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Author

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The Center for Marine Biodiversity and Conservation
Opening Conference
Scripps Institution of Oceanography
25-27 May 2001

The opening conference to launch the Center for Marine Biodiversity and Conservation (CMBC) at Scripps Institution of Oceanography (SIO) was held 25-27 May 2001. The goal of the conference was to identify priorities in the study of marine biodiversity and conservation, announce the establishment of the Center, and solicit ideas for its future development. Invited participants and guests hailed from a diversity of disciplines and institutions from the social, physical and biological sciences, national and local academic institutions, national and international governmental institutions, NGO's, and industry (please see attached list of participants). The agenda featured plenary addresses, which were open to the public, followed by a graduate student poster session and four panel discussions (please see attached agenda). We asked all participants to be challenging and provocative.

Plenary session

The morning plenary session on Saturday, 26 May 2001, drew over one hundred twenty five attendees, and featured talks by Jane Lubchenco, Fred Grassle, John Ogden, Jeremy Jackson and Marea Hatzios (please see attached abstracts). Each talk was followed by an open discussion between the speaker and audience. At mid-day, the 85 invited participants (scientists, professionals and graduate students) continued on for the afternoon lunch and poster session, panel discussions and dinner. Graduate students, working at SIO, UC San Diego, Southwest Fisheries Science Center (NOAA) and the Universidad Autónoma de Baja California, presented posters featuring their research in various aspects of marine biodiversity and conservation (please see attached list of posters). The invited participants reviewed these posters and the students received a great amount of personal feedback from some of the world's best-known marine scientists.

Panel discussions

The three panel discussions on Saturday afternoon focused on topics of urgent importance in marine biodiversity and conservation: the taxonomy crisis (systematics and genetics), marine protected areas/overfishing, and invasive species/disease. Eighty-five invited participants (scientists, professionals and graduate students) participated in the panel discussions. The goal of these discussions, to set a focused scientific agenda in these areas, was reached by the panel scientists defining their "top five" research priorities followed by an open discussion. Sunday morning, the panel focused on the bridges between academic institutions and government, NGO's and industry. Panelists briefly presented their views and the remainder of the time was devoted to an open discussion. We asked that all participants be provocative, challenging and speculative. Each panel is described briefly below:

Panel on the Taxonomy Crisis: Genetics and Systematics

Panelists: Richard Norris (Woods Hole Oceanographic Institution), Steve Palumbi (Harvard University) and Les Watling (University of Maine)

All three panelists argued that the importance of systematics is currently underplayed in marine conservation, and asserted that genetics is now an integral part of this research. Norris also emphasized the importance of identifying genetic 'hotspots' in the ocean. Both Norris and Palumbi emphasized the need to understand patterns of dispersal in the ocean. All panelists emphasized the need to integrate ecological and community-based perspectives into the use of systematics in marine conservation. Members of the audience were concerned about the importance of the panelists' goal of counting all the species, and concern was expressed whether this was an urgent conservation need and whether it was feasible. It was also noted that attempts to conduct expeditions and surveys often resulted in inconsistent counts in marine systems, primarily due to the large number of species and the small number of samples that could be collected. The suggestion was made that collaborative survey efforts between nations could help decrease the costs of survey efforts. Finally, the panelists recommended that CMBC should provide opportunities for a new generation of systematists, who were involved in systematics from a conservation perspective, focused not only on counting species, but understanding the ecological role that species play in marine communities.

Panel on introduced species and disease

Panelists: Jim Carlton (Williams College), Kim Ritchie (Scripps Institution of Oceanography and MicroGenomics)

Carlton focused on introduced species and emphasized that we do not have much data on invasive species in the marine realm. He recommended worldwide databases on invasive species, as problems arise when information about invasive species is not adequately distributed. Ritchie emphasized the complete lack of knowledge about diseases in the marine realm and recommended exhaustive genetic studies of microbial faunas present in important marine communities, such as coral reefs. Members of the audience expressed concern about the growing number of invasions in marine ecosystems. There was discussion about whether CMBC should focus on using past invasions as a model to recommend management options in the future, or whether CMBC should study invasions in an academic context. Similar discussions followed about the role of disease in the marine environment. Members of the audience felt that conducting exhaustive studies as recommended by Ritchie might be too expensive and may not be viable from a management perspective. On the other hand, due to immense bacterial diversity, it would be difficult to use existing data to make management recommendations. The panelists recommended that the role CMBC would play in this conservation arena would depend on whether the center was focused on management issues or broader academic understanding of threats to marine systems.

Panel on marine protected areas and overfishing

Jim Bohnsack (National Marine Fisheries Service), Mark Hixon (Oregon State University), Nancy Targett (University of Delaware)

All three panelists recommended comprehensive management plans for marine protected areas. Targett emphasized multi-stakeholder planning, which is presently lacking. Bohnsack presented the idea of no-take marine reserves and argued that if they were possible on land, why not in the sea? He also argued that there is a need to increase political activism in the marine realm of conservation. Hixon emphasized the need to identify biodiversity hotspots and to explore the possible indirect effects of marine reserves. The members of the audience heatedly discussed the role marine reserves should play. Certain members of the audience felt that they should be only about conservation, and not have to be attached to an economic value. Others felt that it is possible for a marine reserve to be economically profitable, as evidenced by reserves in Belize. The audience cautioned against using terrestrial criteria to define reserves in the sea. The audience also discussed the possible zoning of the ocean, with some totally protected areas and some areas where take is allowed. The political implications of zoning were also discussed. The panelists recommended that marine conservationist take a more pro-active role in the political arena and that CMBC facilitate this through training programs.

