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IMPLEMENTATION COMPLETION AND RESULTS REPORT
(TF-53909)

ON A

GLOBAL ENVIRONMENT FACILITY GRANT

IN THE AMOUNT OF US\$11 MILLION

TO

THE UNIVERSITY OF QUEENSLAND

FOR A GLOBAL

CORAL REEF TARGETED RESEARCH AND CAPACITY BUILDING FOR
MANAGEMENT PROJECT

May 27, 2011

Sustainable Development Department
East Asia and Pacific Region

CURRENCY EQUIVALENTS

(exchange rate effective April 30, 2010)

Currency Unit = Australian dollar (\$A)

US\$1 = \$A 1.07

\$A 1 = US\$0.93

FISCAL YEAR

January 1 – December 31

ABBREVIATIONS AND ACRONYMS

CAS	Country Assistance Strategy
CPS	Country Partnership Strategy
COE	Center of Excellence
CRTR	Coral Reef Targeted Research and Capacity Building for Management Project
DGF	Development Grant Facility
GEF	Global Environment Facility
GEO	global environment objective
ICR	Implementation Completion Report
IOC	Intergovernmental Oceanographic Commission of UNESCO
ISR	Implementation Status and Results Report
KPI	key performance indicators
LGU	local government unit
M&E	monitoring and evaluation
MPA	marine protected area
MTR	mid-term review
NGO	nongovernmental organization
PDO	project development objective
PEA	project executing agency
QEA	Quality at Entry Assessment
SP	Synthesis Panel
STI	science, technology, and innovation
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNFCCC	United Nations Framework Convention on Climate Change
UQ	University of Queensland
WG	working group

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Coral Reef Targeted Research and Capacity Building for Management Project

CONTENTS

Data Sheet

- A. Basic Information
- B. Key Dates
- C. Ratings Summary
- D. Sector and Theme Codes
- E. Bank Staff
- F. Results Framework Analysis
- G. Ratings of Project Performance in ISRs
- H. Restructuring
- I. Disbursement Graph

1. Project Context, Global Environment Objectives and Design.....	1
2. Key Factors Affecting Implementation and Outcomes	6
3. Assessment of Outcomes	11
4. Assessment of Risk to Development Outcome.....	17
5. Assessment of Bank and Borrower Performance	18
6. Lessons Learned.....	21
7. Comments on Issues Raised by Borrower/Implementing Agencies/Partners.....	23
Annex 1. Project Costs and Financing.....	1
Annex 2. Outputs by Component.....	3
Annex 3. Economic and Financial Analysis	10
Annex 4. Bank Lending and Implementation Support/Supervision Processes.....	11
Annex 5. Beneficiary Survey Results	13
Annex 6. Stakeholder Workshop Report and Results.....	14
Annex 7. Summary of Borrower's ICR and/or Comments on Draft ICR	15
Annex 8. Comments of Cofinanciers and Other Partners/Stakeholders	26
Annex 9. List of Supporting Documents	27
MAP	

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1. Project Context, Global Environment Objectives and Design

1.1 Context at Appraisal

Coral reefs are critical assets at the global, regional, and local level. Already extensively degraded in many areas, they face increasing and possibly irreversible threats from the impacts of local marine (and terrestrial) development and resource exploitation, as well as from global climate change and associated ocean warming and acidification. Currently there are many gaps in scientific knowledge of these stresses, their impact on reefs, the consequences for the economies and ecosystems they support, and how to mitigate or adapt to these stresses. Filling these gaps and improving knowledge of coral reef dynamics is essential for fostering public understanding and behavioral changes, improving coral reef management and conservation, and giving policymakers at both the local and international level the information they need to make responsible policy decisions.

Coral reefs have exceptional biodiversity value and are significant drivers of economic growth in the more than 60 developing countries where they occur. There are no reliable global estimates of the value of coral reefs, but annual net present values of up to \$29 billion, primarily from their contribution to tourism and fisheries, but also for coastal protection, and other non-market values, have been cited.¹ Many impoverished coastal communities depend on reefs directly for food, livelihoods, and environmental security. Of the 30 million small-scale fishers in the developing world, most are dependent either directly or indirectly on coral reefs, and more than 400 million poor people in tropical coastal areas depend on fish (mainly marine) for at least half of their consumption of protein and essential nutrients. Coral reefs also help protect coastlines from erosion and can mitigate the impact of tropical storms. Thus, in terms of economic development, health and livelihoods, and biodiversity conservation, coral reefs are closely linked to the Bank's poverty and environment agenda.

The Coral Reef Targeted Research Project (CRTR) responds to the GEF's strategic priority for the International Waters (IW) Focal Area identified in the GEF FY03–06 Business Plan to: "Expand global coverage to other water bodies of cross-cutting foundational capacity building and innovative demonstration projects." Improving governance of transboundary aquatic resources is a hallmark of GEF's IW Focal Area and supports its growing emphasis on building integrated management approaches for large marine ecosystems (LMEs) that may span national boundaries. Coral reef ecosystems are inherently open and transboundary by virtue of the flow of nutrients, pollutants, and marine organisms across ecosystem boundaries and national frontiers. Pollutants entering the system are primarily land-based, emphasizing connections between drainage basins and shallow, coastal receiving waters, where most coral reefs are found.

Through a series of highly integrated investigations in four coral reef regions of the world, the CRTR Project was designed to fill the most significant gaps in our global understanding of the relationship between major stressors and the structure and function of coral reefs. The Project

¹ Conservation International. 2008. *Economic Values of Coral Reefs, Mangroves, and Seagrasses: A Global Compilation*. Center for Applied Biodiversity Science, Conservation International, Arlington, Va.

would explore the role of ecosystem processes such as connectivity, community dynamics and structure in responses to stress, e.g., in the form of differential bleaching, disease incidence and recovery to determine what factors may confer resilience and sustainability in response to major forms of stress. By bridging knowledge gaps related to impacts of climate change and localized human stress (much of it land-based) on the sustainability of transboundary aquatic ecosystems, the project fits within the Integrated Land and Water Operational Program (OP 9). Furthermore, the project addresses strategic priorities in other GEF Focal Areas—Biodiversity, Climate Change and Land Degradation—through its research on habitat and larval connectivity, marine biodiversity in protected areas, eutrophication and disease, and coral bleaching.

1.2 Original Global Environment Objectives (GEO) and Key Indicators

The project's *Global Environment Objective* (GEO) is to fill critical gaps in our global understanding of what determines coral reef ecosystem vulnerability and resilience to a range of key stressors—from localized human stress to climate change—and to inform policies and management interventions on behalf of coral reefs and the communities that depend on them.

As a stand-alone GEF project a separate *Project Development Objective* (PDO) is not required. However, a PDO closely aligned with the GEO was included in the project appraisal document (PAD). That PDO was “to align, for the first time, the expertise and resources of the global coral reef community around key research questions related to the resilience and vulnerability of coral reef ecosystems, to integrate the results, and to disseminate them in formats readily accessible to managers and decision-makers. A related objective is to build much-needed capacity for science-based management of coral reefs in developing countries, where the majority of reefs are found.” In the ICR these objectives and their related indicators are treated as elements of the GEO and intermediate objectives.

The nine original key performance indicators (KPIs) are listed in the table in Section 1.3.

1.3 Revised GEO (as approved by original approving authority) and Key Indicators, and reasons/justification

The GEO was not revised.

The key performance indicators were consolidated and reconfigured in a second-order restructuring of the project in July 2009 to make them more relevant and verifiable. The need for revised indicators was discussed in 2007 and the revision followed the recommendation in the independent mid-term review (MTR) completed in August 2008.

Though linked to quantifiable outputs (such as published research papers, coordination meetings, toolkits), most of the indicators also had a fundamentally qualitative aspect in that they had to produce the right outputs, facilitate the intended collaboration, and put appropriate information in the right hands. Revising the indicators did not require establishing new baselines or changing M&E arrangements, and in fact the project informally adopted and began tracking them more than a year before their formal approval. The table below compares the original and revised KPIs.

Table 1. Key Performance Indicators (KPIs)

<i>Original</i>	<i>Revised</i>
1. Formerly fragmented coral reef research efforts are coordinated and targeted for the first time around key science and technology gaps	1. International teams of coral reef scientists collaborating with local researchers at Center of Excellence to investigate and report on key ecological questions underpinning effective management
2. Research findings are mainstreamed into World Bank country dialogue and assistance strategies for countries with coral reefs	2. Results from targeted research are synthesized, interpreted and communicated to key audiences or stakeholders in appropriate formats. Uptake of information changes level of debate or business practices.
3. Coral reef management projects under early implementation or in preparation – many with GEF support – incorporate research findings and links to targeted research in project design	
4. The GEF uses results to guide future resource allocations to address cross cutting issues in Climate Change, International Waters and Biodiversity in the context of transboundary water resources management, and to guide clients in the design of large-scale targeted research.	
5. Policies in participating countries to protect coral reefs or mitigate impacts from key stressors are strengthened as a result of new information. At least one example of policy adoption or reform in favor of coral reefs documented by end of project.	3. Sectoral policies, business and management practices are aligned with CRTR research findings regarding coral reef sustainability at local, government level, and at the national level in at least one country.
6. Major partners from different sectors are aligned with this initiative, building momentum toward a critical mass of resources and a sustained effort	See RPI 1
7. Research results are peer reviewed by members of the scientific and management community and include knowledge products [from all 6 WGs] and decision support systems relevant to managers and policymakers	4. Results of research are peer reviewed annually for quality control and product delivery against agreed benchmarks; synthesized; interpreted and disseminated to different audiences.
8. Institutional and human capacity for science-based management of coral reef ecosystems is built in participating countries where coral reefs are found. – Centers of Excellence (COEs) fully engaged in hosting research and training by end of project.	See RPI 1
9. Results are linked to management such that coral reef managers are empowered with knowledge and tools to make better decisions	5. Coral reef management community is empowered with new tools and techniques to assess reef health and take appropriate action
	6. Local decision-makers understand the importance of coral reefs to their stakeholders and begin to incorporate reef friendly practices in their business models
	7. Heightened level of debate on urgent policy actions to enhance resilience of coral reef ecosystems to impacts from climate change.

The restructuring linked the first three revised indicators (1–3) to the GEO and the others (4–7) to the PDO. In the ICR Data Sheet these “PDO indicators” are entered as intermediate indicators since the project did not formally require a PDO. The revised KPIs also replaced the unwieldy list of 22 intermediate output indicators from the PAD, which were no longer monitored as part of the formal results framework. Most of these involved routine implementation activities and outputs, while the substantive aspects were already largely reflected in the KPIs.

1.4 Main Beneficiaries

Direct beneficiaries of this project include coral reef scientists and researchers, managers of coral reefs and decision makers at local, national and regional levels in developing countries. They will benefit from a greater understanding of the threats facing coral reefs and enhanced capacity, knowledge, and tools to address these. The people dependent on the coral reefs, including impoverished coastal communities, are indirect beneficiaries. The general public in developing countries with significant coral reefs is expected to benefit through a greater understanding of the value and importance of these natural assets and the growing threats they face from human actions—both local and global.

It is important to note that while the beneficiaries are defined in terms of the measureable, short-term outcomes of the project, this is a case in which the fundamental rationale and value of the project cannot be viewed in isolation from its long-run, indirect objectives and beneficiaries—contributing to worldwide preservation of coral reefs and globally significant biodiversity, and the welfare of all people and economies affected by the health of coral reef ecosystems.

1.5 Original Components

The project was conceived as the first phase of a long-term effort to fill gaps in knowledge about the response of coral reefs to various natural and human-induced stresses and to better link scientific research to management and policy in order to improve coral reef conservation and sustainability.

The project focuses on activities and research in *six thematic areas* and *four major coral reef regions*. The themes were identified through extensive consultation with the scientific and management communities during preparation. Each thematic area is led by an interdisciplinary working group (WG) and each region is linked with a university that is an emerging “Center of Excellence” (COE) in coral reef research. The COEs serve as host for some of the WGs, and the focus of a particular WG may be stronger in some regions and COEs than others. However, the WGs are independent of the COEs, they include scientists from various research institutions in both developed and developing countries, and they carry out activities and targeted research in all four regions.

The project components are:

- **Component 1—Addressing Knowledge and Technology Gaps** (US\$11.2 million), includes direct field and laboratory research in five thematic areas: (a) Bleaching and Local Ecological Response; (b) Disease; (c) Connectivity; (d) Restoration and Remediation; and (e)

Remote Sensing. The WGs would set up experiments using standard operating procedures. The project's sixth thematic area is the focus of Component 3.

- **Component 2—Promoting Scientific Learning and Capacity Building** (US\$4.2 million), addresses development and strengthening of the COEs, especially in developing countries, where most coral reefs are located, and enable targeted research by the WGs. The four regions and their associated COEs are (a) Western Caribbean/Mesoamerica—Puerto Morelos Laboratory of the Universidad Nacional Autonoma de Mexico; (b) Eastern Africa—Institute of Marine Science, University of Dar es Salaam, Zanzibar, Tanzania; (c) Southeast Asia—Marine Science Institute in Bolinao, University of the Philippines; and (d) South Pacific/Australasia—Heron Island Marine Research Laboratory, University of Queensland (UQ), Great Barrier Reef, Australia. Significant capacity would be built through north-south cooperation and apprenticeship-type management. Senior scientists from leading universities would promote technical skills such as experimental design, taxonomic classification, communication, and scientific writing.
- **Component 3—Linking Scientific Knowledge to Management and Policy** (US\$4.0 million), focuses on guiding and integrating the work of the WGs and COEs as well as linking research to management. The *Modeling and Decision Support* WG would create models to simulate the response of coral reefs to pressures from natural sources, human activities, and climate change to help decisionmakers. The outputs of these models, including social and economic implications, would help decisionmakers define policies and management actions. A Synthesis Panel (SP) reviews research and budget proposals, integrates results across WGs and COEs, makes policy recommendations, and provides guidance on program direction and resource allocation to the Executive Committee. In addition to publishing findings in the peer-reviewed scientific literature, the SP develops management and policy briefs in a form easily internalized by different audiences.
- **Component 4—Project Administration** (US\$2.9 million), supports project implementation and management. A Project Executing Agency (PEA) would be set up in the Center for Marine Studies, UQ.

