COOPERATIVE RESEARCH CENTRE FOR THE GREAT BARRIER REEF WORLD HERITAGE AREA

Annual Report 2000–01

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

CRC AUSTRALIA

cRc Reef Research Centre

Science for sustaining coral reefs

Objectives

Major achievements

Program A. Management for sustainability

To create innovative systems to assist policy-makers and environmental managers in decision-making for the use and conservation of the Great Barrier Reef World Heritage Area (GBRWHA).

- Socio-financial profiling of Queensland's commercial, charter and harvest fishing fleets, has provided managers, industry and other stakeholders with an innovative, interactive tool to predict the magnitude, location and nature of the direct and indirect social and financial effects of changes in fisheries policy.

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.

- Cyclone Wave Atlas, now available online, will be used with Pontoon Guidelines to assist GBRMPA and the tourism industry in achieving world's best practice in optimising construction and mooring of offshore structures in the GBRWHA.

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.

- CRC Reef collaborated with IUCN and United Nations Environment Programme (UNEP) to produce a report about the status and action plan for dugongs in 37 countries and territories around the globe.

Program D. Information systems and synthesis

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

- CRC Reef researchers contributed to public debate on world heritage issues through production of analyses, reports and brochures on water quality, crown-of-thorns starfish and the coral harvest fishery.

Program E. Education and communication

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

- Students from the Fishing and Fisheries research project organised and ran a highly successful student-stakeholder workshop to communicate their research results to industry and management.

Program F. Commercial and international

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

- External grants exceeded projected income. International collaborative research on the Global International Waters Assessment resulted from an agreement with UNEP.

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

Association of Marine Park Tourism Operators
Australian Institute of Marine Science
Great Barrier Reef Marine Park Authority
James Cook University
Queensland Department of Primary Industries
Queensland Seafood Industry Association
Sunfish Queensland Inc.

CRC Reef Research Centre
PO Box 772
TOWNSVILLE QLD 4810
Telephone: 07 4729 8400
Facsimile: 07 4729 8499
Email: info@crcreef.com
Web Site: www.reef.crc.org.au

Design by WWd, www.wwd.net.au

Great Barrier Reef World Heritage Area

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

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

Commercial and recreational fisheries, tourism, shipping and ports operate in the GBRWHA. These industries are economically important both for the state of Queensland and for Australia. The GBRWHA supports 2,780 licensed master fishers and more than 600 tourist operators which generates significant employment, directly and indirectly. Major export ports and shipping channels are located in, or adjacent to, the area. Reef-based tourism is estimated to be worth about $2 billion a year and fisheries worth about $750 million annually.

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

CONTENTS

EXECUTIVE SUMMARY

1. EXECUTIVE SUMMARY

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

Photo: Rob Parsons

Chairman and CEO's report

The Cooperative Research Centre for the Great Barrier Reef World Heritage Area (incorporated as CRC Reef Research Centre) is a knowledge-based partnership of coral reef managers, researchers and industry. CRC Reef provides research solutions to protect, conserve and restore the world's coral reefs by ensuring industries and management are sustainable and that ecosystem quality is maintained. Through the active policy setting and direction from the Board, CRC Reef ensures that the needs of end-users are incorporated into the design, instigation and progress of research.

Centrally located to the Indo-Pacific region, in Townsville in far northern Queensland, CRC Reef Research Centre and its members are an internationally recognised focus of expertise and experience in coral reef science, technology and management.

In 30 June 2001, CRC Reef completed its first full year as an operating company, CRC Reef Research Centre, implementing the Centre Agreement between our members and the Commonwealth's CRC Program. The incorporation was a positive move and has increased the focus and responsibility of the Board of Directors. It has also simplified operating procedures for the Secretariat, although the Board is very grateful for the sound support provided by James Cook University (as Centre Agent) during the establishment phase.

The Board is also addressing its own performance; it completed a workshop on corporate governance in mid 2000 and has implemented a Corporate Governance Charter.

Research results

This Annual Report gives a full account of the activities under our Research and Education programs (Sections 4 and 5). Highlights are listed inside the front cover. The Board is particularly proud of an innovation by postgraduate students in the Fishing and Fisheries project, who organised a very successful workshop aimed at communicating the results of their research to more than 35 stakeholders. This approach embraces the ideals of the Cooperative Research Centres Program in enhancing collaboration and the transfer of research outputs between researchers and industry, and in developing high quality graduate researchers.

Many other areas within the research programs are demonstrating the importance of taking a broader view of the interactions between human activities and the natural systems of the Great Barrier Reef World Heritage Area. Developments within the relatively new Ports and Shipping program show the potential for positive benefits from the integration of research into introduced pests, modelling of port hydrodynamics, evaluating critical marine habitats in port and shipping lanes, and examining coastal water quality issues. The Centre will encourage increased cooperation between researchers studying related problems along the coastal margin of the World Heritage Area. Similar integration of work both within and outside of the CRC Reef led to a renewed investigation of the potential for river run-off to trigger outbreaks of crown-of-thorns starfish.

Research priorities

In November 2000, the Board re-evaluated its strategic priorities for research. The major problem areas now being tackled through CRC Reef's research are:

Water quality	• Identifying causes of poor water quality (including terrestrial run-off) • Quantifying effects of poor water quality • Assessing solutions to stop decline in water quality
Coral bleaching	• Understanding the adaptability of corals • Predicting ecosystem effects • Developing remediation or reseeding methods • Establishing monitoring networks • Understanding the health of corals
Crown-of-thorns starfish	• Establishing the major causes or triggers for outbreaks • Assessing the role of human activities (especially water quality and predator removal) • Assessing impacts on tourism • Developing effective control methods
Biodiversity (use and conservation)	• Mapping biodiversity at ecosystem, species and genetic levels • Studies of vulnerable and threatened species • Developing sustainable uses of biodiversity (non-extractive uses such as bioproducts)
Sustainable fishing (commercial, recreational and traditional)	• Quantifying sustainable harvest levels • Assessing environmental impacts • Understanding the social and economic dimensions of fishing • Developing new and more rapid assessment methods • Reducing the mortality of released fish
Sustainable aquaculture	• Quantifying the effects of aquaculture on water quality and habitats • Developing zero or low impact techniques • Assessment of suitable sites for aquaculture
Sustainable tourism	• Understanding the capacity of the region for tourism (including shore-based capacity) • Assessing tourist perceptions and enhancing tourism experiences • Assessing the effects of crowding on tourism (as it relates to management policies)
Skills development	• Enhancing the skills of those involved in monitoring programs • Enhancing the professional expertise of new managers in industry, government and of researchers

New initiatives

Great Barrier Reef Research Foundation

The CRC Reef Board initiated the concept of a Great Barrier Reef Research Foundation, initially to provide funds exclusively for the continued operation of the Centre.

Subsequent to its formation, the Foundation's objectives were broadened to "building knowledge for the conservation and sustainable use of coral reefs around the world, and especially of the Great Barrier Reef."

The Minister for Environment and Heritage launched the Foundation in Canberra in February 2001. This philanthropic organisation has strong support from Australia's leading business people and has raised significant new funds for research in its first year of operation.

CRC Reef has also played a role in steering the Foundation: CRC Reef's Chairman, Sir Sydney Schubert, was the inaugural Chairman of the Foundation; and the CRC Reef's CEO, Dr Russell Reichelt, is Chairman of the International Scientific Advisory Committee.

The Centre has signed a Memorandum of Understanding with the Foundation, assisting its fund-raising efforts through promotions, and providing technical and administrative support.

International marine project development

CRC Reef has established a subsidiary company, International Marine Projects Activities Centre Ltd (IMPAC), to attract international marine project developers (especially United Nations workers) to work in Townsville which is a region that is a centre of excellence in marine science.

A goal of IMPAC is to forge links with other Australian reef researchers, such as the Tropical Marine Network partners, and make the Great Barrier Reef a global hub for reef science.

An international coral reef research network

At an APEC working group meeting in Hong Kong in May 2001, CRC Reef joined forces with Agriculture, Fisheries and Forestry Australia (AFFA) to propose an international cooperative research centre for coral reefs. The centre would build an international knowledge network, and attract private sector partners by creating a framework for investment in commercial development of sustainable fisheries throughout East Asia and the Western Pacific.

At a May 2001 meeting in Hong Kong, the APEC Working Group gave in principle support to the concept of an international network of researchers and industry with a goal of promoting the conservation and sustainable use of coral reefs in the Indo-Pacific region. CRC Reef will be working with the Australian government to encourage partnerships, enhance existing mechanisms and establish new ones where appropriate. The US State Department has agreed to assist in our efforts to develop the concept in the interest of promoting conservation and sustainable use of coral reefs.

Assessing the state of global waters

During the year, CRC Reef was contracted to provide assessments for the United Nations Environment Programme (UNEP), working through the University of Kalmar in Sweden, in support of the Global International Waters Assessment.

Scientists learning the language of business

In partnership with CRC Reef, a new company, BABEL-sbf Pty Ltd, conducted a training course to raise the capacity for CRC Reef researchers to communicate more effectively with commercial operators. The course included the basics of project management, and addressed some of the issues that can arise in cultural clashes between science and business.

Tropical Marine Network

In partnership with the Great Barrier Reef Research Foundation, CRC Reef facilitated the formation of the Tropical Marine Network. The network members are James Cook University, the Australian Museum, University of Queensland and University of Sydney; the owners of the island research stations on the Great Barrier Reef. CRC Reef's researchers and students make use of the research stations, and the formation of the Network is a further, very positive step towards increased cooperation among institutions managing infrastructure and research on the Great Barrier Reef.

Looking forward

CRC Reef recognises that the ports and shipping industry are major contributors to the economic development of the region. The Centre has conducted a series of surveys for the regional port authorities to assist in identifying exotic species that may have arrived via ships' hull fouling or ballast water from foreign ports.

In the coming year, CRC Reef will work with its members to improve methods of measuring the status of the Great Barrier Reef and its coastal waters. The Centre will also extend these methods into the region through the emerging international network of cooperating researchers and industry users of coral reef ecosystems.

The Board has set a goal of building new sources of revenue to reduce the Centre's dependence on the CRC grant by 2006, when the current agreement finishes. The Centre aims to achieve this through the partnership with its members. CRC Reef will deliver research results for the Great Barrier Reef World Heritage Area, and also focus on marketing the expertise of the Centre's researchers to the rest of the world, where they already enjoy a high professional reputation.

Sir Sydney Schubert, Chairman
Dr Russell Reichelt, CEO

2. STRUCTURE AND MANAGEMENT

The CRC Reef secretariat (left to right): Deputy CEO (Research), Dr David Williams; Administrative Assistant, Ms Amanda Norman; Executive Assistant, Ms Dawn Birch; CEO, Dr Russell Reichelt; and Executive Officer, Ms Anne Tucker.

Photo: Rob Parsons

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

- Association of Marine Park Tourism Operators (AMPTO)
- Australian Institute of Marine Science (AIMS)
- Great Barrier Reef Marine Park Authority (GBRMPA)
- James Cook University (JCU)
- Queensland Seafood Industry Association (QSIA)
- The State of Queensland through its Department of Primary Industries (QDPI)
- SUNFISH Queensland Inc.

and an Agreement with the Commonwealth of Australia.

CRC Reef has formed a public not-for-profit company, CRC Reef Research Centre (ABN 62 089 499 034), to conduct its business. Income tax exemption has been granted for the company.

The management structure consists of the Board and the Chief Executive Officer (CEO), supported by a Secretariat dealing with administrative and financial activities. The Board is advised by Advisory Groups and Committees, and a Centre Visitor.

The Board comprises an independent Chair and nine directors.

Board membership at 30 June 2001 was:

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

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

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

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

The CEO attends all meetings of the Board and is responsible to the Board for the operational management of 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.

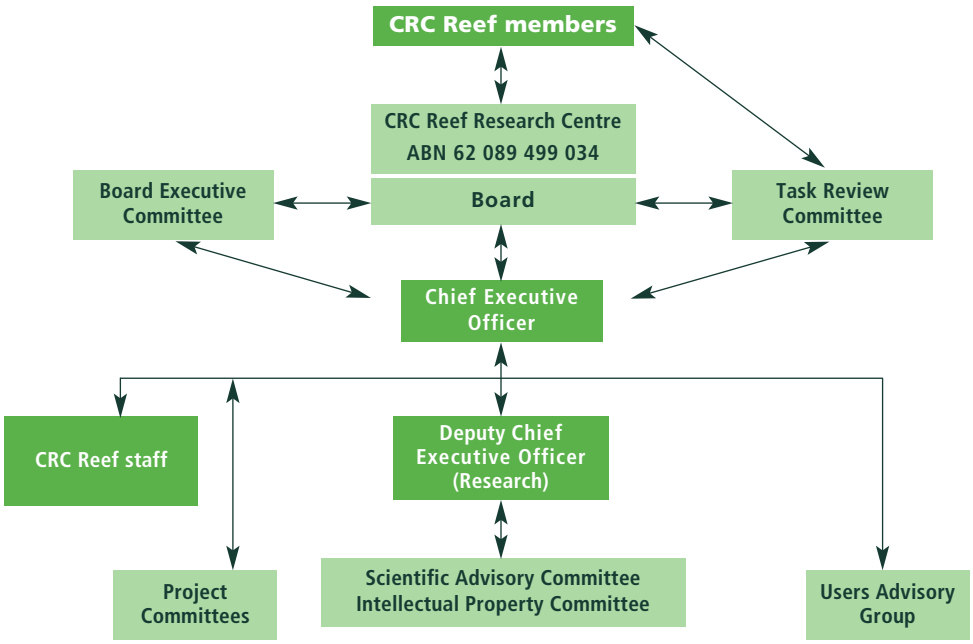
A set of standing committees advises the Board and assists CRC Reef management:

- Board Executive Committee (BEC)
- Task Review Committee (TRC)
- Scientific Advisory Committee (SAG)
- User Advisory Group (UAG)
- Intellectual Property Committee (IPC)

The Board Executive Committee provides guidance to management between quarterly full Board meetings; undertakes the role of Audit Committee; reviews remuneration and performance of the CEO; reviews Board performance and operations including remuneration matters; examines funding opportunities; and advises the Board on the above matters. The Committee met four times during the year and membership at 30 June 2001 was:

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

MANAGEMENT STRUCTURE



The Users Advisory Group considers issues and information 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 CRC Reef's programs. The Task Review Committee reviews tasks and policy proposals on behalf of members of CRC Reef and advises and makes recommendations to the Board on such matters. The committees have met on three occasions and membership at 30 June 2001 included:

Users Advisory Group

Dr R Reichelt (CEO)
Dr D Williams (DCEO)
Ms B Barnett (Extension)
Mr M Turner (EPA/QPWS)
Mr D Windsor (AMPTO)
Dr A Green (GBRMPA)
Mr C Wilson (QPA)*
Mr D Bateman (SUNFISH)
Ms R Lea (QFMA)
Mr D Souter (QSIA)
Mr P Comben (Conservation)
Prof M McManus (NTMN)
Ms Jade Daylight-Baker (ATSIC) º

Scientific Advisory Committee and Intellectual Property Committee

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

Task Review Committee

Sir S Schubert (Chair)
Mr D Windsor (AMPTO)
Dr A Green (GBRMPA)
Mr J Robinson (SUNFISH)
Mr D Souter (QSIA)
Professor N Palmer (JCU)
Dr P Isdale (AIMS)
Mr P Finglas (QDPI)

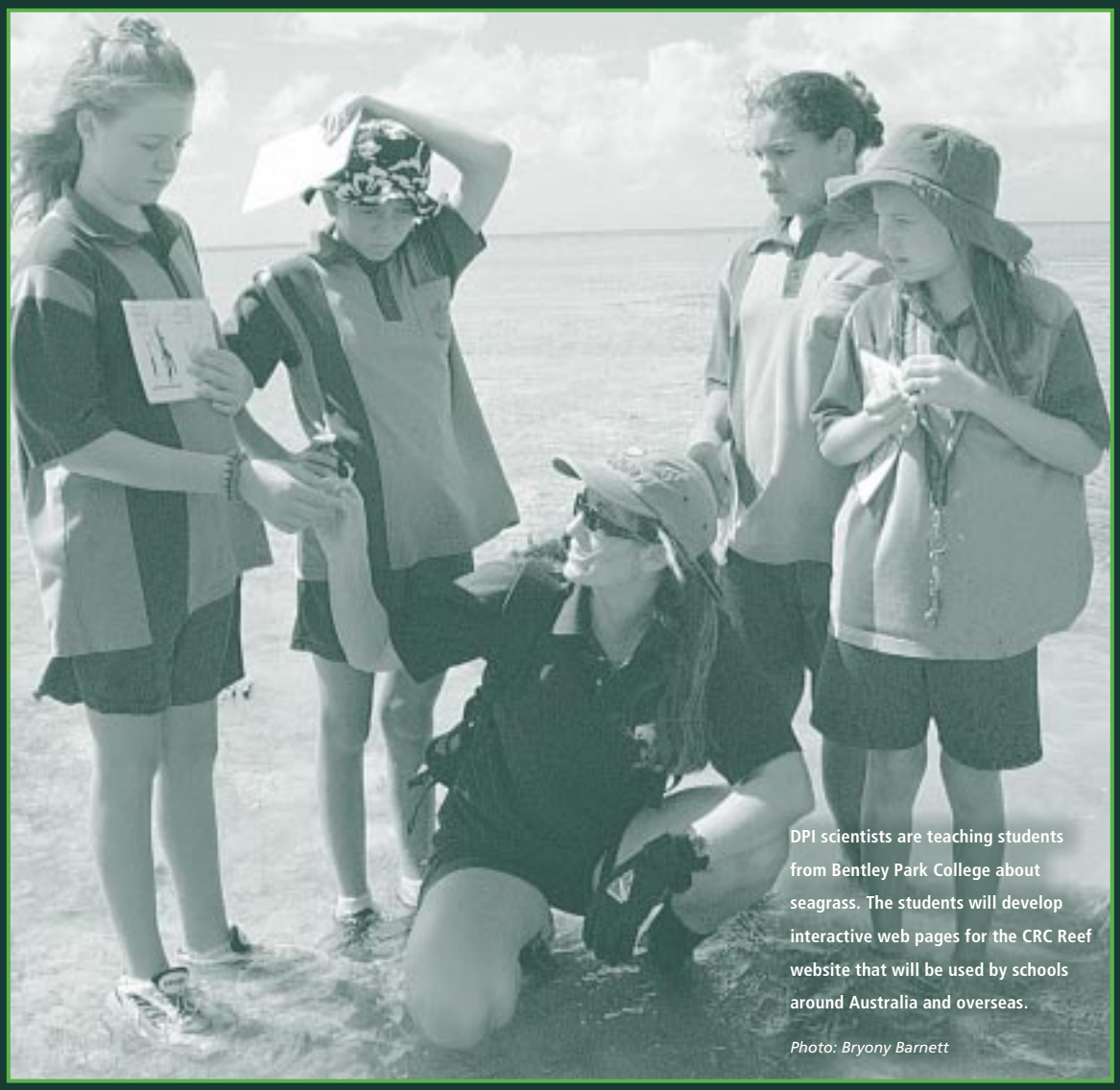
*Mr Craig Wilson has replaced Ms Caryn Anderson as QPA representative
ºMs Jade Daylight-Baker has replaced Mr A Nolan as interim ATSIC representative

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

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

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

3. COOPERATIVE LINKAGES



DPI scientists are teaching students from Bentley Park College about seagrass. The students will develop interactive web pages for the CRC Reef website that will be used by schools around Australia and overseas.

Photo: Bryony Barnett

Objective:

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

Highlights:

- Redevelopment of CRC Reef Communication and Extension Strategy to set a new framework for internal and external communication.
- Revision and expansion of the CRC Reef Task Associate Program including induction training of researchers and task associates.
- Collaboration with Queensland Department of Primary Industries Marine Plant Ecology Group and Bentley Park College, Cairns, to develop interactive seagrass web pages.
- In collaboration with the tourism industry, presentation of a workshop for local control of crown-of-thorns starfish.

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

- a new and expanded communication and extension strategy, which is supported by its members;
- strong support for multi-agency research tasks;
- provision of opportunities for CRC Reef researchers and stakeholders to meet in workshops, meetings, steering and advisory committees etc.;
- a highly inclusive and representative committee structure;
- a survey of CRC Reef partners to measure satisfaction with cooperative arrangements and identify areas for further improvement;
- 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.

Following the earlier review of the extension and communication practices of CRC Reef, a new Communication and Extension Strategy has been prepared. This involved consultation with all CRC Reef advisory committees and researchers. New strategies have been outlined, and are being implemented, to achieve the key objectives:

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

INTERNAL LINKS WITH PARTICIPATING ORGANISATIONS

In line with CRC Reef performance indicators, a survey of the satisfaction of parties was completed in early 2001. Survey results covered quality and relevance of research, collaborative arrangements, communication of research, and performance of the Board and CRC Reef administration. For 16 of the 19 questions, member responses averaged between 1 and 2 on a 5-point scale (satisfied to very satisfied). For the remaining three questions, responses averaged between 2 and 3 (satisfied to neutral) and related mainly to the task associate program which had some implementation problems but has now been extensively revised. The survey will be repeated at annual intervals to assess changes in satisfaction levels.

CRC Reef has redeveloped its task associate program to increase liaison between CRC Reef researchers, resource managers and private operators. The role of the task associate is to improve the relevance and application of strategic research, facilitate information transfer and help develop public policy and better industry practices. Induction training in the task associate program has been conducted with staff of GBRMPA, JCU, QDPI, AIMS and the tourism industry to promote understanding of the program objectives, and roles and responsibilities of the task leaders and task associates.

The Tourism Task Advisory Group was formed to supplement the task associate program; bring together tourism researchers and industry task associates; identify tourism industry information needs; and provide a vehicle for transfer of information between the CRC Reef and industry. A workshop with this group contributed significantly to the review and revision of the task associate program guidelines. Additional task associates from the tourism industry have been assigned to research tasks within the Sustainable Tourism program, to improve links with the industry. In addition, updates about CRC Reef research are presented regularly at regional AMPTO meetings.

The Users Advisory Group also helps facilitate links throughout CRC Reef. This group met twice during the year with representatives from AMPTO, GBRMPA, QSIA, QDPI, EPA, SUNFISH, Ports Corporation of Queensland and the network of marine research stations. The Users Advisory Group had significant input in developing the new Communication and Extension Strategy and identifying the information needs of CRC Reef members.

Collaborative research projects being conducted with members include:

- a joint CRC Reef/QDPI fisheries task, funded by the Fisheries Research and Development Corporation (FRDC) and led by Dr Andrew Tobin, examining the biological status and spawning activity of spanish mackerel on the east coast of Queensland;
- CRC Reef/CSIRO collaborative research led by Dr Bruce Mapstone on modelling of multiple-species fisheries, jointly funded by CRC Reef and FRDC;
- Management Strategy Evaluation (MSE) modelling for fisheries co-sponsored by GBRMPA and FRDC;
- extension of the best practice pontoon and mooring tasks by Associate Professor Thomas Hardy to include a survey of all existing pontoons in the GBR Region, in collaboration with GBRMPA and with cooperation from a local engineering consultant; and
- minke whale research led by Dr Alastair Birtles (JCU) in collaboration with tourism industry members from the Cod Hole and Ribbon Reef Operators Association (CHARROA), in particular Undersea Explorer.

Stakeholder linkages were also enhanced by:

- extensive email information networks between staff, students and associates;
- publishing scientific results in newsletters, reports, brochures and in the media;
- 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, to provide information for management plans, fisheries proposals and tourism policy; and
- participation of CRC Reef researchers and staff on a wide range of working parties, state government Advisory Committees, national and international groups where research results can be utilised directly in management outcomes by member agencies.

EXTERNAL LINKAGES

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

Strong links have been developed by CRC Reef and QDPI researchers with ports and shipping industry associations to identify and monitor habitats critical to the GBRWHA adjacent to shipping lanes and ports. CRC Reef has also collaborated with the Townsville Port Authority in producing and distributing fact sheets about baseline surveys for introduced marine pest species.

