

Census of Coral Reefs (CReefs)

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<http://www.creefs.org>

1. 2006 ACCOMPLISHMENTS & SCIENTIFIC HIGHLIGHTS

This should be a summary of significant work, results, and conclusions. Please describe the scientific activities completed in the past year (for example, cruises, analyses workshops, major reports). What were the meaningful scientific results of these activities, and how do they contribute to our overall understanding of marine biodiversity and its role in ocean ecosystems.

Workshops

Two mobilization workshops were held early in 2006 to advance major goals of the CReefs project. The workshops took place in Hawaii following the 2006 Ocean Sciences Meeting at which CReefs held its own session entitled “Biodiversity of Coral Reef Ecosystems”. The purpose of this session was to bring together international scientists to begin to address patterns of species diversity for understudied reef-associated groups across gradients of human disturbance, kinds and distributions of species obligately associated with healthy coral reefs and how widely they are distributed, prospects for maintenance of species diversity on reefs suffering various levels of human impacts, and how much and what kinds of taxonomic and ecological information are required to manage reefs effectively.

The first Mobilization Workshop – CReefs Site Sampling, Planning, and Methodology Workshop - held in Feb 2006, established the taxonomic focus, locations and sampling strategies for future CReefs field activities. The workshop brought together taxonomic experts, leaders of major coral reef initiatives and other reef specialists to discuss many crucial details necessary to ensure maximum integration and consistency of approaches across CoML and other projects. Decisions were reached regarding cruise locations, under-studied taxonomic groups to be targeted, key taxonomists, sampling and observation strategies, data collection and management, local institute/agency support, and legacy field sites.

Locations were chosen based on geographical representation, the existence of appropriate gradients in human disturbance, the willingness of key laboratories/partners to support and provide resources for the project, and the potential for synergy with ongoing activities. The first cruise, “Census of Coral Reef Ecosystems: Understudied Species and the Biodiversity of French Frigate Shoals, Northwestern Hawaiian Islands Marine National Monument” (OES 06-11), is planned to take place in the Northwestern Hawaiian Islands Marine National Monument (NWHIMNM) (permits received) for which 23 days of ship time have been secured onboard the NOAA vessel Oscar Elton Sette. French Frigate Shoals (FFS) is the ideal locale for a census because of its relatively pristine nature, its location at the centre of the Hawaiian Islands, and the role it plays in connectivity of organisms across three distinct biogeographic regions. It supports numerous habitat types, has high species endemism, and a wealth of existing supplemental data. Future field operations for biodiversity sampling of understudied species will be in Australia (at one of the following locations - Heron or Lizard Island Research Station in the Great Barrier Reef; Ningaloo or Scott Reef in Western Australia) and in the Caribbean (probably in Panama, in conjunction with the Smithsonian at the Bocas del Toro Laboratory). Our ability to mount these field operations will depend on acquiring further funding. These sites will serve as baseline comparisons for future research conducted on a global scale.

Following the mobilization workshop a series of meetings and conference calls ensued in preparation for the October 2006 sampling cruise. Ten working groups were established amongst the experts involved to prepare for the cruise and further meeting/calls have taken place weekly since May 2006. Numerous meetings have also taken place with the NWHI management agencies, US Fish and Wildlife Service, the State, and Marine National Monument, as well as with cultural and environmental groups.

The overall objective of the NWHIMNM cruise, led by CReefs PI Russell Brainard, National Oceanic and Atmospheric Administration, is to investigate and document the biological diversity of understudied reef-associated non-coral invertebrates, turf and coralline algae, and microbial communities at French Frigate Shoals in the recently designated Northwestern Hawaiian Islands (NWHI) Marine National Monument (MNM). This project is unique in documenting diversity in ecologically critical, but poorly known organism groups (across a range of habitats) that have historically been understudied because of lack of taxonomic expertise or logistical difficulties in sampling. In addition to using traditional morphological taxonomic identifications, DNA from these poorly understood species will be used in a bar-coding study to help future researchers identify taxonomically challenging taxa. Data collected will be input into regional and global databases and outreach and education personnel will package scientific findings and expedition notes into multiple formats that can be used for a variety of educational and outreach purposes. The data from this effort will be combined with existing research, providing a more complete species inventory--thereby filling critical gaps in information, and will provide research that can aid in a greater understanding of biodiversity on a local, national, and global scale.

