

**PROJECT MANAGEMENT FOR
GEFSEC**

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Due Date:**08/11/2000****FOR ACTION: Walter J. Lusigi****STATUS: Open**

Project Name: Coral Reef Targeted Research: Effects of near Term Anthropogenic Stress and Confounding Impacts of Climate Change on the Resilience of Coral Reef Ecosystems and the Implications for Management

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Date Logged: 08/08/2000 09:25:15 AM
Logged By: Ramon Prudencio C. De Mesa (GEF)

CORRESPONDENCE DESCRIPTION:

From: Lars Vidaeus
Organization: WB
Reference #:
To: Mr. Keneth King
Dated: 07/27/2000
Type: OP12
Subject: **PDF A: TR: Regional: Coral Reef Targeted Research: Effects of near Term Anthropogenic Stress and Confounding Impacts of Climate Change on the Resilience of Coral Reef Ecosystems and the Implications for Management**


ACTION INSTRUCTIONS:

Please reply directly and provide a copy

Note: Electronic file attached.

INFORMATION COPIES:

Colin P. Rees, Alan Miller, Alfred M. Duda, Andrea Merla, Rittner, Kanta Kumari, Herbert Acquay, Mario A. Ramos/Person/World Bank, Maria C. J. Cruz/Person/World Bank, Samia Rechache, Days



Agustinus S. Kaber
07/27/2000 05:40 PM

Subject: A new submission from the World Bank.
Project Title: Caribbean and Indo-Pacific Regions: Coral Reef Targeted Research
Type: PDF A - Request for Comments

Please find below the indicated submission(s) for your information and/or action.

Date: 07/27/2000
Name: A. Robin Broadfield
Region: EAP
Country: GLOBAL
Project Title: Caribbean and Indo-Pacific Regions: Coral Reef Targeted Research
Focal Area: Multi-Focal Area/OP12
Type: PDF A - Request for Comments



PDF A Memo-Coral Reefs.d; Block A PDF-Coral Reefs 6-20-00 black.

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To: Gcoordination@Worldbank.Org

OFFICE MEMORANDUM

DATE: July 27, 2000

TO: See Distribution Below

FROM: Lars Vidaeus, GEF Executive Coordinator

EXTENSION: 34188

SUBJECT: **Caribbean and Indo-Pacific Regions: Coral Reef Targeted Research
PDF Block A Request**

Please find attached a PDF Block A for the above-mentioned project. We would appreciate your comments by August 4, 2000. The proposal has been reviewed and approved by the following national experts and organizations:

1. Edgardo Gomez, Marina Science Institute, Philippines, Chair of the Scientific and Technical Advisory Committee of the Global Coral Reef Monitoring Network
2. M. Lim Suan, Department of Environment and Natural Resources, Philippines
3. Kevin W.P. Hiew, Department of Fisheries, Malaysia
4. Sudariyono, State Ministry of Environment, Indonesia
5. Terrence J. Done, International Society for Reef Studies, Australia
6. Henry Usher, GEF Operational Focal Point, Belize

Thank you.

Distribution for Comments

R. Asenjo, UNDP

A. Djoghla, UNEP (Nairobi)

K. Elliott, UNEP (Washington)

cc (for information only):

Messrs./Mmes: K. King, GEF Program Coordination, (GEFSEC);

M. Gadgil, STAP; M. Griffith, STAP (Nairobi);

Broadfield (EASES); Aryal, Hooten, Khanna, Mackinnon, Stephens (ENV);

