UNIVERSITY OF CALIFORNIA, SAN DIEGO

BERKELEY • DAVIS • IRVINE • LOS ANGELES • RIVERSIDE • SAN DIEGO • SAN FRANCISCO

SANTA BARBARA • SANTA CRUZ

SCRIPPS INSTITUTION OF OCEANOGRAPHY, 0202
CENTER FOR MARINE BIODIVERSITY AND CONSERVATION
TEL: (858) 822-2790
FAX: (858) 534-7313

9500 GILMAN DRIVE
LA JOLLA, CALIFORNIA 92093-0202
EMAIL: CMBC@UCSD.EDU
URL: CMBC.UCSD.EDU

Center for Marine Biodiversity and Conservation
Annual Report

July 2018– June 2019

Our research, public programing, education, and alumni foster scientific *exchange*, create *access* to science and *trust* with ocean users, decision makers and the public needed to help the oceans continue to feed, employ and nourish humans and all of life on Earth.

•***Foster exchange*** – Workshops and a visiting scholars program create opportunities for two-way exchange of ideas and allow a dive deep into specific questions to find innovative solutions.
•***Create access to Science***–Student training is a core mission, with broadened efforts to reach more through short courses (both in-person and online) and public events.
•***Build trust*** – Shared experiences and open and honest dialog are the building blocks of trust.

This report details the activities in these areas in the past year along with on-going research updates.

FOSTER EXCHANGE

BUILDING COLLABORATIONS

U.S. Department of State

At the request of San Diego Diplomacy Council CMBC and SWFSC arranged an MPA Roundtable discussion with an international fisheries delegation. SIO co-hosted a global social hour for these guests.

Visiting International Fisheries Delegation with hosts.

Ashoka U Exchange

In collaboration with Rady School of Management, CMBC hosted a site visit for participants who ranged from high school, undergraduate, graduate, faculty and community partners. The Exchange is interested in "Changemaker" activities. This site visit highlighted activities around ocean health, climate change, stewardships, and local community involvement.

World Wildlife Fund

We met with WWF in a two day collaboration meeting to discuss research priorities and mutual work in Mexico. The current MOU needs revision and the group took time to review and draft a new MOU for expanded collaboration, considerations and commitments.

Visiting Scholars

CMBC hosts two Visiting Scholars. Sara McDonald, is a Senior Fisheries Scientist with the Monterey Bay Aquarium Seafood Watch Program. Between July 2018 and June 2019, Sara worked with several MAS-MBC students who were interested in learning more about seafood sustainability and conducting independent research (including Capstone projects) on the topic. Specific work was as follows:

- Conducted a guest lecture on IUU fishing, traceability, smuggling, and forced labor for the Fall Quarter's Ocean Law and Policy course
- Conducted a guest lecture on seafood ratings and certifications programs for the Sustainable Seafood course during Winter Quarter
- Served as Capstone Committee Chair for MAS-MBC student James Bruce
- Served as Capstone Committee member for MAS-MBC student Emi Koch
- Served as Independent Study advisor for five MAS-MBC students who worked on special projects pertaining to the Seafood Watch Standard for Fisheries and the Seafood Slavery Risk Tool (Emi Koch, Ross Cooper, Cynthia Hsia, Katherine Rainone, Kat Montgomery)
- Conducted an expert elicitation workshop with MAS-MBC researchers and scientists from the IATTC and NOAA Fisheries SW Fisheries Science Center to help determine susceptibility of various taxa to fisheries bycatch.
- Participated in "Behind the Scenes at Scripps: The Sustainability of Local Seafood" event
- Coordinated with CMBC Visiting Scholar, Lyall Bellquist (TNC), on bycatch and review of CA state fisheries.