CRC Reef members, AIMS and GBRMPA, have negotiated a collaborative agreement with NOAA (US Commerce Dept) to research the link between ocean temperatures and coral bleaching. Scientists from AIMS and NOAA have shared data to improve the efficiency of satellite observations which are impaired by the tropical atmosphere. Essential data were collected from an instrument mounted on one of the tourist ferries working in the GBR (thanks to AMPTO). Scientists from GBRMPA and AIMS collaborated to measure bleaching thresholds in reef corals and to determine their capacity to adapt to higher temperatures. Further collaborations with CSIRO Atmospheric Research and QDNR are exploring future scenarios as part of assessing the threat of global climate change to coral reef ecosystems.

Collaborative Working Groups have been established to compile current knowledge on key issues, including crown-of-thorns starfish, climate change and coral bleaching, as well as research needs for seagrass, coral harvesting and catchment management. Participants include CRC Reef, AIMS, GBRMPA, QDPI, QDNR, University of Queensland, University of Technology, Sydney, CRC Coastal and representatives of the coral harvesting industry.

Many reef tourism operators are directly involved in CRC Reef research.

Photo: Pure Pleasure Cruises

In Cairns, reef tourism operators continue to be actively involved with the 'Eye on the Reef' program, jointly funded by GBRMPA and CRC Reef. This industry-based monitoring program collects information about the health of reef sites, water temperatures and unusual changes in marine life. The tourism industry, through AMPTO, is currently funding the development of a database which will enable the data to be compiled and reports generated for feedback to the industry and management agencies.

Newly appointed CRC Reef Extension and Communication staff attended the CRC Communicators' conference in Robertson, NSW in September 2000, establishing links with communicators from other CRCs.

A group of CRC Reef staff and representatives, including the Chairman, DCEO and Centre Visitor, attended the CRC Association national conference in Perth in May 2001, and a satellite workshop on education to maintain links with other CRCs and the national CRC Program.

CRC Reef hosted a workshop of education staff from CRC Coastal, CRC Greenhouse Accounting and CRC Sugar, to explore opportunities for collaboration in design and delivery of student training programs. As an outcome, CRC Reef and CRC Coastal collaborated to organise delivery of multivariate statistics training for postgraduate students and researchers at both CRCs.

In 2000, the Board reviewed input by CRC Reef to the Cairns cooperative research unit; a collaboration of three CRCs plus the Cairns Port Authority, Cairns City Council and Tourism Tropical North Queensland. Following the Board recommendations, CRC

Reef input has been redirected to more specific tourism industry extension, including regular CRC Reef updates at regional AMPTO meetings and the delivery of an industry workshop on local controls for crown-of-thorns starfish in April 2001. The workshop was attended by 70 representatives of the tourism industry, CRC Reef, AIMS, GBRMPA, EPA and private consultancies and included the distribution of a new CRC Reef brochure on the current state of knowledge of crown-of-thorns starfish.

Collaborative extension activities have been conducted by staff of CRC Reef and the QDPI Marine Plant Unit, working with school students and staff from Bentley Park College in Cairns to develop interactive seagrass web pages for the CRC Reef web site.

CRC Reef provides information and products to more than 1000 small-to-medium enterprises in tourism, fishing, ports, shipping and engineering industries, mostly through peak associations such as AMPTO and QSIA. Many operators are directly involved with research, some as task associates, and support staff by assisting with logistical aspects of fieldwork, such as provision of ship-time.

During 2000-01, CRC Reef was associated with more than 150 organisations, including the following:

Australian universities and TAFE colleges

- Australian National University
- Edith Cowan University
- Griffith University
- James Cook University
- Northern Territory University
- Southern Cross University
- Sydney University of Technology
- University of Queensland
- University of Central Queensland
- University of Tasmania
- University of Western Australia

CRCs and other research organisations

- AIMS
- CRC Coastal
- CRC Catchment Hydrology
- CRC Aquaculture
- CRC Freshwater Ecology
- CRC for Greenhouse Accounting
- CRC for Sustainable Sugar Production
- CRC for Sustainable Tourism
- CRC for Tropical Rainforest Ecology and Management
- CSIRO Land and Water
- CSIRO Marine Research
- CSIRO Antarctic Division
- Lizard Island Research Station

Government departments and corporations

- Australian Bureau of Meteorology
- Australian Maritime Safety Authority
- Australian Fisheries and Aquaculture Unit
- Australian Fisheries Management Authority
- Australian Heritage Commission
- Australian Museum
- Coast and Land Management, WA
- EcoFish
- Environment Australia
- Great Barrier Reef Marine Park Authority
- Museum and Art Gallery of the Northern Territory
- Museum of Tropical Queensland
- Museum of Victoria
- National Oceans Office
- National System Resources
- Northern Territory Parks and Wildlife Service
- Ports Corporation Queensland
- Queensland Department of Transport - Maritime Services
- Queensland Department of Primary Industries
- - Southern Fisheries Centre
- - Northern Fisheries Centre
- Queensland Department of Natural Resource Management
- Queensland Department of State Development
- Queensland Environmental Protection Agency
- Queensland Fisheries Service
- Queensland Museum
- Queensland Parks and Wildlife Service
- Tasmanian Marine and Safety Division
- Torres Strait Fisheries Scientific Advisory Committee
- WA Fisheries
- Western Australia Museum
- Wet Tropics Management Authority

Local government and consultative organisations

- Cairns City Council
- Cairns Esplanade Redevelopment Scientific Advisory Committee
- Cairns Port Authority
- Gladstone Port Authority
- Mackay Port Authority
- Townsville Port Authority
- Townsville City Council
- Trinity Inlet Management Program
- Weipa Catchment Coordinating Group

Community organisations

- AUSTAG
- Australian Coral Reef Society
- Australian Marine Science Association
- Australian National Sportsfishing Association
- Fisheries Management Advisory Committees
- Hopevale Community Council
- National Tropical Marine Network
- Order of Underwater Coral Heroes (OUCH)
- Regional Marine Resource Advisory Committees (Cooktown, Port Douglas, Townsville, Cairns, Airlie Beach, Rockhampton)
- Sunfish
- Zonal Advisory Committees

Private companies

- Astron Environmental (WA)
- BHP Cannington
- Big Cat Cruises
- Cairns Dive Centre
- Cairns Marine Aquarium Fish
- Captain Cook Reef Cruises
- Digital Dimensions
- Down Under Dive
- Dunk Island Resort
- Econnect Pty Ltd
- FantaSea Cruises
- Fisheries Research Consultants
- Frankland Island Cruises
- Friendship Cruises
- GIS Australasia
- Great Adventures
- Great Keppel Island
- Gutteridge Haskins Davey Pty Ltd
- Haba Dive
- Hamilton Island Resort
- Hayman Island Resort
- Lizard Island Resort
- Mike Ball Dive Expeditions
- North Marine Services
- Ocean Rafting
- Ocean Spirit Cruises
- Pacific Marine Group
- Passions of Paradise
- PDI Consultancy
- Peri Pty Ltd.
- Poseidon Outer Reef Cruises
- Prosail
- Pure Pleasure Cruises
- Quickcat Cruises
- Quicksilver Connections
- Quicksilver Diving Services
- Reefwatch Australia
- Reef Jet
- Sea Research
- Seaworld
- South Molle Island Resort
- Sunferries, Magnetic Island
- Sunlover Cruises
- Sinclair Knight Merz
- Systems Engineering Australia
- Taka Dive
- Undersea Explorer
- WBM Oceanics

Industry associations

- AMPTO
- Bundaberg Canegrowers
- Cod Hole and Ribbon Reef Operators Association
- Dive Queensland
- Great Barrier Reef Charter Association
- Innisfail Canegrowers
- Interpretation Australia Assoc North
- Queensland Engineers Association
- Mackay Canegrowers
- Queensland Canegrowers
- Queensland Farmers Federation
- QSIA
- Townsville Enterprise
- Tourism Tropical North Qld
- Tourism Council of Australia
- Whitsunday Bareboat Operators Association

INTERNATIONAL LINKS

CRC Reef's strategy for international links is directed towards contracting expertise to conduct and develop research, ecologically sustainable marine industries and manage tropical marine ecosystems. The aims are to enhance Australia's objectives in relation to assisting developing countries, to develop export industries, and to generate income for CRC Reef. A report on the Commercial and International Program is provided in Section 6. International links related to current research programs are presented below.

Collaboration between Professor Howard Choat (JCU) and Dr Ross Robertson (Smithsonian Tropical Research Institute), and researchers from the Seychelles Fisheries Authority, the Smithsonian Institution and Simon Bolivar University of Venezuela, has facilitated studies of population biology and biogeography of Caribbean and Indo-Pacific reef fishes, with sampling in the Seychelles and Barbados.

The expertise of CRC Reef researchers is being sold internationally.

Photo: Lyle Vail

In February 2001, QDPI researchers Dr Rob Coles and Dr Len McKenzie initiated a new seagrass monitoring program, SeagrassNet, in collaboration with the University of New Hampshire, with funding from the Packard Foundation. By monitoring sites in the tropical Indo-Pacific region, the project will establish generic methods that can be used globally in both research-based and community monitoring programs.

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

Professor Helene Marsh, Program Leader (JCU) and Melissa Nursey-Bray have continued to benefit from funding and logistical support from a Pew Fellowship and a Churchill Fellowship, to further their research on dugong management.

Postgraduate student, Geoffrey Muldoon (JCU), has collaborated with the International Marine Life Alliance in Hawaii to monitor the global live fish trade.

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

Extensive collaboration has occurred between CRC Reef researchers and staff and international organisations and agencies, including the following:

Organisations and programs

BHP Indonesia
Blue Planet
Churchill Fellowship
East West Centre and Ocean Policy Institute
Falconbridge Nickel, New Caledonia
International Marine Life Alliance, Hawaii
IUCN – Fisheries Group
Lihir Mining Company
Ministry of State for Environment, Indonesia
Marine Aquarium Council, Hawaii
Natal Shark Research Board
National Oceanic and Atmospheric Administration
New England Aquarium
New Zealand Department of Conservation
NOAA Fisheries, USA
Packard Foundation
Pew Foundation
Reef Fish Aggregations
Rio Tinto (PNG)
Seagrass Net
Seychelles Fisheries Authority
UNEP
World Conservation Monitoring Centre

Universities and research institutions

Bird Migration Research Center, Yamashina
Bristol University, UK
Institute of Ornithology, Japan
Institute of Polar and Marine Research, Germany
Jena University
Kasetsart University, Bangkok
Palau International Coral Reef Centre
Purdue University, USA
Royal Society for Protection of Birds, UK
Simon Bolivar University, Venezuela
Southampton Oceanographic Laboratory, UK
Smithsonian Institution, Washington
Stanford University, USA
Universite Joseph Fourier, France
University of Azores, Portugal
University of Capetown, South Africa
University of Massachusetts, Boston
University of New Hampshire, USA
University of Maine
University of Malaysia, Sabah
University of Philippines
University of South Florida
University of Southern Mississippi
University of the South Pacific
University of Washington
US Fish and Wildlife Service
US Naval Research Laboratory

VISITORS TO THE CENTRE

CRC Reef hosted a number of visitors, including:

Dr Olaf Linden	University of Kalmar, Sweden Swedish International Development Agency (SIDA)
Dr Jamie Oliver	Senior Scientist (Coral Reef Projects), ICLARM Malaysia
Dr H.M. Kasim Moosa and Indonesian COREMAP Delegation	APU, Indonesian Institute of Sciences
Yusaka Tanaka	General Manager, Environment Research Institute, Wave Waterfront Vitalization & Environment Research Centre, Tokyo
Jun Hayakawa	Researcher, Port and Marine Environment Division, Environment Research Institute, Wave Waterfront Vitalization and Environment Research Centre, Tokyo

Chinese Delegation

Sun Zhihui	Deputy Administrator, State Oceanic Administration
Chen Shibiao	Director General, Department of General Affairs, State Oceanic Administration
Kang Zuejun	Deputy Director General, Department of Policy & Planning, Ministry of Finance
Li Jianxin	Deputy Director General, Chinese Arctic and Antarctic Administration, State Oceanic Administration
Wei Yan	Program Officer, Department of International Cooperation

The Milner Bay Environment Advisory Group which includes AIMS, Melbourne RMIT, Sinclair Knight Merz, Egis Consulting, Anindilyakwa Land Council, GEMCO (Billiton) and NT Government met at CRC Reef in November 2000 to review the status of the marine environment at Milner Bay in Groote Eylandt (NT). The Group recommended research and monitoring priorities for the area, which is a coral and seagrass habitat adjacent to a major spill of diesel into the groundwater close to the coastline.

4. RESEARCH

CRC Reef researcher at James Cook University, Dr Kerry Neil, is surveying tropical ports for introduced marine species.

Photo: Rob Parsons

RESEARCH

Highlights

- Socio-financial profiling of Queensland's commercial, charter and harvest fishing fleets, has provided managers, industry and other stakeholders with an innovative, interactive tool to predict the magnitude, location and nature of the direct and indirect social and financial effects of changes in fisheries policy.
- PhD student Ms Melissa Nursey-Bray won a Churchill Fellowship to study models developed for cooperative management of indigenous resources in southern Africa. The indigenous fishery for abalone in South Africa has been a focus of her research. Melissa will be able to put this experience to good use in her research on cooperative management of dugong and turtle hunting by Cape York Aboriginal communities.
- In a series of workshops, the Fishing and Fisheries research team met with a range of stakeholders to resolve the operational objectives for the reef line fishery to be included in the Management Strategy Evaluation project. The workshops demonstrated the benefits of the high level of effort that the Fishing and Fisheries research team have devoted to liaison with stakeholders. All main stakeholders had significant input to this work. It was noteworthy that there were more similarities than differences in the objectives of different stakeholder groups.
- CRC Reef supported the production of a monograph, The Dugong (*Dugong dugon*): Status Report And Action Plans For Countries And Territories In Its Range. This report is a global overview of the status of the dugong and its management in 37 countries and territories and provides comparative information to enable individual countries to develop their own, more detailed conservation plans.
- Synthesis documents on coastal run-off, coral harvesting, comparative survey methods for crown-of-thorns starfish, and the diversity and processes of seagrass habitats, facilitated by CRC Reef researchers, were all pivotal to national debate on these important environmental issues.

Program A. Management for sustainability

Program Leader: Professor Helene Marsh, JCU

OBJECTIVES:

To create innovative systems which are transparent to industry and management so that policy makers and environmental managers can 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.

The traditional focus of natural resource management in Australia is broadening from the biological and physical aspects of natural resources to incorporate social, cultural and economic factors into the policy, planning and design processes. Research in this program will document the social, cultural and economic values of the World Heritage Area. It will also develop performance indicators for specific management objectives and methods to optimise resource usage, coordination, information sharing, decision-making and decision implementation.

Project A1. Social, cultural and economic values

Project Leader: Dr Mark Fenton, JCU

Identifying the social impacts of potential changes in access to, and use of, Queensland's fisheries resources

Dr Mark Fenton, JCU

Social assessment surveys of the commercial fishing industry, harvest industry and charge operators have been completed, and three reports of the survey results have been reviewed and edited for final publication. A social assessment database has been developed, tested and reviewed by CRC Reef and GBRMPA and is now available to CRC Reef members and other stakeholders. The location of resource use (as reported by fishers in surveys) has been compared with that reported in log books and a report of this research prepared. A scoping study to examine the potential for extending the research undertaken with the commercial fishing sector, to the recreation and tourism sectors, has been undertaken and a report completed. Previous social assessment survey research with commercial fishers identified coastal communities with some dependency on marine resource use. Further research has been undertaken to identify social indicators of how sensitive these communities are to change. GBRMPA is using these results in their Representative Areas Program, to evaluate the impact of changes in reef zoning on people who use the reef commercially.

Biological samples collected during research surveys provide valuable information about the status of the Great Barrier Reef line fishery.

Photo: CRC Reef

Towards co-operative management of indigenous hunting by a remote community in the GBRWHA

Ms Melissa Nursey-Bray, JCU

Developing a capacity for cooperative management of indigenous resources in the GBRWHA requires an understanding of the social, cultural and economic values that indigenous people place on marine resources. Dugongs and turtles are the traditional foods with the highest value for the indigenous communities which use the GBRWHA. The development of cooperative arrangements for turtle and dugong hunting is a significant step towards indigenous communities managing their land and sea country, as well as contributing towards effective strategies for species' management. This project will investigate the social, economic and cultural importance of turtle and dugong hunting in the Aboriginal communities of Hopevale and Yarrabah, in the context of the process of community hunting management programs over a two-year period. The research is aimed at eliciting the discourses about hunting among indigenous and non-indigenous groups, with a view to understanding their implications for cooperative hunting management initiatives in the future. Information is collected by a combination of participant observation, appraisal, oral story and literary review technique. This will help to document and understand the ways in which different values inform/ed the process of planning. Results will include the documentation of the history and planning of hunting practice in north Queensland, recommendations for management and co-management initiatives, and community outcomes as appropriate and advised by Hopevale and Yarrabah.

Cultural heritage of the GBRWHA

Ms Celmara Pocock, JCU

This project is seeking to understand indigenous and non-indigenous cultural heritage values of the reef by synthesising existing material, collecting additional data and consulting extensively with communities of interest. The study aims to investigate how social values are established, transform, continue and are lost over time, and to explore the notions of social value and attachment to place as evidenced through the tourism industry and the experiences of tourists and tour operators. The complexities of understanding heritage values and their management in local, regional, national and global communities of interest will be demonstrated through a case-study approach, with field information from the Whitsundays and Cairns regions of the GBRWHA. Particular emphasis is placed on the advancement of key cultural heritage concepts.
These include the application of cultural landscape and social values approaches in a cultural heritage management context.

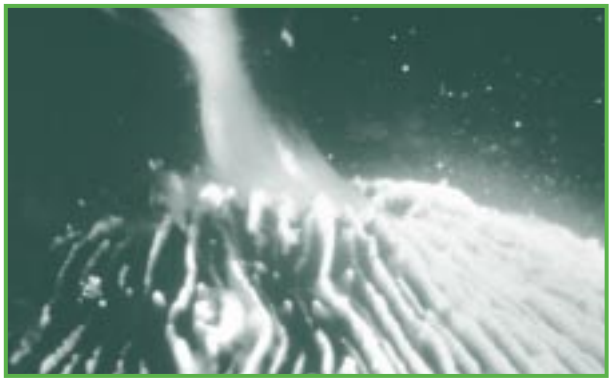
Project A2. Decision support for managers

Project Leader: Dr Stephen Crook, JCU

Performance indicators for the GBRWHA

Dr Zena Dinesen, GBRMPA

With a view to developing indicators for the management of the GBRWHA, Dr Dinesen tested a combination of relevant features of various models. These models included the management effectiveness evaluation framework developed by IUCN/WCPA to evaluate the management of protected areas, methodologies used in State of the Environment Reporting, and indicators for ecologically sustainable fishing. Following a review, the decision was made to continue this project in-house at GBRMPA to maximise the opportunities for managers to be involved in the process of developing indicators.



Indicators of coral health are being developed.

Photo: AIMS

Developing indicators of coral reef health

Ms Elizabeth Dinsdale, JCU

Evaluating the effectiveness of management of protected areas has been highlighted as a priority to ensure that these areas achieve their conservation objectives. This project will identify environmental indicators that describe the condition of coral reefs. Identifying environmental indicators will allow the effectiveness of management strategies to be evaluated and monitoring efforts to be focused. The indicators will be identified using ecological measurements. They will be defined by people's perceptions of healthy coral reefs. A pilot study has been conducted in the Whitsundays region of the GBRWHA, at sites with various levels of boating use. It assessed which ecological measures will describe the condition of coral communities that are influenced by varying levels of boating use. The results suggest that some ecological measurements were useful to describe coral condition and others were not. Therefore, to conduct effective evaluation of coral condition, the selection of indicators is particularly important.

Latent effort in the live fish trade

Mr Geoffrey Muldoon, JCU

This research aimed to review the global and emergent Australian live fish trade; examine the impact of the live reef food fish trade on the structure and operation of the GBR reef-line fishing fleet; and to explore the bio-economic implications arising from economic incentives to increase capital investment through simulation modelling. Results indicate:

- substantial fleet-wide shifts toward supply of catch for overseas live-fish markets;
- an increasing dependence on Australian-sourced product to meet demand for selected species;
- 'live' operations generate substantially higher returns to capital than do 'frozen' operations; and
- the determinants of investment in live technology are both economic (value of product, cost of conversion to live) and operational (size of vessel, number of tenders).

Results were presented at two international conferences, to the student-stakeholder workshop held in March 2001, and to the full board of ReefMAC (Reef line fishery Management Advisory Committee). These presentations increased awareness of the importance of Australia to global live-fish trade issues in both the volume of fish supplied and its ability to contribute to an improvement in the conduct of the live trade.

There are substantial fleet-wide shifts to the supply of catch for overseas live-fish markets.

Photo: CRC Reef

Project A3. Informing the management process

Project Leader: Dr Barbara Kennedy, JCU

Ownership of genetic resources in the GBRWHA, its ecotone and the Exclusive Economic Zone

Dr Merrilyn Wasson, ANU

This task aims to ensure that the rapidly changing Intellectual Property regimes which apply to the genetic resources of the GBRWHA and ecotone are interpreted and used to advantage by CRC Reef members. Research is focusing on how national legislation on Intellectual Property may be used to protect CRC Reef members from changing international requirements with regard to genetic resources. In view of the burgeoning importance of genetic resources found in areas under indigenous title, traditional knowledge on Intellectual Property rights is being included in the study through a collaborative arrangement with an indigenous expert. A paper has been prepared for FAO about the complex interaction between ownership of reef and marine biodiversity under the Law of the Sea Convention, the Biodiversity Convention and the WTO TRIPS agreement.

Supporting development of co-management by GBRMPA with indigenous and other stakeholders

Professor Helen Ross, UQ; Mr James Innes, GBRMPA

The researchers have set up a co-managed research structure in which the main clients of the information share planning and decision-making with the researchers. The committee has established a good working relationship, good communications, and a plan of research activities, budget and communication plan. All these are subject to continual revision as required. Committee members are in the process of consulting with Sea Forum and other relevant agencies about case studies on co-management or partnership initiatives, to be conducted by those who took the initiatives with this project's guidance and funding. An indigenous researcher from the Townsville area has been appointed as research assistant to the project. She will be based at JCU with access to GBRMPA.

Program B. Sustainable industries

Program Leader: Dr Bruce Mapstone, JCU

OBJECTIVES:

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

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

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

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

Project B1. Ports and shipping

Project Leader: Dr Rob Coles, DPI

Identification and monitoring of habitats critical to the GBRWHA in or adjacent to shipping lanes and coastal ports

Dr Michael Rasheed, DPI

Surveys of seagrass, mangrove and benthic macro-invertebrate communities have commenced for several Queensland Ports, including Mourilyan Harbour, Mackay, Cairns, Karumba and Weipa. For some ports, a GIS of habitat distribution has been created and reports to industry funding organisations have been completed. Areas of high collision/grounding risk in shipping lanes where there is little information about critical habitats have been identified in conjunction with shipping management authorities. This information has been used to focus habitat research within shipping lanes and identify priority areas for critical habitat surveys. This task has developed strong links with ports and shipping industry organisations through workshops, meetings and regular contact with organisations including individual Port Authorities, consultancy companies, universities, Queensland Government departments and GBRMPA. Critical habitat information collected within ports has been used in planning for port development and maintenance programs. Information collected about seagrass communities in the ports of Weipa and Karumba has been used to modify dredge management plans. Information collected in the seagrass, algae and macro-invertebrate surveys of the port of Mackay will be used by the Mackay Port Authority in planning of future port expansion. Critical habitat information to be collected adjacent to shipping lanes will be used to update the Oil Spill Response Atlas (OSRI).