ENVGC ISC, IRIS 2

BLOCK A PDF

PART I – ELIGIBILITY	
1. Project name: Coral Reef Targeted Research: Effects of near term anthropogenic stress and confounding impacts of climate change on the resilience of coral reef ecosystems and the implications for management.	2. GEF Implementing Agency: The World Bank
3. Country or countries in which the project is being implemented: Caribbean and Indo-Pacific regions initially; other coral reef regions of the world subsequently.	4. Country eligibility: Since the project deals with international waters and there is no convention governing eligibility under this program, all coral reef countries are potentially eligible—particularly those with extensive coral reefs resources, which are part of a regional system.
5. GEF focal area(s), and/or cross-cutting issues: The proposed targeted research cuts across issues related to Climate Change, International Waters and Biodiversity. Coral reefs are the most biologically diverse marine ecosystems on earth. They are typically coastal and transboundary in extent—thus international resources or public goods—and are vulnerable to, as well as being indicators of, climate change.	6. Operational program/Short-term measure: Design and implementation of ecosystem-based approaches to management of IW resources; to better understand responses over time and space of coral reef ecosystems to impacts from localized stress vs. climate change and related phenomena, to reduce vulnerability, mitigate impacts and enhance potential for recovery. (OP 6 and IW focal areas).
7. Project linkage to national priorities, action plans, and programs: Most developing countries with substantial coral reef resources rely on them for food, tourism and coastal protection. Coral reefs provide protein and livelihoods to millions of people in the tropics and sub-tropics. With the rapid growth of tourism—particularly nature-based and coastal tourism—high quality coral reefs have the potential to generate tremendous foreign exchange earnings. At the same time, however, small island states and coastal countries with significant coral reef resources are facing the challenges of burgeoning populations and migration along the coast, uncontrolled development, and adapting to climate change. Pollution of freshwater and coastal waters, loss of habitat and destructive/over-fishing are placing increasing stress on these valuable ecosystems, undermining their ability to cope with natural disturbance and longer term systemic changes related to climate change. The most recent manifestation of this was the 1998 El Niño-triggered bleaching event, resulting in massive coral reef mortality over much of the world's coral reefs. With the declining health of coral reefs, countries stand to lose natural resources of global importance and a key source of current and future economic benefits. Many of these countries, through Regional Seas and other international conventions, national environmental action plans and economic development plans, are committed to better protection and management of coral reefs, but the response has been inadequate. While partly a function of resource constraints, ignorance of the processes and driving forces that control coral reef ecosystem response at the local level has limited the effectiveness of interventions to date. This, coupled with a background of complex atmospheric and climate change related processes, which appear to interact with local stressors, has resulted in inadequate predictions of ecosystem response. Identifying system boundaries, the key determinants of ecosystem stability at the local level, and the relationship between coral reef ecosystems at the regional and global levels, will require targeted, long-term research. Such research will need to be carefully designed to ask the right questions at the local level, and then coordinate results within and across regions, to reveal commonalities in ecosystem response, the connections between reefs systems, and the effects of trans-systemic processes (such as warming of the world's oceans and disease pandemics) on coral reef health globally.	
8. GEF national operational focal point and date of country endorsement: Since this is a proposal for targeted research which will involve many countries across several regions, individual endorsement letters are not required. However, letters will be obtained from countries in regions where research will be implemented initially to complement ongoing Bank/GEF operations (e.g., Belize, Philippines, Indonesia)	

9. Project rationale and objectives: Most initiatives to address the increased vulnerability and accelerating decline of coral reefs around the world do not have the benefit of systematic research or adequate data sets to assess ecosystem response to stress over the medium to long-term. This is necessary to evaluate ecosystem trends, separate and account for natural variability as opposed to stress-induced change, and to determine the cost-effectiveness of management interventions over extended periods. Longer term, targeted research is also needed to determine key factors and processes associated with vulnerability or resilience of coral reefs to human-induced stress, against a background of climate change and other system wide changes. While anthropogenic impacts on coral reefs are well documented, the relationship between climate change and is only now being explored. The latter has been linked to persistent and potentially far reaching impacts on reefs through El Niño events, such as the 1998 event and the currently emerging ENSO in the Central Pacific. These climatological events result in increased Sea Surface Temperatures, closely associated with coral bleaching and mortality, more frequent storms, and potentially changes in disease vectors leading to increased incidence of disease in corals. Understanding the key natural drivers/processes in coral reef systems (e.g., recruitment/colonization; predator-prey interactions; grazing, competition, disease, nutrient cycling), the impacts of human disturbance on the processes, as well as effects of climate change, will allow us to improve predictions on how reef ecosystems are likely to respond to future stress. This will directly benefit policymakers and managers in identifying the most appropriate and cost effective interventions to protect these resources. Without this information, management efforts will continue to operate under significant uncertainty, and with poor, unsupported metrics in assessing results.