CMBC Visiting Scientist, Lyall Bellquist, from The Nature Conservancy reports these activities:

- Funded a collaborative project with the Semmens Lab to test a new citizen science fisheries data collection platform in southern California
- Funded a graduate student in the Sandin Lab to develop a new federal fisheries permit database, and conduct national- and regional-scale analyses of the role, impact, and lessons learned from these permits as adaptive fisheries management tools
- Collaborated with the Semmens Lab to achieve funding for the continuation of the statewide California Collaborative Fisheries Research Program ($1M)
- Published manuscript in collaboration with Nick Wegner and John Hyde (NOAA) documenting effectiveness of descending devices for reducing post-release mortality in the California recreational rockfish fishery
- Produced draft manuscript in collaboration with HJ Walker documenting range shifts and/or unusual occurrences of 37 species of fishes associated with recent oceanographic anomalies in the Southern California Bight
- Submitted Saltonstall-Kennedy grant proposal with Brice Semmens and NOAA to conduct genetic identification of a cryptic congener in the vermilion rockfish species complex, and create a new fisheries-independent time series to be used in the first stock assessment that separates vermilion and sunset rockfishes
- Formed a collaboration with Uwe Send to develop a BOEM proposal for fine-scale oceanographic monitoring at Point Conception
- Formed a collaboration with Clarissa Anderson (SCOOS) to integrate a spatially explicit model of Harmful
- Algal Blooms (C-HARM) with commercial fisheries data in California

- Formed a collaboration with Steve Stohs to produce analysis of swordfish catch and bycatch rates using experimental commercial fishing gear
- Produced a summary of the current status of the barred sand bass fishery with Brice Semmens for NOAA review
- Organized TNC-SIO-IATTC fishing trip with prince of Pohnpei
- Initiated discussions to develop a TNC-SIO master agreement for future collaborative research and potential intern program
- SIO286 lecture: "Spatial management vs. traditional fisheries policy"

Having these scholars on-site helps with preparations of collaborative papers, proposals and manuscripts. They also enhance the educational experience for our students.

CREATING ACCESS TO SCIENCE

PUBLIC EVENTS

SALTY CINEMA

The goal of Salty Cinema is to bring together community leaders, scientists, communicators, filmmakers and businesses to celebrate the ocean and promote conservation. CMBC sponsored one Salty Cinema event this period.

The environmentally conscious film screening series this year featured the polar oceans. The film was followed by a panel discussion with questions from the 80 audience members. The polar ocean event focused on short films selected from the Association of Polar Early Career Scientists film festival. Panelists were Dr. Kathryn Mengerink JD, Christian McDonald, Dan Lubin, and Allison Lee Cusick.

The popularity of Salty Cinema within the community resulted in a gift to continue these student driven public events with faculty oversight for the next three years. Faculty oversight committee members are Greg Rouse, Samantha Murray and Christian McDonald. All the student coordinators from past events have graduated and are employed. The committee agreed to wait until fall 2019 to organize a new student committee.

PLASTIC AWARENESS GLOBAL INITIATIVE – OCEAN SCIENCE PUBLIC EVENTS

The Salty Cinema event held in early 2018 titled "*A Plastic Ocean*" spurred the Wilsdorf Mettler Future Foundation's request that we coordinate an event to launch their Plastic Awareness Global Initiative (PAGI). The aim of PAGI is to bring broad awareness to a quickly overwhelming issue of plastic saturation in the global environment - primarily in the oceans, to co-ordinate various efforts throughout the world addressing the pressing problem, and to leverage the expertise from Scripps Institution of Oceanography to the daunting challenges associated with the growing social/environmental problems of plastics in the oceans.

CMBC organized a 4-day synthetic workshop to consider the status of science and future research directions regarding plastics in the ocean. We hosted 26 researchers representing the U.S., United Kingdom, Switzerland, Japan, Norway, Bahamas, Netherlands, and Australia. Participants formed three focus groups 1) *Scope and scale of plastics in the biological ocean* 2*) Life cycle of plastics in the sea*, and 3) *Biological scope of the solutions*. The results of the working groups will be three papers to form a series in an appropriate journal.

