CenSeam:
a Global Census of Marine Life on Seamounts

DRAFT
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Note:  This document is a draft.  There are several components still under active
development – these are outlined in an addendum following the proposal text.  We expect
these items to be finalized in time to be processed for the April 15 Sloan Board meeting.
1. BACKGROUND

The Census of Marine Life (CoML) is an international science research program with the goal of assessing and explaining the diversity, distribution and abundance of marine life – past, present and future. CoML field projects are sampling understudied marine realms with the goal of creating a synthetic understanding of the patterns of life in the oceans by 2010.

In August, 2003, a workshop in Newport, Oregon, brought together 33 seamount scientists from 11 countries (Appendix H) to overview the current state of knowledge on seamounts and to evaluate the usefulness and timeliness of developing a new CoML field program on seamounts. The workshop participants concluded that such a program could have a significant impact by energizing seamount science globally and by contributing fundamental new knowledge of a major and understudied ocean habitat to the CoML's efforts. Below, the rationale for the program (named Cen Seam, for "A Global Census of Marine Life on Seamounts") and its proposed activities during the initial 2-year planning phase are outlined.

2. SEAMOUNTS – WHAT IS KNOWN

Seamounts are submerged mountains in the ocean's floor, generally caused by volcanic activity. Their summits can vary from a few meters to several kilometers below the water's surface. While the true number of seamounts is unknown, because most of the ocean floor remains unmapped in detail, it is estimated that there are more than 100,000 seamounts over 1 km high and many more of smaller elevation (Wessel 2001; Fig. 1), making them ubiquitous deep-ocean habitats.

Seamounts have been sampled since the time of the Challenger expedition, but only in the last few decades have deep-water sampling gear and underwater vehicles (towed cameras,
ROVs, submersibles) allowed for detailed community sampling, mapping and imaging. At least 253 seamounts have been sampled biologically, though this includes many that have received only opportunistic observations of a few species and those for which the data are lost or currently inaccessible (Fig. 1). From the sampling undertaken to date a picture has begun to emerge of the biological communities that exist on seamounts. Rather than provide an exhaustive review of the state of knowledge of seamount communities, we will summarize the key points that are most relevant to the CoML mandate.

**Seamounts support unique biological assemblages.** The species compositions of seamounts differ from those of the surrounding deep-seafloor and continental margins of similar depth. Because of the winnowing of currents over seamount topography, many seamounts have rocky substrates (unusual in the deep-sea) where emergent epifauna such as corals, crinoids, and sponges can live. Some deep coral reefs and sponge beds have been aged at hundreds to thousands of years, and can support hundreds of associated species (Rogers 1999; Kelly and Rowden 2001). Because they often have elevated biomasses, seamounts act as feeding grounds for migrating fishes, marine mammals, and seabirds (Hui 1985; Blaber 1986; Haney et al. 1995).

Seamounts are particularly known for supporting high numbers of endemic species (species found only on one seamount or seamount chain and, to date, nowhere else in the ocean). In several recent studies, 30-50% of species found were new to science and potential endemics (Parin et al. 1997; Richer de Forges et al. 2000; Koslow et al. 2001); this amounted to literally hundreds of new species. In one area, nearby seamounts on a single ridge shared a median of only 21% of their species in common (Richer de Forges et al. 2000). Despite the fact that in other regions the rate of endemism is "only" 5-15% (Rowden et al. 2002, 2003, 2004), given the large number of seamounts in the world’s ocean their contribution to marine biodiversity may be
significant. "Relict" faunas – lineages previously thought long extinct – have also been discovered on seamounts (Kelly and Rowden 2001; Schlacher et al. 2003). Because of the geographic, hydrographic and topographic isolation of most seamounts, the probabilities of finding novel species, physiologies, ecologies and chemistries with future study is high.

*Seamount research can advance marine biogeography.* The mechanisms of faunal dispersal across ocean basins is one of the key unknowns in our understanding of the present-day biogeography of deep-sea fauna. It has been proposed that seamounts play several important roles in basin-scale marine biogeography, acting as regional centers of speciation, stepping-stones for dispersal across ocean basins and boundary currents, and refugia for populations with shrinking range (Hubbs 1959). Seamounts, with their wide distribution and abundant faunal
assemblages, offer case studies for evaluating the importance of large-scale currents, meso- and local-scale eddies, life history characteristics, geographic settings and geological history to community structure and rates of gene flow.

3. **Societal Benefits of CenSeam**

Over 76 species have been commercially harvested from seamounts (Rogers 1994), including major fisheries for orange roughy, pelagic armourhead, oreos, rockfish, and alfonsino.

To date, most of these fisheries have not been sustainably managed, with many examples of fisheries opening and collapsing within a decade (e.g. Uchida and Tagami 1984; Koslow et al. 2000; Clark 2001). Efforts to improve management are widespread, with regional fisheries management organizations and bilateral and multilateral agreements arising to restrict fishing pressure or issue moratoriums. Furthermore, there is growing concern over the damage that deep-sea trawling can have on the benthic communities on seamounts (e.g. Clark & O’Driscoll *in press*). Led by Portugal, Australia, and New Zealand, individual countries have started citing marine protected areas on seamounts. In 2004 the United Nations General Assembly will begin discussions on a mechanism for declaring protected areas on seamounts in international waters, a process that will likely continue for several years. All of these efforts require a scientific foundation that does not currently exist. For example, it is currently not possible to advise on whether seamounts should be managed individually or as chains or groups that interact, nor can hotspots of diversity or endemism be mapped outside of a few well-studied regions. While CenSeam will not make management recommendations, it can play a critical role in providing the science required for management and policy decisions.
4. RATIONALE FOR CenSeam

Seamount ecology has been recently energized, first by the discovery of highly endemic and unusual fauna in several recent studies, and secondly by growing concern over the impacts and sustainability of commercial deep-sea fisheries on seamounts. As Appendix F indicates, many seamount activities are already ongoing or in development globally, and millions of dollars are being contributed to new expeditions. However, in large part these efforts are uncoordinated, resulting in inefficient sampling, data that cannot be compared across regions, lost opportunities, and major gaps in sampling coverage. Furthermore, because it is not feasible to sample all 100,000+ seamounts, future sampling must be strategically guided by a global perspective to fill critical knowledge gaps and target understudied regions and types of seamounts. CenSeam can provide the framework needed to integrate, guide, expand, and leverage off of these efforts in order to build towards a global understanding of seamounts.

