overhang during a photographic session on the reef. Photos are an important part of reporting changes in the reef health.

Photo: Ken Anthony

12. BUDGET

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

	Actual 1999/00	Cumulative Total To Date Actual	Cumulative Total To Date Agr'mt	Projected Agr'mt[1] 2000/01	Agr'mt 2001/02	Agr'mt 2002/03	Agr'mt 2003/04	Agr'mt 2004/05	Agr'mt 2005/06	Grand Total Total[2] 7 Yrs	Grand Total Agr'mt 7 Yrs	Variance 7 Yrs
AIMS												
Salaries	517	517	545	718	757	757	722	650	609	4,730	4,758	(28)
Capital	0	0	0	0	0	0	0	0	0	0	0	0
Other	1,631	1,631	1,317	1,636	1,766	1,766	1,442	1,265	1207	10,713	10,399	314
TOTAL	2,147	2,147	1,862	2,354	2,523	2,523	2,164	1,915	1,816	15,442	15,157	285
AMPTO (REPRESENTING THE TOURISM INDUSTRY & OTHERS)												
Salaries	63	63	40	40	40	40	40	40	40	303	280	23
Capital	0	0	0	0	0	0	0	0	0	0	0	0
Other	57	57	37	230	230	230	230	230	230	1,437	1,417	20
TOTAL	120	120	77	270	270	270	270	270	270	1,740	1,697	43
GBRMPA												
Salaries	174	174	156	187	187	187	187	187	187	1,296	1,278	18
Capital	0	0	0	0	0	0	0	0	0	0	0	0
Other	229	229	194	233	233	233	233	233	233	1,627	1,592	35
TOTAL	403	403	350	420	420	420	420	420	420	2,923	2,870	53
JCU												
Salaries	440	440	440	405	405	405	405	394	394	2,848	2,848	0
Capital	0	0	0	0	0	0	0	0	0	0	0	0
Other	834	834	830	755	755	755	755	739	739	5,332	5,328	4
TOTAL	1,274	1,274	1,270	1,160	1,160	1,160	1,160	1,133	1,133	8,180	8,176	4
QCFO												
Salaries	283	283	293	13	13	13	13	13	13	361	371	(10)
Capital	0	0	0	0	0	0	0	0	0	0	0	0
Other	90	90	68	20	20	20	20	20	20	210	188	22
TOTAL	373	373	361	33	33	33	33	33	33	571	559	12
QDPI												
Salaries	357	357	179	294	311	314	314	314	314	2,216	2,038	178
Capital	0	0	0	0	0	0	0	0	0	0	0	0
Other	557	557	353	508	530	535	535	535	534.6	3,734	3,530	204
TOTAL	913	913	532	802	841	849	849	848	849	5,950	5,569	381
SUNFISH												
Salaries	67	67	72	0	0	0	0	0	0	67	72	(5)
Capital	0	0	0	0	0	0	0	0	0	0	0	0
Other	20	20	12	0	0	0	0	0	0	20	12	8
TOTAL	87	87	84	0	0	0	0	0	0	87	84	3
ANU												
Salaries	0	0	0	26	26	26	26	26	26	156	156	0
Capital	0	0	0	0	0	0	0	0	0	0	0	0
Other	0	0	0	36	36	36	36	36	36	216	216	0
TOTAL	0	0	0	62	62	62	62	62	62	372	372	0
CSIRO MARINE												
Salaries	34	34	33	84	85	85	77	107	77	549	548	1
Capital	0	0	0	0	0	0	0	0	0	0	0	0
Other	57	57	45	116	118	118	106	147	107	768	756	12
TOTAL	91	91	78	200	203	203	183	254	184	1,318	1,304	13
QFMA												
Salaries	50	50	50	4	4	4	4	4	4	77	76	0
Capital	0	0	0	0	0	0	0	0	0	0	0	0
Other	86	86	80	66	66	66	66	66	66	484	478	6
TOTAL	136	136	130	71	71	71	71	71	71	561	555	6
TOTAL IN-KIND CONTRIBUTIONS												
Salaries	1,985	1,985	1,808	1,771	1,828	1,831	1,788	1,735	1,664	12,602	12,426	177
Capital	0	0	0	0	0	0	0	0	0	0	0	0
Other	3,560	3,560	2,936	3,600	3,754	3,759	3,423	3,271	3,173	24,541	23,917	624
GRAND TOTAL												
IN-KIND	5,544	5,544	4,744	5,372	5,582	5,590	5,211	5,006	4,837	37,143	36,343	800

(1) The Agreement figure for 2000/01 includes deferred Participant contributions from 1999/00

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

TABLE 2 : CASH CONTRIBUTIONS ($'000s)