As part of this effort we organized two public events: *The Science of Plastic in the Sea* and *Solutions for Marine Plastic Pollution*. Plenary speakers were Dr. Brice Semmens from SIO, Dr. Jenna Jambeck, University of Georgia, and Dr. Linda Amaral Zettler from the Royal Netherlands Institute for Sea Research. Joining them for the panel discussion were Dr. Jenni Brandon (SIO), Dr Mincer (Florida Atlantic University), Dr. Lavender Law (Sea Education Association)

The second event, *Strategies for Solving the Problem of Plastics in the Sea*, featured NGOs presenting their efforts to curb the flow of plastic and discuss techniques for collecting marine debris. Each event addressed an audience of almost 200 people. Both public events were live webcast and recorded for future viewing on the CMBC YouTube Channel.

We are now in talks with the foundation for PAGI II: Ocean Plastic and Social Science. Initial discussion with our economists and human-behavior researchers revolves around organizing this event as a "hackathon."

KNOWLTON-JACKSON DISTINGUISHED LECTURE IN MARINE BIODIVERSITY AND CONSERVATION

This year Dr. Rashid Sumaila (Canadian Institute for the Oceans and Fisheries) was selected as distinguished speaker and he presented "*Interdisciplinary collaborative ocean economics research with examples from the ocean trenches*." Sheila Walsh Reddy (The Nature Conservancy) was the CMBC alumni speaker and presented "*New Science and Technology for Conservation Solution."* This is our premier event and as always was well attended by the local community.

Mark your calendar for the 2020 fisheries focused event which will be held on April 16. Our distinguished speaker is Dr. Patricia Majluf (Oceana -Peru) with alumnus Dr Michael Navarro (University of Alaska Southeast). We hope for donor support to webcast and record this and future Knowlton-Jackson events.

FRENCH AMERICAN TALKS ON BIODIVERSITY

CMBC co-sponsored this public event at the request of the Scientific Office of the French Embassy in the USA as part of their new FACT-B program (*French Ameri-Can Climate Talks – Biodiversity*). The FACT-B series aims to raise public awareness in France, the United States, and Canada, as well as reinforce exchanges between scientist and experts on biodiversity issues. Days before this event, IPBES released the intergovernmental report on the state of knowledge related to biodiversity and ecosystem services. The report states that "*one million species are at risk of extinction."* Speakers and discussion panelists included Anne Larigauderie, Executive Secretary of IPBES (Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Policy) Jean-Francois Silvain, President of the Foundation for Research on Biodiversity, as well as Lisa Levin and Doug Bartlett of Scripps. We subtitled the event *Deep Ocean Biodiversity Challenges in the 21st Century* to draw attention to the deep. Special thanks to Postdoc Natalya Gallo for moderating. This event attracted a different audience than our other public events and expands our outreach to the community.

SUSTAINABLE SEAFOOD EVENT

CMBC supported the development office efforts to raise funds for EW Scripps. Stuart Sandin and Sarah Mesnick (NOAA fisheries) served as co-hosts for a sustainable seafood event. Sarah was panel moderator and panelists included Jennifer Smith and alumni Oriana Poindexter. The panel discussion as followed by seafood tasting, discussion and socializing with Scripps researchers, NOAA scientists, local chefs and fishermen.

BROWN BAG TALKS

CMBC Brown Bags this year featured a student talk on *Science Communication Through Art* and *Responses of Coral Reefs to Global Warming*, and guest speaker, Nancy Knowlton who presented *Earth Optimism in an Age of Rage.*

In conjunction with SIO's Sustainability effort during Earth Week, we hosted *The Science of Sustainable Surfing: What's in your surfboard, what happens when you're done with it, and how surfboards can be used as scientific platforms.*

Panelists:

- Phil Bresnahan, The Smartfin Project/Scripps Inst. of Oceanography – *using surfers and surfboards as platforms for citizen science-based oceanographic data collection*
- Stephen Mayfield, UCSD – *Turning algae into everything from surfboards to flip-flops*
- Kevin Whilden, Sustainable Surf – ECOBOARD certification, *Foam to Waves, and other Deep Blue projects*
- Billy Burns, Rerip San Diego – *Upcycling used and broken boards into art and building materials.*

EDUCATION

PIER

CMBC continues to host and manage the University of California San Diego Specialization Program for Environmental Interdisciplinary Research. Drs Norris and Watson who served as co-chairs since the program's inception stepped down this year. Drs. Sandin and Braswell (Anthropology) have assumed the leadership role. Three new faculty members joined the PIER Steering Committee this year; David Pedersen (Anthropology), Jeff Bowman (SIO) and Eric Gartzke (Political Science). Two students were admitted to the PIER specialization in 2019. Both from SIO: Julia Chavarry joins the program in summer and Danielle McHaskell in the fall quarter 2019.

SIO students have benefited from donor support since program inception but those pledges have now expired. The availability of funding for SIO students in the 2020-21 academic year is questionable.

MAS-MBC

Drs. Smith and Norris served as co-chairs for the MAS program this year. The co-chair role changes based on their availability during the academic year. Drs. Smith and Jacobsen (Economics) will serve a co-chairs for 2019-2020.

CMBC faculty and researchers are also key members of the summer course teaching team and advisors to the MAS students. Beyond the 16 unit summer course CMBC faculty provide required core courses for MAS. This year Stuart Sandin taught Marine Science Economics and Policy - Marine Protected Areas (SIO286), Sarah Mesnick taught Marine Science Economic & Policy - Sustainable Seafood (SIO286), and Lisa Levin taught a special course this year in International Biodiversity Policy (SIO 278). Offered in Spring 2019, Levin's class gave students an opportunity to learn about how they can bring science to UN agencies developing international policy that affects biodiversity.

Twenty-five students completed the MAS program this year and successfully presented their capstone projects at the annual symposium. The live and recorded broadcast of the symposium serves to increase program awareness globally and maintain our alumni engagement.

ALUMNI HIGHLIGHTS

CMBC Alumna Ayana Johnson received one of the UCSD 40 under 40 awards and she was invited as keynote speaker for this year's Scripps Student Symposium.

CMBC now boasts our 26 alumni in D.C. serving with USDA, various offices at NOAA, and at NGOs including National Geographic, Conservation International, The Nature Conservancy and others.

CMBC founder, Dr. Nancy Knowlton, meet with alumni in Washington D.C.

Dr. Amanda Carter joined the D.C. group this year having received a Knauss Policy Fellowship. This brings our total Knauss Fellows to 20 since CMBC training in science, economics, and policy began. Our total for California Seagrant Policy Fellowships grew by three this year for a total of 15. Awards went to MAS-MBC alumni Megan Emidy serving at the Port of San Diego, Allison Kellum at the Ocean Protection Council on Climate, and Scott Shatto at the Ocean Protection Council on Marine Protected Areas.

Dr. Nancy Knowlton, CMBC founding director, was awarded the National Marine Sanctuaries Foundation Lifetime Achievement Award for her contributions to coral research, science communication and marine science education. Young professionals whose careers have been shaped by Dr. Knowlton's efforts span the globe as leaders and influencers, shaping US ocean policy in the halls of Congress and conducting research that combines the natural and social sciences to inform decision making.

CMBC alumni were there to congratulate her at the gala during Capitol Hill Ocean Week.

Pictured here with Drs Jeremy Jackson and Nancy Knowlton are some CMBC alumni who attended the gala. Matt Mulrennan, Dr. Miriam Goldstein, Kim McIntyre, Dr. Ayana Johnson, and Shannon Yee.