Baseline biota surveys and surveys for introduced marine organisms – Ports of Weipa, Karumba, Townsville, Cape Flattery

Dr Kerry Neil, JCU; Dr Rob Coles, DPI

The introduction of exotic marine organisms into Australian waters as a result of ballast water dumping practices or shipping movements is of growing concern. There are over 100 exotic marine species reported from Australian waters, most of which, it is believed, were introduced unintentionally via mariculture

and shipping activities. To control the spread of introduced marine pests, we need to know their present distribution and abundance in Australian ports. During 2000-01, CRC Reef and JCU conducted for Ports Corporation Queensland (PCQ) the first baseline survey of the coastal biota in the Ports of Weipa, Karumba, Townsville, Cape Flattery and adjacent marine environments. The aim of the surveys was to describe the existing marine communities and determine whether any non-indigenous species, of pest status or otherwise, were present. Field observations suggest that pest species known to threaten the natural biodiversity of coastal habitats were not present in the samples. However, until all specimens undergo further taxonomic analysis we cannot be sure about the presence of exotic species. More detailed identification of collected taxa is underway and the results will be reported in October 2001. This information has been used by PCQ to assist them in managing their ports. It will also be used to underpin a Decision Support System (DSS) that will enable the risk of exotic marine organism introductions to be assessed and managed on a port-by-port basis.

Hydrodynamic, sediment and dredge modelling of ports

Associate Professor Tom Hardy, JCU

The aims of this project are to develop fine-scale two- and three-dimensional hydrodynamic and wave models for areas in and around ports so that dredge disposal sites can be optimised. Modelling sediment movement and prediction of siltation in channel and harbour basins allows port facilities to be designed to optimise dredging costs and reduce environmental impacts. Simulations of tidal and wind driven currents were performed on several hydrodynamic model grids which were established for a number of combined wind and tide scenarios. During these simulations, algorithms to track water borne substances were used to investigate the flushing characteristics of two ports. The modelling undertaken for the ports of Townsville and Cairns shows that the two regimes are hydrodynamically very different. The Cairns seaport is a small part of the large estuary system, Trinity Inlet. Large amounts of water enter the system each tide causing strong currents near the mouth. Waterways in this system are dominated by an asymmetric loop around Admiralty Island. Townsville port is a significantly modified version of the originally small estuary system of Ross Creek. The modifications have created complex current patterns inside and outside the port. A large eddy feature outside the harbour near the western breakwater on the flood tide has been observed in aerial photographs. Inside the harbour, the model predicts a dual eddy structure. Townsville Port Authority has indicated that the results from the inner harbour model can be used as a training tool for the contaminant spill response group.

Project B2. Sustainable tourism

Project Leader: Dr Gianna Moscardo, JCU

Understanding tourist use of the GBRWHA

Dr Gianna Moscardo, JCU

The CRC Reef tourism research team are developing a web of detailed data that describes tourists who visit the GBR and adjacent coastal region. Surveys conducted by the researchers are providing a comprehensive market segmentation profile of visitors to all regions of the GBR. The surveys are varied according to geographic location in the GBR region (i.e. outer reef/islands or adjacent mainland coast) as well as changing needs and trends. The surveys contain questions which capture the attitudes, motivations, socio-demographic characteristics, travel patterns, and activity participation and preferences of visitors to the GBR region. The information generated by these surveys can be used for both private and public sector management and marketing of tourism. For example, information about patterns of reef travel and activity participation can assist planners with decisions about access and the provision of facilities. Information about visitor expectations and satisfaction can be used to adjust and develop products and promotional campaigns. During 2000-01, the main component of this project was developing and conducting a major reef visitor survey. The English version of this survey is being administered to visitors on reef daytrips and dive operations from the Whitsundays to Port Douglas. Factors associated with repeat reef visitation have been identified. The major market segments/visitor groups have been identified and described, based on the type of reef trip experience they are seeking. The findings can be used by tour operators to benchmark their business performance, explore options for product adjustment and redevelopment, and examine the feasibility of new products. The results can be used by marine park managers to monitor social indicators, identify use conflicts and areas of potential impact problems, and understand patterns of use and changes in use.

CRC Reef researchers based at James Cook University recently undertook a survey of Townsville Port for introduced marine pests.

Photo: Townsville Port Authority

Developing ecologically sustainable dwarf minke whale tourism

Dr Alastair Birtles, JCU; Dr Peter Arnold, MTQ; Mr Peter Valentine, JCU; Mr Andrew Dunstan, *Undersea Explorer*

The little-known dwarf minke whale *Balaenoptera acutorostrata* was discovered in GBR waters during the 1980s, and research into its biology and ecology has only recently begun. During the 1990s, live-aboard dive tour operators in the Cairns section of the GBR began reporting in-water interactions with these whales along the Ribbon Reefs during the winter months. The biology and behaviour of these whales has been studied since 1996. At the same time, the dynamics of the interactions between the whales and dive tourists have been studied to develop a framework for managing these interactions in an ecologically sustainable manner. In the 2000 field season, over 200 whales were seen during 41 encounters over a six-week period. About 100 whales could be individually recognised, of which around 20 were re-sighted during the season. Three whales first identified in 1999 were re-sighted in 2000, using images in Portable Digital Photo Identification Catalogue (PODPIC) to match the video images taken in 2000. This represents the first case of year-to-year site fidelity for an oceanic rorqual in tropical wintering grounds. It also suggests that a discrete 'population' may inhabit the Cairns section of the Marine Park and be subject to whale watching, although more data are needed to establish the extent to which this occurs. A Code of Practice for swimming with whales has been updated and an industry and management workshop held in Cairns in June 2001. The Minke Whale Information Package was updated and distributed to live-aboard operators in the Cod Hole and Ribbon Reef Operators Association (CHARROA), with a Minke Whale Project research update. CRC Reef has incorporated much of this information about the minke whale research on its website.

CRC Reef researchers based at James Cook University are working with the tourism industry to develop a Code of Practice for swimming with dwarf minke whales.

Photo: Alastair Birtles

Great Barrier Reef: destination image and attractiveness

Professor Philip Pearce, JCU

The CRC Reef tourism research team has developed a media-monitoring project to gain a better understanding of the GBR's destination image and competitiveness. It will also reveal how informed visitors and residents are about the status of the GBR and associated attitudes towards tourism. The project involves an ongoing monitoring of the presentation and coverage of the GBR both as a travel destination and World Heritage protected environment. The monitoring covers stories and coverage of the GBR and adjacent coastal areas in regional newspapers; travel stories about the GBR and competitor coastal and marine destinations in the travel sections of local, national, British and north American newspapers; leading magazines in Australia, the United Kingdom and United States; international travel trade, and specialist diving and backpacking publications; and major inflight magazines. By examining the extent and type of coverage given to the GBR and other coastal and marine destinations, we can begin to understand the type of images and expectations visitors have of the GBR. We can also compare the GBR with its competitors and identify strengths and weaknesses that could be addressed through changes in products and promotion. New stories about the GBR reported in regional newspapers were identified, scanned and coded for the year 2000. Several hundred articles were assessed and the dominant themes of the news stories were identified. Three major themes were noted: human safety; impacts on the reef and reef management; and animal well-being. The stories concerned with the management of the reef were the most numerous. Additional travel features defined as stories about the GBR reported in the travel sections of United Kingdom, United States of America and national newspapers, local newspapers and national, international and travel trade magazines were also studied. Very positive appraisals were recorded in these features. Competitor destinations were identified and comparisons of the images of the GBR and its competitors were explored. The study has the potential to assist reef management and reef operators to plan better their use of media sources.

Visitor strategic response project

Dr Gianna Moscardo, JCU

This project was designed to respond to shorter-term specific research needs related to socio-economic aspects of tourism and recreation in the GBRWHA. The relevance of this project is that one of the highest priority information needs identified by GBRMPA is to have research information to support a Limits of Acceptable Change approach to managing GBR settings. Thus, this project aims to develop and test a method to gather this information with respect to visitors as users of the Marine Park. Two studies were conducted within this project during 2000-01.

The first involved a field experiment to evaluate the effectiveness of different methods for measuring visitor limits of acceptable change. A major issue for tour operators and marine park managers is how to set limits for use of reef sites or destinations. Traditional measures of visitor perceptions of acceptable use of natural settings have been criticised for being overly conservative and difficult for visitors to use reliably. Given the importance of this issue to the stakeholders, the development and testing of alternative methods is an important research activity. This study tested three measures of visitor perceptions of levels of acceptable use of a marine setting – the traditional verbal rating scales; more descriptive scenarios; and the use of digitally altered visual images. The team also conducted a survey of reef daytrip visitors in response to requests from tour operators. The aim of the study was to examine visitor evaluations of reef pontoons to make suggestions for improvements to existing pontoons and suggested design features for new pontoons. More than 400 visitors were surveyed on a variety of operations. The major conclusions of this study were that the quality of reef pontoon facilities has a moderate impact on visitors' overall satisfaction with their GBR day trip. It is the fourth most important trip feature after the quality of the fish, coral and tour staff. Further, while no major problems were identified with the facilities and design of the existing pontoons on those operations surveyed, satisfaction ratings suggested there was some room for improvement. Visitors suggested the amount of shade, access to the water, the provision of secure storage or lockers and changes to flooring surfaces were areas for improvement of existing pontoons.

Improving the sustainability of human-reef wildlife interactions

Dr Gianna Moscardo, JCU

There is a belief among tourism industry personnel and natural area managers that opportunities to view wildlife are a major and increasingly important component of visitor expectations. There is also growing concern that increasing visitor attention or pressure could have negative impacts on some species of wildlife. There are also concerns expressed by tourism industry personnel that existing tourism opportunities could be improved and that increasingly restrictive management regulations may have negative economic impacts on tourism. To date, there is little evidence to inform this debate. This project will provide some GBR-specific information about the importance of wildlife viewing opportunities, likely future demand, and the factors that influence visitor behaviour and responses to the available wildlife interactions. A survey was completed with 744 reef visitors on a variety of daytrip operations based in the Whitsundays, Cairns and Port Douglas. Preliminary results indicated that seeing marine wildlife was the third most important motivation for a reef trip after seeing coral in its natural surroundings and spending time in a natural setting. Compared with the patterns revealed in other surveys, a high proportion of reef visitors in this sample were specialist wildlife tourists. Visitors were generally satisfied with their overall reef wildlife experience but there was room for improvement in the information provided about the wildlife.

Reef tourism industry personnel - information, training and career needs

Professor Philip Pearce, JCU

This project seeks to understand the working environment of reef tourism industry staff. An assessment of job satisfaction and career perceptions will be undertaken so that better training and career planning may be put in place. The project has been improved and refined by sustained industry input. The data collection phase of the project is yet to commence.

Public perceptions of the Great Barrier Reef and its management

Dr Gianna Moscardo, JCU

The CRC Reef tourism project team together with GBRMPA identified information needed for the effective management of reef tourism. How people perceive the GBR, their experiences of it, and their understanding of how and why it is managed, is important information for GBRMPA when developing, implementing and monitoring management strategies and tools. Such strategies and tools include zoning provisions, plans of management, permitting, public education, interpretation and extension. This study has been developed to evaluate current knowledge and perceptions of the GBR and provide recommendations about the design of effective education/interpretation for reef users and the wider public. This project aims to improve both the quality of reef interpretation and the effectiveness of management strategies. The final telephone survey for this project has been completed. The 2001 survey was conducted with more than 1100 residents from coastal regions adjacent to the GBR, Brisbane, Sydney, Canberra and Melbourne. The survey collected information about GBR visitation patterns, perceptions of the overall status of the GBR, and knowledge about the most important issues for management attention. The project team has also been working with GBRMPA to have data about patterns of recreational use included in their GIS system and in the Representative Areas Program selection and impact assessment processes.

Project B3. Innovative engineering

Project Leader: Associate Professor Tom Hardy, JCU

Interactive atlas of wind and waves in the GBRWHA

Associate Professor Tom Hardy, JCU

A CD-based model which simulates wave patterns resulting from cyclones has been developed from an analysis of 6000 virtual tropical cyclones. The model has been demonstrated to management, industry and engineering designers. It provides probability relationships for wave heights from cyclonic storms at thousands of points along the length of the GBR. The Wave Atlas will be a readily accessible tool to resolve the difficult issue of wave design for tourism pontoons on the GBR, by allowing an evaluation of the probability of generating waves of particular sizes in a specified location as a result of cyclonic conditions. This project aims to extend the Atlas to include cyclone wind information, non-cyclonic wind and wave information. In addition, the model will move from a static system of limited sets of pre-canned presentations of data to an unlimited dynamic system. With this the user will have access to all the data and have much more flexibility in access to the whole data set. An interactive cyclone wind field model calibration system has been developed to calibrate the Coral Sea cyclone wind field model. This program will be an invaluable tool for researchers to investigate the winds from any cyclone and at any location. A preliminary version of the Atlas has been released (return periods for significant wave height) and is available at http://MMU.jcu.edu.au. This will allow designers of reef infrastructure access to state-of-the-art design wave information.

Fine-scale wave modelling in coral reef regions

Associate Professor Tom Hardy, JCU

Information about waves on the GBRWHA is needed for engineering design (such as reef pontoons) and marine park management, as well as for understanding the link between physical and biological processes. Because the cost of using wave-measuring equipment is prohibitive, researchers have developed numerical models. Models have the advantage in predicting what might happen under certain conditions on the GBR. The aims of this project are to develop the capability of fine-scale wave prediction in and around coral reefs; to demonstrate the model capability to reduce design loads at existing pontoon sites; and to enhance consulting possibilities both in the region and internationally. A state-of-the-art, computer wave model, SWAN, has been adopted for the fine-scale wave model for coral reef areas. SWAN (with adaptations) should be able to refine the resolution available in the Atlas data (1500 m) down to ~100 m. An engineering Honours student is establishing a SWAN model for John Brewer Reef. He will simulate both Tropical Cyclone Aivu and normal trade wind conditions. Model and field measurements will be compared and then adaptations to the model considered.

Innovative engineering will ensure the safety of offshore structures such as tourism pontoons.

Photo: FantaSea Cruises.

Best-practice mooring and pontoon design

Associate Professor Tom Hardy, JCU

This task aims to develop computer design tools to facilitate the design of mooring configurations. Innovative mooring techniques will improve existing methods (e.g. taut moorings) and optimise the balance between cost and strength of moorings for reef tourism pontoons. Three engineering Honours theses have been completed which relate directly to this task. The topics included: the investigation of wind loads on open roof structures; the development of a computer design tool for pontoon moorings; and the economic aspects of mooring systems. An engineering thesis student is currently assessing existing pontoon mooring systems and will test a mooring design computer tool. In cooperation with GBRMPA, the existing tourism pontoons in the GBR region will be surveyed. This will enable a clear understanding of exactly what pontoons and pontoon mooring systems are presently operational throughout the GBR. These mooring systems will be evaluated using the computer design tool.

Project B4. Fishing and Fisheries

Project Leader: Dr Bruce Mapstone, JCU

Effects of line fishing on the Great Barrier Reef

Dr Bruce Mapstone, JCU

This project continues from the first CRC Reef. This year, the first set of surveys following all the manipulative work (opening and closing of reefs to fishing) were completed. The developmental work on the Management Strategy Evaluations (MSE) was also completed. The outputs from these MSE tools (ELFSim) will give stakeholders and managers an unprecedented basis on which to weigh up the relative strengths and weaknesses of management options. As in previous years, interaction between stakeholders and researchers has been central to this work, both informally during port visits and formally during fieldwork and stakeholder workshops. The second stakeholder workshop focused on the MSEs was especially productive and resulted in significant clarification of detailed operational objectives for the reef line fishery and clear specification of the initial sets of management evaluations. All main stakeholders had significant input to this work; it was noteworthy that there were more similarities than differences in objectives posited by different stakeholder groups.

Liaison and information management for Fishing and Fisheries research

Drs Bruce Mapstone and Annabel Jones, JCU

The Fishing and Fisheries Project continues to be proactive in using a coordinated strategy of extension and liaison to provide a vehicle for constructive flow of information between stakeholders and Fishing and Fisheries researchers. This strategy is very successful in raising the profile of the Fishing and Fisheries Project as well as CRC Reef. It has also resulted in many industry representatives being willing to provide researchers with data for ongoing Fishing and Fisheries research projects. A special highlight was the high level of participation by stakeholder representatives from industry, management, research and conservation groups at several workshops convened by the Fishing and Fisheries group. One of these workshops produced a number of management strategies to be evaluated by ELFSim, an evaluation tool being developed with the Effects of Line Fishing (ELF) project. Results from these evaluations will be reported to stakeholders at a further workshop later in 2001 and will be of great benefit in future discussions of appropriate management options for the Queensland reef line fishery. Another workshop instigated and convened by Fishing and Fisheries postgraduate students was well attended by a range of stakeholder groups and highly praised by participants as an excellent initiative. Research results continue to be provided in appropriate formats. For example, a further three ELF newsletters were published, including a special edition dedicated to results from research into the charter boat industry in Queensland.

Connectivity between coastal/estuarine and reefal fish assemblages

Dr Rod Garrett, DPI

This task aims to improve understanding of the relationship between species populations in coastal and estuarine locations and those in more offshore environments. The information from this research will help devise and implement effective strategies for sustainable fisheries use or conservation management. The initial focus is on mangrove jack *Lutjanus argentimaculatus*, a highly prized table- and sport-fish target of recreational fishers in the WHA. During 2000-01, the project's emphasis has been to undertake a preliminary scan of the genetic diversity expressed by mangrove jack populations over the species' range in Queensland waters. Mitochondrial DNA in fin tissues has been sequenced from specimens in many locations, and the extent of variability in certain microsatellite alleles has been assessed. The pilot study will be completed in 2001 and the results should determine whether a full-scale investigation into genetic stock structure should proceed. In concert with the genetic analysis of stock structure, there has been a major effort to determine movement and growth patterns of mangrove jack from the inshore phase of its life cycle to offshore habitats. Fish captured inshore have been tagged and released, and subsequent recaptures closely monitored. During 2000-01, captive marked populations of mangrove jack were used to derive estimates of tag shedding and tag-induced mortality, for both saltwater and freshwater environments. The program of monitoring mangrove jack populations in rivers of the WHA continued through 2000-01. The biological information generated in this study when coupled with the genetic analysis of stock structure, should provide clear management directions for the species in eastern Queensland. In particular, the project will deliver inputs for management of wild populations of mangrove jack and develop effective stocking and aquaculture programs for the species.

Spatial variation in population dynamics of red-throat emperor

Mr Ashley Williams, JCU

This project aims to examine the demographic structure (age, growth, survivorship) and reproductive biology (spawning season, sex ratio, size/age at sex change, reproductive stage) of red-throat emperor populations in different regions of the GBR. The project will also examine the effects of line fishing on the demographic structure of red-throat emperor. To date, results indicate significant inter-regional differences in the age, growth, survival rates, sex ratio and reproductive potential of red-throat emperor. Preliminary analyses of the age, growth and survivorship data from consecutive years (1995 - 99) indicate

that these parameters are relatively stable on a temporal scale of years. So, the spatial patterns in demographics of this species appear to be temporally consistent. Formal analysis of these data, as well as data for examining the effects of fishing, awaits the completion of a data checking process.

Fisheries resource allocation issues in estuaries

Ms Renae Partridge, JCU

This project aims to examine the catch characteristics of recreational fishers in estuaries that are open and closed to commercial gillnet fishing. Data is mostly collected from voluntary recreational catch logbooks. The project began in March 2001 so no results are available yet. However, the logbooks have been produced and promotions have recently begun via newspapers, radio, tackle shops and fishing clubs. After three weeks of promotion, over 100 logbooks have been distributed, with 20 already returned. More promotions are planned. Historical data for the local region, particularly Hinchinbrook, have been sourced from a number of recreational and charter fishers and from recreational fishing competitions such as the annual Hinchinbrook Barra Classic. These will be examined to assess the effects of the Dugong Protection Areas on recreational catch.

Comparative demography and life history features of serranid fishes: implications for fisheries and conservation management

Ms Rachel Pears, JCU

The cods and gropers in the Serranidae or grouper family are important predators in coral reef ecosystems. With growing demands from the live fish trade in the Indo-Pacific, cods and gropers are likely to become more marketable in future. For most cod and groper species, there is little information about basic characteristics such as how old they get, how quickly they grow and at what age and size they reach maturity. These questions are the focus of this research project. As a first step, diver-surveys have been conducted on the northern GBR to estimate the relative abundance of the different grouper species. These surveys will be extended to other regions. A sample collection program is currently being established with the help of the fishing industry to provide specimens for the biological work. The resulting information about age and reproduction will be useful for sound management of these species on the GBR.

Abundance estimates of maori wrasse and barramundi cod

Professor Howard Choat, JCU

Maori wrasse and barramundi cod are two high-profile species in the international live fish trade. This task aims to improve count protocols for very large and cryptic reef fish species, and to survey habitats on the mid- and outer-shelf of the GBR. A comparison was also made between fished and unfished areas. Surveys were completed in early 2001, and video-recordings were made to compare with visual counts. Maori wrasse had an abundance of 3-4 adults per 40 m of reef front, but counts were much higher than the average in the reef preservation zones which were unfished. Counts of barramundi cod indicate that they are relatively rare on mid- and outer-shelf reefs. The swim count protocol has been adopted by international agencies for marine park and fisheries evaluations.

Coastal fisheries resource monitoring in the GBR WHA

Drs Rod Garrett and Neil Gribble, DPI

This task is designed to value-add to the DPI Queensland Fisheries Service's state-wide long-term monitoring program for key fisheries resources. It will capture maximum benefit for species within the WHA by monitoring the abundance of economically and recreationally important coastal fisheries resources in the GBRWHA over time. Pre-wet season and post-wet season barramundi research surveys were completed in Trinity Inlet and the Burdekin delta. Results suggest low catch rates of barramundi in both locations. Onboard observations of commercial netting operations were also completed in the Burdekin delta. Low catch rates may be at least partially related to seasonal patterns in barramundi abundance. Information about the relative abundance and species composition of other finfish species that were captured in barramundi net operations has also been obtained for these areas. Some 49 species of teleosts and elasmobranchs have been identified. Annual post-wet season surveys of mud crabs were completed in Princess Charlotte Bay, Trinity Inlet, Hinchinbrook Passage and Bowling Green Bay. Pre-wet season surveys were also completed in Trinity Inlet. Preliminary analyses suggest high catch rates of mud crab in the WHA, particularly in Bowling Green Bay. Prawn trawl surveys were undertaken at some 40 sites in the GBRWHA in March and April 2001 using the DPI research trawler. Some 117 species have been identified in the trawl samples. Monthly surveys of mangrove jack populations in four rivers in the Wet Tropics Management Area adjacent to the WHA have been undertaken. Additional sampling of mangrove jack was conducted at four other streams flowing into the WHA.

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

Photo: Rob Parsons

Program C. Maintaining ecosystem quality

Program Leader: Dr Peter Doherty, AIMS

Objectives:

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

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

This program is a balanced package of mapping, monitoring and strategic process-oriented research that aims to establish benchmarks and performance indicators 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 Peter Doherty, AIMS

Seabed biodiversity in the GBRWHA

Dr Roland Pitcher, CSIRO Marine Research

Comprehensive inventories and maps of the distribution and abundance of seabed habitats and assemblages serve as a benchmark of their current status, and are useful to GBRMPA managers for future planning, management and WHA reporting. Preliminary progress has been made by collating and analysing existing data from a range of sources. A workshop with collaborators has been conducted. A number of project staff also contributed to GBRMPA's non-reef Representative Areas Program by helping to develop guidelines for selection of candidate areas. The team is working on a sampling options paper that will form the basis for a multi-institutional program of fieldwork to fill critical gaps in our knowledge of seafloor communities.

Long-term monitoring of coral reefs within the GBRWHA

Dr Hugh Sweatman, AIMS

The AIMS Long-Term Monitoring Program surveys crown-of-thorns starfish, reef fishes, corals and other benthic organisms on 48 reefs between latitudes 14°S and 24°S to assess regional reef status. In 2000-01, another set of annual surveys was completed which showed the recovery of reefs from coral bleaching caused by high sea temperature in 1998. The results of previous surveys have been published and the majority of information about the status of reefs on the GBR is available on the AIMS website. Information on the status and distribution of outbreaks of crown-of-thorns starfish provided valuable input into the public debate on starfish impacts within the WHA. During the year, senior staff assisted AMPTO to obtain $1 million funding from the Queensland Government for local control of crown-of-thorns starfish around selected sites critical to reef tourism. CRC Reef provided statistical advice about project design and will monitor the effectiveness of the control programs.