10. Expected outcomes:

- **Establishment of a framework that identifies the most significant scientific questions to be addressed for the direct benefit of coral reef management over the short, medium and long-term.**
- Determination of factors associated with reef ecosystem stability and resilience to major disturbance events, such as bleaching, and whether resilience can be protected or enhanced.
- Improved understanding of chronic forms of stress (such as disease, sedimentation, eutrophication, overfishing, etc.) compared to major disturbance events, in terms of coral reef ecosystem sustainability over space and time.
- Enhanced capacity for coordinated, applied research investigations (and targeted monitoring) within a region to specifically benefit management.
- Enhanced capacity for interpretation of results and prediction of trends to benefit managers.

11. Planned activities to achieve outcomes: A series of targeted research investigations will be designed within and across coral reef regions, to help clarify the near term and longer term impacts of different forms of stress on reef ecosystems, their cumulative effects on ecosystem resilience, and ways to minimize impacts or enhance recovery. It is envisioned that this work will be carried out in phases (over a 15 year time frame) and will be designed over sufficiently large spatial and temporal scales to provide coral reef managers and decision-makers with a clearer understanding of the impacts of localized/human disturbance on coral reef health and associated biodiversity, social and economic values. The findings should also help us to assess implications for coral reef sustainability against apparent changes in the earth's climate. The research would help prioritize interventions at the local level in response to localized environmental impacts, as well as the necessary, coordinated regional and global level policy interventions to offset the effects of climate change other system wide processes.

Among the possible research topics to be investigated would be the following:

- **Sources, sinks and pathways of coral reef larval recruitment between reefs within a region or subregion**
- Determination and study of spawning aggregations of major reef fish species, and their importance to standing stock within a region
- Genetic relationships between coral reefs (including algal symbionts' tolerance to elevated Sea Surface temperatures) both within and between regions
- Efficacy of marine protected areas in conserving fish and invertebrate populations (controlled experimental treatments)

- Before-After-Control-Impact (BACI) assessment of paired reefs to determine longer term trends in population dynamics and disease frequency
- Further etiological research, taxonomy and documentation of coral diseases
- Chemical pathways and coral reef responses to variations in nutrient dynamics, as well as pollutants
- Multivariate modeling studies to assist in predicting responses to multiple stressors (such as temperature, salinity, sedimentation, nutrients, pesticides, heavy metals, organophosphates)

The program would likely take an incremental approach, beginning in two coral reef regions of the world: the Caribbean and the Indo-Pacific, where stakes are highest from the point of view of reefs at risk and Bank/GEF investments. Depending on the methodology applied and outcomes achieved, additional regions would be added.

12. Stakeholders involved in project:

Donor and organizational support: The World Bank, UNEP, the International Coral Reef Initiative-Coordination Planning Committee, the International Society for Reef Studies, ICLARM, NOAA, AIMS; Implementing and Executing Bodies: Anticipated stakeholders include ICLARM, Global Coral Reef Monitoring Network (GCRMN) participating institutions and nodes; marine research institutions at the local and regional levels in participant countries. **The Block A would be used to identify the principal partners and stakeholders in the targeted research program.**

PART II – INFORMATION ON BLOCK A PDF ACTIVITIES

13. Activities to be financed by the PDF:

This Block A grant would be used to undertake a gap analysis of what research is currently being carried out and what is known about coral reef processes in relation to ecosystem stability, resilience or vulnerability to various forms of stress—both human induced and climate-related—which are associated with declines in coral reef health over different parts of their range. Annex 1, which compiles information on existing coral reef programs around the world, provides a useful starting point for this analysis. An objective of this analysis would be to develop a framework for the design of long-term, targeted research that would lead to more accurate predictions of the sustainability of coral reef ecosystems under different localized stress regimes, against a wider backdrop of climate change and related system wide phenomena. To support ongoing management efforts on the ground, the research would need to focus on the most pervasive forms of stress in a given area and how these feedback on ecosystem processes, quantify cause and effect relationships to the extent possible between different types of stress and ecosystem response, as well as their interactive effects, and recommend management interventions that would minimize or mitigate the cumulative impacts of human disturbance and climate change on coral reefs, while allowing benefits from their use. Developing robust models for sustainable use will require informed decision-making based on rigorous science, predictive modeling and an accurate analysis of trends in reef health at the local, regional and global levels. Filling this knowledge gap will be critical to the success of ongoing as well as proposed GEF supported efforts for the conservation and sustainable use of coral reefs throughout the world. The PDF Block A will tap the best available expertise to frame the key questions for the design of a sustained, targeted research agenda in support of these objectives. The research will be carried out across different spatial and temporal scales, and will be coordinated by an internationally recognized research institution committed to science-based management and building with partners in the developing world.