In addition to new sampling, CenSeam will also work to consolidate and synthesize existing data. Sampling to date represents millions of dollars of investment yet in many cases the data are functionally inaccessible to the scientific community, being distributed in hundreds of publications, "grey literature" reports, and unpublished institutional holdings. Accessing and analyzing these data for emergent patterns (and using them to help guide future research) will be an important means of increasing our knowledge of seamount ecosystems.

The goal of CenSeam is to provide a framework to catalyze new seamount sampling activities, coordinate existing and planned programs for maximum impact, and integrate and analyze incoming information to create new knowledge. As with all CoML Field Programs, CenSeam will extend until 2010, and all three of these work components will continue in parallel. The planning and expansion phase, which is proposed here, will run from 2004 to 2006.
2006-2009 will focus heavily on field expeditions, and 2009-2010 will emphasize information integration. By the end date of 2010 we expect to have created a strong, united seamount research community that has made 1) significant progress towards globally representative sampling of seamount types and locations; 2) significant progress on the science questions outlined above; and 3) a comprehensive new understanding of seamount ecology to contribute to the CoML's final report.

5. CenSeam Science Priorities: The "Knowable Unknowns"

Despite considerable research to date, there still remains much to be learned about seamount ecosystems. The primary task of the August 2003 CoML Seamounts planning workshop was to identify those areas of highest priority for a future global research program. These will form the science foundation of CenSeam. Overall, CenSeam will seek to answer:

*What roles do seamounts play in the biogeography, biodiversity, productivity, and evolution of marine organisms and what is their effect on the global, oceanic ecosystem?* This question is broken down into the following specific research themes. (For more complete details see the workshop report: Stocks et. al. *in press*; seamounts.sdsc.edu/workshop)

**A. What factors drive seamount community structure, diversity, productivity, and endemism, both at the scale of whole seamounts and individual habitats within seamounts?**

While rates of endemism on seamounts can be high, this varies substantially by seamount as does community composition. What are the factors (e.g. depth, shape and size, location, spatial isolation, surface productivity, hydrology, geological age, substrate type, etc.) that influence seamount community structure? Can this understanding be used to predict the communities on unsampled seamount?
B. What are the impacts of fisheries on seamount community structure and function? To what degree do seamounts represent already-impacted systems?

C. What are the key processes influencing the differences in community structure observed between seamount and non-seamount regions, among seamounts, and among habitats within an individual seamount? To what degree are seamounts genetically isolated and limited by dispersal and recruitment dynamics? To what degree do seamounts interact with surrounding deep habitats? In other words, what is the spatial and ecological "footprint" of a seamount in the surrounding ocean with respect to productivity sources and sinks, food web connectivity, and physical factors that influence biology (i.e. shedding productive eddies)?

D. What roles do seamounts play in global oceanic ecosystems with respect to biogeography, biodiversity, evolution, and productivity. What part of the ocean's biodiversity is held by seamounts? Are seamounts significant centers of speciation in a global context? Are they sources or sinks of productivity? What are the key processes?

6. PROPOSED ACTIVITIES AND GOALS

Below, each of the core activities proposed for CenSeam is described. They are not listed in chronological order, as most will interact and run in parallel.

Goal 1: Fostering new field expeditions

The program will identify priority regions and opportunities for attracting funding to launch new field programs. CenSeam will assist the community to assemble the resources and expertise required for successful projects by 1) identifying regions or types of studies that are of high priority to the global knowledge base and which have potential for funding; and 2) providing seed funding for development activities. The CenSeam network has the potential to
build multi-institution and multi-national collaborations that are expected to be highly competitive for funding.

**Activity 1.1 Community workshop**

One large workshop will be held in year one, in association with the second Steering Committee meeting, to assemble members of the international seamount research community. Travel funds will be provided for SC members and ~15 additional key members of the research community. The goals will be to prioritize regions and types of studies, identify proposal opportunities for new seamount expeditions, and assemble working groups to pursue those proposals. Priorities will be based on the potential contribution to global seamount biogeography and the potential for successful expeditions based on community interest, appropriate expertise and resources, and funding avenues. Furthermore, the workshop will serve to raise awareness of Cen Seam and CoML within the scientific community and encourage involvement in its various activities. We are in discussion with Telmo Morato, Ricardo Santos, and Tony Pitcher to merge the Cen Seam workshop with a seamount ecology and fisheries conference planned at the University of the Azores in early 2005, the proceedings of which proposed as a devoted, peer-reviewed volume in Blackwell's Fish and Fisheries series.

**Activity 1.2 Proposal planning support**

Based on output from the community workshop, target regions will be identified for proposal writing activities. Based on Steering Committee recommendations, funds will support two international proposal-writing efforts with $10,000 subcontracts; the funds can be used for travel for potential collaborators to meet or for salary needed by organizers. It is expected that
the coordinating and networking activities of CenSeam will result in far more than two proposals, as not all will need funding to proceed.

**Goal 2: Expanding and coordinating existing and planned seamount research**

Another main goal of CenSeam will be to maximize the impacts of the many existing and planned seamount projects (Appendix F).

**Activity 2.1 Standardized methods**

A working group composed of representatives of affiliated projects will create recommendations for standard methods and data reporting practices. This will begin as a breakout session during the proposed community workshop and continue via remote communications.

**Activity 2.2 Community networking**

Given the many groups and countries that have ongoing interests in seamount research, hold important expertise (such as taxonomists), or manage relevant resources (such as ships, ROVs and submersibles), CenSeam will facilitate collaborations by:

- Compiling a contact list of experts interested in participating in seamount research.
- Affiliating with existing seamount research programs through a Memorandum of Understanding outlining mutual support (Appendix G). This will include data sharing agreements, and informing CenSeam of ongoing or planned activities.
- Creating an electronic newsletter and bulletin board. For example, groups will be able to announce that they have an open berth on an expedition, or that they have samples within particular taxonomic groups and are seeking identifications.
Activity 2.3  Mini-grants to expand the scope of otherwise-funded expeditions.

The Steering Committee will seek applications for and award mini-grants that will substantially expand the scope of funded seamount research activities. For example, an expedition with an open berth may be able to add an entirely new research component for just the cost of a new participant's travel to the port of departure. Or a cruise may request funds to ship samples to an additional taxonomist, or add genetic or isotopic analyses. Expenses required to meet CenSeam standardized methods recommendations are also fundable, as is further work on unprocessed samples preserved from past expeditions.

Goal 3: Data Management and Data Analysis

As important as new field sampling is, the research will be incomplete without synthesizing and analyzing both existing and incoming data to create new knowledge about the patterns and processes operating on seamount communities.

