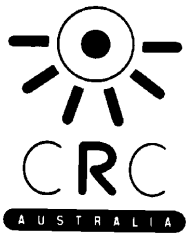
Cooperative Research Centre for the
Great Barrier Reef World Heritage Area

Annual Report 2003-04



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

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1. OBJECTIVES

The CRC for the Great Barrier Reef World Heritage Area (CRC GBR WHA)'s goal is to support and promote the ecologically sustainable development and management of the Great Barrier Reef World Heritage Area (GBRWHA), Torres Strait and tropical reef ecosystems.

CRC Reef Research Centre's aim is to undertake an integrated program of applied research and development, education, training and extension to enhance the viability of reef-based industries and to provide an improved basis for reef management and regulatory decision-making. The strategy is to complement existing research and to improve on research results through collaboration between research institutions; to ensure relevance and effective outcomes through collaboration with industry and management partners; and to develop commercial and international activities. Research performed in the new CRC will be multi-disciplinary, linking across the natural and social sciences. Key outputs from the Centre will include well-researched and authoritative statements on key issues affecting the conservation and use of the GBRWHA.

The specific aims of CRC Reef are:

- To provide innovative technology, information, tools and advice to resource managers, industries and other stakeholders so that in the GBRWHA, human activities are ecologically sustainable with long-term benefits to Australia; industries are profitable and promote world's best practice for ecologically sustainable operations; and GBRWHA values are protected.
- To provide exciting and innovative education and training programs for future leaders in research, industry and management in Australia and overseas.
- To continue the collaborative and cooperative culture created by the first CRC Reef Research Centre between researchers, industry, stakeholders and resource managers.
- To develop alternative sources of support and income which will sustain the Centre in the longer term.

The objective of **CRC Torres Strait** is to be a centre of excellence in research and education in the Torres Strait area and through the participants and other institutions, undertake world-class research and training to support this aim. The aims of CRC Torres Strait are to establish a coordinated and integrated research program to:

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

2. EXECUTIVE SUMMARY

During 2003-04, CRC for the Great Barrier Reef World Heritage Area (CRC GBRWHA) completed its fourth year of operation with some major achievements. Two supplementary programs were implemented, namely the joint venture with Rainforest CRC, called Catchment to Reef, and CRC Torres Strait.

The Boards of CRC Reef and CRC Torres Strait set research priorities and encourage a strong science program, as well as student education and community engagement. In 2003-04, total cash resources of CRC Reef Research Centre and CRC Torres Strait (the Centre) were $9.3m of which $7.38m were spent on research programs supporting 158 research tasks. Of the total cash resources expended on research programs, $3.5m was from the Australian Government CRC Programme, $3.8m cash was from our members and other sources, with an additional $9.2m of in-kind support such as staff time, laboratories and vessels provided. This is a major component of the overall effort on the Great Barrier Reef and in Torres Strait. In 2003-04, the Centre also supported directly, or indirectly, a total of 106 graduate students.

The CRC Reef Board commissioned a review of the Centre's achievements by Dr Don Kinsey: '*CRC Reef has an outstanding performance record. It is appropriately entrepreneurial and has expanded operating horizons. CRC Reef addresses matters of great significance to the GBRWHA and also to a much broader consumer group which adds enormously to the value of CRC Reef.'* (Kinsey review, May 2004).

The major issues confronting the Great Barrier Reef have been the continuing spread of the crown-of-thorns starfish, the effects of poor water quality on coastal reefs in the Wet Tropics and the potential impacts of global warming. CRC Reef continues to deliver research to address these critical issues. CRC Torres Strait began research to address key issues in the region: Harvested Marine Resources, Biophysical Processes, and Marine Systems Management Evaluations and Risks. Education and training will offer postgraduate scholarships as well as secondary or undergraduate and community level training for Torres Strait peoples.

A key role of the Centre has been to coordinate, fund and manage research supporting both the managers and users of the Great Barrier Reef and Torres Strait. For example, the re-zoning of the entire Great Barrier Reef by the Great Barrier Reef Marine Park Authority (GBRMPA) was completed in mid 2004. The re-zoning was a major policy achievement by the GBRMPA which is recognised both nationally and internationally. CRC Reef supported the re-zoning over a number of years by providing information needed to describe the more than 70 separate bioregions of the Reef, by briefing sectoral committees on the status of fisheries and by briefing review panels and Ministerial committees on the role of marine protected areas.

The Centre has also supported the development of some very applied R&D, for example, a pilot plant to treat ships' ballast water is being developed to reduce the risk of introducing exotic marine species via this vector.

In addition to its role of providing information to the public about the health of the Reef and marine resources in the Torres Strait, the Centre place a strong emphasis on enhancing communication among its members and stakeholders. Through newsletters, short brochures and its websites, the Centre provides information on our state of knowledge on key issues.

CRC Reef staff organised a number of conferences in partnership with our member organisations. For example, the conference 'Catchment to Reef: Water Quality Issues in the Great Barrier Reef' that attracted 170 people, and began charting new directions for improving water quality under the Reef Water Quality Protection Plan.

CRC Reef and CRC Torres Strait staff provided expert advice to Management Advisory groups in Queensland and Torres Strait including the National Oceans Office, the Great Barrier Reef Consultative Committee and Queensland Biotechnology Advisory Council.

Centre members are also sought by international groups seeking the research capacity which is now established in the region. The International Maritime Organization (IMO) sought advice from CRC Reef researchers at DPI&F Northern Fisheries Centre on methods of surveying ports of east Africa for exotic species. The International Ocean Institute (IOI)-Australia, with an office in the International Marine Projects Activities Centre (IMPAC) in Townsville, are now coordinating research and education for IOI Centres in south-east Asia from Bangkok, to Jakarta and Fiji. IMPAC has hosted six international training workshops since its establishment with support from the Commonwealth and Queensland Governments and the Great Barrier Reef Research Foundation.

Health of the environment

Clean water is an essential pre-requisite for maintaining the health and resilience of the Reef. The Centre's joint venture with Rainforest CRC, called Catchment to Reef, is a three-year program to develop the tools needed by both scientists and land-managers to implement the Reef Water Quality Protection Plan. The Reef Plan is a long-term project to halt and reverse the decline of water quality in catchments that drain into the Reef region. The Catchment to Reef program will build on the strong past performance of key CRC Reef researchers such as **Dr Miles Furnas** and **Dr Katharina Fabricius** based at the Australian Institute of Marine Science (AIMS).

In addition to helping the drive towards cleaner water, the Centre has supported researchers from Queensland DPI&F who provided advice on dredging programs, conducted exotic species surveys in the economically important ports of the region and monitored the habitats of critical sea lanes.

Health of people using the reef

Irukandji syndrome is caused by stings from small box jellyfish that live in tropical waters. This is a problem for both visitors to the Reef and people who live along the shores of the Reef. CRC Reef researchers continued their work on the ecology of the stingers, and also bred stingers in captivity which is the first step toward development of an anti-venom and will ultimately provide material for further taxonomic and molecular studies.

Supporting managers and sustainable industry

Monitoring

Centre staff completed a web-based system for reef tourism operators to record their field observations. Called 'Eye on the Reef', the program is steered by the Great Barrier Reef Marine Park Authority and is a positive step towards capturing the valuable observations by users of the Reef. **Ms Robin Aiello** from Cairns has played a very important role in establishing this program.

The Centre supported several other community monitoring efforts. **Seagrass Watch**, coordinated by seagrass experts from DPI&F is now an extensive program giving 'ownership' of the marine resources to coastal communities. Seagrass Watch sites have also been established in Torres Strait. The Centre also encouraged development of **Reef Check** in the Reef region. Reef Check is a basic monitoring technique that can be adopted by school students, dive clubs, Indigenous communities and other groups with a strong interest in the health of their Reef. A review of all monitoring programs in the Great Barrier Reef World Heritage Area was published on the Reef Futures website during the year.

CRC Torres Strait researchers completed a major survey of critical habitats adjacent to the Prince of Wales Shipping Lane and Port of Thursday Island which will assist environmental planning, management of the Port of Thursday Island and regional oil spills

Tourism
CRC Reef researchers from James Cook University (JCU) in collaboration with Reef tourism operators, developed protocols for safe swimming with whales which are now in use. The Association of Marine Park Tourism Operators (AMPTO), a member of CRC Reef, plays a key role in setting research priorities for the Centre. These priorities are focussed on maintaining the health of the Great Barrier Reef and ensuring all uses are sustainable. A review by CRC Reef scientist **Assoc Prof Vicki Harriott** found that the offshore tourism industry has relatively low impact on the Reef system. CRC Reef also provided scientific advice to AMPTO and the Great Barrier Reef Research Foundation on designing its control program for the crown-of-thorns starfish.

Fisheries
CRC Reef fisheries experts from James Cook University (JCU) completed a major report on the effects of line fishing on the Reef and provided detailed advice on key species such as mackerel and red bass. JCU's internationally recognised expertise in dugong ecology provided a basis for advice on management of traditional hunting of dugong and turtle in northern Australia and overseas. CRC Torres researchers have analysed historical catch and effort data of commercial islander fishers in the eastern Torres Strait reef line fishery which is now available for assessment of alternate management strategies (funded by Australian Fisheries Management Authority).

Conservation of biodiversity
The Great Barrier Reef achieved its World Heritage status primarily because of the extraordinary biodiversity within its extensive coral reef system. A thorough knowledge of the biodiversity of the Reef is a key to better understanding the reef ecosystem and is a major goal for the Centre.

The Centre's research into biodiversity is very diverse. For example, CRC Reef researchers from JCU discovered links between roseate tern populations in Australia and Japan that led to new conservation measures for these migratory birds. A brochure about coral disease was published on the CRC Reef website which highlighted for the first time the risks that coral disease could pose to the GBR based. These risks were based on experiences in the Caribbean where coral communities have been badly degraded by disease. Other biodiversity-related research by the Centre included:

- Studies of swimmer interactions with dwarf minke whales on the Great Barrier Reef, in collaboration with tourism operators, has led to the first government-regulated swim-with-whales industry in the world.
- Samples of seafloor habitat and marine life at more than 600 sites in the Great Barrier Reef during the first year of the Great Barrier Reef Seabed Biodiversity Project. This $6 million multi-agency collaboration will assist sustainable fisheries and biodiversity conservation objectives within the Great Barrier Reef World Heritage Area.
- Using high-resolution swath surveys, discovered major underwater sand wave crests in the Torres Strait that move 6-13m with change in wind and wave direction and may significantly impact on distribution of seagrass.
- Provided information about the status and condition of Queensland seagrass communities that has been vital for the management of seagrass resources in the Great Barrier Reef World Heritage Area.
- Provided advice about the movement of dugongs to Queensland Parks and Wildlife Service to aid in planning for the Great Sandy Marine Park.

- Briefed the Department of Environment and Heritage about research on coastal dolphins which resulted in a set of recommendations for cetacean research and conservation priorities in Australian waters.

Global climate change

CRC Reef supported researchers from the Australian Institute of Marine Science (AIMS) working with GBRMPA and the United States National Oceanographic and Atmospheric Administration to develop a daily update monitoring system for the Reef, and continued experimental work on the potential for corals to survive warming events. The Reef Futures team published a forecasting modelling tool for exploring possible futures for the Reef in the decades to come if the climate changes as forecast.

The future

Although an independent review of the Centre was very positive, the Centre was advised that its application for renewal to the CRC Programme was unsuccessful in the 2004 round. Therefore, the Centre begins 2004-05 with uncertainty about its future within the CRC Programme beyond 2006. The Boards of CRC Reef and CRC Torres Strait will develop their strategy for the future of the Centre in 2004-05. The value of the cooperative approach to research and education on the Great Barrier Reef and in Torres Strait has been recognised by the Centre's members, government and the public. There is a strong likelihood that the cooperation will continue.

Sir Sydney Schubert, Chairman
Prof Russell Reichelt, CEO

3. STRUCTURE AND MANAGEMENT

Highlights

- Industry Task Associates assigned to all research tasks to ensure enhanced performance of research tasks.
- Annual survey of satisfaction of members reports high satisfaction of members.
- CRC Reef Research Centre Ltd and CRC Torres Strait Ltd reporting against Australian Stock Exchange (ASX) Corporate Governance principles.
- CRC Torres Strait Ltd adopts the manual for Corporate Governance developed by CRC Reef Research Centre Ltd.

The CRC Reef Research Centre and CRC Torres Strait management structures, policies and procedures adhere to good corporate governance practices and guidelines.

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

The CRC Reef Research Centre Ltd together with the CRC Torres Strait Ltd (not-for-profit companies limited by guarantee) deliver the research programs of the CRC for GBRWHA. Directors work in the interests of the company, rather than the particular member who may have nominated them, and make proper and immediate disclosure of any conflict of interest. The Board plays a strong role in setting strategic directions for the Company, including reviews of the full research program every six months and strategic direction annually. An independent Chair presides over the Boards of the two companies.

Integral to the good governance of these two organisations is the governance charter and a code of conduct that applies to all directors and staff, who are expected to observe the highest standards of behaviour and act with integrity, striving at all times to enhance the reputation and performance of the company. The Charter and Code of Conduct was initially developed by CRC Reef Research Centre and was subsequently adopted by the Board of CRC Torres Strait Ltd.

STRUCTURE AND MANAGEMENT

The Cooperative Research Centre for the Great Barrier Reef World Heritage Area (CRC Reef Research Centre Limited) is an incorporated cooperative joint venture established in 1999 by an Agreement between CRC Reef members: Association of Marine Park Tourism Operators (AMPTO); Australian Institute of Marine Science (AIMS); Great Barrier Reef Marine Park Authority (GBRMPA); James Cook University (JCU); Queensland Seafood Industry Association (QSIA); the State of Queensland through its Department of Primary Industries and Fisheries (DPI&F); SUNFISH Queensland Inc; and an Agreement with the Commonwealth of Australia. The Great Barrier Reef Research Foundation (GBRRF) became a member in 2001-02.

The success of a supplementary bid for a program of research in the Torres Strait in 2003 resulted in new participants joining the CRC for the GBRWHA including the Torres Strait Regional Authority (TSRA), Commonwealth Scientific and Industrial Research Organisation (CSIRO), GeoScience Australia (GA), National Oceans Office (NOO) and the Australian Fisheries Management Authority (AFMA). The new participants became associate members of the incorporated entity, CRC Reef Research Centre, and members of the newly established CRC Torres Strait Ltd which was charged with the responsibility of delivering on the Torres Strait Research Program for the Centre.

The management structure for the two entities (CRC Reef Research Centre Ltd and CRC Torres Strait Ltd) is very similar with both companies comprising of a Board and a Chief Executive Officer (CEO), supported by a Secretariat dealing with administrative and financial activities. The Boards are advised by Advisory Groups and Committees.

MEMBERSHIP AND ROLES OF ADVISORY GROUPS AND COMMITTEES

Members of the CRC Reef **Board** and the CRC Torres Strait Board are listed below. The Boards regulate all operations of CRC Reef and CRC Torres Strait including: monitoring and determining strategic development; reporting to the members and the Commonwealth; approving CRC Reef and CRC Torres Strait Programs; the annual budget; financial arrangements and commercialisation of CRC Reef and CRC Torres Strait intellectual property; and appointing the CEO and Program Leaders. The CRC Reef Board meets four times during the year and the CRC Torres Strait Board meets three times a year.

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

CRC REEF

The **CRC Reef Board** comprises an independent Chairman and 10 Directors. Board members at 30 June 2004 were:

Sir S Schubert, BE, BA, GDip (Highways & Traffic), GDip (Bus Admin), independent Chairman
Mr M Burgess, Deputy Chairman, AMPTO
Hon V Chadwick, BA, DipEd, Chair, GBRMPA
Mr P Willers, Acting Director, AIMS
Mr D Hutchen, Chair, AMPTO
Mr P Neville, BEcon (Hons), Executive Director, Fisheries Group, DPI&F
Prof N Palmer, BSc (Hons), PhD, Pro Vice Chancellor (Research & International), JCU
Mr M Pope, LLB
Mr W Sawynok, AssocDip Land Surveying, Research Officer, SUNFISH
Mr D Souter, BSc (Hons), Chief Executive Officer, QSIA
Mrs J Stewart, LLB, Executive Director, GBRRF

The Alternate Board members as at June 2004 were Mr I Gordon (AMPTO), Mr C McKenzie (AMPTO), Mr A Pelt (AMPTO), Dr D Wachenfeld (GBRMPA), Dr P Isdale (GBRRF), Prof H Marsh (JCU), Mr C Bishop (DPI&F) and Mr V Veitch (SUNFISH).

The Board receives comprehensive business reports at each meeting to enable it to assess company performance, financial status and conformance to all requirements of the company, whether they come from legislation or obligation to members and stakeholders. An audit committee reviews the external audit reports once per year and advises the Board accordingly. The Board evaluates its own performance and that of management through an annual survey. A procedure exists for disclosure and recording of conflict of interest (see Corporate Governance). Details of CRC Reef organisational structure are listed below.

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

The **Board Executive Committee** provides guidance to management between quarterly full Board meetings; undertakes the role of Audit Committee; reviews Board performance and operations including remuneration matters; examines funding opportunities; and advises the Board on the above matters. The Committee met three times during the year. Membership at 30 June 2004 was Sir S Schubert (Chairman), Mr P Willers (AIMS), The Hon V Chadwick (GBRMPA), Ms J Stewart (GBRRF) and Prof N Palmer (JCU).

The Scientific Advisory Committee (SAC) provides scientific and technical advice to the Board through the CEO and Task Review Committee on the research and technology transfer aspects of CRC Reef's programs. The committee met on four occasions and membership as at 30 June 2004 was Dr D Williams (Chairman), Prof R Reichelt (CEO); Program Leaders, Social Science Representative, Postgraduate Student, Mr C McKenzie (AMPTO), Dr D Wachenfeld (GBRMPA) and Mrs J Stewart (GBRRF).

The **Task Review Committee** reviews tasks and policy proposals on behalf of members of CRC Reef and advises and makes recommendations to the Board on such matters. The committee met twice and membership at 30 June 2004 was Sir S Schubert (Chairman), Mr P Willers (AIMS), Mr C McKenzie (AMPTO), Dr D Wachenfeld (GBRMPA), Mrs J Stewart (GBRRF), Prof N Palmer (JCU), Ms A Clarke (DPI&F), Mr D Souter (QSIA) and Mr V Veitch (SUNFISH).

The **Intellectual Property Committee** provides advice to the Board through the CEO and membership as at 30 June 2004 was Prof R Reichelt (Chairman), Ms S Riding (AIMS), Ms F McDonald (GBRMPA), Mr J Taylor (JCU) and Dr P Isdale (UQ).

The **Indigenous Working Group (IWG),** with a majority of Indigenous representatives, advises CRC Reef on developing and implementing the Indigenous Engagement Strategy. The IWG met twice during the year to advise on appropriate communication channels and the development of protocols for CRC Reef researchers engaging with Indigenous people. Members at 30 June 2004 were Ms B Barnett (Extension Manager, CRC Reef), Ms L Craig (Indigenous Conservation Coordination Unit, EPA); Ms M George (Wulgurukaba Aboriginal Corporation), Mr V Jose (National Secretariat of Torres Strait Islander Organisations), Ms M Nursey-Bray (CRC Reef researcher), Dr S Pannell (Program Manager, Rainforest CRC), Mr P Rist (Girringun Aboriginal Corporation), Mr C Turner (Indigenous Policy Liaison Unit, GBRMPA).

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

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

CRC TORRES STRAIT

The **Board of CRC Torres Strait** comprises an independent Chairman and nine Directors. Board members at 30 June 2004 were:

Sir S Schubert, BE, BA, GDip (Highways & Traffic), GDip (Bus Admin), independent Chairman
Ms A Clarke, BA (Jurisprudence), DPI&F
Mr M Fordham, TSRA
Dr C Foster, PhD, Geoscience Australia
Mr J Gunn, BSc (Hons), CSIRO
Mr T Kris, TSRA
Prof N Palmer, BSc (Hons), PhD, Pro Vice Chancellor (Research & International), JCU
Prof R Reichelt, PhD, FAICD, CRC Reef
Mr L Roberts, AFMA
Mr S Sullivan, NOO

The Alternate Board members as at June 2004 were Dr S Troy (NOO), Prof N Pankhurst (JCU), Mr C Bishop (DPI&F) and Mr R Cooper (GA).

The Board receives comprehensive business reports at each meeting to enable it to assess company performance, financial status and conformance to all requirements of the company, whether they come from legislation or obligation to members and stakeholders. A procedure exists for disclosure and recording of conflicts of interest (see below). Details of CRC Torres Strait organisational structure are outlined below.

The Board of the CRC Torres Strait are advised by the **Torres Strait Scientific Advisory Committee** (SAC) which provides scientific advice to the Research Director. The Research Director of CRC Torres Strait is a member of a number of important stakeholder and community advisory bodies in the Torres Strait including the Torres Strait SAC and the **Torres Strait Local Agencies Coordination Committee** (TSLACC). Prof R Reichelt is Chairman of the **Torres Strait Fisheries Management Advisory Committee**. Their involvement provides a conduit for the Board to receive briefings on issues pertinent to conducting research in the Torres Strait.

CORPORATE GOVERNANCE

CRC for GBRWHA hereafter referred to the Centre (encompassing both CRC Reef Research Centre Ltd and CRC Torres Strait Ltd) have developed structures, policies and procedures with due recognition to the importance in adhering to good corporate governance practice and guidelines. The Company has documented this in a Corporate Governance Charter that is approved by the Board.

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

Principle 1: Lay solid foundations for management and oversight

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

Principle 2: Structure the Board to add value
During the financial year, the Boards of CRC Reef comprised 10 non-executive directors (including the Chairman) and the Board of CRC Torres Strait comprised nine non-executive directors. The names and details of the directors in office at 30 June 2004 are listed above.

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

The Boards consider that all directors work in the interests of the Company. There are established policies in place to ensure conflicts of interest are fully disclosed and the disclosure is recorded in the minutes of the meeting. Where appropriate, the director is excluded from all discussions and considerations of the matter by the Board, and Declaration of Interests is a standing agenda item for all Board Meetings. The Chairman of the Centre is an independent director, and the role of the Chairman and the CEO are not exercised by the same person.

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

Principle 3: Promote ethical and responsible decision-making
The Centre has established a code of conduct which is signed off by all employees. All directors, managers and employees of the Centre are expected to observe the highest standards of behaviour and act with integrity, striving at all times to enhance the reputation and performance of the Company.

Principle 4: Safeguard integrity in financial reporting
The CEO of the respective companies states to the Board in writing that the Company's financial reports present a true and fair view in all material respects of the company's financial condition and operational results are in accordance with relevant accounting standards.

An Audit Committee meets once a year to consider the performance of the Centre and reviews external audit reports on the Centre's finances. The committee comprises of five non-executive directors. The Chairman of the Committee is also the Chairman of the Board. The Executive of the respective organisations also attend the meetings. Minutes of all committee meetings are provided to the Board.

Principle 5: Make timely and balanced disclosures
The Centre makes quarterly reports of its financial status to the Commonwealth government, and more detailed business reports are provided to Directors at respective Board meetings of the Companies.

Principle 6: Respect the rights of shareholders
The Centre has members rather than shareholders. The Centre keeps the members informed of its performance and all major developments in an ongoing manner. Information is communicated to members through its publications: annual financial report –distributed to all members; annual CRC Reef report – distributed to all members; CRC Reef newsletters, brochures and technical reports – wide circulation among members and others.

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

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

Principle 7: Recognise and manage risk
The Centre reviews its priorities and overall strategies at least once per year. The Centre has established policies and operational procedures for its administration and funding of research. Research work is conducted under individual contracts with research providers, where the contract conditions make detailed provisions for management of intellectual property, health and safety, expenditure, ethical conduct and publications.

Principle 8: Encourage enhanced performance
The Boards undertake an annual review of their performance and that of the Company's executive management through a Board Satisfaction survey.

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

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

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

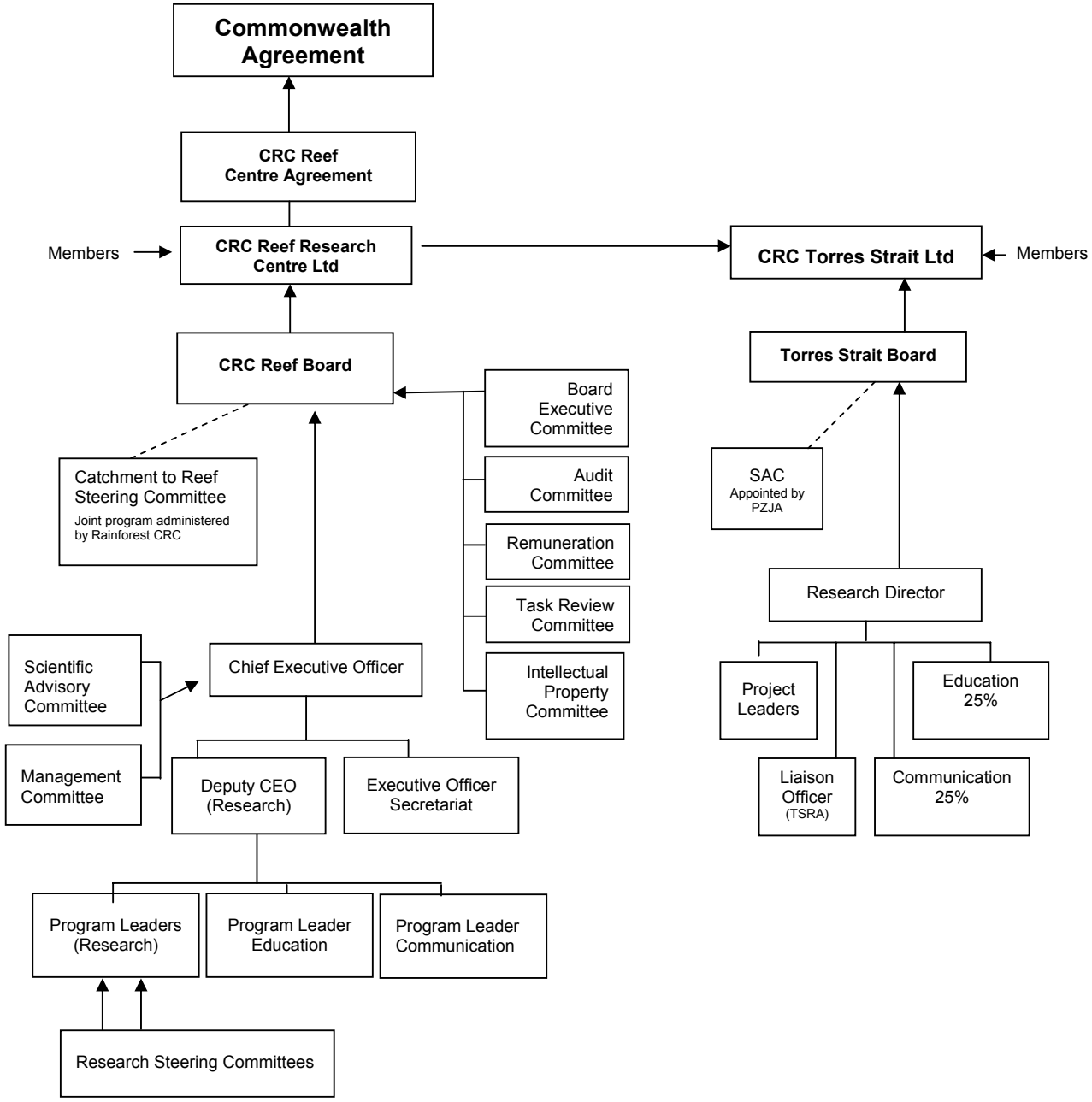
Principle 9: Remunerate fairly and responsibly
In accordance with the not-for-profit nature of the companies, the constitutions provide that no remuneration will be payable to directors other than the Chairman. The members of the Company determine the remuneration of the Chairman. A remuneration committee reviews the emoluments of the Chairman and makes recommendations to the members of the Company for consideration at a meeting of the members.

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

The Remuneration Committee comprises of three non-executive directors (the Chairman of the Board is not a member of the Committee). The Chairman of the Committee reports to the Board on the proposed recommendations in relation to the CEO's remuneration. The CEO, who makes an annual review of both performance and remuneration, determines remuneration of other employees.

Principle 10: Recognise the legitimate interests of stakeholders

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



4. COMMERCIALISATION, TECHNOLOGY TRANSFER AND UTILISATION

Highlights

- The level of commercial contracts has increased from approximately $250,000 in 1999-2000 financial year to $2.1m in 2003-04.
- Research by **Professor Helene Marsh** was used as rationale to establish a Commonwealth Working Party on the management of traditional hunting of threatened species and is being used to advise this working party and GBRMPA.
- Strong links found between populations of roseate terns in Australia and Japan which has led to the listing of this bird on the Japan-Australia Migratory Bird Agreement (JAMBA) to ensure this species is managed across national boundaries.
- Work on the social assessment of commercial fishers was used as the basis for the structural adjustment package for re-zoning of the GBR Marine Park.
- The Centre employs nine Natural Resource Management (NRM) facilitators working in Queensland regions who will support and communicate Commonwealth natural resource management policies and initiatives at a regional scale with a view to forming partnerships.