To gather and prioritize the key research questions that will need to be pursued in each coral reef region taking part in this coordinated effort, a number of key consultations will be required. These would bring to bear the expertise of highly respected researchers and managers from a range of coral reef related disciplines and geographic regions in formulating the key questions and the experimental design to field test hypotheses. To date, early consultations on developing a targeted research agenda have taken place on three separate occasions within various Regions (the International Tropical Marine Ecosystems Management Symposium (fall 1998), the National Coral Reef Institute meeting on coral reef restoration and recovery (spring 1999), and the International Symposium on the Extent of Coral Reef Bleaching (Feb., 2000), in which World Bank staff have already participated, through Environment Department support. These have provided excellent background information on the status of the world's coral reefs, identified the most significant forms of human-induced stress and documented our state of knowledge of the extent and near term effects of El Niño and other climatological events on reefs around the world.

It is now time to narrow these questions down based on a gap analysis of what is known and what remains to be investigated, identify a broad methodological approach to coordinate and integrate the research effort, and begin to scope out the design and implementation of a targeted research program. This research agenda and preliminary implementation plan will form the basis for design of a robust targeted research program in selected regions of the world. The design will be incremental and allow for additional sites to be added to the research program as content and process issues are worked out and new executing agencies are identified.

A PDF Block A is being requested to support the cost of additional consultations and formulation of the preliminary research agenda. To maximize the use of PDF Block A funds, it is proposed that these consultations be organized to coincide with a series of upcoming international symposia, including, the International Coral Reef Initiative's Regional Symposium for Coral Reefs in the Pacific: Status and Monitoring, in conjunction with the upcoming ICRI-Coordination and Planning Committee meeting in Noumea, New Caledonia in May of this year, and the 9th International Coral Reef Symposium in Bali, Indonesia (October, 2000). The latter is a quadrennial event drawing the largest single gathering of coral reef scientists from all over the world. Each of these consultations could identify regional priorities for those targeted investigations that can best benefit applied management, and can assist in filling gaps for critical unknowns concerning basic ecological processes (i.e. sources and sinks of larval recruitment, etiology of disease and its incidence in a given region, etc.). These planned activities will result in specific recommendations for targeted research. This PDF A will finance the costs for holding consultations (renting of meeting rooms and supplies) during each of the planned upcoming meetings. The Block A would result in a discussion paper outlining the proposed Research Framework, partners and stakeholders, time frame and other requirements for a Block B proposal to design a targeted research programs with GEF support.

14. Expected outputs and completion dates:

- A. Discussion paper on the priority targeted research questions based upon a detailed review of the most recent literature and developed by each of the regions during the consultations, as well as from selected senior scientists (end of Nov., 2000)
- B. A proposal detailing the priority questions and the logistics recommended for implementing the framework in at least one coral reef region of the world (end of Dec., 2000)
- C. List of specialists consulted and a subset of candidates who may serve as members of a steering committee in supervising targeted research, and interpreting results on regional and possibly global scales. Nov., 2000)
- D. The above would form the basis for a revised Block B proposal to develop a full scale targeted research project (January 2001).

15. Other possible contributors/donors and amounts:

The World Bank has already supported staff and travel costs for several earlier consultations for the Block A grant request, as well as convening scientific experts for preliminary discussions. Contributions by the Bank to date and for involvement of Bank staff in future meetings related to the PDF Block A:

World Bank:	25,000
Other donors have contributed in cash and in kind to consultations and information for this proposal:	
AIMS	3,000 (to date)
ICRI Secretariat	1,500 (draft review and concept presentations before the ICRI-CPC)
ICRS	(in kind through draft review, travel of members/institutional support during 9 th ICRS)
NCRI	(in kind contribution for use of facilities for initial consultations)
UNEP	TBD
Netherlands/Bank Partnership	(in kind Initial and ongoing consultations with Swedish Sida, use of Cordio results, and publication costs)

16. Total budget and information on how costs will be met (including the Block A grant):

Earlier estimations place total project costs at approximately \$10 million; however, project budgets will be developed in detail following each of the consultations.