Activity 3.1 Seamount database and information system

To make the fruits of past seamount research available to future research planning and analysis, we will expand the existing, open-access SeamountsOnline database and information system developed by Karen Stocks (seamounts.sdsc.edu) to include data from more seamounts, bathymetry maps, and descriptive information on sampled and unsampled seamounts (geological age, substrate type, etc.). The secretariat will oversee system expansion and data entry from the literature, and will solicit data from sources such as affiliated field programs, research institutions, museum collections, the commercial fishing community, and fisheries management organizations. SeamountsOnline is already serving data freely through its own website and
through the Ocean Biogeographic Information System (OBIS) and will continue to serve as CenSeam's primary contribution to OBIS. Karen Stocks, who is on the OBIS Technical Working Group and the OBIS Steering Committee, will act as the OBIS liaison.

Activity 3.2 *Mini-grants for data digitization/preservation/translation/quality control*

Many large and high-quality datasets are not currently available, lurking in undigitized form or insufficiently documented for use. While the scale of funds available will not cover the full expense of major digitization and quality control projects, our experience to date indicates that even modest funds (e.g. to support an undergraduate assistant for data entry) can stimulate work that the investigator is interested in completing, but would otherwise not prioritize as highly. Awardees will be selected by the Steering Committee.

Activity 3.3 *Comprehensive analysis and synthesis*

A working group will conduct data analyses on the integrated database being compiled. Guided by the program's science priorities, the focus will be on understanding patterns in seamount biodiversity, endemism, community structure, and genetic structure. The first activity will be descriptive: what are the patterns, where are the hotspots, where are the gaps? The second phase will be mechanistic: relating community structure to, e.g., geological age, depth, latitude, hydrology, larval dispersal, and evolutionary processes. Outputs of the working group will also be valuable for guiding research priorities.

The working group will meet during a breakout session at the community workshop to identify key tasks to be completed by group members over the following year. In year 2, a workshop will bring the members together to evaluate progress and plan for a synthetic, high-
profile overview publication. Members of the CoML FMAP program (Future of Marine Animal Populations), including Ransom Myers, will participate in the working group to supply modeling and statistical expertise.

**Goal 4: Public education and outreach**

*Activity 4.1 Public website*

The program website will have a section targeting outreach, including public-level descriptions of the program and seamount ecology, and video and still imagery from seamounts. This site will be registered with educational projects such as the US Digital Libraries program.

*Activity 4.2 Broad publication*

CenSeam will use publications in multiple venues to raise awareness of seamount science and CenSeam program outcomes. In addition to peer-reviewed, discipline-specific journals, CenSeam will target high-profile venues such as *Science, Nature*, and *BioScience*. For example, *Science* writer David Malakoff has expressed an interest in following his August 2003 news feature on the increase in seamount research with an article on the launch of CenSeam. Nancy Baron, the Ocean Science Outreach Director for SeaWeb and a communications expert, will advise on channeling CenSeam science into these outlets.

The secretariats will also foster general-public media coverage by creating press releases, compiling high-quality image banks, and directing journalists to appropriate experts for interviews. They will also seek to publish a seamount book aimed at the educated public, which may coordinate with a book Tony Koslow has been contracted to produce for the University of New South Wales Press on deep sea ecology.
Activity 4.3 Supporting the CoML education and outreach effort

CenSeam will provide materials to the CoML outreach office by 1) writing general-level materials for the CoML ed/outreach website; 2) contributing to the annual highlights report; 3) compiling high-resolution seamount still and video imagery suitable for PR materials and an Omnimax/IMAX-style movie; and 4) seeking seamount cruise opportunities appropriate for teacher participation (e.g. through the Teacher Armada program). The proposed postdoctoral associate will act as the ed/outreach contact point.

Activity 4.4 Museum exhibit

We are in discussions with several institutions that produce museum displays to create a seamount exhibit (see Addendum for current status).

Organization and Management

Secretariats. The project will have two secretariats, one for the northern hemisphere, hosted jointly by Scripps Institution of Oceanography's Center for Marine Biodiversity and Conservation (CMBC) and the San Diego Supercomputer Center (SDSC) in the USA, and one for the southern hemisphere, hosted by the National Institute of Water and Atmospheric Research (NIWA) in New Zealand (see letters of support in the appendices.) Each secretariat will be responsible for regional networking and outreach (the Southern secretariat will have responsibility for the entire Indian Ocean). The Northern secretariat will also oversee databasing and data analysis efforts (SeamountsOnline is already served from SDSC) and overall program administration.

Staff. Karen Stocks will oversee the northern secretariat, supported by a full-time postdoctoral researcher having responsibility for day-to-day management. Malcolm Clark will
oversee the southern secretariat, supported by Ashley Rowden, a fellow seamount research scientist at NIWA (CVs can be found in the attached appendices.) We have not yet identified a person for the postdoctoral position. While finding a strong candidate is an immediate priority, Karen Stocks will have sufficient salary support from this proposal and her allied NSF seamounts grant to carry the program forward while conducting a thorough search to find the most qualified candidate.

A Steering Committee composed of scientists representing a broad spectrum of relevant expertise and countries of origin will serve to guide the program's development and to advance the program within their home countries and institutions. The following people have agreed to serve on the Steering Committee.

- George Boehlert, Oregon State University, US (ichthyology, plankton)
- John Dower, University of Victoria, Canada (biophysical interactions)
- Baban Ingole, National Institute of Oceanography, India (benthic ecology)
- Tony Koslow, CSIRO, Australia (fisheries ecology)
- Gui Menezes, University of the Azores, Portugal (fisheries biology)
- Alex Rogers, British Antarctic Survey (deep corals, polar systems)
- Thomas Schlacher, University of the Sunshine Coast, Australia (taxonomy)
- Tim Shank, Woods Hole Oceanographic Institute, US (evolutionary and population genetics)

In addition, the following people will be invited to attend the first SC meeting and, if they prove strong contributors, will be asked to sit permanently: Tsukamoto Katsumi, University of Tokyo, Japan; Andrey Gebruk, P.P. Shirshov Institute of Oceanology, Russia; and a geologist yet to be determined.
As defined in the activities outlined above, tasks such as regional proposal efforts and data analysis and synthesis will be conducted by working groups overseen by the secretariats.

**Timeline and Deliverables**

*0-6 months:* First steering committee meeting held. Community outreach to create lists of interested specialists and to affiliate programs. Website expanded to include outreach materials and community bulletin board. Database expanded and used to create a "gap analysis" of existing seamount coverage. Candidate priority regions and proposal opportunities solicited.