1.6 Revised Components

The components were not revised.

1.7 Other significant changes

The participation of the Intergovernmental Oceanographic Commission (IOC) of UNESCO, originally assigned responsibility for communications aspects, did not materialize. This caused changes in communication funding and in the development of outreach networks. The PEA explored and implemented other sources of funding for the project's research outputs, and in order to maintain a consistent communication effort, the University funded the project's communication effort through its own contributions, and networks were established via the PEA management team, the Centers of Excellence and the researchers.

Another significant change was the addition of a \$200,000 Local Government Initiative (LGI) specifically aimed at strengthening engagement with local government, civil society, and private sector stakeholders, and linking project research to key local issues. The LGI is described in more detail in Section 2.2.

2. Key Factors Affecting Implementation and Outcomes

2.1 Project Preparation, Design and Quality at Entry

The project had a very long gestation period (six years), lasting from 1998 to 2004, which provided a host of opportunities for in-depth consultation with the scientific and natural resource management communities, and allowed both scientists and managers to select areas of priority for the project. The lengthy and detailed preparation period enhanced project design in numerous ways, listed below. While this section is subdivided by (a) background analysis, (b) stakeholder involvement and commitment, (c) project design, and (d) risk assessment, the topics discussed in the first three subsections overlap considerably and in some cases could have been put under a different subheading.

Background Analysis

Rationale—Consultations among the scientific community after the 1998 El Niño-mass bleaching event, presented at the first Inter-Tropical Marine Ecosystems Management Symposium (ITMEMS) November 1998, resulted in the prioritization of research themes, the narrowing down of field sites.

Prioritization of research—A review of previous Bank / GEF coral reef conservation projects identified some weaknesses in their design, including lack of scientific foundation, which called for in-depth understanding of biological and physical processes of coral reef ecosystems.

Project site selection—During preparation, CRTR sites were selected after extensive consultation and on the basis of specific criteria: the existence of Bank and GEF investments in coral reef management; existing baseline data; available infrastructure; and sufficient coral reef scientists engaged in research to support the establishment of a COE.

Government and Stakeholder Involvement and Commitment

Government role—The governments of Mexico, the Philippines, and Tanzania endorsed the feasibility and priority of the project and formally requested that the GEF funds be made available to the University of Queensland to carry out the project. However, in practical terms the most important involvement and commitment to the project was on the part of the scientific community, which was very closely involved and consulted in project preparation, as reflected in the examples below.

Translating research into management—During preparation, the project held workshops and side events at international conferences to bring together managers and researchers to define scientific priorities, and allow the integration of science into management.

Working Group member selection—The selection of individuals and team leaders was done through extensive consultation within the scientific community. The Working Group Chairs, selected to lead the effort in the key thematic areas, were highly respected scientists with international reputations.

Assessment of Project Design

Selecting the World Bank as GEF Implementing Agency—The rationale for selecting the Bank as the GEF Implementing Agency was the Bank’s ongoing policy dialogue with countries, and its ability to influence policy.

Strong project executing agency—A major study to identify the most appropriate institutional arrangements and flow of funds for the project was carried out, and led to the establishment of the PEA within the UQ, Australia as recipient of the Grant funds on behalf of project beneficiaries.

Project / program timeframe—The timeframe of the project (5 years within a 15-year program) was realistic; it took into account the fact that coral reefs, like other marine ecosystems, are influenced by long term processes, which require long-term studies and management trials.

Logical framework—Factors that may have negatively affected implementation included the fact that the objectives and “related objectives” of the project were stated slightly differently numerous times. They included: fill critical gaps in understanding; inform policies; align expertise and resources; integrate results; disseminate results; build capacity; transform research institutions; all contributing to improved prospects for sustainability.

Components—Similarly, the components were well defined, however, their presentation could have been improved; in the description of Component I, the words “scientific research” could have been featured more prominently, rather than somewhat obscure phrases such as “understanding some of the basic forcing functions” affecting coral reefs. For Component II, the words “build capacity” could have been featured more prominently.

Risk Assessment

The assessment of risks was suitable, but did not include an overall risk rating. The only risk rated as substantial was that “the research findings do not lead to demonstrable improvements in management or policies affecting coral reefs.” However, this is misleading since the outcome of having demonstrable improvements in management or policies was a longer-term objective related more to the 15-year, multiphase program than to the initial 5-year stage that the first CRTR project represented. The initial phase focused more on filling research gaps and building institutional capacity and networks of researchers than realizing concrete policy and management reforms. While some targets were included for connecting research to policy, they were limited in the original KPIs to only one case, and in the revised indicators to only one country.

QEA 2005

A Quality at Entry Assessment (QEA) by the Bank's Quality Assessment Group (QAG) in September 2005 gave the project an overall rating of Satisfactory. More specific discussion of the assessment is included in Section 5.1.

2.2 Implementation

Executing agency. One key factor that contributed to successful project implementation was having a strong implementing agency with adequate capacity. The Project Executing Agency (PEA) located at UQ benefited from solid management experience, strong accounting, fiduciary and internal controls systems, and a procurement system that met international (and Bank) standards.

Implementation arrangements and complexity. Although the institutional structure of the project was complex, it was workable; the size of the WGs was designed to enable maximum dialogue, and the function of the WGs, COEs and SP was well defined. The low incidence of WG member turn-over was an indicator of members' commitment and desire to continue their affiliation with the project.

Restructuring. The project went through a second order restructuring to reformulate the performance indicators to make them more operational. The reformulated indicators were not changed substantively but were consolidated from nine indicators to seven, and modified to facilitate measurement. The project objectives did not change. The project informally adopted and began tracking the revised indicators nearly two years before they were formally approved.

Collaboration, feedback, and adaptation. Implementation was aided by continuous discussion and exchange by members of WGs, the SP, the Bank and COEs, which allowed for ongoing evaluation of project implementation, replication and continuation of successful aspects, and dropping of less successful aspects. This collaboration and building of scientific communities and networks was not only a strength in implementation but perhaps more importantly it was one of the fundamental objectives of the project. The MTR, which included participation and assessment by an independent team of five consultants with experience in project execution, capacity building and scientific research, was also very valuable in this respect and helped identify the strengths and weakness in project design, overall project performance and monitoring and evaluation. The result was a reformulation of the indicators to improve tracking of outcomes.

Initiative to enhance linkages and results. The project also responded to a point raised by the 2005 QEA—that greater emphasis was needed on policy outcomes—by strengthening the component on linking scientific results to management actions and local policy decision-making. The team obtained additional Development Grant Facility (DGF) funding of US\$200,000 to develop a Local Government Initiative (LGI) in each COE. This fostered many low-cost activities with high potential impact, such as (a) extension work with mayors in several provinces in the Lingayan Gulf area of the northern Philippines and development and enforcement of standard guidelines for Marine Protected Area enforcement; (b) preparation of feasibility studies for different wastewater treatment options for domestic sewage in Zanzibar Town (to be financed, potentially, through a separate Bank loan); (c) work with traditional leaders and local government in the Solomon Islands and Cook Islands; and (d) engagement with

mayors, local politicians and hotel association members on the threats to coral reefs from groundwater contamination, disease and the environmental impacts of tourism in the Riviera Maya south of Cancun, Mexico.

Reporting, planning, and coordination. The candor and quality of project ISRs was good. The initial ISRs had some gaps, such as entry of indicators, but these were filled as implementation got underway. The ISRs consistently rated project implementation as Satisfactory. Semi-annual reporting on technical and financial progress, annual or more frequent meetings of the Scientific Synthesis Panel and the project's Executive Committee, and follow-up and execution by the Executive Secretary of decisions related to annual work programs and budgets of the Working Groups and COEs helped ensure successful implementation of an otherwise complex project.

2.3 Monitoring and Evaluation (M&E) Design, Implementation and Utilization

Design

The design of the Bank's results framework had some good indicators, however they were too numerous, sometimes not quantified, and not clearly defined regarding their hierarchy: GEF level, project level, or component level; output, outcome, or intermediate; and in some cases were poorly linked to project components. A simplification, or a simplified presentation of objectives and indicators, would have been preferable.

The 2005 QEA found that arrangements for evaluating impact and measuring outcomes were inadequate because the indicators were mostly tracking outputs such as scientific papers and workshops rather than outcomes such as researchers' increasing their work in the priority areas and managers' adoption of the improved management tools. Quantification of the expected outcomes was also found to be incomplete. This led to improvements early in project implementation to the M&E framework.

Implementation

Tracking of project indicators was required as part of the annual work plans for both the WGs and COEs, but the initial focus was on outputs. This changed once project components began to run efficiently, and more attention could be paid to KPIs. The structure of the project and its implementation arrangements, and particularly the role of the Synthesis Panel in providing effective leadership, was based on regular review of research plans, progress, and outcomes to guide ongoing research and collaboration as described in the summary of Component 3 (see Section 1.5). During implementation, the PEA selected a subset of key indicators to track and reported on these in its semi-annual reports. Throughout the project there was very good information on how resources were being used, what outputs were being produced, and how they were contributing to project objectives.

Utilization

As mentioned above, ongoing review and assessment of project activities, outputs, and their link to objectives was an integral part of the project concept itself. The coordinating role of the WGs and the SP, proved very effective in reviewing the value and relevance of the activities being

conducting and translating this assessment into guidance for the project's evolving research and information dissemination program. The development of the LGI initiative described in Section 2.2 is another example of how the project used ongoing assessment of its activities and objectives to identify possible gaps and opportunities to strengthen outcomes. The revision of the indicators themselves reflected the use of M&E to improve the definition and measurement of outcomes.

2.4 Safeguard and Fiduciary Compliance

The project did not trigger any environmental safeguards as it included only research, capacity building, and technical assistance. It aimed to build capacity for science-based management of coral reefs and create the framework to allow scientists and managers to interact and share knowledge. Any indirect impacts from the additional capacity were expected to be positive, as they would improve coral reef management. Likewise, field experimentation supported by the project, carried out under established scientific standards and review, was not expected to have detrimental environmental impact.

Arrangements for project governance were satisfactory. Corruption was not a significant concern and did not receive attention in project design. However, the executing agency arrangements through the UQ led to regular and rigorous follow-up on the use of funds. Regarding fiduciary aspects, financial management and procurement was carried out satisfactorily, largely owing to project administration being done by a high-capacity university (UQ). Financial management (FM) supervision reports from March 2010 indicated that there were no issues as the CRTR Phase I account was closed, and specialists reviewing the account called the FM aspects of the project exemplary.

2.5 Post-completion Operation/Next Phase

The project was designed as part of what would ideally be a 15-year program, implemented in three phases. Although commitments for funding were only assured for the first phase, there was acknowledgement on the part of funding partners that investing in targeted research with the aim of building capacity for science-based management of coral reefs and catalyzing more informed policies and actions based on a robust understanding of how climate change and local stressors affect the ability of reefs to persist and provide essential services to communities, was a long-term proposition. The objective of phase 1 was to create the infrastructure, demand, and capacity for research in support of better coral reef management.

Phase 1 of the project successfully contributed to:

- building capacity in developing country research institutions;
- robust research about ecological processes and how these were affected by climate impacts and local human drivers;
- the publication of high-quality applied research papers;
- the production and dissemination of high-quality tools, manuals and guidelines for managers and decision-makers based on research outputs;
- work by social scientists with local communities to increase indigenous knowledge with respect to reef resource use; and
- work with local mayors to understand the factors that influence their decision-making.

Another legacy of Phase I has been increased knowledge about the gap between science and management, and how to address it.

A second phase of the program is planned, and would build on the knowledge and tools gained in Phase I. It would focus more on the economic valuation of coral reefs, including the value of coral reef ecosystem services and the cost of their degradation to society. The second phase would also emphasize greater integration of science and management. In Phase II, GEF funds would represent a smaller percentage of the overall project cost, as different sources of funding would progressively be added to the program. A formal funding request to the GEF is planned.

Phase II would be designed as a regional project, more closely linked to Bank investment projects in the East Asia/Pacific Region focused on coastal resources management. For example, the CRTR would channel information to the Coral Triangle Initiative (CTI)—a multi-donor regional program being undertaken with GEF support and to the Bank financed Coral Reef Rehabilitation and Management Project (COREMAP) III which would be part of the CTI; the Pilot Program on Climate Resilience in Pacific SIDS (e.g., Samoa); and to the Central Philippines Rural Development Project. It is anticipated that partnerships with research institutions, governments and private foundations will expand and financing from these sources will become a major source of funding in Phase II.

The institutional arrangements under Phase II would be modified somewhat to accommodate the more action-oriented research themes and adaptive management approach. Task teams of 10–20 members would focus on research questions. The Synthesis Panel would continue to serve as a steering committee to review, direct and approve the themes and study areas. Outreach, connections with local governance and communication would still largely take place through the COEs, although new COEs could be added to the program, depending on financing.