Objective

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

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
- provision of consulting, training and advisory services.

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

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

The Education Program is another important component of the strategy (see Section 6). Postgraduate students receive training in generic skills useful to industry and work closely with industry in the Task Associate Program. The employment of a large percentage of graduates with industry and research partners also facilitates transfer of research results.

Centre researchers are very active in presenting research findings at conferences and seminars (Section 9). The Centre produces technical reports as well as communication products in plain language so results are accessible to the broader community. The CRC Reef, CRC Torres Strait,

IMPAC and Reef Futures websites are also a critical mechanism to ensure utilisation and application of research results (Section 4, 8, 9). These are highly regarded by users.

Consultancies and third party projects

There has been an expansion in the number of third party funded research tasks and consultancies conducted by Centre researchers. Many tasks were funded by external sources (see Section 5 for a full list), including:

- An examination of the exploitation dynamics and biological characteristics of east coast Spanish mackerel (funded by FRDC);
- Development of a research and monitoring initiative for Commonwealth Marine Protected Areas (funded by DEH);
- Baseline surveys and monitoring program development by DPI&F researchers for the Port of Cairns (funded by Cairns Port Authority);
- Development of molecular diagnostic techniques for the Asian green mussel to rapidly identify introduced pests funded by Australian Department of Agriculture, Fisheries and Forestry (DAFF). The work will contribute to the collaborative management strategy being developed by Cairns Port Authority, DAFF, CCIMPE, EPA and DPI&F (funded by DAFF);
- CRC Reef researchers are providing Woodside Petroleum with crucial wave information to ensure the safety of offshore oil production platforms in Arafura and Timor Seas and on the Northwest Shelf. The Marine Modelling Unit based at JCU was the only group that could do this work at the level of sophistication required.
- A coastal flooding and frequency study conducted by the JCU Marine Modelling Unit for EPA and the Australian Bureau of Meteorology;
- Collation and review of Islander commercial catch history in the Eastern Torres Strait Reef Line Fishery (funded by TSRA and AFMA).

Natural Resource Management Facilitators

The Commonwealth and States have established a national network of Natural Resource Management (NRM) Facilitators across Australia to underpin the delivery of the Natural Heritage Trust and other Commonwealth NRM Programs at all levels including state, regional and local levels, and particularly in support of regional arrangements. The NRM Facilitator Network consists of 30 NRM Facilitators in all States and Territories, 13 Indigenous Land Management Facilitators, 60 Regional NRM Facilitators and 8 Local Government NRM Facilitators.

CRC Reef Research Centre Ltd employs nine NRM facilitators working in Queensland regions who are outposted in: Torres Strait, Cape York, Northern Gulf, Southern Gulf, Burnett-Mary, Mackay-Whitsunday/Fitzroy, Burdekin-Wet Tropics, South-West NRM/Balonne-Maranoa/Border Rivers and South East Queensland/Western Catchments. The primary purpose of the strategic regional positions is:

- to provide leadership and support in order to increase the level and effectiveness of community and other stakeholder involvement in regional natural resource management processes and in particular the delivery of the Natural Heritage Trust and the National Action Plan for Salinity and Water Quality; and,
- support and communicate Commonwealth natural resource management policies and initiatives at a regional scale with a view to forming partnerships and mutual understanding;
- provide an avenue for direct community feedback on natural resource management programs and issues to the Commonwealth Government.

Examples of organisations that use Centre research and basis of interaction.

TYPE OF RESEARCH USER	PRINCIPAL RESEARCHER AND DESCRIPTION OF ACTIVITIES
CORE PARTICIPANT	
GBRMPA	**Prof Helene Marsh's** (Program A) research was used as rationale to establish a Commonwealth Working Party on the management of traditional hunting of threatened species and is being used to advise this working party and GBRMPA. **Prof Helen Ross** (A3.3) works closely with GBRMPA to develop co-management arrangements at regional and local scales. **Prof Helene Marsh** (A4.2) facilitated a workshop with GBRMPA, government agencies, universities and Indigenous owner groups to review and refine methods for monitoring dugong populations. **Ms Amanda Hodgson** (C1.4.1S) has provided advice to GBRMPA about the response of dugong to boat traffic supporting a go-slow campaign for recreational vessels. **Dr Gianna Moscardo** (B2.2) has undertaken a large-scale telephone survey of recreational use of the GBRMP which GBRMPA will use to assist future management decisions. **Dr Miles Furnas** (C2.1) continues to provide water quality advice to GBRMPA which has been used as part of the justification for the GBR Water Quality Protection Plan. **Mr Len McKenzie** (C1.3) has provided information on the status and condition of Queensland seagrass communities that has been vital for the management of seagrass resources in the GBRWHA. **Dr Miles Furnas** (C2.1) and **Dr Katharina Fabricius** (C2.2) have collected data on run-off and water quality in the GBR catchment which has been vital to the creation of the Reef Water Quality Protection Plan. **Mr Stuart Kininmonth** (D4.1) has developed the interactive Reef Futures Website, which has been used by GBRMPA to visualise temperature fluctuations on the Reef and examine information from long-term monitoring.
DPI&F	**Ms Vimoksalehi Lukoschek (C1.4.1S)** has provided advice about distribution of seasnakes to DPI&F and CSIRO to help assess and mitigate sea snake bycatch in Australia's northern prawn trawl fisheries. **Mr Rod Garrett** (B4.5) provided results to DPI&F that have been used in preparing a draft risk assessment for tropical east coast sharks.
AIMS/JCU	**Mr Stuart Kininmonth** (D4.1) developed centralised storage systems for Geographic Information System (GIS) data at both AIMS and JCU.
GOVERNMENT	
LOCAL GOVT	Seagrass-Watch, co-ordinated by **Mr Len McKenzie** (C1.3), contributed information to regional coastal plans for the Wet Tropics, Whitsundays and Mackay, and Shire Council strategic plans. **Ms Lisa-ann Gershwin** (C6.1) assisted Broome Shire Council to develop a proactive Irukandji jellyfish sampling and management plan at Cable Beach. **Dr Britta Schaffelke** (D3.1) coordinated the development of the CRC Reef Monitoring Database which has been used by Townsville City Council to review past monitoring activities and facilitate future planning of monitoring especially under the Council's Creek to Coral initiative.

TYPE OF RESEARCH USER	PRINCIPAL RESEARCHER AND DESCRIPTION OF ACTIVITIES
GOVERNMENT	
STATE GOVT	**Ms Melissa Nursey-Bray** (A1.2.2S) was asked to comment on the NT draft Turtle and Dugong Management Framework. **Mr James Sheppard** (C1.4.3.1a) provided advice about the movement of dugongs to QPWS to aid in the planning process for the Great Sandy Marine Park. **Ms Elizabeth Dinsdale** (A2.1.3S) reviewed the condition of the coral reefs on the Abrohlos Islands for Fisheries WA. **Mr Len McKenzie** (C1.3) provided information on Queensland's seagrass resources for the Queensland State of the Environment report. **Dr Janice Lough** (C3.1) and colleagues reported to the State of Queensland Greenhouse Taskforce on the potential effects and strategies to mitigate global climate change and coral bleaching on the GBR. **Dr Britta Schaffelke** (D3.1) has overseen the development of the CRC Reef Monitoring Database which has been used by the Queensland EPA to inform planning of future water quality monitoring, especially to support the Reef Water Quality Protection Plan.
AUSTRALIAN GOVT	**Mr Guido Parra** (C1.4.5S) briefed the Dept of Environment and Heritage about his research on coastal dolphins which resulted in a set of recommendations for cetacean research and conservation priorities in Australian waters. **Professor Tom Hardy** (B3.0) was commissioned to provide information about storm surges to the Australian Bureau of Meteorology and the Queensland EPA to assist future planning for Hervey Bay and the Sunshine Coast. **Mr Will Oxley** (C1.12) reported to the Department of Environment and Heritage on the biological status of Elizabeth and Middleton Reefs Marine National Nature Reserve.
INDUSTRY	
PORTS	**Dr Michael Rasheed** (B1.3) provided results of port monitoring programs to port authorities who used them extensively in planning and reviewing port activities. **Dr Rob Coles** (B1.0.2) conducted critical habitat surveys adjacent to high risk areas of shipping lanes in the GBR, which will be incorporated in the Oil Spill Response Atlas being developed by the Australian Maritime Safety Authority. **Dr Kerry Neil** (B1.0.3) has undertaken baseline surveys of ports which are of extreme benefit to port authorities to assist in environmental management. **Mr Ben Radford** (D2.1.1S) developed coral and sediment models which have been used by both Apache Energy Pty and Hamersley Iron to assess the impacts of drilling and dredging activities in ports in Western Australia.
TOURISM	**Dr Alastair Birtles** (B2.8) worked with GBRMPA and tourism operators to develop a code-of-practice for swim-with-whale activities on the northern GBR. **Ms Lisa-ann Gershwin** (C6.1) worked with Surf Life Saving Queensland to identify stingers and ensure that beaches are temporarily closed at high-risk times during stinger season to protect swimmers. **Dr Britta Schaffelke** (D1.1) in conjunction with tourism operators and managers, developed Eye-on-the-Reef a web-based monitoring program that reports back to industry about trends at their sites.

TYPE OF RESEARCH USER	PRINCIPAL RESEARCHER AND DESCRIPTION OF ACTIVITIES
INDUSTRY	
FISHING	**Dr Gavin Begg** (B4.1a) and his team provided advice to the Queensland Fisheries Service (QFS) to assist in developing management plans for the Coral Reef Finfish fishery, the east coast Spanish mackerel fishery, and Queensland Inshore fishery. **Mr Ross Marriott** (B4.12S) has provided results about red bass life history to QFS which have supported the decision to protect this species.
INTERNATIONAL	
	Professor Marsh's (Program A) report to the United Nations Environment Programme (UNEP) (2002) on the global status of dugong is being used (partially sponsored by CRC Reef) has been very important to the argument in a court battle between the US Government (Donald Rumsfeld) and US and Japanese Conservation Groups. The court has been asked to rule on whether the *US National Historic Preservation Act* can be used to stop the US Military using an offshore landing facility. The facility is scheduled to be built in dugong habitat off Okinawa, Japan, by the Japanese Government following an agreement between the President of the United States and the Prime Minister of Japan. **Ms Anna Lashko** (C1.4.2.1S) found links between roseate terns in Australia and Japan which has led to the listing of this bird on the Japan-Australia Migratory Bird Agreement (JAMBA) to ensure this species is managed across national boundaries. **Mr Geoffrey Muldoon** (E2.1.16/1S) has been collaborating to develop an International standard of best-practice for the live reef food fish trade funded by the Asia Pacific Economic Cooperation (APEC) and the MacArthur Foundation. **Mr Len McKenzie's** (C1.3) long-term monitoring of Green Island seagrass meadows contributes to the Global Seagrass Monitoring Network research which can be accessed at www.seagrassnet.org

Case studies demonstrating successful technology transfer

Introduced marine pests

In Australia, introduced marine organisms are threatening the ecological and economic value of our unique coastal marine ecosystems. Most Non-Indigenous Species (NIS) are believed to be unintentional introductions associated with shipping and mariculture activities. Effective integrated pest management requires monitoring (for new introductions and the spread of previous introductions), strategies for preventing new incursions, and options for managing any incursions that occur. Centre researchers are undertaking a series of research projects that are addressing each of these requirements to better our capability of mitigating the risks associated with marine pest incursions.

Monitoring for the introduction and/or spread of NIS is being addressed through the conduct of baseline and targeted marine pest surveys of Australian ports at high risk of marine pest introductions. The invasive Asian green mussel (AGM) was detected during the baseline survey of Cairns port and subsequent targeted surveys have determined the spatial extent of the infestation and assisted in the development of an appropriate eradication response. A CRC Reef project which is developing genetic tools for detecting larvae of AGM is also assisting in improving our capability of managing this pest incursion.

In addition, NIS monitoring strategies that can be implemented by industry to provide early warning of NIS incursions, or monitor the spread of taxa, have been developed through CRC Reef student projects on ship fouling organisms, modelling of port hydrodynamics and larval settlement patterns.

This research is providing a greater understanding of the causes and movement of introduced marine pests thereby allowing us to develop management strategies that prevent or minimise the risk of new introductions and/or NIS spread following introduction.

Research users: Ports industry, shipping industry, AQIS, QEPA, DPI&F, GBRMPA, IMO GloBallast, DAFF and CSIRO.

Critical habitats and shipping

The Centre's program of seagrass and benthic habitat surveys for Queensland ports and shipping lanes has continued to expand and now includes eight ports - Mourilyan, Cairns, Thursday Island, Mackay, Karumba, Weipa, Skardon River and Gladstone as well as several high risk areas of shipping lanes passing through the GBR. The surveys were developed in close consultation with the relevant port authorities and shipping management agencies and have received significant financial contributions from port and shipping agencies including Ports Corporation of Queensland, Mackay Port Authority, Trinity Inlet Waterways, Gladstone Port Authority, Cairns Port Authority and Australian Maritime Safety Authority.

Port authorities have used results of the monitoring programs extensively in planning and reviewing their port activities. The number and geographic spread of Queensland sites now being monitored has enabled the researchers to determine regional scale changes in abundance and distribution of seagrass. This has assisted in distinguishing broader climatic causes of change from local human-induced changes. The Geographic Information System of port benthic habitats has been used by port authorities to plan port expansions and maintenance programs that will have minimal impacts on the ports sensitive marine habitats. Surveys of habitats adjacent to high accident risk areas of shipping lanes are soon to be incorporated into AMSA's Oil Spill Response Atlas to assist in response to potential oil spills and shipping accidents.

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

Research users: Ports industry, shipping industry, DPI&F, AMSA, GBRMPA.

Fishing and fisheries

The Fishing and Fisheries (F&F) Project involves several inter-related research tasks focused on important commercial, recreational and Indigenous fisheries of the GBR and Torres Strait. Data and information from these tasks have been used in the development of State fisheries management plans for coral reef fin fish, Spanish and spotted mackerel and east coast shark; DEH and DPI&F stock assessment and monitoring requirements; and species descriptions for NOO in the Northern Planning Area. F&F researchers continue to expand the breadth and scope of the Project's research directions, collaborations and liaison activities.

Research users: GBRMPA, DPI&F, NOO, AFMA, TSRA, Western Pacific Regional Fishery Management Council, commercial and recreational fishing groups, conservation groups.

Water quality
CRC Reef and CRC Torres Strait staff and researchers have continued to play pivotal roles in providing information about water quality in the GBR lagoon. **Dr Miles Furnas** and **Professor Russell Reichelt** were members of the Reef Protection Plan Science Panel responsible for advising the Queensland Government on water quality improvement targets. First results of a multidisciplinary study assessing inshore coral reefs along gradients of water quality in areas of river run-off have provided insight into the way that nutrients, sediments and the herbicide diuron that are washed off the land affect reefs. This research has also led to the development of a new method which helps scientists and managers to weigh evidence and assess causes and impacts in complex ecological systems, and to communicate such findings to the public. Significant progress was also made in the ongoing research assessing the links between changing water quality and increased frequencies of outbreaks of crown-of-thorns starfish.

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

Coral bleaching, climate change and modelling the future
An assessment of near real-time heat stress and risk of coral bleaching on Australian reefs is now available on the ReefFutures website. Web users get a map of how much hotter or colder than normal sea temperatures are for the whole world, and a detailed 'hot spot' map for just Australia. These maps, which are excellent predictors of the risk of coral bleaching, are produced by collaborators at NOAA in the USA. The website automatically updates with the latest information for the entire Australian coast from NOAA, and from AIMS' network of automatic weather stations. Another click on the same page gets you to the ReefFutures simulator, which shows how the state of the reef in future will depend not only on the rate of global warming, but also on our success in preventing seaweeds taking over reefs, through improving water quality and ensuring there are plenty of grazing organisms on the reefs. These are two key requirements for ecological resilience – the capacity of the reefs to bounce back after damage of any sort – be it coral bleaching, crown-of-thorns starfish impact, cyclone damage or flood plume.

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

Wildlife studies
CRC Reef's Species Conservation project provides essential information for the conservation of marine wildlife. Surveys of dugong using a camera mounted on a helium balloon ('blimp–cam') indicated that animals are particularly vulnerable to boat strikes if boats were travelling at high speeds. The research supports speed limits for boats in important dugong habitats because dugongs do not seem to learn to avoid dangerous boat traffic.

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

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

Knowledge exchange
CRC Reef compiled information about 122 monitoring programs in the GBRWHA to assist research users to identify data gaps, and better integrate future monitoring to optimise the use of limited resources. Monitoring of the physical, biological and socio-economic conditions of the GBRWHA ranges from large-scale monitoring by government and research organisations to community monitoring in coastal environments with an education and awareness focus. The monitoring review is now available on the Reef Futures website (www.reeffutures.org). The monitoring programs are

grouped into seven categories: water quality, marine wildlife, fish and fisheries, marine invertebrates, marine plants, physical environment and socio-economic information. Overviews as well as detailed monitoring information can be accessed by searching the database via the Reef Futures website. Each search lets users create webmaps that show locations of selected monitoring programs. Further links are provided to detailed reports on specific monitoring programs including the objectives of the monitoring program, the methods used and further reading.

Research users: Australian Commonwealth and State government agencies, scientists and the community.

5. RESEARCH

Conserving World Heritage Values (Program A)

Program Leader: Professor Helene Marsh, JCU

Highlights

- Links between roseate terns in Australia and Japan were found which has led to the listing of this bird on the Japan-Australia Migratory Bird Agreement (JAMBA) to ensure this species is managed across national boundaries.
- Work by CRC Reef researchers **Dr Mark Fenton** and **Ms Nadine Marshall** on the social assessment of commercial fishers was used as the basis of the structural adjustment package for the re-zoning of the Great Barrier Reef marine Park.
- Report by **Professor Helene Marsh** to the United Nations Environment Programme (UNEP, 2002) about the global status of dugongs (partially sponsored by CRC Reef) has been very important to the argument in a court battle between the US Government (Donald Rumsfeld) and US and Japanese Conservation Groups. The court has been asked to rule on whether the *US National Historic Preservation Act* can be used to stop the US Military using an offshore landing facility. The facility is scheduled to be built in dugong habitat off Okinawa, Japan, by the Japanese Government following an agreement between the President of the United States and the Prime Minister of Japan.
- Research by Program Leader **Professor Helene Marsh** was used as rationale to establish a Commonwealth Working Party on the management of traditional hunting of threatened species and is being used to advise this working party and GBRMPA.

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

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

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

Use and value of the World Heritage Area (Project A3)
Project Leader: Professor Malcolm Waters (JCU)

In recent years, both the Queensland Fisheries Service (QFS) and the GBRMPA have expended considerable effort in research to understand the magnitude of the catch and the broad spatial patterns of recreational fishing effort in the GBRWHA. **Dr Stephen Sutton** is extending these studies by conducting the most comprehensive social assessment of recreational fishing ever conducted in Queensland. His study is systematically collecting data on the social characteristics of recreational anglers in Queensland and measuring and documenting the level of diversity within the Queensland angler population. Dr Sutton and his team completed a telephone survey of ~12,000 households in Queensland to identify and contact a sample of recreational fishers. A 12-page mail survey designed in consultation with QFS, Sunfish, and GBRMPA was subsequently sent to 2,300 recreational fishers contacted through the telephone survey. More than 1,400 completed questionnaires have been received and coded for analysis. This survey will provide stakeholders and managers with a database of social information on recreational fishing in Queensland that can be used to inform future decision-making

CRC Reef postgraduate student **Dr Celmara Pocock** completed her PhD which developed a theoretical context for understanding heritage in the GBR region. Her study provides insight into how the GBRWHA is experienced by visitors and how their knowledge of the region is framed, communicated and transformed through time. Both technology and social change have affected the way both the landscapes and underwater world is valued, presented and experienced. Results of the research have been presented at international conferences, published in the international professional literature and disseminated to a popular audience through media interviews both print and radio, and through an innovative multimedia package.

Using the novel approach of co-managed research, **Professor Helen Ross, Mr James Innes** and **Ms Melissa George** have worked with several Indigenous communities to facilitate the design, development and implementation of arrangements between Indigenous peoples and the managers to mange 'Sea Country' in the GBRWHA. The outputs of this research include: (1) a literature review of the forms of co-management available throughout the world, (2) a discussion of how co-management could work along Native Title, (3) a series of illustrative case studies produced by Indigenous groups in a variety of formats including a video and printed report, and (4) a framework paper which provides a user-friendly guide to the design and implementation of management arrangements for Sea Country. The research is now being extended with a new task which considers the practicalities of regional and local implementation of arrangements between agencies and indigenous peoples with different capacities and aspirations.

Species conservation (Project A4)
Project Leader: Professor Helene Marsh (JCU)

Roseate terns are seabirds which nest on tropical and temperate islands in the Atlantic, Indian and Pacific Oceans. They are considered endangered in North America, Europe and South Africa. The species' stronghold is Australia where more than 60,000 birds breed on islands between Lady Musgrave Island in the GBRWHA and Fremantle in Western Australia. CRC Reef postgraduate student **Ms Anna Lashko** completed her studies of the genetic relationships among roseate terns, using a variety of molecular techniques. She established that there are two lineages of roseate tern globally representing an historic separation between individuals in the Atlantic and Indo-Pacific Ocean basins. Within each ocean basin, the genetic evidence suggests that there has been a range expansion since the last glacial period approximately 6,000 years ago. During this period, some genetic structure has developed with the breeding colony in the Seychelles diverging from those in

Japan and Australia. There is, however, no genetic structure among breeding colonies in Australia and Japan, indicating the individuals in this region regularly interbreed with those from other breeding colonies. The roseate tern has now been listed on the Japan-Australia Migratory bird Agreement (JAMBA) in recognition of the need to managing the roseate tern across national boundaries. This study also highlights the need for roseate terns which nest in the GBRWHA to be managed across all relevant Australian jurisdictions.

In collaboration with researchers in the USA and the Australian National University, **Professor Helene Marsh, Dr Ivan Lawler** and **Dr Donna Kwan** have been investigating the sustainability of the dugong harvest in the northern Great Barrier Reef region and Torres Strait using a variety of modelling techniques. Modelling based on the current estimates of the annual dugong harvest and estimates of dugong population size obtained from aerial surveys indicate that the current harvests in Torres Strait and the northern GBR Region are unsustainable. In addition, any Indigenous hunting is unsustainable on the urban coast of Queensland, given the decline in dugong numbers in this region and the other impacts on these species. The sustainable management of dugong hunting is a challenge because of the tension between the obligations to protect both the species and a sustainable hunting culture and the complex and dynamic ecological, legal, socio-economic, cultural and management environment. Because dugongs move across jurisdictions and because of the different statutory environment in different regions, a nested series of national, regional and local initiatives is required to conserve dugongs. The greatest challenge will be at the local community level. A working party has recently been established by the Department of Environment and Heritage to consider the situation and the GBRMPA has given high priority to progressing Traditional Marine Use Resource Agreements (TUMRAs) with Indigenous groups. Capacity to manage indigenous dugong hunting sustainably and cost-effectively has been facilitated by other Centre projects which provided advice to managers about the design of future aerial surveys and the conduct of the wildlife necropsy program.

CRC Reef postgraduate student **Mr James Sheppard** has been using space-age technology to enhance the ecological basis for managing dugongs in the GBR region under the supervision of **Dr Ivan Lawler** and **Professor Helene Marsh.** Analysis of the data from animals fitted with GPS transmitters and dive computers show that dugongs track the bottom when they go on long-distance movements and use inshore areas more at night than during the day. The research will inform the process of re-zoning the Sandy Strait Marine Park and the review of the inshore fin-fisheries.

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

TASK TITLE	RESEARCHER	TASK ASSOCIATE
Use and value of the World Heritage Area (A3)	**Prof M Waters**	**TASK ASSOCIATE**
Spatial allocation of GBR use, phase 2 (2.1.6/2)	Ms B Breen (JCU)	Mr J Innes (GBRMPA), Dr L Fernandes (GBRMPA)
Social & economic values assoc. with Indigenous use of marine resources. 1: Towards cooperative management of Indigenous hunting by a remote community (A1.2.2S)	PGS Ms M Nursey-Bray	Mr J Innes (GBRMPA)
Social assessment of recreational fishing in the GBR region (A1.2.3a)	Dr S Sutton (JCU)	Mr J Innes (GBRMPA), Mr C McKenzie (SSI Aust), Mr V Veitch (SUNFISH), Mr D Souter (QSIA)
Understanding the social characteristics of Queensland's recreational anglers (A1.2.3b)	Dr S Sutton (JCU)	Mr J Innes (GBRMPA), Mr D Cameron (GBRMPA)
A conceptual and operational understanding of resource dependency (A1.2.4S)	PGS Ms N Marshall (JCU)	Mr J Innes (GBRMPA)
Cultural heritage of the GBRWHA (A1.3.1)	Dr S Greer (JCU)	Mr J Innes (GBRMPA), Mr C McKenzie (AMPTO)
Cultural heritage of the GBRWHA (A1.3.1S)	PGS Ms C Pocock (JCU)	Mr J Innes (GBRMPA), Mr C McKenzie (AMPTO)
Cultural heritage management of two World Heritage communities	PGS Ms J Harrington (JCU)	

(A1.3.2S)		
Supporting development of co-operative management in GBRWHA, by GBRMPA and Indigenous peoples (A3.3)	Prof H Ross (UQ)	Steering Committee
Development of co-management arrangements at regional and local scales: an adaptive management approach (A3.4)	Prof H Ross (UQ)	Mr J Innes (GBRMPA)
Species conservation (A4)	**Prof H Marsh (JCU)**	
A scientific basis for reducing the impact of vessel traffic on sea turtles (A4.1)	Prof H Marsh (JCU)	Dr K Dobbs (GBRMPA)
Review and refinement of most appropriate co-ordinated and cost-effective methods and priorities for determining dugong population numbers and distribution in Qld and Torres Strait (A4.2)	Prof H Marsh (JCU)	Dr K Dobbs (GBRMPA), Mr J Prescott (AFMA)
Conservation genetics of sea snakes (Family Hydrophiidae) in Australian waters with emphasis on the GBRWHA (C1.4.1S)	PGS Ms V Lukoschek (JCU)	Dr L Fernandes (GBRMPA)
Population genetic structure of roseate tern populations in Australia, and preliminary investigation of genetic relationships among roseate tern subspecies (C1.4.2.1S)	PGS Ms A Lashko (JCU)	Dr K Dobbs (GBRMPA), Mr P O'Neill (QPWS)
Enhancing the ecological basis for managing dugongs in the GBRWHA (C1.4.3.1a)	Dr I Lawler (JCU)	Dr K Dobbs (GBRMPA)
The impacts of anthropogenic noise on coastal marine mammals: dugongs and dolphins (C1.4.3.1S)	PGS Ms A Hodgson (JCU)	Dr K Dobbs (GBRMPA)
Enhancing the ecological basis for conservation management of dugongs using innovative satellite tracking technologies (C1.4.3.2S)	PGS Mr J Sheppard (JCU)	Dr K Dobbs (GBRMPA)
Review and refinement of the Queensland marine mammal and turtle strandings and mortality program focussed in the GBRWHA (C1.4.4a)	Dr K Dobbs (GBRMPA)	Steering committee
Ecology and conservation biology of coastal dolphins (C1.4.5S)	PGS Mr G Parra (JCU)	Prof H Marsh (JCU)

Sustainable industries (Program B)

Program Leader: Ms Anne Clarke, DPI&F

Highlights

- Completion of final report about the Effects of Line Fishing Project which has attracted enormous stakeholder interest and has critical application for management.
- Involvement in the National Oceans Office Northern Marine Planning Area which is a collaborative study detailing the description and data gaps of key marine species in the Northern Planning Area.
- Commencement of the FRDC funded post-release survival project as part of the National Strategy for the Survival of Released Line Caught Fish.

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

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

This program aims to balance the benefits of development with its threats to nature. A practical and thorough understanding of the industries, their needs and their impacts has been the focus of the research in this program. This research will provide information about the uses in the GBRWHA so that regulation and best practice can be achieved, and so that these uses do not threaten key World Heritage Values of the region and the industries can remain economically and socially viable.

The focus has been on two major industries that rely on the GBRWHA (tourism and fisheries) and one industry that must co-exist with it (port and shipping activities) to provide services to a multitude of land-based industries. This industry knowledge of both benefits and impacts, is supported with a program of engineering and environmental modelling research.

Ports and shipping (Project B1)

Project Leader: Dr Rob Coles, DPI&F

Many ports and marinas operate in or adjacent to the GBRWHA and thousands of ships traverse the waters of the World Heritage Area annually, often carrying cargoes that would threaten the environment if released in an accident. These activities are vital to the normal social and economic function of Queensland (the value of trade through ports operated by the Ports Corporation of Queensland alone is 68 billion dollars per year) but pose potential risks to the environment.