*6-18 months:* Community workshop held, proceedings published in peer-reviewed literature. Mini-grants distributed by SC resulting in proposals submitted for at least two new, international expeditions. Working group on standards formed and recommended standards document produced. Data analysis working group formed, scope and distribution of work determined, and preliminary results produced.

*18-24 months:* SC meeting to plan next phase of program. Publication of results from expeditions and data analysis components in multiple outlets. Continued proposal submissions.

**Relationships to other CoML Programs**

Two CoML programs already include seamount components: Mid-Atlantic Ridge Ecosystems (MAR-ECO) and the Gulf of Maine Area (GoMA). To avoid competition with these programs, and to make use of their well-developed networks of seamount researchers, CenSeam will act to support and expand their activities within their geographic focus regions, and target new initiatives in regions not already covered. Franz Uiblein will act as liaison between CenSeam and MAR-ECO, and the postdoctoral researcher will liaise with GoMA.

Chemosynthetic Ecosystems (ChEss): Seamounts and vents/seeps are sampled through
similar means, and are often in close proximity (in fact, there are many hydrothermally-active seamounts). Collaborative cruises between these two programs will be pursued, such as the possibility of writing proposals for additional time with the Pisces submersible while it may be sampling vents and seeps near New Zealand on the NZ ship *Tangaroa* in late 2005, or with the Alvin submersible when the Atlantis is transiting directly over the New England Seamounts in late 2005. Lisa Levin, who is on the ChEss steering committee, will act as liaison.

**CeDaMar** and the emerging **Abyssal** and **Margins** programs share a need for similar taxonomic specialists and have the potential for shared cruises or comparative data analyses. Lisa Levin will act as liaison to these programs.

**POST** and **TOPP**: Tagging technologies can be used to address the critical questions of to what extent seamount communities are connected through individual movements to surrounding communities, and what is their importance as feeding grounds for migrating fishes, marine mammals, and seabirds. George Boehlert will liaise with these groups to explore, for example, the positioning of POST listening stations on NE Pacific seamounts.

**SCOR**: CenSeam has been invited to attend the next meeting of the SCOR New Technologies for Observing Marine Life working group to present technology needs and discuss the potential for SCOR assistance.

**Barcoding of Life**: Genetic methods, including rapid identification through barcoding, will be extremely important in studying diverse and highly endemic seamount species. The standard methods group will consider recommendations for preserving samples or subsamples for later genetic analyses, and we will actively seek to contribute to the BoLD genetic library as it develops. SC member Tim Shank will act as liaison.

Interactions with **OBIS**, **FMAP** and **CoML Education and Outreach Effort** are
described under activities 3.1 and 3.3, and 4.3 respectively.

7. **Budget – For 2-Year Initial Phase** - This is a draft and will be re-evaluated as items in the addendum are resolved

<table>
<thead>
<tr>
<th>Salary</th>
<th>Amount</th>
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<tbody>
<tr>
<td>Karen Stocks (~4 mo/yr)</td>
<td>$60,000</td>
</tr>
<tr>
<td>Postdoctoral researcher (full time)</td>
<td>$102,000</td>
</tr>
<tr>
<td>Programmer/website developer (2 mo/yr)</td>
<td>$32,500</td>
</tr>
<tr>
<td>Lisa Levin (1 wk/yr)</td>
<td>$6,000</td>
</tr>
</tbody>
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| Equipment: Desktop computer     | $2,000 |
| Supplies: office supplies, software, phone charges, etc. | $6,000 |

| Workshops: 2 Steering committee meetings (15 people, 3 days) | $50,000 |
| Community workshop                        | $50,000 |
| Analysis workshop                          | $16,000 |

| Travel: For secretariat representatives | $16,000 |
| Outreach: Publication/Book costs         | $18,000 |
| Nancy Baron: 5 days/year consulting      | $8,000  |
| Museum exhibit                           | $20,000 |
| Brochures, supplies, image license fees, etc. | $5,000 |

| Subcontracts: NIWA - for southern secretariat | $67,840 |
| Proposal planning subcontracts (2)           | $20,000 |
| Data acquisition subcontracts (3)             | $21,000 |
| Sampling expansion subcontracts (3-4)         | $20,000 |
| Tony Koslow                                   | $10,000 |

| Direct Costs | $530,340 |
| Indirect @ 15% | $79,551 |
| Total        | $609,891 |
| SDSC matching funds | $(10,000) |
| **Requested funds** | $599,891 |

**Budget Notes**

- Salary estimates include benefits and mandatory systems administration fees
• The programmer/web developer will assist with expanding SeamountsOnline as described in the data system and outreach components.

• The community workshop will pay the travel and accommodation costs of the Steering Committee and key members of the standards and analysis working groups.

• Travel for secretariat members is essential for CenSeam to coordinate other programs, visit potential participants, present results at scientific meetings, etc.

• The NIWA subcontract includes 150 hours/year for Malcolm Clark, 100 hours/year for Ashley Rowden, ~100 hours/year for administrative support (including hosting one of the Steering Committee meetings), and travel (see above rationale).

• Lisa Levin will assist with liaison to other deep-sea programs, including ChEss, CeDaMar, and the developing CoML margins and abyssal programs. She will seek collaborative proposal opportunities.

Additional Supporting Funds (see appendices for letters of support)

The northern secretariat co-hosts are offering $10,000 in matching funds (from SDSC), waived room charges for meetings, 1 week/year of Lisa Levin's time (a 1:1 match), and access to CMBC’s administrative staff for logistical support such as workshop planning (from CMBC). In addition, CMBC has funds for graduate student fellowships through a new interdisciplinary graduate program aimed at marine biodiversity and conservation studies. While these fellowships must be awarded through a competitive process, CMBC sees work proposed here as appropriate for a student in their program, and encourages CenSeam to seek a qualified graduate student applicant.

SeamountsOnline has already benefited from a $100,000 NSF DBI grant to K. Stocks for
initial development. The NMFS has committed $60,000 for entry of seamount data from the P.P. Shirshov Institute of Oceanology, and the Natural Resources Defense Fund is currently paying K. Stocks and Rainer Froese $15,000 for literature data entry and a summarization of existing knowledge of seamount ecology. A $200,000 NSF ADVANCE grant for 2004-2007 will support ~4 months/year of K. Stocks' time to expand the data contents of SeamountsOnline and conduct global analyses in-line with CenSeam priorities.

Support for the southern secretariat by New Zealand Ministry of Fisheries (Mfish) includes a NZ$3.5 million commitment to future seamount research, mainly for new expeditions. In addition, NIWA is seeking funds to support a graduate student or postdoctoral researcher devoted to seamount taxonomy. A formal Memorandum of Understanding will be developed for the final draft of this proposal.