Dinner, served at the Birch Aquarium, overlooking the Pacific Ocean on the SIO campus, enabled all invitees to linger and interact casually. Scheduling time for the attendees to continue discussion was mentioned frequently as one of the best aspects of the conference.

Panel on the bridges between academic institutions and government, NGO's and industry in the study of marine biodiversity and conservation

Panelists: Martín Hall (Inter American Tropical Tuna Commission), Rebecca Lent (National Marine Fisheries Service), Ghislaine Llewellyn (World Wildlife Fund), Russ Moll (California Sea Grant), Ellen Pitkitch (Wildlife Conservation Society), Carl Safina (Audubon Society), Barbara Taylor (National Marine Fisheries Service), Karsten Zengler (Diversa Corporation)

Sunday morning, 27 May 2001, was devoted to a single, and perhaps the most interesting discussion, on the bridges between basic and applied science in the study and conservation of marine biodiversity. The panel members chosen for this discussion represented non-academic organizations and groups, hailing from national and international governmental agencies, conservation groups and industry. Taylor opened by sharing her own search for a graduate school program that would provide training in the quantitative skills necessary to tackle applied questions in marine conservation, a search that is still difficult today, and one that CMBC could fill. She recommended that marine conservation students need training in solving real problems with appropriate types of analysis, and in communicating these results to facilitate decision making. Safina focused on the failure of science to communicate. He suggested that scientists publish for audiences of 50,000. He suggested that research is not finished when data are published, but when its implications change behavior, and that scientists have a professional responsibility to study solutions, not just problems. Hall also emphasized that science is important, but communication is even more so. He suggested that CMBC's training role should go beyond diagnostics and focus on identifying and implementing solutions to marine problems that are exportable and inclusive. He emphasized the importance of students gaining sea

experience on fishing boats and suggested two important areas with open niches: improvements in fishing gear and marine ecosystem management. He stated that at present we are eating the lions and tigers of the marine world and that no one knows the consequences. Continuing in this vein, Pickett focused on the need for training applied problem solvers in field experimentation, multi-agency work and quantitative methods. Zengler explained how industry views the tremendous genetic resources and market value of marine biodiversity. He pointed out that marine conservation should not focus just on fisheries, but on the entire ocean. He also pointed out that links between industry and academia could be made to support conservation and the study of biodiversity. Lentillus stated how science, policy, politics, and the public can be brought together to implement management decisions. She recommended training needs in socio-economics, habitat studies, behavior and policy. Molle explained California Sea Grant's roll in fostering communication between scientists and the public. To effect change, he pointed out the need for marine scientists to speak with one voice; perhaps CMBC's role can be in bringing the many voices together. Lastly, Llewellyn recommended the need for basic, strategic (long range planning) and implementation science. She, as the others before her, suggested that CMBC aim high and think big.

In contrast to Saturday's panelists, this panel rejected the need for more systematists and supported training people to solve problems. This dichotomy was debated during the following discussion. The audience agreed that one of the problems is the university system, which does not award applied work. Jeremy Jackson mentioned the need to change culture to solve problems. The need for interdisciplinary training to effect this change was elaborated upon by many, offering suggestions for CMBC in the way of mentors, funding support, links with on-site NGO's, and short workshops. Tim Gerrodette, referring to Safina's comment that conservation is 5% science and 95% politics, asked how CMBC could change this balance. Responses focused on the need to follow through on science to ensure integration into conservation and to communicate. The overwhelming sentiment was that the Center for Marine Biodiversity and Conservation is a tremendous opportunity where we can bring together the necessary personnel, resources and training to facilitate these changes.

Conclusions

Several themes emerged from the conference for which there was universal agreement. First, this is the time to tackle problems affecting marine biodiversity, and SIO is an ideal institution to support these activities. Second, the scale and the urgency of the problems require a bold approach in order to truly make a difference. Third, the need for natural and social scientists to work side by side was a recurrent message. Many participants urged CMBC to go beyond classic marine science curricula and incorporate law, policy, socioeconomics, and communication courses. Such a graduate program is not offered in any academic institution worldwide, and CMBC was urged to establish that kind of program as soon as possible. In conclusion, the participants viewed CMBC as a tremendous opportunity to make a difference in the study and conservation of marine biodiversity, by using good, interdisciplinary science as an essential tool to understand and conserve marine biodiversity, and by training the future (first) generation of scientists with broad expertise in marine biodiversity and conservation as well as effective communication skills.