The Ports and Shipping project has consolidated over the last year, with strengthened engagement with ports and port activities along the coast. The research team has surveyed all major ports in tropical Queensland to map natural habitats and search for exotic pests. The environment issues in sections of two major shipping channels, Margaret Bay and Hydrographers Passage, identified as at high risk, have also been mapped. The Department of Primary Industries and Fisheries supported the project during the year by converting the temporary staff position held by **Dr Michael Rasheed** to permanent status – a vote of confidence that was much appreciated by the project.

CRC Reef and industry partnership has enabled long-term data sets, up to 10 years, to be collected in Karumba, Weipa, Cairns, and Mourilyan Harbour. This has enabled estimates of expected natural variation to be made as part of advice on port planning. The major ports of Gladstone and Hay Point have been added in the last year to the sites where the group has contracted to provide baseline information.

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

The Ports and Shipping project is a good model of integration across disciplines, with integration of port surveys for native habitats, surveys for introduced pests and modelling of water movements and sediment transport in and around ports. To prevent the introduction of exotic marine species, the Centre, together with joint venture partners, is taking steps to develop an efficient method of 'cleaning' shipboard ballast water to remove or kill all larvae in the ballast water so that they will not be released into Australian seas. A portable pilot plant for treatment has been developed and is being trialled with a variety of organisms under controlled conditions. It will soon be field-tested with ballast water from active vessels. This technology has the potential to provide world-leading bio-security to the international shipping industry and significantly reduce the risks of exotic pest introductions via ballast water.

Tourism (Project B2)
Project Leader: Dr Gianna Moscardo, JCU

Tourism research in the last year focused on finalising long-running research projects and publishing findings. At the end of this year, the significant changes detected in the expectations of many tourists visiting the GBRWHA have been analysed with particular reference to changes in patterns pre- and post-September 2001.

Final analysis has revealed that trends in repeat visitation are continuing and new Australian markets are emerging. Fewer tourists sought interactions with wildlife, solitude and 'wilderness' experiences compared with those that sought more social, experiential activities such as diving and 'resort style' holidays. This shift in expectations has management implications. This shift in expectations may reflect a change in the demographics of tourists visiting the GBR where many tourists who would previously have visited international resorts in south east Asia are choosing tropical Australian holidays in the wake of terrorist threats overseas.

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

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

training kit was developed to aid operators and others in the provision of interpretive guided tours of GBR destinations.

Engineering and environmental control (Project B3)
Project Leader: Professor Tom Hardy, JCU

Dr Katsuya Hirayama from the Port and Airport Research Institute, Yokosuka, Japan worked at the Marine Modelling Unit (MMU) at JCU for most of this year improving the modelling of wave breaking for a very fine-scale wave model.

Fulbright scholar **Mr James Bird** completed his Masters research in which he investigated the use of modelling to better understanding coral bleaching incidents. In collaboration with researchers at AIMS, James coupled thermodynamic and hydrodynamic models that offer interesting explanations of differences in coral mortality at Scott Reef (off northwest Australia) during the 1998 bleaching event. James is finishing his thesis and has accepted a fellowship for a PhD at Harvard.

Six honours students worked on topics related to the project. Three finished their theses in October. These studies evaluated the use of the Pontoon Guidelines using data from existing GBR pontoons, investigated possible alternatives for protecting the boat ramp at Forest Beach, and modelled erosion at Rowes Bay. Three students started in March. Two of these applied a fine scale, 3-D hydrodynamic model for the Ports of Townsville and Cairns, and one tested the sensitivity of grid resolution for overland flooding during severe tropical cyclones in Townsville.

The MMU has been awarded a major research/consulting project from Woodside Energy Ltd (10-4 wave study, >$350,000). Waves during the tropical cyclone populations of Arafura, Timor and Northwest Shelf regions will be modelled to determine the 1 in 10,000 year wave conditions.

For the Northern Territory Storm Surge study ($20,000), the MMU established storm surge models for the Northern Territory and northeastern Western Australia. The models will be used by our partner *Systems Engineering Australia* to simulate storm surge during tropical cyclones to improve forecasting during a storm and regional development planning.

Hervey Bay and Sunshine Coast, Queensland East Coast, and web reporting storm tide studies ($100,000, $55,000 and $10,000) have been completed. The Australian Bureau of Meteorology and the Queensland EPA commissioned these studies with the financial support from the Greenhouse Special Treasury Initiative.

Fishing and fisheries (Project B4)
Project Leader: Dr Gavin Begg, JCU

The Fishing and Fisheries (F&F) Project has continued to consolidate and broaden its profile over the past year, with ongoing and developing research in waters adjacent to and in the GBR and Torres Strait. Several final reports, scientific publications, student theses and popular articles were completed during the year including those related to the large-scale spatial and temporal Effects of Line Fishing (ELF) Experiment, measurement uncertainty and post-capture changes in sizes of coral trout, spatial patterns in population biology of red throat emperor, and exploitation dynamics and biological characteristics of east coast Spanish mackerel. Outcomes from these research projects and others have contributed directly to the management, assessment and long term monitoring requirements for Queensland's valuable coral reef fish, mackerel and tropical east coast shark fisheries.

The F&F team were also extremely active in liaising with stakeholders over the past year through a range of surveys designed to provide information on recreational and commercial fishing in the GBR.

Sustainable industries (Program B) – list of tasks

	TASK LEADER	TASK ASSOCIATE
Ports & Shipping (B1)	**Dr R Coles (DPI&F)**	
Ports & Shipping Implementation (B1.0.2)	Dr R Coles (DPI&F)	Ms A Clarke (DPI&F)
Port surveys (B1.0.3)	Dr K Neil (DPI&F)	Dr R Coles (DPI&F), Ms S Trimarchi (PCQ), Ms K Kelleher (CPA), Ms A Clarke (DPI&F)
Port baseline surveys for introduced marine species - Cairns (B1.11)	Dr K Neil (DPI&F)	3rd Party Contract (CPA)
Marine flora, fauna and marine pest surveys - Cairns Port (B1.11a)	Dr K Neil (DPI&F)	3rd Party Contract (CPA)
Cairns Harbour and Trinity Inlet seagrass monitoring (B1.16)	Dr M Rasheed (DPI&F)	3rd Party Contract (CPA)
Molecular diagnostic techniques for Asian green mussel (B1.17)	Dr K Neil (DPI&F)	3rd Party Contract (DAFF)
Long-term monitoring of seagrass, Port of Weipa, Sept 2003 (B1.18)	Dr M Rasheed (DPI&F)	3rd Party Contract (PCQ)
Long-term monitoring of seagrass, Port of Karumba, Oct 2003 (B1.19)	Dr M Rasheed (DPI&F)	3rd Party Contract (PCQ)
Long-term monitoring of seagrass, Port of Mourilyan, Dec 2003 (B1.20)	Dr M Rasheed (DPI&F)	3rd Party Contract (PCQ)
Hydrodynamic, sediment and dredge modelling of ports (B1.2)	Prof T Hardy (JCU)	Ms M Louden (TPA), Ms K Kelleher (CPA)
Marine habitat resource mapping at Port of Skardon River (B1.21)	Dr M Rasheed (DPI&F)	3rd Party Contract (PCQ)
Identification of polychaetes from Port baseline survey reference collections (B1.22)	Dr P Hutchings (AM)	Dr K Neil (DPI&F)
Port of Thursday Island - baseline surveys for introduced marine pests (B1.23)	Dr K Neil (DPI&F)	3rd Party Contract (PCQ)
Port of Thursday Island - seagrass monitoring (B1.24)	Dr M Rasheed (DPI&F)	3rd Party Contract (PCQ)
Marine pest surveys - Cairns Port 2004 (B1.26)	Dr K Neil (DPI&F)	3rd Party Contract (CPA)
Christmas Island coral monitoring and introduced marine pest surveys (B1.27)	Dr K Neil (DPI&F)	3rd Party Contract (GHD Services)
Identifying & monitoring of critical habitats in or adjacent to shipping lanes and coastal ports (B1.3)	Dr M Rasheed (DPI&F)	Ms S Trimarchi (PCQ)
Ballast water treatment pilot study (B1.5)	Dr P Schneider (JCU)	Dr R Reichelt (CRC Reef)
Sustainable Tourism (B2)	**Dr G Moscardo (JCU)**	
Understanding tourist use of the GBRWHA (B2.1.1)	Dr G Moscardo (JCU)	Mr J Innes (GBRMPA), Mr C McKenzie (AMPTO)
Visitor strategic response project (B2.2)	Dr G Moscardo (JCU)	Mr J Innes (GBRMPA), Mr C McKenzie (AMPTO)
Presentation and management of Environment Management Charge data (B2.7)	Mr J Innes (GBRMPA)	Dr G Moscardo (JCU), Mr C McKenzie (AMPTO)
Towards ecologically sustainable dwarf minke whale tourism (B2.8)	Dr A Birtles (JCU)	Mr S Kielbaska (Mike Ball Dive Expeditions)
Towards sustainable environmental experiences for the live-aboard diving industry on the GBR (B2.9S)	PGS Mr D Miller (JCU)	Mr C McKenzie (AMPTO), Ms K Gorman (GBRMPA)
Engineering & Environmental Control (B3)	**Prof T Hardy (JCU)**	
Marine modelling synthesis, application and development (B3.10)	Prof T Hardy (JCU)	Ms K Kelleher (CPA), Mr M Allen (EPA)
Queensland east coast storm tide statistics - web presentation of data (B3.11)	Prof T Hardy (JCU)	3rd Party Contract (EPA)
Northern Territory storm surge study (B3.12)	Prof T Hardy (JCU)	3rd Party Contract (Systems Engineering Australia)
Tropical cyclone wind modelling (B3.13)	Prof T Hardy (JCU)	3rd Party Contract (Woodside Australian Energy)
Extension of fine-scale circulation modelling to the entire GBR region (B3.4)	A/Prof L Bode (JCU)	Dr P Doherty (AIMS)
Tropical cyclone wave impacts: Caloundra/ Maroochy and Hervey Bay (B3.5)	Prof T Hardy (JCU)	3rd Party Contract (EPA)

A modelling study for assessment of tropical cyclone ocean hazards (B3.8)	Prof T Hardy (JCU)	3rd Party Contract (Bureau of Meteorology)
Nutrient recovery from reef-bound waste water effluents (B3.9)	Dr P Schneider (JCU)	Ms J Johnson (GBRMPA)
Fishing & Fisheries (B4)	**Dr G Begg (JCU)**	
Perceived & actual differences in recreational line catch trends in estuaries open & closed to commercial fishing in nth Qld (B4.10S)	PGS Ms R Tobin (JCU)	Mr D Cameron (GBRMPA), Dr D McPhee (UQ)
Forecasting fishing impacts on population biology of red bass (B4.12S)	PGS Mr R Marriott (JCU)	Mr M Russell (GBRMPA), Mr M Elmer (QFS)
Exploitation dynamics & biological characteristics of east coast Spanish mackerel harvested by recreational & commercial sectors (B4.13)	Mr A Mapleston (JCU)	3rd Party Contract (FRDC)
Review and assessment of the Australian east coast spotted mackerel stock (B4.16)	Dr G Begg (JCU)	Mr D Cameron (GBRMPA), Mr M Lightowler (QFS)
Otoliths in the tropics - theory and methods (B4.17)	Ms B Green (JCU)	Mr M Russell (GBRMPA)
Development of a management plan for Elizabeth and Middleton Reefs Marine National Nature Reserve (B4.18)	Dr G Begg (JCU)	3rd Party Contract (DEH)
Collation & review of Islander commercial catch history in the Eastern Torres Strait reef line fishery (B4.19)	Dr G Begg (JCU)	
Fishing & Fisheries Project Implementation (B4.1a)	Dr G Begg (JCU)	Mr M Russell (GBRMPA), Mr D Souter (QSIA)
Comparative demography and life history features of cods and gropers: implications for fisheries and conservation management (B4.20S)	PGS Ms R Pears (JCU)	Mr M Russell (GBRMPA)
Third International Symposium on Fish Otolith Research & Application (B4.21)	Dr G Begg (JCU)	Dr D Williams (CRC Reef)
Driving innovation in environmental performance in the Queensland fishing industry (B4.2)	Dr D McPhee (UQ)	3rd Party Contract (FRDC)
National strategy for increasing survival of released line-caught fish: investigating survival of fish released in Australia's tropical & subtropical line fisheries (B4.23)	Dr I Brown (DPI&F), Dr G Begg (JCU)	3rd Party Contract (FRDC)
Description of key species groups in the Northern Planning Area (B4.24)	Dr G Begg (JCU)	3rd Party Contract (NOO)
The effects of line fishing on the GBR (B4.2a)	Dr A Jones (JCU)	Steering Committee
Population dynamics & stock structure of red-throat emperor & others (B4.3.1)	Dr C Davies (AAD)	Mr M Russell (GBRMPA), Mr D Souter (QSIA)
Modelling multi-species fishery dynamics (B4.4)	Dr G Begg (JCU)	Mr M Russell (GBRMPA), Mr D Souter (QSIA)
Modelling multi-species targeting of fishing effort in Qld coral reef finfish fishery (B4.4a)	Dr G Begg (JCU)	
Coastal fisheries resource monitoring in the GBRWHA (B4.5)	Mr R Garrett (DPI&F)	Mr D Cameron (GBRMPA), Mr M Doohan (QFS), Mr D Souter (QSIA)
Liaison and information management for Fishing & Fisheries research (B4.6)	Dr A Jones (JCU)	Steering Committee
Measurement uncertainty and post-capture changes in sizes of coral trout (B4.8)	Mr C Lunow (DPI&F)	Mr R Grimley (QBFP)
Consequences of spatial patterns in life history of a coral reef fish subject to different harvest strategies (C3.4S)	PGS Ms M Bergenius (JCU)	Mr M Russell (GBRMPA)
Hydrodynamics cause spatial variability in coral reef assemblages: implications for marine reserve design (C3.5S)	PGS Ms J Eagle (JCU)	Dr P Doherty (AIMS)
Determining optimal capacity where latent effort exists (E 2.1.16/1S)	PGS Mr G Muldoon (JCU)	Mr M Russell (GBRMPA)

PGS - Postgraduate student

Maintaining Ecosystem Quality (Program C)

Program Leader: Dr Peter Doherty, AIMS

Highlights

- The GBR Seabed Biodiversity Project sampled seafloor habitats and associated biota at more than 600 sites during its first year. This $6 million multi-agency collaboration will assist sustainable fisheries and biodiversity conservation objectives within the GBRWHA.
- Seagrass-Watch is a community-based program that monitors condition and trend in seagrass meadows at 70 sites throughout coastal Queensland. Results from this task were provided to management agencies to assist with dredging proposals, algal blooms, coastal developments and marine park management.
- CRC Reef researchers showed a plausible link between rainfall, water quality and outbreaks of the crown-of-thorns starfish on reefs adjacent to the Wet Tropics coastline of the GBRWHA.
- CRC Reef researchers in collaboration with AIMS and NOAA have created an early warning system with daily updates for GBRMPA to know when sea temperatures are conducive to coral bleaching, while continuing experiments into the potential for corals to survive further warming of the ocean
- Maps of sea surface temperature (SST) collected by orbiting satellites are now processed daily, posted on the AIMS website and transmitted to other science agencies (CSIRO, NOAA) for inclusion in global assessments. Last summer, GBRMPA was updated daily on the risk of coral bleaching in the GBRWHA.
- CRC Reef researchers reported the first captive breeding of Irukandji jellyfish which have been responsible for two recent fatalities of visitors to north Queensland, and receives overwhelming interest from local and international media.

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

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

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

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

Biodiversity: status and trends (Project C1)
Project Leader: Dr Peter Doherty, AIMS

Sampling for the **GBR Seabed Biodiversity Project** started in September 2003. This is a major collaboration involving two research provider partners in CRC Reef (AIMS, DPI&F), CSIRO Marine Research and the Queensland Museum. It is supported by cash of $2 million from the Centre, FRDC, and NOO, and a co-investment (staff, vessels, equipment) of $4 million from the four providers. The GBR Seabed Biodiversity Project is overseen by a Steering Group, which includes representatives from industry (QSIA), managing agencies (QFS, GBRMPA), and community (SUNFISH).

The project will map seafloor habitats and characterise their associated fauna and flora at more than 1,500 locations in the GBRWHA. This information will be used to deliver risk-assessments for trawl fisheries in the Marine Park (required under the Commonwealth Environment Protection and Biodiversity Conservation Act and the State-Commonwealth review of management arrangements for the East Coast Trawl Fishery due in 2006), to provide detail about biodiversity in the Marine Park, that will provide a baseline that can be used to monitor change following the rezoning of the GBRMP, and to enhance regional marine planning (part of implementing Australia's Oceans Policy) in other marine jurisdictions.

By June, the RV Lady Basten from AIMS had visited 615 sites to sample seabed habitats and biota. In the same period, FRV Gwendoline May from DPI&F trawled potential by-catch species from 239 of these same sites. During the field trips on RV Lady Basten, 255 hours of video was collected using two special-purpose deep-water cameras built by the CSIRO workshops in Hobart. Another 570 hours of video footage was collected from deployments of baited video cameras that attract large fish, including sharks and rays, and sea snakes. Plants and animals were collected with a towed dredge from 553 sites (where zoning and the bottom permitted). Primary sorting of this material was done at sea and resulted in 6,750 preserved samples spread among the various agencies. Initial inspection has shown that these samples contain a lot of new biodiversity including many undescribed species. Most of the material will be housed in the permanent collections of the Queensland Museum (QM) and will sustain specialist investigations for many years beyond the timelines for delivering the task's immediate objectives (e.g. the fisheries risk assessments). Sediments were collected from the same sites and will be analysed in collaboration with GA as these are likely to be important predictors of the fauna. In addition, 75 Gb of echogram data has been collected along the cruise tracks. This information will be compared with other data sources to investigate the potential of acoustic methods to provide rapid assessment of seabed communities in future seabed mapping exercises.

The Long-Term Monitoring Team (LTMT) at AIMS completed its 12th consecutive survey of coral reef health throughout the GBR. A key result from last year was the lower incidence of coral diseases, from a historical high in 2003; perhaps reflecting the return to cooler waters after the 2002 coral bleaching episodes (see below). In addition, the Team monitored the spread of crown-of-thorns starfish outbreaks to reefs south of Townsville. This information formed an important part of GBRMPA's State of the Reef report (2003) and Queensland's State of Environment report. The section of the AIMS website which houses LTM information has been revamped but future reporting will be distributed on CD-ROM rather than paper, since the former provide a more flexible multimedia format and the inclusion of images including video.

Responding to strong public interest in the impact of coastal water quality on inshore reefs, CRC Reef commissioned the LTMT to obtain a snapshot survey of condition on selected inshore reefs, which are not strongly represented in current monitoring programs because of the difficult conditions (poor visibility, stingers, sharks, crocodiles). The fieldwork started after the wet season (because of the

threat of marine stingers) and has so far managed to assess 21 sites. The field surveys were preceded by a literature review summarising historical knowledge of these places.

Responding to the widespread coral bleaching in 2002, DEH commissioned the LTMT to survey the condition of Lihou Reef in the Coral Sea, which is a Marine National Nature Reserve under Commonwealth legislation. Subsequently, this was extended to requests for similar surveys of other reserves, including Elizabeth and Middleton Reefs, and Lord Howe Island. In the next step, CRC Reef was asked to provide advice on strategies for cost-effective monitoring of all of the Commonwealth's Marine Protected Areas in tropical waters. Recently, this has been extended to the provision of advice on monitoring in the temperate zone including marine reserves south of the Australian mainland.

CRC Reef researchers from DPI&F's Marine Plants Group based at the Northern Fisheries Centre, Cairns, continued their studies of tropical seagrass meadows in the GBRWHA and internationally. In the last year, they investigated the effect of environmental factors (temperature, water quality) on seagrass health. In addition, they collaborated with JCU postgraduate students to determine the nutritional quality of seagrasses as food for dugongs, and to develop spatial models linking dugong and seagrass distributions. In another collaboration with Monash University, they provided input to a risk-based model linking contaminants from terrestrial catchments with ecological impacts in receiving water bodies.

Condition and trend monitoring of seagrass resources was continued through Seagrass-Watch, which is an extensive and successful community-based monitoring program. During the year, new sites were added in Cooktown, Weipa, and Mission Beach, bringing total coverage to 70 sites throughout coastal Queensland. Seagrass meadows at Green Island, Cairns, were remapped a decade after tertiary sewage treatment was implemented on the island. Preliminary results show a dramatic change in species composition towards dominance by an invasive species that thrives in disturbed environments.

In addition, 37 sites in nine countries in the Western Pacific (Federated States of Micronesia, Palau, Philippines, Japan, Malaysia, Indonesia, PNG, Solomon Islands, and Fiji) were monitored as part of the Global Seagrass Monitoring Network, which is supported in part with international funding from the David and Lucille Packard Foundation. Each node involves local communities and government participants. Task leaders also contributed to the organising and scientific committees planning Seagrass 2004, an international meeting of experts that will be held in Townsville in September.

Both community-based monitoring programs were provided with feedback through informative quarterly newsletters, which are distributed to 450 participants and libraries throughout Queensland, Australia, and the western Pacific. Findings from Seagrass-Watch were provided to management agencies to assist their responses to dredging proposals, algal blooms, coastal developments and marine park management. Furthermore, the task group worked closely with GBRMPA to design a seagrass monitoring component in the GBR Water Quality Protection Plan.

Water quality (Project C2)
Project Leader: Dr Miles Furnas, AIMS

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

In the last 12 months, CRC Reef started to wind down a successful comparative study of the condition of inshore coral reefs adjacent to agricultural catchments in the wet tropics and relatively pristine catchments in Princess Charlotte Bay. Clear gradients in water quality were found within and between these two study regions. The diversity of soft corals and the abundance of four major families of hard coral decrease along these gradients, while the diversity of red algae and the abundance of green algae increase in the opposite direction.

Justified by this evidence of potential impact, research continued into the transport and transformation of land-based pollutants, especially the major nutrients (phosphorus, nitrogen) controlling plant growth, once they reach the marine environment. Fieldwork has been completed and data are being analysed to develop better models of nutrient fates. A new collaboration was established with marine modellers from JCU, who have developed a hydrodynamic circulation model for the whole Marine Park, to produce shelf-scale nutrient budgets.

AIMS continued to deploy its proprietary mud loggers in seven important and representative rivers draining into the Marine Park, and their success means they are also likely to become another component in the monitoring supporting the GBR Water Quality Protection Plan. In addition, the same group of researchers continued to monitor chlorophyll levels in the Park especially in coastal waters adjacent to developed catchments. On request, these data were provided to the Coastal CRC to assist its modelling work in Keppel Bay, and also to Queensland EPA and CSIRO Land & Water to validate a remote sensing project as part of a water quality initiative by the Douglas Shire.

Mr Jon Brodie from JCU completed a literature review of nutrient exports from 'pristine' catchments, which have little land clearing and human development, to provide an essential benchmark against which to judge the rehabilitation of modified catchments. A collaboration with **Dr Glen De'ath**, from AIMS, also reviewed and assessed the likely linkage between water quality and outbreaks of crown-of-thorns starfish on the GBR. Their major finding was that higher loads of bioavailable nutrients in flood plumes coming from rivers in the Wet Tropics Region (between Hinchinbrook Island and Cooktown) have the potential to enhance the survival of larval starfish.

Dr Britta Schaffelke from CRC Reef started work to assess the incidence and cause of nuisance outbreaks of an alga affecting the amenity of major sites of offshore tourism. Blooms were less serious than in the previous two summers, when the 'golden algae' covered as much as 50% of the reef surface at some sites. Storms in May appear to have removed most of the visible algae, which did not grow back aggressively afterwards. As with the incidence of coral disease (above), the declining incidence of these algal blooms may be linked to recent changes in sea temperature and plans for water quality monitoring have been put on hold.

Climate change and coral bleaching (Project C4)
Project Leader: Dr Janice Lough, AIMS

The enhanced greenhouse effect is warming global and regional temperatures in the air, on the land, and in the sea. Reef-building corals are very sensitive to their thermal environment; they lose their

algal symbionts and bleach with a sustained rise of more than a degree Celsius in the maximum sea temperature. As a result, coral reefs were highlighted as a 'unique and threatened ecosystem' in the Intergovernmental Panel on Climate Change (IPCC) Third Assessment Report.

There was widespread coral bleaching on the GBR in the summers of 1998 and 2002. In response, CRC Reef researchers with others (AIMS, NOAA) have created an early warning system for GBRMPA to detect sea temperatures conducive to bleaching, while continuing experiments into the potential for corals to accommodate further warming of the oceans.

High-resolution monitoring of the physical environment of the GBRWHA is being achieved through real-time satellite remote sensing, validated by an extensive network of *in situ* temperature loggers, oceanographic moorings, and the AIMS automated weather station network. Maps of sea surface temperature (SST) collected by orbiting satellites are now processed daily, posted on the AIMS internal website and transmitted to other science agencies (CSIRO, NOAA) for inclusion in global assessments. For the past three summers, GBRMPA has been updated twice weekly on the bleaching risk factor. Last summer, this information was provided daily, when a mild bleaching event was recorded for the GBR.

The SST maps are being validated by direct monitoring of bulk sea temperatures at 45 sites on the GBR. These records have shown that bleaching can be predicted with an accuracy of 70% from the maximum 3-day SST value for each pixel in the satellite image. Based on this relationship, an increase of just another degree above the temperatures seen during the last two bleaching episodes is predicted to result in bleaching on >80% of reefs in the GBRWHA. Coral bleaching thresholds that were developed from controlled laboratory experiments have proven to be robust when tested in the field and have been translated into more important coral mortality thresholds from sites that suffered >50% morbidity during recent events. Disturbingly, mortality thresholds were found to be just 0.5-1.0 degrees higher than the bleaching threshold indicating the knife-edge stability of the coral-algal symbiosis.

Laboratory studies on the physiology and biochemistry of coral-algal symbioses have been supplemented by careful and limited transplantation of non-breeding reef corals between parts of the GBR to forecast how they will respond to warmer temperatures. As reported last year, one set of corals transplanted from the Keppel Islands (23^{o}S) to Magnetic Island (19^{o}S) survived bleaching with a different strain of symbionts from their original state. While this change of partners gave the corals from the Keppels the same thermal properties as native corals from Magnetic Island, the increased tolerance is likely to be limited to 1-2 degrees which is at or below the predicted rate of future warming. As a result, the final report to the Queensland Greenhouse Taskforce (Done et al. 2003) attracted considerable interest from government and the media.

Irukandji (Project C6)
Project Leader: Dr David Williams, AIMS/ CRC

Marine stingers (cubozoan jellyfish) have long been recognised as a serious risk to swimmers during north Queensland's wet season with the highest-known risk from the infamous *Chironex fleckeri*. Following two recent fatalities from Irukandji Syndrome, it is clear that there are other dangerous cubozoan jellyfish. The difficulty is that there are multiple candidates, most are small by comparison with *Chironex*, and there is no useful inventory of these animals. Although a related cubozoan *Carukia barnesi* has been linked with Irukandji Syndrome, it is unlikely to be the only jellyfish responsible for the syndrome.

Funding obtained from the Commonwealth and Queensland Governments, and the GBRRF, permitted CRC Reef to commission preliminary research to collect and identify suspected and definite Irukandji jellyfish for taxonomic and toxicological objectives. Unfortunately, last summer was one of the quietest years on record for Irukandji stings. As with the cases of reduced incidence of coral disease and algal blooms (see above), the scarcity of Irukandji may have a common environmental cause. However, it seems likely that low rainfall rather than reduced sea temperatures may be the driving factor for changes in jellyfish abundance.

Although of benefit to the tourism industry, the low incidence of reports made it difficult to collect many animals. Nevertheless, **Ms Lisa Ann Gershwin** from JCU with assistance from Surf Life Saving Australia managed to collect a range of specimens, including three possible new species from Broome.

Irukandji represent a threat to swimmers and divers in north Western Australia, which led to a request for assistance from the Broome Shire Council and some of the major pearl producers. In return for assistance to collect specimens, Ms Gershwin distributed posters and brochures on Irukandji identification and safety, and provided advice about matters like beach closures. One serendipitous outcome of the collection of live animals was the first known captive breeding of these animals. The report of this attracted intense media interest.

Jellyfish collected last summer have been examined for a range of morphological and molecular characters. Genetic markers will provide an independent and unambiguous classification that can validate taxonomy based on morphology. Partial sequences of ribosomal DNA (18S) were obtained for 17 cubozoan taxa. There was a high level of sequence divergence which indicates that these markers can be used to discriminate closely related species. These will be applied to a revision of Australian cubozoans as more material becomes available.

It is possible that a biochemical marker can be developed that will identify the source of a sting by analysing skin scrapings from a person with Irukandji syndrome. Since different jellyfish stings may require different treatments, such a test would be equivalent to the venom tests possible with snake bite victims.

Catchment to Reef (Project C7)

Project Leader: Dr Richard Pearson, JCU

Catchment to Reef is a co-operative project between the Centre and the Rainforest CRC. The Project identifies the interconnectedness between catchments and the nearshore marine environment, and the need to address land management practices in a co-ordinated fashion to improve water quality in the GBR Lagoon. Acknowledging the linkage that rivers and streams create between catchment and reef is extremely important in terms of research, and in finding the best ways to address the environmental issues that are associated with this linkage.