Manta tow surveys are used to monitor the coral reefs within the Great Barrier Reef World Heritage Area.

Photo: AIMS

Identifying critical marine plant habitats within the GBRWHA

Drs Robert Coles and Len McKenzie, QDPI

CRC Reef research has provided vital information about Queensland seagrass communities that is being used to manage seagrass resources of the GBR and elsewhere. A focus of the task this year was to collate and validate all existing coastal seagrass mapping data in Queensland. Once completed, this data will be important to GBRMPA for marine park management (in 2000-01, it was used to help define bioregions as part of GBRMPA's Representative Areas Program) and the Australian Maritime Safety Authority to assist with responses to oil spills. The task also monitors the status of the most important seagrass meadows within Queensland. Working with local authorities, state agencies and community groups, this information has been important for understanding the effects of floods and the possible impacts of dredging. The CRC Reef/DPI Seagrass-Watch community-based monitoring program started monitoring seagrasses in the Cairns, Townsville and Moreton Bay regions.

Population genetic structure of roseate tern populations in Australia, and a preliminary investigation of genetic relationships among roseate tern subspecies

Ms Anna Lashko, JCU

This project aims to examine population genetic structure in roseate terns *Sterna dougallii* on a variety of spatial scales: local (within and among island groups in the GBR), regional (Australia-wide) and global. The data will provide a scientific basis to develop a management plan for the roseate tern within the GBRMP based on the population genetic structure of the species within the GBRMP and Australia. Samples have been obtained from breeding colonies in southern Western Australia and the southern GBR, as well as from non-breeding groups in the Swain Reefs in the GBR. Further samples will be collected in Australia and other regions of the world where breeding colonies of roseate terns occur, including the US, Caribbean, UK, Portugal, Japan and South Africa. These collections will be done in collaboration with researchers in each region. Microsatellite and mitochondrial DNA markers are being developed; the first roseate tern microsatellite was discovered in early June

An ecological basis for managing dugongs and green turtles in the GBRWHA

Professor Helene Marsh, JCU

This task aims to determine trends in the distribution, abundance and conservation status of dugongs in the GBRWHA, and to assess the likely impacts on selected populations of dugongs and green turtles of indigenous hunting by Cape York communities. The major focus for 2000-01 has been the production of a monograph, The Dugong (*Dugong dugon*): Status Report And Action Plans For Countries And Territories In Its Range. This document presents a global overview of the status of the dugong and its management in 37 countries and territories and provides comparative information to enable countries to develop their own, more detailed conservation plans. The information indicates that the dugong is believed to be extinct in four countries/territories and declining in at least a further 17 nations. The major concerns are mortalities associated with fishing (>34 countries), habitat loss (>36 countries), hunting (>26 countries) and boating impacts (>13 countries). An aerial survey of the GBRWHA between Hunter Point (just south of Cape York) and Innisfail was completed. This survey indicates that dugong numbers are stable in this region but that there have been large-scale movements of dugongs within the region.

Fine-scale surveys for crown-of-thorns starfish

Mr Udo Englehardt, Reefwatch Australia

Since 1994, fine-scale surveys for adult and juvenile crown-of-thorns starfish have been completed on about 20 reefs between Cooktown and Townsville. The number of small starfish found in the 1998-99 surveys was very high. This indicated the potential for outbreaks of starfish on reefs near Cairns which had had been impacted by starfish within the previous five years. In the 2001 surveys, the fate of these starfish recruits was determined. Information about starfish distribution was compared with the AIMS long-term monitoring project. Preliminary results indicate that large populations of juveniles detected in earlier surveys did not survive to maturity on reefs which had low coral cover (as a result of a previous starfish outbreak), probably because of a lack of food.

Population biology and biogeography of Caribbean and Indo-Pacific reef fishes

Professor Howard Choat, JCU

This project is a collaborative project between CRC Reef and the Smithsonian Institution. Sampling and field observations have been completed at two locations: Venezuela and the northern GBR, in addition to a pilot study at the Seychelles. Abundance estimates, age (by collection of otoliths) and genetic structure from DNA analysis were collected for 26 reef fish species. The data are being analysed, and new genetic markers for reef fish have been developed and successfully trialled.

Project C2. Assessing land-based threats and impacts

Project Leader: Dr Miles Furnas, AIMS

Assessing land-based threats and impacts: nutrient supply and fluxes

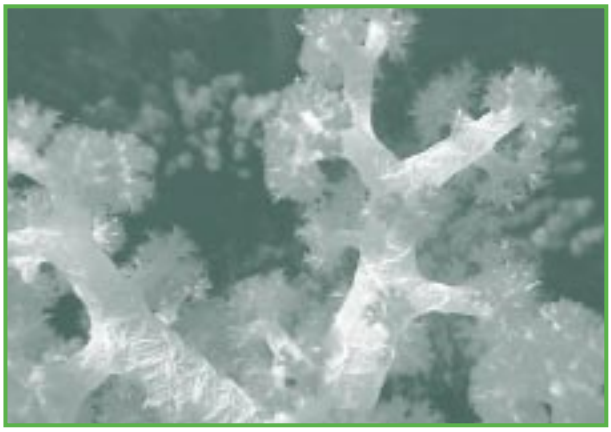
Dr Daniel Alongi, AIMS

Research cruises to compare nutrient (nitrogen, phosphorus) cycling in sections of the GBR influenced by anthropogenic run-off (Innisfail) and remote from significant human influence (Princess Charlotte Bay) were completed. These cruises focused on quantifying pelagic primary and secondary production; nutrient transfers to the benthos; and nutrient cycling by soft bottom benthic communities. The sediment and physical oceanographic characteristics near one set of reefs in the Tully-Innisfail region were characterised to define local sources of sediment affecting reefs and physical conditions affecting sediment resuspension and transport. Primary and secondary production rates were measured in the nominally impacted (Innisfail) and pristine (Princess Charlotte Bay) regions. Both areas are characterised by low to moderate primary productivity, indicating the lack of significant nutrient inputs. Despite moderate productivity, actively growing phytoplankton were quickly consumed by grazers, indicating rapid turnover of nutrients absorbed by the pelagic biota. The data will provide essential information for assessing biological responses to nutrients in river plumes. Sediment characteristics around reefs in study and control areas were mapped. Nephlometers deployed off Tully and the wet tropical islands recorded several high turbidity events associated with coastal resuspension (Tully), cyclonic disturbance (High Islands) and flood plumes (High Islands). Turbidity loggers were deployed in seven rivers: Normanby, Barron, north Johnstone, Tully, Herbert, Burdekin and Fitzroy.

Impacts of terrestrial run-off on coastal reef communities

Dr Katharina Fabricius, AIMS

Extensive surveys of reefs in the Tully to Port Douglas (TPD) region and the Princess Charlotte Bay (PCB) regions were completed. These regions are exposed to different levels of terrestrial run-off from anthropogenic activities. Fleshy macroalgae, hard corals, soft corals, juvenile corals, coralline algae, sediment composition and water quality were surveyed to characterise the ecological status and condition of the two regions. Hard coral cover, species richness and density of recruits, and soft coral richness were low in reefs of the TPD region when compared with PCB, indicating recent disturbance of these reefs. Species richness and abundance of fleshy macroalgae were generally higher in the PCB region than the TPD region. The differences suggest that reefs in the TPD region were recently disturbed (apparently by a combination of bleaching, run-off and crown-of-thorns starfish). Lab and field experiments were used to investigate the effects of sediments and nutrients on benthic communities. Experiments showed that the amount and duration of exposure to sediment affects the photosynthetic yields and recovery of some coastal hard corals. Experiments also showed that while nutrient enhancement promoted growth and survival of macroalgal recruits, herbivory was more important for macroalgal growth and survival. This demonstrates that herbivores are critical in moderating nutrient effects on algal populations. Nutrient effects on macroalgal fecundity were also investigated. The findings indicate that terrestrial run-off may inhibit recovery of coral populations after disturbances, rather than simply enhance algal growth.



The numbers and diversity of soft corals are being assessed to determine the impacts of terrestrial run-off on reef communities.

Photo: Vicki Harriott

Terrestrial run-off to the Great Barrier Reef – a synthesis

Dr Miles Furnas, AIMS

The first draft of a book reviewing the effects of terrestrial run-off on the GBR was largely finished. Data on run-off compiled for the book is now being used by GBRMPA to set catchment management targets for the discharge of nutrients into coastal receiving waters.

Sediment impacts (Lihir gold mine, Papua New Guinea)

Ms Sea Rotmann, JCU

The thickness of the tissue layer (TTL) in corals can be used as a cheap, simple and reliable tool to measure environmental impacts from anthropogenic sources. A five-week fieldtrip to Lihir Island was conducted in February/March 2001. Twenty coral colonies in shallow and deep water at Masahet (control site) were cored on a regular schedule. The corals' TTL increased linearly throughout the month, then decreased by up to 20% immediately after the full moon, due to coral skeleton formation. The tissue thickness of corals from sites severely affected by sediments was thinner than corals at minor impact and control sites. The corals at Kapit showed TTL of <2mm, which is assumed to be lethal.

Regional dynamics in the marine climate of the GBRWHA

Dr Derek Burrage, AIMS

The impacts of global climate change are a major national and international issue. This project pursues research to develop a more complete information base about regional climate and its impact on coral reefs. An archive of sea surface temperatures (SST Atlas) is being continually updated via near real-time processing of satellite data from NOAA. Time-temperature curves for bleaching thresholds of 13 coral reefs have been established. These will be used to improve the early warning system for coral bleaching based on the automatic weather station network. These tolerance curves will also form the basis of a risk assessment of climate change impacts on the GBR. Regional modelling of altimetry and sea surface height was progressed and relationships between regional currents, sea level and temperature variations identified using the processed datasets. A numerical hydrodynamic model of southern GBR tidal circulation was implemented. The first airborne surveys and ground-truthing of Sea Surface Salinity and Temperature in the GBR were conducted, and the results used to determine the extent of freshwater plume influence in the GBR lagoon.

Hydrodynamic dispersal models for the GBRWHA

Dr Lance Bode, JCU

A fine-resolution computer model of currents has been developed for the Cairns Section of the GBR for the months between October and February from 1967–98. These currents are driven by a combination of the tides, measured winds and the hydrodynamic coupling between waters in the GBR and the Coral Sea. The computed currents have been used in a dispersal simulation model to compute reef 'connectivity' – the seasonal transport of larvae between every pair of reefs in the region. For each year of the simulations, approximately 12 million particles were tracked. The dispersal model has been used to: assess the levels and variability of larval supply to reefs in the region; identify effective and reliable source reefs (suppliers of larvae to other reefs); identify effective sink reefs (those which receive regular supplies of larvae from other reefs, and might therefore be appropriate reefs for exploitation); and identify reefs whose populations are consistently replenished through self-seeding. The latter reefs may be ideal candidates to select for marine reserves because they appear to play an important role in maintaining fish stocks in the region.

Reef fish dispersal

Ms Rebecca Fisher, JCU

This project aims to address questions about the capacity of larval fish to control their dispersal by active movement. Larval behaviour such as swimming speed, feeding, orientation and nocturnal activity levels will be examined. Research on the factors influencing sustained swimming abilities in reef fish larvae have been completed, with feeding of larval fish in the water column identified as a factor which greatly increases the dispersal potential of reef fish above previously accepted values.

A book reviewing the effects of run-off from the land will soon be released.

Photo: AIMS

Program D. Information systems and synthesis

Program Leader: Dr Terry Done, AIMS

OBJECTIVES:

The objectives of this program are to:

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

This program is closely linked to the Extension and Communication Program because it includes elements of innovation in information management and analysis, decision support and expert consideration of policy-related issues. A major revision of the tasks in this program has been proposed and will be implemented in 2001. The revised program, 'Reef Futures', will be closely linked to a newly developed Data Centre at AIMS. These initiatives will greatly enhance the analytical capacity of both CRC Reef and AIMS.

Project D1. Information systems

Project Leader: Dr Adam Lewis, GBRMPA

Information management system

Associate Professor Vicki Harriott, JCU

A project database, called CRC ReefBase, was completed which records details of research proposals. Procedures to incorporate reporting into CRC ReefBase are underway. The CRC Reef website was completely redeveloped to include information about research programs and outcomes of CRC Reef research projects. It has been designed to be accessible to multiple user-groups including the general community, and will be a major tool to increase awareness of the goals and research outcomes of CRC Reef.

Research results can now be found on the CRC Reef website.

Photo: Rob Parsons

Environmetrics and data mining

Dr Glenn De'ath, JCU

This project made a major contribution to the GBRMPA Representative Areas Program (RAP). This involved developing methods and software for the candidate areas (CA) selection process of the RAP. These methods have been packaged into TRADER – a suite of software which rapidly and efficiently generates potential schemes of CA that can be modified interactively. TRADER builds on previously developed methods and software used in the first stage of the RAP – the bioregionalisation. It complements other reserve design software being applied and has made vital contributions to the RAP. A set of statistical and GIS tools (TREES++) were developed and have been published electronically. This package includes the statistical method, multivariate regression trees. A workshop was conducted to show these tools to the local scientific community. Collaborations with other CRC Reef programs (A and C) resulted in publications in key areas of CRC Reef research – crown-of-thorns starfish, biodiversity and terrestrial run-off.

Project D2. Information synthesis

Project Leader: Dr Terry Done, AIMS

Spatial decision support

Dr Terry Done, AIMS

The project team contributed to Representative Areas Program (RAP) technical and scientific steering committees to define principles and set critical parameters for the design of the Representative Areas network. A review of hazard, vulnerability and risk as they apply to unmanageable impacts within the GBRWHA was initiated to assist in understanding the nature, timing and extent of ecological change. This was complemented by analysis of a 20-year record of coral community changes in all major reef zones and two latitudes. This will enable the consequences of exposure to a hazard (both the impact and recovery) to be better modelled, an important element in understanding natural and anthropogenic change in coral reef communities. A complementary field study that quantifies the differences in nature, rates, and year-to-year reliability of settlement and recruitment of new corals was extended into its eighth year. A GIS-based Decision Support System modified for marine use in a PhD project was applied in Ningaloo Reef, Western Australia. Field work was initiated to better characterise habitat/environment relationships in reefs of the Dampier Archipelago and Montebello Islands.

Working groups and synthesis

Dr Terry Done, AIMS

This task utilises expertise from across CRC Reef to produce statements, issues papers and/or reports that address issues of concern for decision makers in industry, management and policy areas. This year, CRC Reef researchers produced several important outputs: a major report that drew together and integrated the best available scientific information about the impacts of terrestrial run-off on the GBRWHA; a series of conceptual models to depict the diversity of seagrass habitat types in tropical regions and the key processes that define them; a report about the ecological sustainability of the coral harvest fishery which was widely used by industry and management to debate the future of the fishery in Australia; a major independent review of the contrasting contributions that two concurrent survey methods make to understanding propagation of crown-of-thorns starfish outbreaks as waves through the central GBR; a study to investigate relationships between flood plumes and the timing and location of initiation of outbreaks of crown-of-thorns starfish; and a review to GBRMPA that endorsed the analytical processes used to identify areas suitable for protection in representative areas of the GBR. Project staff also collaborated with Indonesian counterparts to develop the scientific program, and arrange and implement logistics of the Ninth International Coral Reef Symposium which had 1500 registrants.

EDUCATION

5. EDUCATION

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

Photo: Helene Marsh

Objective

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

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

Highlights

- Three postgraduate students supported by CRC Reef scholarships completed their degrees and a further three submitted theses for examination.
- Seven new postgraduate students were awarded scholarships and recruited into research programs for 2001, with a total of 21 students receiving CRC Reef stipends in 2000-2001.
- Students from the Fishing and Fisheries research project organised and ran a highly successful student-stakeholder workshop to communicate their research result to industry and management.
- Six students received travel grants of $1200 and presented papers at the International Coral Reef Symposium in October 2000.

Staffing structure

The CRC Reef Project Leader for Education, Dr Vicki Hall resigned to take up a position with the Australian Research Council in April 2001. Following the high turnover of staff in the previous 15 months, duties in the education and communication area were revised to better utilise staff skills and cover the diverse needs of the program. Education and Communication Program Leader, Dr Vicki Harriott, is now responsible for student academic support and advice, in addition to previous roles in strategic planning and management of the program. The newly appointed Project Manager, Education and Communication, Mr Tim Harvey, will coordinate student liaison as well as administration of the scholarship and grants schemes. He will also manage student training opportunities in collaboration with Extension Manager, Ms Bryony Barnett. The new strategy is operating well, and allows more interaction between education/training and communication/extension activities.

Innovations and outcomes in education and training

Postgraduate students within the CRC Reef Fishing and Fisheries project organised a successful student/stakeholder workshop in March 2001. It was attended by 35 stakeholders representing interests in commercial and recreational fishing, charter operations, resource management, indigenous communities, conservation and research organisations. Eight student presentations were followed by lengthy discussion with stakeholders. The success of the day demonstrated the benefits of close communication between research providers and users. The workshop also gave students experience in running workshops, practice with presentation skills, and led to enhanced uptake of research findings, as well as raising the profile of CRC Reef in the industry and management community.

A comprehensive student induction program was offered in May 2001 and was very well-received by students starting their studies with CRC Reef. The postgraduate student orientation handbook was comprehensively revised and updated. It includes information on intellectual property, training and grant opportunities and guidelines for funding student proposals. As part of the induction, students were surveyed about their training needs to assist in planning of training opportunities.

Final agreement was reached on a plan to provide statistical support to CRC Reef students after earlier efforts to recruit a statistical advisor within James Cook University were unsuccessful in attracting a suitable candidate. The student advisory service began in June 2001.

The newly developed CRC Reef website contains extensive information about the postgraduate education program. The site will be increasingly used for information transfer, particularly to provide documentation for scholarships. Summaries of all student projects are now available on the website.

Collaboration with education and training programs from other CRCs was enhanced by a workshop at CRC Reef in December 2000, as well as representation at the education and training workshop at the CRCA conference in Perth. Extensive discussion about sharing resources for postgraduate skills-development and training resulted in several options to be pursued. For example, courses in Science-Business Fusion and multivariate statistics developed at CRC Reef have also been offered at other CRCs, reducing the development cost for all parties.

Recruitment of students

Seven PhD scholarships were awarded in 2001 in the fields of environmental studies, marine biology and engineering, bringing the total number of scholarships awarded by CRC Reef since 1999 to nineteen. An additional two students received stipends to complete postgraduate projects initiated under the previous CRC Reef. The Centre also has 61 students registered as student associates, i.e. they have an association with the CRC Reef through their project or 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 encouraged. Five of the postgraduate students receiving stipend support in the last year had supervision from outside James Cook University (including AIMS, GBRMPA). A total of 27 student associates of CRC Reef have external supervision (AIMS, CSIRO, QDPI, GBRMPA, UQ).

A student agreement has been developed in conjunction with JCU that clarifies issues about intellectual property and contractual obligations of CRC Reef scholarship students. New students in 2001 have signed the agreement.

Revised performance indicators for education

Following three rounds of student recruitment and the development of a forward budget for student scholarships, the projected numbers of students and scholarships over the life of the CRC Reef have been consolidated. Details of performance indicators with respect to student numbers in the Commonwealth Agreement are not clear. The tabulated performance indicators (Schedule 6) list a target of 35 full scholarships and 15 top-up scholarships over the life of the Centre. However, the text for the Education Program in the Commonwealth Agreement lists an objective to provide scholarships and research funding for 25 PhD and 10 Masters degree students, in addition to students completing from the first CRC Reef.

The former target as listed in Schedule 6 is not achievable within the framework of funding priorities for the Centre. Instead, CRC Reef seeks approval of the Cooperative Research Centres Program for the following revised targets over the life of the CRC Reef. These compare favourably with the number of scholarships offered in other CRCs.

Postgraduate scholarships (including full scholarships, top-up scholarships and industry scholarships, but excluding completing students from the previous CRC Reef)

PhD 20
Masters 10

Research support (grants, awards and infrastructure support, excluding completing students from the previous CRC Reef)

PhD 30
Masters 10
Honours 30

Grants and awards

CRC Reef continued to support student attendance at conferences. Six students were given grants of $1200 to attend the Ninth International Coral Reef Symposium in Bali in October 2000. Each student presented a paper at this international meeting of 1500 coral reef scientists and managers. CRC Reef students were also supported to attend the Australian Marine and Aquatic Postgraduate Students workshop at Stradbroke Island, and the annual conference of the Australian Marine Science Association and the Australian Coral Reef Society.

CRC Reef provided opportunities for student involvement at the undergraduate level through augmentative grants and graduation prizes. Eight 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.

At the 2001 James Cook University graduation ceremony, Ms Bronwyn van Gool 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. The prize was sponsored by the Australian Marine Tourism Operators Association (AMPTO), a CRC Reef member.

Training

Student training opportunities included a three-day course in multivariate statistics attended by nine CRC Reef students, and a one-day course in media skills attended by 20 students and staff. Subsequently, several students have gained experience with the media by being interviewed for newspaper, radio and television about their work with CRC Reef.

In collaboration with the private company Babel-sbf, CRC Reef developed a course on Science-Business Fusion which is designed to teach scientists about commercialisation of science and working productively with business. The first three-day course was run at CRC Reef in December 2000. CRC Reef sponsored four student places on the course. The Science-Business Fusion course has subsequently been marketed to other CRCs and centres on a profit-sharing basis with Babel-sbf.

Many students presented conference papers at the CRC Reef Research Days in September 2000, providing experience in presentation skills in an informal environment. A prize of $100 for the best student talk at the conference was donated by Babel-sbf, and was awarded to Mr Geoffrey Muldoon.

Successful student completions

Three CRC Reef scholarship postgraduate students completed their degrees in 2000, and a further three submitted their theses for examination. Completions and submissions by student associates are listed in the following tables.

Student employment

CRC Reef continues to produce well-rounded graduates that are highly sought after in the work place. Eleven current and recently graduated students have been employed by industry or national and international agencies during 2000-01.