Feedback from participants

Participants were asked to voice their feedback to the meeting. Selected excerpts follow:

The symposium was the best think-tank meeting I have ever attended. The speakers and panelists were excellent. There was a dimension of urgency, commitment, cooperation and excitement that was felt by all participants. This was a unique meeting and everyone I talked to was thankful that SIO had the foresight to host it. --Victor Vacquier, Professor, Scripps Institution of Oceanography

I thoroughly enjoyed participating in the Biodiversity and Conservation Workshop this past weekend! I look forward to great things from the Center. I hope that it will ultimately serve to focus scientists concerned about biodiversity into one voice, a voice that can then be used to move forward an national agenda on this important topic. This time you had scientists and reps from governmental organizations and NGOs. Perhaps next time, it would be useful to include people who are actively involved in policy decisions and analysis to try and explore how we as scientists can better assist them in moving forward legislation that focuses on conserving marine biodiversity in U.S. waters (and globally for that matter). -- Nancy Target, Professor, University of Delaware

I found it very interesting to hear the perspectives of the fisheries and NGO people, particularly as they seemed to value 'basic' science much less than some of the other speakers/audience. It is always handy to hear defense of points of view that are very different for one's own perspective. --Dick Norris, Woods Hole Oceanographic Institution

I enjoyed the panel discussions very much, and thought they were perhaps the best part of the workshop. Good luck with the center, and my only regret about its establishment is that it was not at least 10 years sooner. --Jerry Kooyman, Scripps Institution of Oceanography

I must tell you that the content really has shaken me up. I've been beset by a pallof sorts and a disturbing feeling that I am not spending my professional time as well as I could. I sincerely hope this center get off the ground. If so, I would like to be a part of it if you could use any of my input. --Lisa Ballance, National Marine Fisheries Service

(The best part) was the small number of attendees allowed good interactions, (however), the short time restricted meaningful interactions between attendees. For example, the non-academics were last on the schedule so their point of view was made known only moments prior to many participants' departure. -- Barbara Taylor, Southwest Fisheries Science Center, NMFS

I enjoyed the mixture of approaches to the common topic and hearing people's views about what the Center might focus on. The twin concepts of charismatic microfauna and off-shore farming providing for coastal zone biodiversity what modern agriculture does for the American prairie were two of the homezingers for me. --Doug Kinzey, National Marine Fisheries Service

What I most liked about the meeting besides being a great learning opportunity was the honest, candid appraisal and self-evaluation of many of the problem areas in Marine Biology and Oceanography. e.g., how do we get our own house in order and then communicate our UNITED message to everyone else. The final meeting might be even more productive if you collectively (after stating the problems) determine a course of action including a list of the top five or six priorities to aggressively pursue for the next year. -- Frank Jordan, Moore Foundation

Acknowledgements

WethanktheMooreFamilyFoundationfortheirgeneroussupportofthisconference.SIO, UCSDandSDStategraduatestudentsandvolunteersensuredthateveryoneandeverything arrivedontimeat theconference: MeghanFerguson, ErinOlson, JoelFodrie, MathewCraig, ChristopherJanousek, JonathanFlowers, KarineViaud, JessicaMcClure, BonnieBecker, David Levenson, JulieOswald, UmaRamakrishnan, NicholasKellar, CynthiaTaylor, and DavidKline. BihnNhieuatBalboaTravelhandledalltravelarrangementsexpertly. AnitaTrevinoandthe folksatUCSDcateringprovidedwonderfulrefreshments. Ourthankstoall.

List of Participants

Allen, Robin	InterAmericanTropicalTunaCommission
Bailey, Lawrence	ScrippsInstitutionofOceanography
Bailiff, Megan	PrivateConsultant
Ballance, Lisa	SouthwestFisheriesScienceCenter
Barlow, Jay	SouthwestFisheriesScienceCenter
Becker, Bonnie	ScrippsInstitutionofOceanography&NationalParkService
Bohnsack, Jim	NationalMarineFisheriesService
Brownell, Robert	SouthwestFisheriesScienceCenter
Bullock, T.H.	UniversityofCaliforniaSanDiego
Burton, Ron	ScrippsInstitutionofOceanography
Carlin, Elaine	JointUS/NorwegianResearchTeam
Carlton, Jim	WilliamsCollege
Chereskin, Tere	UniversityofCaliforniaSanDiego
Cornuelle, Bruce	ScrippsInstitutionofOceanography
Craig, Matthew	ScrippsInstitutionofOceanography
Dayton, Paul	ScrippsInstitutionofOceanography
deStrulle, Arlene	BirchAquarium
Dewar, Heidi	PflegerInstituteofEnvironmentalResearch
Dizon, Andrew	SouthwestFisheriesScienceCenter
Dutton, Peter	SouthwestFisheriesScienceCenter
Eberhard, Marty	FundaciónCientíficaSanFrancisco
EnriquezParedes, Luis	UniversidadAutónomadeBajaCalifornia
EscorzaTreviño, Sergio	SouthwestFisheriesScienceCenter
EspejelCarbajal, Ileana	UniversidadAutónomadeBajaCalifornia
Faulkner, John	ScrippsInstitutionofOceanography
Faulkner, Meryl	ProjectWildlife
Ferguson, Megan	ScrippsInstitutionofOceanography&SouthwestFisheriesScienceCenter
Flowers, Jonathan	ScrippsInstitutionofOceanography
Fodrie, Joel	ScrippsInstitutionofOceanography
Forcada, Jaume	SouthwestFisheriesScienceCenter
Galver, Luana	SouthwestFisheriesScienceCenter
Gardner, Kirk	DevelopmentOffice,ScrippsInstitutionofOceanography
Gayler, Ivan	FundaciónCientíficaSanFrancisco
Gerrodette, Tim	SouthwestFisheriesScienceCenter
Gille, Sarah	ScrippsInstitutionofOceanography
Goetze, Erica	ScrippsInstitutionofOceanography
Graham, Jeff	BirchAquarium
Grassle, Fred	InstituteofMarineScience,RutgersUniversity
Hall, Martin	InterAmericanTropicalTunaCommission
Hastings, Phil	ScrippsInstitutionofOceanography
Hatzios, Marea	TheWorldBank