This will be the first CoML project to provide a means for improving our understanding of the biodiversity of coral reef ecosystems in the Northwestern Hawaiian Islands and globally it will aid in the protection of all coral reef species by identifying especially rare and vulnerable species. The research planned is unprecedented in the level of taxonomic expertise that will be brought together to conduct ship-based coral reef censuses of the most poorly known taxonomic groups and will occur in the fall of 2006 (with a shorter, possible piggy-back mooring recovery cruise in the fall of 2007).

Sampling techniques have been selected to ensure a broad range of organisms can be collected from 12 different habitats ranging in depth from 0-300m. Within these habitats representatives from marine invertebrate phyla that dwell as mobile or sessile epifauna or infauna, algae and organisms within the water column (invertebrates, algae, and microbes) will be collected. CReefs will be working with CoML ICoMM to collect and process microbial samples and will adhere to their protocols. The following sampling techniques have been proposed and developed for this and future cruises - hand collection, rubble brushing/extraction, sand sampling, suction (developed from Vacuum used in New Caledonia by Philippe Bouchet's team), yabbie pumps, light and lobster traps, plankton nets, scooping, grabs, newly developed artificial reef matrix structures (ARMS—developed in conjunction w/ NOAA, Joel Martin NHMLAC and Gustav Paulay FLMNH), cryptofauna analysis (some to be postponed to coincide with ARMS recovery), algal and microbial collections.

Protocols have also been established for sample processing following organism collection – labeling, preservation, DNA sampling, identification, storage, photography and data management. Participants on the cruise have been chosen to fill the areas of expertise required and to ensure the cruise is a success. Though they are property of the State of Hawaii, the samples will be on long-term loan to the following agencies for processing/storage: Bishop Museum, University of Hawaii, Hawaii Institute of Marine Biology, CoML's ICoMM (Woods Hole and UC Merced), Florida Museum of Natural History, Natural History Museum of LA County, Scripps Oceanography, and possibly institutes in Mexico, Brazil, and Puerto Rico. Data associated with the samples will be stored centrally in the CReefs Collection Database and made available to NOAA internal databases, Moorea Biocode project, OBIS and the Pacific regional node (for details see below - second Mobilization Workshop – Database creation and linkage with OBIS).

Other recent and upcoming significant CReefs associated expeditions/efforts consist of a Scripps Institution of Oceanography led expedition to the Line Islands in 2005, an ongoing operation in Moorea (see above), an expedition to Sao Tome (in collaboration with Brazilian scientists) and a new expedition planned for October: the Santo Expedition to Santo, Vanuatu (led by Philippe Bouchet, Muséum national d'Histoire naturelle, France). The Line Islands cruise in August-September 2005 went to Kiritimati, Tabuaeran, Palymra and Kingman Islands. These islands represent a gradient in human population from 9500 to 0. Thousands of samples were collected, photographed, and preserved for genetic analysis. This summer, the Moorea Biocode project attempted to collect all the marine invertebrates of Moorea, estimated to be approximately 10,000 species. The microbial Vanuatu expedition will focus on mollusks, one of the most diverse of all marine groups, to determine if the staggering numbers of species found in an earlier expedition (up to 3000 species per site in New Caledonia) are typical of reefs in the region.

Development of molecular techniques has also progressed through two meetings and ongoing laboratory trials. In September 2005, CReefs co-sponsored a workshop with the Smithsonian to develop molecular techniques for coral reef organisms. Held in Panama, the workshop brought together 40 people from 10 countries to discuss barcoding and the development of anonymous markers to count numbers of entities without identifying them (a technique parallel to those used by microbial census takers). Barcoding methods are being used in all the expeditions described above, while anonymous censusing (a more challenging situation) is being tried on samples from the Line Islands Cruises. In addition, to follow-up on the Panama meeting, several members of CReefs attended a marine Bar-code workshop in Amsterdam in May 2006.

The second Mobilization Workshop held in Hawaii, March 2006 focused on Database creation and linkage with OBIS. The workshop sought input from scientific end-users, OBIS and data managers to discuss plans for development of a user-friendly online CReefs Website and Database with tools to provide interactive visualization and analysis capabilities. The CReefs Collection database will be created and become the central repository for all CReefs Collection data. It will be developed to manage 1) sample data collected during trips 2) track voucher location post-trip 3) taxonomic updates and comparisons 4) generation of new data (eg barcoding) and 5) linkage of sub-samples (eg microbes)