Employment history of students (2000-01)

Scholarship students	Place of employment
K Anthony	Postdoctoral Fellow, James Cook University
K Michalek-Wagner	Research scientist, GBRMPA
G De'ath	Research Fellow, James Cook University
P Marshall	Great Barrier Reef Marine Park Authority
M Rasheed	Queensland Department of Primary Industries
D Welch	Australian Institute of Marine Science
J Robertson	Aquaculture industry

Student associates	
A Baird	Postdoctoral Fellow, Japan
R Berkelmans	Research scientist, AIMS
J McConochie	Research scientist, James Cook University
J True	Museum of Tropical Queensland

CRC Reef students in 2000-01 are:

	Postgraduate scholarships	Student associates
PhD students	24	32
Masters/MSc qual. students	6	8
Honours level students	0	21
TOTAL	30	61

POSTGRADUATE SCHOLARSHIPS

The following students have CRC Reef Scholarships or a combination of CRC Reef 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 (JCU) Dr B Molony (JCU) Dr B Mapstone (JCU)	Current	CRC Reef/APRA
W Bailey	MEngSc	JCU/Task B 1.2	Numerical modelling of the sediment transport in the GBR region	02.01.01	Assoc Prof T Hardy (JCU) Prof J Patterson (JCU)	Current	CRC Reef/APRA
M Bergenius	PhD	JCU/Program E	Connectivity in reef fish populations	18.06.01	Assoc Prof G Russ (JCU) Dr P Doherty (AIMS)	Current	CRC Reef
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) Dr A Williams Dr S Shafer	Current (part time)	CRC Reef
E Dinsdale	PhD	JCU/Task A 2.1.3	Measuring the success of conservation strategies to protect scleractinian corals on the GBR	01.01.01	Assoc Prof V Harriott (JCU) Dr M Fenton (JCU) Mr P Valentine (JCU)	Current	CRC Reef
M Dommisse	PhD	JCU/Task 1.1.1	Detritus and its influences on water quality in the GBR: quality and quantity	01.09.95	Assoc Prof C Alexander (JCU) Dr M Furnas (AIMS)	Completed	CRC Reef
J Eagle	PhD	JCU/Program E	Larval accumulation areas: a tool for predicting reef fish population dynamics and connectivity	30.06.01	Prof M Kingsford (JCU) Dr G Jones (JCU)	Current	CRC Reef/APRA
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 Reef/APRA
D Grover	MSc	JCU/Task C 1.4.2.2	The role of environmental factors in the distribution of breeding seabird populations in the GBRWHA	01.01.01	Dr E Gyuris (JCU) Mr J Monaghan (JCU)	Current	CRC Reef
J Harrington	PhD	JCU/Task 1.3.2S	Valuing a place: how do communities identify cultural heritage significance? A comparative study in two world heritage areas	29.03.99	Dr S Greer (JCU) Dr D Miles (JCU)	Current	CRC Reef/ APRA
A Heap	PhD	JCU/Task 1.3.1	Sedimentology of the Whitsundays	17.02.97	Dr P Larcombe (JCU) Dr G Dickens (JCU)	Submitted	CRC Reef
J Higgs	PhD	JCU/Task 2.4.14	Distribution of recreational boating activities in the Townsville region	01.02.95	Dr B Mapstone (JCU) Assoc Prof G Russ (JCU)	Suspended	CRC Reef
A Hodgson	PhD	JCU/Task C 1.4.3.1S	Impacts of anthropogenic noise on dugongs and coastal dolphins	27.03.00	Prof H Marsh (JCU) Dr L Chilvers	Current	CRC Reef/APRA
J Kritzer	PhD	JCU/Task 5.5.6S	Spatial and temporal variation in the population dynamics and life history traits of the tropical snapper *Lutjanus carponotatus* on the GBR	01.03.98	Prof H Choat (JCU) Dr C Davies (NOO)	Submitted	CRC Reef/ IPRS
A Lambeck	MSc	JCU/Task 1.3.1	Sphere of influence of northern rivers	01.01.98	Dr P Larcombe (JCU) Dr S Abbott (JCU)	Completed	CRC Reef

IPRS: International Postgraduate Research Scholarship

Name	Degree	Institution enrolled/ task affiliation	Thesis title	Commencement date	Supervisor	Status of study	Source of funding
A Lashko	PhD	JCU/Task C 1.4.2.1	Genetic diversity in the relationship between nesting and feeding aggregations of seabirds in the GBRWHA	31.03.00	Dr E Gyuris (JCU) Dr M Waycott (JCU)	Current	CRC Reef
V Lukoschek	PhD	JCU/Task C 1.4.1	Conservation genetics of sea snakes (Family Hydrophiidae) in Australian waters, with emphasis on the GBRWHA	07.02.00	Prof H Marsh (JCU) Dr M Waycott (JCU)	Current	CRC Reef/APRA
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)	Completed	CRC Reef
R Marriott	MSc	JCU/Task B 4.2	An investigation into aspects of reproduction and regional variation in growth for populations of red bass, *Lutjanus bohar*	30.03.01	Dr B Mapstone (JCU) Prof H Choat (JCU)	Current	CRC Reef
J McKinlay	PhD	JCU/Task 2.4.17	A spatial and temporal analysis of the Queensland multi-species commercial line fishery from fishers logbook data	01.01.97	Dr B Mapstone (JCU) Dr C Davies (NOO) Dr G De'ath (JCU)	Current (part-time)	CRC Reef/APRA
G Muldoon	PhD	JCU/Task 2.1.16	An ecological economic approach to determining optimal capacity where latent effort exists	15.07.97	Dr L Fernandes (GBRMPA) Assoc Prof O Stanley (JCU) Dr B Mapstone (JCU) Dr C Davies (NOO)	Current	CRC Reef
M Nursey-Bray	PhD	JCU/Task A 1.2.2S	Conflict, co-option or co-management: eating our words? Towards indigenous hunting management in north Queensland	01.10.00	Prof H Marsh (JCU) Assoc Prof S Turton Prof H Ross (UQ)	Current	CRC Reef
R Partridge	MSc	JCU/Task B 4.10	The effect of a two-tiered management regime on the catch characteristics of recreational and charter line fisheries operating in tropical estuarine systems	12.03.01	Dr B Mapstone (JCU) Dr M Sheaves (JCU)	Current	CRC Reef
R Pears	PhD	JCU/Task B 4.20	Comparative demography and life history features of cods and gropers: implications for fisheries and conservation management	01.05.00	Prof H Choat (JCU)	Current	CRC Reef/APRA
C Pocock	PhD	JCU/Task A 1.3.1S	Management of cultural heritage values in the GBRWHA	27.03.00	Dr D Roe (JCU) Dr S Greer (JCU) Dr D Collett	Current	CRC Reef
B Radford	PhD	JCU/Task D 2.2	Effects of water quality on the distribution of corals on coastal reefs: development of tools for environmental assessment and risk management	31.03.00	Dr T Done (AIMS) Dr B Willis (JCU) Dr K Anthony (JCU) Dr A Lewis (GBRMPA) Dr J Delaney	Current	CRC Reef
J Robertson	PhD	UQ/Task 2.4.16	Ecological and economic implications of conservation management strategies intended to minimise the impacts of fishing on the GBR	01.01.94	Dr H Campbell (UQ) Mr R Beard (UQ) Dr B Mapstone (JCU)	Current	CRC Reef
S Rotmann	PhD	JCU/Task C 2.5	Assessment of the use of coral tissue thickness as a monitor of reef health and performance	22.05.00	Dr S Smithers (JCU) Dr D Barnes (AIMS)	Current	CRC Reef/ Lihir Mining
D Welch	MSc	JCU/Task 2.412/5	Development of techniques which minimise size selectivity for sampling populations of the common coral trout *Plectropomus leopardus* for age structure analysis.	01.01.95	Assoc Prof G Russ (JCU) Dr B Mapstone (JCU) Dr C Davies (JCU)	Submitted	CRC Reef
A Williams	PhD	JCU/Task 2.4.12/2	Population structure of the *Lethrinus miniatus* on the GBR	31.03.98	Dr B Mapstone (JCU) Dr C Davies (JCU) Assoc Prof G Russ (JCU)	Current	CRC Reef/APRA

POSTGRADUATE ASSOCIATES

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

Name	Degree	Institution enrolled/ task affiliation	Thesis title	Commencement date	Supervisor	Status of study	Source of funding
A Abdulla	PhD	JCU/Program B	Multispecies interactions in coral reef fish: implications of predator removal by fishing	01.03.00	Dr B Mapstone (JCU) Dr J Caley (JCU) Dr S Connelly (JCU)	Current	IPRS
J Ahn	MSc	JCU/Task 2.2.3	Chinese and Japanese reef tourists' understanding of safety and environmental messages	01.02.99	Dr E Kim (JCU) Dr G Moscardo (JCU)	Completed	CRC Reef
N Aragones	PhD	JCU/Task 2.1.8	Techniques for the restoration of tropical seagrass beds	27.02.95	Dr G Inglis (NIWA)	Suspended	CRC Reef/AusAID
P Armsworth	PhD	JCU/Task 1.2.1	The mathematical ecology of reef fishes	01.02.98	Dr L Bode (JCU) Assoc Prof D Bellwood (JCU)	Completed	CRC Reef
R Arthur	PhD	JCU/Task D 1.1	Coral competition and recovery in reefs affected by a coral mass mortality	30.06.99	Assoc Prof V Harriott (JCU) Dr Terry Done (AIMS)	Current	IPRS/ Diversitas
A Astorquia	Hons	JCU/Task B 3.2	Small scale wave modelling at John Brewer Reef	01.03.01	Assoc Prof T Hardy (JCU)	Current	CRC Reef
W Bailey	Hons	JCU/Task B1.2	Flushing characteristics of Trinity Inlet using a numerical hydrodynamic model	01.03.00	Assoc Prof T Hardy (JCU)	Completed	CRC Reef
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)	Submitted	CRC Reef
C Bastidas	PhD	JCU/Task 1.4.1	Space monopolisation by soft corals: a measure of coral reef disturbances	27.07.98	Dr K Fabricius (AIMS) Dr B Willis (JCU)	Current	CRC Reef
R Berkelmans	PhD	JCU/Task 1.1.4	Upper thermal tolerance limits for acclimation of reef corals	15.08.96	Dr B Willis (JCU) Dr J Oliver (GBRMPA)	Submitted	CRC Reef
S Bray	Hons	JCU/Program E	Latitudinal trends in the age structure and life history of the damselfish *Pomacentrus moluccensis*	01.03.01	Assoc Prof G Jones (JCU) Dr J Caley (JCU)	Current	CRC Reef Hons Aug Grant
S Bryce	PhD	JCU/Task 1.3.1	Sediment transport in mangrove creek systems of north Queensland	01.01.95	Dr P Larcombe (JCU) Dr R Carter (JCU)	Submitted	CRC Reef
J Bunt	PhD	JCU/Task 1.3.1	Sediment transport in mangrove systems and causes of turbidity	20.02.97	Dr P Larcombe (JCU) Dr P Ridd (JCU)	Submitted	CRC Reef/ IPRS
L Burgess	Hons	UQ/Program E	The influence of incubation temperature on hatching morphology and swimming performance of green sea turtle hatchlings *Chelonia mydas* in the GBR	01.03.01	Dr J Lanyon (UQ) Dr David Booth (UQ)	Current	CRC Reef Hons Aug Grant

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

Name	Degree	Institution enrolled/ task affiliation	Thesis title	Commencement date	Supervisor	Status of study	Source of funding
J Cavanagh	PhD	JCU/Task 1.3.5	Organochlorine pesticide residues in near-shore marine sediment cores of the Herbert and Burdekin regions and their relationship to historical agricultural activities	01.07.96	Dr K Burns (AIMS) Dr G Brunskill (AIMS) Assoc Prof R Coventry (JCU)	Submitted	CRC Reef
D Ceccarelli	PhD	JCU/Task C 2.2	Effects of territorial damsel fish on community structure of coral reefs Dr G Jones (JCU)	01.02.01	Dr K Fabricius (AIMS) Dr L McCook (AIMS)	Current	CRC Reef
M Depczynski	Hons	JCU/Program E	Reef biodiversity and the role of fishes in coral reef ecosystems	01.03.01	Dr D Bellwood (JCU)	Current	CRC Reef Hons Aug Grant
M Devlin	PhD	JCU/Task C 2.2	Temporal and spatial dynamics of a wet tropics flood plume and the effects on inshore coral reef biota	01.05.98	Dr K Fabricius (AIMS) Dr S Smithers (JCU) Mr J Monaghan (JCU)	Current (part-time)	CRC Reef
G Diaz	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 Reef
G Doherty	PhD	JCU/Task 1.3.5	Trace element geochemistry of the intertidal zone of Cleveland Bay, Queensland	01.01.98	Dr G Brunskill (AIMS) Dr M Ridd (JCU)	Submitted	CRC Reef
O Floerl	PhD	JCU/Task B1.10	Marinas as reservoirs for marine fouling organisms	12.01.99	Prof H Marsh (JCU) Dr C Battershill (AIMS) Dr G Inglis (NIWA)	Current	CRC Reef/ IPRS
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 (part-time)	CRC Reef
D Gibson	Hons	JCU/Task E5.1	Cross-shelf distributions of tropical plankton on the Central Great Barrier Reef	06.09.99	Assoc Prof C Alexander (JCU) Dr M McCormick (JCU)	Completed	CRC Reef Hons Aug Grant
C Gralton	Hons	JCU/Program E	An evaluation of the role of recruitment in the recovery of inshore coral assemblages in the Palm Island group following the 1998 bleaching event	01.03.01	Dr Bette Willis (JCU)	Current	CRC Reef Hons Aug Grant
J Guinotte	PhD	JCU/Task 1.5.2	Human impacts on reef systems	15.07.99	Dr A Lewis (GBRMPA) Dr T Done (AIMS) Prof D Gillieson (JCU)	Suspended	CRC Reef/ IPRS
L Harrington	PhD	JCU/Task C 2.2	Role and significance of coralline algae on coastal reefs in areas of terrestrial run-off	01.01.01	Dr K Fabricius (AIMS) Dr J Collins (JCU) Dr R Steneck	Current	CRC Reef/ IPRS
J Jompa	PhD	JCU/Task 1.4.1	Coral algal interactions and their roles in reef degradation	04.07.97	Dr L McCook (AIMS) Prof H Choat (JCU)	Current	CRC Reef/ AusAID
M Kospartov	Hons	JCU/Task E5.1	A multi-scale investigation of the size structure of coral populations	02.02.00	Assoc Prof T Hughes (JCU)	Completed	CRC Reef Hons Aug Grant
J Kung	PhD	JCU/Task 2.4.20	Economic management of multispecies fisheries and the commercial collection of aquarium fishes on the GBR	01.03.95	Dr B Mapstone (JCU) Assoc Prof O Stanley (JCU)	Submitted	CRC Reef

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

Name	Degree	Institution enrolled/ task affiliation	Thesis title	Commencement date	Supervisor	Status of study	Source of funding
S Leuzinger	Hons	JCU/Program E	Effects of stress and resource limitation on energy allocation in reef corals	01.03.01	Dr K Anthony (JCU) Dr B Willis (JCU)	Current	CRC Reef Hons Aug Grant
A Maltby	Hons	JCU/Task 3.3	Determining wind loads on tourist pontoons	01.03.00	Assoc Prof T Hardy (JCU) Dr J Ginger (JCU)	Completed	CRC Reef
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 GBR	01.10.00	Dr C Davies (NOO) Dr B Mapstone (JCU) Prof H Choat (JCU)	Completed	CRC Reef
J McConochie	MSc	JCU/Task 3.1	Numerical modelling of synthetic cyclone generated waves in the GBR region	30.03.99	Assoc Prof T Hardy (JCU) Prof J Patterson	Current (part-time)	CRC Reef
J Mellors	PhD	JCU/Task 1.4.4	Nutrient effects on inshore seagrasses of the GBRWHA	03.07.92	Dr R Coles (QDPI) Prof H Marsh (JCU)	Current (part-time)	CRC Reef
K Messer	Hons	JCU/Task B1.2	Modelling flushing of contaminates in the port of Townsville	01.03.00	Assoc Prof T Hardy (JCU)	Completed	CRC Reef
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 GBR	03.03.97	Prof H Choat (JCU) Dr C Davies (NOO)	Submitted	CRC Reef/ AusAID
S Muloin	PhD	JCU/Task 2.2.1	The psychological benefits experienced from human/animal interactions	29.03.94	Prof P Pearce (JCU)	Completed	CRC Reef
B Palmqvist	Hons	JCU/Task E5.1	Nineteenth century guano mining industry on the GBR	02.02.00	Dr M Gibbs (JCU)	Completed	CRC Reef Hons Aug Grant
A Penny	Hons	JCU/Program E	The effects of fishing on mud crab *Scylla serrata* (Crustacea: Portunidae) in north Queensland: incidence and effect of damage on sub-legal and female crabs	01.03.01	Dr M Sheaves (JCU)	Current	CRC Reef Hons Aug Grant
R Pratt	MSc	JCU/Task 2.3.2	Coral reef restoration, ecology and techniques	28.02.94	Assoc Prof T Hughes (JCU)	Current (part-time)	CRC Reef
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)	Withdrawn	CRC Reef
M Puotinen	PhD	JCU/Task 1.1.3	Tropical cyclone impacts on coral reefs: modelling the disturbance regime in the GBR Region	10.04.95	Dr T Done (AIMS) Dr A Lewis (GBRMPA) Prof D Gillieson (JCU)	Submitted	CRC Reef
P Riolo	MAppSc	JCU/Task 1.5.2	Sea surface temperature interpolation	02.08.99	Mr J Monaghan (JCU) Dr W Skirving (AIMS)	Current	CRC Reef
J Robins	PhD	JCU/Task 2.5.3	The impact of trawling on sea turtles.	01.03.98	Prof H Marsh (JCU) Dr D Die (CSIRO)	Current	CRC Reef

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

Name	Degree	Institution enrolled/ task affiliation	Thesis title	Commencement date	Supervisor	Status of study	Source of funding
M Samoilys	PhD	JCU/Task 2.4.2	Reproductive strategies of the common coral trout on the northern GBR	01.06.92	Prof JH Choat (JCU) Dr P Doherty (AIMS)	Completed	CRC Reef
L Santana	Hons	JCU/Task C 2.2	Effects of territorial damselfish on coral recruitment and survival	01.03.01	Dr K Fabricius (AIMS)	Current	CRC Reef
C Schoenberg	PhD	Uni. Oldenburg/ Task 1.4.1	Ecology of bioeroding sponges on the GBR	01.01.96	Dr C Wilkinson (AIMS) Dr L McCook (AIMS) Dr K Fabricius (AIMS)	Completed	CRC Reef
J Scott	Hons	JCU/Program E	Genetic analysis of the population structure of the red throat emperor (*Lethrinus miniatus*) using microsatellite DNA variation	01.03.01	Dr L van Herweden (JCU) Prof H Choat (JCU)	Current	CRC Reef Hons Aug Grant
B Smith	Hons	JCU/Task 3.3	A computer design tool for designing moorings in the GBR	01.03.00	Assoc Prof T Hardy (JCU) Mr M Matheson (JCU)	Completed	CRC Reef
L Smith	MSc	JCU/Task 2.2.4	Developing dwarf minke whale tourism interpretation	28.02.00	Dr A Birtles (JCU)	Current	CRC Reef
C Steinberg	PhD	JCU/Task C 3.2	A modelling investigation of the pathways of biota in the Southern GBR	01.03.97	Dr L Bode (JCU)	Current (part-time)	CRC Reef
S Thomas	PhD	JCU/Task C 2.5	Sediment deposit instrument development on Lihir Island, PNG	31.07.99	Dr P Ridd (JCU) Prof M Heron (JCU)	Current	CRC Reef/ IPRS
J True	PhD	JCU/Task 1.3.7	Massive scleractinian corals as indicators of environmental change	01.01.97	Dr B Willis (JCU) Dr D Barnes (AIMS)	Current (part-time)	CRC Reef
P Tudman	Hons	JCU/Task D 2.1	Modelling the trophic effects of fishery closures and cross-shelf variation on coral reefs of the Central GBR	01.03.01	Assoc Prof G Russ (JCU) Dr T Done (AIMS)	Current	CRC Reef Hons Aug. Grant
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	Assoc Prof G Russ (JCU)	Completed	CRC Reef Hons Aug Grant
B Van Gool	Hons	JCU/Task 3.3	Optimising pontoon mooring design in the GBRWHA	01.03.00	Assoc Prof T Hardy (JCU)	Completed	CRC Reef
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)	Completed	CRC Reef
C Ware	PhD	JCU/Task 2.2.1	Understanding travel decision making and patterns	15.02.99	Prof P Pearce (JCU) Dr L Murphy (JCU)	Current (part-time)	CRC Reef
S Wilbraham	Hons	UQ/Program E	Remote-sensing based classification and monitoring of Low Isles	01.03.01	Assoc Prof J Jell (UQ)	Current	CRC Reef Hons Aug Grant
B Woods	PhD	JCU/Task 2.2.3	The interpretive and educational dimensions of wildlife tourism	15.03.98	Dr G Moscardo (JCU) Prof P Pearce (JCU)	Current (part-time)	CRC Reef
C Yagi	PhD	JCU/Task 2.2.1	Tourist perceptions of other tourists	02.08.99	Prof P Pearce (JCU) Dr G Moscardo (JCU)	Current	CRC Reef

Hons Aug Grant = Honours Augmentative Grant
IPRS = International Postgraduate Research Scholarship

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

CRC Reef has supported the marine tourism industry in its successful bid for financial assistance to support local control of crown-of-thorns starfish, and is part of the scientific team for the study.

Photo: GBRMPA

Objective

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

Highlights:

- Projects on water quality in the GBRWHA have contributed significantly to the development of government policies on coastal run-off and catchment management.
- Research on the crown-of-thorns starfish has supported industry claims for government assistance with local control efforts, and a prediction of the patterns of movement of starfish has been developed.
- Research on climate change and patterns of coral bleaching have been critical in developing an understanding of the impacts of projected climate change on the future of coral reefs.
- Research on the socio-economic impacts of the commercial line, trap and harvest fisheries has been used by GBRMPA to influence the way that areas for highly protected marine parks can be selected to reduce impacts on communities depended on reefal areas.

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.

Links with users are enhanced and technology transfer facilitated by involving users at all levels of research and communication. For example, a broad-based User Advisory Group has been established to advise on research priorities. Industry-based Task Associates have also been assigned to each research task with responsibilities to provide research direction and to disseminate research results.

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

CRC Reef researchers are very active in presenting research findings at conferences and seminars (see section 9). CRC Reef Research Days were held in 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 was high.

The CRC Reef produces communication products that explain research results in plain language so results are accessible to the broader community. These are highly regarded by users. All Technical Reports include an introduction by relevant industry Task Associate and an Executive Summary.

The Extension and Communication section of CRC Reef has been restructured to emphasise the significance of face-to-face communication among CRC Reef members, and between researchers and research-users. Examples of this increased emphasis include the re-establishment of the CRC Reef Research Days; introduction of an Induction Session for researchers and Task Associates; the establishment of an industry and management Tourism Research Advisory Group; as well as participation in regional tourism industry meetings.

Case studies demonstrating successful technology transfer practices

1. Water quality

Several research projects on water quality within the Great Barrier Reef World Heritage Area have contributed greatly to public debate about the significance of changes in water quality in the inshore environment. Research results included in a book on run-off by Dr Miles Furnas, supported by CRC Reef, are being used by GBRMPA to set catchment management targets. Dr David Williams produced a major report that integrated the best available scientific information on the impacts of terrestrial run-off on the GBRWHA which has helped to inform public debate on the issue.

Research users: GBRMPA, government agencies, conservation groups

2. Marine pests and introduced species

The introduction of exotic marine pests into Australian waters via ballast water dumping practices or on ships' hulls is of growing national concern. Australia is developing a Decision Support System which will be used throughout Australian ports to assess the risk of introduction of marine pests. CRC Reef is conducting baseline surveys in four Queensland ports. These surveys are contributing to knowledge of biodiversity within individual ports, and will identify whether introduced species are present. Several species which are new to science were discovered during the surveys. Information from these surveys will be used by ports authorities to manage their ports.

Research users: ports industry, shipping industry, AQIS, GBRMPA

3. Socio-economic impacts of commercial fisheries

Extensive socio-financial information has been collected that describes the commercial fishing industry in Queensland. For the first time, direct links have been made between areas that are fished, the profile of the people that fish there, and the social and financial networks that these people have with the local and broader community. The information has been presented in a user-friendly manner that allows managers and industry to access the information. The results are especially useful for managers, because it enables potential social impacts associated with changes in fisheries and marine policy to be assessed. This allows for the impacts of proposed changes in policy to be modelled in advance. The research is also useful for both managers and industry in assessing the current status of commercial fishing in Queensland. Other research on the live fishery, which has become increasingly significant in Queensland in recent years, has been used by Reef MAC and GBRMPA to refine their policies on merits and issues in the live fish trade.

Research users: QFS, GBRMPA, recreational and commercial fishers

4. Dugong research

Research on seagrass habitats and dugong ecology has provided information that has been used to develop and manage Dugong Protection Areas. Professor Helene Marsh has produced a monograph, The Dugong (*Dugong dugon*): Status Report And Action Plans For Countries And Territories In Its Range. This overview of international status and management of dugong will assist individual countries to develop detailed conservation plans. Professor Marsh's expertise in this field was recognised by the award of a prestigious Pew Fellowship and additional funding from the Australian Research Council (ARC) and GBRMPA. Other research on incidental capture of dugong in shark netting during the past century has indicated potential depletion of dugong populations during that period, and is of great concern to managers of the GBRWHA.

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

5. Coral bleaching and climate change

A large multi-disciplinary project on sea surface temperatures, coral temperature tolerance and regional modelling of water temperatures is providing data to assist in assessing the risk of climate change to the Great Barrier Reef. In particular, research by Dr Ray Berkelmans is testing theories about whether corals could adapt to predicted water temperature rises as a result of climate change. The research program was extensively supported by tourism operations and research agencies in a program for exchange of water temperature data loggers. Research on climate change and coral bleaching was extensively cited in the 2001 Intergovernmental Panel on Climate Change report, and by Environment Australia.