Heckel, Gisela	Universidad Autónoma de Baja California
Hixon, Mark	Oregon State University
Huff, Tonya	Scripps Institution of Oceanography
Hunter, John	Southwest Fisheries Science Center
Hyde, John	Southwest Fisheries Science Center
Jackson, Jeremy	Scripps Institution of Oceanography
Janousek, Christopher	Scripps Institution of Oceanography
Jordan, Frank	Moore Foundation
Neil, Anna	Scripps Institution of Oceanography
Kellar, Nicholas	Scripps Institution of Oceanography & Southwest Fisheries Science Center
Kennel, Charlie	Scripps Institution of Oceanography
Kinzey, Doug	Southwest Fisheries Science Center
Kline, David	Scripps Institution of Oceanography
Knower, Torre	Scripps Institution of Oceanography
Knowlton, Nancy	Scripps Institution of Oceanography
Kooyman, Gerald	Scripps Institution of Oceanography
Roy, Kaustuv	University of California at San Diego
Lang, Amiee	Southwest Fisheries Science Center
Lent, Rebecca	Pacific Regional Office, National Marine Fisheries Service
Lerch, Melissa	Scripps Institution of Oceanography
Levenson, David	Scripps Institution of Oceanography & Southwest Fisheries Science Center
Levin, Lisa	Scripps Institution of Oceanography
Lewellyn, Ghislaine	World Wildlife Foundation
Lubchenco, Jane	Oregon State University
Lukas, Sharon	Scripps Institution of Oceanography
Mangin, Katrina	University of Arizona
Martínez, Milmer	Southwest Fisheries Science Center
McClure, Jessica	Southwest Fisheries Science Center
Mengerink, Kathryn	Scripps Institution of Oceanography
Mesnick, Sarah	Southwest Fisheries Science Center & CMBC Program Coordinator
Moll, Russ	California Sea Grant
Munk, Edie	University of California San Diego
Nasby, Nicole	Pfleger Institute of Environmental Research
Neira, Carlos	Scripps Institution of Oceanography
Niiler, Peter	Scripps Institution of Oceanography
Norris, Richard	Woods Hole Oceanographic Institution
Ogden, John	Florida Institute of Oceanography
Ohman, Mark	Scripps Institution of Oceanography
Oleson, Erin	Scripps Institution of Oceanography & Southwest Fisheries Science Center
Olson, Paula	Southwest Fisheries Science Center
Oswald, Julie	Scripps Institution of Oceanography & Southwest Fisheries Science Center
Palenik, Brian	Scripps Institution of Oceanography
Palumbi, Steve	Harvard University
Pikitch, Ellen	Wildlife Conservation Society

Pitman,Robert	SouthwestFisheriesScienceCenter
Ponganis,Kathi	UniversityofCaliforniaSanDiego
Ponganis,Paul	ScrippsInstitutionofOceanography
Ralls,Katherine	SmithsonianInstitution
Ramakrishnan,Uma	ScrippsInstitutionofOceanography&SouthwestFisheriesScienceCenter
Ritchie,Kim	ScrippsInstitutionofOceanography&Scientist,MicroGenomics
RojasBracho,Lorenzo	ProgramaNacionaldeInvestigaciónyConservacióndeMamíferosMarinos
Rosenblatt,Richard	ScrippsInstitutionofOceanography
Safina,Carl	AudubonSociety
Sala,Enric	ScrippsInstitutionofOceanography
Schramm,Yolanda	UniversidadAutónomadeBajaCalifornia
Sharp,Katherine	ScrippsInstitutionofOceanography
Sisson,Joyce	SouthwestFisheriesScienceCenter
Smith,StephanLuellen	UniversityofCaliforniaSanDiego
Southern,Sarka	SouthwestFisheriesScienceCenter
Spalding,Mark	OrcaFund&UniversityofCaliforniaSanDiego
Squires,Dale	SouthwestFisheriesScienceCenter
Stocks,Karen	SanDiegoSuperComputer&ScrippsInstitutionofOceanography
Talley,Theresa	UniversityofCaliforniaDavis
Talley,Drew	UniversityofCaliforniaDavis
Targett,Nancy	UniversityofDelaware
Taylor,Barbara	SouthwestFisheriesScienceCenter
Taylor,Cindy	ScrippsInstitutionofOceanography&SouthwestFisheriesScienceCenter
Thomson,Donald	UniversityofArizona
Tillman,Michael	SouthwestFisheriesScienceCenter
Vacquier,Judy	BirchAquarium
Vacquier,Vic	ScrippsInstitutionofOceanography
Vasavada,Utpal	NorthwestFisheriesScienceCenter
Vetter,Russ	SouthwestFisheriesScienceCenter
Viaud,Karine	SouthwestFisheriesScienceCenter
Vitulli,Christine	ScrippsInstitutionofOceanography
Watling,Les	UniversityofMaine
Weller,David	SouthwestFisheriesScienceCenter
Wesson,Dolores	CaliforniaSeaGrant
Zengler,Karsten	DiversaCorporation

Agenda

Friday 25 May

5:30 Registration and reception at the Bistro in the Hotel La Jolla (top floor -till 8:30pm)

Saturday 26 May

8:00 Breakfast on the patio outside of Sumner Auditorium

OPENING REMARKS, Sumner Auditorium

9:00 Charles F. Kennel, Director, SIO and Nancy Knowlton, Director, CMBC

POSITION PAPERS, Sumner Auditorium

9:15 Jeremy Jackson, Historical overfishing and expectations of recovery: Are we ready to be managers or still just voyeurs?