The Catchment to Reef Project will develop new tools to assess and monitor the health of catchments and aquatic systems in both the Wet Tropics and GBRWHA. These tools will enable landholders and stakeholders to better understand and manage the effects of human activities on water quality and ecosystem health, and be involved in the process of improving catchment quality in the Wet Tropics region. In addition to nutrients, the research will broaden its focus to include organic contaminants such as herbicides following research reported last year that showed corals to be very sensitive to a wide range of such chemicals.

The Catchment to Reef project will address issues related to water quality decline and river ecosystem health, including:

- riparian performance;
- the need to develop benchmarks for water quality monitoring;
- developing tools to assess the health of rivers;
- determining priorities for river rehabilitation;
- detecting stress in marine organisms caused by contaminants;
- assessing the health of nearshore marine environments using marine organisms as indicators of change.

Each task aims to produce guidelines, tools or protocols that can be used to build the capacity of stakeholders and landholders to better monitor and manage issues associated with river ecosystem health and water quality.

Improving water quality and ecosystem health is a task for the whole community – scientists, stakeholders, landholders and the general public. To be effective, a project like Catchment to Reef must engage with each group to provide the information they require, and to identify the means by which those groups can gain the most benefit from, and be most helpful to the Project. By producing practical outputs from the research, which suit the practitioners, the Project will ensure stakeholders and landholders are given the best assistance in addressing water quality and river ecosystem health issues.

To accomplish the engagement of stakeholders and landholders the Catchment to Reef Project incorporates a dedicated extension program. Converting outputs to outcomes – adoption of tools through the training of practitioners (C7.7) will compliment the research in the Project and ensure delivery of the Project's outputs to the community. Overcoming environmental issues through collaboration between scientists and stakeholders, and by building the capacity of the community to recognise and tackle such issues is becoming increasingly important, and will form the basis of environmental management in the near future.

In the last 12 months, four postgraduate students have commenced studies with support from this successful supplementary bid. **Ms Melanie Shaw** from UQ will develop and deploy a new generation of passive water samplers to monitor levels of organic contaminants. **Mr Matthew Slivkoff** from Curtin University will use a sensitive spectroradiometer built by the AIMS workshop to compare the radiation leaving water of different properties with the spectra detected by ocean observing satellites. This work will become part of an international collaboration with NASA/NOAA designed to validate processing algorithms for the new generation of ocean colour satellite (MODIS) with the aspiration to move chlorophyll monitoring away from collection and lab analysis to this more cost effective method. **Mr Tim Cooper** from JCU will develop physiological indicators of the health of inshore corals; initially based upon tissue thickness in massive *Porites* corals, which has proven a useful indicator in studies of the impact of mining discharges into the ocean. **Mr Ben Johnston** from JCU will investigate a range of condition indicators for the health of seagrass meadows. If any or all of these tasks are successful, they will have wide application to measuring coastal water quality in all tropical regions.

In addition to the students, a postdoctoral researcher, **Dr Sven Uthicke**, will evaluate the utility of biofilms (microbial, algal) to provide a natural indicator of eutrophication and develop new tools based upon this approach. An experimental facility has been built at AIMS to manipulate exposure to controlled water quality settings. This facility is being used by **Dr Anke Klüter** to investigate the utility of microarray technology, which measures gene-protein expression, to reveal biochemical markers indicative of sublethal stress in reef corals.

Maintaining ecosystem quality (Program C) – list of tasks

	TASK LEADER	TASK ASSOCIATE
Biodiversity: Status & Trends (C1)	**Dr Peter Doherty (AIMS)**	
Measuring the success of conservation strategies to protect GBR scleractinian corals (A2.1.3S)	PGS Ms E Dinsdale (JCU)	Dr P Marshall (GBRMPA)
Seabed biodiversity on the continental shelf of the GBRWHA (C1.1.2a)	Dr N Gribble (DPI&F), Dr R Pitcher (CSIRO), Dr P Doherty (AIMS), Dr J Hooper (QM)	Steering committee: Dr D Williams (CRC Reef), Dr D Huber (GBRMPA), Dr D Souter (QSIA), Mr V Veitch (SUNFISH), Mr B Ehrke (QSIA), Dr B Kerrigan (QFS)
Mapping bycatch & seabed benthos in the GBR for environmental risk assessment& sustainable management of Qld east coast trawl fishery. FRDC 2003/021 (C1.1.2f)	Dr R Pitcher (CSIRO)	3rd Party Contract (FRDC)
Seabed Biodiversity - acoustics component (C1.1.2g)	Dr R Pitcher (CSIRO)	3rd Party Contract (NOO)
Coral ID project (C1.10)	Dr J Veron (AIMS)	3rd Party Contract (GBRRF)
Research & monitoring initiative for Commonwealth Marine Protected Areas (C1.12)	Mr W Oxley (AIMS)	3rd Party Contract (DEH)
Research & monitoring initiative for Commonwealth Marine Protected Areas. Coringa-Herald (C1.12a)	Mr W Oxley (AIMS)	3rd Party Contract (DEH)
Research & monitoring initiative for Marine Protected Areas. Development of a strategy document (C1.12b)	Mr W Oxley (AIMS)	3rd Party Contract (DEH)
Research & monitoring initiative for Commonwealth Marine Protected Areas. Biodiversity surveys: Elizabeth & Middleton Reefs Nature Reserve (C1.12c)	Mr W Oxley (AIMS)	3rd Party Contract (DEH)
Research & monitoring strategy for Commonwealth Temperate Marine protected Areas (C2.1.3)	Mr W Oxley (AIMS)	3rd Party Contract (DEH)
Status of nearshore reefs of the GBR 2003-04 (C1.14)	Dr H Sweatman (AIMS)	Dr L McCook (GBRMPA)
Review of seagrass & sediment nutrient status in the Central Region of the GBRWHA (C1.15)	Dr J Mellors (DPI&F)	
Long-term monitoring of coral reefs of the GBRWHA (C1.2)	Dr H Sweatman (AIMS)	Dr D Wachenfeld (GBRMPA)
Identifying critical marine plant habitats within the GBRWHA (C1.3)	Mr L McKenzie (DPI&F)	Dr K Dobbs (GBRMPA), Dr D Haynes (GBRMPA)
Western Pacific seagrass project - Packard Foundation (C1.8)	Dr R Coles (DPI&F)	3rd Party Contract (University of New Hampshire)
Water Quality (C2)	**Dr M Furnas (AIMS)**	
Assessing land-based threats and impacts: nutrient supply fluxes (C2.1)	Dr M Furnas (AIMS)	Dr D Haynes (GBRMPA), Mr V Veitch (SUNFISH)
Water quality in undeveloped and pristine areas of the GBR Catchment (C2.10)	Mr J Brodie (JCU)	Dr D Haynes (GBRMPA)
Assessment and review of links between COTS outbreaks on the GBR and water quality changes associated with land use change in the GBR catchment (C2.11)	Mr J Brodie (JCU)	3rd Party Contract (GBRRF)
Golden algae nuisance blooms in the GBR region: causes & solutions (C2.12)	Dr B Schaffelke (CRC Reef)	Dr L McCook (GBRMPA), Mr R Hore (Reef Biosearch)
Assessing impacts of terrestrial run-off on inshore reefs (C2.2)	Dr K Fabricius (AIMS)	Dr D Haynes (GBRMPA), Mr V Veitch (SUNFISH)
Factors affecting coral fitness in an experimental reef mesocosm (C2.3S)	PGS Ms S Anthony (JCU)	Mr J Hoey (GBRMPA)
Physical movement of sediment and its biological impact on reef corals (C2.5)	PGS Ms S Rotmann (AIMS)	3rd Party Contract (Lihir Management Company)
Herbert River integration study (C2.6)	Dr D Williams (CRC Reef)	
Long-term chlorophyll monitoring of GBR waters (C2.8a)	Dr M Furnas (AIMS)	Dr D Haynes (GBRMPA)
Climate Change & Coral Bleaching (C4)	**Dr J Lough (AIMS)**	
Regional dynamics in the marine climate GBRWHA (C3.1)	Dr J Lough (AIMS)	Dr P Marshall (GBRMPA)
Long-term monitoring of sea temp at PCQ ports (C3.1.1)	Dr R Berkelmans (AIMS)	Ms S Trimarchi (PCQ)
Climatic & oceanographic change from high-resolution records in large fossil *Porites* from Magnetic Island Qld (C4.12S)	PGS Mr S Lewis (JCU)	Dr J Lough (AIMS)

Irukandji Research (C6)	**Dr D Williams (CRC Reef)**	
Identifying Cubomedusae responsible for Irukandji syndrome using molecular & morphological characters (C6.1)	Dr M Van Oppen (AIMS)	3rd Party Contract (GBRRF)
Irukandji Syndrome: definition, physiological progression & optimal treatment (C6.2)	Dr J Seymour (JCU)	3rd Party Contract (GBRRF)
Collection of Irukandji jellyfish from onshore & offshore coastal Qld for taxonomy & toxinology research (C6.3)	Dr P Fenner (SLSQ)	3rd Party Contract (GBRRF)
Catchment to Reef (C7)	**Dr P Doherty (AIMS)**	
Advanced technologies for monitoring water quality in the GBR (C7.1)	Dr M Furnas (AIMS)	Dr L McCook (GBRMPA), Dr D Haynes (GBRMPA)
New tools for assessing health, status and trends in nearshore marine ecosystems (C7.2)	Dr K Fabricius (AIMS)	Dr D Haynes (GBRMPA), Dr L McCook (GBRMPA)

PGS - Postgraduate student

Reef Futures (Program D)

Program Leader: Dr Terry Done, AIMS

Highlights

- A review of monitoring programs in the GBRWHA was launched on the Reef Futures website which is invaluable for planning and coordinating future monitoring programs in the GBR region.
- A new Reef State model was launched on the Reef Futures website which demonstrates the benefits for the GBR of lower rates of global warming and good management. The system includes an interactive capacity for web users to explore future scenarios for coral reefs of the GBR.
- A new study using epidemiological methods showed the strongest link yet between coastal development and the state of coral reefs.
- A study demonstrated a strong link between reef water quality and outbreaks of crown-of-thorns starfish. The study highlights the benefit of improving water quality in the GBR.
- A new information management system was launched, accessed through the Reef Futures website, which stores and delivers introductory information, suggested reading, and over 400 datasets to researchers and the public.

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

Knowledge exchange (Project D3)

Project leader: Dr Britta Schaffelke, JCU

This project acts as a forum for knowledge compilation, integration and transfer that operates across research tasks and works in close cooperation with the Communication section and the Exploring Reef Futures team.

The team played a major role in organising the conference, Catchment to Reef: Water Quality Issues in the GBR Region, in March 2004. One hundred and seventy scientists, managers and other interested parties shared new information and insights on regional water quality research. This was a timely update, incorporating the results of many new studies that have been undertaken, both in catchments and in GBR waters. The proceedings of the conference are being published as a special issue in the international journal Marine Pollution Bulletin, and will be a benchmark of current state of knowledge on GBR water quality.

Another major achievement was the completion of a Review of Monitoring Programs in the GBRWHA and making the results publicly available on the Reef Futures website. Feedback from web users indicates that this accessibility to the review is proving very useful for planning of future monitoring program in the GBR region.

Finally, the project made major contributions to the development and growth of Centre websites. The CRC Reef website was redesigned and is regularly updated, the embedded Reef Futures portal to the Centre's information management system was further developed, and new websites created for CRC Torres Strait and International Marine Project Activities Centre (IMPAC), using designs that indicate their relationship with CRC Reef.

Exploring Reef Futures (Project D4)
Project leader: Dr Terry Done, AIMS

The project made good progress in four main areas: exploring future scenarios; understanding the major pressures of terrestrial run-off and crown-of-thorns starfish; statistical support for design and analysis of research tasks; development of an advanced knowledge management system.

Exploring future scenarios for coral reefs in the GBR involved two parallel activities. First, a prototype simulation model called Reef State was further refined to predict future reef state under different assumptions about rate of climate change, rate of adaptation in corals, the heat-sensitivity of the corals, and rate of growth of seaweeds. Second, progress was made in developing spatial risk maps of the GBR showing the year-by-year risk of heat stress conditions that have potential to cause coral bleaching and death. These maps are based on past patterns of heat stress and damage, and incorporate empirical bleaching thresholds for different places, and simple proxies for oceanographic processes and acclimatisation. Each modelling stream is based on use of Bayesian Belief Networks, and this approach will also be central to integrating these and other streams in future developments. The other streams will include risk maps for flood plumes, water quality, cyclone waves and crown-of-thorns starfish. At completion, each of the GBR's 3,000 reefs will be characterised according to its annual encounter probabilities for exposure to these pressures singly and in combination. These encounter probabilities will be important inputs into impact assessments and evaluation of effects of management and policy options on key reef quality indicators.

Meaningful projections of the future should be based on the best possible understanding of key pressures in the system, two of which are terrestrial run-off and crown-of-thorns starfish. In relation to terrestrial run-off, the project developed a framework based on statistical and epidemiological methods to assess their effects on coral reefs. Key indicators of reef state and resilience were much poorer in reefs off the Wet-Tropics coast (with intense coastal development) than those in Princess Charlotte Bay (with limited coastal development). The results of this study were used in development of the Reef Water Quality Protection Plan. It has been suggested that the frequency of damaging outbreaks of crown-of-thorns starfish outbreaks may be increasing as a result of enhanced survival due to increasing nutrients. Models developed to investigate this hypothesis showed that the link is plausible, and that it could be causing a shift from infrequent outbreaks to a chronic state of infestation. An analysis of 10 years of data on chlorophyll levels - potentially an important determinant of crown-of-thorns starfish survival – was consistent with this interpretation.

The project provided statistical design and analysis support to a number of other projects: design and analysis of microarray experiments to investigate water quality pollution and genetic expression of stress; analysing large complex data sets for an eleven year data set from the AIMS Long-Term Monitoring Program; statistical support to the CRC Reef Seabed Biodiversity Project; analytical contributions to numerous research papers.

The project has a major role in making knowledge broadly available. This year, we further developed and implemented an efficient and versatile information management system providing access to scientific knowledge for the public and Centre members. The system, accessed through the Reef Futures website, stores and delivers over 400 datasets to researchers and the public at AIMS and JCU. The system includes products of a review of GBR monitoring in detail and with advanced search and visualisation tools. Monitoring researchers in Queensland can now compare their activities with each other both spatially and thematically. The system also includes an interactive capacity for web users to explore future scenarios for coral reefs of the GBR. Web users can also see maps in near real-time of heat stress on all Australian coral reefs (through automatic downloads of satellite-derived products produced by NOAA), and real time graphs of sea temperatures at a network of AIMS weather

stations. The introduction of a modified mirror of AIMS data at JCU enhanced the speed and ease of access to these materials, and the collaborative research efforts in marine science.

Reef Futures (Program D) – list of tasks

TASK TITLE	TASK LEADER	TASK ASSOCIATE
Information Synthesis (D2)	**Dr Terry Done (AIMS)**	
Effects of water quality on the distribution of corals on coral reefs (D2.1.1S)	PGS Mr B Radford (JCU)	
Book: Geoscience of the GBR (D2.2b)	Dr P Larcombe (CEFAS)	Mr A Costen (EPA)
Review of the 25-year strategic plan for the GBRWHA (D2.5b)	Dr B Kennedy (JCU)	Mr J Innes (GBRMPA), Mr J Day (GBRMPA)
Knowledge Exchange (D3)	**Dr Terry Done (AIMS)**	
Knowledge exchange (D3.1)	Dr B Schaffelke (CRC Reef)	
Exploring Reef Futures (D4)	**Dr Terry Done (AIMS)**	
Ownership of genetic resources in the GBRWHA, its ecotone and the EEZ (A3.1)	Dr M Wasson (ANU)	Dr C Battershill (AIMS)
Information management system (D1.1)	Dr B Schaffelke (CRC Reef)	Mr A Chin (GBRMPA)
Knowledge management system (D4.1)	Mr S Kininmonth (AIMS)	Ms S Davies (GBRMPA)
Exploring Reef Futures (D4.2)	Dr S Wooldridge (AIMS)	Dr P Marshall (GBRMPA)
Data and information analysis (D4.3)	Dr G De'ath (AIMS)	Dr D Williams (CRC Reef)

PGS – Postgraduate student

Torres Strait (Program T)

Program Leader: Dr David Williams, CRC Reef/AIMS

Highlights

- Major survey of critical habitats adjacent to the Prince of Wales Shipping Lane and Port of Thursday Island completed which will assist environmental planning, management of the Port of Thursday Island and regional oil spills.
- Initial results found no introduced marine species in Thursday Island harbour. Samples from the baseline survey are still being analysed and will be of extreme benefit to assist in environmental management and protection of natural resources.
- Surveyed the fish and crustaceans on the seafloor between reefs in Torres Strait. Another survey next year will focus on seabed habitat, sediment and less mobile animals.
- Analysed historical catch and effort data of commercial islander fishers in the eastern Torres Strait reef line fishery which is now available for assessment of alternate management strategies (funded by Australian Fisheries Management Authority).
- A survey for exploited sea cucumbers on Warrior Reef in Torres Strait was completed, including information about burrowing behaviour and the benthic habitat to assist interpretation of changes in abundance.
- Using high-resolution swath surveys, discovered major underwater sand waves in the Torres Strait that move rapidly associated with changes in wind and wave direction which may significantly impact on distribution of seagrass.
- Seagrasses in Thursday Island harbour appear healthy and have a similar distribution to a baseline survey undertaken in April 2002.
- Seagrass monitoring site established at Back Beach, Thursday Island, by Torres Strait High School and TAFE students under the Seagrass Watch program.
- Appointment of an Indigenous Aquaculture Extension Officer, Mr Brian Singleton.
- Protocols for research in the Torres Strait developed which are available on the new CRC Torres Strait website and help to facilitate strong communication between researchers and Torres Strait communities.
- 20 CRC Reef and CRC Torres Strait staff and students completed cultural awareness training with the JCU School of Indigenous Australian Studies.
- Research in Torres Strait greatly assisted by the appointment of Marine Research Liaison Officer, and Torres Strait islander, Mr Toshio Nakata, who is based at Torres Strait Regional Authority on Thursday Island.

Objectives

- To provide information on key ecological processes in Torres Strait that will improve understanding of the sustainability of the Torres Strait marine ecosystem and conservation of threatened marine species.
- To provide information on status and trends of fisheries and other economically and culturally important natural resources of Torres Strait necessary for effective coordinated and integrated natural resource management.
- To assist in the development and implementation of marine strategies for Torres Strait.
- To provide information to support regional marine planning in Torres Strait and northern Australia.
- To assess the impacts of resource exploitation on the Torres Strait marine environment.
- To provide tools for the evaluation of the consequences of alternative management strategies on Torres Strait stakeholders, marine resources, communities and cultural values.
- To create innovative systems to make available to Torres Strait peoples and other end-users data and information, either existing or generated by the program.

- To identify candidate species for new aquaculture from the natural resources of Torres Strait that are compatible with the aspirations and lifestyles of Torres Strait peoples, and to develop the technology and knowledge base to support sustainable production in new Torres Strait based aquaculture industries.
- To develop education and extension programs to enhance the involvement of Torres Strait peoples in research and development opportunities in Torres Strait.
- To improve the capacity of Torres Strait communities to understand and utilise research results for enhanced economic and social development.
- To improve the capacity of researchers to engage with Torres Strait communities in the design and conduct of research and in the transfer of research results.

This program brings together the main resource management agencies, research institutions and stakeholders in Torres Strait as well as the Torres Strait Regional Authority (TSRA), representing the Torres Strait community. The participants bring substantial resources (over $13 million over three years) to the Program as well as scientific and management expertise and are combining their efforts into a single, integrated, multi-disciplinary research, education and communication program, directed towards the identified needs of stakeholders and end-users. Their expertise derives from considerable experience in Torres Strait and the adjacent GBRWHA. The core participants are AFMA, AIMS, CSIRO Marine Research, CRC Reef, GeoScience Australia, JCU, NOO, DPI&F and the TSRA. Supporting participants are GBRMPA, GBRRF and QSIA.

This program offers a unique opportunity to bring efficiencies and synergies to the current research effort, to improve the delivery of information needed for sustainable development of Torres Strait and peoples and to add considerably to the value of current research and extension efforts. The result is an integrated, multi-disciplinary applied program of research far beyond that which could be done previously or by any of the participants acting independently.

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

Sustaining the harvest of marine resources (Project T1)
Project Leader: Dr Gavin Begg, JCU

This Project has initiated research on a diversity of culturally and economically important marine resources in the Torres Strait. This Project is designed to provide information about the sustainability of key marine resources including turtle, dugong, tropical rock lobster, prawn, reef fish, mackerel and beche-de-mer. In addition, this Project plans to identify candidate species and opportunities for aquaculture that will enhance the economic wellbeing of Torres Strait Islanders, while potentially reducing impacts on wild harvest species. Although research has only recently commenced in several tasks, initial progress has been satisfactory with extensive communications between researchers, stakeholders and Torres Strait communities ensuring the success of preliminary field trips and the strategies to collect data.

Historical catch and effort data of commercial Islander fishers in the eastern Torres Strait reef line fishery has been analysed and will be integrated into management strategy evaluations designed to assess the fishery. Similar data sources will be compiled for commercial non-Islander and traditional Islander fishers. Catch and effort data, as well as biological samples of key reef fish species have also

been collected from non-Islander commercial fishers during observer surveys in March and May. Analogous data for the Islander sector will start being collected in July 2004. These data may also supplement other data sources that are currently being compiled for the task that are designed to assess the eastern Torres Strait Spanish mackerel fishery.

Abundance surveys were conducted for the tropical rock lobster, prawn and beche-de-mer fisheries as part of the Sustainable Harvest Project. Although tropical rock lobsters and prawns are harvested by both Islander and non-Islander fishers, the beche-de-mer fishery is almost exclusively an Islander-only fishery. The initial survey for beche-de-mer was conducted on Warrior Reef, where the northern section of the reef showed low abundances. Additional information was also recorded on burrowing behaviour and benthic habitat that will be examined in relation to abundance levels and population dynamics of local beche-de-mer populations.

The annual survey of the Torres Strait prawn fishery was conducted in February, with bycatch samples retained for later processing. Fishers were also interviewed to update vessel and fishing gear information to be used in the assessment of the fishery. The models used in this assessment were also refined and updated to include the Australian 2003 logbook data and Papuan New Guinea logbook data for the Torres Strait Protected Zone.

Research outcomes from the Sustainable Harvest Project will provide information about the status and trends of important marine resources in the Torres Strait for integrated assessment and management, while contributing to effective policy formulation and management decision making.

Understanding ecosystem processes (Project T2)
Project Leader: Dr Alan Butler, CSIRO

It is essential to manage the marine environment, the marine resources and the conservation values of Torres Strait on a regional, ecosystem basis. This Project aims to provide information about key ecological patterns and processes in Torres Strait that will improve the understanding of the dynamics of the Torres Strait marine ecosystem and hence – working with other researchers in the Program - will provide sound scientific support for coordinated and integrated management.

Mapping and characterisation of key biotic and physical attributes of the Torres Strait ecosystem (led by CSIRO), focussed on the inter-reef seafloor, started with a survey in January 2004 aboard FRV Gwendoline May. The survey concentrated on demersal, motile animals that are sampled by a modified prawn trawl. The component of the work that concerns sessile benthic animals (using towed video, benthic sled and other devices) will be undertaken in early 2005. The data from the 2004 cruise have been logged and specimens have been preserved. Sorting has been underway for several months: fishes and crustaceans at CSIRO in Cleveland, and sponges and other sessile invertebrates at Queensland Museum in South Brisbane.

A high-resolution swath sonar survey and detailed sampling program has been undertaken in two areas near Turnagain Island to reveal bathymetry, sediments and habitats. This is part of a project on biophysical processes in the Torres Strait marine ecosystem (led by GA) which will ultimately produce models of water movement and its influence on sediment movement. The survey was undertaken from 27 March to 17 June 2004 on JCU's research vessel RV James Kirby. The focus of the survey was to understand the movement of the sandwaves and changes to water turbidity as possible mechanisms for widespread seagrass die-back events. The orientations and migration directions of the sandwaves and ridges are affected by the different wind-driven currents of the summer monsoon and winter trade wind seasons. Repeat sonar surveys three weeks apart revealed that the sandwave crests had moved west up to 6-13m, coinciding with a change in wind and wave direction from NW

to SE. Data from the survey are still being analysed, but hydrological modelling work has commenced. A second survey in October 2004 will determine how far the sandwaves have moved and assess any effects on seagrass distribution.

Four field trips in 2003-04 assessed the distribution and abundance of seagrass in Torres Strait (led by DPI&F). These included a reconnaissance trip, a trip to measure productivity and map the Mabuaig seagrasses, participation in the biophysical processes trip (above) to quantify the effect of sand wave movement on seagrasses, and an exercise to obtain productivity measurements of seagrass at Thursday Island. Data from these trips are being analysed. This work will link with other tasks in the Torres Strait Program, to better understand key ecosystem processes and, in particular, the causes of seagrass die-back.

Evaluating management strategies and risk (Project T3)
Project Leader: Dr Rob Coles, DPI&F

In this first phase of the project, staff made several trips to Thursday Island and nearby islands in the Torres Strait to discuss the strategy for the project and arrangements for basing activities in local communities. The project has used services provided by TSRA and the Torres Strait Island radio to communicate plans and activities to the widest possible audience.

The team has successfully completed a survey of Thursday Island Harbour to set a baseline for introduced marine pests. Fundamental to controlling and managing the spread of pests is knowledge of the marine communities that are present naturally. This is particularly important in the high-risk areas where commercial ships and passing recreational vessel anchor. None of the introduced pest species targeted by the team were found in the baseline survey.

Good progress has been made in surveying critical habitats adjacent to the Prince of Wales shipping lane where large areas of seagrass and dugong feeding grounds are close to shipping traffic. This information is being prepared in a GIS format and will be incorporated into the AMSA oil spill atlas.

A detailed seagrass mapping survey has been completed around reefs in the region to the north east of Mabuiag Island. This is part of a study to examine seagrass distribution and productivity working in conjunction with the Understanding Ecosystem Processes Project. The aim is a better understanding of the dynamics of Torres Strait seagrasses and insight into the reasons for past changes, particularly declines in the seagrass meadows.

Education (Project T4)
Project Leader: Prof Helene Marsh

A strong Education Program is central to all CRCs. The challenge for CRC Torres Strait is to develop a program which is relevant and effective for Torres Strait Islanders.

The Torres Strait Prestige Research Scholarship has been awarded to **Mr Frank Loban** who will undertake a Masters degree at JCU to investigate the prospects for Islanders to become involved in fisheries management especially enforcement.

Following little response to offers of postgraduate scholarships, the Project Leader held discussions with the Principal of Thursday Island High School. As a result, it is proposed that a program is developed that targets OP (Overall Position)-eligible year 11 and 12 students who are studying multi-strand science and marine studies. The objective of the program will be to: raise the profile of natural resource management and marine science as potential careers for Torres Strait Islanders; and provide young Torres Strait Islanders with role models of natural resource managers and marine scientists.

It is envisaged that the program will comprise: a series of talks from visiting CRC Torres Strait scientists (the first talk entitled 'Torres Strait dugong capital of the world' was delivered in February); participation in Seagrass-Watch four times per year; a series of workshops for students developed in conjunction with teachers from the School, especially **Ms Sophie Ramke** and **Mr Andrew Denzin**; and opportunities for students to undertake structured work placements with CRC Torres Strait scientists undertaking field work in Torres Strait.

A formal partnership arrangement has been signed between CRC Torres Strait and Thursday Island High School (which recently amalgamated with the local TAFE). Proposals being considered under this arrangement include: use of the school's boat and TAFE lecture facilities; structured work placements for Torres Strait Islanders and for Torres Strait Islanders to undertake post-school cadetships in partner organisations.

Extension (Project T5)
Project Leader: Dr Annabel Jones

The Torres Strait Program was conceived as one that would require extension and liaison activities to ensure the research tasks were successful. Liaison and extension activities have been adopted to ensure that research is conducted in culturally appropriate ways and to assist in developing positive relationships between researchers and Torres Strait Islanders. CRC Torres Strait has adopted many extension strategies that have been successful for other research programs in CRC Reef as well as developing a new Communication and Extension Strategy and some new communication methods for work in Torres Strait.

Mr Toshio Nakata has been appointed as Marine Research Liaison Officer. He is based in TSRA at Thursday Island, and is a Torres Strait Islander with a wealth of knowledge and experience in Torres Strait over many years. His assistance and knowledge has been an immense help with many research tasks.

A CRC Torres Strait logo has been developed which is used on stationary, clothing for researchers, the website and media releases. This will help establish CRC Torres Strait as a distinctive research project of excellence.

CRC Torres Strait has developed a website (www.crctorres.com) with important and practical information for researchers working in Torres Strait. The site provides researchers with information on appropriate methods for conducting research in Torres Strait; the best means of communication with Islanders and other CRC Torres Strait researchers; and recommended liaison and extension activities. The website also provides another method for disseminating information about the program to the wider community.