**Future Funding Strategies**

As Appendix F indicates, there are a variety of institutions interested in funding seamount research. The initial phase of CenSeam is structured to support the production of successful proposals for future field programs. In later years, the secretariat will work to increase the funds available for seamount research from non-traditional sources such as pharmaceutical and biomaterials companies interested in the novel diversity on seamounts. The potential of combining paid ecotourism with seamount research using the Keldysh/MIR is also under discussion. As demonstrated above, we recognize that seamounts are emerging as important management issues within many countries and internationally. We will work with management agencies to create the knowledge system they need for effective management, and see this as a longer-term source of support.
ADDENDUM: Components in Development

1. *The Role of Tony Koslow.* Tony Koslow is an experienced seamount researcher at CSIRO in Australia. On Feb. 19th he will go before the Science Directions Team of CSIRO to argue for an Australian contribution to the CenSeam program in the form of devoted ship time and support for his involvement. Depending on the outcome, Tony may be asked to chair the CenSeam Steering Committee and take on the development of Indian Ocean activities for the southern secretariat.

2. *In-kind support for the southern secretariat.* The commitment of the New Zealand Ministry of Fisheries to the CenSeam southern secretariat will be formalized in a Memorandum of Understanding. Certain components, including funding for a graduate student or postdoctoral associate, are still under discussion.

3. *A museum exhibit.* We have had preliminary conversations with several institutions regarding a seamount exhibit. Greg Stone at the New England Aquarium may be interested in support funds for developing a proposal to the NSF Informal Science Education program for a traveling museum exhibit on seamounts. The Birch Aquarium at Scripps may be willing to add a seamount component to its proposed deep sea science exhibit. And the Ocean Institute, which develops interactive experiences for elementary-school groups, may see seamounts as an appropriate component of it's NSF-funded ocean floor theme. Because of the travel schedules of parties involved, we have not yet been able to finalize these plans.
4. *A Deep Corals Component*. Deep-sea coral beds have been identified as a priority habitat by the CoML US National Committee, and the deep coral research community has already begun organizing towards an international action plan (McDonough and Puglise 2003). There is a coral initiative emerging within the CoML, however this focuses on shallow-water, tropical corals. Many deep-coral communities are found on seamounts, and there is overlap in the research community and the technologies needed to sample the two areas. We are in discussion with the deep coral group regarding how to best bring deep corals exploration into CenSeam. These discussions started only days before this CenSeam proposal draft was due, and are ongoing.
LITERATURE CITED

Blaber, S.J.M. 1986. The distribution and abundance of seabirds south-east of Tasmania and over
the Soela Seamount during April 1985. Emu 86: 239-244.


Clark, M.; O’Driscoll, R. In press: Deepwater fisheries and aspects of their impact on seamount

Haney, J.C., L.R. Haury, L.S. Mullineaux, and C.L. Fey. 1995. Sea-bird aggregation at a deep


Hubbs, C.L. 1959. Initial discoveries of fish faunas on seamounts and offshore banks in the

Biodiversity Update 4: 3.

Continental slope and deep-sea fisheries: Implications for a fragile ecosystem. ICES

benthic macrofauna off southern Tasmania: community structure and impacts of trawling.
Marine Ecology Progress Series 213: 111-125.

Planning and Collaboration Workshop for the Gulf of Mexico and North Atlantic Ocean.


List of Appendices

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E. Letter of support from New Zealand Ministry of Fisheries
F. Ongoing and planned seamount programs
G. Memorandum of understanding
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Appendix A: CV for KAREN I. STOCKS
San Diego Supercomputer Center, University of California San Diego
9500 Gilman Drive MC 0505, La Jolla, CA  92093-0505, USA
Tel:  1 858 534-5009      Fax:  1 858 822-3631
kstocks@sdsc.edu

EDUCATION

1994 – 2000  Ph.D. in Oceanography, Rutgers University
Factors Determining Macroinfaunal Community Structure in Salt Marshes
Advisor: J. Frederick Grassle

1988 – 1992  Bachelor of Science  cum laude with Honors in Wildlife and Fisheries Biology,
University of Massachusetts at Amherst

APPOINTMENTS

7/03 – pres.  Assistant Research Scientist, San Diego Supercomputer Center
Pending    Lecturer, Scripps Institution of Oceanography

12/00 - 11/02  NSF Biological Informatics Postdoctoral Fellow
Title: Development of a Biogeographic Information System for Seamounts
San Diego Supercomputer Center and Scripps Institution of Oceanography
Advisors: Lisa Levin, David Stockwell

1/94 – 11/00  Graduate Researcher/EPA STAR Fellow, salt marsh community ecology,
Rutgers U.

4/96 – 6/97  Statistical Consultant, for ENSR, Woods Hole, MA.
Analyzed benthic community data using multivariate statistics

Developed a wildlife life history database for federal government use.

RELATED FUNDING

to Knowledge."  P.I. K. Stocks.

11/03 – 8/04  Natural Resources Defense Council.  $15,000.  "A Seamount Biodiversity
Analysis."  P.I. K. Stocks.

4/03 – 6/03  Conservation International.  $15,000.  "A Seamount Case Study."  P.I. L.
Madin, WHOI.  Subcontract $3,957 to K. Stocks.

12/00 – 11/02  NSF Biological Informatics Postdoctoral Fellowship.  $100,000.
"Development of a Biogeographical Information System for Seamounts."  P.I. K.
Stocks.
SYNERGISTIC ACTIVITIES

**International Scientific Steering Committee Member** and **Technical Working Group Member, Ocean Biogeographic Information System**

**Steering Committee Member, Center for Marine Biodiversity and Conservation**, Scripps Institution of Oceanography.

**Scientific Steering Committee Member**, Biogeography of Deep-Water Chemosynthetic Ecosystems (ChEss). 8/2002 – present

**Metadata and Data Discovery Expert Team Member**, Data and Communications Steering Committee, Integrated Sustained Ocean Observing System (IOOS).

**PUBLICATIONS (most recent/relevant)**

Most available at http://seamounts.sdsc.edu/stocks_page.htm


Appendix B: CV for Malcolm Clark
National Institute of Water and Atmospheric Research
Private Bag 14–901, Wellington
m.clark@niwa.co.nz
tel: +64 4 386 0300, fax: +64 4 386 0574

Academic Qualifications:
1977  BSc Victoria University of Wellington (V.U.W)
1978  BSC (Hons-First Class in Zoology), V.U.W
1982  PhD V.U.W

Honours/Distinctions/Societies:
1977  Senior Scholar, V.U.W
1978  Postgraduate Scholarship, V.U.W
1978  Offered Commonwealth Scholarship, U.K (declined)
1980  DAAD Fellowship, Institut fur Seefischerei, Hamburg, W. Germany
1988–91 Secretary and Council Member, NZ Marine Sciences Society.