Research Users: international community, Australian government agencies

6. Human-wildlife interactions

Two projects are targeting the interactions between reef tourism and wildlife - one primarily from the perspective of tourism and the other analysing in more detail the minke whale population which is the basis for a significant tourism program in Cairns. Both studies provide information that will be used by the tourism industry to enhance visitor experience and minimise visitor impacts. The minke-whale project exemplifies the benefits of cooperation between researchers and the marine tourism industry. The industry has supported the research with free ship time, while the researchers have contributed updated interpretive material on the whales to inform industry members and tourists. The work has contributed to community education through articles in National Geographic, Sport Diving Magazine, Dive Log Australasia. The project has also worked with management agencies to assist in developing guidelines for the industry.

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

7. Crown-of-thorns starfish

For several years, predation on corals by the crown-of-thorns starfish have impacted on tourism operations in the Cairns and Port Douglas region, with populations set to move further south to the Townsville and Whitsundays region. Research on the starfish includes the Long-Term Monitoring Program, the study of fine-scale distribution of crown-of-thorns starfish, an analysis of the effectiveness of the two survey methods, and an examination of the potential impacts of water quality on starfish abundance. Information was provided to the industry by a science-industry workshop on local controls of starfish in tourism destinations and a new user-friendly brochure on state of knowledge on starfish and their outbreaks. CRC Reef has supported the marine tourism industry in its successful bid for financial assistance to support local controls of starfish, and is part of the scientific advisory team for the study.

Research users: Queensland tourism industry, State and federal governments, GBRMPA

8. Seagrass research

An extensive research program about seagrass in ports has been used in planning for port development and maintenance programs, including modification of dredging practices in the GBRWHA. Information on distribution of sensitive habitats adjacent to shipping lanes will be used to update the oil spill response atlas which is used in management of potential oil spills. Similarly, information collected in the Seagrass Watch community monitoring program is used regularly for planning and contingency use such as in response to dredging and development proposals and waste disposal. Maps of the location of previously unrecognised deep water seagrass and benthic communities has contributed to the GBRMPA Representative Areas Program. This work provides information about habitat type in the inter-reefal areas for evaluation of protection of representative samples of all habitat types in the marine park.

Research users: port authorities, community, QPWS, GBRMPA, Regional City Councils

Information from Seagrass-Watch community monitoring is used regularly for planning of development proposals.

Photo: DPI

9. Sustainability of the coral harvest fishery

At the request of the Management Advisory Committee to Queensland's harvest fisheries (HarvestMAC), CRC Reef produced a document that synthesised available information on the ecological sustainability of coral harvesting practices.
The research included consultation with industry representatives, management agencies such as QFS, QPWS and GBRMPA, and a panel of scientific authorities on coral ecology. The document was reported to HarvestMAC, and contributed significantly to an evaluation of policies on the fishery in several government departments.

Research users: QFS, coral harvest and aquarium industry, GBRMPA, QPWS, federal and state government departments

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

Core participants including AMPTO, AIMS, DPI, GBRMPA, QSIA and Sunfish.

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

Queensland ports and shipping industry including Ports Corporation, Queensland; Lucinda Port Authority; Mourilyan/Abbot Point Ports; Weipa Port; Townsville Port Authority; Cairns Port Authority.

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

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

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

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

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

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

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

Environmental consulting companies including Sinclair Knight Merz.

Conservation and community groups including Hopevale Community Council; Environment Australia; North Queensland Conservation Council; Trinity Inlet Management Program; World Wide Fund for Nature.

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

Commercial and international program

CRC Reef established the Commercial and International Program as a strategy to raise new funding for research and place the Centre in a strong financial position in the next few years to ensure its long-term viability. In 2000-01, CRC Reef's revenue from sources other than the members and the CRC Program was $670,000, which is up from the previous year's figure of $270,000.

Although there are strong elements of 'public good' in CRC Reef's programs, there is also an intention to raise research funds by the Centre becoming a preferred supplier of tropical marine expertise in research, education and training for the national and international markets. Areas of specific expertise among our members include:

- training and advisory services in coastal zone management, marine protected area management;
- monitoring and assessment techniques for coral reefs and related tropical ecosystems;
- extension and education techniques relating to ecologically sustainable uses of coral reefs.

CRC Reef aims to establish international education links to attract students and trainees to CRC Reef-related activities, and to undertake research, training and advisory contracts relevant to the aims of the Centre.

The Centre is seeking new contributing members and associate members as well as funding from external granting bodies. In 2000-01, the Great Barrier Reef Research Foundation was approved by the Board to become a member of CRC Reef in the 2001 financial year.

The Chairman and CEO's Report outlines a number of new initiatives that should increase revenue for the CRC Reef. Although the Great Barrier Reef Research Foundation is still focusing on fund-raising, and has yet to begin funding major research programs, the Foundation has sought CRC Reef's assistance in project management of the crown-of-thorns starfish program being conducted by two of the Centre's members: the Australian Marine Park Tourism Operators and the Australian Institute of Marine Science.

CRC Reef is committed to developing cost-effective methods for treating ships' ballast water to reduce the risk of introducing exotic species to our ports and coastline. The Centre has been advised that its proposal to the Commonwealth Government for support of the Ballast Water Treatment Consortium project has been approved - this work should begin in 2001-02. The project was developed as a result of research by a CRC Reef doctoral student, Darren Oemcke, who was funded by the Ports Corporation of Queensland.

During the year, the contracts for research on the status of ports and shipping lane habitats progressed through researchers at James Cook University and Queensland Department of Primary Industries.

CRC Reef is committed to developing cost-effective methods for treating ships' ballast water.

Photo: Queensland Port Authority

7. STAFFING AND ADMINISTRATION

There were amendments to the Specified Personnel list during 2000-01 which were approved by the CRC Program. No major equipment items were purchased over the year.

Specified personnel

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

PhD student Mr Jamaluddin Jompa and Dr Laurence McCook inspect settlement plates for coral and algae.

Photo: Rob Parsons

PROFESSIONAL STAFF CONTRIBUTIONS 2000-01

Name	Role	Total % of time	% Spent on research					% Education	% Communication	% Administration
			Program A	B	C	D	Total			
Australian Institute of Marine Science										
Dr A Mitchell	R	100			100		100			
Dr D Burrage	R	15			15		15			
Dr M Furnas	R	100			100		100			
Dr D McKinnon	R	24			24		24			
Ms R Ninio	R	20			20		20			
Ms K Page	R	20			20		20			
Ms E Evans-Illidge	R	5			5		5			
Dr T Done	R	70				65	65	5		
Dr W Skirving	R	81			81		81			
Ms S Duggan	R	30			30		30			
Dr H Sweatman	R	35			35		35			
Dr D Williams	A	30					0			30
Ms M Wakeford	R	14			14		14			
Dr P Doherty	A	22					0			22
Mr C Steinberg	R	13			13		13			
Mr A Thompson	R	20			20		20			
Mr L Trott	R	54			54		54			
Mr A Cheal	R	20			20		20			
Mr P Dixon	R	30			30		30			
Mr I Miller	R	20			20		20			
Mr B Fitzpatrick	R	20			20		20			
Dr J Lough	R	6			6		6			
Dr D Alongi	R	57			57		57			
Dr P Isdale	A	10					0			10
TOTAL (Person Years)		**816**	**0**	**0**	**684**	**65**	**749**	**5**	**0**	**62**
Department of Primary Industries										
Dr S Campbell	R	96			96		96			
Mr C Lunow	R	35		35			35			
Mr A Roelofs	R	46			46		46			
Mr R Yoshida	R	50			50		50			
Mr R Garrett	R	32		32			32			
Mr W Lee Long	R	39			39		39			
Dr N Gribble	R	36		36			36			
Ms S Helmke	R	32		32			32			
Dr J Mellors	R	36			36		36			
Ms C Roder	R	20			20		20			
Dr A Tobin	R	38		38			38			
Ms A Cahill	C	5					0		5	
Ms B Gibbs	A	20					0			20
Mr P Neville	A	10					0			10
Mr C Bishop	A	5					0			5
Mr P Finglas	A	2					0			2
TOTAL (Person Years)		**502**	**0**	**173**	**287**	**0**	**460**	**0**	**5**	**37**
Great Barrier Reef Marine Park Authority										
Dr A Green	R	40								40
Dr A Smith	R	5		5			5			
Dr S Morris	R	3			3		3			
Dr M Devlin	R	7			7		7			
Mr A Skeat	R	2	2				2			
Mr T Stokes	R	2					0			2
Mr M Bishop	R	2		2			2			
Mr J Innes	R	55	40	13		2	55			
Various prof staff	R	5	2				2			3
Dr D Haynes	R	12			12		12			
Mr D Cameron	R	7		7			7			

(continues next page)

A Administration C Communication R Research

Name	Role	Total % of time	% Spent on research					% Education	% Communication	% Administration
			Program A	B	C	D	Total			
Great Barrier Reef Marine Park Authority (continued)										
Ms J Waterhouse	R	7				7	7			
Mr J Brodie	R	10			10		10			
Mr A Chin	R	11				1	1	10		
Mr J Day	R	3	3				3			
Dr A Lewis	R	5				5	5			
Dr D Wachenfeld	R	40					0			40
Ms K Lally	A	5					0			5
Hon V Chadwick	A	10					0			10
TOTAL (Person Years)		**231**	**47**	**27**	**32**	**15**	**121**	**10**	**0**	**100**
James Cook University of North Queensland										
Assoc Prof G Russ	R	20					0	20		
Dr M Fenton	R	10	5				5	5		
Mr I Lawler	R	10			10		10			
Assoc Prof T Hardy	R	30		25			25	5		
Dr L Bode	R	30			30		30			
Prof P Pearce	R	20		20			20			
Dr M Waycott	R	20			10	5	15	5		
Dr A Birtles	R	25		25			25			
Ms F Richards	R	20		20			20			
Dr E Gyuris	R	15		10			10	5		
Dr P Corkeron	R	5			5		5			
Mr P Valentine	R	15		15			15			
Mr C Linfoot	R	25		25			25			
Dr D Roe	R	10		10			10			
Mr N Black	R	20		20			20			
Prof H Marsh	R	10	5				5	5		
Mr P Osmond	R	17		17			17			
Mr V Pullella	R	5		5			5			
Mr D Thomson	R	17		17			17			
Ms K Sharp	R	5		5			5			
Prof M Kingsford	R	5		5			5			
Mr A Hoey	R	5		5			5			
Mr C Ware	R	20		20			20			
Prof D Gardner	R	5		5			5			
Dr D Lee-Ross	R	15		15			15			
Mrs A Sharp	R	25		25			25			
Mr S Peterson	R	1		1			1			
Ms H Penrose	R	50			50		50			
Dr S Greer	R	10	10				10			
Prof J H Choat	R	30		10			10	20		
Prof S Crook	E	5					0	5		
Dr J Collins	E	5					0	5		
Prof N Palmer	A	12					0			12
TOTAL (Person Years)		**517**	**20**	**305**	**100**	**0**	**430**	**75**	**0**	**12**
OTHERS										
Mr D Windsor (AMPTO)	A	10					0			10
Mr D Hutchen (AMPTO)	A	10					0			10
Mr F Pantus (CSIRO)	R	5		5			5			
Dr B McDonald (CSIRO)	R	2.5		2.5			2.5			
Dr A Punt (CSIRO)	R	5		5			5			
Dr A D Smith (CSIRO)	R	2.5		2.5			2.5			
Sir S Schubert	A	10					0			10
Mr T Loveday (QSIA)	A	15					0			15
Dr R Little (FRDC)	R	25		25			25			
TOTAL (Person Years)		**85**	**0**	**40**	**0**	**0**	**40**	**0**	**0**	**45**

A Administration **R** Research **E** Education

Name	Employer	Role	Total % of time	% Spent on research					% Education	% Communication	% Administration
				Program							
				A	B	C	D	Total			
CRC Funded Staff											
Dr R Reichelt	CRC	A	100					0			100
Ms A Norman	JCU/CRC	A	100					0			100
Ms A Tucker	JCU/CRC	A	100					0			100
Ms L Arnell	CRC	A	42					0			42
Ms D Birch	CRC	A	58					0			58
Ms B Barnett	CRC	C	80					0	20	60	
Dr L Goggin	CRC	C	80					0	20	60	
Mr T Harvey	CRC	A	10					0	10		
Mr T Donovan	CRC	A	10				8	8			2
Dr B Mapstone	JCU	R	100		100			100			
Mr G Carlos	JCU	R	10		10			10			
Dr A Jones	JCU	R	100		100			100			
Ms H Penrose	JCU	A	50			50		50			
Dr G De'ath	JCU	R	100	5		5	90	100			
Ms R Partridge	JCU	R	10		10			10			
Mr R Marriott	JCU	R	5		5			5			
Mr J Ackerman	JCU	R	20		20			20			
Mr R Baker	JCU	R	5		5			5			
Mr M Curnock	JCU	R	100		100			100			
Mr J McConochie	JCU	R	100		100			100			
Ms N Marshall	JCU	R	100	100				100			
Mr S Edgar	JCU	R	100	100				100			
Dr K Neil	JCU	R	71		71			71			
Dr L Mason	JCU	R	80	50	30			80			
Ms J Sheaves	JCU	R	43		43			43			
Mr J Cruz	JCU	R	65		65			65			
Dr F Hoedt	JCU	R	41		41			41			
Dr G Moscardo	JCU	R	90		90			90			
Ms L Hawksworth	JCU	R	70		70			70			
Ms A Galletly	JCU	R	50		50			50			
Ms F Richards	JCU	R	100		100			100			
Ms R Saltzer	JCU	R	50		50			50			
Dr G Begg	JCU	R	100		100			100			
Dr D Lou	JCU	R	100		100			100			
Ms A Weibkin	JCU	R	10		10			10			
Dr M Fenton	JCU	R	50	50				50			
Dr M James	JCU	R	33	33				33			
Dr V Hall	JCU	E	90			40		40	20	30	
Dr V Harriott	JCU	E	100				50	50	20	30	
Prof H Marsh	JCU	R	30	15		15		30			
Dr D Williams	AIMS	R	50	10	10	10	10	40	5		5
Dr K Fabricius	AIMS	R	100			100		100			
Dr L McCook	AIMS	R	100			100		100			
Ms S Ghonim	AIMS	R	100			100		100			
Ms M Wright	AIMS	R	100			100		100			
Mr T Stieglitz	AIMS	R	50			45		45			5
Mr M Mahoney	AIMS	R	100			90		90			10
Mr S Delean	AIMS	R	100	100				100			
Dr R Berkelmans	GBRMPA/AIMS	R	100			100		100			
Mr S Hyland	QDPI/QFS	R	100		100			100			
Mr R Yoshida	QDPI	R	21			21		21			
Dr A Tobin	QDPI	R	60		60			60			
Ms M Campey	QDPI	R	100			100		100			
Mr L McKenzie	QDPI	R	100			100		100			
Mr W Lee Long	QDPI	R	50			50		50			
Mr S Campbell	QDPI	R	4			4		4			
Ms C Roder	QDPI	R	80			73		73	5		2
Dr R Coles	QDPI	R	50		15	25		40	5		5
Dr M Rasheed	QDPI	R	96		95			96			
TOTAL (Person Years)			**4014**	**463**	**1550**	**1129**	**158**	**3300**	**105**	**180**	**429**

A Administration C Communication E Education R Research

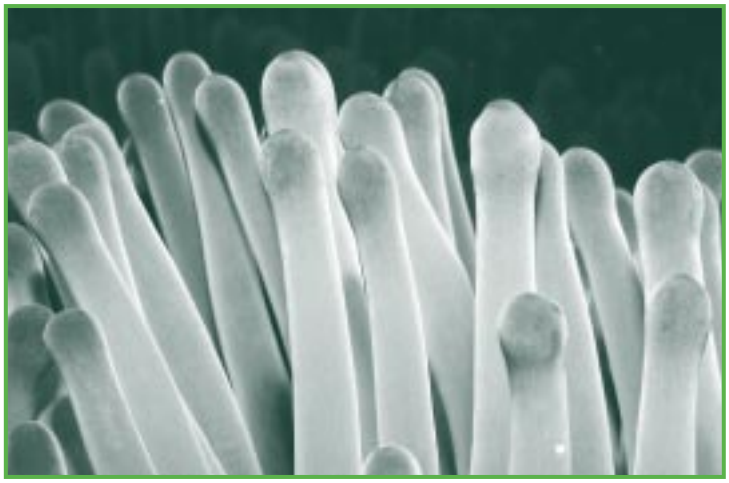
Summary of Contributions in Person Years (100% = 1 Person Year)

Professional staff	Total Equiv. Person Years	% Spent on research					% Education	% Communication	% Administration
		Program							
		A	B	C	D	Total			
Total contributed	21.51	0.67	5.4	11.08	0.85	18.00	0.90	0.05	2.56
Total funded by CRC	40.14	4.63	15.51	11.29	1.58	33.00	1.05	1.80	4.29
GRAND TOTAL	**61.65**	**5.30**	**20.91**	**22.37**	**2.43**	**51.00**	**1.95**	**1.85**	**6.85**
Proportion of total professional staff resources in each activity	100	9	34	36	4	83	3	3	11

Support Staff (Person Years)

(1) Contributed	
Organisation	**No. staff**
AIMS	0.44
QDPI	0.52
GBRMPA	0.20
JCU	0.1
TOTAL	**1.26**

(2) CRC funded	
Organisation	**No. staff**
AIMS	0.12
QDPI	0.20
GBRMPA	0.00
JCU	2.00
TOTAL	**2.32**



Anemone

Photo: Vicki Harriott

8. SCIENTIFIC PUBLICATIONS

Refereed papers

Adams, S.A., Williams, A.J. 2001. A preliminary test of the transitional growth spurt hypothesis using the protogynous coral trout, *Plectropomus maculatus* (Serranidae*:* Epinephelidae). *J. Fish Biol*. 59: 183-185

Adams, S., Mapstone, B.D., Russ, G.R. Davies, C.R. 2000. Geographic variation in the sex ratio, sex specific size, and age structure of *Plectropomus leopardus* (Serranidae) between reefs open and closed to fishing on the Great Barrier Reef. *Can. J. Fish. Aquat. Sci.* 57: 1448-1458.

Anthony, K.R.N. Fabricius, K.E. 2000. Shifting roles of heterotrophy and autotrophy in coral energetics under varying turbidity. *J. Exp. Mar. Biol. Ecol.* 252: 221-253.

Armsworth, P.R. 2000. Modelling the swimming response of late stage larval reef fish to different stimuli. *Mar. Ecol. Prog. Ser.* 195: 231-247.

Armsworth, P.R. 2001. Directed motion in the sea: efficient swimming by reef fish larvae. *J. Theoretical Biol.* 210: 81-91.

Armsworth, P.R. 2001. Effects of fishing on a protogynous hermaphrodite. *Can. J. Fish. Aquat. Sci.* 58: 568-578.

Armsworth, P.R., James, M.K., Bode, L. 2001. When to press on or turn back: dispersal strategies for reef fish larvae. *American Naturalist.* 157: 434-450.

Bastidas, C., Benzie, J.A.H., Uthicke, S., Fabricius, K.E. 2001. Genetic differentiation among populations of a broadcast spawning soft coral, *Sinularia flexibilis*, on the Great Barrier Reef. *Mar. Biol.* 138: 517-525.

Ceccarelli, D.M., Jones, G.P., McCook, L.J. 2001. Territorial damselfish as determinants of the structure of benthic communities on coral reefs. *Oceanogr. Mar. Biol.* 39: 355-389.

Coles, R.G., Lee Long, W.J., McKenzie, L.J., Roelofs, A.J. De'ath, G. 2000. Stratification of seagrasses in the Great Barrier Reef World Heritage Area, Northeastern Australia, and the implications for management. *Biologia Marina Mediterranea* 7: 345-348.

De'ath, G. Fabricius, K.E. 2000. Classification and regression trees: a powerful yet simple technique for the analysis of complex ecological data. *Ecology* 81: 3178-3192.

Fisher, R., Bellwood, D.R., Job, S. 2000. The development of swimming abilities in reef fish larvae. *Mar Ecol Prog Ser* 202: 163-173.

Greenwood, T. 2001. A tough audience: the influence of previous coral reef experience on visitors to Australia's Great Barrier Reef. In: Pforr, C., Janeczko B. (eds) CAUTHE 2001: Capitalising on Research. *Proceedings of the Eleventh Australian Tourism and Hospitality Research Conference.* University of Canberra, Canberra. 7-10 February 2001 pp. 117-131.

Hardy, T.A., Mason, L.B., McConochie, J.D. 2000. A wave model for the Great Barrier Reef. *Ocean Engineering* 28: 45-70.

Hughes, T.P., Baird, A.H., Dinsdale, E.A., Moltschaniwskyj, N.A., Pratchett, M.S., Tanner, J.E., Willis, B.L. 2000. Supply-side ecology works both ways: the link between benthic adults, fecundity, and larval recruits. *Ecology*. 81: 2241-2249.

Inglis, G.J. 2000 Variation in the recruitment behaviour of seagrass seeds: implications for population dynamics and resource management. *Pacific Conservation Biology* 5: 251-259.

Inglis, G.J. 2000. Disturbance-related germination of *Halodule uninervis* seeds. *Biologia Marina Mediterranea* 7: 63-66.

Inglis, G.J., Kross, J.E. 2000. Evidence for systemic changes in the benthic fauna of tropical estuaries as a result of urbanisation. *Mar. Pollut. Bull*. 41: 367-376.

Kim, E., Lee, D. 2000. Japanese tourists' experience of the natural environments in North QLD region – Great Barrier Reef experience. *Journal of Travel and Tourism Marketing* (Special Issue) 9: 93-113.

Lough, J.M. 2000. 1997-98: Unprecedented thermal stress to coral reefs? *Geophysical Research Letters* 27: 3901-3904.

McCook, L.J. 2001. Competition between coral and algal turfs along a gradient of terrestrial influence in the nearshore central Great Barrier Reef. *Coral Reefs: Special Issue* on *Algal Dynamics on Coral Reefs* 19: 419-425.

McCook, L.J., Wolanski, E., Spagnol, S. 2001. Modelling and visualizing interactions between natural disturbances and eutrophication as causes of coral reef degradation. In: Wolanski, E. (ed) *Biological-physical links: Oceanographic processes on the Great Barrier Reef.* CRC Press. 8: 113-126.

McCook, L.J., Jompa, J., Diaz-Pulido, G.D. 2001. Competition between corals and algae on coral reefs: a review of evidence and mechanisms. *Coral Reefs: Special Issue* on *Algal Dynamics on Coral Reefs* pp. 400-417

McKenzie, L.J., Lee Long, W.J., Coles, R.G., Roder, C.A. 2000. Seagrass-Watch: Community based monitoring of seagrass resources.*Biologia Marina Mediterranea*. 7: 393-396.

Michalek-Wagner, K., Bowden, B.F. 2000. The effects of bleaching on the secondary metabolite chemistry of alcyonacean soft corals. *Journal of Chemical Ecology* 26: 1543-1562.

Michalek-Wagner, K., Willis, B.L. 2001. Impacts of bleaching on the soft coral *Lobophytum compactum*. I. Fecundity, fertilization and offspring viability. *Coral Reefs* 19: 231-239

Michalek-Wagner, K., Willis, B.L. 2001. Impacts of bleaching on the soft coral *Lobophytum compactum*. II. Biochemical changes in adults and their eggs. *Coral Reefs* 19: 240-246

Moscardo, G. 2000. Understanding wildlife tourism market segments: an Australian marine study. *Human Dimensions of Wildlife* 5: 36-53.

Moscardo, G., Green, D., Greenwood, T. 2001. How great is the Great Barrier Reef? Tourists' knowledge and understanding of the World Heritage Status of the Great Barrier Reef. *Tourism Recreation Research*. 26: 19-25.