The Moorea Biocode Project (MBC) has developed a collection database that fundamentally suits CReefs collection requirements. MBC is a joint Franco-American project with the goal to genetically barcode the first complete tropical ecosystem. The project's on-line database will capture and track all information associated with collected samples. Gustav Paulay has been working with Chris Meyer (MBC Project Coordinator) to improve the functionality of the Biocode Database and recently tested it during a collection trip in Moorea (August) (also joined in part by Dr. Laetitia Plaisance, CReefs postdoctoral fellow) with a view to assess its suitability for CReefs collection activities. Further development is currently underway to streamline taxonomic data entry and to automate filling of repetitive fields. CReefs plans to implement the Biocode Database for its data requirements during the first CReefs collection cruise in Hawaii (October 2006). There are a range of issues associated not only with the initial collection and recording of sample information, but post-collection activities such as tracking samples between organizations including sub-sampling, taxonomic updates and data-sharing agreements. Mechanisms and data tools will be created and developed to further manage the CReefs Collection Data.

CReefs will populate the CReefs Database (and OBIS) with data arising from collection trips as well as existing data from international coral reef efforts and mined data. In the short-term, relevant collections residing at AIMS, NOAA and SIO will be targeted with externally significant datasets and data mining activities incorporated as additional resources become available. AIMS became a Data Provider in June 2006 and successfully served four datasets to OBIS Australia (40,000 records). The Pacific Region Integrated Data Enterprise (PRIDE) proposal submitted in Feb 2006 will provide funding in 2007 to assist with preparation of NOAA data for integration into OBIS.

Analyses

CReefs will also contribute significantly to the Barcode of Life Initiative with the Line Islands, Moorea, upcoming OES 06-11 and future cruises, as well as through associated projects. Laetitia Plaisance has been employed as a CReefs Postdoctoral fellow with Nancy Knowlton and work is underway to analyze samples collected in the Line Islands and in Moorea. Initial focus is on crustaceans collected from heads of *Pocillopora* corals, which have the potential to provide standardized assessment protocols that can be used globally. Barcode sequences will be submitted to the Barcode of Life Initiative and GenBank and the results will also be submitted to the Ocean Biogeographic Information System (OBIS). In August 2006, Laetitia joined the Moorea Biocode team and sampled the coral reef cryptic fauna of Moorea. The same kind of sampling and molecular analyses will be employed during CReefs Collection trips. Comparative analyses of molecular data from the different localities will allow for an interesting and innovative way to estimate biodiversity in coral reef ecosystem and to evaluate the effect of reef degradation on reef-associated species diversity.

Activities planned for the remainder of 2006

September 2006

1) First of a series of conference calls in the lead-up to the Data Tools Workshop to be held in NZ

Oct 6-28, 2006: OES 06-11 Cruise

NOAA led CReefs biodiversity cruise (see section 1)—sampling of understudied species over a range of habitats in French Frigate Shoals, NWHIMNM or Kingman Atoll, Line Islands. This cruise will include field collections and processing, implementations and testing of methodologies, techniques, data management and outreach and education activities (see section 4).

November-January 2006

- 1) OES 06-11 Cruise Report to USFWS, State of Hawaii, and NWHIMNM
- 2) CReefs Protocols document including:
 - sampling methodologies
 - processing techniques
 - sample management
 - sample tracking
 - voucher transfer
 - data sharing agreements
- 3) Ensure CReefs/NOAA Collection Database, Moorea Biocode, and NBII PBIN are complete with sample information, images etc (assign people to data entry and verification) from the OES 06-11 cruise and populate OBIS with the data.
- 4) Begin molecular laboratory analysis of well-characterized groups from FFS Cruise.
- 5) Provide an Education and Outreach update on the CReefs Website describing the activities and outcomes from the first CReefs Collection Cruise
- 6) Secure processing for unknown specimens
- 7) Secure processing funds/submit funding proposals (work with management and collaborative agencies)
- 8) CReefs Data Tools workshop, November 26-December 9, 2006

To enhance capabilities of the CReefs Collection database and processes associated with taxonomic identification, sample tracking, data entry, analysis and visualization - key Data Tools will be identified for development. Our goal is to produce an interactive web-based application bringing together significant sources of distributed coral reef data with capabilities to perform sophisticated data manipulation and analysis. A Data Tools workshop is planned for New Zealand in Nov 2006 to further this goal. During the workshop programming will commence on specific Data Tools identified by CReefs and OBIS as important in improving capabilities of both the CReefs website, OBIS and the wider community. Following this workshop, additional funds will be sought to ensure programming proceeds and tools are developed past the prototype stage.