An email list for researchers, Task Associates and other stakeholders has been created to facilitate communication within the program. It is an efficient method for disseminating up-to-date information to researchers.

Media exposure for CRC Torres Strait has been targeted to ensure that Torres Strait communities are informed about the research. Many visiting CRC Torres Strait researchers have been interviewed by the local radio station which has a large audience throughout Torres Strait. Several articles have also appeared in the local Torres Strait newspaper, and the TSRA Newsletter which has wide circulation throughout the region. Information flyers and posters, which are extremely successful, have been distributed through participating Island Community councils.

A Task Associate program has been implemented for CRC Torres Strait tasks with Associates appointed for projects as well as each task to ensure that relevant stakeholders have an integral role in the development and implementation of tasks.

Torres Strait (Program T) – list of tasks

TASK	RESEARCHER	TASK ASSOCIATE
Sustaining the Harvest of Marine Resources (T1)	**Dr G Begg (JCU)**	**Mr J Prescott (AFMA), Mr P Yorkston (TSRA), Mr B Ehrke (QSIA)**
Evaluation of the Eastern Torres Strait reef line fishery (T1.1)	Dr A Williams (JCU)	Mr J Prescott (AFMA), Mr P Yorkston (TSRA)
Status assessment of the Eastern Torres Strait Spanish mackerel fishery (T1.2)	Dr G Begg (JCU)	Mr J Prescott (AFMA)
Sustainability assessment of Torres Strait rock lobster fishery (T1.3)	Dr Y Ye (CSIRO)	Mr J Prescott (AFMA)
Sustainability assessment of Torres Strait sea cucumber fishery (T1.4)	Mr T Skewes (CSIRO)	Mr J Kung (QFS), Mr J Prescott (AFMA)
Towards ecologically sustainable management of the Torres Strait Prawn Fishery (T1.5)	Mr C Turnbull (DPI&F)	Mr J Prescott (AFMA), Mr J Kung (QFS), Mr G Anderson (Torres Strait Prawn Entitlem't Holders)
Indigenous aquaculture - extension & community development (T1.7)	Mr C Robertson (DPI&F)	Dr C Battershill (AIMS), A/Prof R de Nys (JCU), Dr M Rimmer (DPI&F), Dr C Jones (DPI&F)
Modelling the impact of multiple harvest strategies in Eastern Torres Strait Reef Line Fishery (T1.8)	PGS Ms S Busilacchi (JCU)	Mr J Prescott (AFMA), Mr J Marrington (AFMA)
Developing collaborative community-based management prescriptives for Torres Strait Indigenous bêche-de-mer & trochus fisheries (T1.9)	PGS Ms A Prichard (JCU)	Mr P Yorkston (TSRA), Mr S Taylor (AFMA)
Information to assist Torres Strait Islanders manage their traditional fisheries for green turtles & dugongs in a sustainable manner (T1.11)	PGS Ms J Grayson (JCU)	Mr P Yorkston (TSRA), Mr S Taylor (AFMA)
Understanding Ecosystem Processes (T2)	**Dr A Butler (CSIRO)**	**Dr V Nelson (NOO), Mr P Yorkston (TSRA)**
Mapping & characterisation of key biotic & physical attributes of the Torres Strait ecosystem (T2.1)	Dr R Pitcher (CSIRO)	Mr S Jackson (NOO)
Mapping & characterisation of key biotic & physical attributes of the Torres Strait ecosystem (T2.1a)	Dr R Pitcher (CSIRO)	3rd Party Contract (NOO)
Biophysical processes in the Torres Strait marine ecosystem (T2.2)	Dr P Harris (GA)	Dr V Nelson (NOO), Mr P Yorkston (TSRA)
Distribution & abundance of seagrass in Torres Strait (T2.3)	Dr R Coles (DPI&F)	

Evaluating Management Strategies and Risks (T3)	**Dr R Coles (DPI&F)**	**Dr S Jackson (NOO), Mr P Yorkston (TSRA), Mr J Prescott (AFMA)**
Cultural indicators for traditionally-important marine resources in Torres Strait (T3.1)	Dr D Kwan (JCU)	Mr P Yorkston (TSRA), Mr S Jackson (NOO), Mr S Taylor (AFMA)
Management of introduced marine species risks in Torres (T3.2)	Dr K Neil (DPI&F)	Ms S Trimarchi (PCQ)
Integrated ecosystem modelling for evaluating multiple-use management strategies (T3.3)	Dr F Pantus (CSIRO)	Mr J Prescott (AFMA), Dr V Nelson (NOO)
Identification & mapping critical habitats adjacent to shipping lanes & ports in Torres Strait (T3.4)	Dr M Rasheed (DPI&F)	Mr B Brunner (PCQ)
Port of Thursday Is - baseline surveys for introduced marine pests (T3.5)	Dr K Neil (DPI&F)	3rd Party Contract (CRC Reef)
Port of Thursday Island seagrass monitoring (T3.6)	Dr M Rasheed (DPI&F)	3rd Party Contract (CRC Reef)
Education (T4)	**Prof H Marsh (JCU)**	
Education opportunities for Indigenous involvement in marine ecosystem monitoring (T4.1)	Dr J Mellors (DPI&F)	
Engaging Torres Strait Islanders in dugong & turtle research (T4.2)	Dr I Lawler (JCU)	3rd Party Contract (DEH)
Extension (T5)	**Dr A Jones (JCU)**	**Mr T Nakata (TSRA)**
Guidelines for ethical & effective communication for researchers working in Torres Strait (T5.1)	Dr A Jones (JCU), Ms B Barnett (CRC Reef)	Mr P Yorkston (TSRA)

6. EDUCATION

Program Leader: Professor Helene Marsh, JCU

Highlights

- Seven students supported by CRC Reef scholarships completed or submitted their theses.
- A total of 20 students received CRC Reef scholarships during 2003-04, including four students working on Catchment to Reef tasks.
- Two students received CRC Torres Strait scholarships.
- Augmentative Grants in 2003-04 were awarded to one Honours students and eight MSc or PhD students.
- A CRC Reef Student Megafauna Workshop in February 2004 forged closer links between managers, stakeholders and student researchers with a professional interest in marine megafaunal issues.
- Results of CRC Reef Students were published in 20 publications (Appendix 5).
- An analysis prepared for the recent review, indicated that CRC Reef students produced 32% of CRC Reef publications, and 43% of refereed journal articles on 9% of the CRC Reef budget.
- **Mr Frank Loban** was awarded the CRC Torres Strait Prestige Scholarship for a Torres Strait Islander.

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

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

In addition, a further objective was established for CRC Torres Strait Education and Training Program: to provide training and education opportunities and support at a variety of secondary, tertiary and postgraduate levels specifically for Torres Strait islanders.

Student Induction Program
A comprehensive student induction, including a CRC Reef student handbook, was offered in May 2004 and was well received by students starting their studies with the Centre.

Current Student Status
In 2003-04, the Centre supported 35 Scholarship Students (32 PhD, 3 MSc), which included seven PhD students from the previous CRC. Of these, 22 received a scholarship in 2003-04. Seven Scholarship Students submitted or completed their theses during the year.

The Centre also supported 71 Student Associates (39 PhD, 18 MSc, 14 Hons), who had an association with CRC Reef or CRC Torres Strait through their project or supervisor or through the receipt of financial support other than a scholarship. This includes 30 recipients of CRC Reef Augmentative Grants and 9 students from the previous CRC. Twenty-five Student Associates submitted or graduated during the year.

Four new PhD scholarships were awarded under the joint Rainforest CRC and CRC Reef Catchment to Reef initiative. One PhD and one MSc scholarship were awarded for CRC Torres Strait.

The majority of the Centre students are enrolled at JCU, where Centre students represent 17% of all postgraduate research students (an increase from 12% in 1999-2000). One Scholarship Student was enrolled at UQ and one at Curtin University.

POSTGRADUATE STUDENTS 2003-04		
Degree	**Scholarship Students***	**Student Associates**
PhD	31 (1)	37 (2)
MSc/ MEngSc etc	2 (1)	18
Honours/ GDip	0	14
Total	**35**	**71**

Table includes students who submitted or graduated during 2003-04 and students who have received scholarships in the past but have not yet submitted. Numbers in brackets are CRC Torres Strait students.

Grants and Awards

The Centre now offers Completion Scholarships to support Scholarship Students to complete their degrees. These scholarships are awarded on a competitive basis and fund students for a further three months of candidature to finalise and submit their theses. Two students, **Ms Anna Lashko** and **Ms Amanda Hodgson**, were awarded completion scholarships in 2003-04. Ms Lashko recently submitted her PhD.

The Centre continued to support student attendance at conferences. Eleven students were supported with grants totalling $9,250 to attend both national and international conferences.

CRC Reef Augmentative Grants support postgraduate research in areas of core and strategic interest to CRC Reef. Grants totalling $10,000 were awarded to one Honours student and eight MSc or PhD students, who become CRC Reef Student Associates.

Training

The Centre training offered to postgraduates has been reviewed and largely discontinued. James Cook University is now offering a number of generic skills courses that can be accessed by any student. Most CRC Reef Scholarship Students are now in the final stages of their theses and require specific assistance to finish their degrees rather than generic skills training, which is more important at the beginning of a postgraduate project. A statistical support service for Centre students was initiated in July 2001 and continued in 2003-04. The service operates in conjunction with JCU and provides both individual consultation time with a statistical advisor and several short courses in topics of interest. The scheme continues to be well-supported by students, especially since many CRC Reef students are now in the final stages of their projects and require support for data analyses.

A well-received **CRC Reef Student Megafauna workshop** was held in February 2004 to forge closer links between managers, stakeholders and student researchers with a professional interest in marine megafauna issues. CRC Reef students presented the results of their marine megafauna research and several stakeholders gave overviews of their involvement with marine megafauna. From the workshop a series of 'Research Outcomes and Implications Briefings' have been produced by students, which are short, plain-English research summaries to make current scientific knowledge available to policy-makers and people affected by policy changes. These will be available on the CRC Reef website.

Former CRC Reef student, **Dr Jane Mellors** is developing strong links with Thursday Island High School assisted by **Dr Gillian Brodie** and under the aegis of CRC Torres Strait. They are working with High School staff to develop activities centred around Seagrass Watch which are aimed at

sharing knowledge about the local marine environment with the students who have considerable traditional knowledge about their coastal environments.

Student employment
CRC Reef graduates are sought by industry and research partners which facilitates the transfer of expertise. In 2003-04, the following CRC Reef students have been employed in positions relevant to their training with CRC Reef.

STUDENT	PLACE OF EMPLOYMENT
Scholarship students	
Celmara Pocock	Postdoctoral Scientist, University of Tasmania
Ashley Williams	Research Fellow, Effects of Line Fishing Project, CRC Reef
Jane Harrington	Project Manager, Jo McDonald Cultural Heritage Management Pty Ltd, Marrickville NSW
Student associates	
Ameer Abdulla	Marine Specialist, IUCN Global Marine Program, IUCN-the World Conservation Union, Malaga, Spain
Aaron Ballagh	Researcher, Effects of Line Fishing Project, CRC Reef Research Centre.
Elizabeth Burgess	Consultant, TRAFFIC Southeast Asia, Kuala Lumpur, Malaysia
Cathryn Clarke	Technician, Pacific Biological Station, Department of Fisheries and Oceans, Government of Canada, Nanaimo, Canada
Darren Grover	Senior Project Officer, Approvals and Wildlife Division, Department of the Environment and Heritage, Canberra
Jane Mellors	Fisheries Scientist, DPI&F, Townsville Qld
Josh Madin	National Centre for Ecological Analysis and Synthesis, University of California, Santa Barbara, CA USA
Heather Patterson	Research Fellow (Zoology), U of Melbourne, Melbourne
Severine Thomas	Water Quality Officer, Reef HQ, GBRMPA, Townsville Qld

Students in the spotlight

Using perceptual assessments of coral reef health CRC Reef Scholarship Student **Ms Elizabeth Dinsdale** identifies how people describe the coral reef environment. Survey participants with different levels of coral reef experience, such as scientists, managers, tourist operators and participants that in some cases had never visited a coral reef, were presented coral reef photographs to describe and rate the health of these reefs. The subjective health assessments were similar for all participants. For example, coral reefs with low anchoring activity were perceived to be in good health, whereas reefs associated with high anchoring activity were perceived to be unhealthy. This suggests that peoples' perception about the health of an environment is realistic and could be used as an indicator to identify where better coral reef protection is required.

The behaviour of dugongs is difficult to study. They spend most of their time eating seagrass on the ocean floor, are usually found in turbid water, and individuals are hard to identify. To overcome these problems, CRC Reef Scholarship Student **Ms Amanda Hodgson** developed the blimp-cam: a tethered, helium-filled balloon with a remote controlled video camera, which transmits video images, providing a birds-eye view of large dugong herds in Moreton Bay. Ms Hodgson observed behavioural responses of dugongs to boats and found that dugongs were not always able to move away from the path of boats travelling at high speed (planing), but had sufficient time to avoid non-

planing boats. Reducing speed limits for boats in important dugong habitats would be an appropriate strategy to address this issue.

CRC Reef Scholarship Student **Mr Steve Lewis** investigates 6000-year-old fossil coral heads from Magnetic Island. Using coral geochemistry and sedimentary layering, he tries to understand the conditions these corals experienced during their lifetime and the cause of their death. He used a modern coral with a growth record from 1812 to 1986 to compare information relating to climate, river run-off and water quality with the fossil corals, indicating that temperature and rainfall conditions have been quite similar over the past 6000 years. The fossil corals appear to have died due to highly turbid conditions and were buried by a layer of silt. The geological record in the modern coral shows a change in land management since Europeans first settled the area after 1870. This study will provide a valuable historical context for the management of the inshore GBR and of land use practices in the connected river catchments.

CRC Reef Scholarship Student **Mr James Sheppard** quantifies fine-scale foraging activities of dugongs in the GBR region to develop models describing where and when dugongs feed. This will enhance the ecological basis for conservation management of this threatened species. Mr Sheppard uses tracking equipment with new, accurate GPS technology to monitor the habitat use of wild dugongs at very high resolution, as well as marine videography and analyses of the nutritional value of their seagrass food. Dugong tagging in Hervey Bay revealed that dugongs prefer one particular site of the Bay, the seagrass meadows at the Burrum river mouth. James also confirmed that the Hervey Bay and GBR dugong populations are connected and identified a previously unrecognised important dugong winter habitat at the northern tip of Fraser Island.

Cultural heritage values of the GBR are an important part of the region's significance, but are poorly understood. CRC Reef Scholarship Student **Ms Celmara Pocock** explored changes in visitor experiences of the Reef through both contemporary and historic images and texts. While early visitors developed a strong sense of place through sensuous encounters with the environment, such as the sound of *Casuarina* trees, modern technologies such as high-speed transport and air-conditioning have reduced such interactions. Consideration of cultural aspects of natural attributes may facilitate continuity in broad public appreciation of particular environments. Tourism marketing could apply these values to cater for the different expectations and experiences of local, interstate and overseas visitors, and also offer a means to encourage return visitors.

Cods and groupers are major targets of many reef fisheries around the world and also valued as iconic species by dive tourism. Yet little is known about the biology of many of these fishes. CRC Reef Scholarship Student **Ms Rachel Pears** studies the abundance, age and growth and reproductive biology of GBR grouper species. Her results suggest that large groupers such as the camouflage and flowery cods can be long-lived and may reach over 40 years of age. Flowery cods first reproduce as females and then some fish change sex to males after they reach about 70cm. Large females are important breeders over their reproductive lifespan which is more than 30 years. Many cods and groupers are naturally low in abundance and larger fish are a particularly rare but valuable part of the population. Ms Pears' study will contribute to better management and conservation of these important fishes.

The focus of CRC Reef Student Associate **Ms Michelle Boyle's** research is the post-hatchling stage of a sea turtle's life history, especially Loggerhead and Green sea turtles. Dietary and genetic information will provide information on their ecology and migration routes in the south-west Pacific region, to inform conservation and management programs for Australian populations. Dietary information confirms a pelagic lifestyle and shows that both species are omnivorous with a tendency towards carnivory. The high proportion of stomachs (62%) that contain plastics is of concern.

Preliminary results show genotypes previously unknown from descriptions of Australia's sea turtle genetic stocks.

CRC Reef Student Associate **Ms Lisa-Ann Gershwin's** work focuses on the identification, classification and evolutionary relationships of Australian cubozoan jellyfishes, including the deadly box jellyfish and the Irukandjis. Her work forms the foundation for other studies as most of the species are not yet named and classified. To date, Ms Gershwin has identified four new species of box jellyfish and nine new species of Irukandjis in Australian waters alone. Of these, probably three are capable of killing a previously healthy adult. Knowledge of a region's biodiversity is important, but where matters of public health and financial concerns such as tourism and fisheries industries are at stake, as in the case of stinging jellyfish, knowledge of jellyfish species is crucial to successful risk management.

7. COLLABORATION

Highlights

- The Great Barrier Reef Seabed Biodiversity Project, an unprecedented multi-agency collaborative venture, is mapping sea floor habitats and their associated marine life across the length and breadth of the Marine Park.
- Expansion of the Global Seagrass Monitoring Program to develop collaborative partnerships between science and community based teams in the countries of the western Pacific.
- **Dr Kerry Neil** from DPI&F helped to develop expertise for detecting marine pests in third world countries as part of extension work coordinated by the IMO GloBallast program.
- Research into swimmer interaction with dwarf minke whales on the Great Barrier Reef, in collaboration with tourism operators, has led to the first government-regulated swim-with-whales industry in the world.
- The Catchment to Reef project run jointly by the Centre and Rainforest CRC has developed cooperative linkages between scientists and stakeholders, to deliver tools that will help improve the quality of water flowing onto the Reef.

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

Cooperative linkages between Centre members and with external agencies are vital to the operations and future of the Centre. The strategies used by the Centre to achieve and maintain strong cooperative linkages are:

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

Internal links with member organisations

Links between researchers and member organisations are strengthened through the Task Associate Program. The role of the Task Associate is to improve the relevance and application of strategic research, facilitate information transfer and help develop public policy and better industry practices. Forty four personnel from AFMA, AIMS, GBRMPA, JCU, PCQ, QSIA, SUNFISH, EPA, DPI&F, Sea Forum and private industry are assigned as associates to 64 CRC Reef tasks. A further 15 people from 9 organisations are assigned to 22 tasks for CRC Torres Strait.

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

Collaborative research remained a high priority for the Fishing and Fisheries Project with active research tasks involving JCU, DPI&F and AIMS as well as external linkages to CSIRO and NOO.

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

Stakeholder linkages were also enhanced by:

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

External linkages

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

The first two years of a three-year project to develop a pilot plant to test the treatment of ships' ballast water was completed in May. The first phase of the project was supported by Natural Heritage Trust finding (through the Australian Department of Environment and Heritage), Ports Corporation of Queensland, the Ports of Townsville, Mackay and Gladstone, Amiad Australia, Modular Solutions Technologies, CRC Reef and JCU. Results of the work are extremely encouraging and it is likely that a combination of treatments will be necessary to meet ballast water standards that have been established by the International Maritime Organization (IMO). The research indicates that filtration combined with chlorine dioxide, pressure and shear as well as perhaps ultraviolet irradiation will be effective at treating ballast water. In its third year, the project is being supported by the Ports, Amiad Australia, CRC Reef, JCU and the Great Barrier Reef Research Foundation. It is anticipated that a business entity will be formed to commercialise the development phase.

In 2003-04, a working database for the' Eye on the Reef' was completed. From data collected by participants in the reef tourism industry, the first set of Nature Diaries was generated and distributed. Training workshops for industry staff were run in Cairns and Port Douglas by Project Coordinator **Ms Robin Aiello**, with support from GBRMPA and the Centre. A total of 23 staff from all 10 participating tourism companies completed the training. New project kits were developed and distributed, incorporating a new 'Bleachwatch' component for recording coral bleaching. Industry support for the program remains strong (Section 9).

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

- Extension of hydrodynamic and transport models to the entire GBR, as well as parts of the Torres Strait and the Gulf of Papua was enabled through collaboration with the Australian Bureau of Meteorology who supplied wind information. The connectivity modelling has been of value to GBRMPA for the Representative Areas Program.
- Long-term monitoring of sea temperature at ports is now in its ninth year with more than 9 million records collected. PCQ are an integral part of the monitoring with 16 loggers located at eight ports since 1998. These data have been used in developing bleaching thresholds for

corals, correlating with changes in seagrass abundance, risk assessment of introduced marine species and assessing the impact of dredging.

- Mapping and monitoring of port habitats by the DPI&F Marine Ecology Group for Port Authorities, and in consultation with Technical Advisory Committees, in Cairns, Karumba, Mourilyan, Skardon River, Thursday Island and Weipa.
- Mapping of habitats in high accident risk areas of shipping lanes by the DPI&F Marine Ecology Group in the Margaret bay region and Hydrographers Passage for Australian Maritime Safety Authority's Oil Spill Response Atlas (OSRA).
- Continued involvement by CRC Reef scientist based at AIMS, **Dr Scott Wooldridge**, in a World Bank/Global Environment Fund (GEF) Project that aims to develop a Dynamic Decision Support System targeting reefs in Mexico, Philippines, Australia and America.
- Centre-funded extension activities in conjunction with research by **Dr Alastair Birtles** (JCU) and **Dr Peter Arnold** (MTQ) on swim-with-whale activities on the northern GBR. The tourism industry contributed significantly to the research program and participated in two pre-season workshops held in Cairns in April and May 2004.
- Seagrass monitoring under the Seagrass-Watch Program, continues to be well supported by community groups who have conducted surveys throughout coastal Queensland.

Postgraduate students have also benefited from **external and international collaborations**:

- In collaboration with the Field Museum of Natural History, Chicago (USA), information about Australian sea snakes from the work of CRC Reef postgraduate student **Ms Vimoksalehi Lukoschek** has been included on a website about Aquatic Snakes of Southeast Asia (http://www.fieldmuseum.org/aquaticsnakes/index.html).
- QPWS provides ongoing assistance in dugong research by CRC Reef postgraduate student, **Mr James Sheppard**, who also shares the use of satellite tracking equipment with a corresponding project at Edith Cowan University in Perth.
- CRC Reef postgraduate student **Mr Guido Parra** has collaborated with Dr Howard Rosenbaum from the American Museum of Natural History by providing samples of humpback dolphin skin for a global revision of the taxonomy of the genus *Sousa*.
- CRC Reef postgraduate students **Mr Ross Marriott** and **Ms Rachel Pears** from JCU continue to collaborate with the Seychelles Fishing Authority in their fisheries population studies. The Seychelles Fishing Authority will use results from their research for the sustainable management of local harvest operations.
- CRC Reef postgraduate student **Ms Mikaela Bergenius** collaborates with CSIRO Marine Research to develop fisheries population models for coral trout.
- Fisheries WA invited CRC Reef postgraduate student **Ms Elisabeth Dinsdale** to review the conditions of coral reefs on the Abrolhos Islands in collaboration with AIMS.
- CRC Reef postgraduate student **Mr Stephen Lewis** undertakes geochemical analysis of fossil corals in collaboration with the University of Queensland.
- Industry partners Hamersley Iron and Apache Energy in WA support the work of CRC Reef postgraduate student **Mr Ben Radford** on water quality effects on corals.
- Extensive logistics support was provided to CRC Reef postgraduate student **Mr Dean Miller** by several dive tourism operators.

During 2003-04, the Centre was associated with more than 197 organisations including:

Universities and TAFE Colleges

Australian National University	Macquarie University	University of Central Queensland
Barrier Reef Institute of TAFE (Townsville)	Monash University (Water Studies Centre)	University of New South Wales
Curtin University	National Centre for Environmental Toxicology, UQ	University of Queensland
Edith Cowan University	Southern Cross University	University of Western Australia
Griffith University		
James Cook University		

CRCs and other research organisations

Australian Academy of Sciences	Antarctic Climate and Ecosystems CRC	CRC for Sustainable Tourism
Australian Coral Reef Society	CRC Coastal Zone, Estuary and Waterway Management	CRC for Tropical Rainforest Ecology and Management
Australian Institute of Nuclear Science and Engineering	CRC Tropical Savannas	CSIRO Atmospheric Research
AIMS	CRC Predictive Mineral Discovery	CSIRO Land and Water
		CSIRO Marine Research
		CSIRO Sustainable Ecosystems
		Townsville Hospital

Government departments and corporations

Australian Bureau of Meteorology	Great Barrier Reef Marine Park Authority	Qld Fisheries Service
Australian Centre for International Agricultural Research	Greenhouse Special Treasury Initiative	Queensland Department of Primary Industries and Fisheries
Australian Maritime Safety Authority	Geoscience Australia	Queensland Department of Natural Resources and Mines
Australian Fisheries Management Authority	Indigenous Land Corporation	Queensland Department of the Premier and Cabinet
Australian Institute of Aboriginal and Torres Strait Islander Studies	Museum and Art Gallery of Northern Territory	Queensland Dept of State Development
Australian Ocean Colour Working Group	Museum of Tropical Queensland	Queensland Environmental Protection Agency
Australian Museum	Museum of Western Australia	Queensland Fisheries Service
Coastal Protection Council	National Oceans Office	Queensland Museum
Consultative Committee on Introduced Marine Pest Emergencies	Northern Territory Department of Infrastructure, Planning and Environment	Queensland Parks and Wildlife Service
Department of Agriculture, Fisheries and Forestry	Northern Territory Fisheries Division	Queensland Ports Association
Department of Conservation and Land Management (CALM), WA	Northern Territory Parks and Wildlife Service	Torres Strait Fisheries Scientific Advisory Committee
Department of Environment and Heritage	North Queensland Land Council	Torres Strait Regional Authority
Department of Education, Science and Training	Ports Corporation Queensland	Western Australian Fisheries
	Queensland Department of Transport - Maritime Services	Western Australian Museum
		Wet Tropics Management Authority
		Wet Tropics NRM Board

FRDC		

Local Government and Consultative Organisations

Broome Shire Council	Hinchinbrook Shire Council	Mackay Port Authority
Cairns Port Authority	Local Technical Advisory Consultative Committees (Cairns, Karumba, Weipa)	TSRA
Darwin City Council		Townsville Port Authority
Fitzroy Basin Association		Townsville City Council
Gladstone Port Authority		Trinity Inlet Waterways

Community Organisations

Ambiilmungu Ngarra Aboriginal Corporation	Giru Dala Council of Elders Aboriginal Corporation	Order of Underwater Coral Heroes (OUCH)
Australian Coral Reef Society	Gooreng Gooreng Elders	Marine Coastal Community Network North Australia Indigenous Land and Sea Management Alliance
Australian Marine Science Association	Hopevale Community Council	Reef Check Australia
Australian Society for Fish Biology	The Humane Society International	Sea Forum Working Group
Balkanu Cape York Development Agency	Indo-Pacific Sea Turtle Conservation Group	SUNFISH
Burdekin Rangelands Landcare Group	Lions Foundation	Surf Life Saving Broome
Cooktown State High School	Local Marine Resource Advisory Committees (Cooktown, Port Douglas, Townsville, Cairns, Airlie Beach, Rockhampton)	Surf Life Saving Queensland
Earthwatch Australia		Trees for the Evelyn and Atherton Tablelands
Fisheries Management Advisory Committees		Townsville Bird Observers Club
Girringun Aboriginal Corporation		The Wilderness Society
		World Wide Fund for Nature

Private Companies

Apache Energy	Nimrod Explorer	Sunferries
Broome Pearls	Open Channel Publishers	Sunlover Cruises
Digital Dimensions	Paspaley Pearls	Taka Dive
Explorer Ventures	Poseidon Cruises	Tangalooma Resort
FantaSea Cruises	Quicksilver Dive	Tropical Diving
Great Adventures	Quicksilver Connections	Tusa Dive
Hamersley Iron	SeaWorld Research and Rescue Organisation	Undersea Explorer
Illusions	Scuba Schools International	URS, Perth
Mike Ball Dive Expeditions		Woodside Energy

Industry Associations

AMPTO	Dive Queensland	Queensland Seafood Industry Association
Cod Hole and Ribbon Reef Operators Association	Pearl Producers Association	Townsville Enterprise Ltd

International links

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

A report on the Commercial and International Program is provided in Section 8. International links by current research programs are presented below.

The F&F team similarly broadened their international collaborations through their involvement in coordinating the Third International Symposium on Fish Otolith Research and Application, and invitations to the Western Pacific Regional Fishery Management Council Coral Reef Fish Stock Assessment Workshop and the National Marine Fisheries Service, USA.

The Global Seagrass Monitoring Program has developed a successful collaborative partnership between science and community-based teams in countries of the western Pacific. The group are collaborating with universities (University of New Hampshire, University of the Philippines, University of South Pacific, University of Guam, University of Malaysia Sabah), NGOs (WWF South Pacific Programme, The Nature Conservancy, Wildlife Conservation Society, Ailan Awareness, Palau Conservation Society, Kosrae Conservation Society, Pohnpei Conservation Society), schools (Nadroga Navosa Provincial School Fiji, St John's College Fiji, Kosrae Elementary School FSM, College of Micronesia, Puerto Galera Academy Philippines), research organisations (Palau International Coral Reef Center, Borneo Marine Institute) and governments (Kosrae Marine Resources Division, Indonesia National Parks).