3. Assessment of Outcomes

3.1 Relevance of Objectives, Design and Implementation

Global—At closing, the project's objectives, which were to fill knowledge gaps and to inform policy and management for coral reefs and communities that depend on them, are still highly relevant. Pressure on coral reefs, both from human sources and from climate change, has continued to increase since the project was launched. Research carried out by the project indicates that coral reefs, as we have known them, will not likely survive the rapid increases in global temperatures and atmospheric CO₂ that are forecast this century, and coral reefs around the world are still in such serious decline that they put at risk the environmental and economic stability of many coastal nations. The livelihoods and welfare of 100 million people living along the coasts of tropical developing countries will be among the first casualties of the loss of coral reef systems. Of the 109 countries with significant coral reef communities, at least 93 are experiencing damage. Many designated coral reefs have reached such a state of decline that they can no longer be considered as coral reefs. Coral reef research targeted at management actions and policy change is therefore still highly relevant.

Tanzania—The original objectives are still relevant to Tanzania’s 2007-10 National Strategy for Growth and Reduction of Poverty. This strategy recognizes that artisanal reef fisheries are faced with illegal and unregulated practices (dynamite fishing), and that a common governance regime for fisheries between mainland Tanzania and Zanzibar is required. The strategy also targets improving revenue from tourism, which is partly dependent on coral reefs, and underscores sustainable economic growth. It emphasizes the use of environmental impact assessments and improved natural resource management to sustain growth sectors such as tourism or fisheries. The project’s knowledge-based management objective is therefore still highly relevant for this country.

Philippines—In the Philippines, the 2010-12 Country Assistance Strategy (CAS) identifies the sustainable management of natural resources as a strategic objective (#4: Reduce Vulnerabilities). The strategy covers adaptation measures against climate change that may be expanded to other vulnerable sectors such as coastal areas, where an integrated coastal zone management approach could contribute to reducing vulnerability to natural disasters and other hazards while promoting sustainable livelihoods and poverty reduction. Thus, informed decisions on coral reef management from the project would support this strategy.

Western Caribbean—In the western Caribbean, Mexico’s 2008-2013 Country Partnership Strategy (CPS), Pillar IV (Environmental Sustainability) aims to promote sustainable natural resource management and ensure environmental sustainability. It aims to increase natural protected areas to around 3 million ha (not including forests) and to implement Integrated Water Resources Management Programs in 13 water basins. In Belize, the latest CAS (2001-2005) includes environmentally sustainable development as one of its four main pillars. In Honduras, a 2007 Country Environmental Analysis (CEA) recognizes that protecting, conserving, and making sustainable use of coral reefs, among other natural resources, will contribute to the long-term economic development of the country. This is supported by the CAS Strategic Objective 3: Strengthen Environmental Protection and Risk Management to improve the viability of protected areas. The CRTR project is in keeping with these strategies and policies.

Program (multi-phase)—Similarly, the programmatic design, based on a first phase to improve knowledge, a second phase to expand knowledge and translate it into management actions, and a third phase to consolidate results, reformulate hypotheses, expand the number of sites and research themes, and continue to develop and implement management tools, is still relevant. The program was designed in a way that allowed for flexibility in how research and management action were pursued, through the mechanism of the Synthesis Panel, in a way that ensured that relevant themes were permanently included in the project.

3.2 Achievement of Global Environmental Objectives

Progress toward the first part of the project’s Global Environmental Objective, to **Fill Critical Knowledge Gaps**, was very successfully achieved. Project members wrote or co-authored numerous research findings in over 600 peer-reviewed scientific journals, books, conference presentations, electronic products and other publications. The project disseminated knowledge in a large number of training workshops, information exchanges, conferences, media events and meetings. Knowledge products were widely available electronically on the project’s website.

Scientific advances were made in each of the six research themes (coordinated by their respective working groups). A few highlights include:

- *Bleaching and Ecological Response*: revealed the role of temperature in increasing the incidence and susceptibility of corals to disease.
- *Disease*: developed a database for a worldwide assessment of disease occurrences around the world and identified correlations between aquaculture and the incidence of disease on adjacent reefs.
- *Connectivity*: increased knowledge of coral genetics and coral larval biology and behavior, which is critical for understanding and incorporating factors of spatial scale and connectivity into sustainable reef management.
- *Restoration*: demonstrated various cost-effective methods of coral restoration.
- *Remote Sensing*: developed a new technique to identify areas less susceptible to coral bleaching.
- *Modeling and Decision Support*: developed user-friendly models founded on fundamental ecological and economic processes.

Progress toward the project's other main GEO, to **Inform Policies and Management Interventions**, was also successfully achieved. Research from the project has informed management actions and has led to valuable information to protect coral reef systems. A significant use of the scientific knowledge produced by the project is to inform improved management of MPAs:

- *Bleaching and Ecological Response WG*: established an important baseline for exploring the major responses of corals to environmental pressures arising from climate change;
- *Disease WG*: found that coral health was strongly correlated with fish diversity, providing additional support to the concept of MPAs as positive contributors to biodiversity.
- *Connectivity WG*: communicated science to management audiences resulting in connectivity issues more formally informing management decisions.
- *Restoration WG*: carried out coral recovery by culture and transplantation, and led research in coral larval recruitment.
- *Remote Sensing WG*: created software for monitoring the health of coral reefs; included informing Belize's legislation to ban herbivorous fish exploitation by providing a compelling report on the drastic decline of parrotfish and corresponding rise in macroalgae.
- *Modeling WG*: created models and tools to predict the impact of coastal developments and climate change on coral reefs.
- The adoption of MPA Enforcement Protocol Guidelines for law enforcement in the Philippines helped enforcers within LGUs discharge their duties and functions more effectively.
- The project's 2007 paper in *Science*, the journal of the American Association for the Advancement of Science (AAAS), was extremely influential in informing the international debate on ecological tipping points and safe targets for CO₂ concentrations surrounding negotiations for a United Nations Framework Convention on Climate Change (UNFCCC) post-Kyoto Protocol in Copenhagen and beyond. The paper has been cited in the scientific literature over 400 times, making it one of the most cited in the area

of climate change and ocean acidification over the last three years. It was also cited the Bank's *World Development Report 2010: Development and Climate Change* and in UN reports as well as in calls for setting 350 ppm as the target for a safe limit to atmospheric CO₂ concentrations.

Although the project did not require a PDO, it is worth discussing the achievement of the project's stated PDO as well, since it was fundamentally interconnected with the GEO and includes some specific objectives that are valuable in assessing the project's outcomes:

Considerable progress was made toward the PDO: to **align expertise and resources** of the global coral reef community around key research questions, to **integrate** the results, and to **disseminate** them in formats readily accessible to managers and decision-makers. For example, the port development and gas pipeline industry adopted the project's Coral Reef Restoration Guidelines as best practice to mitigate loss of corals and marine biodiversity. A \$25 billion liquefied natural gas pipeline along the coast of Yemen, and a port development project in Jordan both adopted these guidelines.

In fulfilling its aim of **aligning the coral reef community around key research questions**, the project:

- supported remote sensing applications to anticipate bleaching events and provide early warning to reef managers (with the Coral Reef Watch Program of the U.S. National Oceanic and Atmospheric Administration);
- Supported joint research between the Australasian COE and the Australian Research Council;
- worked with Filipino mayors to identify cost-effective business practices to relieve pressure on reefs and adopt protocols for enforcement of MPAs ; and
- in Mexico, the project informed public debate on limiting tourism growth around coral reefs

Substantial progress was also made toward the project's related objective, to **build capacity for science-based management**:

- at the Puerto Morelos, Mexico COE, annual courses, capacity development workshops, graduate courses and training workshops for local managers were developed; the COE also developed high-quality facilities, access to scientific journals, high-speed wireless Internet service and procured microscopes, laboratory equipment and data systems.
- The East African COE increased capacity in the region through supporting postgraduate students, raising awareness, and hosting workshops.
- The Southeast Asian COE built its own capacity; trained operators, caretakers and Local Government Units (LGUs) on sustainable mariculture practices; and supported training sessions of the League of Municipalities of the Philippines (LMP) on coral restoration.
- The Australasian COE, already of high capacity, ran a 12-day interactive course for small island states on Planning for Ecosystem-Based Management (EBM); completed a Local Government Initiative project in the Solomon Islands on coastal zone management; conducted a Pacific Leadership Forum for Pacific countries to address EBM for coastal areas.

Additional information is presented in Annex 2.

3.3 Efficiency

An economic rate of return and net present value were not computed for this capacity building and knowledge creation project. The economic analysis in the PAD was largely a qualitative discussion and analysis of the benefits anticipated by the project's financing of the incremental costs needed to strengthen, better coordinate, and leverage existing research programs and institutions so that their investments and activities are enhanced and are better targeted toward facilitating tangible policy and management outcomes.

In this regard the limited resources the project made available were used effectively and actually helped attract or coalesce even greater grant resources as well as contributions of in-kind services or shared operating expenses around the research topics and programs supported by the project. The project's ability to attract researchers, collaborators, and tangible and intangible resources reflects not only the addition of more inputs, but as mentioned previously, its success in achieving a key project outcome and increasing the likely sustainability of the outcomes.

At appraisal the project anticipated cofinancing of \$3 million from the DGF and about \$8.3 million from various other sources to complement GEF financing of \$11 million. At closing the project had leveraged donor funding, research grants, and additional contributions of resources and incremental operating costs of \$32.1 million (including all non-GEF financing).

3.4 Justification of Overall Outcome Rating

Rating: Satisfactory

The project was found to be **RELEVANT** to both continuous pressures on coral reefs and to national priorities identified by countries in which the project operates; all countries recognized sustainable development of natural resources as a priority.

The project made significant progress towards **MEETING ITS OBJECTIVES** (both those stated in the GEO and the PDO). For the *GEO*, in terms of **filling critical knowledge gaps**, the project met and exceeded its target and produced a wide array of knowledge products, publications, conference proceedings, guidebooks and scientific peer-reviewed articles. In terms of **informing policy and management**, the project made substantial progress in steering and informing policy makers and coral reef managers in protecting critical species, in climate change, and in the value of managing MPAs (See Annex 2 for detailed examples.) For the *PDO*, in terms of **aligning expertise and resources, integrating results and disseminating them**, the project was successful in creating scientific partnerships, in promoting practices that protect and restore coral reefs, and on public involvement in reef protection. The project's objective of **building capacity for science-based management** was also met through the sustained efforts at funding postgraduate students, at providing training and through running workshops and seminars.

Regarding **EFFICIENCY**, the project was able to stimulate substantial interest from the academic community, which provided support in the form of staff time, funds and facilities to the project.

The project leveraged nearly three dollars of financing from other sources for every dollar of the GEF grant.

3.5 Overarching Themes, Other Outcomes and Impacts

(a) Poverty Impacts, Gender Aspects, and Social Development

The first phase of the project (2005-2010) has increased knowledge and informed policies for coral reefs, and will lead to improved management of these resources for the communities that depend on them, the latter often representing the poorer strata of society. So far, the project has primarily set the scientific foundation for the next phases and started to inform policies that will have an impact on poverty.

The project is therefore in keeping with the Millennium Development Goals (MDGs) that the Bank is working to achieve, the seventh being “*Implement national strategies for sustainable development by 2005 so as to reverse the loss of environmental resources by 2015.*” Supporting coral reefs as a resource has already contributed to this goal (for example in the port development and gas pipeline industry adopting reef-friendly guidelines, and other policy changes mentioned in the text above), and would further support this goal in subsequent phases.

The project also supports the Bank’s Social Policy Program, which focuses on making Bank policies and programs equitable and sustainable. Actions under the Social Policy include creating human, physical, natural, and financial assets that poor people own or can use. Programs to build the assets of poor people include community-based schemes to protect aquatic resources and other elements of the natural environment.

Additionally, the project, largely centered on technical assistance and capacity building, is in accordance with the draft World Bank Education Strategy 2020, which connects education not only to a country’s economic prosperity, but also to healthier and happier lives and more effective environmental stewardship. The project’s accomplishments in strengthening scientific education and institutions, supporting academics and researchers, and linking knowledge to issues and policymakers, has helped put key information in the hands of those who can help translate it into tangible conservation, policy, and resource management strategies.

(b) Institutional Change/Strengthening

The project was successful in reinforcing the capacity of the COEs and developing their role as regional hubs for scientists and researchers on coral reefs, which was one of the central goals of the projects. This is key to helping strengthen the importance and participation of developing countries in research on critical ecosystems mainly located in their territory and of critical importance to their well-being. To varying degrees, the COEs emerged as more engaged and respected institutions, which were more capable of attracting and hosting local, regional, and international researchers, providing better support to their own students and scientists, and building linkages with stakeholders, from direct users of coral reef resources at the community level to policymakers at the local, national, and even international level. While not strictly institutions, the COEs helped build active networks of coral reef scientists, engaged in debate on research priorities, hosted key research that shed light on conflicting hypotheses regarding the

potential for corals to adapt to rapidly changing climate, partnered in the institutional strengthening and skills development of their faculty and graduate students, and actively sought out new opportunities for south-south collaboration. . For more details, particularly on the COEs, see Section 3.2 and Annex 2.

(c) Other Unintended Outcomes and Impacts *(positive or negative, if any)*

One unintended outcome was the design by a major NGO of a similar coral reef science for management project based on many of the elements of the CRTR Program. The NGO was successful in getting major funding for the project from a donor who had previously been approached by the Bank, but who did not have a history of cofinancing Bank projects. Thus, although the CRTR project did not benefit directly from this outcome, many of its intended beneficiaries did, in Belize, the South Pacific and other locations.