Major Reports and Submissions

SIO Node (most relevant only)

Sala, E. and N. Knowlton. In press. Global marine biodiversity trends. Annual Review of Environment and Resources.

Anker, A., C. Hurt and N. Knowlton. Revision of the *Alpheus cristulifrons* Rathbun species complex (Crustacea: Decapoda: Alpheidae), with description of a new species from the tropical eastern Atlantic. Submitted (includes barcodes)

Anker, A., C. Hurt and N. Knowlton. Revision of the *Alpheus nuttingi* (Schmitt) species complex (Crustacea: Decapoda: Alpheidae), with description of a new species from the tropical eastern Pacific. Submitted (includes barcodes)

Anker, A., C. Hurt and N. Knowlton. *Alpheus christofferseni*, n. sp., and *A. aequus* Kim & Abele, 1988: a pair of transisthmian snapping shrimp species (Crustacea: Decapoda: Alpheidae) associated with innkeeper worms (Echiura: Thalassematidae) Submitted (includes barcodes)

June 2006 submission of proposal for Pew Fellowship on Caribbean coral reefs.

NOAA Hawaii Node

Pacific Region Integrated Data Enterprise (PRIDE) Proposal.

Submitted Feb 2006 and accepted. Funding (avail 2007) will be to prepare NOAA datasets for integration in OBIS and NBII PBIN databases.

2006 Ocean Sciences Session on “Biodiversity of Coral Reef Ecosystems”

Northwestern Hawaiian Islands Marine National Monument Permit.

Northwestern Hawaiian Islands State Marine Refuge Permit.

Northwestern Hawaiian Islands USFWS National Wildlife Refuge Special Use Permit

-The above 40 page permit applications were submitted to the management agencies of the NWHIMNM to obtain permits for the “Census of Coral Reef Ecosystems: Understudied Species and the Biodiversity of French Frigate Shoals, Northwestern Hawaiian Islands Marine National Monument” October research cruise. These documents provide background information on CoML CReefs, the NWHIMNM and history of the science involved. Details are provided about the cruise objectives, sampling techniques, methodologies, habitat selection, cultural considerations and outreach, funding sources, standards for compliance and data sharing agreements.

NOAA Oscar Elton Sette Cruise Instructions

-For October cruise--Instructs the vessel captain and crew on support needed, operational plans and needs, scientific staff, etc.

Northwestern Hawaiian Islands USFWS National Wildlife Refuge Special Use Permit: Outreach

-This document supports the outreach component of the October cruise

NOAA Diving Program Dive Plan for OES 06-11 Cruise

A cruise report will be submitted to each of the management agencies within 60 days after the cruise and it is anticipated that multi-agency collaborative publications will also stem from this effort.

AIMS Australia Node

Bay, L. K., Buchler, K., Gagliano, M. and Caley, M. J. 2006. Intraspecific variation in the pelagic larval duration of tropical reef fishes. *Journal of Fish Biology* 69:1206-1214.

- Game, E. T. and Caley, M. J. 2006. The stability of P in coral reef fishes. *Evolution* 60:814-823.
- Bay, K. L., Crozier, R. H. and Caley, M. J. 2006. The relationship between gene flow and pelagic larval duration in eight species of Pomacentrid fishes on the Great Barrier Reef. *Marine Biology* 149:1247-1256
- Kassahn, K. S., Caley, M. J., Ward, A. C., Connolly, A., and Crozier, R. H. Genomic responses of a coral reef fish to short-term heat stress identified by heterologous microarray experiments. *Molecular Ecology* (In press).
- Wakeford M, Done TJ, Johnson CR (draft). Modeling the role of local processes in structuring a coral reef community.

CReefs Affiliated

- Mora C, Andrefouet S, Costello MJ, Kranenburg C, Rollo A, Veron J, Gaston KJ, Myers RA. 2006. Ecology. Coral reefs and the global network of Marine Protected Areas. *Science*. 2006 Jun 23;312(5781):1750-1.

FMAP researchers Camilo Mora and Ransom Myers, working with their OBIS colleague Mark Costello, released the results of the first global assessment of the extent, effectiveness and gaps in coverage of coral reefs by Marine Protected Areas (MPAs). They found that less than 2% of coral reefs worldwide are within MPAs that have regulations on extraction, poaching and other major threats to these fragile ecosystems.