Dr Kerry Neil based at DPI&F was sponsored by the GloBallast IMO Group and URS Perth to attend the First International Workshop on Ballast Water Risk Assessment in Melbourne. About 50 international delegates including port and shipping managers and marine scientists gathered to discuss methods and outcomes of Ballast Water Risk Assessment and to make recommendations for progressing the use of consistent and effective Ballast Water Risk management at the international level. Dr Neil's participation has assisted in developing a more cooperative linkage with international agencies.

Dr Kerry Neil based at DPI&F was invited to participate in extension work coordinated by the IMO GloBallast program. This program is developing expertise for detecting marine pests in third world countries. Dr Neil is assisting in training, and in designing and running a marine pest baseline survey in the Port of Mombasa, Kenya. Dr Neil attended a meeting in November 2003 and provided lectures and training to African agencies (primarily Kenyan Government agencies) about survey needs and methods. Dr Neil's research team hosted and trained a Kenyan delegate during a survey in Australia in April 2004.

Other international collaborations by Centre researchers include:

- Fine-scale wave modelling by visiting scholar **Dr Katuya Hirayama** from the Marine Environment and Engineering Division of the Port and Airport Research Institute, Yokusuka, Japan, working with **Assoc Prof Tom Hardy** at JCU School of Engineering.
- As part of an Australian Academy of Sciences travel scholarship, Project Leader **Dr Gavin Begg** from JCU, collaborated with scientists from the Northeast Fisheries Science Centre in Woods Hole. This collaboration involved assessing the use of alternate models, establishment of appropriate reference points and critical review of the assessment.

- Collaboration on coral bleaching by AIMS and NOAA scientists to develop satellite products for risk assessment on the GBR, and Coral Reef Early Warning System (CREWS).
- Collaboration of AIMS scientist **Dr Janice Lough** with the University of Florida to detect coral bleaching from space using IKONOS satellite data.
- Membership of the NOAA/National Environmental Satellite, Data and Information Service (NESDIS) Sea Surface Temperature calibration and validation committee by AIMS scientist **Dr William Skirving**.

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

Organisations and programs

Ailan Awareness	Lihir Mining Company	Seychelles Fishing Authority
Apache Energy	Locally Managed Marine Area Network	South west Florida Water Management district, USA
Arafura Timor Seas Experts Forum	McArthur Foundation	The Nature Conservancy
Asia Pacific Economic Cooperation	National Marine Fisheries Service, USA	TV New Zealand
Indonesia National Parks	National Oceanic and Atmospheric Administration, USA	United Nations Environment Programme
International Ocean Institute	Operations Cetaces, New Caledonia	Wildlife Conservation Society
IMO – GloBallast	Packard Foundation	Western Pacific Regional Fishery Management Council, USA
International Whaling Commission	Palau Conservation Society	World Seagrass Association
IUCN – World Conservation Union	Pohnpei Conservation Society	World Wide Fund for Nature
Kosrae Conservation Society	Seagrass Net	

Universities and research institutions

American Museum of Natural History	North Carolina State University, USA	University of Masachusetts
Borneo Marine Institute	Palau International Coral Reef Centre	University of Miami, USA
College of Micronesia	Port and Airport Research Institute, Japan	University of New Hampshire, USA
Field Museum of Natural History, Chicago	Solitary Island Marine Park Authority	University of Philippines
Kosrae Marine Resources Division	University of Guam	University of the South Pacific
Marine Research Institute, Iceland	University of Iceland	University of Southern Florida
Max Planck Institute for Marine Microbiology	University of Malaysia Sabah	University of Washington, USA

8. COMMERCIAL AND INTERNATIONAL (Program F)

Highlights

- The level of commercial contracts for the Centre has increased from approximately $250,000 in the 1999-00 financial year to $2.1m in the 2003-04 financial year.
- IMPAC is developing into a major international training centre on oceans governance. IOI-OceanLearn to be a major focus as well as UN Train-Sea-Coast.
- Three workshops have strengthened ties with Melanesia to help design MPAs and include Traditional Knowledge.
- The Global Coral Reef Monitoring Network (GCRMN) published two guidebooks on monitoring coral reefs, especially MPAs.
- The Nature Conservancy (TNC) organised a survey of the marine life of the Solomon Islands that discovered the second highest diversity of corals in the world.

Objectives:
The commercial and international program will:

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

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

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

The level of commercial contracts for the Centre has increased from approximately $250,000 in the 1999-00 financial year to $2.1m in the 2003-04 financial year. Included in these commercial contracts are benthic surveys of introduced marine pests in Queensland ports. There is potential for even better products in this area through collaboration of JCU's hydrodynamic modellers with DPI&F marine ecology expertise.

The Ballast Water Treatment Pilot Plant, installed at JCU in Townsville, aims to develop the technology to treat ships' ballast water for introduced marine pests. Project managers **Dr Phil Schneider** and **Mr Steve Hillman** have reported positive results in the first phase of the project but with more effort now required to complete the pilot plant testing, there is a continuing need for fund raising to complete the tests next year. This project flows directly from the doctoral research of a recently completed CRC Reef student funded by the Ports Corporation of Queensland, and has very strong support from the Coasts and Clean Seas Program of the Australian Government's Department

of Environment and Heritage. The aim in the coming year is to attract a commercial partner to take the pilot plant results into a commercialisation phase.

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

Interest in the Arafura and Timor Seas Expert Forum (ATSEF) remains strong with input from Australia, Timor Leste, Indonesia and PNG. In Australia, the key contributors are AIMS, CRC Reef and ANU. The marine consortium has been supported by DEH and the National Oceans Office. ATSEF is planning a conference in Dili in November 2004.

International Marine Project Activities Centre

The International Marine Project Activities Centre Ltd (IMPAC) continues to 'export' the marine science and management expertise concentrated in Townsville into the Asia-Pacific region. IMPAC is the international arm of the CRC Reef Research Centre Ltd and has attracted leading NGOs to Townsville.

IMPAC is a partnership aimed at improving collaboration between international project agencies which are assisting developing countries with sustainable development and conservation of coral reefs, mangrove forests and seagrass beds and their associated fisheries. The agencies accommodated at IMPAC in 2003-04 were:

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

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

A major function for IMPAC is catalysing international workshops and this last year has been particularly successful:

- IOI and IMPAC hosted a major training course, 'Issues and Instruments for Responsible Fisheries Policy', in July with lecturers from Fiji, Hobart and Wollongong. A class of 13, with 10 being full-fee paying participants included five Indonesian visitors funded by NOO. Feedback was particularly encouraging and further courses are planned. The workshop also had considerable media coverage.

- IMPAC hosted the 'Multilateral Environmental Conventions' Workshop in October 2003 which was requested by Pacific states to assist in the implementation of the UN conventions on World Heritage, Biological Diversity, Ramsar (wetlands), CITES and Migratory Species. There were 10 Pacific delegates and seven experts representing the convention secretariats and potential donors. The Pacific delegates specifically called for assistance in incorporating Traditional Knowledge into environmental management.
- The Nature Conservancy, through **Dr Alison Green**, ran a very successful workshop on 'Designing a Network of MPAs for Kimbe Bay, PNG' with 30 participants from PNG, Indonesia, Palau, USA and Australia. IMPAC assisted with some funding for PNG delegates.
- IMPAC hosted a workshop in March 2004 on 'Traditional Knowledge and Environmental Law' in the Pacific, co-sponsored with the Christensen Fund ($33,000 contribution). There were 16 international attendees from PNG, Vanuatu, Solomon Islands, Fiji, New Caledonia, Palau and Timor Leste (supported by the World Bank), as well as six experts from within Australia. The attendees made recommendations for action needed to incorporate Traditional Knowledge and Management Practices into the mechanisms that governments use for resource management.

The Pacific states have asked IMPAC to assist in training of integrated oceans governance, the recognition of traditional knowledge and development of Marine Protected Areas. This is considered a growth area for IMPAC in the future.

IMPAC associates (**Dr Clive Wilkinson**, **Prof Robin South**, **Mr Posa Skelton**) and visitors (**Dr Lyndon Devantier**, **Dr David Lawrence** and **Ms Bryony Barnett** of CRC Reef) have completed nine assessments for the Global International Waters Assessment, a project directed by the United Nations Environment Programme and the Swedish Government. These include Southeast Asia, the Pacific and five assessments around Australia and New Zealand. Major conclusions were reached on the need for urgent remedial action to halt the decline in marine and coastal resources of our near neighbours.

International Ocean Institute (Australia) completed its first two years of operation as a registered company within Australia with operational support provided by the IOI Headquarters, and money earned from projects in Asia and the Pacific. **Professor Robin South** and **Mr Posa Skelton** of IOI (Australia) are integral to the development of a training centre in IMPAC. They have been planning for the establishment of the IOI Virtual University (until December 2003) and then for the IOI Training Programme under a new banner IOI-OceanLearn. This is also linked to the Education Task Force of the Nippon Foundation International Ocean Governance Network (IOGN) project, which is planning an international network of centres to provide postgraduate training in all aspects of ocean governance. IMPAC is currently bidding for several projects on training for Southeast Asia and Melanesia.

Planning is well advanced for the Pacem in Maribus XXXI international conference on 'Building Bridges towards Integrated Oceans Governance: Linking Ocean Science, Engineering, Technology & Policy' which is jointly organised by IOI-Australia and Institute of Marine Engineering, Science and Technology (IMarEST) to be held in Townsville in October 2005. The conference Secretariat is hosted within IMPAC. It is expected that about 300 participants will attend this meeting.

Exchanges during the above workshops have led to IMPAC and the Centre being invited to assist in the development of National Oceans Policies in Thailand and Indonesia through IOI-Australia.

The **Global Coral Reef Monitoring Network (GCRMN)** operates within IMPAC with the Coordinator **Dr Clive Wilkinson**, also Coordinating IMPAC in cooperation with AIMS. The GCRMN has published two guidebooks to assist MPA managers in performance evaluation of managed areas:

- Monitoring Coral Reef Marine Protected Areas by Wilkinson, Green, Almany, Dionne was produced in September 2003 and released at the IUCN World Parks Congress in South Africa.
- Methods for Ecological Monitoring of Coral Reefs: A Resource for Managers, by Hill and Wilkinson was published in June 2004.

The GCRMN continues to interact with a network of hundreds of people in over 80 countries who are monitoring their coral reefs and is currently writing Status of Coral Reefs of the World: 2004. Preliminary findings are that human stresses are continuing to damage reefs around the world through pollution, over fishing and damaging developments, but that there are major initiatives around the world aimed at reversing these trends and establishing marine protected areas. The global major threats focus on Global Climate Change, especially temperature related coral bleaching and apparent increases in destructive predators and coral diseases.

Dr Alison Green, Marine Science Coordinator of The Nature Conservancy's Global Marine Initiative, is based in IMPAC. Dr Green provides scientific advice for design and implementation of Marine Protected Areas (MPAs) aimed at conserving the rich marine biodiversity in the Asia Pacific region. Dr Green participates in TNC projects across the Asia Pacific with an emphasis on PNG, the Solomon Islands, Indonesia, and Micronesia (particularly Palau and Pohnpei).

In February 2004, IMPAC hosted a TNC scientific workshop entitled, Designing a Network of Marine Protected Areas for Kimbe Bay, West New Britain, PNG. The objective of this workshop was to bring together scientific experts to develop MPA design principles that will ensure the protection of the biodiversity of this remarkable area with maximum benefit to local communities. In May - June 2004, Dr Green led a team of world-renowned scientific experts on a five-week marine assessment of the Solomon Islands, which found this area is a high priority for marine conservation with the second highest coral diversity in the world. Both the Kimbe Bay workshop and the Solomon Island survey involved scientists and managers from the Townsville community, including many Centre members. The TNC office also participated in IMPAC-related activities including co-authoring the publication 'Monitoring Coral Reef Marine Protected Areas' to provide practical advice on how monitoring can support the effective management of MPAs. The booklet was launched by **Drs Wilkinson** and **Green** at the 2003 World Park Congress in Durban South Africa by the Assistant Secretary for the US Department of State, John Turner, and was distributed widely. **Dr Green** also co-chaired the mini-symposium entitled 'Designing Effective Marine Protected Areas' at the Tenth International Coral Reef Symposium in Okinawa (June-July), Japan.

IMPAC has hosted the Townsville office of the Great Barrier Reef Campaign of the **World Wide Fund for Nature** (WWF) since early 2003. Community Liaison Officer **Ms Sarah Lowe** spent 2003 mobilising and supporting community aspirations for greater protection of the Marine Park, and liaising with groups along the coastline, from Hopevale to Gladstone. The busiest part of this year was GBRMPA's second phase of community participation (June to August), in which the draft zoning plan was scrutinised and discussed at local meetings. With the 1 July 2004 entry into force of the new GBR Marine Park zoning regulations, WWF Australia is ending its four-year GBR Campaign. The Campaign was directed from Brisbane, with an office in Townsville providing a local community presence along the GBR coastline.

In closing its Campaign, WWF is pleased to see the completion of this bold initiative, which fulfils Australia's international obligations (World Heritage Convention) and commitments (World Summit

on Sustainable Development) as well as the aspirations of most Australians for increased protection of a national icon.

IMPAC is hosting **Mr Geoffrey Muldoon**, a consultant on several fisheries economics projects. During the year, he has coordinated an Asia Pacific Economic Cooperation (APEC) project to develop Industry Standards of Best-Practice for the Trade in Live Reef Food Fish in the Asia-Pacific, with the goal of improving the conduct of all industry stakeholders. The project has produced a range of consumer awareness materials and implementation toolkits for industry, government and non-government organisations. He and some associates have begun a three-year project funded by the Australian Centre for International Agricultural Research to undertake Economic and Market Analysis of the Live Reef Food Fish Trade in the Asia-Pacific, which is being coordinated through CRC Reef.

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

9. PUBLIC PRESENTATIONS, PUBLIC RELATIONS AND COMMUNICATION

Program Leader: Dr Louise Goggin, CRC Reef

Highlights

- New current state-of-knowledge brochures about seagrass and introduced marine species were produced, as part of the Centre brochure series about major issues affecting the GBRWHA.
- Provision of expert advice to management committees including those for the Great Barrier Reef Marine Park, Queensland ports, and the Queensland Government's Irukandji jellyfish response taskforce.
- Organisation of a major conference called Catchment to Reef: Water Quality Issues in the Great Barrier Reef Region in Townsville in March 2004, updating scientists, managers and other interested parties on new regional water quality research undertaken both on the catchment and in GBR waters.
- Coordination of the Third International Symposium on Fish Otolith Research and Application which will attract about 300 delegates from 35 countries.
- Media coverage that has been higher than ever before, with Centre research highlighted in over 500 media reports in print, on television, radio and online.
- Production of a poster which clarifies the difference between species of coral trout that will be invaluable for anglers.

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

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

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

With the launch of the Torres Strait program, an additional Communication and Extension strategy was developed to ensure communication with stakeholders is effective and appropriate. The objectives of the strategy for Torres Strait are:

- effective dialogue between CRC Torres Strait, its member agencies and stakeholders so that there is an increased understanding about sustainable use and conservation of marine resources in the Torres Strait.
- consistent message communicated to all audiences using the most appropriate communication tools.
- involvement of key people and organisations in planning and implementing communication activities.
- awareness among target audiences of marine resources in the Torres Strait and their value.
- influence policy development, and natural resource planning and management.

Significant conference and seminar presentations
Centre researchers are very active in presenting research findings at conferences and seminars to the scientific and broader community. Researchers presented at seminars (102), workshops and regional conferences (54 presentations), national (28 presentations) and international conferences (55 presentations), with a total of 239 presentations based on work supported by the Centre. They included:

CRC Reef task leader **Dr Katharina Fabricius** was an invited speaker at the World Parks Congress in Durban in September 2003, where she talked about the linkages between land and sea, using the GBR as a case study.

Manager of Knowledge Exchange and Education for the Centre, **Dr Britta Schaffelke**, gave the plenary lecture about introduced seaweeds at the 18th International Seaweed Symposium in Norway in June 2004.

CRC Reef researcher **Dr Merrilyn Wasson** from ANU, who is studying the ownership of genetic resources, was commissioned to present at the Duke Symposium on the impact of trade on Exclusive Economic Zone (EEZ) management in North Carolina, USA, in November 2003.

CRC Reef project officer **Mr Steve Hillman** presented a paper on a pilot plant to sterilise ships' ballast water at the Second International Ballast Water Research and Development Symposium, London, UK, in July 2003.

A total of 25 researchers from CRC Reef presented papers at the Tenth International Coral Reef Symposium in Okinawa, Japan in June 2004.

The Knowledge Exchange team co-organised a major conference, Catchment to Reef: Water Quality Issues in the Great Barrier Reef Region, in Townsville in March 2004, updating scientists, managers and other interested parties on new regional water quality research undertaken both on the catchment and in GBR waters.

The Centre will co-host the Third International Symposium on Fish Otolith Research and Application in Townsville in July 2004, which has attracted significant national and international attention with participants from 35 countries. International and local steering committees have been appointed to assist with preparation. Sponsorships from several Commonwealth, State and international research and management agencies have been secured.

Many Centre researchers have provided expert advice to Department of Primary Industries and Fisheries' Management Advisory Committees (MACs), the Great Barrier Reef Marine Park Authority's Reef Advisory Committees (RACs), and other advisory committees and working groups in Australia and worldwide. Advisors to these groups include **Prof Helene Marsh** (Commonwealth working party on the management of traditional hunting of threatened species), Mr Guido Parra (Conservation, biodiversity and World Heritage RAC), **Dr Alastair Birtles** (International Whaling Commission Scientific Committee), **Mr Cameron Murchie** (Torres Strait finfish working group), **Dr Gavin Begg** (Inshore Finfish MAC, Queensland Fishing Industry Research Advisory Committee, Reef MAC, Spotted Mackerel Stock Assessment steering committee, Torres Strait finfish working group), **Ms Renae Tobin** (Queensland Fishing Industry Research Advisory Committee), Dr Madeleine Van Oppen (Townsville Local Marine Advisory Committee), **Dr Katharina Fabricius** (Water quality RAC, Townsville Local Marine Advisory Committee), and **Dr David Williams** (Fisheries RAC, Reef MAC). **Drs Michael Rasheed and Rob Coles** are members of the dredging Technical Advisory Consultative Committees (TACC) for the ports of Weipa, Karumba, Mackay and Cairns and provide advice on

dredging programs for these ports that will ensure port activities will have minimal impacts on sensitive marine environments. **Ms Lisa-Ann Gershwin** provides advice to the Queensland Government's Irukandji jellyfish response taskforce on identification of jellyfish thought to cause Irukandji syndrome. In addition, **Professor Russell Reichelt** is Chairman of the National Oceans Advisory Group [advises Australia's National Oceans Ministerial Board on oceans policy]; the GBR Consultative Committee [advises Australia's Environment Minister on implementation of the GBR Marine Park Act]; the Great Barrier Reef Research Foundation International Scientific Advisory Committee; Torres Strait Fisheries Management Advisory Committee; Queensland EPA Scientific Advisory Committee; CSIRO Wealth from Oceans Flagship Advisory Committee; and member of the Queensland Biotechnology Advisory Council and Australia's State of the Environment Committee.

Extension activities

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

Public displays

CRC Reef exhibited at the North Queensland Field Days in May 2004 and the Reef Talk series during the Australian Festival of Chamber Music in Townsville. The Effects of Line Fishing team from CRC Reef exhibited at the Townsville Sportfishing Clubs, Fishing and Boating Expo in March 2004.

Radio broadcasts

Research by the Centre and other science organisations is being broadcast to thousands of listeners in north Queensland. The Centre coordinates weekly interviews on local ABC radio with scientists from AIMS, DPI&F, GBRMPA, JCU, Museum of Tropical Queensland, CRC for Predictive Mineral Discovery, Tropical Savannas CRC, The Townsville Hospital and the Marine and Coastal Community Network.

As part of the communication strategy developed for the Torres Strait program, researchers are encouraged to talk about their research on the local radio station based on Thursday Island that broadcasts across Torres Straits. Most researchers visiting Torres Strait have spoken about their research on the radio to ensure that communities in Torres Strait are kept up-to-date with movements of researchers and results from research.

Industry liaison

CRC Reef has maintained its Task Associate Program, with 44 Task Associates assigned to 64 research tasks, to increase liaison between CRC Reef researchers, resource managers, industry and private operators (see Section 7). CRC Torres Strait also implemented a Task and Project Associate program with 15 people from nine organisations to 22 research tasks and projects.

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

The 'Eye on the Reef' project is an industry-based monitoring program in which volunteers from the marine tourism industry in the Port Douglas/Cairns area collect information about reef health at 25 regularly visited sites. The project is jointly supported by GBRMPA and CRC Reef. Collection of data has continued in 2003-04 with data entered into a web-accessible database. A well-received automated reporting system called 'Nature Diaries' visualises the

data for each tourism operator. The project will be reviewed in 2004-05 and opportunities and benefits of expanding the program will be explored (Section 7).

CRC Reef supported minke whale workshops in Cairns, in November 2003 and May 2004, to update researchers, managers and tourism industry representatives on results of previous work, provide information about research during the coming field season and receive feedback from operators.

Indigenous liaison
The Centre has continued to expand its Indigenous engagement, through individual research tasks, cultural awareness training for researchers, and knowledge exchange activities.

The Indigenous Working Group (IWG) met twice during the year, and provided direction for Indigenous engagement through selected research tasks, with advice on communication strategies and aspirations for future direction of Indigenous involvement by the Centre as part of the re-bid process.

A major milestone was an Information Sharing Workshop 'What we know about Trinity Inlet' held in Cairns in March – a collaboration between the Centre, DPI&F, the North Queensland Land Council, EPA Indigenous Conservation Coordination Unit, and Queensland Department of State Development. The workshop set the path for future collaboration with Cairns Traditional Owners, by researchers based at DPI&F Northern Fisheries Centre.

Research and monitoring activities with significant Indigenous involvement included:

- Case studies of marine resource management issues at four Indigenous communities, as part of cooperative management research by **Professor Helen Ross** (UQ) and **Mr James Innes** (GBRMPA). The Steering Committee included members of Sea Forum. A workshop evaluation of the task was hosted and facilitated by the Girringun Aboriginal Corporation in Cardwell.
- Collaboration with the Indigenous Palm Island community by AIMS researcher **Dr Chris Battershill**, to complete a feasibility study and commercialisation plan for sponge aquaculture by community members.
- The DPI&F Seagrass-Watch Program, coordinated by **Mr Len McKenzie** and **Dr Stuart Campbell**, involved training of members of the Hopevale Community (Cooktown) and liaison with Giru Dala Council of Elders Aboriginal Corporation (Bowen).
- The Western Pacific Seagrass Net Program, led by **Dr Rob Coles** (DPI&F), has forged strong links with Indigenous communities in the Western Pacific (Malaysia, Philippines, Indonesia, Palau, PNG etc.), with training of community members in seagrass monitoring techniques.
- Ongoing contact with a Cultural Reference Group from the Hopevale Community, established by CRC Reef postgraduate student **Ms Melissa Nursey-Bray** to guide research on social and economic values associated with Indigenous use of marine resources.
- DPI&F researcher **Mr Stuart Hyland** consulted with the North Queensland Land Council and Traditional Owners in Cairns and Cardwell during fisheries monitoring activities in Trinity Inlet and Hinchinbrook Channel.
- **Prof Helene Marsh**, **Dr Ivan Lawler** and PhD students**, Mr James Sheppard** and **Ms Amanda Hodgson**, researching aspects of dugong behaviour, were closely involved with Traditional Owners at Hervey Bay, Shoalwater Bay and Stradbroke Island where they are doing their research.
- A research agreement with the Cardwell-based Girringun Aboriginal Corporation enabled social surveys of Indigenous recreational fishers by JCU Honours student **Ms Kara Dew**.

Communication and extension activities:

- An interpretive video on dugong research, produced by JCU researchers **Prof Helene Marsh**, **Dr Donna Kwan** and **Dr Ivan Lawler** in collaboration with representatives from Cape York Land Council, TSRA, AFMA, GBRMPA, Hopevale Community and the Mabuiag Island Community was promoted and distributed to relevant communities.
- A reef education program was conducted with Townsville Barrier Reef Institute of TAFE Indigenous Arts students, to develop artworks based on Centre research.
- Extension Manager, **Ms Bryony Barnett**, attended a Girringun Aboriginal Community Land Sea Forum, and presented information about the Catchment to Reef Program.
- The Centre contributed funds to Indigenous Working Group members **Mr Phil Rist** and **Ms Melissa George** to attend the World Parks Congress in Durban, South Africa, in September 2003.
- Twenty Centre researchers and staff completed cultural awareness training with the JCU School of Indigenous Australian Studies.

Communication products

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

Newsletters: Two issues of CRC Reef News were produced in 2003-04 with a broad coverage of research news and staff updates and were circulated to 1200 people and organisations. The June 2004 issue was also distributed as an e-newsletter by email to a further 640 people. Three newsletters from the Effects of Line Fishing (ELF) project were also produced. These newsletters target fishers, management authorities and researchers and have been a very successful medium to keep industry in touch with the project.

Technical reports: In 2003-04, 10 technical reports were printed and/or published on the CRC Reef website. Most technical reports will be produced electronically in future.

Brochures: New brochures about seagrass and introduced marine species were produced to supplement the Centre series of brochures about the state of knowledge of major issues that affect the GBRWHA. The existing brochure on crown-of-thorns starfish was updated. The brochures were distributed with the CRC Reef newsletter and delivered to reef tourism operators for distribution to passengers, and to GBRMPA for distribution with education packs. There has been a very positive response to the brochures which summarise important research in an attractive and accessible format. A one-page poster created by the Fishing and Fisheries team to help anglers to identify different species of coral trout on the GBR also proved popular. A web brochure about coral disease has also been written and is available on the CRC Reef website.

Websites: The CRC Reef website is designed to make information about CRC Reef and its activities, as well as more general information about the GBR, more accessible to the scientific and general community. The website features downloadable files of CRC Reef publications including CRC Reef technical reports, brochures and newsletters. In addition, websites for the International Marine Project Activities Centre (IMPAC) (www.impac.org.au) and CRC Torres Strait (www.crctorres.com) were launched this year. CRC Torres Strait website houses 'Guidelines for researchers working in

Torres Strait' as well as summaries about research tasks, information about the Torres Strait, the Task Associate Program, and calendar for researcher visits to Torres Strait.

Visitor information flyers: This year, forms that advise Torres Strait communities about visits by researchers to the Torres Strait were also developed. The flyers are written in plain English and include photographs of the researchers and information about the purpose of the visit and where the researchers will be working. These flyers have proven very successful in informing Torres Strait communities about research in the region.

Media: A media skills training course was offered in November and was attended by 15 people including Centre students, researchers, the liaison officer from CRC Torres Strait, a participant from IMPAC and three staff members from GBRMPA.

Media coverage this year has been higher than ever before with 19 media releases distributed by the Centre since July 2003. The GBR Seabed Biodiversity Project received a lot of press coverage, along with the discovery of golden noodle algae, research linking crown-of-thorns starfish with run-off, and the first Irukandji jellyfish born in captivity. In May, a huge amount of media interest was created by the threat to CRC Reef's future funding. Media coverage for the year is listed below.

	Local	State/National	International
CRC Reef			
Print	149	72	11
Radio	148	34	4
TV	51	11	1
Online	NA	NA	49
IMPAC			
Print	6	4	0
Radio	9	0	0
TV	2	2	0
Online	NA	NA	1
CRC Torres Strait			
Print	6	0	0
Radio	7	3	1
TV	2	2	0
Online	NA	NA	1

10. MANAGEMENT AND OPERATING

Dr David Williams, Deputy CEO of CRC Reef, is also Research Director of the newly formed company, CRC Torres Strait Ltd, which was established to implement the Torres Strait research program. Additional information about the structure and management of CRC Torres Strait can be found under Section 3.

Ms Anne Clarke from DPI&F was appointed as Program Leader for Program B with the departure of Professor Bruce Mapstone to the Antarctic Climate and Ecosystems CRC.

No major items of equipment were purchased in 2003-04. No renovations or changes in occupancy of buildings were undertaken in 2003-04.

11. SPECIFIED PERSONNEL

There were amendments to the Specified Personnel list during 2003-04 as listed below.