9:45 Fred Grassle, Step toward an Ocean Biographic Information System useful for ecological research and conservation biology studies

10:15 Break

10:30 John Ogden, Ocean resource management and conservation in Florida

11:00 Marea Hatziolos, The role of science in shaping policy for marine biodiversity conservation

11:30 Jane Lubchenco, Conservation in the political arena

LUNCH AND STUDENT POSTER SESSION

12:15 On the Patio at Building T -29

PANEL DISCUSSIONS, 4500 Hubbs Hall

1:55 Introduction, Enric Sala, Associate Director, CMBC

2:00 Panel on systematics/genetics (Watling/Palumbi/Norris)

3:15 Break

3:30 Panel on introduced species/disease (Carlton/Ritchie)

4:45 Break

5:00 Panel on marine protected areas/overfishing (Bohnsack/Hixon/Targett)

DINNER, Birch Aquarium

6:15 Walk to aquarium

6:30 Cocktails

7:30 Dinner

Sunday 27 May

8:00 Breakfast, on the patio at 4500 Hubbs Hall

PANEL DISCUSSION, 4500 Hubbs Hall

8:30 Introduction, Sarah Mesnick, Program Coordinator, CMBC

8:35 Panel on the bridges between academic institutions and government, NGO's and industry (Taylor/Safina/Hall/Pikitch/Zengler/Lent/Moll)

10:30 Concluding remarks and discussion, Nancy Knowlton, Director, CMBC

11:00 Light lunch on the patio at 4500 Hubbs Hall

Jeremy Bradford Cook Jackson
Scripps Institution of Oceanography

Historical Overfishing and Expectations of Recovery: Are we ready to be managers or still just voyeurs?

Abstract: Historic overfishing of most fisheries began more than a century ago; setting off trophic cascades, changes in food web topology, and loss of habitats before ecological investigations began. Most animals larger than 1 kg have been removed, 3-dimensional habitats have collapsed to 2 dimensions, and microbial domination of ecosystems is spreading throughout the global coastal oceans. The time required for all these changes to have occurred greatly exceeds the time elapsed since the deliberate cessation of fishing began for any species. Thus, increases in stocks following protection are positive evidence of recovery, but failure to increase after a few years or even decades does not mean that recovery cannot or will not occur. Time lags in recovery may reflect unfavorable life history traits, Allee effects, loss of critical habitat, deleterious effects of other fisheries, natural environmental variation, or chance, among other factors. Whenever we stop a fishery, the ocean has already changed dramatically because of our fishing in the past, and failure to recover does not justify fishing again. On the other hand, no one will be patient for decades without tangible results. We need to reconstruct food webs before intensive fishing began to model ancient trophic interactions for clues about pristine ecosystem structure and function, and to identify factors that may be critical for reestablishing populations that have not recovered on their own. Then we need to test our ideas with bold, large-scale manipulations of species and habitats in the oceans that go beyond marine reserves to deliberately alter the status quo. That means really active management. These are lessons well established for lakes and it is time to apply them to the oceans.

Biography: Jeremy Jackson is William and Mary B. Ritter Professor of Oceanography and Director of the Geosciences Division at the Scripps Institution of Oceanography, University of California, San Diego. He is also a Senior Scientist and Director of the Center for Tropical Paleocology and Archeology at the Smithsonian Tropical Research Institute in the Republic of Panama. From 1971 to 1985 he was Assistant, Associate, and Full Professor of Ecology at the Johns Hopkins University. Dr. Jackson is the author of some 100 scientific publications and author or editor of five books. His research has focused on three main areas, including coral reef ecology, speciation and macroevolution of marine invertebrates, and the ecological and evolutionary consequences for the tropical American marine biota of the gradual formation of the Isthmus of Panama over the past 25 million years. He co-founded the Panama Paleontology Project in 1986, an international group of some 30 scientists, to help support the isthmian research. Dr. Jackson is a Fellow of the American Academy of Arts and Sciences and the American Association for the Advancement of Science, and received the Secretary's Gold Medal for Exceptional Service at the Smithsonian Institution in 1997. He has served on committees of the National Research Council and the Advisory Board of the National Center for Ecological Analysis and Synthesis, and has presented 12 plenary lectures over the last ten years.

Recent Publications:

Jackson, J.B.C. and 17 others. 2001. Historical overfishing and the recent collapse of coastal ecosystems. *Science* (in press).

Jackson J.B.C. 2001. What was natural in the coastal oceans? *Proceedings of the National Academy of Sciences USA* 98:5411-5418.