2. SOCIETAL BENEFITS, IMPACT & APPLICATIONS

Marine Policy or Management

Scientific findings will contribute to the overall understanding of marine biodiversity and its role in ocean ecosystems and will significantly increase scientific knowledge of coral reef diversity in regions not well studied. Scientific data and reports will lead to a better understanding of marine biodiversity, abundance, reef health, anthropogenic gradients and impacts. It could be applied to (not limited to) the following:

- 1) Greater understanding of patterns of species diversity for understudied reef associated groups over gradients of human disturbance
- 2) Knowledge of types/distribution of species obligately associated with healthy coral reefs
- 3) Prospects for maintenance of species diversity on reefs suffering various levels of human impacts
- 4) Greater understanding of amounts/types of taxonomic and ecological information required to manage reefs effectively
- 5) Assisting implementation of management practices to reduce anthropogenic impacts
- 6) Supporting creation of MPA in sensitive /threatened areas

In conjunction with the aforementioned applications, three major goals that the OES 06-11 cruise, CReefs associated and future cruises will contribute to are (1) establishment of effective research programs that provide species, genetic, and community-level information to support ecosystem-based management, (2) increased capacity for ecosystem-based management and predicting ecosystem change through retrospective analysis, the development of improved tools, and the establishment of a data management system of marine biodiversity information, and (3) the establishment of effective long-term mechanisms for the dissemination of information about

marine biodiversity and public engagement in ocean issues. We will contribute to these goals by bringing together experts in the fields of invertebrate, algal, and microbial taxonomy to thoroughly survey various marine habitats at French Frigate Shoals, to establish community based species lists and to document previously unknown species. Diversity will be documented for managers, public stakeholders, and the scientific community with a rich variety of specimens, photographs, and genetic samples. These efforts will assist managers by providing a more complete picture and baseline information regarding this pristine ecosystem and the species within it that they are charged with protecting. We will do this by combining our research efforts with existing research, providing a more complete species inventory, thereby filling critical gaps in information, and by providing research which will aid in a greater understanding of biodiversity on a local, national, and global scale. We will also contribute by bringing together other experts in management and data tools.

CReefs will populate the CReefs Collection Database and OBIS with data arising from biodiversity surveys/sampling, as well as existing data from international coral reef efforts and mined data. In the short-term, relevant collections residing at AIMS, NOAA and SIO will be targeted with externally significant datasets and data mining activities incorporated as additional resources become available. AIMS has successfully served four datasets to OBIS Australia (40,000 records) and funding will be available in 2007 to assist in preparing NOAA datasets for integration. It is recognized that a large amount of valuable data on coral reef biodiversity is scattered in the scientific literature, gray literature and in unpublished form. It includes checklists, surveys, field notes, photographs, keys and descriptions. A major goal of the CReefs project is to increase access to existing coral reef data through mining activities.

Operational Monitoring and Observations

It is a CReefs goal that sampling methodologies and protocols developed for CReefs field operations be adopted by researchers when assessing the status of understudied coral reef species in other locations. In particular, CReefs has worked with Joel Martin NHMLAC, Gustav Paulay FLMNH, and the NOAA Coral Reef Ecosystem Division to develop newly modified/enhanced Artificial Reef Matrix Systems (ARMS) modeled after ARMS developed and used by Joel Martin. These ARMS are to be tested at NOAA CRED monitoring sites throughout the Pacific for future use by CReefs and NOAA as well as other organizations. CReefs is also working with a recently developed vacuum design, created and successfully used by Philippe Bouchet's team in New Caledonia. In addition to the collection protocols, CReefs will encourage the use of the CReefs Collection Database as a data repository and sample management tool for similar biodiversity studies requiring data identification, storage, update, and tracking. Data from this database will be fed into OBIS. CReefs collection data will provide valuable baseline information for future monitoring studies at selected locations.

Data Tools will be developed by CReefs to assist with taxonomic identification, improve management of collection data, and to increase accessibility to, and synthesis of existing data through search techniques and visualization tools. Input will be sought from data managers, scientists and OBIS to ensure tool development will benefit a wide range of users. CReefs outreach (see Outreach/Education section) and in particular the CReefs website, will provide significant coral reef biodiversity information and will be linked with the CReefs Database.

Marine Industries

Greater understanding of abundance, distribution and resilience of reef species for extractive, tourism and conservation and management activities.