Another positive, unplanned outcome was the establishment of the Future Leaders Network, comprising about 60 up-and-coming (mostly developing country) researchers supported under the project at the post-graduate level, forming a knowledge network to inform and improve the impact of their research on coral reef issues. Through this knowledge network, which has already resulted in the production of an anthology of research papers—some already published—the next generation of developing country leaders in the field of coral reef management is being groomed.

3.6 Summary of Findings of Beneficiary Survey and/or Stakeholder Workshops

No specific beneficiary assessment was conducted; however, the direct beneficiaries of the project (coral reef scientists and researchers, managers of coral reefs and decision makers), expressed their enthusiasm for the project. This is in spite of initial doubts expressed by some of the beneficiaries, who felt that the project was too “top-down,” with a donor-driven agenda that was not relevant to operators in the field. However, the self-assessing and adaptive design of the project helped change these views, and by the end of the project support by beneficiaries was unanimous and strong.

4. Assessment of Risk to Development Outcome

Rating: Moderate

Risk is discussed on three main levels: project risk, program risk, and environmental risk. The project was designed as the first step toward a longer-term objective, and if seen in isolation the risk that the steps achieved under the project itself will be lost is low to moderate. However, this cannot be seen in isolation of the risk to the higher level programmatic goals, which is significant due to the uncertainty of lining up the cofinancing needed to continue the next two phases over ten years. Environmental risk in this project is somewhat unique in that the risk provides the compelling and urgent rationale for the project, whose purpose is to mitigate those risks, but at the same time environmental risk poses threats to the project that are beyond its control (such as global warming).

The main risk to ultimate achievement of the project's development outcome (to inform policies and management interventions on behalf of coral reefs and the communities that depend on them) is that funding for the *next* phase of the project, which will focus more on policy outcomes, does not materialize. This risk is tied to leveraging WB or other donor funds in order for GEF to meet its cofinancing requirements. The GEF was designed as a cofinancing trust fund, and requires that at least one-half, and preferably three-fourths of the entire project financing be from GEF implementing agencies (multilateral banks or UN agencies), government, or other donors. This risk is significant. Capacity built, the scientific foundation established, and continued funding from existing sources (that have already contributed to the project) would however ensure some project continuity, but at a smaller scale.

An environmental risk to project outcomes exists in the rate at which coral reefs are being degraded by both local human pressure (e.g., over-fishing, destructive practices related to fishing and other exploitation of reef resources, run-away tourism development, pollution, watershed and coastal degradation) and impacts associated with climate change. If devastating events like the 1997-98 global bleaching episodes related to El Nino recur with increasing intensity and regularity, coral reefs will continue to decline in quality and distribution. Furthermore, as fishers feel the effects of declining reef resources, they are likely to intensify their efforts, including engaging in highly destructive (dynamite) fishing for short-term benefit. In light of increasing global warming (the first four months of 2010 were the hottest on record), and ocean acidification, this risk is significant. However, this only emphasizes the relevance of the project and the urgency of moving ahead with the next planned phases.

A continuing risk to achieving project outcomes is that if research leads to policies, these are not necessarily enforced and do not necessarily translate into action. Project outcomes only go so far as "informing policies and management interventions" but project impacts would be reduced if governments and regional authorities have no enforcement mechanism. This risk is moderate, in part because coral reef managers are included in the project.

5. Assessment of Bank and Borrower Performance

5.1 Bank

(a) Bank Performance in Ensuring Quality at Entry

Rating: Satisfactory

Quality at Entry is rated Satisfactory, as, in spite of a lengthy preparation period, the Bank took into account an exhaustive number of criteria, including the opinion of leading scientists in the field, gaps in knowledge that the project would address, workable and efficient implementing arrangements, site selection and project member selection. The Bank chose an Australian university with high implementing capacity as the Project Executing Agency, which has been found in regional and global projects to correlate positively with achievement of outcomes. This arrangement allowed the Bank to limit its need to manage the details of project execution and focus instead on strategic issues.

Project objectives were adequately targeted at knowledge management and policy reforms, with the ultimate objective of improving environmental and social conditions in coral reefs worldwide. The project's policy reform especially would have lasting impacts on this environment.

While the project had satisfactory overall targets, the results framework was excessively complex, evidenced by the need to realign some indicators before midterm, and by the project's tracking of only a subset of all the given indicators on a periodic basis in the ISRs prior to restructuring.

A Quality at Entry Assessment (QEA) undertaken by the Bank's independent Quality Assurance Group (QAG) in 2005 rated the project satisfactory and recognized both its relevance and the value of the data it would generate in targeting effective management interventions. The assessment did recommend, however, that the project's focus on policy outcomes be strengthened, noted that the baseline of current scientific knowledge was weak (essential to measuring progress in the closing the gap in knowledge), and that there should be a better system for evaluating project impact and measuring outcomes. The assessment also flagged internal Bank procedures as potential obstacles to global projects because Bank processes are generally geared toward single-country projects, with measurable and tangible impacts over a five-year time horizon. The QEA also found the level of interest and ownership in the project by Bank management in operations to be weak.

(b) Quality of Supervision

Rating: Satisfactory

Quality of Bank Supervision is Satisfactory, as the Bank adequately monitored project outputs, provided support to key members of the project (PEA and SP), participated in key annual meetings, consistently promoted the program to potential partners both within and outside the Bank, and provided added support for strategic economic and sector work (ESW) linked to project outcomes. Supervision was characterized by continuity from the earliest design stage through to project completion and strong dedication of the Bank Task Team Leader (TL).

The Bank was realistic in assessing project performance; ISR ratings were realistic in recognizing that the linkage between scientific knowledge and management was only moderately satisfactory at times and needed greater attention. Resources and time committed to the project were sufficient, and the TL was actively engaged in identifying additional Bank resources (e.g., the DGF funds for the Local Government Initiative), links to Bank operations where CRTR outputs could enhance performance or improve the design of coastal projects, and working with the PEA to troubleshoot emerging issues and potential problems. Because the PEA had strong capacity, it did not require frequent or extensive assistance from the Bank team on routine implementation matters.

Internal to the Bank, however, the engagement of Country Management (operations) was limited, due to the global nature of the project, and its perceived focus on public goods. The executing arrangements which funneled resources directly to university research institutions rather than to government ministries may also have limited involvement by Country Teams in

participating regions. This reduced the effectiveness of Bank intervention in terms of integration with the broader country dialogue and influencing decision-makers. A recent review of regional and global Bank projects by the Independent Evaluation Group (IEG), found this tendency among country managers and economists to marginalize or ignore such knowledge projects, to be more or less consistent throughout the Bank's portfolio. In the case of CRTR there was the added factor that the project executing agency was not based in a developing country and therefore was not directly linked to a specific country management unit. Phase 2 is being designed to directly address these political economy issues by focusing on a single region (EAP) and including a strong component on economic valuation of coral reef ecosystem services fundamental to livelihood and food security, tourism revenues and adaptation to climate change.

(c) Justification of Rating for Overall Bank Performance

Rating: Satisfactory

Overall Bank performance is Satisfactory based on Satisfactory Bank performance in ensuring both quality at entry and quality of supervision results.

5.2 Borrower

(a) Government Performance

Rating: Not Applicable

Although technically the governments of Mexico, the Philippines, and Tanzania were the requesting governments for release of the GEF funds to the University of Queensland as the project executing agency, they did not actively participate in preparation or implementation of the project, nor did they hinder in any way the successful implementation of the project. The cooperation of these governments, as well as the Australian government, was necessary to the extent that the project's research activities were carried out in their national territory, by or under the auspices of academic and scientific institutions based there. But they did not have the usual government role that lends itself to performance assessment.

(b) Implementing Agency or Agencies Performance

Rating: Not Applicable

The implementing agency (University of Queensland) is also the grant recipient. Since there is no separate government performance rating, the performance of UQ is evaluated in Section 5.2(c), for overall borrower performance.

(c) Justification of Rating for Overall Borrower Performance

Rating: Highly Satisfactory

As both the grant recipient and project executing agency, the University of Queensland demonstrated a high level of competence and performance in administering sub-grants to the COEs and individual researchers, managing the various aspects of the project, and carrying out its fiduciary responsibilities and accountabilities. Planned and actual disbursements were virtually the same and the project closed with full grant disbursement well within the anticipated time horizon. Financial management performance was a significant strength of project implementation, and was described as exemplary by the Bank's FM unit in charge. The PEA carried out annual audits of the COEs, and significantly strengthened their capacity to maintain accounting and reporting consistent with international good practice. All independent audits carried out by the Government of Queensland on UQ's administration of the project were clean. No issues in terms of compliance with covenants arose during supervision. UQ was proactive at identifying and quick to resolve the relatively minor implementation issues that occurred, and selected and utilized M&E data in a timely way. It also fostered and maintained close coordination between the WGs and COEs and within the relevant scientific community more generally. Some outreach to other stakeholders (e.g. some local governments) was also initiated. UQ demonstrated a high level of scientific know-how and commitment to achieving the project's development objectives. The commitment of the University of Queensland to the project was further demonstrated by its contribution of co-financing to cover significant administrative costs.

6. Lessons Learned

The major lessons learned are the following:

Bank Systems

Internal to the Bank, the project supported more general findings that administrative, supervision and reporting systems in the Bank are not well designed for implementation of regional (and global) programs. Specifically, there was a lack of ownership at the level of Country Departments which hindered the integration of the project into country dialogues and hence in translating findings into management actions and policy at the national level. Bank systems and processes are geared to delivery and accountability at the country level, not at the global level, and global projects such as coral reef conservation and management (with low financial rates of return and no investments attached to them) are challenged by the lack of incentives for country team collaboration. Project preparation and reporting templates are inadequate to deal with the types of cross-cutting issues and concerns of global projects such as the CRTR. Similarly, financing options for global projects are limited: funding for project preparation is increasingly inadequate because of declining GEF resource availability.

Natural vs Socio-Economic Pressure

Many of the problems facing coral reefs are not natural phenomena but rather a product of socio-economic, political, and governance factors. With the exception of unsustainable fishing and direct physical damage from mechanical means related to dredging or vessel groundings, most prevalent impacts to coral reefs originate outside the system—as land based sources. These include pollution and major infrastructure development, including tourism. Coastal development planning is often decided by a combination of federal and state ministries. Thus, it is necessary to complement ecological research with social science to understand the real drivers of change in coral reef ecosystems, to form strategic alliances with local representatives of federal agencies as well as, increasingly, with provincial and state governments with jurisdiction over coastal

development, to liaise regularly with national and international NGOs, and to stay in continuous contact with local and national media to raise the visibility of issues affecting coral reef health.

Economic Benefits of Coral Reefs

Additional work to demonstrate the economic benefits of coral reefs and the services they provide is needed. Reefs perform a range of functions, including coastal defense. The damage caused in Mexico by Hurricane Wilma, a Category 5 storm in November 2005, was significantly dampened by the reef acting as a natural barrier. An economic valuation of the ecosystem services performed by the reef in this and other instances, particularly in light of predictions of more frequent, high intensity storms, would have considerable value. Demonstrating the role of reefs in contributing to food security and environmental security—in addition to livelihoods and GDP through tourism for example—would also promote local ownership of the reef on the part of local governments, as a symbol of a community's wealth. Such economic valuation, and the loss in services from degraded reefs, is planned under Phase 2.

Broadening Project Scope

Management of coral reef ecosystems needs to be integrated into coastal zone management or some form of marine spatial planning that includes zoning for different uses compatible with the maintenance of ecosystem processes. Unless these are understood along with the drivers that determine their state, it will be impossible for managers to sustain or enhance the productivity of coral reef goods and services, which are essential to coastal economies and livelihoods. The CRTR has contributed essential knowledge about coral reef ecosystem vulnerability to key drivers like climate change, ocean chemistry (acidification); overfishing of herbivores, habitat fragmentation and loss of connectivity (e.g., with essential habitats such as mangroves and with source reefs), poor water quality, and destructive fishing. This information can be built on in Phase 2 to help address priority management issues in key locations that will serve as regional pilots and demonstrations of science-based approaches.

Small-Scale Training

Locally targeted workshops involving the participation of national and international scientists was a cost-effective training approach; larger scientific workshops often produce solid products, but are more difficult and costly to organize. Involving local lecturers, endorsed by the CRTR/SP, is an effective technique, as is the distribution of printed material, which is useful in disseminating learning to third parties. Overall, the demand for training is very high.

Translating research into policy through outreach and mentoring

Working with local governments has been an effective means of translating research and science into policy and management, to the extent that it occurred under the project.

The important role of mentoring—of developing country institutions, scientists and graduate students through partnerships and knowledge exchange in international scientific networks—is key to creating the necessary capacity to harness science and technology for sustainable development. This should be underscored in future capacity building projects.

Communication should be adequately resourced up front to market messages to intended audiences, promote uptake of transformative information and tools by practitioners and to raise

the general level of awareness of the public about the urgency of actions needed to prevent the wide-scale loss of coral reefs. The redesign of the project's website (www.gefcoral.org) amply demonstrated the importance of web-based communication in reaching out to key stakeholders.

7. Comments on Issues Raised by Borrower/Implementing Agencies/Partners

(a) Borrower/implementing agencies

The Bank concurs with the findings of the borrower's completion report summarized in Annex 7, and notes that there were no issues raised by borrower that departed significantly from the assessment of the Bank or that require a response by the Bank. The borrower's report as well as the inputs provided to the Bank's ICR team were timely, relevant, and of very high quality. Borrower comments on earlier versions of the ICR helped clarify some key issues, fill gaps, and generally improve the final report.