Pandolfi J.M. & J.B.C. Jackson. 2001. Community structure of Pleistocene coral reefs of Curaçao, Netherlands Antilles. *Ecological Monographs* 71:49-67.

Jackson J.B.C. 1997. Reef since Columbus. *Coral Reefs* 16:S23-S32.

Jackson J.B.C. 1995. The role of science in coral reef conservation and management. Pages 5-9 in Partnership Building and Framework Development, Final Report, The International Coral Reef Initiative Workshop, Silliman University, Dumaguete City, Philippines.

❧ J. Frederick Grassle ❧

Institute of Marine and Coastal Sciences, Rutgers University

Steps Toward an Ocean Biogeographic Information System Useful for Ecological Research and Conservation Biology Studies

Abstract: The integrated study of marine biodiversity, systematics, and biogeography requires close cooperation among taxonomists, oceanographers, and ecologists. The use of satellite remote sensing, autonomous vehicles, and the development of regional and global ocean observing systems is creating a revolution in the study of life in the oceans. Precise, geographically referenced information on chlorophyll biomass, primary productivity, export production, inter- and intra-annual variation in sea surface temperature, current characteristics at all depths, bottom characteristics including high resolution bathymetry and sediment transport properties, river plumes, frontal zones, and rates of nutrient cycling are becoming more readily available and can be used to generate ecological and evolutionary hypotheses and guide sampling.

An Ocean Biogeographic Information System (OBIS, a component of the Census of Marine Life) provides access to data generated by the Census of Marine Life and serves as a portal for retrieval and analysis of existing data on ocean biology at the species level. Few databases usefully summarize known distributions of marine life, and the available websites are not organized to encourage frequent use and intercomparison of data. The OBIS system will be an online, global, user-friendly atlas, capable of absorbing, integrating and assessing data. The information output will support searching, analyzing, modeling, and mapping marine biogeographic information through a dynamic web interface that can be accessed worldwide.

Biography: J. Frederick Grassle has studied benthic community ecology in a variety of habitats including: estuaries (Buzzards Bay, Great Bay/Mullica, and Narragansett Bay); continental shelves (Georges Bank, Mid-Atlantic Bight Continental Shelf), deep-sea sediments (Atlantic Ocean Basins, Panama Basin, Galapagos, and Phillipine Trench); coral reefs (Heron Island, Great Barrier Reef); hydrothermal vents (Galapagos, East Pacific Rise, Guaymas, and Gorda Ridge). Recent interests include development of a coastal observatory (New York Bight Long-term Ecosystem Observatory --LEO) and a national Coastal Ocean Observing system and an international Ocean Biographic Information System (OBIS). B.S. Yale University, 1961; Ph.D. Duke University, 1967; Fulbright Scholar, 1967-1969; Assist., Assoc., Sr. Scientist Woods Hole Oceanographic Inst.; Professor of Marine and Coastal Sciences Rutgers University, 1989; Director, Institute of Marine and Coastal Sciences, 1989.

Selected Publications:

Grassle, J.F. and J.P. Grassle. 1974. Opportunistic life histories and genetics systems in marine benthic polychaetes. *J. Mar. Res.* 32:253-284.

Grassle, J.F. 1985. Hydrothermal vent animals: distribution and biology. *Science.* 229:713-717.

Grassle, J.F. and N.J. Maciolek. 1992. Deep-sea species richness: regional and local diversity estimates from quantitative bottom samples. *American Naturalist* 139(2):313-341.

Snelgrove, P. V. R., J.F. Grassle, and R.F. Petrecca. 1994. Macrofaunal response to artificial enrichments and depressions in a deep-sea habitat. *J. Marine Research* 51:345-369.

Snelgrove, P. V. R., J.F. Grassle and R.F. Petrecca. 1996. Experimental evidence foraging food patches as a factor contributing to high deep-sea macrofaunal diversity. *Limnology and Oceanography* 41:605-614.

Grassle, J.F., S. Glenn, and C. von Alt. 1998. Ocean observing systems for marine habitats. *Ocean Community Conference '98, Marine Technology Society, Proceedings* 1:567-571.

Snelgrove, P. V. R., J.P. Grassle, J.F. Grassle, R.F. Petrecca, H. Ma. 1999. In situ habitat selection by settling larvae of marine soft sediment invertebrates. *Limnology and Oceanography* 44(5):1341-1347.

The Role of Science in Shaping Policy for Marine Biodiversity Conservation

Abstract: Conserving global public goods such as marine biodiversity presents a formidable challenge to developing nations, where coral reefs and other repositories of the world's marine biodiversity are concentrated. Constrained by poverty, unstable governance arrangements, and weak institutional capacity, policy making in these countries is typically driven by economics and the need to demonstrate short-term returns on investments. Conversion of natural capital to servicede debts, and meeting immediate social welfare and other national priorities, put hidden and undervalued resources like marine biodiversity at great risk, and makes conservation a distant, and often poorly defined, goal. Science can play a critical role in changing the decision-making rubric for marine biodiversity conservation, but it must provide the right kind of information -- and in the right format. For science to be effective in helping make the case for conservation of marine biodiversity and shaping policies that govern its use, science must contribute toward determining the value of marine biodiversity to society -- and internalizing the costs of lost goods and services, including fundamental life support, in the decision-making process. Understanding marine ecosystem boundaries and linkages with aquatic systems upstream is essential to calculating impacts downstream from off-site economic development. Distinguishing localized, anthropogenic stress from background noise or regional and global processes like climate change, assessing system resilience or vulnerability to stress and creating robust system models, will allow for more accurate scenario building and risk assessment of different policy options. As important as providing reliable and timely information to decision-makers and the public, is framing the information within a context that is relevant and linked to the broader policy agenda. Identifying the economic and social trade-offs -- or potential win/win opportunities -- of a range of management options affecting marine biodiversity, will help inform the debate over what and how to conserve. Opening the debate to a wide array of stakeholders will help ensure ownership of the decision and hold policy makers accountable. Examples from Central America and East Asia are used to illustrate these points.