Professional positions held:
2000  Principal Scientist, Deepwater Fisheries, NIWA. (Head of 6 – 12 scientific and technical staff working on all major middle depth and deepwater fisheries in New Zealand)
1995–  Project Director, Deepwater Fisheries, NIWA.
1993–95  Deepwater Group Leader, MAF Fisheries (continuing work below, plus research on Chatham Rise, East Coast of New Zealand, and northern North Island orange roughy fisheries. Responsible for research direction, finances, and staff management of a team of 7 researchers)
1986–93  Scientist, Deepwater Group, MAF Fisheries. (Research on orange roughy, leading programmes to assess fisheries in areas of the Challenger Plateau, west coast of the South Island, Puysegur Bank-subantarctic, Lord Howe Rise)
1985–86  Contract scientist, Fisheries Research Division (MAF) (design and lead a year-long trawl survey of deepwater fish around the North Island)
1983–84  Research scientist, NZ Department of Lands and Survey (research on global subantarctic islands, marine reserves)
1982–83  Research Assistant, V.U.W Marine Laboratory (paddle crab-shellfish predation)

Present Research/Professional Specialities:
Seamount biology and ecology, impacts of fishing, stock assessment of deepwater fish species, biology of orange roughy, trophic relationships of fish species

Relevant experience:
Malcolm has helped organise, and lead, several international surveys. He was the voyage leader on a survey of deepwater fish species off New Caledonia in 1997, which involved scientists from New Caledonia, France, USA, UK, and Australia. He also lead a recent Australian-New Zealand survey of fish and invertebrate biodiversity of seamounts in the Tasman Sea (termed NORFANZ) which included scientists from 6 countries. In January 2004 he will lead a team of 8 New Zealand
and Italian scientists to survey biodiversity of the Ross Sea (Antarctica) and nearby seamounts. Within New Zealand he has been responsible for research on most New Zealand orange roughy fisheries, and has designed and lead over 30 deepwater fish surveys and other research cruises.

He heads the NIWA research programme on the biology and ecology of seamounts, including the impacts of deepwater trawling on their benthos. This programme started in 1998, and has expanded from an initial inventory of seamounts to include surveys of a number of seamounts in New Zealand waters to describe their benthic fauna, and evaluate the impacts of bottom trawling on the benthos.


**Relevant recent publications (of 25 refereed and 65 additional):**


January 15, 2004

Karen Stocks  
Assistant Research Scientist  
San Diego Supercomputer Center  
University of California, San Diego MC 0505  
9500 Gilman Drive  
La Jolla CA 92093-0505

Dear Dr. Stocks

I am delighted to strongly endorse and support the "Census of Marine Life for Seamounts" proposal. I am excited about the role that the SDSC can play in co-hosting the program's secretariat and supporting an information system for studying the biodiversity and biogeography of these important marine habitats.

The San Diego Supercomputer Center (SDSC) shares a common vision of the value of using information technologies to advance the frontiers of environmental sciences. In this area, we are currently home to the Encyclopedia of Life, and have researchers building the SEEK (Scaleable Environment for Ecological Knowledge) System. We look forward to the opportunity to work with you to leverage the vast computational infrastructure at SDSC in support of this project. SDSC’s resources include high-end computing and storage, web and database servers, high-speed networking, scientific visualization systems as well as the broad expertise of its staff. The project will have the opportunity to take significant advantage of this unique, national resource to maximize the overall goals and impact of the proposed project.

In addition to the opportunity to leverage SDSC’s unique resources, we will commit cost sharing of $10,000 in support of this proposal for the Census of Marine Life Program for Seamounts.

SDSC is deeply committed to supporting the Seamounts proposal to CoML and we’re excited about our partnership with you on this effort. Please feel free to contact myself or Anke Kamrath (kamratha@sdsc.edu) for any additional information.

Sincerely,

Francine Berman  
Director, San Diego Supercomputer Center and NPACI  
Professor and High Performance Computing Endowed Chair, U.C. San Diego

CC:

Anke Kamrath, Chief Operating Officer, SDSC  
Allan Blatecky, Executive Director, Research and Programs, SDSC  
John Helly, Senior Environmental Researcher, SDSC  
Mary Hart, Associate Director, Business and Facilities Services, SDSC
January 23, 2004

Karen Stocks
San Diego Supercomputer Center
University of California at San Diego
MC0505
9500 Gilman Drive
La Jolla, CA 92093 -0505

Re: Letter in support of Seamount Proposal

Dear Karen,

On behalf of the Center for Marine Biodiversity and Conservation (CMBC) at Scripps Institution of Oceanography, I am pleased to write in support of your proposed project to CoML to create an international program on Seamounts and to have CMBC act as co-host for the Northern Hemisphere Secretariat.

The CMBC has the goals of furthering science to assess the state of marine ecosystems, developing interdisciplinary programs that link biological, physical, social and (most important in this context) information sciences, communicating science issues to the public, and educating a new generation of biodiversity scientist. Seamounts are increasingly being recognized as critical marine habitats worldwide, and the CMBC would be pleased to host and support this activity.

With respect to support, we are pleased to offer the assistance of our administrative assistant, Penny Dockry, with planning the two workshops proposed for San Diego, and will waive our usual 10% administrative fee. In addition, the CMBC can help to promote the CoML Seamounts program through the many workshops and meetings in which the CMBC participates, and by highlighting it on the CMBC website, which is being developing as a resource for marine biodiversity news and information. Furthermore, CMBC has graduate student fellowships through a new interdisciplinary graduate program aimed at marine biodiversity and conservation studies. While these fellowships must be awarded through a competitive process, CMBC sees work proposed here as appropriate for a student in their program, and encourages the seamount program to seek a qualified applicant.

We commend you on the merits of this proposal and look forward to continuing collaborations with you with regard to our mutual interests in marine biodiversity, conservation and information sciences.

Sincerely,

Nancy-Knowlton
Director, CMBC
Appendix E: Letter of Support from the New Zealand Ministry of Fisheries

Ref: CenSeam

29 January 2004

Karen Stocks
San Diego Supercomputer Center
University of California San Diego
9500 Gilman Drive MC 0505
La Jolla, CA 92093-0505
USA

Dear Karen

CENSUS OF MARINE LIFE SEAMOUNT PROGRAM

As discussed the New Zealand Ministry of Fisheries (MFish) is very supportive of the proposed CenSeam: a Census of Marine Life Program for Seamounts. We congratulate you on taking up the challenge of developing this program and we anticipate that MFish will become an affiliate to the program.