(b) Cofinanciers

No comments received (other than from University of Queensland, a co-financier as well as "the Borrower").

(c) Other partners and stakeholders

Various stakeholders, project participants, and members of the Synthesis Panel commented on earlier drafts of the ICR. These comments were more part of the deliberative process of refining and fine-tuning the report rather than comments on the final draft.

Most of these comments reflected agreement with the Bank's assessments, clarified specific points that have mostly been addressed in the final draft, or expressed more favorable views than the Bank on either overall outcomes or particular aspects of the project. Other comments pertained to the discussion over refinements in the design and strategy of future phases of the CRTR program. The Bank agreed with most of these comments, except the comment of one commentator who questioned the relevance of some components. This view was not shared by the Bank or by other stakeholders and partners except to the extent that the project had built into its design a mechanism (the Synthesis Panel) for reevaluating and sharpening the focus and relevance of its activities on an ongoing basis, as well as for learning lessons to apply in the transition to the design of subsequent phases of the program.

Annex 1. Project Costs and Financing

(a) Project Cost by Component (in US\$ million equivalent)

Components	Appraisal Estimate	Actual/Latest Estimate	Percentage of Appraisal
1. Addressing Knowledge and Technology Gaps	11.20	11.20	100
2. Promoting Scientific Learning and Capacity Building	4.20	5.48	130
3. Linking Scientific Knowledge to Management and Policy	4.00	2.92	73
4. Project Administration	2.90	2.90	100
Total Baseline Cost	22.30	22.50	101
Physical Contingencies	0.00		
Price Contingencies	0.00		
Total Project Costs	22.30	22.50	101
Front-end fee IBRD	0.00		
Total Financing Required	22.30	22.50	101

Note: Does not include the full cost of activities supported by resources from foreign universities, research centers, working group members, and centers of excellence in the form of additional research grants, personnel support, equipment and laboratory use, and other in-kind costs that were not included in the original project financing estimates (see table on following page).

(b) Financing (in US\$ million equivalent)

Source of Funds	Type of Cofinancing	Appraisal Estimate	Actual/Latest Estimate	Percentage of Appraisal
Global Environment Facility (GEF)		11.0	11.0	100
Recipient (University of Queensland)	Parallel	2.5	2.5	100
State of Queensland	Parallel	2.6	2.6	100
DGF - Associated IBRD Fund	Joint	3.0	3.2	107
Foreign Universities	Parallel	3.2	3.2	100
Total		22.3	22.5	101

Note: The “foreign universities” category was intended to include a broad range of research institutions, national agencies, and private foundations (but excluding researcher salaries and other in-kind contributions). Even without in-kind contributions, the grants, scholarships, and other direct cost support from these sources substantially exceeded the appraisal estimate. However because this category was not well-defined at appraisal, only \$3.2 million are attributed in Table (b) to avoid any possible misinterpretation of the data. A complete summary of these resources is presented in Table (c).

(c) Resources and Financing Leveraged by CRTR

<i>WG / COE</i>	<i>Amount (US\$ million)</i>		<i>Total</i>
	<i>Grants and direct costs (a)</i>	<i>In-kind contributions (b)</i>	
<i>Working Groups</i>	<i>11.86</i>	<i>8.36</i>	<i>20.21</i>
Bleaching	1.90	0.64	2.54
Connectivity	1.93	0.66	2.59
Disease	0.00	0.50	0.50
Modeling	0.15	1.36	1.51
Restoration	0.18	0.51	0.69
Remote sensing	7.70	4.69	12.39
	0		
<i>Centers of Excellence</i>	<i>0.78</i>	<i>2.85</i>	<i>3.63</i>
Caribbean / Mesoamerican	0.47	0.56	1.03
Eastern Africa	0.00	0.10	0.10
Southeast Asia	0.00	0.55	0.55
South Pacific / Australasian	0.31	1.64	1.95
Total	12.64	11.20	23.84

Note: Includes the \$3.2 million from the category of “foreign universities” from Table (b), as well as all other direct financing and in-kind support provided by a broad range of universities, research institutions, national science agencies, government programs, and private foundations. Resources obtained or contributed by the working groups and centers of excellence are included. Detailed records are included in the project files.

- a. Grants and direct costs—includes grants, scholarships, travel, workshop and meeting costs, and related expenses either linked to project activities or leveraged by the project on the condition of CRTR participating in or being a collaborative partner in execution of the grants.
- b. In-kind contributions—includes the costs of facilities, equipment, datasets, some administrative and operating costs of COEs and WGs (not covered by Component 4), normal fees and charges that were waived for CRTR researchers and activities, and a share of the salaries of project researchers paid by other parties.

Annex 2. Outputs by Component

Component I. Addressing Knowledge and Technology Gaps (US\$11.2 million)

This component, to systematically define knowledge gaps in coral reef ecosystems, was very successfully achieved. Project members produced, or were involved in the production of, numerous research findings in over 600 peer-reviewed scientific journals, books, conference presentations, electronic products and other publications. Knowledge was disseminated in a large number of training workshops, information exchanges, conferences, media events and meetings that have been participated in or organized by project members. Scientific advances were made in each of the six research themes:

- studies from the *Bleaching and Ecological Response WG* revealed that temperature plays a key role in increasing the incidence and susceptibility of corals to disease, and that during extreme temperature events, small colonies survive better than larger colonies, while during mild temperature events, colony size does not influence bleaching;
- the development of a marine laboratory (marine “Lab in a Box”) by the *Disease WG* greatly advanced coral disease research by creating an environment in which all parameters can be controlled and studied. This WG also carried out a global assessment and mapping of coral disease to give an indication of the comparative incidence of coral disease by region; perhaps most importantly research findings indicating lower disease incidence within MPAs compared to areas outside MPAs linked to the control of disease vectors through predation within marine protected areas provide an importance argument for the establishment and maintenance of MPAs.
- research under the *Connectivity WG* has led to an extension in knowledge of coral genetics, and advanced knowledge of coral larval biology and behavior that are important contributions in developing new models of coral dispersal, with positive consequences for management;
- research by the *Restoration WG* has demonstrated various cost-effective methods of coral restoration, pioneered in the Philippines. The research team explored methods including larvae rearing and coral fragment transplantation techniques with much promise and the potential for scaling up;
- a new technique developed by the *Remote Sensing WG* has led to the ability to identify areas of the coastal zone that have particularly benign physical conditions in terms of coral bleaching, with important implications for the creation and management of MPAs. The WG created the state-of-the-art Reef Observer software tool to identify whether changes in coral reefs can be detected using remote sensing; and extended the online Reef Remote Sensing Toolkit to help practitioners match their remote sensing objectives to the appropriate technologies. The upgraded Toolkit was released on the website in 2010;
- one of the major strengths of the *Modeling and Decision Support WG* lies in the research carried out by PhD and Masters students. Other advances were made in the development and calibration of user-friendly models that are being validated for each region, and in general (being built from fundamental ecological and economic processes).
- More generally, knowledge products were widely available electronically on the project’s website, disseminated at international conferences and workshops involving managers as well as scientists (the 11th International Coral Reef Symposium in which the project co-organized a week long Symposium on Coral Reef Management included inputs from the social and biophysical sciences).

Component II. Promoting Scientific Learning and Capacity Building (US\$5.5 million)

This component, aimed at transforming regional research institutions into Centers of Excellence, and to build capacity for science-based management of coral reefs in developing countries, largely achieved its objectives. Capacity was built and WG thematic studies were facilitated at the COEs:

- Capacity was built at the Puerto Morelos, Mexico COE, according to a plan that was successful in constructing a solid capacity building structure which included annual courses, capacity development workshops, graduate courses and training workshops for local managers. The COE developed high-quality facilities and students gained full access to all main scientific journals through the electronic subscription services provided. Open access high-speed wireless Internet service was made available for visitors, students and researchers. A large part of the COE's funding has been spent on procuring equipment, such as microscopes, laboratory equipment and data systems.
- The East African COE has supported postgraduate students in coral reef management, research and training, raised awareness with communities and with public sector entities, and has organized workshops on coral reef disease, remote sensing and restoration, all contributing to increased capacity in the region. Collaboration with experts in remote sensing, connectivity and restoration has increased the COE's own capacity, and COE staff are now being consulted regularly on coastal zone management, conservation policy and the creation of MPAs. A formal program of capacity building was initiated, covering topics such as coral disease, remote sensing, modeling techniques, coral settlement, recruitment and restoration, and mapping. Physical capacity developed at the COE includes acquisition of field and laboratory equipment, the refurbishment of the marine aquarium, and in upgrading internet connectivity and power supply (purchase of a standby generator). Increased capacity has contributed to the acquisition of new knowledge, greater exchange of information and improved linkages between the project and District Government officials, natural resource managers, regional organizations, individual researchers and local communities. However, while it achieved some capacity to support the project, capacity of the Zanzibar COE has not reached the capacity of the other institutions within the program. The recent installation of a new Director of IMS holds promise in this direction. The COE could adopt a number of measures to improve performance: Implement a more structured approach to WG / COE program planning; Clarify responsibilities for the task of "outreach" and publicizing CRTR activities; Clarify responsibilities between technical and administrative COE personnel; ensure that the National Advisory Group of experts meet regularly; and widen the scope of scientific journal availability at the COE.
- The Southeast Asian COE at Bolinao (Philippines) has made substantial progress over five years in building its capacity by managing local research projects, leading outreach activities, and carrying out scientific investigations. The COE first built its own capacity and then supported the WGs, other linked projects, students and a variety of other users in conducting research, building a knowledge base, and translating science into management. Building the COE's own capacity was successfully carried out and included making a marine microbiological laboratory fully operational, upgrading the reference museum for corals, and making the general field service capabilities of the COE user-friendly (for example the use of boats, dive gear and lockers). Communications facilities and laboratories were updated and made functional. Infrastructural achievements also include upgraded study and conference facilities, reference collections, overnight quarters of high standard and wireless internet connection. It contributed to the capacity of other

stakeholders, for example through the Local Government Initiative (LGI) that trained operators, caretakers and core Local Government Unit (LGU) personnel on sustainable mariculture practices and encouraged cooperation among the stakeholders with respect to sustainable mariculture management in their respective localities. Outreach activities were also important for the COE, which supported training sessions on community-based coral transplantation and distributed information packages at the general assembly of the League of Municipalities of the Philippines (LMP) as part of an Information, Education and Communication (IEC) initiative. The COE delivered a broad variety of both formal and informal capacity development, training and public awareness-raising activities. Coastal resource management projects funded by other donors have indirectly served as links between science and management.

- The Australasian COE has run a 12-day interactive course for small island states on Planning for Ecosystem-Based Management (EBM), and completed work on a Local Government Initiative project in the Solomon Islands that would result in improved coastal zone management; it conducted an intensive, interactive three-day Pacific Leadership Forum for heads of the environment and fisheries departments from Pacific countries to address EBM for coastal areas. The Forum was aimed at high level executives that are in a position to develop effective policy and implement change.

The project has published an anthology of research undertaken by project-supported students during Phase One: Building capacity in coral reef science: An anthology of CRTR scholars' research 2010 which showcases the state-of-the-art scientific research carried out under the project. In total, the project delivered over 230 events – training courses, workshops, media opportunities, meetings and conferences, covering technical and scientific aspects of coral reefs as well as management approaches such as ecosystem-based management. Finally, a major achievement of the WGs is the development of a Common Sampling Methodology, implemented by all four COEs, in permanent plots meant, to allow key biophysical processes to be effectively compared across space and over time. The Common Sampling Methodology is expected to continue well beyond the life of project.

Component III. Linking Scientific Knowledge to Management and Policy (US\$2.9 million)

The Synthesis Panel (SP), established to give direction to the program, oversaw research, integrated results across Working Groups and COEs, and made policy recommendations. The science carried out in Phase 1 has had considerable influence in linking science directly to management, and many of the results are now being taken up in the design of new investment projects. Policy reform in some cases (e.g., in fisheries regulations, strengthened enforcement proving relevant to localsome and policy. Examples include:

- **In Mexico**, engagement with municipal governments and the tourism industry on the damage to reefs from contaminated groundwater as a result of accelerated coastal development has informed public debate on the limits to tourism growth in the most tourism intensive area of Mexico, and temporarily canceled two-large scale development projects threatening the Puerto Morelos reefs. There is now interest by local government, the hotel owners and a prominent NGO along the Riviera Maya to establish a Payment for Ecosystem Services (PES) for wetlands, based in large part on the results of the CoE's research on groundwater contamination and its impacts on the reef, and ultimately, the tourist economy of the state.

- **In Zanzibar**, the COE has been involved in the dynamite fishing debate and using their expertise to suggest ways to engage with key actors to control this destructive practice as well as to help restore damaged reefs. One promising outcome with support from the Local Government Initiative has been the completion of a feasibility study on Alternatives for Sanitary Sewage Collection, Treatment and Disposal in Zanzibar Town. Nutrient enrichment and sedimentation of surrounding reefs from municipal sewage discharged directly into nearshore waters around Stone Town, jeopardized reef health as well as human health and the tourism amenity value of beaches and reefs. The study, commissioned by the Zanzibar Municipal Council in collaboration with IMS under the LGI, was carried out by a local engineering firm to identify the most cost-effective option to reduce this land-based threat to the marine environment. The results will be used to inform the design of Phase 2 of the Bank financed Zanzibar Municipal Services Project.
- **In the Philippines**, the project worked with mayors to identify cost-effective business practices to relieve pressure on reefs and adopt protocols for enforcement of MPAs, which were mainstreamed into the activities of LGUs (Local Government Units).
- **In the Solomon Islands**, the Australian COE worked with local communities to determine environmental stress, identify potential changes to the natural environment, and developed recommendations including the establishment of ‘no take’ zones for shellfish in the region. The project also promoted joint research between the Australasian COE and the Australian Research Council.