3. WORK PLANNED FOR 2007

Throughout 2007

Analysis of genetic samples collected in Line Islands and Moorea

Jan/Feb 2007

- 1) Proposal to the Sloan Foundation for continued support of the CReefs project.
- 2) Prepare for next field component
- 3) Submission of proposal to NSF for funding of snapping shrimp systematics/barcoding (these shrimp have >1000 species globally)

Mar 2007 –

- 1) Australian cruises (proposals for major funding initiatives for Australia and Indonesia, refer to geographic expansion)
- 2) Outreach component for Australia field effort

April/May 2007-

- 1) Begin integration of NOAA data into PBIN and OBIS (date depends on receipt of PRIDE funds)
- 2) Follow-up reports from field operations

August 2007-

- 1) Follow-up Hawaii cruise (piggy-back NOAA cruise to pick up ARMS for processing)

2007-

- 1) Sampling/data updates from cruises
- 2) If funding can be made available, hire an FMAP post doc to assist with data synthesis central to the CReefs project for the purpose of producing peer reviewed scientific papers.
- 3) Seek funding for Outreach video documentary component (tie to field expeditions)
- 4) Secure funding opportunity for a field site in the Western Atlantic (Mexico – Caribbean) to begin in 2008.
- 5) Seek funding for global expansion including sites in the Eastern Atlantic, Indian Ocean, Western Pacific, Central Pacific and Eastern Pacific.
- 6) Continue development of the CReefs website.
- 7) Publish scientific papers on DNA-based assessment of coral reef biodiversity, coral reef ecosystem paper (will also form part of CoML 2010 final report), collaborative papers and a major scientific review to high profile journal.

4. EDUCATION & OUTREACH

Over the course of the last 12 months, through multiple presentations, electronic highlights, overviews and discussions, CReefs-led and other workshops and conferences, conference calls and meetings, brochures and posters, CReefs has been reaching out to experts in taxonomy, data information systems, and management agencies to bring together expertise, partnerships and collaboration on an international level. As a result of this, the project is developing collaborations at a rapid rate and has brought some major players in coral reef research on board. The project has been posted in the CoML news/highlights, and CReefs accomplishments and news have been in the NOAA Pacific Islands Fisheries Science Center highlights on a weekly basis for NOAA personnel and management to view.

September/October 2005

CReefs in conjunction with NOAA Pacific Islands Fisheries Science Center, took part on Kona Community Day, during the annual bill fishing tournament, in an outreach exhibit in which it had its own joint display with the NOAA Coral Reef Ecosystem Division. With this, CReefs was on two local Hawaii news channels (for Hawaii community viewers).

CReefs, its ties with the CoML and regional/global data integration goals were presented to the Hawaii NOAA GIS Users Group, who took a keen interest in the project(s) and thus combined efforts in the development of the NOAA PRIDE grant proposal.

CReefs presented to and immersed 200 students grades 3 -12 in the effects/threats of marine debris to coral reef ecosystems in anticipation of the *20th Anniversary of the International Coastal Clean-up* and also discussed career development with these groups. This was extremely successful—the students were captivated and ready to make a difference and many of them took part in the clean-up effort to follow.

CReefs developed a poster for the CoML conference in Germany, which in turn has caught a large amount of attention from NOAA PIFSC and headquarters—who either have it on display or have requested it for display. This will be updated for the upcoming October 2006 cruise...time permitting.

January/February 2006

CReefs worked to secure a web site placeholder with NBII PBIN and reserved its site domain (www.creefs.org).

CReefs Official Announcement took place in a joint effort between Scripps Oceanography, AIMS, NOAA, and CoML. The announcement reached several countries.

CReefs reached out with the Ocean Sciences session and Workshop in February and as mentioned previously, brought many experts on board. Also during this time, we brought another NOAA faction onboard, National Centers for Coastal Ocean Sciences, which resulted in the joint submission of the funded data-integration PRIDE proposal. Knowlton gave an invited plenary talk at this major meeting on coral reef biodiversity and conservation.

March-June 2006

Hawaii Node Coordinator out of commission for medical reasons

April 2006

PI Dr. Brainard presented as a keynote speaker at a major coral reef conference in Georgia.

June 2006

The CReefs Hawaii node coordinator had been accepted in 2005 to participate in a joint NOAA and Project WET (Water Education for Teachers) Coral Reef Education Project Workshop to assist in the development of a *Coral Reef Reader and Study Guide* and *Coral Reef Educator's Guide* for high school students and the public in Miami Florida—this had been postponed until June 21-24, 2006 as a result of possible dangers involved with Hurricane Rita. Moews participated in the workshop in June which brought together a diverse group of teachers, scientists, and outreach experts from all over the nation. The workshop was highly successful and the curriculum is under development. Furthermore, CReefs has plans to work with the CREP program to provide information from the upcoming OES 06-11 cruise.