Name	Organisation	Percent time with Centre	Role
Prof Russell Reichelt	CRC Reef	100	Chief Executive Officer, CRC Reef
Dr David Williams	AIMS	90	Deputy CEO (Research), Research Director (CRC Torres)
Professor Helene Marsh	JCU/CRC Reef	60	Leader, Program A & E
Ms Anne Clarke	DPI&F	15	Leader, Program B
Dr Peter Doherty	AIMS	57	Leader, Program C
Dr Terry Done	AIMS	60	Leader, Program D
Dr Louise Goggin	CRC Reef	50	Leader, Program E
Dr Britta Schaffelke	JCU/CRC Reef	100	Manager, Education & Knowledge Exchange
Dr Robert Coles	DPI&F	60	Project Leader
Dr Miles Furnas	AIMS	75	Project Leader
Assoc Prof Tom Hardy	JCU	30	Project Leader
Dr Gianna Moscardo	JCU	40	Project Leader
Professor Philip Pearce	JCU	30	Project Leader
Dr Gavin Begg	JCU	35	Project Leader
Dr Annabel Jones	JCU	20	Project Leader
Dr Alan Butler	CSIRO	10	Project Leader
Dr Roland Pitcher	CSIRO	5	Research Staff
Dr David Wachenfeld	GBRMPA	20	Research Staff

APPENDIX 1. PERFORMANCE INDICATORS

OBJECTIVES

Quantitative indicators:

Performance Indicator	Target over life of Agreement	Measure-1999-2000	Measure 2000-01	Measure 2001-02	Measure 2002-03	Measure 2003-04
Total resources	$75.4m total resources	$10.5m	$11.7m	$11.8m	$12.1m	$19.37m
Cash resources	$40.4m cash resources	$4.9m	$6.0m	$5.9m	$6.2m	$9.3m
Centre publ'ns transferring research outcomes & technology to industry	70 Centre reports	5	19	36	18	36
Industry seminars	50 seminars	32	67	61	68	102

Other indicators:

Benefit to Centre. Building intellectual capital. An additional 59.76 professional positions (excluding in-kind staff) have been added among the partners as a result of the Centre.

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

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

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

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

QUALITY AND RELEVANCE OF RESEARCH PROGRAM

Quantitative indicators:

Performance Indicator	Target over life of Agreement	Measure 1999-2000	Measure 2000-01	Measure 2001-02	Measure 2002-03	Measure 2003-04
Research program resources	$53.34m total cash and in-kind resources on research program	$8.3m	$9.9m	$9.7m	$10.07m	$16.6m
Advisory groups and steering committees	10 advisory groups and steering committees for research	6	4	5	5	7
External publications	15 publications p.a. in refereed journals	33	35	28	37	34
	10 papers p.a. in internat'l conferences	10	8	7	7	8
	20 papers p.a. in national conferences	2	6	7	3	10
	5 book chapters	3	5	13	10	13
	3 invitations to deliver plenary addresses p.a.	3	4	6	3	2

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 Centre.
- Enhanced research reputation: Honours and awards for researchers; see Appendix 4.
- Election to key positions in scientific bodies: See Sections 5, 7 and 9.

- Demonstrated user satisfaction: User input to planned projects via SAC, TRC and Task Associate Program. Survey of satisfaction of partners showed high level of satisfaction.
- Involvement of research users in deciding and conducting research: User input to planned projects is via SAC, TRC, Task Associates and steering committees.

STRATEGY FOR UPTAKE AND UTILISATION OF RESEARCH RESULTS

Quantitative indicators:

Performance Indicator	Target over life of Agreement	Measure 1999-2000	Measure 2000-01	Measure 2001-02	Measure 2002-03	Measure 2003-04
Resources devoted to communication and tech transfer	Minimum $2.5m cash & in-kind on communication & tech. transfer	$327,000	$325,000	$473,000	$388,000	$874,000
Centre products	Newsletter 4 p.a.	7	5	5	7	5
	Major website update every 2 yrs	Major upgrade initiated	Major upgrade completed	Minor upgrade & revision	Maintenance	2 new websites
	Tech reports 10 p.a.	5	2	7	5	10
	Targeted short courses 3 p.a.	4	1	5	3	4
Commercial contracts for CRC expertise	Increasing over life of CRC (Total $2.35m)	$252,000	$459,000	$600,000	$840,154	$2.1m

Other indicators:

Application by industry of Centre products. Applications include briefings to industry and environmental groups, and publications. These include workshops on dwarf minke whales, collaboration with industry, and close communication with Representative Areas Program.

Recognition by general public and stakeholder groups. High public profile and understanding of the Centre and CRC Program; see Section 4, 7, 9. Increased exposure via local radio programs. Production of user-friendly colour brochure series and poster to identify coral trout.

Implementation by national and international agencies of Centre products. See Sections 4, 8.

Communication and implementation of Centre research outcomes and technology. CRC Reef Communication Strategy updated. CRC Torres Strait Communication Strategy developed. Each research proposal includes strategy and budget for communication. Appointment of Task Associates to each task. See Sections 4, 7, 9.

COLLABORATIVE ARRANGEMENTS

Quantitative indicators:

Performance Indicator	Target over life of Agreement	Measure 1999-2000	Measure 2000-01	Measure 2001-02	Measure 2002-03	Measure 2003-04
Cooperation in research in Aust. & overseas; more efficient use of resources	20 collaborative arrangements	Section 3	Section 3	Section 3	Section 5	Section 4, 7
Research providers contributing resources	$32.1m total cash and in-kind	$4.9m	$5.3m	$5.5m	$5.7m	$8.85m
Research providers FTEs in-kind	18.56 FTE in-kind	34.72	22.67	22.76	21.6	25.83
Collab'n between researchers	80% projects involve 2 or more parties	82%	67%	82%	100%*	100%*
	Participants workshop 4 p.a.	6	8	16	6	7
	Shared supervision of students 5 p.a.	9 stipend students	8 stipend students	29 stipend students	24 schol students 31 assoc students	24 schol students 27 assoc students
Collaboration b/w researchers & research users	University & non-university supervisors for 25%	25%	38%	40%	40% schol students 29% assoc	54% schol students 34% assoc

	of postgrad students				students	students
Collaboration with other research institutions	25 projects p.a.	26 institutions	22 institutions	24	35	29 institutions
International collaboration	Centre researchers involved in 25 intn'l collaborations a year	45 institutions	48 institutions	56	67	50
	5 visitors p.a.	27	10 visitors/ delgat'ns	12 visitors	6 delegations	4 deleg'ns 6 w'kshops (80 participants from 10 countries)
	Formal arrangem'ts with intl organisat'ns- 1 p.a.	4	1	1	6	4
	3 postgrad students to present at intl conferences	1	6	5	14	10
Associate membership program	4 p.a. associate members	2	NA	NA	NA	NA
Secondments of industry staff to research providers	1 secondment to research provider p.a.	1	1	0	0	0
Secondments of research provider staff to industry	3 secondments to industry p.a.	2	0	1	0	0

* All tasks, except third party tasks, have industry associates.

Other indicators:

Collaboration with other CRCs. Joint venture with Rainforest CRC.

EDUCATION AND TRAINING

Quantitative indicators:

Performance Indicator	Target over life of Agreement	Measure 1999-2000	Measure 2000-01	Measure 2001-02	Measure 2002-03	Measure 2003-04
Training and equipping postgraduate students as future leaders in research and management	35 postgrads employed	10	7 schol students 4 student assoc	6 schol students 4 student assoc	2 schol students 8 student assoc	3 schol students 9 student assoc
	30 postgrads employed in user or related industry	10	11	10	10	12
Increase in knowledge & skill base available	Workshops & short courses attended by 10 industry & user persons p.a.	Section 9	Section 9	Section 9	Section 8	Section 9
Program resources	$2.7m cash and in-kind resources	$443,000	$477,000	$514,000	$522,000	$570,000
Postgraduate program	30 scholarships	28	21	22	25	22
	15 additional students supported	54	63	66	58	62

Other indicators:

Industry training. All new students underwent induction including information about opportunities for industry collaborations in May 2004. Student/stakeholder workshop in February 2004. Short course in media skills offered in November. Twenty Centre researchers and staff completed cultural awareness training with the JCU School of Indigenous Australian Studies.

Student performance management. All students are reviewed annually and six-monthly as part of the Centre task reviews.

MANAGEMENT STRUCTURE AND ARRANGEMENT

Quantitative indicators:

Performance Indicator	Target over life of Agreement	Measure-1999-2000	Measure 2000-01	Measure 2001-02	Measure 2002-03	Measure 2003-04
Total cash and in-kind resources in general administration	$5.8m cash and in-kind	$856,000	$1.0m	$1.08m	$1.13m	$1.32m
Additional revenue raised	$5.8m	$270,000	$637,000	$629,000	$1,052,000	$2.204m
New partners	2	Discussions with parties well-advanced	GBRRF to become a partner in July 2001	No new partners	No new partners	5 new partners
Management skills	All program/ project leaders to attend one course	4/5 Program Leaders	1 Program Leader	All previously completed	1 new Program Leader to complete	+ See below

+ No change to CRC Reef. All CRC Torres Strait project leaders (6) undertaken an Induction.

Other indicators:

Continuity of long-term partnerships and research effort. Satisfaction of partners survey completed in 2004.

Governance. Nominees for each party on Board. Majority of user and independent members on Boards (CRC Reef: 7/10. CRC Torres Strait: 6/9).

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

PERFORMANCE EVALUATION

Quantitative indicators

Performance Indicator	Target over life of Agreement	Measure-1999-2000	Measure 2000-01	Measure 2001-02	Measure 2002-03	Measure 2003-04
Annual task reviews	Six-month and annual	Six-month and annual	Six-month and annual	Six-month and annual	Six-month and annual	Six-monthly and annual
External audit	Annual	Annual	Annual	Annual	Annual	Annual
Audit committee	Quarterly meetings	Board Exec meetings.	Board Exec meetings.	Board Exec meetings	Board Exec meetings	Board Exec meetings
Annual Board scrutiny of task performance and budget	Quarterly meetings	Quarterly meetings	Quarterly meetings	Quarterly meetings	Quarterly meetings	Quarterly meetings
Reports to Board and CRC Program	Monthly, quarterly and annual reports to Board and CRC Program	Target reached	Target reached	Target reached	Target reached	Target reached

Other indicators:

Efficient and effective performance. Satisfaction of parties survey in 2004 indicated high level of support from members.

International consultant advice. See Section 4, 7 and 8.

Annual report. Reports made and submitted on time.

APPENDIX 2. REVIEW OF TRACK RECORD OF CRC REEF

In April 2004, the Centre was reviewed by Dr Don Kinsey. A summary of his review follows. The unabridged version of his review is available from the CRC Reef website at: http://www.reef.crc.org.au/about/Reviewoftrackrecord2004.htm.

CRC Reef has an outstanding performance record. It is appropriately entrepreneurial and has expanded operating horizons. CRC Reef addresses matters of great significance to the GBRWHA and also to a much broader consumer group which adds enormously to the value of CRC Reef. While a significant part of its value to Australia will continue to be the provision of *Public Good* and public sector management products, there has been a very successful expansion of the customer base to private sector bodies such as port authorities, shipping, and offshore oil and gas.

Corporate governance works exceedingly well and the strongly user-based Board ensures focus on required products and realistic commercialisation of relevant products. The CEO has an excellent entrepreneurial focus while maintaining the Programs at a high level of technical and scientific excellence. The subsidiary company, IMPAC is proving an effective channel for several international associates attracting significant funds. Further expansion of partnership and Board structure will considerably strengthen the relationship to the expanding user-base.

Immediately available, applicable, and well-packaged products are offered to all users. Offering timely products which may still be speculative (e.g. Reef Futures predictive tools) is a major achievement. This almost private sector image is of enormous benefit. Some additional links across and between programs are recommended.

Research has diversified considerably with new target users and steering groups/consortiums being established. The development of consortiums indicates a very sound commercial focus. CRC Reef would seem to be now recognized as a prime focus for advice in the management of ports and shipping, and in aspects of offshore structures. Most expansions are in line with recommendations of Year 2 Review. Further expansion of water quality research from the Wet Tropics into catchments throughout the GBR is recommended.

CRC Reef is structured and managed with a very strong product focus to efficiently take advantage of commercial opportunities. Many Performance Indicators for financial targets have been met or exceeded. The very much exceeded Performance Indicator for income generated from commercial contracts is a very noteworthy achievement.

The Education Program is a highlight of CRC Reef. The 113 publications already arising from student research is outstanding and indicates a degree of career orientation that is exceptional.

The Extension Program is the extremely successful backbone of the CRC output. There is scope for further raising the operating level of Extension to fully cover the total range of technological, scientific, and management products.

APPENDIX 3. POSTGRADUATE STUDENTS

SCHOLARSHIP STUDENTS WHO SUBMITTED OR COMPLETED DURING 2003-04
The following students had CRC Reef Scholarships or a combination of CRC Reef Scholarship and other awards eg. Australian Postgraduate Award (APA) or James Cook University Scholarship (JCU).

Name	Degree	Institution Enrolled/ Task Affiliation	Thesis Title	Commenced	Supervisor	Status of Study	Source of Funding
S Adams	PhD	JCU / Task 5.5.7	The reproductive biology of three species of *Plectropomous* (Serranidae) and responses to fishing.	01/03/97	Prof H Choat (JCU) Dr B Molony (JCU) Prof B Mapstone (ACE CRC)	Completed	CRC Reef/APA
W Bailey	MEngSc	JCU / Task B1.2	Development of a lagrangian sediment transport model for application to the marine environment.	02/01/01	Prof T Hardy (JCU) Prof J Patterson (JCU)	Completed	CRC Reef/APA
R Fisher	PhD	JCU / Task C 3.3	The functional capabilities of reef fish larvae: implications for dispersal during the pelagic phase.	28/06/99	Prof D Bellwood (JCU)	Completed	CRC Reef/APA
A Lashko	PhD	JCU / Task C1.4.2.1S	Population genetic structure of roseate tern *Sterna dougallii* populations in Australia and surrounding regions and a preliminary investigation of the relationships among subspecies.	31/03/00	Dr E Gyuris (JCU) Dr M Waycott (JCU)	Submitted	CRC Reef
C Pocock	PhD	JCU / Task A1.3.1S	Romancing the reef: history, heritage and the hyper-real.	27/03/00	Dr D Roe (JCU) Dr S Greer (JCU) Dr D Collett (DEH)	Submitted	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) Prof B Mapstone (ACE CRC)	Completed	CRC Reef
A Williams	PhD	JCU / Task E2.4.21S	Spatial patterns in population biology of a large coral reef fish: what role can movement play?	31/03/98	Assoc Prof G Russ (JCU) Dr C Davies (AAD) Prof B Mapstone (ACE CRC)	Completed	CRC Reef/APA

SCHOLARSHIP STUDENTS – AT JUNE 2004
The following students have CRC Reef or CRC Torres Strait (marked *) Scholarships or a combination of CRC Reef Scholarship and other awards eg. Australian Postgraduate Award (APA) or James Cook University Scholarship (JCU).

Name	Degree	Institution Enrolled/ Task Affiliation	Thesis Title	Commenced	Supervisor	Status of Study	Source of Funding
S Anthony	PhD	JCU / Task C2.3S	Coral disease in a large-scale reef mesocosm.	01/03/02	Assoc Prof B Willis (JCU) Dr K Michalek-Wagner (GBRMPA) Assoc Prof R de Nys (JCU) Dr D Bourne (AIMS)	Current	CRC Reef/JCU
M Bergenius	PhD	JCU / Task B4.18S	Consequences of spatial patterns in life history characteristics of a coral reef fish subject to different harvest strategies.	18/06/01	Dr G Begg (JCU) Assoc Prof G Russ (JCU) Prof B Mapstone (ACE CRC) Dr R Little (CSIRO)	Current	CRC Reef
B Breen	PhD	JCU / Task 2.1.6/2	Spatial allocation of resource use in the Cairns section of the GBRMP.	28/02/94	Dr S Shafer (Texas A & M) Prof H Marsh (JCU) Dr A Williams (QPWS)	Current (Part-time)	CRC Reef
T Cooper	PhD	JCU / Task C7.2	Identifying tools to monitor the status of near-shore reefs.	01/11/03	Dr K Anthony (JCU) Dr K Fabricius (AIMS)	Current	CRC Reef
E Dinsdale	PhD	JCU / Task A2.1.3	Measuring the success of conservation strategies to protect scleractinian corals on the GBR.	01/01/01	Assoc Prof P Valentine (JCU) Assoc Prof V Harriott (SCU) Dr D Fenton (JCU)	Current	CRC Reef
J Eagle	PhD	JCU / Task C3.5S	The influence of local scale hydrodynamics on larval and food supply to coral reef assemblages.	30/06/01	Prof M Kingsford (JCU) Dr G Jones (JCU)	Current	CRC Reef/APA
J Grayson*	PhD	JCU / Task T1.11	Information to assist Torres Strait Islanders and Aboriginal people of Torres Strait manage their traditional fisheries for dugongs and green turtles in a sustainable manner.	01/01/04	Prof H Marsh (JCU)	Current	CRC Torres Strait
D Grover	MSc	JCU / Task C1.4.2.2	The role of environmental factors in the distribution of breeding seabird populations in the GBRWHA.	01/01/01	Dr E Gyuris (JCU) Mr J Monaghan (JCU)	Current (Part-time)	CRC Reef
J Harrington	PhD	JCU / Task A1.3.2S	'Being Here'. Heritage, belonging and place making: a study of community and identity formation at Avebury (England), Magnetic Island (Australia) and Ayutthaya (Thailand).	29/03/99	Dr S Greer (JCU) Dr R Henry (JCU)	Current (Part-time)	CRC Reef/APA
J Higgs	PhD	JCU / Task 2.4.14	The response of the recreational reef line fishery to changes in Marine Park Zoning status and environmental parameters.	01/02/95	Prof B Mapstone (ACE CRC) Assoc Prof G Russ (JCU)	Suspended	CRC Reef

A Hodgson	PhD	JCU / Task C1.4.3.1S	Dugong behaviour and the effects of boats and pingers.	27/03/00	Dr L Chilvers (U Canterbury) Prof H Marsh (JCU)	Current	CRC Reef/APA
B Johnston	PhD	JCU / Task C7.2	Effects of water quality on seagrass meadows of the GBR.	27/01/04	Dr M Waycott (JCU) Dr J Holtum (JCU) Dr B Longstaff (EPA) Dr K Fabricius (AIMS)	Current	CRC Reef
S Lewis	PhD	JCU / Task C4.1S	Climatic and oceanographic change from high-resolution records in large fossil *Porites* coral heads, Magnetic Island, Queensland.	31/03/01	Dr G Shields (JCU) Dr J Lough (AIMS)	Current	CRC Reef/JCU Earth Science Schol.
F Loban*	MSc	JCU / Task	Indigenous participation in fisheries management.	01/03/04	Prof H Marsh (JCU) Prof P Havemann (JCU)	Current	CRC Torres Strait
V Lukoschek	PhD	JCU / Task C1.4.1S	Conservation genetics of sea snakes (Hydrophiidae) in Australian waters, with emphasis on the GBRWHA.	07/02/00	Dr M Waycott (JCU) Dr S Keogh (ANU) Prof H Marsh (JCU)	Current (Part-time)	CRC Reef/APA
R Marriott	PhD	JCU / Task B4.12S	Forecasting fishing impacts on the population biology of the red bass, *Lutjanus bohar*.	30/03/01	Dr G Begg (JCU) Prof B Mapstone (ACE CRC) Prof H Choat (JCU)	Current	CRC Reef
N Marshall	PhD	JCU / Task A1.2.4S	A conceptual and operational understanding of resource dependency.	01/07/01	Dr D Fenton (JCU)	Current	CRC Reef
J McKinlay	PhD	JCU / Task 2.4.17	A spatial and temporal analysis of the Queensland multi-species commercial line fishery from fishers' logbook data.	01/01/97	Prof B Mapstone (ACE CRC) Dr G De'ath (AIMS) Dr C Davies (AAD)	Suspended	CRC Reef/APA
D Miller	PhD	JCU / Task B2.9S	Towards sustainable environmental experiences for the live-aboard dive industry on the GBR.	30/03/02	Dr A Birtles (JCU) Assoc Prof P Valentine (JCU)	Current	CRC Reef/JCU
G Muldoon	PhD	JCU / Task E2.1.16/1S	Innovation and fisheries investment where latent effort exists: sustainability implications for the GBR reef-line fishery.	15/07/97	Prof B Mapstone (ACE CRC) Assoc Prof P Valentine (JCU) Assoc Prof O Stanley (JCU)	Current (Part-time)	CRC Reef
M Nursey-Bray	PhD	JCU / Task A1.2.2S	Conflict, co-operation or co-management: eating our words? Towards indigenous hunting management in north Queensland.	01/10/00	Assoc Prof S Turton (JCU) Prof H Ross (UQ) Prof H Marsh (JCU)	Current	CRC Reef
R Pears	PhD	JCU / Task B4.20S	Comparative demography and life history features of cods and gropers: implications for fisheries and conservation management.	01/05/00	Prof B Mapstone (ACE CRC) Dr G Begg (JCU) Prof H Choat (JCU)	Current (Part-time)	CRC Reef/JCU
B Radford	PhD	JCU / Task D2.1S	Effects of water quality on the distribution of corals on coastal reefs: development of tools for environmental assessment and risk management.	31/03/00	Dr K Anthony (JCU) Dr K van Neill (UWA) Dr T Done (AIMS) Assoc Prof B Willis (JCU)	Current	CRC Reef
S Rotmann	PhD	JCU / Task C2.5	Tissue thickness as a method to measure coral response to sediment stress on Lihir Island, PNG.	22/05/00	Dr S Smithers (JCU) Dr D Barnes (AIMS)	Current	CRC Reef/Lihir Mining

M Shaw	PhD	UQ / Task C7.1	Developing advanced tools for water quality monitoring of contaminants introduced to the GBRWHA by adjacent land uses.	15/08/03	Assoc Prof J Mueller (UQ) Dr M Furnas (AIMS)	Current	CRC Reef
J Sheppard	PhD	JCU / Task C1.4.3.2S	Enhancing the ecological basis for conservation management of dugongs, using innovative satellite tracking technologies.	01/01/02	Prof H Marsh (JCU) Dr I Lawler (JCU)	Current	CRC Reef/JCU
M Slivkoff	PhD	Curtin Uni / Task C7.1	Remote sensing of water quality in the coastal/GBR region.	04/12/03	Prof M Lynch (Curtin U) Dr M Furnas (AIMS)	Current	CRC Reef
R Tobin	PhD	JCU / Task B4.10S	The perceived and actual differences in recreational line catch trends in estuaries open and closed to commercial gillnet fishing in north Queensland.	12/03/01	Dr S Sutton (JCU) Prof B Mapstone (ACE CRC) Dr M Sheaves (JCU)	Current (Part-time)	CRC Reef/JCU

STUDENT ASSOCIATES WHO SUBMITTED OR COMPLETED IN 2003-2004
The following students had links to CRC Reef through research support.

Name	Degree	Institution Enrolled/ Task Affiliation	Thesis Title	Commenced	Supervisor	Status of Study	Source of Funding
A Ballagh	BSc Hons	JCU / Task B4.1a	Determination of growth trends in Queensland east coast Spanish mackerel *Scomberomorus commerson* using otolith back-calculations.	20/02/03	Dr G Begg (JCU) Dr I Lawler (JCU)	Completed	CRC Reef
R Bannister	BSc Hons	JCU / Task C1.11	Feeding ecology of dictyoceratid sponges.	01/07/02	Assoc Prof R de Nys (JCU)	Completed	CRC Reef
C Birrell	MSc	JCU / Program E	Influences of benthic algae on coral settlement and post-settlement survival: implications for the recovery of disturbed and degraded reefs.	01/02/01	Assoc Prof B Willis (JCU) Dr L McCook (AIMS) Dr K Anthony (JCU)	Completed	CRC Reef Aug Grant
J Castorina	BE Hons	JCU / Task B3.10	Improving the usability of the Forest Beach boat ramp.	01/01/02	Prof T Hardy (JCU)	Completed	CRC Reef
C Clarke	MSc	JCU / Program E	The ecological role of sea hares (Opisthobranchia: Anaspidea) within tropical intertidal habitats.	30/07/01	Dr G Brodie (JCU) Assoc Prof R de Nys (JCU) Prof A Klussmann-Kolb (Goethe Uni)	Submitted	CRC Reef Aug Grant
G Dunshea	BSc Hons	JCU / Program E	Molecular age estimation in the sirenian *Dugong dugon*: applicable tool or genetic curiosity?	03/02/03	Dr I Lawler (JCU) Dr M Waycott (JCU) Dr D Kwan (JCU)	Completed	CRC Reef Aug Grant
J Guenther	BSc Hons	JCU / Program E	The effect of surface microtopography of *Pinctada* and *Pteria* species on the settlement of fouling organisms.	03/02/03	Assoc Prof R de Nys (JCU) Assoc Prof P Southgate (JCU)	Completed	CRC Reef Aug Grant
J Hasling	Mtourism	JCU / Task B2.8	Take a closer look: designing effective interpretation for the dwarf minke whale	26/07/02	Dr A Birtles (JCU)	Completed	CRC Reef

			industry.				
D Hawthorn	Mtourism	JCU / Task B2.8	Exploring the practical application of sustainability indicators for nature-based tour operators.	11/02/03	Dr A Birtles (JCU)	Completed	CRC Reef
J Madin	PhD	JCU / Program E	Biomechanical strategies of reef corals.	31/03/00	Prof T Hughes (JCU) Dr S Connolly (JCU)	Completed	CRC Reef Aug Grant
S McKenna	BSc Hons	JCU / Task B1.0.3	An evaluation of the factors affecting the structure, abundance and distribution of tropical estuarine fouling assemblages.	01/01/03	Dr K Neil (DPI&F)	Completed	CRC Reef
J Mellors	PhD	JCU / Task 1.4.4	Sediment and nutrient dynamics in coastal intertidal seagrass of north eastern Tropical Australia.	03/07/92	Prof H Marsh (JCU) Dr R Coles (DPI&F)	Completed	CRC Reef
H Patterson	PhD	JCU / Program E	Otolith chemistry, early life history, and potential self-recruitment of coral reef fishes.	01/03/01	Prof M Kingsford (JCU)	Completed	CRC Reef Aug Grant
M Puotinen	PhD	JCU / Task 1.1.3	Tropical cyclone impacts on coral reefs: modelling the disturbance regime in the GBR Region.	10/04/95	Dr A Lewis (GBRMPA) Dr T Done (AIMS) Prof D Gillieson (JCU)	Submitted	CRC Reef
J Ryan	BE Hons	JCU / Task B3.3	Evaluation of the pontoon mooring design guidelines.	01/03/03	Assoc Prof T Hardy (JCU)	Completed	CRC Reef
G Sjursaether	Mtourism	JCU / Task B2.8	Involving tourism operators in the ecologically sustainable management of their industry: Developing a sighting network for the GBR minke whale ecotourism industry.	17/02/03	Dr A Birtles (JCU)	Completed	CRC Reef
E Slaughter	BSc Hons	JCU / Program E	Federal and State Government exploitation of GBR Islands between 1830 and 1950.	01/01/03	Dr M Gibbs (JCU)	Completed	CRC Reef Aug Grant
J Sofonia	GDip RM	JCU / Program E	Effects of sediment characteristics on stress responses in corals.	06/09/01	Dr K Anthony (JCU) Assoc Prof B Willis (JCU)	Submitted	CRC Reef Aug Grant
M Taverner	Mtourism	JCU / Task B2.1.2	Understanding visitor perceptions of threatening wildlife in north Queensland.	01/01/03	Dr G Moscardo (JCU)	Completed	CRC Reef
N Tonkin	BSc Hons	JCU / Program E	Ghost Ports and Harbours.	01/01/03	Dr M Gibbs (JCU)	Submitted	CRC Reef Aug Grant
A van Ruth	BE Hons	JCU / Task B3.10	Determining erosion in Rowes Bay.	01/01/03	Prof T Hardy (JCU)	Completed	CRC Reef
T Vintgers	Mtourism	JCU / Task B2.8	Involving tourism operators in sustainable management of their industry towards a better understanding of minke whale behaviour during swim encounters.	07/02/03	Dr A Birtles (JCU)	Completed	CRC Reef
C Vollhardt	MSc	Ruprecht Karls University, Heidelberg/ Task C2.9	The effects of the herbicide diuron on corals.	11/11/02	Dr A Negri (AIMS) Prof T Braunbeck (Ruprecht Karls University)	Completed	CRC Reef

M Weber	MSc	Bremen / Task C2.2	Effects of various types of sediments on the photophysiological health of scleractinian corals.	20/09/02	Dr K Fabricius (AIMS) Dr M Wolff (U Bremen)	Completed	CRC Reef
C Yagi	PhD	JCU / Task 2.2.1	Tourists encounters with other tourists.	02/08/99	Prof P Pearce (JCU) Dr G Moscardo (JCU)	Completed	CRC Reef

STUDENT ASSOCIATES – STATUS AT JUNE 2004
The following students have links to CRC Reef or CRC Torres Strait (*) through research support.