Additionally:

- The work undertaken by the *Bleaching and Ecological Response WG* has established an important baseline for exploring the major responses of corals to environmental pressures arising from climate change, for example background temperature, light conditions and water current. These results have been mapped and provide the basis for identifying least and/or most vulnerable reefs and predicting the spatial distribution of future coral reefs. The information would be instrumental in improving management strategies for coral reefs to adapt to changes in the environment and developing management priorities that are most appropriate for their future. The project also designed a standard monitoring protocol that examines coral reef processes over simply measuring the status of reefs; processes define future state understanding processes help the project and reef scientists and managers address coral reefs in multiple regions more effectively.
- The work undertaken by the *Disease WG* found that disease prevalence was lower within established MPAs than in the adjacent fished areas, and that coral health was strongly correlated with fish diversity, providing additional support to the concept of MPAs as positive contributors to biodiversity and as successful methods of preserving healthy coral reefs. It found that fish cage culture in the Philippines - a growing alternative to small scale capture fisheries - is associated with disease in corals on adjacent reefs. The WG also carried out studies to link water quality to disease, and developed a new modeling tool to predict the likelihood of the outbreak of disease (*white syndrome*) in the Great Barrier Reef based on temperature. The Disease WG also developed a marine “Lab in a Box” that enables cutting-edge advanced microscopy and microbiology in coral disease research in remote field settings. This capability could serve as a tool for remote island and reef managers, who often have limited resources at their disposal.

- The work undertaken by the *Connectivity WG* has resulted in connectivity issues more formally informing management decisions. The WG has made important advances in communicating the science to management audiences and produced a number of training workshops and written products for managers. This has led to the creation of long-term connections between scientists and managers. For example, the WG held a workshop titled “Connectivity in Coral Reef Systems – Lessons to Date and Goals for the Future” which brought together 10 members of the WG and six scientists with no prior contact with the project who are working on connectivity issues at Pacific locations.²
- The work undertaken by the *Restoration WG* is a management action in itself. The WG has focused on monitoring recovery processes, enhancing coral larval recruitment, and enhancing recovery by culture and transplantation. Research has produced valuable information on substrates to be used for outplanting, the value of natural versus artificial recruitment, the importance of water velocity, the survival of transplants on natural versus artificial coral, and obstacles to artificial rearing of corals (e.g. fish browsing). Work has included successful collaboration with local communities in the Philippines on transplanting corals, with potential for scaling up; in one exercise, local volunteers transplanted more than a thousand second generation transplants and locally available ‘corals of opportunity’ successfully, with a high degree of survival.
- The *Remote Sensing WG* achieved all its stated goals, including the creation of software for monitoring the health of coral reefs, methods to detect changes in coastal environments, application of remote sensing to the management of biodiversity, and the creation of an Ocean Atlas to manage coral bleaching. Direct policy and management implications from the WG’s research includes informing Belize’s legislation to ban herbivorous fish exploitation by providing a compelling report to Government on the drastic decline of parrotfish and corresponding rise in macroalgae. An important new technique for enhancing the resilience of Marine Protected Areas and the design of MPA Networks, involves remote sensing to categorize areas of coral reef that appear resistant to bleaching or recover more rapidly following an El Nino event, which typically includes a (sometimes prolonged) spike in Sea Surface Temperature. This can cause widespread bleaching and ultimately mortality. Knowing the relation of these “bleaching resistant” reefs to other reefs in the area through larval connectivity analysis—to identify source and sink reefs for coral and fish larval dispersal—allows for marine managers to optimize the design of marine reserves to incorporate resilience to climate change. The method has been showcased in the Bahamas and Belize, and will be used to help design an expanded system of MPAs in a new WB/GEF financed project in the Eastern Caribbean (OECS) soon to go the Board.
- The *Modeling WG* has created models and tools to predict the impact of coastal developments and climate change on coral reefs. Specifically, it developed new regional models for Mexico and the Philippines that allow realistic policy-relevant scenarios to be tested at the regional scale. The local models allow users to explore prognoses for their reefs based on current and expected future conditions.

² CRIOBE facility, Moorea, French Polynesia, 7-11 March, 2009

- The adoption of MPA Enforcement Protocol Guidelines as standard operating procedures for law enforcement activities in the Philippines helps enforcers within LGUs discharge their duties and functions more effectively

More broadly, the project has informed policy in the following ways:

- The promotion of the adoption by the port development and gas pipeline industry of its Coral Reef Restoration Guidelines (Edwards and Gomez, 2007) as best practice to mitigate loss of corals and marine biodiversity. A \$25 billion World Bank-financed Liquefied Natural Gas pipeline along the coast of Yemen, and a port development project in Jordan both adopted these guidelines.
- Collaboration with the Coral Reef Watch Program of the U.S. National Oceanic and Atmospheric Administration (NOAA) - which supports remote sensing applications to anticipate bleaching events and provide early warning to reef managers - and monitoring tools to assess changes in and recovery of coral reefs community structure from disturbance events.
- The publication of a very influential article in *Science*, the journal of the American Association for the Advancement of Science (AAAS), that has informed the international debate on ecological tipping points and safe targets for CO₂ concentrations surrounding negotiations for a UNFCCC post-Kyoto Protocol in Copenhagen and beyond. The paper was cited in the Bank's World Development Report 2010: Development and Climate Change and in UN reports as well as in calls for setting 350 ppm as the target for a safe limit to atmospheric CO₂ concentrations. The paper led directly to the admission by the Australian government that exceeding 450 ppm carbon dioxide in the atmosphere would have dire consequences for Australia's Great Barrier Reef; the results were presented at the Climate Change Science Summit meeting in Copenhagen in March, 2009. In addition to recommending deep cuts in greenhouse gas emissions, the study linked action combating local stresses to enhance the potential for adaptation. These were included on the agenda of several countries when they met in Copenhagen for the climate change negotiations associated with COP15, in December, 2009. The information was also used in a study under the Coral Triangle, which examined the impacts of a changing climate on the coastal ecosystems and people of the Coral Triangle. This particular study received significant attention (>1200 media articles and the Institute for Scientific Information (ISI)'s most cited paper on climate change and ocean acidification in the last three years) and fed into the successful signing of the Coral Triangle Initiative.
- Management tools were translated into several languages to make them more accessible (Coral Reef Restoration Guidelines are a good example of this - translated into four languages and in high demand).

Component IV. Project Administration (US\$2.9 million)

This component provided overall project coordination and management, as well as communication on project results.

The PEA based at the UQ demonstrated a high level of competence in administering sub-grants to COEs and individual researchers, fiduciary responsibility, and accountability. Planned and actual disbursements were virtually the same and the project closed with full grant disbursement

within the anticipated time horizon. Financial management and procurement performance was a significant strength of project implementation. No issues in terms of compliance with covenants were reported during supervision. The PEA/UQ resolved the relatively minor implementation issues that occurred in a timely manner, and selected and utilized M&E data in a timely way. It also maintained close coordination between the WGs and COEs and within the relevant scientific community more generally. Some outreach to other stakeholders (e.g. some local governments) was also initiated. The PEA demonstrated a high level of commitment and scientific know-how towards achieving development objectives. Financial Management (FM) supervision reports from March 2010 indicated that there were no issues as the CRTR Phase I account was closed, and specialists reviewing the account called the FM aspects of the project exemplary.

Communication of findings, an important output of the project, was carried out successfully. Knowledge products were widely available electronically on the project's website, disseminated at international conferences and workshops involving managers as well as scientists: for example, the 11th International Coral Reef Symposium in which the project co-organized a week long Symposium on Coral Reef Management included inputs from the social and biophysical sciences. The CRTR disseminated a range of products ranging from advisory briefs and guides, to reports, technical manuals and guidelines, and case-study analyses. The CRTR Communication Team has continued to work with the Working Groups and COEs in producing relevant products adapting their research outputs for target audiences.

Annex 3. Economic and Financial Analysis

Given the capacity building and technical assistance nature of the project, no economic or financial analysis was carried out.

The sections of the PAD corresponding to economic and financial analysis discussed the incremental cost analysis prepared for GEF purposes.

Annex 4. Bank Lending and Implementation Support/Supervision Processes

(a) Task Team members

Names	Title	Unit	Responsibility/ Specialty
Lending			
Marea E. Hatziolos	Sr. Coastal & Marine Specialist	ENV	TTL/marine resource
Robin Broadfield	Sr. Environmental Specialist	EASER	GEF Regional Coordinator
Anthony J. Hooten	Consultant	ENV	Coral Reef Ecology
Ronald Points	Consultant	EASPR	Financial Flows/Disbursement
Agustinus S. Kaber	Program Assistant	EASEN	Operational Admin
Maurice Le Blanc	Consultant	OPCCS	Procurement
David Michael Chandler	Sr Financial Management Specialist	EAPCO	FM
Supervision/ICR			
Marea E. Hatziolos	Sr. Coastal & Marine Specialist	ENV	TTL/marine resources
David Michael Chandler	Sr Financial Management Specialist	EAPCO	FM
Stephen Paul Hartung	Financial Management Specialis	EAPFM	FM
Nina Queen Irving	Senior Program Assistant	EASER	Operational Admin.
Agustinus S. Kaber	Program Assistant	EASEN-	Operational Admin
Maurice Le Blanc	Consultant	OPCCS	Procurement
Lucy Magembe	Temporary	ENV	Tanzania
Priya Mathur	Operations Analyst	ENVCF	Links to COREMAP
Cristiano Costa e Silva Nunes	Procurement Specialist	EAPPR	Procurement
Peter Brandriss	Operations Analyst	EASER	ICR
Nicolas Katshoubey	Consultant	EASER	ICR

(b) Staff Time and Cost

Stage of Project Cycle	Staff Time and Cost (Bank Budget Only)	
	No. of staff weeks	USD Thousands (including travel and consultant costs)
Lending		
FY03	8.01	96.07
FY04	13.64	184.59
FY05	5.06	49.06
Total:	26.71	329.72
Supervision/ICR		
FY05	9.22	41.50
FY06	11.40	64.10
FY07	15.95	99.62
FY08	9.61	67.55

FY09	8.53	49.30
FY10	7.76	69.62
Total:		391.69

Annex 5. Beneficiary Survey Results

No Beneficiary Survey was carried out (see Section 3.6)

Annex 6. Stakeholder Workshop Report and Results

Dialogue and consultation with stakeholders was held in conjunctions with a number of international meetings on coral reef science and management. Perhaps the most important was at the first ITMEMS (Intertropical Marine Ecosystems Management Symposium) held in Townsville, Australia, in 1998, shortly after the mass (global) bleaching event associated with the record-breaking ENSO of 1997-1998.

The results of those discussions were documented in the project preparation documents (PDF Block A and Block B grants).

Annex 7. Summary of Borrower's ICR and/or Comments on Draft ICR

A. Comments by the Borrower on the Draft ICR.



B. The Borrower's Completion Report

Note: Because the borrower's completion report exceeded 10 pages, some initial sections repeating basic project data and component descriptions nearly identical to those already in the ICR were removed. The analytical and evaluative sections are included in their entirety, and the borrower has reviewed and endorsed the shortened version below.

I. Achievement of Objectives and Outputs

A. Achievement of Objectives

The CRTR Project was able to meet its two overarching objectives through the establishment of a robust research program, which investigated coral reef functions and resilience across a spectrum of research areas and issues, namely: coral bleaching, disease, connectivity, restoration and remediation, remote sensing and, modelling and decision support. In taking this approach to its research agenda, it enabled the Project's researchers to work across disciplines and fields and not be limited by a narrow focus. It also enabled the exploration of emerging research questions generated by research results, and the ability to synthesise information within the research focal areas of the scientific Working Groups. In doing so, it ensured that within the Working Groups, the information was synthesised to be able to impart to stakeholders and audiences key messages, advice and information.

The Project's success also lay in the establishment of research networks commencing with the internal network of 70 international coral reef researchers from 17 countries, across the six

Working Groups and Centers of Excellence. This does not include the numerous researchers involved in the CRTR Project's research agenda through researcher's laboratories, the institutions associated with the Centers of Excellence or other researchers involved in various ways over the past five years.

In addition to this senior researcher network, the Project developed a Future Leaders Network comprising 60 Masters, PhD and Postdoctoral Fellows from 20 countries, who were sponsored or supported under the Project through the Working Groups or Centers of Excellence. In addition to these 'formal' networks, the Project has been part of wider networks spanning across research disciplines and the Centers of Excellence. *The establishment of these integrated networks working across common issues is a core factor to the success of the Program* and should not be readily overlooked.