August-October 2006

Information regarding CReefs and the upcoming cruise have been provided to the NOAA Headquarters website.

The following preparations are underway for the OES 06-11 cruise:

The proposed cruise activities will involve a dedicated outreach component. A website dedicated to the CReefs effort is currently under development with the combined efforts of Randy Kochevar (Ad2 and ToPP), AIMS, and NOAA, which will lead to on-line information regarding the activities performed, data collected and outreach during the cruise. In particular, CReefs is coordinating with Randy to create a strong splash screen for the introduction to the website, with the future possibilities of a downloadable screensaver including a rich variety of coral reef species and an educational CD-ROM. Outreach relative to the cruise will be placed on a number of sites including, but not limited to NOAA, CReefs, and Navigating Change, all of which will be updated simultaneously by CReefs and PBIN. It will include information about this unprecedented effort and its findings, cooperation between the scientists that brought this effort to fruition, biographies, and a means for interaction. Outreach and education personnel, including representatives from the Marine National Monument, NOAA PIFSC, and CReefs will package scientific findings and expedition notes into multiple formats that can be used for a variety of educational and outreach purposes. They will work with teachers from at least 5 separate high schools who are excited to implement the cruise material into their curriculum by following the progress of the cruise, and structuring multiple lesson plans around the research conducted. A memo regarding the cruise/website will be forwarded on to the coral list and Navigating Change, and other lists. There will be web-based interactions whereby the students will learn from pictures, species descriptions, scientists' experiences, and question/answer sessions. Creative angles will be taken in which the students will conduct comparative studies between species found in their own areas such as Kaneohe Bay, Oahu and the location of sampling, French Frigate Shoals, through the frequently visited Google Earth and/or they will be asked to conduct their own research and create a magazine, comic book, newspaper, report,

storybook, poetry, art or something similar to report their findings/what they have learned. From this, we will request that the teachers (time permitting) take this project a step further and have the students do outreach of their own, by presenting their projects to other students in other grades or classes. Furthermore, information from this cruise will be provided to the Coral Reef Education Project, a combined effort between NOAA and the international project Water Education for Teachers (WET), for use in the Student Reader and Study Guide (which are currently being developed) for high school, college, and public coral reef education.

An extra space has been made available on the cruise for an outside outreach component with previous experience in the NWHI--award-winning photographer Susan Middleton. Middleton, former chair of the California Academy of Sciences department of photography (1982-1995), has been “dedicated to the documentation and portraiture of rare and endangered animals, plants, sites, and cultures for the past 30 years, inspired by the earth’s biological and cultural diversity.” In conjunction with National Geographic and the permission of USFWS, she recently co-produced the NWHI “Archipelago: Portraits of Life in the World’s Most Remote Island Sanctuary”. In this book, capturing the intrinsic beauty and life in the NWHI, Middleton states that “their inaccessibility and need for protection mean that few people will be able to see and experience these islands and reefs directly. For us, this presents a unique challenge—the importance of sharing this national public treasure to help create the awareness, and the appreciation, that will be critical to its future protection”(Liittschwager & Middleton 2005). Middleton has expressed enthusiasm toward the proposed research at FFS and in raising public awareness of the understudied and less celebrated inhabitants of coral reefs. She is dedicating her efforts to outreach for the project and pending the management agencies’ approvals, will be producing a book similar to Archipelago through National Geographic or a similar group with a broad reach. Her photos will be available for management and outreach to USFWS, the State, NOAA’s Marine National Monument and Pacific Islands Fisheries Science Center, and CoML CReefs. Middleton will also provide a set of outstanding printed photographs for exhibits. The potential for Middleton to carry this project through future field efforts with CReefs is also on the table .

Pending ship delays, a media advisory will be released through NOAA’s Pacific Islands Fisheries Science Center and the Census of Marine Life and a send-off for the scientists will take place at the NOAA vessel Sette including a traditional Hawaiian ceremony prior to departure to sanction the gathering of knowledge, with respect for cultural traditions and a slide show of the Northwestern Hawaiian Islands. This will be open to the classrooms and agencies involved and the media. A post-cruise press conference will also be sought out and pending funds, a video b-roll could be provided.