Matt is a 2010 graduate of the MAS-MBC program. He is Director of Ocean Initiatives for XPrize and recently Co-Founder Kolossal. The company conducts expeditions to film exotic marine life while campaigning to protect their habitats. Matt is the lead coordinator for the MAS Alumni Network and he created and maintains the MAS-MBC facebook page.

Miriam Goldstein received her Ph.D. in 2012. She transitioned from her Knauss Fellowship to the Legislative Assistant to US House of Representative Jackie Speier. She's now Director of Ocean Policy for the Center for American Progress.

Kim McIntyre, graduated in 2007 from the MAS-MBC program. She was Director of Ocean Law and Policy for Strategic Ocean Solutions before taking her current position as Director of the Monterey Bay Aquarium's Conservation Partnership program.

Ayana Johnson, another Knauss Fellow, received her Ph.D. in 2011. She served as Executive Director of the Waitt Institute and founded their Blue Halo Initiative throughout the Caribbean islands. She founded the Ocean Collective, an organization that pulls together teams to address specific ocean conservation challenges.

Shannon Yee, a MAS-MBC alumna from 2010 is Policy and Conservation Director for the National Marine Sanctuary Foundation. She plays a critical role each year organizing the Ocean Gala and other events for Capitol Hill Ocean Week.

RESEARCH UPDATES

CONSERVATION TECHNOLOGY

NRT-HDR: Training for a revolution in data-driven 21st century environmental science.

We proposed a graduate training program to combine the unique, convergent nature of environmental research at Scripps Institution of Oceanography (SIO) with innovations in engineering and data science represented by the Halicioğlu Data Science Institute (HDSI). The program builds on the strong legacy of environmental planetary data acquisition uniquely represented by SIO and will train a new generation of doctoral students equally adept in data and the environmental sciences, enabling a revolution in scientific inquiry that will span all fields of planetary science. George Sugihara was lead PI and selected co-PIs from other centers who were non-responsive to our call to address the core participant requirements. We could not meet the deadline for submission but have a complete project proposal for the next call.

BIODIVERSITY AND HUMAN IMPACTS

MARINE BIODIVERSITY & CONSERVATION

The Southern California Bight Elasmobranch Consortium continues monitoring of shark and ray movements in and around the La Jolla MPAs (over 70 individuals now carry acoustic tags). A paper identifying nursery areas of Blue and Shortfin Mako sharks is in press, and studies on temperature preferences of juvenile elasmobranchs continue.

Dr. Hastings reports that the staff of the SIO Marine Vertebrate Collection have published descriptions of several new species of fishes including a grouper, a wrasse, a damselfish and two scaleless black dragonfish, and have supported the descriptions of several other new fish species.

CMBC promotes the Scripps Endowment for the Collection by promoting ongoing Name a New Species project under the leadership of Dr. Greg Rouse.

Greg Rouse and Lisa Levin participated in a Schmidt Ocean Institute cruise aboard the RV Falkor in January 2019 to explore never seen parts of the Costa Rica margin and offshore seamount in hopes of creating new conservation opportunities for the country. Some of the phenomenal cruise highlights can be viewed at https://www.youtube.com/watch?v=N7_nQVhMsAc

CORAL REEF ECOSYSTEMS – THE 100 ISLAND CHALLENGE

The 100 Island Challenge is a centralizing campaign aimed to learn about how coral reef communities are structured by natural conditions and anthropogenic disturbances. The effort capitalizes on the wide variety of contexts from across tropical islands, making it plausible to select islands in a manner analogous to the factorial design of manipulative experiments – the islands span ranges of oceanographic context, island geomorphology, and anthropogenic context. The 5-year campaign of the 100 Island Challenge reached its midpoint this year.