Biography: Marea Hatziolos is senior specialist in coastal and marine resources in the Environment Department of the World Bank. She heads the Blue Team, an interdisciplinary group focusing on environmental aspects of Freshwater, Coastal and Marine Resources Management and the linkages between these systems in the design of Bank projects and implementation of the Bank's Water Policy. Related to this is the development of regional strategies for Bank investment in integrated coastal management and marine biodiversity conservation, in light of increased development pressure on these systems, heightened demand by clients and opportunities for partnerships with the Global Environment Facility. In addition to her policy work, she is responsible for projects in Central America, dealing with Conservation and Sustainable Use of the Mesoamerican Barrier Reef System and Sustainable Coastal Tourism. Dr. Hatziolos serves as the Bank's representative to the International Coral Reef Initiative (ICRI), and to the U.N. Commission on Sustainable Development Sub-Committee on Oceans and Coastal Areas.

Recent Publications:

Cortes, J. and M. Hatziolos. 1998. Status of Coral Reefs of Central America: Pacific and Caribbean Coasts, in Wilkinson, C. (ed). Status of Coral Reefs of the World: 1998. Australian Institute of Marine Science.

Hatziolos, M., A. Hooten, M. Fodor, (eds.). 1998. Coral Reefs: Challenges and Opportunities for Sustainable Management. Proceedings of an Associated Event at the Fifth Annual World Bank Conference on Environmentally Sustainable Development. Washington, D.C. 224pp.

Hooten, A. and M. Hatziolos, (eds.). 1995. Sustainable Financing for Coral Reef Conservation. Proceedings of a Workshop. The World Bank: Environmentally Sustainable Development Proceedings, Series 9, Washington D.C. 166pp.

Ocean Resource Management and Conservation in Florida

Abstract: In 1990, Congress formally established the Florida Keys National Marine Sanctuary--over 9500 km² in area including all of the Florida Keys from Key Largo to the Dry Tortugas and contiguous with Everglades and Biscayne National Parks. Efforts since then to preserve this unique ecosystem have raised fundamental choices for the future of marine protected areas in the United States. The environment of Florida Keys has long been regarded with alarm. Heading along a list of problems are precipitous declines in commercially and recreationally fished species, steadily declining coral cover, decreased water quality, and increasing blooms of benthic and planktonic algae. The Keys Sanctuary management plan is unique. But there are powerful social forces arrayed against the concept of limiting growth and regulating human behaviour for sustainable use of the environment. There is great resistance to the use of zoning to close areas of the ocean to fishing and extractive use. We must develop the political will to take the opportunity afforded by the Sanctuary to work towards sustainability of marine resources. Until this happens, the fate of the "American Tropics" remains in doubt. Further information on the Florida Keys National Marine Sanctuary may be obtained at the website (www.fknms.nos.noaa.gov).

Biography: John C. Ogden has been Director of the Florida Institute of Oceanography (FIO) and Professor of Biology at the University of South Florida since 1988. He received his undergraduate degree from Princeton University and his Ph.D. in Biological Sciences from Stanford University in 1968. After two years at the Smithsonian Tropical Research Institute in Panama he joined Fairleigh Dickinson University, built the West Indies Laboratory (WIL) in St. Croix in the Virgin Islands, and began his continuing field work on global coral reefs and associated ecosystems. Dr. Ogden was Director of WIL from 1981-1988, operated the saturation diving facility *HydroLab* for NOAA during this period, and directed the construction and initial operations of *Aquarius*, the only currently operational facility. Dr. Ogden has published over 100 scientific papers, has contributed to several books, and has produced several television films on tropical ecosystems. He has served on numerous federal and state commissions dealing with coastal ecosystem management, marine protected areas, and coral reef conservation and was a member of the founding Advisory Council of the Florida Keys National Marine Sanctuary. He presently serves on the Board of the World Wildlife Fund and the Center for Marine Conservation, and is a Fellow of the American Association for the Advancement of Science.

Recent Publications:

Ogden, J.C. 1997. Ecosystem interactions in the tropical coastal seascape, p288-297. In: C. Birkeland (ed.) *Life and Death of Coral Reefs*, Chapman and Hall, NY, 536p.

CARICOMP (J.C. Ogden with 32 other authors) 1997. Caribbean coastal marine productivity (CARICOMP): a research and monitoring network of marine laboratories, parks, and reserves. *Proc. 8th Int. Coral Reef Symp* 1: 641-646.

Ogden, J.C. 1997. Marine managers look upstream for connections. *Science* 278: 1414-1415.