In terms of outputs, the Project was able to achieve all that was targeted. The components, activities and examples of corresponding outputs produced are as follows:

1. Addressing knowledge and technology gaps (Total Cost US\$8 million; GEF US\$8 million)

This component was carried out to generate knowledge and information to assist in addressing the gaps in our understanding of coral reef ecosystem resilience and vulnerability to a range of key stressors. An approach of coordinating international researchers to work within six scientific working groups was employed as the framework for investigating key research questions around coral bleaching, coral disease, connectivity, remote sensing, coral restoration & remediation, and modeling & decision support. Specific information generated from these Working Groups was abundant; however, some highlights include the following:

a. Key information to understanding the causes and stresses associated with mass coral bleaching events and coral disease was produced and communicated widely in the form of scientific papers, targeted media, as well as research and management tools. Research into the impacts of stress events on coral reefs has led to an improved understanding of how coral reefs respond or adapt to the impacts of different stress events. Observations have demonstrated that mild thermal stress events show different responses from those to extreme events - during extreme events, small colonies do better than larger colonies, while during mild events, colony size does not influence bleaching. The first systematic global survey of the genetics of the all-important algal symbionts within corals (genus *Symbiodinium*) was produced as part of this project. Furthermore, separate studies from the Bleaching and Disease Working Groups has revealed thermal stress plays a key role in increasing the incidence and susceptibility of corals to disease.

b. During the past five years the Disease Working Group has undertaken a global assessment of coral disease. As part of this project, and in collaboration with the Cornell Center for a Sustainable Future program, the Group is analyzing the global spatial and temporal patterns of disease and developing a model to forecast future disease prevalence based on environmental factors for the Caribbean region. In addition to this model, a disease forecasting program ("Reef Temp") is also being developed for Australia.

c. Research from across the scientific working groups has also led to valuable information for the improved establishment of Marine Protected Areas (MPAs), and their value in protecting coral reef systems from environmental and anthropological impacts. For example, work

undertaken into the resilience to disease through the establishment of Marine Protected Areas has found lower disease prevalence within MPAs than the adjacent fished areas, which was strongly correlated with fish functional diversity.

d. Equally important in determining zoning such as marine protected areas, or understanding which reefs are replenished from what sources is the understanding of the connectivity of larvae both from coral and fish species. Research into the development of immunogenetic tags to identify coral planulae to species, and the development of a novel ‘magnetic particle’ technique for measuring movement of water and particles away from spawning sites of corals, has led to an extension in knowledge of coral genetics in the Mesoamerican region, and advanced knowledge of coral larval biology and behavior that could be important in developing new models of coral dispersal. The work undertaken by the Connectivity Working Group has now resulted in connectivity issues being more firmly incorporated into management decisions.

e. A new technique developed by the Remote Sensing Working Group has led to the ability to identify areas of the coastal zone that have particularly benign physical conditions in terms of coral bleaching. These have important implications for marine protected areas design for accommodating global change. The method also includes important new advances to the design of marine reserves such that connectivity and different reserve design criteria can be incorporated explicitly into the algorithm. The methods have now being showcased for the Bahamas and Belize.

f. Practical on-ground information for managers has also been developed. With the increasing emphasis on aquaculture as a source of food and income for many communities throughout areas such as Asia, CRTR researchers made breakthrough discoveries in determining microorganisms such as *Roseobacter* spp. and *Disulfovibrio* spp., are likely to be moving from fish pens onto the reef. This discovery necessitates that “Best Practices Guidelines” be established for aquaculture adjacent to reefs in order to preserve the ecosystem for fisheries and other services it sustains.

g. Research into coral restoration techniques has demonstrated a number of successes with a number of cost-effective methods of coral restoration being explored. Much of this work is being undertaken in Bolinao, Philippines, whereby the research team has been exploring methods including coral fragment transplantation techniques and larval rearing before being transplanted out onto the reef. Recent work has included collaborations with local communities on the transplantation of corals and the work has shown good results and promise with the potential for scaling up. The activity used no scuba and no adhesives, strictly volunteer time, and generated much interest for future expansion.

h. Remote sensing tools developed over the five years will also assist in management and policy decision-making at the regional and local scales. The creation of the Reef Observer software tool uses a state-of-the-art model of radiative transfer, together with a large spectral library of coral reef substrata, to quantify the feasibility of any coral reef remote sensing project. Reef Observer also has a capacity to identify whether particular changes in coral reef state can be detected using remote sensing. The radiative transfer software used to power Reef Observer is now complete and is being disseminated free of charge.

i. The online Reef Remote Sensing Toolkit was extended to help practitioners match their remote sensing objectives to the appropriate technologies (this toolkit covers a wide range of mapping problems and essentially stops short of making prescriptive predictions for more

detailed remote sensing problems – for which Reef Observer is used).

These are just some of the findings generated by the team of CRTR researchers which are being relayed to coastal and marine managers. The findings from Phase One will play an important role in assisting to develop mitigation and adaptation strategies and provides the basis for identifying least/most vulnerable reefs and predicting the spatial distribution of future coral reefs and developing management priorities that are most appropriate for their future.

2. *Promoting scientific learning and capacity building (Total Cost US\$2,877,364 million; GEF US\$1,162,951 million; DGF US\$1,714,413 million)*

At the planning phases of Phase One, most coral reef research was based in universities and research institutes in the developing world, whereas most coral reefs are located in developing countries, and over the past five years, this has not changed to a great degree. Component Two of the CRTR Program focused on balancing this discrepancy and linking developing countries and their coral reef research institutes into the network of international researchers, and to build the capacity of researchers and students in these countries. Key achievements under this component have included:

1. The establishment of a 'Future Leaders Network' composed of 60 sponsored or supported CRTR Program Masters and Postgraduate students, and Postdoctoral fellows across 20 countries. This network has maintained its linkages and has recently produced the publication '*Building capacity in coral reef science: An anthology of CRTR scholars' research 2010*', which is an anthology of research work undertaken by some of the students in the network during Phase One. Subsequently, all of the students have either graduated or are nearing submission of their PhD dissertations.
2. Major courses and events have been held across the regions at the Centers of Excellence, and in other locations throughout the world. Since the Program began in late 2004, Program members have undertaken or participated in over 230 events – training courses, workshops, media opportunities, meetings and conferences. These have included technical training workshops into the latest research techniques into impacts on coral reefs as well as emerging management approaches such as ecosystem-based management. The CRTR Program researchers and Centers of Excellence have collaborated with partners, experts and participants across a broad range of fields to impart their knowledge and information to researchers, managers and policy decision-makers on new emerging techniques that will better equip them with the skills to assist with coral reef research and management in the regions.
3. Researchers under the Program have developed standard operating procedures so that key biophysical processes that operate on coral reefs can be effectively compared across space and over time. Known as 'Common sampling' procedures, this set of methods standardizes specific measures that will help in developing future predictions of the state of coral reefs resulting from both local anthropogenic impacts (such as pollution or effects from fishing and overuse or extraction) and those associated with climate change. The procedures and specific sites have been established in all Centre of Excellences locations over the course of Phase One and will be an ongoing commitment from the Centre of Excellence institutions.

3. *Component Three: Linking scientific knowledge to management and policy (Total Cost*

US\$2,922,636 million; GEF US\$1,437,049 million; DGF US\$1,485,587 million)

This component was aimed at linking the outcomes from the Working Groups and Centers of Excellence to management and policy to ensure better decision-making was undertaken. Key outputs and achievements from this component during the first phase included:

1. The Local Government Initiative has provided opportunities for the Centers of Excellence to work with local Governments and communities to build their understanding of the impacts on coral reefs and the biodiversity (and ultimately livelihoods) they support. For example, the Australasian COE worked with the Kahua Association (KA) in the Makira Province in the Solomon Islands to determine indicators of present environmental stresses and identified potential future changes to the natural environment as a result of present and projected human development. Recommendations were then developed for future activities to be undertaken and implemented by the KA including the establishment of 'no take' zones for shellfish in the region.

In the Philippines, the COE worked with local government units (LGUs) in the Lingayen Gulf area to improve their understanding of the importance of coral reefs and the impacts land-based activities and overfishing were causing to their sustainability. The COE also worked with the LGUs to develop a cohesive set of MPA Enforcement Guidelines for better management and enforcement across the MPA networks in the region.

In Zanzibar the COE has been working with the Stone Town Council to undertake a scoping study for alternative arrangements for the treatment of waste from the town to minimize the impact of current waste disposal methods onto the nearby reefs and waters.

2. In Mexico, the local community, including local CRTR scientists and managers, were successful in employing the results of CRTR research projects to temporarily cancel two large scale development projects threatening the Puerto Morelos reefs. Results from the research on groundwater and circulation modeling were instrumental in a public campaign to cancel two large-scale projects threatening the reefs off Puerto Morelos. The information generated by the COE on the hydrodynamics of the reef lagoon was instrumental in highlighting the dangers of construction and operations in the vicinity of protected areas. Furthermore, the information generated through the groundwater project was instrumental in highlighting the negative impacts from a proposed development plan for the town (increasing population from 12,000 to 180,000 in five years). The information was a key component in identifying the urban development plan as unsustainable and a threat to the main source of revenue for the local population and nearshore coral reefs. Furthermore, CRTR information was successfully disseminated and presented to inform local government candidates in municipal elections of the importance of issues pertaining to environmental sustainability and coral reef related resources.
3. The Chair of the Bleaching Working Group, Professor Ove Hoegh-Guldberg, was commissioned by the Australian Federal Government Garnaut Review to submit a paper on the implications of climate change for Australia's Great Barrier Reef. This contribution led directly to the admission by the Australian government that exceeding 450 ppm carbon dioxide in the atmosphere would have dire consequences for Australia's Great Barrier Reef. The conclusions of the paper had also fed into World Bank dialogue (the chair addressed audiences such as the World Bank environment sector managers and GEF officials), and the

results were presented at the climate change science summit meeting in Copenhagen in March, 2009.

4. This information was also used in a study under the Coral Triangle also led by Prof. Hoegh-Guldberg and other CRTR members (including Professor Ed Gomez, Ms Melanie King, Mr Geoff Dews, and Dr Marea Hatzios as a reviewer), which examined the impacts of a changing climate on the coastal ecosystems and people of the Coral Triangle. This particular study received significant attention (>1200 media articles) and fed into the successful signing of the Coral Triangle Initiative, one of the most hopeful regional conservation initiatives ever taken within Southeast Asia. In addition to recommending deep cuts in greenhouse gas emissions, the study linked action combating local stresses to enhance the potential for adaptation. These were included on the agenda of several countries when they met in Copenhagen for the climate change negotiations associated with COP15, in December, 2009.
5. Within the Philippines, the COE has been instrumental in leading to some major uptake by the Local Government Units in the Lingayen Gulf area. For example, the activities have led to the production of the MPA Enforcement Protocol Guide (*Gabay Hinggil Sa Pagpapatupad ng mga Batas ng Sanktwaryo sa Bolinao, Pangasinan*). The Guide is helping improve the law enforcement activities covering the eight MPAs in the municipality and serves as a guide for enforcers to effectively discharge their duties and functions. In addition to this, the initiative has also led to the Mayors of the LGUs to agree to continue collaboration with neighboring municipalities.
6. CRTR researchers, Professors Peter Mumby and Robert Steneck are continuing to undertake work in Bonaire with the marine park management committee and general public on factors influencing the health of reefs in Bonaire. Advice has been provided on the initiative to ban fish traps and on reducing the harvest of parrotfishes. This is leading to efforts to strengthen public and political commitment with one outcome being a change to legislation to reduce the fishing of parrotfish.
7. In Tanzania, the Centre of Excellence has been involved in the dynamite fishing debate and using their expertise to suggest ways to engage with key actors to control this destructive practice as well as to help restore damaged reefs.
8. The CRTR Project was an active participant at the 5th Biennial GEF International Waters Conference held in Cairns (Australia) in 2009, with representation at the pre-conference technical workshops, plenary sessions and Conference technical workshops. The pre-conference technical workshops (24-25 October) featured leading Australian and international experts in complex basin and marine systems, dealing with resolving conflicting demands among diverse stakeholders, and coping with water scarcity and the technical as well as societal impacts of climate change. The CRTR Project was well represented at the marine workshop with many of the Synthesis Panel either presenting or contributing as Panel members during the discussion periods.

4. Component Four: Project Management (Total Cost US\$3.4million; GEF US\$0.4million; UQ AUD\$3million)

The Project Executing Agency (PEA) has continued to undertake the management role for the past five years and in doing so has successfully obtained a 100% disbursement rate of the grant

funds. A key success to this has been the exceptional networks and cooperation developed between the PEA and the grant institutions, much of which has been done in ‘good faith’. Importantly in the final stages of this Phase, the CRTR Communication Team has continued to work with the Working Groups and Centers of Excellence in producing relevant products adapting their research outputs for target audiences. Information produced and packaged during the year has included a range of products ranging from advisory briefs and guides, to reports, technical manuals and guidelines, and case-study analyses.

Phase One has seen a culmination of high-level, synthesised research information, knowledge products and capacity building activities being undertaken with the networks generated now spanning across 70 senior scientists and 60 scholars from 23 countries. The success from the first five years has been seen in the numerous research findings, many of which have been published in over 600 research publications, and in the large number of training workshops, information exchanges, conferences, media events and meetings that have been participated in, or organised by, Project members. Additionally, there have been management and policy successes with local practices under review or changes already being made as outlined in Component 3.