A detailed stewardship report is available, providing more detail regarding progress and accomplishments of the 100 Island Challenge. A few highlights include the following:

- The study design targets conducting surveys at each island at least two times, thereby getting information of demographic rates of reef organisms. Given the coincident timing of anomalous warm-water events linked with ENSO events, an opportunity has emerged to study responses of coral reefs to thermal stress.
- Surveys have also tracked recovery dynamics for multiple time points following disturbances, and in many cases there is strong evidence of rapid coral recruitment and growth, evidence consistent with community adaptation to changing environmental conditions.
- Three new PhD students joined the team this year – Anela Akiona, Kendall Chancellor, and Orion McCarthy.
- The application of 3D imaging of coral reefs has provided unique data. A strong partnership has emerged between CMBC and UC San Diego engineering students and faculty, serving as a strong case study of conservation technology here at Scripps.
- The 100 Island Challenge team has been central to 2 academic workshops and 6 training programs, helping to contribute to the coordination of networks of professionals conducting ecological monitoring of coral reefs; inclusion of new conservation technologies is accelerating this coordination.

DEEP OCEAN STEWARDSHIP INITIATIVE

Levin contributed on behalf of DOSI and the Deep Ocean Observing System the following:

- OceanVisions 2019, Georgia Aquarium, Atlanta – *Deep-Ocean Solutions (April 2019)*
- IPBES /CMBC - *Deep Ocean Biodiversity Challenges in the 21st Century (May 29, 2019)*
- NC State University invited presentation *The Final Frontier: Biodiversity Discovery and 2ast Century Challenges in the Deep Ocean (April 2019).*
- Convened Deep-Ocean Stewardship Session at Deep Sea Biology Symposium (Sept. 2018 – Monterey)
- COP 24 Press conferences: *Global Observing Needs of the Deep Ocean*
- Levin participated as a lead author in IPCC *Special Report on Oceans and Cryosphere in a Changing Climate*
- Policy brochure on climate change presented to the UN BBNJ delegates – stimulated discussion and a special side event hosted by multiple nations
- DOSI/DOOS contribution at the Decade for Ocean Science Global planning meeting (Copenhagen, May 2019)

Levin received, on behalf of DOSI a 3 year award from Marc and Lynne Benioff and a 2019 grant from the JM Kaplan fund to support DOSI's efforts to interact with high-level decision-makers, provide policy briefs, and hold special events to expand awareness, scientific understanding, and advice to members of the International Seabed Authority who consider deep seabed mining regulations.

SUSTAINABILITY AND ECOSYSTEM BASED FISHERIES MANAGEMENT

GULF OF CALIFORNIA MARINE PROGRAM (GCMP)

The GCMP continues to address environmental and associated social issues in Mexico's coasts by engaging researchers, students, resource users, and local communities.

Fisheries: We have thus far monitored over 19,000 fisheries trips composed of 109 species, with 9 communities utilizing our GPS trackers. Working with collaborators, we estimated the fishing population and fishing locations associated with relevant socio-economic indicators relating to poverty levels. This information shows the regional differences and points towards priority areas and productive and differentiated approaches to fisheries and economic development.

Mangroves: We have partnered with Engineers for Exploration to use drones to monitor mangroves in Mexico while providing them the resources and guidance on the skills needed to do so. As such, we have developed both a drone protocol as well as a two-day structured workshop that has been shared with collaborators, university students, and rangers from Mexico's National Commission of Natural Protected Areas. Additionally, we have better understood regional roles that mangroves play in carbon storage, and have developed a prioritization scheme in selecting regions in which conservation efforts should be directed towards.

Data Sharing and Science Communications: The GCMP maintains committed to data transparency and communicating science to target stakeholders and decision makers, increasing access to robust science to further science and improve marine resource management. dataMares has enabled us to make progress in assembling large, robust, rich databases. The platform hosts 105 databases, over 115 data visualizations, and has contributed to 9 data journalism articles. We have continued to leverage other forms of science communications as well, through the likes of photography and videography as with our Mares Mexicanos and Natural Numbers initiatives. Together, we have over 50 videos on the value of nature.