Pearce, P.L., Moscardo, G. 2001. "Been already and done it before". Understanding visitors repeating trips to the Great Barrier Reef. In: Pforr, C., Janeczko, B. (Eds) CAUTHE 2001: *Capitalising on Research. Proceedings of the Eleventh Australian Tourism and Hospitality Research Conference*. University of Canberra, Canberra. 7-10 February 2001, pp 268-280.

Plathong, S., Inglis, G.J., Huber, M.E. 2000. Effects of self-guided snorkeling trails on coral in a tropical marine park. *Conservation Biology* 14: 1821-1830

Shafer, C.S., Inglis, G.J. 2000. Influence of social, biophysical and managerial conditions on tourism experiences within the Great Barrier Reef Marine Park. *Environmental Management* 26: 73-87.

Richins, H., Pearce, P. 2000. Influences on tourism development decision making: coastal local government areas in Eastern Australia. *Journal of Sustainable Tourism* 8: 207-231.

Rouphael, A.B., Inglis, G.J. 2001. "Take only photographs and leave only footprints"?: an experimental study of the impacts of underwater photographers on coral reef dive sites. *Biological Conservation* 100:281-287.

Stewart, L.K., Heap, A.D., Woolfe, K.J. 2000. Evaluating the influence of tidal currents on the distribution of silt in Nara Inlet, central Great Barrier Reef, Australia. *Sedimentary Geology* 136: 59-69.

Books or chapters

Byron, G., Malcolm, H., Thompson, A. 2001. The benthic communities and associated fish faunal assemblages of North East Cay, Herald Cays, Coral Sea. In: Herald Cays Scientific Study Report. *Geography Monograph Series No. 6.* The Royal Geographical Society of Queensland, Brisbane. 168 pp. 33-68 pp.

Fabricius, K.E., Alderslade, P. 2001. *Soft Corals and Sea Fans.* Australian Institute of Marine Science. 272 pp.

Maniwavie, T., Sweatman, H., Marshall, P., Munday, P., Rei, V. 2000. Status of coral reefs of Australasia: Australia and Papua New Guinea. In: Wilkinson, C. (ed) 2000. *Status of Coral Reefs of the World*. Australian Institute of Marine Science. 363 pp.

Marsh, H., Eros, C., Penrose, H., Hughes, J. 2001. *The Dugong (Dugong dugon): Status report and action plans for countries and territories in its range.* IUCN and UNEP.

Punt, A.E., Smith, A.D., Davidson, A.J., Mapstone, B.M., Davies, C.R. 2001. Evaluating the scientific benefits of spatial explicit experimental manipulations of common coral trout, *Plectropomus leopardus*, populations on the Great Barrier Reef, Australia. In: Kruse, G.H., Bez, N., Booth, A., Dorn, M.W., Hills, S., Lipcius, R.N., Pelletier, D., Roy, C., Smith, S.J., Witherell, D. (eds) S*patial Processes and Management of Marine Populations*, University of Alaska Sea Grant, AK-SG-01-01, Fairbanks.

Published conference papers

Dinesen, Z.D. 2000. Performance indicators for management of the GBRWHA: measuring performance of management agencies and industries in a multiple-use marine protected area. In: Done, T., Lloyd, D. (eds) *Information management and decision support for marine biodiversity protection and human welfare: coral reefs*. Proceedings of a workshop, Australian Institute of Marine Science, 6-10 December 1999, pp. 77-80.

Done, T., Lloyd, D. (eds) 2000. *Information Management and Decision Support for Marine Biodiversity Protection and Human Welfare: Coral Reefs*. Proceedings of a Workshop, Australian Institute of Marine Science, 6-10 December 1999, 170 pp.

Done, T., Diop, S. 2000. Background paper: Information management and decision support for marine biodiversity protection and human welfare: coral reefs. In: Done, T., Lloyd, D. (eds) *Information management and decision support for marine biodiversity protection and human welfare: coral reefs.* Proceedings of a workshop, Australian Institute of Marine Science, 6-10 December 1999, pp. 5-12.

Floerl, O., Inglis, G.J. 2000. Marine bioinvasions: quantifying the potential of a transfer vector by analysing its relationship with the donor region. *Proceedings of the ICES Annual Science Conference*, Bruegge, Belgium, 27-30 September 2000, 7 pp.

Heron, M., Burrage, D., Hacker, J. 2000. Sea surface salinity remote sensing campaign on the Great Barrier Reef. Special Session on Sea Surface Salinity at Oceans from Space Symposium. In: Barale, J.F, Gower, R., Alberotanza, L. (eds) *Oceans from Space "Venice 2000"*, Venice, Italy, 9-13 October 2000, Abstracts, European Commission, EUR 19661 EN, pp. 282.

McKenzie, L.J., Campbell, S.J. 2001. *Proceedings of Seagrass-watch refresher workshops, Hervey Bay and Great Sandy Straits*. Queensland Fisheries Service, 7 pp.

Marsh, H. 2000. Dugongs in health and disease. In: *Marine Wildlife: The Fabian Faye Course for Veterinarians.* Postgraduate Foundation in Veterinary Science, University of Sydney. Sea World, Gold Coast 4-8 September 2000, pp. 301-317.

McKenzie, L.J., Lee Long, W.J., Coles, R.G., Done, T., Berkelmans, R., Skirving, W. 2001. Australian perspectives on global climate change and coral bleaching: the 1998 event on the Great Barrier Reef. *JAMSTEC International Coral Reef Symposium*, Tokyo, 23-24 February 2000, pp. 230 – 235.

Roder, C.A. 2000. Seagrass-watch: community based monitoring of seagrass resources. Management session. *Fourth International Seagrass Biology Workshop*, University of Corsica, Corsica, France, 25 September – 1 October 2000.

Moscardo, G., Pearce, P.L. 2000. Seasonality and tropical tourism. In: McKellar, B. (Ed) *Tourism: A strategic industry in Asia and Pacific: defining problems and creating solutions. Proceedings of the Sixth Asia Pacific Tourism Association Annual Conference*, 28 June-1 July 2000, Phuket, Thailand, pp. 91-100, APTA.

Russell, D.J. 2001. Mangrove jack research in Queensland. In: Pearce, M. *Proceedings of the 2001 Northern Fish Stocking Group Workshop*, Ayr, North Queensland, 28-29 April 2001. Queensland Fisheries Service Information Series.

Technical reports

Campbell, S.J., McKenzie, L.J. 2001. Seagrass and algal abundance in the Whitsundays region: *Status report,* Queensland Fisheries Service, 14 pp.

Lee Long, W.J., Roelofs, A.J., Coles, R.G., McKenzie, L.J. 2001. Oyster Point Seagrass Monitoring, 1995 to 1999. *Report to the Great Barrier Reef Marine Park Authority*. (Queensland Fisheries Service), 23 pp.

Lewis, A. 2001. Great Barrier Reef Depth and Elevation Model: GBRDEM. *CRC Reef Research Centre, Technical Report No. 33*. CRC Reef Research Centre, Townsville. 58 pp.

Engelhardt, U., Hartcher, M., Taylor, N., Cruise, J., Engelhardt, D., Russell, M., Stevens, I., Thomas, G., Williamson, D., Wiseman, D. 2001. Crown-of-thorns starfish (*Acanthaster planci*) in the central Great Barrier Reef region. Results of fine-scale surveys conducted in 1999-2000. *CRC Reef Research Centre Technical Report No. 32*. CRC Reef Research Centre, Townsville, 99 pp.

Lawler, I., Marsh, H. 2000. Distribution and abundance of the dugong in Hervey Bay - Great Sandy Straits. November 1999. *Report to the Queensland Parks and Wildlife Service*, August 2000.

Lee Long, W.J., Roelofs, A.J., Coles, R.G., McKenzie, L.J. 2000. Oyster Point Seagrass Monitoring, 1995 to 1999. *Report to the Great Barrier Reef Marine Park Authority*. (Queensland Fisheries Service) 22 pp.

Mapstone, B.D., Davies, C.R., Slade, S.J., Jones, A., Kane, K.J., Williams, A.J. 2001. Effects of live fish trading and targeting spawning aggregations on fleet dynamics, catch characteristics, and resource exploitation by the Queensland commercial demersal reef line fishery. *Report to Fisheries Research and Development Corporation*. Project No. 96/138, 72 pp.

Neale, S., Berkelmans, R. 2000. Long-term Sea Temperature Monitoring Program. *Progress Report to the Ports Corporation of Queensland*, September 2000.

Queensland Department of Primary Industries 2000. Port of Karumba Seagrass Monitoring, Interim Progress Report – Wet Season (March 2000). *Unpublished Report to the Ports Corporation of Queensland*, Queensland Department of Primary Industries: Northern Fisheries Centre, Cairns, 10 pp.

Rasheed, M.A., Roelofs, A.J., Thomas, R. 2000. Port of Weipa Seagrass Monitoring. First survey – April 2000. *Unpublished Interim Report to the Ports Corporation of Queensland*, Queensland Fisheries Service: Northern Fisheries Centre, Cairns, 20pp.

Rasheed, M.A., Thomas, R. 2000. Port of Karumba Seagrass Monitoring, Interim Progress Report – Wet Season (March 2000). *Report to the Ports Corporation of Queensland*. Queensland Department of Primary Industries: Northern Fisheries Centre, Cairns, 10 pp.

Rasheed, M.A., Thomas, R. 2001. Port of Karumba Seagrass Monitoring, Progress Report – October 2000. *Unpublished Report to the Ports Corporation of Queensland*, Queensland Department of Primary Industries: Northern Fisheries Centre, Cairns.

Rasheed, M.A., Roelofs, A.J., Thomas, R., Coles, R.G. 2001. Port of Karumba Seagrass Monitoring – First 6 years. *EcoPorts Monograph Series No. 20*, Ports Corporation of Queensland, Brisbane, 38 pp.

Rasheed, M.A., Roder, C.A., Thomas, R. 2001. Port of Mackay Seagrass, Macro-Algae and Macro-Invertebrate Communities – February 2001. *Report to the Mackay Port Authority*, 29pp.

Roelofs, A.J., Rasheed, M.A., Thomas, R. 2001. Port of Weipa Seagrass Monitoring Baseline Surveys, April and September 2000. *EcoPorts Monograph Series No. 21*. Ports Corporation of Queensland, Brisbane, 38 pp.

Stieglitz, T., Steinberg, C. 2001. *AIMS Data Report: Remote Sensing of Sea Surface Salinity Ground Truthing Johnstone River.* Australian Institute of Marine Science, February 2001, pp. 50 + appendices.

Sweatman, H., Cheal, A., Coleman, G., Fitzpatrick, B., Miller, I., Ninio, R., Osborne, K., Page, C., Ryan, D., Thompson, A., Tomkins, P. 2000. Long-term monitoring of the Great Barrier Reef. *Status Report Number 4, 2000*, Australian Institute of Marine Science, 117 pp.

van Herwerden, L., Benzie, J., Peilow, L., Davies, C. 2000. Microsatellite markers for coral trout (*Plectropomus laevis*) and red-throat emperor (*Lethrinus miniatus*). *Australian Institute of Marine Science Report Number 32*, 14 pp.

9. PUBLIC PRESENTATIONS, PUBLIC RELATIONS AND COMMUNICATION

Project Leader: Associate Professor Vicki Harriott, CRC Reef

Bentley Park College students are learning about seagrass from DPI scientists and will use the information to develop interactive web pages for children around Australia and overseas.

Photo: CRC Reef

Objective:

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

Highlights:

- Dr Terry Done as President of the International Coral Reef Society had major responsibility for the Ninth International Coral Reef Symposium in Bali.
- The new CRC Reef website was launched.
- A collaborative venture with CRC Reef, DPI and Bentley Park College was launched and will develop an interactive website which incorporates research about seagrass.
- CRC Reef organised a science/tourism workshop about local controls for crown-of-thorns starfish.

Public Service Medal

Dr Robert Coles from DPI's Northern Fisheries Centre won one of only six Public Service Medals awarded in Queensland on Australia Day 2001. He was awarded the medal for outstanding service in the protection and management of coastal habitat in Queensland and the Asia-Pacific region.

Dr Coles also attended the Fourth International Seagrass Biology Workshop in Corsica and participated in establishing the World Seagrass Association of which he has been elected inaugural secretary.

Significant conference and seminar presentations

During the last year, CRC Reef researchers and staff presented their research to the scientific and broader community. There were workshops and regional conferences (about 30 presentations with a further 37 at CRC Reef Researcher Days), national conferences (12 presentations) and international conferences (35 presentations), with a total of 119 presentations based on work supported by CRC Reef. They included:

Dr Terry Done, CRC Reef Program Leader, as president of the International Coral Reef Society, had a key role in the Ninth International Coral Reef Symposium, Bali, October 2000, which had 1500 registrants. Seventeen CRC Reef staff, researchers and students attended the conference.

Dr Vicki Harriott was an invited speaker at the International Coral Trade Workshop in Jakarta Indonesia in April. The workshop developed environmentally sustainable practices for the international coral harvest fishery.

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

Dr David Williams, Deputy CEO of CRC Reef, gave a presentation about the returns on investing in the Great Barrier Reef: short and long-term benefits, at the CRC Association conference in Perth in May.

Dr Bruce Mapstone, Program Leader with CRC Reef, and Dr David Williams, Deputy CEO, were invited to address an expert panel on the Queensland Fisheries Service Draft Management Plan for the Great Barrier Reef coral reef fin fish fishery.

Some CRC Reef researchers are members of management advisory committees: Dr Bruce Mapstone (Coral Reef Line Fishery Management Advisory Committee - ReefMAC); Dr David Williams (ReefMAC, GBRMPA's Fisheries RAC, Crown-of-thorns starfish Local Controls Advisory Committee); and Dr Peter Doherty (Harvest Fisheries Management Advisory Committee - HarvestMAC).

CRC Reef Research Days were re-introduced after a five year absence to showcase CRC Reef results to research users. Held in September 2000, 37 students and researchers presented their work to managers, researchers, industry and conservation representatives.

Public relations and communication

A dedicated Extension Manager began with the Education and Communication Program in September 2000. This position was created to address a need highlighted during the review of this project in May 2000. A Communication Coordinator also started at the same time to produce printed and online publications and ensure media coverage for CRC Reef research. In collaboration with other new staff in the Education and Communication Program, the existing communication plan and products have been reviewed.

The CRC Reef logo has been redesigned with an accompanying change of stationery and new look for the newsletter, media releases and website. Corporate clothing has also been developed. As part of the new look, a major new display was launched in November 2000. An eight-page capability statement has also been produced.

Extension activities

Public displays

The CRC Reef Fishing and Fisheries team won the Most Innovative Exhibitor Award at the Townsville Sportfishing Clubs, Fishing and Outdoor Expo 2001 which was held in March. The Fishing and Fisheries team also displayed at the Queensland Seafood Festival in Brisbane in March.

CRC Reef exhibited at the 24th Session of the World Heritage Committee in Cairns in September 2000 and at the CRCA conference in Perth in May.

CRC Reef, AIMS and JCU partnered to provide a display at the Australian Science Festival in Canberra in May. A Great Barrier Reef prize was awarded during the exhibition, sponsored by QANTAS, Pure Pleasure Cruises and the Holiday Inn. During National Science Week in north Queensland, CRC Reef coordinated daily science broadcasts on local ABC radio.

Radio broadcasts

Research by CRC Reef and other science organisations is being broadcast to thousands of listeners in north Queensland. In collaboration with AIMS, CSIRO, DPI, GBRMPA, JCU, Museum of Tropical Queensland, Tropical Savannas CRC and World Wide Fund for Nature, CRC Reef is coordinating weekly interviews with scientists on local ABC radio. One-minute scripted pieces about science written by these organisations are also being broadcast twice daily on 4TO, a commercial radio station in Townsville.

Launch of collaborative project

A joint project between CRC Reef, DPI's Northern Fisheries Centre and Bentley Park College was launched in April, 2001. A total of 120 students from the school will work with scientists to develop an interactive website about seagrasses that can be used by other schools, both in Australia and overseas.

Developments in industry liaison

The Effects of Line Fishing (ELF) 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. In March, eight postgraduate students working in the ELF project organised a student stakeholder workshop which covered the social, economic and biological aspects of reef line fishing on the Great Barrier Reef and highlighted the relevance of this work for managers and end-users. The second workshop of a series of three was held in Townsville in November 2000 to discuss management strategy evaluation (MSE) models which are one of the major outcomes of the ELF Project and will be an invaluable tool for management of Queensland fisheries in the future.

CRC Reef has redeveloped its Task Associate Program to increase liaison between CRC Reef researchers, resource managers and private operators (see Section 3). Induction training in the Task Associate Program has been conducted with staff of GBRMPA, JCU, DPI, AIMS and the tourism industry. The Tourism Task Advisory Group includes tourism researchers and industry task associates. It was formed to help identify the information needs of the tourism industry and to ensure transfer of information between CRC Reef and industry. It has met once and an email network has been maintained.

The Eye On The Reef project is a three year industry-based monitoring program in which volunteers from the marine tourism industry in the Port Douglas/Cairns area collect information about reef health at 25 regularly visited sites. The project has a part-time coordinator based in Cairns and is jointly funded by GBRMPA and CRC Reef. Collection of data has continued in 2000-01, but data entry and report production stalled because of problems with the project database. A new database is being developed (as a donation from AMPTO) and, once completed, the project will proceed rapidly. Due to delays caused by the redevelopment of the database, the project will be extended for another year.

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

Dr Elizabeth Potter, a Fulbright scholar and JCU student presented the results of two studies to the tourism industry in the Whitsundays. She assessed the effectiveness of pre-charter briefings for clients hiring self-skippered bareboats and of interpretive activities on a day-reef tour operation. The positive reception from the tourism industry will help build future cooperative research projects in that region.

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

Dr Annabel Jones from the Fishing and Fisheries team explains fish ear bones to a young visitor at a Fishing and Outdoor Expo in Townsville.

Photo: Rob Parsons


ISSCO

Communication products

New staff in the CRC Reef Communication and Extension Program updated the CRC Reef communication plan and reviewed existing communication products. As a result, the emphasis is shifting from paper products to electronic, and face-to-face communication. The CRC Reef logo has been redesigned with an accompanying redesign of stationery and corporate clothing.

Newsletters

As a result of the review of existing products, the CRC Reef newsletter, CRC Reef News, has been reduced from four to two a year and has been redesigned to incorporate the new CRC Reef logo. The two issues produced in 2000-01 carried a broad coverage of research news and staff updates and were circulated to 1200 people and organisations. Three newsletters from the Effects of Line Fishing (ELF) project were also produced. The ELF newsletter is targeted for fishers, management authorities and researchers and has been a very successful medium to keep industry in touch with the project.

Factsheets

Five Exploring Reef Science fact sheets about CRC Reef research were produced and distributed. Two of these were produced in collaboration with Townsville Port Authority. A brochure stand and set of factsheets has been provided for the foyer of the GBRMPA offices.

Technical reports

Two technical reports were produced and distributed in 2000-2001. By the end of June 2000, a further five technical reports had been submitted for publication, representing the ending of the funding cycle for many projects. Increasingly, these reports will be produced electronically with only a minimum number produced as hard copy.

Brochure

In April 2001, a six-page full-colour glossy brochure was produced about the biology and current status of the crown-of-thorns starfish on the Great Barrier Reef. The brochures were delivered to reef tourism operators for distribution to passengers and to GBRMPA for distribution with education packs. The brochures were also sent out with the CRC Reef newsletter.

Website

In April 2000, the new updated and fully revised CRC Reef website was launched. It is designed to make information about CRC Reef and its activities, as well as more general information about the Great Barrier Reef, more accessible to the scientific and general community.

Media

A media skills training course was offered in March 2001, with 25 staff and students from CRC Reef attending.

In November 2000, the CRC Reef Marine Science Journalism Prize of $1000 was awarded to PhD student Jake Kritzer for an article about the age and breeding habits of coral reef fish.

Media coverage in the past year has focused on several topics. Again, outbreaks of crown-of-thorns starfish received considerable coverage both locally and nationally. The CRC Reef technical report on fine-scale surveys for crown-of-thorns starfish was used to brief the media on current status of outbreaks. The brochure produced by CRC Reef was also an invaluable communication tool.

In 2001, the effects of run-off on the Great Barrier Reef received significant attention in regional and national media, particularly following a World Wide Fund for Nature report card for the Great Barrier Reef.

Other topics which have attracted coverage include the International Marine Projects Activities Centre (IMPAC), the wave atlas and pontoon guidelines, media monitoring of the Great Barrier Reef, seagrass survival, the student/stakeholder workshop, the crown-of-thorns starfish workshop on local controls, and sustainability of coral harvesting.

Media publicity since October 2000 is listed in the table below.

	Local	State/National	International
Print	35	19	5
Radio	25	7	0
Television	23	2	0
Online	-	-	2

10. GRANTS AND AWARDS

Grants

Researcher and organisation	Title of grant	Source	Period of grant	$
Ms M Nursey-Bray, JCU	Internship on abalone and rock lobster illegal and legal fishing and permit allocations	Churchill Fellowship	2 months	
Mr C Pocock, JCU	Doctoral Merit Research Scholarship	JCU	2001	$3,000
Mr G Muldoon, JCU	Augmentative Research Grant	GBRMPA	Dec 99 – Dec 00	$1,500
Dr G Moscardo, JCU	Wildlife tourism	CRC Sustainable Tourism	2000 – 03	$87,000
Dr A Tobin, QDPI	Exploitation dynamics and biological characteristics of east coast spanish mackerel harvested by the recreational and commercial sectors	FRDC	2001 – 03	$163,633
Dr B Mapstone, JCU	Modelling multi-species targeting of fishing effort in the Queensland coral reef Fin-Fish Fishery	FRDC	2001 – 04	$369,129
Dr B Mapstone, JCU	Review of reef line fishing in the eastern Torres Strait	AFMA	2000 – 01	$49,942
Mr A Williams, JCU	GBRMPA Augmentative Research Grant	GBRMPA	March 2000 – Dec 2001	$1,600
Mr J Russell, DPI AFFS	Biology, management and genetic stock structure of mangrove jack (*Lutjanus argentimaculatus*) in Australia	FRDC	1999 – 02	$160,000 per year
Prof H Marsh, JCU	Ecologically sustainable community-based management of dugongs	ARC SPIRT, GBRMPA, Hope Vale Aboriginal Council, Pew Foundation	1998 – 02	$182,000
Prof H Marsh, JCU; P Lavery, Edith Cowan University; N Gales, Conservation & Land Management WA	An integrated dugong telemetry facility	RIEF, JCU, Edith Cowan University, Conservation & Land Management WA	2001	$208,000
Prof H Marsh, JCU; G Stone, New England Aquarium	Effects of acoustic alarms on dugongs	Pew Foundation	2000 – 01	$20,000
Prof H Marsh, JCU; G Stone, New England Aquarium		Pew Foundation		$16,950
Prof H Marsh, JCU	SPIRT	ARC		$15,000
Ms A Hodgson, JCU		Australian Defence Force		$5,000
Ms A Hodgson, JCU	Augmentative Research Grant	GBRMPA	1 year	$1,000
Dr M Furnas, AIMS	Analytical support of monitoring	GBRMPA	2001 – 02	$19,750
Dr K Fabricius, AIMS	Identification and documentation of octocorals in Hong Kong	SWIRE Marine Lab	6 months	$3,600
Prof T Hughes, JCU; M Hay, USA; Dr L McCook, AIMS	Effects of herbivore exclusion on inshore reef communities	ARC	2001	$28,705
Dr G Jones, JCU; Dr L McCook, AIMS	Comparison of mobile and territorial herbivore effects on reef communities	ARC	2001	$21,000

AFFS: Agency for Food and Fibre Sciences
ARC: Australian Research Council
FRDC: Fisheries Research Development Corporation
RIEF: Research Infrastructure (Equipment and Facilities) grant (ARC)
SPIRT: Strategic Partnerships with Industry - Research and Training Scheme (ARC)

Awards

Researcher and organisation	Title of award	Source
Ms A Lashko, JCU	Brian R King Award for Seabird Research	Raine Island Corporation ($4,000 and two trips)
Ms B van Gool, JCU	AMPTO Award, Student Prize	AMPTO ($500)
Dr R Coles, QDPI	Public Service Medal	Commonwealth Government
Dr R Coles, QDPI	CRC Reef Travel Award	CRC Reef ($4,000)
Dr R Coles, QDPI Mr L McKenzie, QDPI	SeagrassNet – Western Pacific (Region IX)	Packard Foundation (~$US80,000)
Ms R Fisher, JCU	Terry Walker Award	Australian Coral Reef Society ($2,500)
Ms R Fisher, JCU	Lizard Island Research Station Doctoral Fellowship	Australian Museum ($12,000)

Ms Bronwyn van Gool receives the CRC Reef Prize for the Best Honours thesis relating to the sustainable use of the Great Barrier Reef, from CRC Reef Extension Manager, Bryony Barnett. The prize was sponsored by AMPTO.