PART III – INFORMATION ON THE APPLICANT INSTITUTION	
17. Name: To be determined, as no single applicant has been identified to represent the countries that are likely to be involved. ICLARM, a CGIAR institution recently relocated to Penang, Malaysia, is likely to be the executing agency charged with overseeing the research and disseminating the results.	18. Date of establishment, membership, and leadership:
19. Mandate/terms of reference:	20. Sources of revenue:
21. Recent activities/programs, in particular those relevant to the GEF:	
PART IV – INFORMATION TO BE COMPLETED BY IMPLEMENTING AGENCY	
22. Project identification number:	
23. Implementing Agency contact person: Kathleen Mackinnon, The World Bank, Environment Department. Tel: (202) 458-4682; e-mail: Kmackinnon@worldbank.org .	
24. Project linkage to Implementing Agency program(s): See Annex 2 for a Table of ongoing and proposed World Bank/GEF projects and programs. In light of major projects in Southeast Asia (Indonesia COREMAP) and the Western Caribbean (MBRS), it is proposed that research would begin in these two regions.	

ANNEX 1

A Brief Summary of Global Reef Status and the Need for a Global Targeted Research Effort

In April, 1999, the National Coral Reef Institute, located in Fort Lauderdale, Florida, hosted an International Conference on the Scientific Aspects of Coral Reef Assessment, Monitoring and Restoration. Participants from over 39 countries convened and presented papers on the state of understanding of coral reefs. There was overwhelming consensus during this conference that coral reefs are changing significantly around the world, and many of the agents responsible for such change are either unknown or poorly understood. Damaged or destroyed reefs can be found in over 93 countries, with ones in South and Southeast Asia, East Africa and the Caribbean at the greatest risk.

We know that 1998 was the warmest year in recorded history, and high sea surface water temperatures were exacerbated by the strongest El Niño-Southern Oscillation (ENSO) event ever recorded. Elevated sea surface temperatures (SSTs) led to an unprecedented bleaching of corals. In some cases the bleaching has led to mortality on a massive spatial scale, particularly in the Indian Ocean region (Wilkinson, 1998; Wilkinson, et al. *in press*). According to Wilkinson, et al (*in press*), there are three general categories of potential causes for the 1998 elevated SSTs. These include a stochastic event; El Niño; and global warming. However, the proximal cause of bleaching and mortality has not been universally accepted. A major difficulty in interpretation of these bleaching events is that multiple factors can impact coral reefs simultaneously. While the SST anomalies appear to be good predictors of where coral bleaching may occur, the actual cause of bleaching at a particular reef may be a combination of physical factors such as temperature, number of days of sunlight, ultraviolet radiation level, and biological factors such as coral health. Nonetheless, coral bleaching events appear to have increased in frequency, and it has been hypothesized that global warming is one cause. In a recent report by Boiseau et al (1998) reconstruction of climatic events over the last 137 years, based on spectral analysis of oxygen and carbon isotopes in coral skeletons, indicate that localized climate variability (and thus bleaching) can be strongly affected by ENSO events.

In addition to coral bleaching, a recent article in the journal *Science*, Kleypas, et al. (1999) argues that coral reefs could be directly threatened by the buildup of atmospheric carbon dioxide (CO₂) entering the oceans, and some reefs may already be declining (i.e. those at the extreme ranges of latitude). The authors contend that their data represent some of the first evidence of a direct negative impact of increased CO₂ on a marine ecosystem, which the calcification ability of corals may be reduced. The findings are based on ocean carbon data and computer models, and on laboratory experiments which show that coral and algal calcification declines as the saturation state declines. It should be noted, however, that the coral reefs on which these predictions are based have not been studied *in situ*, and therefore the conclusions remain somewhat speculative.

The potential changes in both temperature and chemistry may have profound effects on the biology, and particularly the reproductive capacity, of corals. While symbiotic algae living within coral tissue make up only about 15 percent of biomass, this symbiotic relationship drives the physiological process for growth and reproduction. Corals that are stressed place their energy into respiration and reproduction shuts down. Because corals live near the upper limit of their physiological tolerances, environmental changes, such as elevated water temperature and chemical changes may contribute to a loss in coral fecundity, thereby exacerbating the inability of coral reefs to be resilient to disturbance or stress.