	Actual 1999/00	Cumulative Total To Date Actual	Cumulative Total To Date Agr'mt	Projected Agr'mt(1) 2000/01	Agr'mt 2001/02	Agr'mt 2002/03	Agr'mt 2003/04	Agr'mt 2004/05	Agr'mt 2005/06	Grand Total Total(2) 7 Yrs	Grand Total Agr'mt 7 Yrs	Grand Total Variance 7 Yrs
PARTNERS												
AIMS	130	130	130	130	130	130	130	130	130	910	910	0
AMPTO (REP TOURISM INDUSTRY)#	1,102	1,102	1,102	1,240	1,240	1,240	1,240	1,240	1,240	8,542	8,542	0
GBRMPA	665	665	665	665	665	665	665	665	665	4,655	4,655	0
JCU	197	197	239	177	135	135	135	135	135	1,049	1,049	0
QCFO*	0	0	0	280	280	280	280	280	280	1,680	1,680	0
QDPI	138	138	138	138	138	138	138	138	138	966	966	0
SUNFISH*	0	0	0	70	70	70	70	70	70	420	420	0
QFMA	0	0	50	50	0	0	0	0	0	50	50	0
TOTAL CASH FROM PARTICIPANTS	2,232	2,232	2,324	2,750	2,658	2,658	2,658	2,658	2,658	18,272	18,272	0
OTHER												
NEW MEMBERS			0	100	100	100	100	100	100	600	600	0
ASSOCIATE MEMBERS		0	50	100	100	100	150	200	700	700	0	
EXTERNAL GRANTS	18	18	0	100	100	100	100	100	200	718	700	18
COMMERCIAL CONTRACTS	252	252	150	150	200	250	350	500	750	2,452	2,350	102
SPONSORSHIP/ DONATIONS			50	50	100	150	200	250	500	1,250	1,300	(50)
INTEREST	30	30	20	20	20	20	20	20	20	150	140	10
CRC GRANT												
	2,400	2,400	2,400	2,900	2,600	2,500	2,500	2,500	1,000	16,400	16,400	0
TOTAL CRC CASH CONTRIBUTION												
	4,931	4,931	4,944	6,120	5,878	5,878	6,028	6,278	5,428	40,541	40,462	130
Cash carried over from previous year												
	960	960								960		
Less Unspent												
	1,462	1,462										
TOTAL CASH EXPENDITURE												
	4,429	4,429	4,944							41,501	40,462	1,039
ALLOCATION OF CASH EXPENDITURE BETWEEN HEADS OF EXPENDITURE												
SALARIES	2,411	2,411	3,115	3,848	3,703	3,703	3,798	3,954	3,420	24,837	25,491	(654)
CAPITAL	0	0	0	0	0	0	0	0	0	0	0	0
OTHER	2,018	2,018	1,829	2,272	2,175	2,175	2,230	2,324	2,008	15,202	14,971	231
TOTAL	4,429	4,429	4,944	6,120	5,878	5,878	6,028	6,278	5,428	40,039	40,462	(423)

(1) The Agreement figure for 2000/01 includes deferred Participant contributions from 1999/00
(2) Total = Cumulative Actual + Outyear 'Estimate'
Derived from the Environmental Management Charge
* Subject to FRDC funding

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

	Actual 1999/00	Cumulative Total To Date Actual	Cumulative Total To Date Agr'mt	Projected Agr'mt[1] 2000/01	Agr'mt 2001/02	Agr'mt 2002/03	Agr'mt 2003/04	Agr'mt 2004/05	Agr'mt 2005/06	Grand Total Total[2] 7 Yrs	Grand Total Agr'mt 7 Yrs	Grand Total Variance 7 Yrs
GRAND TOTAL												
In-Kind Expenditure	5,544	5,544	4,744	5,372	5,582	5,590	5,211	5,006	4,837	37,143	36,344	799
Cash Expenditure	4,429	4,429	4,944	6,120	5,878	5,878	6,028	6,278	5,428	40,039	40,462	(423)
Total Resources Applied to Activities of Centre	9,974	9,974	9,688	11,492	11,460	11,468	11,239	11,284	10,265	77,182	76,806	376
ALLOCATION OF TOTAL RESOURCES												
Total Salaries (Cash & In-Kind)	4,396	4,396	4,922	5,619	5,531	5,534	5,586	5,689	5,084	37,440	37,916	(476)
Total Capital (Cash & In-Kind)	0	0	0	0	0	0	0	0	0	0	0	0
Total Other (Cash & In-Kind)	5,578	5,578	4,765	5,872	5,929	5,934	5,653	5,595	5,181	39,743	38,890	(476)

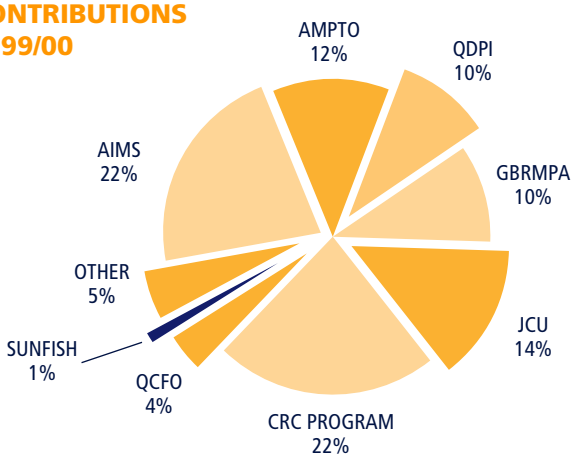
(1) The Agreement figure for 2000/01 includes deferred Participant contributions from 1999/00
(2) Total = Cumulative Actual + Outyear 'Estimate'