Photo: JCU photography

11. PERFORMANCE INDICATORS

The CRC Reef Agreement for the Centre includes a set of performance indicators as follows.

Objectives of the Centre

Quantitative indicators:

Performance indicator	Target over life of Agreement	Measure 1999–2000	Measure 2000–01
Total resources	$75.4m total resources	$10.5m	$11.7m
Cash resources	$40.4m cash resources	$4.9m	$6.0m
CRC Reef publications transferring research outcomes and technology to industry	70 CRC Reef reports	5	19
Industry seminars	50 seminars/workshops	32	67

Other indicators:

Benefit to CRC Reef: building intellectual capital. An additional 40.1 professional positions (excluding in-kind staff) have been added among the partners as a result of the CRC Reef.

Benefit to user core participants: dissemination of Centre IP to parties. The CRC Reef has facilitated dissemination of Centre IP among the partners (See Section 3,6). Examples are Representative Areas Program (GBRMPA), Long-Term Monitoring Program (AIMS).

Benefit to Australia: actual or future potential benefits. Protection of the values of the GBRWHA, support for sustainable industries, risk analysis for global climate changes affects on coral reefs, evaluation of land-based impacts on GBRWHA (See Sections 4, 6, 9)

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

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

Quality and relevance of research program

Quantitative indicators:

Performance indicator	Target over life of Agreement	Measure 1999–2000	Measure 2000–01
Research program resources	$53.34m total cash and in-kind resources on research program	$8.3m	$9.9m
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	35 8 6 5 4

Other indicators:

Scientific status and user satisfaction.

- Demonstrated research quality: all progress in research tasks is reviewed by the Scientific Advisory Committee (SAC), Task Review Committee (TRC) and Board and proposals are peer-reviewed by at least two researchers external to the CRC Reef.
- Enhanced research reputation: Honours and awards for researchers; see Section 10.
- Election to key positions in scientific bodies: see Sections 3 and 9.
- Demonstrated user satisfaction: user input to planned projects occurs via Users Advisory Group (UAG), SAC, TRC and Task Associates. Survey of satisfaction of partners showed high to very high level of satisfaction (section 3).
- Involvement of research users in deciding and conducting research: user input to planned projects is via 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	Measure 2000–01
Resources devoted to communication and tech transfer	Minimum $2.5m cash and in-kind on communication and tech. transfer	$327,000	$325,000
CRC Reef products	Newsletter 4 p.a. Major update of Centre website every second year Technical reports 10 p.a. Targeted short courses 3 p.a.	7 Major upgrade initiated 5 4	5 Major upgrade completed 2 1
Commercial contracts for CRC Reef expertise	Increasing over life of CRC Total $2.35m	$252,000	$459,000

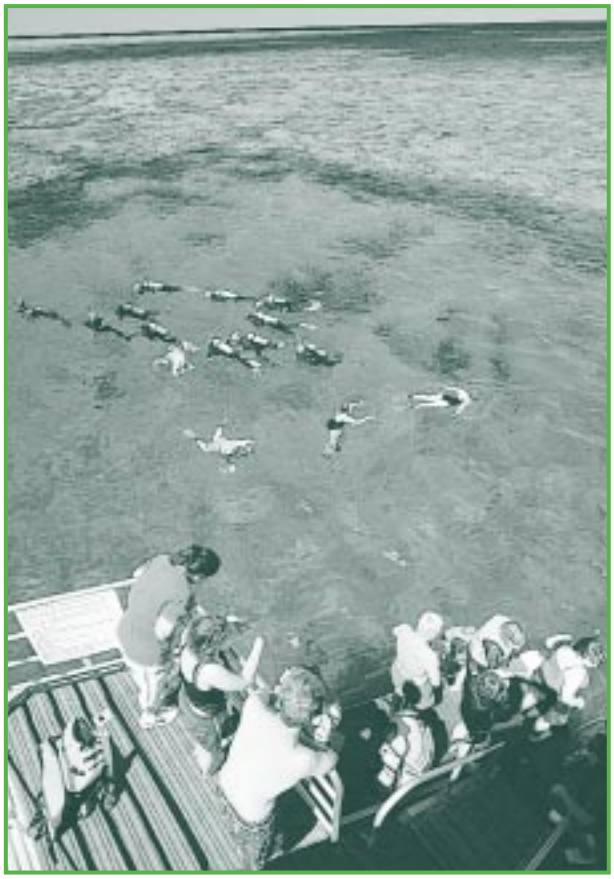
Other indicators:

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

Recognition by general public and stakeholder groups. High public profile and understanding of CRC Reef and CRC Program; see Section 8, 9. Increased exposure via local radio programs.

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

Communication and implementation of CRC Reef research outcomes and technology. A revised detailed CRC Reef Communication Strategy was prepared. Each research proposal now includes strategy and budget for communication; appointment of task associates to each task; UAG meetings; see section 3, 6, 9.



CRC Reef is working with the tourism industry to ensure reef tourism is sustainable.

Photo: Rob Parsons

Collaborative arrangements

Quantitative indicators:

Performance indicator	Target over life of Agreement	Measure 1999–2000	Measure 2000–01
Cooperation in research within Australia and overseas and more efficient use of resources	20 collaborative arrangements	See section 3	See section 3
Research providers contributing resources	$32.1m total cash and in-kind	$4.9m	$5.3m
Research providers FTEs in-kind	18.56 FTE in-kind	34.72	22.67
Collaboration between researchers	80% projects involve 2 or more parties	82%	67%
	Participants workshop 4 p.a.	6	8
	Shared supervision of students 5 p.a.	9 stipend students	28 stipend students have >1 supervisor
Collaboration between researchers and research users	University and non-university supervisors for 25% of postgraduate students	25%	38%
Collaboration with other research institutions	25 projects p.a.	26 institutions	22 institutions
International collaboration	CRC Reef researchers involved in 25 intern. 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	48 institutions 10 visitors or delegations 1 6
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	1
Secondments of research provider staff to industry	3 secondments to industry p.a.	2	0

Other indicators:

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

Education and training

Quantitative indicators:

Performance indicator	Target over life of Agreement	Measure 1999–2000	Measure 2000–01
Training and equipping postgraduate students as future leaders in research and management	35 postgraduates employed	10 employed	11 employed
	30 postgraduates employed in user or related industry	10 employed	10 employed
Increase in knowledge and skill base available.	Workshops and short courses attended by 10 industry and user persons p.a.	See Section 6	See Section 6
Program resources	$2.7m cash and in-kind resources	$443,000	$477,000
Postgraduate program	30 scholarships	28	21
	15 additional students supported	54	61

Other indicators:

Industry training: all new students underwent induction including opportunities for industry collaborations in May 2001. CRC Reef sponsored a Science-Business Fusion short course for students and researchers.

Student performance management: all students were reviewed annually by JCU; and six-monthly and annually as part of CRC Reef Task reviews.

Management structure and arrangement

Quantitative indicators:

Performance Indicator	Target over life of Agreement	Measure 1999–2000	Measure 2000–01
Total cash and in-kind resources in general administration	$5.8m cash and in-kind	$856,000	$1.0m
Additional revenue raised	$5.8m	$270,000	$637,000
New partners	2	Discussions with parties well-advanced	Great Barrier Reef Research Foundation will become a partner in July 2001
Management skills	All program/project leaders to attend one course	4/5 Program Leaders	1 Program Leader

Other indicators:

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

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

Financial management: programs and projects within budget. CRC Reef 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	Measure 2000–01
Annual task reviews	Six-month and annual	Six-month and annual	Six-month and annual
External audit	Annual	Annual	Annual
Audit committee	Quarterly meetings	Board Exec meetings	Board Exec meetings
Annual Board scrutiny of task performance and budget	Quarterly meetings	Quarterly meetings	Quarterly meetings
Reports to Board and CRC Program	Monthly, quarterly and annual reports to Board and CRC Program	Target reached	Target reached

Other indicators:

Efficient and effective performance: satisfaction of parties survey undertaken in 2001.

International consultant advice: see commercial and international section.

Annual report: reports made and submitted on time.

12. BUDGET

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

	Actual 1999/00	Actual 2000-01	Agr'mt 2000-01	Cumulative Total To Date Actual	Cumulative Total To Date Agr'mt	Agr'mt 2001-02	Agr'mt 2002-03	Agr'mt 2003-04	Agr'mt 2004-05	Agr'mt 2005-06	Grand Total Total[1] 7 Yrs	Grand Total Agr'mt 7 Yrs	Grand Total Variance 7 Yrs
AIMS													
Salaries	517	818	718	1,335	1,263	757	757	722	650	609	4,830	4,758	72
Capital	0	0	0	0	0	0	0	0	0	0	0	0	0
Other	1,631	1,784	1,636	3,415	2,953	1,766	1,766	1,442	1,265	1207	10,861	10,399	462
TOTAL	2,147	2,602	2,354	4,749	4,216	2,523	2,523	2,164	1,915	1,816	15,690	15,157	533
AMPTO (REPRESENTING THE TOURISM INDUSTRY & OTHERS)													
Salaries	63	28	40	91	80	40	40	40	40	40	291	280	11
Capital	0	0	0	0	0	0	0	0	0	0	0	0	0
Other	57	19	230	76	267	230	230	230	230	230	1,226	1,417	(191)
TOTAL	120	47	270	167	347	270	270	270	270	270	1,517	1,697	(180)
GBRMPA													
Salaries	174	194	187	368	343	187	187	187	187	187	1,303	1,278	25
Capital	0	0	0	0	0	0	0	0	0	0	0	0	0
Other	229	242	233	471	427	233	233	233	233	233	1,636	1,592	44
TOTAL	403	436	420	839	770	420	420	420	420	420	2,939	2,870	69
JCU													
Salaries	440	406	405	846	845	405	405	405	394	394	2,849	2,848	1
Capital	0	0	0	0	0	0	0	0	0	0	0	0	0
Other	834	755	755	1,589	1,585	755	755	755	739	739	5,332	5,328	4
TOTAL	1,274	1,161	1,160	2,435	2,430	1,160	1,160	1,160	1,133	1,133	8,181	8,176	5
QSIA													
Salaries	283	62	13	345	306	13	13	13	13	13	410	371	39
Capital	0	0	0	0	0	0	0	0	0	0	0	0	0
Other	90	20	20	110	88	20	20	20	20	20	210	188	22
TOTAL	373	82	33	455	394	33	33	33	33	33	620	559	61
QDPI													
Salaries	357	314	294	671	473	311	314	314	314	314	2,237	2,039	198
Capital	0	0	0	0	0	0	0	0	0	0	0	0	0
Other	557	680	508	1,237	861	530	535	535	535	534.6	3,906	3,530	376
TOTAL	913	994	802	1,907	1,334	841	849	849	848	849	6,143	5,569	573
SUNFISH													
Salaries	67	12	0	79	72	0	0	0	0	0	79	72	7
Capital	0	0	0	0	0	0	0	0	0	0	0	0	0
Other	20	5	0	25	12	0	0	0	0	0	25	12	13
TOTAL	87	17	0	104	84	0	0	0	0	0	104	84	20
ANU													
Salaries	0	0	26	0	26	26	26	26	26	26	130	156	(26)
Capital	0	0	0	0	0	0	0	0	0	0	0	0	0
Other	0	0	36	0	36	36	36	36	36	36	180	216	(36)
TOTAL	0	0	62	0	62	62	62	62	62	62	310	372	(62)
CSIRO MARINE													
Salaries	34	23	84	57	117	85	85	77	107	77	488	548	(60)
Capital	0	0	0	0	0	0	0	0	0	0	0	0	0
Other	57	38	116	95	161	118	118	106	147	107	690	756	(66)
TOTAL	91	61	199	152	278	203	203	183	254	184	1,179	1,304	(126)
QFS													
Salaries	50	4	4	54	54	4	4	4	4	4	76	76	0
Capital	0	0	0	0	0	0	0	0	0	0	0	0	0
Other	86	66	66	152	146	66	66	66	66	66	484	478	6
TOTAL	136	70	71	206	200	71	71	71	71	71	560	554	6
TOTAL IN-KIND CONTRIBUTIONS													
Salaries	1,985	1,861	1,771	3,846	3,579	1,828	1,831	1,788	1,735	1,664	12,693	12,426	267
Capital	0	0	0	0	0	0	0	0	0	0	0	0	0
Other	3,560	3,609	3,600	7,169	6,536	3,754	3,759	3,423	3,271	3,173	24,549	23,916	633
GRAND TOTAL													
IN-KIND	5,544	5,470	5,371	11,015	10,115	5,583	5,591	5,211	5,006	4,837	37,242	36,343	900

[1] Total = Cumulative Actual + Outyear 'Estimate'

TABLE 2 : CASH CONTRIBUTIONS ($'000s)

	Actual 1999/00	Actual 2000-01	Agr'mt 2000-01	Cumulative Total To Date Actual	Cumulative Total To Date Agr'mt	Projected (1) Agr'mt 2001-02	Projected (1) 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	260	260	130	130	130	130	130	910	910	0
AMPTO (REP TOURISM INDUSTRY)#	1,102	1,240	1,240	2,342 0	2,342	1,240	1,240	1,240	1,240	1,240	8,542	8,542	0
GBRMPA	665	665	665	1,330	1,330	665	665	665	665	665	4,655	4,655	0
JCU	197	171	135	368	374	141	135	135	135	135	1,049	1,049	(0)
QSIA*	0	0	280	0	280	280	280	280	280	280	1,400	1,680	(280)
QDPI	138	138	138	276	276	138	138	138	138	138	966	966	0
SUNFISH*	0	0	70	0	70	70	70	70	70	70	350	420	(70)
QFS	0	50	0	50	50	0	0	0	0	0	50	50	0
TOTAL CASH FROM PARTICIPANTS	2,232	2,394	2,658	4,626	4,982	2,664	2,658	2,658	2,658	2,658	17,922	18,272	(350)
OTHER													
NEW MEMBERS		0	100	0	100	100	100	100	100	100	500	600	(100)
ASSOCIATE MEMBERS		0	50	0	50	100	100	100	150	200	650	700	(50)
EXTERNAL GRANTS	18	78	100	96	100	100	100	100	100	200	696	700	(4)
COMMERCIAL CONTRACTS	252	459	150	711	300	600	250	350	500	750	3,161	2,350	811
SPONSORSHIP/ DONATIONS		3	50	3	100	100	150	200	250	500	1,203	1,300	(97)
OTHER	0	97											
INTEREST	30	76	20	106	40	20	20	20	20	20	206	140	66
CRC GRANT													
	2,400	2,900	2,900	5,300	5,300	2,600	2,500	2,500	2,500	1,000	16,400	16,400	0
TOTAL CRC CASH CONTRIBUTION													
	4,931	6,007	6,028	10,838	10,972	6,284	5,878	6,028	6,278	5,428	40,737	40,462	275
Cash carried over from previous year													
	960	1,462											
Less unspent balance													
	1,462	1,283											
TOTAL CASH EXPENDITURE													
	4,429	6,221	6,028	10,650	10,972						40,546	40,462	84
ALLOCATION OF CASH EXPENDITURE BETWEEN HEADS OF EXPENDITURE													
SALARIES	2,411	3,374	3,798	5,785	6,913	3,408	3,703	3,798	3,954	3,420	24,068	25,491	(1,423)
CAPITAL	0	0	0	0	0		0	0	0	0	0	0	0
OTHER	2,018	2,847	2,230	4,865	4,059	2,876	2,175	2,230	2,324	2,008	16,478	14,971	1,507
TOTAL	4,429	6,221	6,028	10,650	10,972	6,284	5,878	6,028	6,278	5,428	40,546	40,462	84

(1) The Agreement figure for 2001-02 includes deferred participant contributions from 2000-01 and a revision to the expected income from commercial contracts

(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	Actual 2000-01	Agr'mt 2000-01	Cumulative Total To Date Actual	Cumulative Total To Date Agr'mt	Projected (1) Agr'mt 2001-02	Projected (1) 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	5,470	5,372	11,015	10,116	5,583	5,591	5,211	5,006	4,837	37,242	36,343	900
Cash Expenditure	4,429	6,221	6,028	10,650	10,972	6,284	5,878	6,028	6,278	5,428	40,546	40,462	84
Total Resources Applied to Activities of Centre	9,974	11,691	11,492	21,665	21,180	11,867	11,469	11,239	11,284	10,265	77,788	76,805	984
ALLOCATION OF TOTAL RESOURCES													
Total Salaries (Cash & In-Kind)	4,396	5,234	5,569	9,632	10,493	5,237	5,534	5,586	5,689	5,084	36,762	37,917	(1,155)
Total Capital (Cash & In-Kind)	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Other (Cash & In-Kind)	5,578	6,456	5,831	12,034	10,595	6,630	5,934	5,653	5,595	5,181	41,027	38,887	2,140

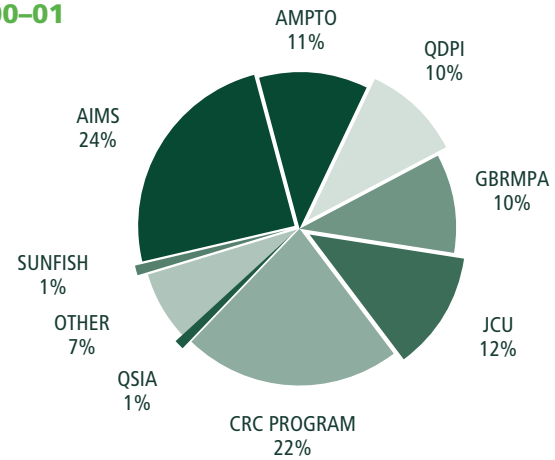
(1) The agreement figure for 2001-02 includes deferred participant contributions from 2000-01 and a revision to the expected income from commercial contracts
(2) Total = Cumulative Actual + Outyear 'Estimate'

TABLE 4 : ALLOCATION OF RESOURCES BETWEEN CATEGORIES OF ACTIVITIES

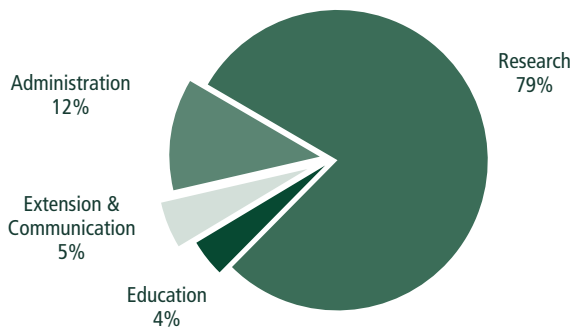
PROGRAM	$ CASH (1) ('000s)	RESOURCE $ IN-KIND (000's)	USAGE STAFF CONTRIBUTED (2)	STAFF FUNDED BY CRC (2)
RESEARCH	4,916	4,965	17.95	33.00
EDUCATION	247	230	0.90	1.05
EXTENSION/TRAINING	312	13	0.05	1.80
ADMINISTRATION	746	263	2.51	4.29
TOTAL	**6,221**	**5,470**	**21.41**	**40.15**

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

TOTAL CASH & IN-KIND CONTRIBUTIONS 2000–01



APPLICATION OF CASH FUNDING 2000–01



NOTES TO AND FORMING PART OF THE FINANCIAL STATEMENT

Basis of accounting

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

Capital purchases

In 2000-01, there were no capital equipment purchases.

Receipts - partners

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

Variation in accounting periods

With the exception of James Cook University, all members of CRC Reef have reported for the period 1 July 2000 to 30 June 2001. James Cook University adopts a four-weekly financial reporting cycle and has reported from 10 June 2000 to 22 June 2001, being the end of the four-weekly cycle immediately prior to 30 June 2001.

Participant cash contributions to the CRC Reef

The Commonwealth Agreement included a cash contribution in 2000-01 of $350,000 attributed to $280,000 from QSIA and $70,000 from Sunfish but subject to FRDC funding. In 2000-01, the Participants did not cite CRC Reef as the administering organisation on applications and so all FRDC projects for 2000-01 were to show funds to the Centre as in-kind contributions rather than cash.

Budget estimates

The Agreement projections for 2001-02 include receipt and expenditure of deferred payments of Participant contributions from 2000-01. The Agreement projections 2002-03 to 2005-06 recorded in Tables 1, 2 and 3 are as contained in Schedule 4, Budget, of the Commonwealth Agreement.

Cash carried over in previous period

At the beginning of the reporting period the CRC Reef 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. The cash held as research advances with the Parties was deemed to have been expended within the current reporting period and is incorporated in the total cash expenditure amount for 2000-01

Unexpended balance

At the end of the reporting period, the CRC Reef held uncommitted funds of $1,283,055 to be allocated for expenditure in 2001-02.

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/QSIA 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 2001

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 2001 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 2001 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: 6 September 2001

Appendix. List of abbreviations

AIMS – Australian Institute of Marine Science
AMPTO – Association of Marine Park Tourism Operators
ANU – Australian National University
AQIS – Australian Quarantine and Inspection Service
ARC – Australian Research Council
ATSIC – Aboriginal and Torres Strait Islander Council
AusAID – Australian Agency for International Development
AUSCORE – Australian Coral Records
BHERT – Business/Higher Education Roundtable
BHP – Broken Hill Proprietary Limited
CALM – Department of Conservation and Land Management
CRC – Cooperative Research Centre
CRCA – Cooperative Research Centres Association
CSIRO – Commonwealth Scientific and Industrial Research Organisation
DPI – Department of Primary Industries
DNR – Department of Natural Resources
ELF – Effects of Line Fishing
EA – Environment Australia
EPA – Environmental Protection Agency
FAO – Food and Agriculture Organization of the United Nations
FRDC – Fisheries Research Development Corporation
GBR – Great Barrier Reef
GBRMP – Great Barrier Reef Marine Park
GBRMPA – Great Barrier Reef Marine Park Authority
GBRWHA – Great Barrier Reef World Heritage Area
GIS – Geographic Information System
GIWA – Global International Waters Assessment
Harvest MAC – Harvest Fisheries Management Advisory Committee
IMPAC – International Marine Projects Activities Centre
IP – Intellectual Property
IPC – Intellectual Property Committee
IWC – International Whaling Commission
IUCN – World Conservation Union
JCU – James Cook University
MAC – Management Advisory Committee
MTQ – Museum of Tropical Queensland
NIWA – National Institute of Water and Atmospheric Research
NTMN – National Tropical Marine Network
NOAA – National Oceanic and Atmospheric Administration, USA
NOO – National Oceans Office
PCQ – Ports Corporation Queensland
QDPI – Queensland Department of Primary Industries
QDNR – Queensland Department of Natural Resources
QFMA – Queensland Fisheries Management Authority
QFS – Queensland Fisheries Service
QPA – Queensland Ports' Association
QPWS – Queensland Parks and Wildlife Service
QSIA – Queensland Seafood Industry Association
RAC – Research Advisory Committee
RAP – Representative Areas Program
ReefMAC – Coral Reef Line Fishery Management Advisory Committee
SAC – Scientific Advisory Committee
TRC – Task Review Committee
UAG – Users Advisory Group
UNEP – United Nations Environment Programme
UQ – University of Queensland
UWA – University of Western Australia
WCPA – World Commission on Protected Areas
WHA – World Heritage Area
WTO TRIPS – World Trade Organization Trade-related aspects of Intellectual Property rights
WWF – World Wide Fund for Nature