We are particularly keen to support the placement of the Southern Hemisphere Secretariat at the National Institute of Water and Atmospheric Research (NIWA) here in New Zealand. At this point I cannot offer specifics on the level of support that MFish will be able to provide to support the Southern Hemisphere Secretariat, however, I can assure you that we are actively investigating a range of possibilities with NIWA.

Following are details of current and planned research programs funded by the Ministry of Fisheries that fit into the proposed CenSeam program. Please note that our research planning for 2004/05 is not yet complete and there may be additional seamount research projects identified in the coming months.

Existing
NORFANZ: A biodiversity survey of the seamounts along the Norfolk Ridge and Lord Howe Rise. Research provider: NIWA. MFish Funds: NZ$500,000.

**Planned**
Seamount Atlas: Developing a Seamount database and Atlas that will describe the known physical and biological attributes, and fishing history associated with each known seamount and allow production of maps of seamounts within the NZ EEZ. Research provider: In negotiation. MFish Funds: NZ$54,000.

Impacts of Fishing on Seamounts: Monitor changes in macrofauna and habitats over time on selected seamounts in the Chatham Rise area that have a range of fishing histories, increase level of information on seamounts by deriving attributes for individual seamounts from a range of available data sources, and undertake multivariate analysis on available seamount data to identify like-seamounts and the major factors that influence them. Research provider: To be determined. MFish Funds NZ$625,000.

With regard to MFish affiliation with the project I will ask our legal group to draft a Memorandum of Understanding between the Ministry of Fisheries and the Census of Marine Life for your consideration and comment. As a Government agency we need to be sure that our involvement in the program does not compromise our national interests.

I hope that this short letter provides the support that you require for your draft proposal. Please do not hesitate to contact me if you require any further information.

Kind regards

[Signed hard copy is in the mail]

Jacqui Burgess
Science Manager Biodiversity
Ministry of Fisheries
Appendix F: Ongoing and Planned Seamount Programs

NOTE: Information on proposals that are pending or in development are confidential and not for further dissemination

[see Appendix E for details on an additional NZ$3.5 million of ongoing and planned seamount research funded by New Zealand's Ministry of Fisheries]

1. NORTH ATLANTIC

1a. OASIS - Oceanic Seamounts: an Integrated Study (European Union).
Holistic community ecosystem investigation of 2 NW Atlantic seamounts (vertebrate and invertebrate, benthic and pelagic, summit to base, including nearby abyssal plain samples for comparison).
Contact: Bernd Christiansen

1b. EUROCORES on 'Deep-Sea Ecosystems' (EuroDeep)
A multinational European collaboration to study and compare the diversity of deep-sea habitats, including seamounts.
Status: pre-proposal submitted to the EC Frameworks Program
Contact: Eva Ramirez Llodra

Investigations of octocorals and their associates, fish, and limited sampling of other invertebrates from selected seamounts within the New England seamount chain.
Project also includes reproductive, larval, and genetic studies of deep water octocorals, and satellite web links for education.
Contact: Les Watling or Ivar Babb.
Status: Funded, sampled first year on Manning, Kelvin, and Bear seamounts. Second year of sampling being planned for 2004.
Funding: NOAA Ocean Exploration $400,000 spread over 5 institutions.

1d. New England Seamounts, Western North Atlantic
Using fossil deep-sea corals to study the paleoceanography of the North Atlantic, and the paleoenvironment of the corals. Modern benthic organisms also surveyed. ALVIN, ABE (WHOI's AUV), and TowCam (WHOI's towed camera sled).
Contacts: Jess Adkins or Dan Scheirer
Status: in progress – cruise completed May-June 2003, samples are being processed
Funding: NSF

The evolutionary history of seamount species populations through phylogenetic and phylogeographic studies of seamount fauna, when combined with paleoclimate, hydrographic, and modern-day habitat data inferred from fossil deep-sea corals will reveal an unprecedented view of the processes that have shaped (and continue to shape) the migratory rates and pathways of marine fauna that have ultimately explain current biogeographic biodiversity patterns in the deep sea.

Contact: Tim Shank
Status: proposed

1f. Dom Joao de Castro Bank, Azores region, North Central Atlantic

Habitat mapping, demersal fish sampling via Submersible/ROV in 2005 by Marine Resources Research Institute, South Carolina Department of Natural Resources (US)

Contact: George Sedberry

1g. Condor Seamount and S. Mateus Seamount, Azores region, North Central Atlantic

By the Departamento de Oceanografia e Pescas, Universidade dos Acores. A treatment/control monitoring study for recovery of a seamount closed to fishing using ROVs/submersibles and moorings.

Contact: Gui Menezes
Status: in development.

1h. Scottish Association for Marine Science and Southampton Oceanography Center

Epifaunal sampling of 3 UK seamounts (Anton Dohrn, Rosemary Bank and Hebrides Terrace; 56 – 59 °N and 9 – 12 °W) using SAMS photo-lander and megacorer/boxcorer

Contacts: Bhavani Narayanaswamy, John Gage and Paul Tyler (SAMS & SOC)

2. SOUTHERN OCEAN

2a. Seamounts in Scotia Sea / Arc and off Antarctic Peninsula:

Opportunistic faunal sampling during Core Research Programme Cruise 2006-2007.

Status: Pending
Contact: Alex Rogers
Funding: British Antarctic Survey


Status – Pending
Contact: Alex Rogers
Funding: British Antarctic Survey
3. SOUTHWEST PACIFIC

3a. Seamounts: their importance to fisheries and marine ecosystems.
A seamount inventory will be expanded with the incorporation of new data, and more extensive biological sampling will help fill significant gaps in our knowledge of biodiversity and seamount resources, as well as describe communities and habitats associated with New Zealand’s seamounts. Research will also focus on understanding the functioning and dynamics of seamount ecosystems, with integrated hydrological, geological, and biological surveys of selected seamounts, to aid in distinguishing between natural and human-induced changes. The programme will determine the extent of commercial fisheries on seamounts and the physical effects of bottom trawling.
Contact: Malcolm Clark
Status: In progress
Funding: NZ$615,000 in 2003/04 from New Zealand's Foundation for Research Science and Technology to NIWA; we anticipate this programme will be funded for another 5 years from July 2004 to 2009