Note: The Hawaii Node Coordinator has been immersed in the management and coordination of a large portion of the project’s efforts including the Ocean Sciences Session, February Workshop, proposals, weekly meetings and conferences calls, permits, cruise preparations, etc. (and limited by medical issues) and thus has had limited amounts of time to dedicate to focused outreach. It is anticipated that with the upcoming cruise and resources for future assistance in this effort that outreach can play a much larger role in the effort.

In October, Knowlton will give invited address to the Yale Institute of Biospheric Studies on coral reef biodiversity and conservation.

5. GEOGRAPHIC EXPANSION

Cruises

2006-7 Hawaii

2007-8 Australia (major corporate sponsor being targeted)

2008 – Caribbean (probably Panama)

Affiliated Projects

Moorea BIOCODE – Chris Meyer

Philippe Bouchet –Vanuatu project, funded through Sloan, identified as a CReefs associated project

Gustav Paulay – CReefs affiliated

Seabed Biodiversity of the Great Barrier Reef

Barcoding

Sao Tome Expedition (Knowlton participant)

Collaboration with FMAP: Pacific Reef Fish collaboration (JC) - Anthropogenic impacts on coral reef fish communities of the Pacific. Web site has been established parefico.biolog.dal.ca. Possible collaboration via Camillo Mora (pending Pew proposal, submitted June 2006)

Discussions between Mike Sinclair and Julian Caley regarding the establishment of a SCOR working party to investigate the utility of habitat mapping in prediction of biological communities across diversity gradients and types of communities.

6. PARTNERSHIPS & COLLABORATION

a. Partnerships

Organization Name	Point-of-Contact (Name)	Nature of Relationship
SIO	Nancy Knowlton	PI
NOAA PIFSC	Russell Brainard	PI
AIMS	Julian Caley	PI
NOAA: NCCOS, Coral Reef Conservation Program, Marine National Monument, CoRiS	Mark Monaco, Alissa Barron, Andy Collins/Randy Kosaki, Parmesh Dwivedi	PRIDE data integration, outreach, outreach/management agency, Data integration
Florida Museum of Natural History	Gustav Paulay	CReefs Executive Committee, taxonomic advisor
Paris MNH	Phillipe Bouchet	CReefs associated project
Berkley	Chris Meyer	Project Coordinator Moorea Biocode Project
HIMB	Jo-Ann Leong	CReefs Executive Committee

University of Hawaii	Tom Schroeder/Alisson Sherwood	JIMAR resources/ UH Botany
CSIRO, AIMS	Roland Pitcher/Peter Doherty	PIs for Seabed Biodiversity Project
USFWS	Don Palawski, Jim Maragos	Management agency
NBII PBIN	Mark Fornwall, Derek Masaki	OBIS, web host, data management
Bishop Museum	Lu Eldredge	Advisory Committee
NHMLAC	Joel Martin	Advisory Committee
OBIS	Mark Costello, Tony Rees	Collaboration, advisor
State of Hawaii	Dan Polhemus	Management agency
Woods Hole, UC Merced	Linda Amaral, Monica Medina	Microbial collections/processing
Smithsonian	Jon Norenburg	Scientific Consultation

See also previous report information on affiliations.

b. Links to Other CoML Ocean Realm Projects

Project Name	Cross-Over Person(s)	Nature of Relationship
NaGISA	Sogin/ Knowlton (Hiro Fukami is Japan POC for CReefs)	Coral reef ecosystems/shore areas
ICoMM	Sogin/Knowlton	Microbes/cruise and protocols
ToPP	Randy Kochevar	outreach
FMAP	Camilo Mora, Ransom Myers	Coral reefs--future

c. Links to CoML National and Regional Implementation Committees (NRICs)

We will be working over the next six months to enhance these connections. Currently our primary affiliations with Europe and Japan are as noted above.

d. Liaisons to CoML Cross-Cutting Groups

Project Name	Liaison Name & Institution	Nature of the Relationship
OBIS	Mary Wakeford/Julian Caley	Data provider, tool builder
HMAP	Nancy Knowlton	Collaboration
FMAP	Julian Caley/Nancy Knowlton	Collaboration
SCOR Tech Panel		
E&O	Russell Brainard/Megan Moews	Liaison
Barcoding	Nancy Knowlton	Major contributor to the Barcode of Life initiative

e. Effectiveness of the Partnerships and collaborations

- Lack of clarity regarding the progress of funding for FMAP postdoctoral fellow.

- Need more personnel resources in order to free up time to fully grasp and work with partnerships, collaboration, and outreach. Having worked with these groups to the degree possible—all have seemed ready and willing.