Name	Degree	Institution Enrolled/ Task Affiliation	Thesis Title	*Start date*	Supervisor	Status of Study	Source of Funding
A Abdulla	PhD	JCU / Task B4.14S	Post settlement mortality in tropical fisheries assessment.	01/03/00	Prof B Mapstone (ACE CRC) Dr J Caley (AIMS) Dr S Connolly (JCU)	Current	CRC Reef/IPRS
J Ackerman	PhD	JCU / Task C1.6	Demography of reef fishes.	28/06/99	Prof H Choat (JCU)	Current	CRC Reef
R Arthur	PhD	JCU / Task D1.1	Reef recovery from large-scale disturbance in the Lakshadweep Islands.	30/06/99	Prof H Marsh (JCU) Dr T Done (AIMS) Assoc Prof V Harriott (SCU)	Current	IPRS/Diversitas
J Aumend	PhD	JCU / Program E	Trace element analysis of otoliths as a technique for identifying the coastal nursery grounds of tropical snapper (*Lutjanus* spp.) from the GBR.	28/09/98	Dr M Sheaves (JCU)	Current (Part-time)	CRC Reef Aug Grant
R Bannister	PhD	JCU / Program E	Feeding biology of *Rhopaloides odorabile*: Shifting between heterotrophy and autotrophy.	01/01/04	Assoc Prof R de Nys (JCU) Dr C Battershill (AIMS)	Current	CRC Reef Aug Grant
L Bay	PhD	JCU / Program E	The evolution of stress on the species border.	01/06/01	Prof R Crozier (JCU) Dr G Jones (JCU) Dr J Caley (AIMS)	Current	CRC Reef Aug Grant
J Bird	MEngSc	JCU / Task B3.10	Modelling sub-reef thermodynamics to predict coral bleaching.	28/07/03	Prof T Hardy (JCU)	Current	CRC Reef
M Blanchette	MSc	JCU / Program E	Development of a rapid bioassay for detection of copper pollution in the GBR: The effect of copper on the esterase activity of cultured zooxanthellae isolated from corals of north Queensland.	01/07/03	Dr K Heimann (JCU)	Current	CRC Reef Aug Grant
S Bourke	BSc Hons	UWA / Task D2.1.1S	Using TLC measurements of coral lipids as a condition measurement of coral health under sediment stress from dredging.	02/02/04	Mr B Radford (U WA) Dr S Saunders (U WA)	Current	CRC Reef
M Boyle	PhD	JCU / Program E	The ecology and migrations of post-hatchling sea turtles in Australia.	31/03/02	Dr M Waycott (JCU) Assoc Prof R Alford (JCU) Dr C Limpus (QPWS)	Current	CRC Reef Aug Grant

S Busilacchi*	PhD	JCU / Task T1.8	Modelling the impact of multiple harvest strategies in the Eastern Torres Strait Reef Line fishery.	19/01/04	Dr G Begg (JCU) Assoc Prof G Russ (JCU) Dr S Connolly (JCU)	Current	CRC Torres Strait
N Cantin	MSc	JCU / Program E	Implications of parental diuron exposure for coral reproduction and larval metamorphosis.	31/03/04	Assoc Prof B Willis (JCU) Dr A Negri (AIMS)	Current	CRC Reef Aug Grant
D Ceccarelli	PhD	JCU / Task C2.2	Effects of territorial herbivorous damselfish on coral reef benthic communities.	01/02/01	Dr G Jones (JCU) Dr L McCook (GBRMPA)	Current	CRC Reef
M Depczynski	PhD	JCU / Program E	The functional role of cryptobenthic reef fishes in coral reef ecosystems.	05/08/02	Prof D Bellwood (JCU)	Current	CRC Reef Aug Grant
M Devlin	PhD	JCU / Task C2.2	Spatial variability of tropical flood plumes.	01/05/98	Dr K Fabricius (AIMS) Dr S Smithers (JCU) Mr J Brodie (JCU)	Current (Part-time)	CRC Reef
P Ettinger-Epstein	PhD	JCU / Program E	Examination of the chemical ecology and commercial viability (biopharmaceutical) of selected GBR sponge species.	31/03/03	Assoc Prof R de Nys (JCU)	Current	CRC Reef Aug Grant
R Evans	MSc	JCU / Program E	Effect of GBRMP zoning on the reproductive potential of reef fishes.	18/03/02	Assoc Prof G Russ (JCU)	Current (Part-time)	CRC Reef Aug Grant
L Gershwin	PhD	JCU / Task C6.1	Phylogeny and taxonomy of the Cubozoa of Australia.	31/03/03	Prof M Kingsford (JCU) Dr M van Oppen (AIMS)	Current	CRC Reef
G Ghitarina	PhD	JCU / Program E	Rapid determination of environmental stress in aquatic ecosystems.	24/02/03	Assoc Prof R de Nys (JCU) Assoc Prof P Southgate (JCU) Dr K Burns (JCU)	Current	CRC Reef Aug Grant
A Grech	PhD	JCU / Program E	Spatial models of dugong and seagrass distribution for habitat management.	23/02/04	Prof H Marsh (JCU) Dr G De'ath (AIMS) Dr R Coles (DPI&F) Mr J Moloney (JCU)	Current	CRC Reef Aug Grant
J Guenther	PhD	JCU / Program E	Behavioural, physical and chemical antifouling properties of starfish (Echinodermata, Asteroidea).	12/01/04	Assoc Prof R de Nys (JCU)	Current	CRC Reef Aug Grant
J Guinotte	PhD	JCU / Task D2.1a	A spatial index for coral bleaching thresholds in the GBR.	15/07/99	Dr W Buddermeier (U Kansas) Dr J Kleypas (NCAR) Prof D Gillieson (JCU) Dr T Done (AIMS)	Current	CRC Reef/IPRS
T Hancock	PhD	JCU / Task D4.3	Clustering and pattern recognition using classification and regression trees.	02/01/03	Assoc Prof D Coomans (JCU) Dr B Litow (JCU)	Current	CRC Reef
L Harrington	PhD	JCU / Task C2.2	Ecology of crustose coralline algae: interactions with scleractinian corals and responses to environmental conditions.	01/01/01	Dr K Fabricius (AIMS) Dr J Collins (JCU) Dr R Steneck (Maine)	Current	CRC Reef/IPRS
J Hazel	MSc	JCU / Task A4.1	Sea turtle responses to vessel traffic.	18/05/04	Prof H Marsh (JCU)	Current	CRC Reef

J Hobbs	PhD	JCU / Program E	Regional scale analysis of processes regulating the abundance and diversity of fishes on the GBR.	30/03/03	Dr G Jones (JCU) Dr P Munday (JCU) Dr S Connolly (JCU)	Current	CRC Reef Aug Grant
A Izurieta	PhD	University of Queensland / Task A3.4	Tools and methods for participatory assessment of progress towards co-management and partnerships for protected areas and conservation of natural resources.	21/08/03	Dr M Hockings (UQ) Prof H Ross (UQ)	Current	CRC Reef
S Kininmonth	PhD	UQ / Task D4.1	Connectivity modelling of the coral reef ecosystem.	01/05/02	Prof H Possingham (UQ) Dr G De'ath (AIMS)	Current (Part-time)	CRC Reef
E Laman-Trip	MSc	JCU / Program E	An age-based analysis of sexual size dimorphism in surgeonfishes (Acanthuridae, Perciformes) from the Indo-Pacific region.	12/02/01	Prof H Choat (JCU)	Current	CRC Reef Aug Grant
M Land	BSc Hons	JCU / Program E	Tracking sediment input of the Tully River: Sedimentology and geochemistry of the northern Rockingham Bay area.	01/03/04	Dr R Wust (JCU)	Current	CRC Reef Aug Grant
D Louden	MSc	JCU / Task C1.11	The effect of depth on the survival feeding biology, growth and morphology of *Ireinia* sp (Porifera, Demospongia) and the implications for aquaculture.	24/03/03	Assoc Prof R de Nys (JCU) Dr C Battershill (AIMS) Assoc Prof P Southgate (JCU)	Current	CRC Reef
J McConochie	MEngSc	JCU / Task B3.1	Numerical modelling of synthetic cyclone generated waves in the GBR Region.	30/03/99	Prof T Hardy (JCU) Prof J Patterson (JCU)	Suspended	CRC Reef
M Myers	PhD	UCLA / Task C1.2	A comparison of ReefCheck methods with other methods for monitoring coral reefs.	01/07/00	Prof R Ambrose (UCLA) Prof G Hodgson (UCLA)	Current	CRC Reef
M Page	PhD	JCU / Program E	Late Quaternary evolution of the north Queensland continental margin.	20/02/00	Dr G Dickens (Rice - Texas) Prof R Henderson (JCU)	Current	CRC Reef Woolfe Schol.
G Parra	PhD	JCU / Task C1.4.5S	Ecology and conservation biology of Irrawaddy, *Orcaella brevirostris*, and Indo-Pacific humpback, *Sousa chinensis*, dolphins at the Central Section of the GBRMP.	01/01/01	Prof H Marsh (JCU) Dr P Arnold (MTQ) Dr P Corkeron (IMR)	Current	CRC Reef
D Peck	PhD	JCU / Program E	Foraging behaviour and genetic divergence in a tropical procellariiform, the wedge-tailed shearwater.	30/03/02	Dr B Congdon (JCU)	Current	CRC Reef Aug Grant
A Prichard*	PhD	JCU / Task T1.9	Development of collaborative community-based management prescriptives for the Torres Strait indigenous beche-de-mer and trochus fisheries.	20/01/03	Dr G Begg (JCU) Prof B Mapstone (ACE CRC)	Current	CRC Torres Strait
Z Richards	PhD	JCU / Program E	Characteristics of rare and common corals: implications for conservation.	31/03/03	Assoc Prof B Willis (JCU) Dr C Wallace (MTQ) Dr M van Oppen (AIMS) Dr D Miller (JCU)	Current	CRC Reef Aug Grant
W Robbins	PhD	JCU / Program E	Growth, demography and genetic stock structure of Queensland reef sharks.	01/02/01	Prof H Choat (JCU)	Current	CRC Reef Aug Grant

A Rumsby	BE Hons	JCU / Task B3.10	Modelling water residence times in the Port of Townsville.	01/01/04	Prof T Hardy (JCU)	Current	CRC Reef
A Scardino	PhD	JCU / Program E	Surface technologies modelled from nature.	03/03/03	Assoc Prof R de Nys (JCU)	Current	CRC Reef Aug Grant
C Steinberg	PhD	JCU / Task B3.4	Numerical modelling in the GBR.	01/03/97	Assoc Prof L Bode (JCU)	Current (Part-time)	CRC Reef
J True	PhD	JCU / Task 1.3.7	Massive scleractinian corals as indicators of environmental change.	01/01/97	Assoc Prof B Willis (JCU) Dr D Barnes (AIMS)	Current	CRC Reef
P Tudman	MSc	JCU / Program E	Modelling the trophic effects of fishing on the coral reefs of the central GBR.	18/03/02	Assoc Prof G Russ (JCU)	Current (Part-time)	CRC Reef Aug Grant
C Ware	PhD	JCU / Task 2.2.1	An examination of the travel patterns, trip-planning strategies, and attraction hierarchy characteristics of visitors to the Cairns FNQ region.	15/02/00	Prof P Pearce (JCU) Dr L Murphy (JCU) Assoc Prof G Ross (JCU)	Current (Part-time)	CRC Reef
S Whalan	PhD	JCU / Program E	Population genetic structure of the sponge *Rhopaloides odorabile.*	01/03/03	Dr C Battershill (AIMS) Dr D Jerry (JCU) Assoc Prof R de Nys (JCU)	Current	CRC Reef Aug Grant

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

APPENDIX 4. GRANTS AND AWARDS

Researcher (Organisation)	Title of Grant or Award	Source	Period of Grant	$
Brown I (DPI&F)	National strategy for increasing the survival of released line-caught fish: tropical reef fish species.	Fisheries Research and Development Corporation	Jul 03 – Jun 07	679,995
Begg G (JCU)	Third International Symposium on Fish Otolith Research and Application	DEST - Innovation Access Programme International Science and Technology	Sept 03 – Dec 04	55,000
Begg G (JCU)	Evaluation of stock assessment models for data poor pelagic fisheries	Australian Academy of Science International Collaboration Program	Apr - May 04	4,000
Coles R (DPI&F)	Travel grant to ERF	CRC Reef	Sept – Oct 03	7,000
Coles R (DPI&F)	Travel grant	UNEP/GEF, Westpac, JSPS, UNESCO/MAB, PNSC	May 04	3,000
Dinsdale E (JCU)	2003 Growing the Smart State PhD Grants	Queensland Government	Jun 03 – Jun 04	4,000
Dinsdale E (JCU)	Doctoral research scheme	JCU	Jun- Jun 04	3,000
Gershwin L (JCU)	Taxonomy and phylogeny of cubozoa	Robert W King Memorial Foundation Scholarship	Jan – Dec 04	15,000
Gershwin L (JCU)	Taxonomy and phylogeny of cubozoa	JCU Postgraduate Research Scheme	Jan – Dec 04	18,000
Gershwin L (JCU)	Taxonomy and phylogeny of cubozoa	Lions Foundation	Jan – Dec 04	5,000
Gershwin L (JCU)	Maintenance of *Carukia barnesi* in captivity	Surf Life Saving Qld	Jan – Dec 04	3,000
Hazel J (JCU)	Sea turtle responses to boat traffic	TESAG JCU	Jul – Dec 04	1,250
Lewis S (JCU)	Ken Woolfe Prize	CRC Reef	Jun 04 – Mar 05	3,000
Lewis S (JCU)	Student grant/award	Australian Coral Reef Society	Jul – Dec 04	2,000
Lewis S (JCU)	Postgraduate award	Australian Institute of Nuclear Science and Engineering	Jul 04 – Mar 05	5,500
Lewis S (JCU)	Doctoral research Scheme	JCU	Jul – Dec 04	2,000
Lukoschek V (JCU)	Travel Award	Australian Biological Resource Study, Bursaries for student travel	Apr – May 04	1,100
Lukoschek V (JCU)	IRA Travel Award	TESAG, JCU	Jun – Aug 04	1,400
Marsh H (JCU)	Sea turtle response to vessel traffic	Sea World Research and Rescue Foundation	Jan – Dec 04	13,800
Marsh H (JCU)	Sea turtle response to vessel traffic	Tangalooma Research Foundation	Jan – Dec 04	8,461
Radford B (JCU)	Industry support	Apache Energy	Jun 04	45,000
Radford B (JCU)	Industry support	Hamersley Iron	Jun 04	3,500

APPENDIX 5. PUBLICATIONS

* Publication by CRC Reef Postgraduate Student or CRC Reef Student Associate.

Refereed Journal Articles

*Adams S. 2003. Morphological ontogeny of the gonad of three plectropomid species through sex differentiation and transition. Journal of Fish Biology. 63:22-36.

Berkelmans R, De'ath G, Kininmonth S, Skirving WJ. 2004. A comparison of the 1998 and 2002 coral bleaching events on the Great Barrier Reef: spatial correlation, patterns and predictions. Coral Reefs. 23:74-83.

*Burrage DM, Steinberg CR, Mason LB, Bode L. 2003. Tidal corrections for TOPEX altimetry in the Coral Sea and Great Barrier Reef Lagoon: Comparisons with long-term tide gauge records. Journal of Geophysical Research. 108:3241.

Campbell SJ, McKenzie LJ. 2004. Flood related loss and recovery of intertidal seagrass meadows in southern Queensland, Australia. Estuarine, Coastal and Shelf Science. 60:477–490.

Cappo M, Speare P, D'eath G. 2004. Comparison of Baited Remote Underwater Video Stations (BRUVS) and prawn (shrimp) trawls for assessments of fish biodiversity in inter-reefal areas of the Great Barrier Reef Marine Park. Journal of Experimental Marine Biology and Ecology. 302:123-152.

Chilvers LB, Delean S, Gales NJ, HolleyDK, Lawler IR, Marsh H, Preen AR. 2004. Diving behaviour of dugongs, *Dugong dugon*. Journal of Experimental Marine Biology and Ecology. 304:203-224.

*Cluett L, Radford B. 2003. Downstream morphological change in response to dam construction: a GIS based approach for the lower Ord River, Western Australia. Water Science and Technology. 48:7 213-257.

*Davis TA, Llanes F, Volesky B, Diaz-Pulido G, McCook L, Mucci A. 2003. A 1H-NMR study of Na-alginates extracted from *Sargassum* spp. in relation to metal biosorption. Applied Biochemistry & Biotechnology. 110:75-90

*Diaz-Pulido G, McCook LJ. 2003. Relative roles of herbivory and nutrients in the recruitment of coral-reef seaweeds. Ecology. 84:2026-2033.

de Silva Samarasinghe JR, Bode L, Mason LB. 2003. Modelled response of Gulf St Vincent (South Australia) to evaporation, heating and winds. Continental Shelf Research. 23:1285-1313.

DeVantier L, Alcala A, Wilkinson C. 2004. The Sulu-Sulawesi Sea: environmental and socioeconomic status, future prognosis and ameliorative policy options. Ambio. 33:693-702.

*Dinsdale EA, Harriott VJ. 2004 Assessing anchor damage on coral reefs: a case study in the selection of environmental indicators. Environmental Management. 33:126-139.

Elvidge CD, Dietz JB, Berkelmans R, Abdrefouet S, Skirving W, Strond AE, Tuttle BT. 2004. Satellite observations of Keppel Island (Great Barrier Reef) 2002 coral bleaching using IKONOS data. Coral Reefs. 23:123-132.

Fabricius KE, De'ath G. 2004. A framework to identify ecological change and its causes: a case study on the effects of terrestrial run-off on coral reefs. Ecological Applications 2004. 1-22.

Fabricius KE, Mieog JC, Colin PL, Idip D, Van Oppen JH. 2004. Identity and diversity of coral endosymbionts (zooxanthellae) from three Palaun reefs with contrasting bleaching, temperature and shading histories. Molecular Ecology. 13:2445-2458.

Fenner PJ, Lewin M. 2003. Sublingual glyceryl trinitrate as prehospital treatment for hypertension in Irukandji syndrome. Med J Aust. 179:655.

Feussner K, Skelton PA, South GR, Alderslade P, Aalbersberg W. 2004 *Ostreobium quekettii* Bornet et Flahault (Ostreobiaceae: Chlorophyceae) invading the barnacle *Acasta* sp. (Pendunculata: Acastinae), endozoic in the octocoral *Rumphella suffruticosa* (Alcyonacea: Gorgoniidae) from Fiji, South Pacific. New Zealand Journal of Marine & Freshwater Research 38: 87-90.

Gyuris E. 2004. An experimental investigation of the effects of human intrustion into breeding colonies of bridled terns *Sterna anaethetus* in the Great Barrier Reef. Pacific Conservation Biology. 9:265-267.

*Hardy YTA, McConochie JD, Mason LB. 2003. Modelling tropical cyclone wave population of the Great Barrier Reef. Journal of Waterway, Port, Coastal and Ocean Engineering. Am Soc Civil Eng. 129:104-113.

Harrison SL, Leggat PA, Fenner PJ, Durrheim DN, Swinbourne AL. 2004. Reported knowledge, perceptions, and behaviour of tourists and North Queensland residents at risk of contact with jellyfish that cause the Irukandji syndrome. Wilderness Environ Med. 15: 4-10.

*Jompa J, McCook LJ 2003. Coral-algal competition: macroalgae with different properties have different effects on corals. Mar Ecol Prog Ser. 258:87-95.

*Jompa J, McCook LJ. 2003. Contrasting effects of filamentous turf algae on corals: massive *Porites* are unaffected by mixed species turfs, but are killed by the red alga *Anotrichium tenue*. Mar Ecol Prog Ser. 258:79-86.

Marsh H, Kenchington RA. 2004. The role of ethics in experimental marine biology and ecology. Journal of Experimental Marine Biology and Ecology. 300:5-14.

Neil K, Hutchings P, Stafford H. 2003. Port surveys for non-indigenous species - the benefits of taxonomic networks. Journal of Marine Science and Environment. C1:11-17.

Ninio R, Delean S, Osborne K, Sweatman H. 2004. Estimating cover of benthic organisms from underwater video images: variability associated with multiple observers. Mar Ecol Prog Ser. 265:107-116.

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South GR, Skelton PA, Veitayaki J, Resture A, Carpenter C, Lawendrau A. 2004. The Global International Waters Assessment for the Pacific Islands: aspects of transboundary, water and coastal fisheries issues. Ambio. 33:98-106.

Suzuki A, Gagan MK, Fabricius K, Isdale PJ, Yukino I, Kawahata H. 2003. Skeletal isotope microprofiles of growth perturbations in *Porites* corals during the 1997-1998 mass bleaching event. Coral Reefs. 22:357-369.

Swadling KM, McKinnon AD, De'ath G, Gibson JAE. 2004. Life cycle plasticity and differential growth and development in marine and lacustrine populations of an Antarctic copepod. Limnology and Oceanography. 49:644-655.

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Wilson SK, Bellwood DR, Choat JH, Furnas MJ. 2003 Detritus in the epilithic algal matrix and its use by coral reef fishes. Oceanography and Marine Biology: an Annual Review. 41:279-309

*Winkel KD, Hawden GM, Fenner PJ, Gershwin L, Collins AG, Tibballs J. 2003. Jellyfish antivenoms: past, present and future. Journal of Toxicology: Toxin Reviews. 22:115–127.

Wooldridge S, Done T. 2004. Learning to predict large-scale coral bleaching from past events: a Bayesian approach using remotely sensed data, in-situ data, and environmental proxies. Coral Reefs. 23:96-108.

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*Choat JH, Pears RJ. 2003. Large fish monitoring. In: Wilkinson C, Green A, Almany J, Dionne S. (eds). Monitoring Coral Reef Marine Protected Areas. Australian Institute of Marine Science and IUCN Marine Program, Townsville.

Hill J, Wilkinson C. 2004. Methods for Ecological Monitoring of Coral Reefs: A Resource for Managers. Australian Institute of Marine Science and Reef Check. 118pp.

*Muldoon G.J. 2003. Chapter 2. The economics of the trade. In: Sadovy YJ, Donaldson TJ, Graham TR, McGilvray GJ, Phillips MJ, Rimmer MA, Smith A, Yeeting B. (eds). While stocks last: the live reef food fish trade. Asian Development Bank, Manila. Pp 19-41.

*Muldoon GJ, Graham T. 2003. Chapter 5. Management of the trade. In: Sadovy YJ, Donaldson TJ, Graham TR, McGilvray GJ, Phillips MJ, Rimmer MA, Smith A, Yeeting B. (eds). While stocks last: the live reef food fish trade. Asian Development Bank, Manila. Pp 73-92.

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Skelton PA, South GR, Millar AJK. 2004. *Gracilaria ephemera* sp. nov. (Gracilariales, Rhodophyceae) a flattened species from Samoa, South Pacific. In: Abbott IA, McDermid KJ. (eds). Taxonomy of Economic Seaweeds. With reference to some Pacific Species. California Sea Grant. 9:231-242.

South GR. 2004. *Hypnea* sp. inedit. (Gigartinales, Rhodophyta) from Fiji, South Pacific and a list of *Hypnea* species occurring in the Fiji Islands. In: Abbott IA, McDermid KJ. (eds). Taxonomy of Economic Seaweeds. With reference to some Pacific species. California Sea Grant. 9:133-139.

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Wilkinson C, Green A, Almany J, Dionne S. 2003. Monitoring Coral Reef Marine Protected Areas. Australian Institute of Marine Science and IUCN. 68pp.

*Willis BL, Page CA, Dinsdale EA. 2004. Chapter 3. Coral disease on the Great Barrier Reef. In: Rosenberg E, Loya Y. (eds). Coral Health and Disease. Springer Verlag, Berlin. Pp 69-104.

*Wolanski E, Brinkman R, Spagnol S, McAllister F, Steinberg C, Skirving W, Deleersnijder E. 2003. Merging scales in models of water circulation: perspectives from the Great Barrier Reef. In: Lakhan VC. (ed). Advances in Coastal Modeling. Elsevier. Pp 411-429.

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Bailet F, Ekau W, South GR. 2004. Global Learning in Ocean Science. Preparatory Workshop for the Building of Partnerships. Opportunities for collaboration in training among International Ocean Institute Operational Centres and European Institutions. Delmenhorst, Germany. 24-28 May 2004. International Ocean Institute. 78pp.

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Brodie J, Furnas M. 2004. Status of inputs from Great Barrier Reef catchments and impacts on the Reef. In: Dawson N, Brodie J, Rayment G, Porter C. (eds). Protecting the Values of Rivers, Wetlands and the Reef. Conference Abstracts, Papers, Posters and Presentations, Townsville 20-23, 2001, Qld. Department of Natural Resources, Energy and Mines, Brisbane

*Dinsdale EA. 2003. Indicators to assess coral reef conditon: integrating views of society. In: Beumer J, Grant A, Smith D. (eds). Aquatic Protected Areas. What works best and how do we know? Proceedings of the World Congress on Aquatic Protected Areas. Cairns, Australia. pp 415-420

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List of Abbreviations

AAD = Australian Antarctic Division
ABC = Australian Broadcasting Corporation
ACE CRC = Antarctic Climate and Ecosystems CRC
AFMA = Australian Fisheries Management Authority
AGM = Asian Green Mussel
AIMS = Australian Institute of Marine Science
AM = Australian Museum
AMPTO = Association of Marine Park Tourism Operators
AMSA = Australian Maritime Safety Authority
ANU = Australian National University
APEC = Asia Pacific Economic Co-operation
AQIS = Australian Quarantine and Inspection Service
AusAID = Australian Agency for International Development
BEC = Board Executive Committee
CALM = Department of Conservation and Land Management
CCIMPE = Consultative Committee on Introduced Marine Pest Emergencies
CEFAS = Centre for Environment, Fisheries and Aquaculture Science
CEO = Chief Executive Officer
CITES = Convention on International Trade in Endangered Species
CPA = Cairns Port Authority
CRC = Cooperative Research Centre
CREWS = Coral Reef Early Warning System
CSIRO = Commonwealth Scientific and Industrial Research Organisation
DAFF = Department of Agriculture Fisheries and Forestry
DEH = Department of Environment and Heritage
DEST = Department of Education, Science and Training
DOT = Department of Transport
DPI&F = Queensland Department of Primary Industries & Fisheries
EEZ = Exclusive Economic Zone
ELF = Effects of Line Fishing
EPA = Environmental Protection Agency (Queensland)
ERF = Estuarine Research Federation
ESD = Economically Sustainable Development
F&F = Fishing and Fisheries
FRDC = Fisheries Research & Development Corporation
FRV = Fisheries Research Vessel
FSM = Federated States of Micronesia
FTE = Full-Time Equivalent
GA = Geoscience Australia
GBR = Great Barrier Reef
GBRMP = Great Barrier Reef Marine Park
GBRMPA = Great Barrier Reef Marine Park Authority
GBRRF = Great Barrier Reef Research Foundation
GBRWHA = Great Barrier Reef World Heritage Area
GCRMN = Global Coral Reef Monitoring Network
GEF = Global Environment Fund
GIS = Geographic Information System
GPS = Global Positioning System
IMarEST = Institute of Marine Engineering, Science and Technology
IMO = International Maritime Organization
IMPAC = International Marine Project Activities Centre
IMR = Institute of Marine Research, Norway
IOGN = International Ocean Governance Network
IOI = International Ocean Institute
IP = Intellectual Property

IPRS = International Postgraduate Research Scholarship
IPCC = Inter-governmental Panel on Climate Change
IUCN = World Conservation Union
IWG = Indigenous Working Group
JAMBA = Japan-Australia Migratory Bird Agreement
JCU = James Cook University
JSPS = Japan Society for Promotion of Science
LTM = Long Term Monitoring
LTMT = Long Term Monitoring Team
MMU = Marine Modelling Unit
MPA = Marine Protected Area
MTQ = Museum of Tropical Queensland
NCAR = National Centre for Atmospheric Research
NESDIS = National Environmental Satellite, Data and Information Service
NGO = Non-Government Organisation
NIS = Non-Indigenous Species
NOAA = National Oceanic and Atmospheric Administration
NOO = National Oceans Office
NRM = Natural Resource Management
OSRA = Oil Spill Response Atlas
OUCH = Order of Underwater Coral Heroes
PCQ = Ports Corporation of Queensland
PGS = Post Graduate Student
PNG = Papua New Guinea
PNSC = Philippines National Seagrass Committee
PZJA = Protected Zone Joint Authority
QBFP = Queensland Boating and Fisheries Patrol
QFS = Queensland Fisheries Service
QM = Queensland Museum
QPWS = Queensland Parks and Wildlife Service
QSIA = Queensland Seafood Industry Association
R & D = Research and Development
SAC = Scientific Advisory Committee
SLSA = Surf Life Saving Australia
SLSQ = Surf Life Saving Queensland
SSI = Scuba Schools International
SST = Sea Surface Temperature
SUNFISH = SUNFISH Queensland Inc
TACC = Technical Advisory Consultative Committees
TESAG = School of Tropical Environmental Studies and Geography, JCU
TNC = The Nature Conservancy
TPA = Townsville Port Authority
TRC = Task Review Committee
TSRA = Torres Strait Regional Authority
UN = United Nations
UNEP = United Nations Environment Programme
UNESCO/MAB = United Nations Educational Scientific and Cultural Organisation, Man and Biosphere Programme
UQ = University of Queensland
UWA = University of Western Australia
WWF = World Wide Fund for Nature