3b. Consequences of Earth-Ocean change
Studies on seafloor geology and processes near New Zealand. Objective 1, “Seafloor Response to Earth Processes” and Objective 4 “Shape of the deep” both address seamounts.
Contact: Ian Wright
Status: in progress
Funding: from New Zealand's Foundation for Research Science and Technology to NIWA

3c. Norfolk III (New Caledonia).
Contact: Bertrand Richer de Forges and Thomas Schlacher.
Status: projected

3d. Exploration of Chemosynthetic Habitats of New Zealand, including hydrothermally-active seamounts, with the Pisces submersible
Contact: Amy Baco-Taylor
Status: proposal pending at Ocean Exploration (US)

4. NORTHERN PACIFIC

4a. Mapping Sirius and Derickson Seamounts, Alaska
This 5-day study will focus on the geology of the seamounts and will include multibeam mapping and ROV JASON II dives. The cruise is scheduled for July, 2004. Location is south of the Alaska Peninsula, on the Pacific Plate.
Contacts: Randy Keller and Robert Duncan (OSU)
Status: Funded
Funding: NOAA/NURP's West Coast & Polar Regions Undersea Research Center.

4b. A Survey of benthic invertebrates on Sirius and Derickson seamounts
This would add a biological component to the work described above
Status: pending NOAA-NURP Alaska for 2004
Contact: Amy Baco-Taylor

4c. Population genetics of seamount invertebrates on the central Gulf of Alaska seamount chain
Biodiversity surveys and genetic analyses
Status: proposal pending at NOAA-NURP Alaska for 2005
Contact: Amy Baco-Taylor

4d. Distribution of deep-sea corals on Gulf of Alaska seamounts (Northern chain)
Status: proposal pending at Ocean Exploration (US)
Contact: Amy Baco-Taylor

5. CENTRAL PACIFIC

5a. Population genetics and reproductive biology of precious corals
Status: funded by OE/NOAA NURP HURL/Hawaii SeaGrant 1998-2004 +
Contact: Amy Baco-Taylor

5b. Seamount surveys of deep-sea corals (and other invertebrates) in relation to geologic setting on the Hawaiian chain
Status: funded by Ocean Exploration 2003-2004+
Contact: Amy Baco-Taylor

5c. Deep-sea corals as habitats – a study of the Hawaiian chain seamounts
Status: proposal pending
Contact: Amy Baco-Taylor
Appendix G: Affiliation Agreement CoML Seamount Program
DRAFT 5 January 2004

Purpose: This document is designed as an indication of mutual interest and support between the emerging Census of Marine Life Field Program on seamounts (represented by the Secretariat) and individuals, institutions or groups representing existing or planned seamount projects (called "partner projects" or "partners" below). It is not designed as a legal document, rather as an informal indication of mutual affiliation.

The CoML Seamount Program agrees to:

1. Promote partner seamount projects in CoML Seamount literature and presentations, acknowledge project contributions in all synthetic products, and provide access to the education and outreach capabilities of the Program.

2. Facilitate participation in SeamountsOnline or directly to the Ocean Biogeographic Information System (OBIS).

3. Seek to expand the funding base for seamount research, and inform partners of funding and other opportunities (e.g. available shiptime, equipment, taxonomic expertise, etc.)

4. Facilitate collaborative opportunities and exchange among partners and between partners and other CoML field programs

5. Make the partner project eligible to compete for mini-grants from Secretariat

The partner seamount project agrees to

1. To the extent possible within copyright and other privacy limitations, make biological data collected by the project available to SeamountsOnline as electronic files or via web links upon publication or by 2009 (whichever is earlier).

2. Acknowledge the relationship to the CoML Seamounts program in all appropriate publications, websites, and productions [The CoML is a science program that does not put forth opinion or policy recommendations. The Secretariat can offer advice if the partner is unsure whether a particular publication is appropriate to associate with CoML].

3. Provide a brief description (abstract) of past and funded future seamount ecology work. The Secretariat also invites information on proposal and other fundraising plans, in order to assist groups to coordinate efforts, but recognizes that these plans may be sensitive.

4. Actively seek beneficial collaborations with other CoML Seamounts partner projects, with assistance from the Secretariat.

5. Work with the scientific steering committee to develop standard sampling/documentation protocols for seamount research to facilitate the comparability of results. To the extent possible, implement standard sampling protocols (unless compelling reasons exist for alternative methods)
Appendix H: Workshop Participants and CenSeam Contributors

Participants in the August, 2003 CoML Seamount Planning Workshop (all have reviewed the proposal)

Nancy Baron, SeaWeb/COMPASS
George Boehlert, Oregon State University, US
Jacqui Burgess, Ministry of Fisheries, New Zealand
Gregor Caillet, Moss Landing Marine Laboratories, US
Bernd Christiansen, Institut für Hydrobiologie und Fischereiwissenschaft, Germany
Sabine Christiansen, WWF International, Bremen
Judith Connor, Monterey Bay Aquarium Research Institute, US
Cynthia Decker, Office of Naval Research
John Dower, University of Victoria, Canada
Heino Fock, ecoanalysis.de
Karen Garrison, Natural Resources Defense Council
Linda Glover, Conservation International, US
Raymond Highsmith, University of Alaska, USA
Baban Ingole, National Institute of Oceanography, India
Eva Ramirez Llodra, Southampton Oceanography Centre, UK
Jon Moore, Florida Atlantic University, US
Bhavani E Narayanaswamy, Scottish Association for Marine Science, UK
Ron O’Dor, Census of Marine Life, US
Alex Rogers, British Antarctic Survey, UK
Evgeny Romanov, Southern Scientific Research Institute of Marine Fisheries and Oceanography (YugNIRO), Ukraine
Ashley Rowden, National Institute of Water & Atmospheric Research (NIWA), New Zealand
Thomas Schlacher, University of the Sunshine Coast, Australia
Tim Shank, Woods Hole Oceanographic Institution, US
Ross Shotton, FAO Fisheries, Italy
Igor Smirnov, Zoological Institute of RAS, Russia
Karen Stocks, San Diego Supercomputer Center, US
Paul Tyler, Southampton Oceanography Centre, UK
Franz Uiblein, University of Salzburg, Austria
Mike Vecchione, National Marine Fisheries Service/National Museum of Natural History
Eric Vetter, Hawaii Pacific University, US
Waldo Wakefield, NOAA National Marine Fisheries Service, US
Alan Williams, CSIRO Marine Research, Australia
Mary Yoklavich, Southwest Fisheries Science Center, US

Others who have contributed to the proposal or expressed an interest in participating in program components

Amy Baco-Taylor, Woods Hole Oceanographic Institution, US
David Billet, Southampton Oceanography Centre, UK