Thus, coral reefs that are healthy are more likely to recover than stressed, damaged or polluted reefs. In fact, human activities continue to be the largest threat to the majority of coral reefs in all

regions of the world. Activities such as overfishing or destructive fishing practices, pollution and sedimentation from coastal development have confounded the impacts observed on many coral reefs.

Prior to last year's bleaching events, previous estimates identified 10% of the world's coral reefs as seriously degraded, and a much greater percentage threatened (Wilkinson 1993). More recently, a map-based analysis of 14 different data sets estimates that 58% of the world's reefs are potentially at risk - ranging from coastal development and destructive and over-fishing practices to over exploitation of resources, marine pollution and runoff from inland deforestation and farming (Bryant, et al 1998). "Reef Check", a community-based rapid assessment of coral reefs conducted in 1997 and 1998, found that most reefs surveyed (over 400 sites) are severely over-fished with most high-value organisms missing (Hodgson in press).

Coral reefs also appear to be experiencing an increase in the frequency and diversity of coral diseases. Since 1970, the number of different coral diseases identified has increased from two to at least 14 different pathogens for corals and coralline algae (Peters, 1999). Most diseases are the result of more than one factor and determining the specific cause of a disease can be difficult. While it has been assumed that coral diseases have a direct relationship with an increase in pollution near coastal development, some preliminary data at various sites in different regions may suggest that the frequency of disease, even among coral reef environments away from human population centers, may have increased in recent years (T. Goreau, personal communication).

These estimates of coral reef degradation have been developed based on the best information available. Recent use of information technology, such as the GIS tools employed by the *Reefs At Risk* analysis, and an Internet-based list server have significantly enhanced global communication, and have allowed vast improvement in the collaboration among coral reef scientists and managers. However, the estimates of impact, particularly at regional and global levels, have been largely based on data with limited precision, qualitative in nature, or anecdotal assessments. This has resulted in highly heterogeneous data sets, largely a consequence of varying methods and capacities of researchers, managers or sport divers, as well as natural variation.

The need for global assessments is becoming crucial to understand and respond to large-scale environmental disturbances, and our ability to separate these from more localized human-related impacts. Examples of broad scale environmental investigations are few (i.e. impacts assessments following oil spills), however, the ones that have been undertaken provide valuable lessons on which subsequent attempts can be based to environmentally assess large spatial areas, and do so with scale variation in mind. One major lesson from catastrophic disturbances, such as the Amoco Cadiz (France - temperate intertidal), the Exxon Valdez (U.S. - subarctic intertidal) and the Galeta (Panama - coral reefs and mangrove intertidal) oil spills, is that long term monitoring and research (i.e. 10-20 years) are required to understand community dynamics and account for the natural temporal and spatial variability observed in marine systems. A second major lesson is that cases in which a framework of study sites were established prior to disturbance events not only result in the best quality of information in determining environmental impacts, but do so at a significantly lower cost over the long term compared to emergency response efforts (Spies, 1993).

During the International Conference on the Scientific Aspects of Coral Reef Assessment, Monitoring and Restoration in Fort Lauderdale, Florida, World Bank staff hosted a meeting with

27 selected researchers and coral reef managers¹, including each of the Conference's Plenary speakers, to review a summary of this targeted research proposal. These researchers were asked to review the proposal brief and offer comments as to the components they believed would be critical to a successful project. Both verbal and written comments were received. While the approaches to the issues and problems differed depending on the researchers' perspectives and academic backgrounds, all of the participants were supportive of the need for the establishing a targeted oversight panel, and there was a unanimous sense of urgency for global and regional coordination given recent disturbance events, and the reported status of reefs and the concern of their decline. The general consensus at the conference was that based on the many reports from around the world, there appears to be a series of observations that suggest a range of potentially significant changes to coral reefs, but the root causes are not well understood.

Many of these researchers suggested names of individuals who might be suitable candidates to serve as panel members, but also suggested specific approaches in outlining plans of action (see page 6). Several scientists also stressed that not enough is known about coral reef biophysical processes, and specific experiments are needed to improve basic understanding of those processes that affect and influence coral reef environments. However, most researchers agreed that nesting investigations at various scales was a most prudent course in uncovering new information about coral reefs, and that this should include a range of screening, monitoring and experimental design. Also, the majority of researchers stressed the need for longer term studies (at least 10 years), to better understand temporal and spatial variability.