Murray, S.N., R.F. Ambrose, J.A. Bohnsack, L.W. Botsford, M.H. Carr, G.E. Davis, P.K. Dayton, D. Gotshall, D.R. Gunderson, M.A. Hixon, J. Lubchenco, M. Mangel, A. MacCall, D.A. McArdle, J.C. Ogden, Joan Roughgarden, R.M. Star, M.J. Tegner, and M.M. Yoklavich. 1999. No-take reserves networks: Sustaining fishery populations and marine ecosystems. *Fisheries* 24(11): 11-25.

Ogden, J.C. 2001. Maintaining diversity in the oceans. *Environment* 43(3): 28-37.

Jane Lubchenco
Oregon State University

Conservation in the Political Arena

Abstract: A generation is defined by its collective experience and its legacy. My generation has witnessed depleted fisheries, degradation of coral reefs, appearance of more than 50 dead zones in coastal waters around the world due to nutrient pollution from the land, increases in invasive species, rising sea levels and other manifestations of climatic change. Will these changes become our legacy to our children and grandchildren? Not if those of us here are willing to effect meaningful change. Confronting myths about oceans and the role of anthropogenic activities is a useful beginning. Providing scientific guidance to inform public dialogue and decisions is important. Promoting powerful conservation and fishery management tools such as marine reserves will be essential if we are to make meaningful progress. Conservation requires political, public and private awareness, commitment and action. What are you doing?

Biography: Jane Lubchenco is an environmental scientist and a marine ecologist who, as Wayne and Gladys Valley Professor of Marine Biology and Distinguished Professor of Zoology at Oregon State University, is actively engaged in teaching, research, and synthesizing and communicating scientific knowledge to the public and policymakers. Dr. Lubchenco received her doctoral degree from Harvard University in 1975. She was Assistant Professor of Biology at Harvard before moving to OSU in 1978. She is a former President of the American Association for the Advancement of Science (AAAS) and of the Ecological Society of America (ESA). She is serving a second term on the National Science Board (NSB; following nomination by President Clinton and confirmation by the Senate) and is a member of the Pew Oceans Commission. Dr. Lubchenco's current research interests include marine conservation biology, biological diversity, ecosystem services, ecological causes and consequences of global changes, and sustainable ecological systems. Her research focuses on rocky intertidal shores and near shore coastal ecosystems in Oregon and around the world with special emphasis on the ecology of seaweeds, plant herbivore interactions and community dynamics. Dr. Lubchenco is active in teaching and communicating science. She teaches courses in ecology, environmental sciences, and marine biology. Dr. Lubchenco lectures widely about marine conservation, biodiversity, climatic change, ecosystem services, ecological consequences of population growth and overconsumption, and other global environmental issues.

Recent Publications:

Lubchenco, J. A New Social Contract for Science. P. 278 -280 In: World Conference on Science: Science for the Twenty-First Century, A New Commitment, published in London by Banson for UNESCO, 544pp.

Dasgupta, P., S. Levin, J. Lubchenco. Economic pathways to ecological sustainability. BioScience 50:339 - 345. 2000

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Graduate Student Research Poster Session

Matthew Craig -Scripps Institution of Oceanography -Phylogenetic Relationships Among the New World Groupers (Serranidae: Epinephelinae)

David Levenson -Scripps Institution of Oceanography & Southwest Fisheries Science Center - Color vision in cetaceans

Julie Oswald -Scripps Institution of Oceanography & Southwest Fisheries Science Center - Acoustic identification of dolphin species in the eastern tropical Pacific Ocean

Uma Ramakrishnan -Scripps Institution of Oceanography & Southwest Fisheries Science Center -Mating systems in the sea: modeling how mating systems affect the proportion of genetically contributing individuals and genetic diversity

Christopher Janousek -Scripps Institution of Oceanography -Biodiversity and ecosystem function relationships in marine benthic habitats

Jonathan Flowers -Scripps Institution of Oceanography -The recruitment sweepstakes has many winners: Genetic evidence from purple urchins

Nicholas Kellar -Scripps Institution of Oceanography & Southwest Fisheries Science Center - Stressed, skinny and stained: molecular analysis of stress response in marine mammals

Cynthia Taylor -Scripps Institution of Oceanography & Southwest Fisheries Science Center - Horizontal and vertical distribution of selected fishes and squids collected in the Southern California Bight

Yolanda Schramm -Universidad Autónoma de Baja California & Southwest Fisheries Science Center -Genetic structure of California and Galápagos sealions

Bonnie Becker -Scripps Institution of Oceanography & National Park Service -Extent of self-seeding in a rocky intertidal ecosystem: The effects of a large kelp forest on retention of invertebrate larvae off of Point Loma, San Diego, California

Katherine Sharp -Scripps Institution of Oceanography -Siblings species of the bryozoan, *Bugula neritina*, produced different brood stages and harbor distinct strains of the bacterial symbiont "*Candidatus Endobugula sertula*"

David Kline -Scripps Institution of Oceanography -The role of the associated microbial community in emerging coral diseases

Laura Fandino -Scripps Institution of Oceanography -Community structure and distribution of marine *Cytophaga*-like bacteria at the Antarctic Polar Front Zone

Markus Heubes -Scripps Institution of Oceanography - *Didemnum guttatum* kills the coral, *Porifera nigrescens*, chemically