TABLE 4 : ALLOCATION OF RESOURCES BETWEEN CATEGORIES OF ACTIVITIES

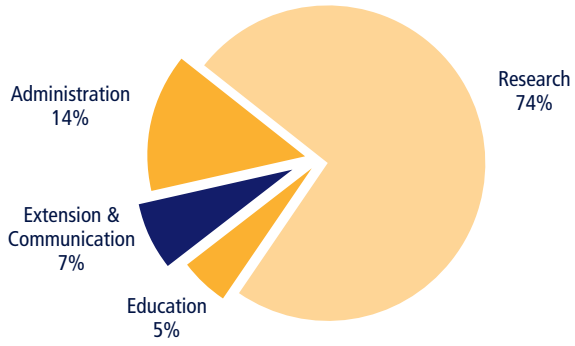
PROGRAM	$ CASH (1) ('000s)	RESOURCE $ IN-KIND (000's)	USAGE STAFF CONTRIBUTED (2)	STAFF FUNDED BY CRC (2)
RESEARCH	3,282	5,065	21.91	22.24
EDUCATION	226	217	0.73	1.01
EXTENSION/TRAINING	314	13	0.44	1.88
ADMINISTRATION	607	249	1.87	4.08
TOTAL	**4,429**	**5,544**	**24.95**	**29.21**

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

TOTAL CASH & IN-KIND CONTRIBUTIONS 1999/00



APPLICATION OF CASH FUNDING 1999/00



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 a cash basis of accounting.

Capital Purchases

In 1999/00, there were no capital equipment purchases.

Variation in Accounting Periods

With the exception of James Cook University, all members of the Cooperative Research Centre have reported for the period 1 July 1999 to 30 June 2000. James Cook University adopts a four-weekly financial reporting cycle and has reported from the 12 June 1999 to the 9 June 2000, being the end of the four-weekly cycle immediately prior to 30 June 2000.

Receipts – Partners

$1,102,000 sourced from the Environmental Management Charge has been recorded as a cash contribution by AMPTO (representing the Tourism Industry). In-kind contributions attributed to QCFO (QSIA) and SUNFISH in 1999/00 are made by way of Fisheries Research and Development Corporation (FRDC) funding of research projects developed within *CRC Reef* and hosted by James Cook University.

Participant Cash Contributions to the CRC

A cash contribution of $42,000 committed in 1999/00 by JCU was deferred for payment to 2000/01 due to the late commencement of a research task.

A cash contribution of $50,000 committed in 1999/00 by QFMA was deferred for payment to 2000/01 due to the amalgamation of QFMA and DPI Fisheries Group to form Queensland Fisheries Service.

Budget Estimates

The Agreement projections for 2000/01 include receipt and expenditure of deferred payments of Participant contributions from 1999/00. The Agreement projections 2001/02–2005/06 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, the CRC held $679,425 cash in hand allocated for expenditure in 2000/01 and Parties held research advances of $782,880 allocated for expenditure in 2000/01.

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), QFMA, QCFO and SUNFISH comprise operational support and therefore overheads have not been applied to these contributions.

13. 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 2000

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 2000 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 2000 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

John Zabala
Partner

Date: 18 August 2000

Appendix: List of Organisational Abbreviations

ABC – Australian Broadcasting Commission
AIMS – Australian Institute of Marine Science
AMPTO – Association of Marine Park Tourism Operators
ANU – Australian National University
ARC – Australian Research Council
AUSCORE – Australian Coral Records
B/HERT – Business/Higher Education Roundtable
BHP – Broken Hill Pty Ltd Cannington
CALM – Department of Conservation & Land Management
CRC – Cooperative Research Centre
CRCA – Cooperative Research Centres Association
CSIRO – Commonwealth Scientific & Industrial Research Organisation
DETYA – Department of Education, Training & Youth Affairs
DNR – Department of Natural Resources
ELF – Effects of Line Fishing
ENSO – El Nino Southern Oscillation
EA – Environment Australia
EPA – Environmental Protection Agency
FRDC – Fisheries Research Development Corporation
GIS – Geographic Information System
GBRMPA – Great Barrier Reef Marine Park Authority
GBRWHA – Great Barrier Reef World Heritage Area
IP – Intellectual Property
IPC – Intellectual Property Committee
IRD – Institut de recherche pour le développement
IWC – International Whaling Commission
IUCN – World Conservation Union
JCU – James Cook University
NOAA – National Oceanic & Atmospheric Administration, USA
QCFO – Queensland Commercial Fishermen's Organisation
QSIA – Queensland Seafood Industry Association
QDPI – Queensland Department of Primary Industries
QFMA – Queensland Fisheries Management Authority
RAP – Representative Areas Program
SLSA – Surf Life Saving Australia
UNEP – United Nations Environment Program
UQ – University of Queensland
UWA – University of Western Australia
WHA – World Heritage Area