Clearly, impacts to coral reefs involve transboundary issues, whether from global or localized stresses, but much of the existing research and management remains focused on local conditions (i.e. countries) as an organizing principle. This proposed project presents an opportunity for the GEF to serve as the catalyst in designing a targeted research effort for coral reefs where investigations can be "nested" within different scales, across national boundaries—from local to regional and global environments. By supporting a hierarchy of investigations through a regionally networked effort, the project can lay the foundation for a coordinated global assessment to better understand and potentially predict future disturbances to coral reefs and their impacts within International Waters. As a result, this program can contribute vital information to countries to enhance their capacity to manage coral reefs at local scales and the human populations that rely upon them, while fostering linkages to promote action at regional and international levels in the face of clear threats to a major global ecosystem.

¹ The following individuals attended the meeting: Agnetta Nilsson, UNEP; Barbara Best, USAID; Bob Buddemeier, University of Kansas; Bob Ginsburg, University of Miami; Chuck Birkeland, University of Guam; Clive Wilkinson, AIMS; Daphne Fauntin University of Kansas; Dick Dodge, NCRI; Ernesto Arias, Ernesto Weil; Esther Peters, Tetra Tech, Inc.; Gregor Hodgson, Reef Check; Jamie Reaser, U.S. State Department; Jim Thomas, NCRI; John McManus, ICLARM; Judy Lang, Austin Natural History Museum; Marjorie Reaka-Kudla, University of Maryland; Mark Hay, Georgia Tech; Nancy Knowlton, Scripps Institute of Oceanography; Nywira Muthiga, Kenya; Paul Jokiel, University of Hawaii; Peter Sale, University of Windsor; Terry Done, ISRS; Tim McClanahan, Kenya; David Obhura, CORDIO; Marea Hatzios, World Bank; Andy Hooten, World Bank.

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ANNEX 2



Terence J. Done Ph. D.
President

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May 31, 2000

Dr Andy Hooten
c/- World Bank
Washington DC
USA

Dear Andy,

Re: Coral Reef Targeted Research: Effects of near term anthropogenic stress and confounding impacts of climate change on the resilience of coral reef ecosystems and the implications for management

As both the President of the International Society for Reef Studies and Leader of AIMS 'Sustaining Coral Reefs Project', I would like to offer my wholehearted support for your Block A PDF Proposal. I believe you have identified an important need for improved understanding of ecosystem processes and sustainability if society is to get the best outcomes for itself and for coral reefs through management and conservation interventions.

ISRS is assisting the Government of Indonesia in organizing the 9th International Coral Reef Symposium, which you have foreshadowed in your proposal as the location of important consultations and formulation of the preliminary research agenda.

I am happy to offer the assistance of ISRS in organizing time, venue and facilities for the consultations at the Bali meeting.

I look forward to early discussions with you on the details.

With sincere best wishes,

Terry Done
President



GOVERNMENT OF BELIZE
Ministry of Economic Development

Economic Development
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Our Ref: IA/UN/1/12/00(36)

P.O. Box 42
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Belmopan
Belize, Central America

June 19, 2000

Mr. Lars Vidaeus
GEF Executive Coordinator
Environment Department, World Bank
1818 H. Street, NW
Washington D.C. 20433

Dear Mr. Vidaeus,

Re: PDF Block A Request for Targeted Research on Coral Reefs

On behalf of the Government of Belize (GOB) and in my capacity as GEF Operational Focal Point I hereby endorse the PDF Block A request by the World Bank to initiate consultations with the scientific and coral reef management communities to design a management oriented research program for coral reef conservation in the Caribbean and other coral reef regions of the world.

In light of increasing pressures from human stress and apparent climate change-related phenomena, a targeted research program to assess coral reef vulnerability and measures to enhance ecosystem resilience and recovery is warranted. GOB is committed to the conservation and sustainable use of the Meso-American Barrier Reef System in collaboration with other partners and stakeholders.

We would be grateful for your assistance in approaching GEF, on behalf of Belize and its partners in conservation, to secure support for the development of a program of Targeted Research for Coral Reef Conservation.

With Highest Regards!

Henry Usher
GEF Operational Focal Point
for Permanent Secretary
Ministry of Economic Development

cc: **Ms. Marea Hatzidolos, Senior Marine Resource Specialist, World Bank**
Programme Officer, UNDP, Belize