Key outputs during the past five years have included:

1. 100% disbursement of grant funds without a ‘no cost’ extension required.
2. All technical and financial reporting submitted to the World Bank within the due date timeframes.
3. CRTR member participation in over 230 events – training courses, workshops, media opportunities, meetings and conferences.
4. Production of over 600 peer-reviewed publications including journal articles, book chapters, conference papers and electronic products, as well as media and grey literature articles. Overall, based on the Journal Impact Factor,³ the CRTR Project publications (for fully funded CRTR research) has a impact factor of 5.3% - this is considered to be very high and is an outstanding achievement for the first five years, particularly as many of the CRTR-funded publications will not be recorded in the ISI index until 2010-2011 (it usually takes an average of 1-2 years after an article has been published before it starts to be cited in published articles).
5. Production of a communication and capacity building strategy resulting in a strong suite of products which are available either for download from the CRTR Project website at www.gefcoral.org or in hard copy. Examples of the suite of information products include:
 - 23 factsheets and advisory briefs on current coral reef issues;
 - *Coral Disease Handbook and Underwater Corals for the Indo-Pacific and Caribbean*: outlines procedures for describing signs, measuring disease impacts, monitoring disease outbreaks, assessing causes, and managing reefs to minimize losses due to disease.
 - *Bleaching and Related Ecological Factors: CRTR Working Group Findings 2004-2009*: This report details the findings of the Bleaching WG, including major contributions to understanding the impact of climate change on coral reefs.
 - *Connectivity Handbook: A Guide for Marine Protected Area Managers*: provides a

³ The Journal Impact Factor (JIF) is a measure of the number of times that a journal is quoted by other journals; the more quoted, the higher standing in the scientific community.

summary of what is currently known about the science of connectivity and the techniques and tools used for measuring connectivity for different types of organisms (e.g., corals, fish and lobster). It also highlights the gaps in our knowledge and offers suggestions and advice on how to use what connectivity information is available.

- *Restoration Manual*: complement the *Reef Restoration Concepts & Guidelines* and provide more detailed hands-on advice, based on lessons-learned from previous experience, on how to carry out coral reef rehabilitation in a responsible and cost-effective manner
- *Directory of Remote Sensing Applications for Coral Reef Management*: This directory is part of a suite of tools aimed to help reef managers make better use of remotely-sensed data.
- *Building capacity in coral reef science: An anthology of CRTR scholars' research 2010*: outlines the research undertaken by members of the Future Leaders Network.
- *The Science of No-Take Fishery Reserves: A Guide for Managers*. This booklet developed by the Connectivity WG examines the science underlying use of no-take fishery reserves as a management tool for coastal fisheries.
- *Advisory Paper: Conserve coastal habitat today, preserve income for tomorrow*. This paper from the Connectivity WG provides advice for planners and policy makers on long-term approaches to coast development and actions that can be taken today to preserve coastal habitats.
- *Research update: New frontiers of remote sensing for reef management*. This update informs resource managers about valuable remote sensing tools that can be used at all stages of coral reef conservation.
- *Standard Operating Procedures for repeated measures of process and state variables of coral reef environments*. The CRTR Project has developed a set of procedures with which to collect state and process variables, allowing data comparison and combination across regions.
- *Community-based restoration - the Bolinao experience*. CRTR researchers at the Southeast Asian COE are training local communities to restore live coral cover to the reefs of Bolinao, Pangasinan Province by sharing low-cost reef restoration techniques.
- *Taboos, customs hold key to managing Tanzania's reefs*. The East African COE has investigated how indigenous knowledge contributes to coastal management in local communities. Customs, taboos and beliefs, used in conjunction with scientifically-developed and improved technology, promise to help protect and sustain fish stocks and coastal habitat.
- *Managing marine resources at the local level – Makira Province, Solomon Islands*. Under the CRTR Local Government Initiative, the Australasian COE worked with communities in the Makira Province, Solomon Islands to determine coastal impacts and prioritise an action list on how the community can work towards reducing them.
- *Local governments critical to effective management and protection of coral reefs - Lingayen Gulf, the Philippines*. This case study reviews the Southeast Asian COE's work under the CRTR Local Government Initiative with coastal municipalities surrounding the Lingayen Gulf to improve management and protection of reefs.

B. Achievement of Impacts and Outcomes

Much of the CRTR Project's research was aimed at closing the knowledge gaps on our understanding of coral reef ecosystems and their resilience or vulnerability to external impacts,

important because of implications for dependent human communities. In addition to expanding the research knowledge base and providing managers on-ground with important information and tools, some of the findings have already had an influence on local government and decision-makers. In particular, the work in the Philippines with the Local Government Units developing a better understanding of the importance of coral reefs and in developing the Marine Protected Area Enforcement Guidelines has had some institutional impact in terms of widespread adoption of good practice in MPA enforcement. Likewise, the work with mayors in Quintana Roo, Mexico emphasizing the importance of integrated planning and assessment of environmental impacts on surrounding ecosystems when formulating coastal development plans and targets has broadened the debate on sustainable tourism, water quality and climate change. In Belize, research documenting the essential role of parrotfish (and mangroves where they feed as juveniles) in maintaining coral reef health has swayed opinion among fishermen and led to support for an issue of regulations prohibiting the commercial harvest or sale of parrotfish.

To ensure greater institutional impact and that the gains from Phase 1 are sustained and built on there needs to be an ongoing commitment to further applied research on coral reefs that is innovative and potentially transformative by funding organisations such as the GEF and World Bank. Similarly government commitment needs to be continually reinforced through policy dialogue, information, and economic incentives, to scale up and improve coastal management practices. Institutional change takes time - positive environmental change even longer - and without a long-term commitment on the part of multiple stakeholders to promoting and nurturing such change, there is a high risk of losing the momentum generated well beyond the life of a project.

II. Financial Performance

As of December 31, 2009 US\$14,166,000 million or 99.8% of the total grant amounting to US\$14.2million had been expended with the remaining US\$34,000 (0.2% of the total funds received) fully committed. As of May 31, 2010 US\$14.2 million or 100% of the total grant has been fully expended.

Full utilisation of the grant proceeds was achieved due to a number of factors. Firstly, a sound procedure developed during project planning whereby the funds would be distributed to Institutions and researchers through a sub-grant process. Secondly, a commitment from the Project Executing Agency and sub-grant recipient Institutions to work together collaboratively in achieving full disbursement but also results from the research and related activities.

III. Major Factors Affecting Implementation and Outcome

There have been no major factors affecting implementation and the outcomes of the Project, although there have been a number of lessons learnt over the planning and implementation phases which are beneficial to future project planning.

IV. Sustainability

The CRTR Project was designed to generate a research effort that would develop knowledge and information to fill the gaps in our understanding of what determines coral reef ecosystem vulnerability and resilience to a range of key stressors, and; to align, for the first time, the

expertise and resources of the global coral reef community around key research questions related to the resilience and vulnerability of coral reef ecosystems.

To ensure sustainability of project interventions after Phase One, the following were given ample attention during the project phase:

1. The building of institutional linkages between the Centres of Excellence and local governments and communities. This is continuing across the regions with researchers based at the Centres of Excellence continuing to provide a wide array of advice and guidance on coral reef functions and the impacts of activities on their sustainability, coastal development and water quality, Marine Protected Area planning and zoning, and policy advice on the impacts of climate change.
2. The establishment of dialogue between individual researchers and Governments, NGOs and community groups throughout the regions. This has led to a number of researchers providing advice to various institutions and groups, and it is envisaged these relationships will continue beyond Phase One.
3. The Project focused upon the communication and dissemination of research results to key audiences and built an effective website to ensure information could be accessed and downloaded (a recent 2009 GEF project's website review placed the CRTR Project at #6 for the average number of unique visitors and number of pages visited). This website will be maintained over the interim until Phase 2 commences to ensure the information is readily accessible at all times.
4. The establishing and strengthening of the research network through the concept of 'scientific working groups' integrating science around key research questions. There was significant value in initially segregating investigators into these working groups to foster ownership and comfort in working in tractable groups. As the Phase progressed these working groups/researchers started to integrate within the groups and across the groups, leading to stronger relationships and a more robust scientific base being produced. This was further enhanced through knowledge exchanges (meetings, fieldwork, conferences etc, and developing ongoing communication forums such as the newsletter and website, the Program has ensured these networks will sustain themselves during the interim between Phases and beyond the project's life.

V. Lessons Learned

Whilst a large number of 'lessons learned' emerged during the five-year phase, these have been prioritised below into the top six lessons from the CRTR Project's Phase One.

1. Given the direct dependency of millions of people on coastal resources there needs to be a long-term commitment by donor organisations and Governments to supporting science and technology that can lead to improved management of these resources. Research is a long-term commitment and cannot achieve policy and management results within short timeframes. It requires a credible knowledge base on which to build the information to be used to guide and advise decision makers.

2. It is important to recognise the need for flexibility to be built into the planning and implementation of large-scale, global projects to recognise emerging issues, priorities and attitudes over the timescales of these projects and therefore the ability, outside the parameters of the project's design scope, and financially, to adapt to these changes. Therefore, in planning a project this flexibility needs to be included beyond the 10% budgetary movement currently allowed. Flexibility to meet emerging issues and changes to project design can be achieved through the commitment of a portion of unallocated funds as a budget category to cater for changes in the operating environment or emerging issues.
3. To ensure on-going success during the life of the project, and to assist in post-project sustainability, the endorsement of partners and the establishment of networks is critical. Within the CRTR Project, the endorsement of all partners including participating sub-grant recipient Institutions was a key to the successful planning and implementation of a complex project based on research outputs and outcomes. Without this commitment the chances of a successful implementation or sustainability beyond the phase is lessened. Furthermore, the building and sustaining of networks, particularly at the global level as demonstrated in the CRTR Project, whilst initially expensive, is critical to the success of any initiative and in ensuring synthesis of information and its dissemination to audiences. Building networks is also critical for sustainability purposes well into the future and not just for the life of the project.
4. To be truly effective on a country, regional or global scale, there needs to be greater recognition at the Bank level of the variety of projects being undertaken within a country, region or at the global scale whose information or knowledge can be integrated. This appeared to be poorly executed at the Bank level (despite the best efforts of the Team Leader), and there was a distinct lack of commitment on behalf of other Bank projects to discuss findings or information.
5. Donor organisations such as the GEF and World Bank need to be more realistic in terms of co-financing when it relates to grant projects, and in this particular case, research projects. It is unrealistic to expect potential partners to provide funds for a project without the ability to develop and guide the project activities (which comes from being involved during the planning phases and beyond into implementation). It also needs to be recognised that research provides co-financing through support from other grant sources and this leads to greater integration of the research across disciplines. These sources constitute a great part of the co-financing and in-kind contributions however, its value is not always recognised.
6. It needs to be recognised during planning and implementation phases the importance of elements such as communication and outreach, and monitoring and evaluation, and realistic financial considerations must be built into project budgets to cater for this, and not be left to eventuate during the project implementation. There must be recognition that these elements are just as much a priority as the research is. Without effective communication and outreach, the ability to bring about change is diminished, and without an effective and on-going M&E strategy in place, the ability to measure impact is also diminished.

Annex 8. Comments of Cofinanciers and Other Partners/Stakeholders

Comments from other partners included written comments from the University of Queensland (also a co-financier), and comments from members of the Synthesis Panel and Executive Committee, regarding project outcomes, lessons learned, and how best to structure a follow-on phase, if funding were available. These comments have been incorporated into the section on Lessons Learned in the main text.

Annex 9. List of Supporting Documents

2nd Order Restructuring

AM 2007 11

Annual Reports: 2008 Australasia, 2008 East Africa, 2008 Mesoamerica, 2008 Southeast Asia, 2009

Building capacity in coral reef science: An anthology of CRTR scholars' research 2010

FM supervision reports for the CRTR Project

GEF ProDoc

Honduras CEA Concept Note 2007

Honduras IDA 2006 CAS

Mobilising Science for Development, Gordon Conway chapters 1 – 7

PAD

PDF B Completion Memo April 6 2005

Progress Report 2006, 2007, 2007 05, 2008, 2009

QAG 2005 2nd Stage Review QEA7

Signed Grant Agreement for Tranche 2

Six Monthly Progress Report: 10 2006 to 03 2007, 10 2008 to 03 2009, 2008

Standard Operating Procedures for repeated measures

Taboos customs in Zanzibar

Vol 1 Final Main MTR Report CRTR Program 2008

Vol 2 Review of the SE Asian COE

Vol 3 Review of the East African COE

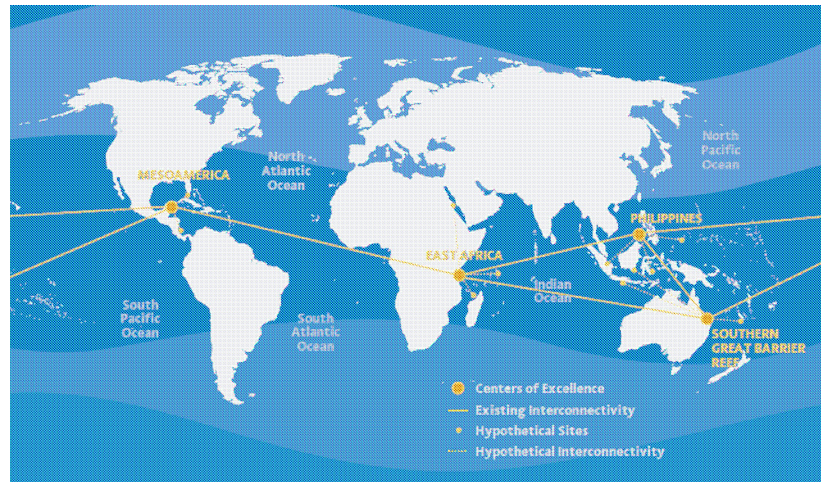
Vol 4 Review of the Mesoamerican COE

Vol 5 Review of the Australasian COE

World Bank CAS / CPS: Mexico 2008, Philippines 2009, Tanzania IDA 2007 CAS

World Bank Concept Note for the World Bank Education Strategy 2020

World Bank Science, Technology, and Innovation (STI)



Project Map: Project Implementation Sites