SUSTAINABILITY AND MANAGEMENT OF MARINE FISHERIES

Price Philanthropies contracted with CMBC to provide a Sustainable Seafood Sourcing assessment for PriceSmart Latin America. The team is reviewing the company's seafood purchasing history while exploring dimensions of sustainability and social impact for each item. The information is being cycled directly back to the purchasing team to design new policies in corporate responsibility with seafood.

Alumna Oriana Poindexter serves as Project Manager and outlined the project goals: 1) Assess current seafood sourcing 2) Empower PriceSmart merchandising team to confidently assess seafood vendors and 3) Support the development of strategic educational materials for customers.

CLIMATE RESEARCH AND NEGOTIATIONS

GREENHOUSE GAS EMISSIONS

Lisa Levin's lab conducted research on ecosystem services and disservices associated with natural stormwater treatment systems (biofilters), focusing greenhouse gas emissions and carbon uptake.

The Smith lab has found a certain species of red algae seaweed produces a compound that could halt bovine production of methane. "*When fed to cows in very small quantities it prevents the production of methane in the digestive process of cow*s," said Jennifer Smith.

CLIMATE POLICY AND NEGOTIATIONS

Levin was co-convener of the session Physiology and Multiple stressors at the Kiel Ocean Deoxygenation Symposium (Sept. 2018). She also contributed to preparation of the Kiel Declaration on Ocean Deoxygenation (https://www.ocean-oxygen.org/declaration) signed by more than 550 scientists. Levin, McCormick and Gallo spoke at the symposium.

At COP 24 in Katowice, Poland Lisa Levin and Yassir Eddebbar gave a press conference on Ocean Deoxygenation. Levin, Samantha Murray and Garfield Kwan gave a press conference at COP 24 on Deep Ocean Observing. Levin and Natalya Gallo contributed to an IUCN special report on Ocean Deoxygenation (to be released Dec. 2019). Levin also contributed to the IPCC special report on Ocean and Cryosphere in a Changing Climate, schedule for release in Sept. 2019). This year's publications highlighted the sensitivity of vision to low oxygen a (McCormick et al. 2019), and extreme hypoxia tolerance in selected fish (Gallo et al. 2019).

The DOSI Climate and Fisheries working groups completed a report with FAO Deep-seas program: FAO. 2019. *Deep-ocean climate change impacts on habitat, fish and fisheries*, Lisa Levin, Maria Baker, and Anthony Thompson (eds). FAO Fisheries and Aquaculture Technical Paper No. 638. Rome, FAO. 186 pp. This was presented to the FAO in Rome, May 2019.

The DOSI Climate and Minerals working groups co-hosted a workshop titled *Deep Ocean Climate Connections with Seabed Mining* June 4-6, 2019 at Scripps. This workshop explored, within the context of deep seabed mining the influence of climate change on deep-sea ecosystems and vice versa, the relevance for spatial planning, diverse modeling approaches and mainstreaming climate into mining guidelines regulations. A policy brief was prepared for presentation at the July 2019 International Seabed Authority meeting in Jamaica (brochure and side event).

Levin presented the Revelle Commemorative Lecture (April 2019) titled" *Sustainability in Deep Water: The Challenges of Climate Change, Human Pressures, and Biodiversity Conservation*" at the National Academy of Sciences in Washington DC (March 2019)- published in Oceanography June 2019 and available at https://livestream.com/accounts/7036396/events/8650413/player?width=640&height=360&enableInfoAndActivity=true&defaultDrawer=&autoPlay=true&mute=false&wmode=transparent

---

The students, staff, and faculty of CMBC are a dynamic and creative group. The breadth and depth of their activities are impressive, as is their commitment to stepping beyond the traditional edge of academic obligation. Whether the activities are national or international, local or global, the outputs share much in common – empowerment of our community to take actions for the ocean. This year the CMBC team came together to explore new and creative means to reach more members of our ocean-stewarding community, hosting workshops and public gatherings about established science, as well as leading research and educational campaigns around emerging topics.

The CMBC vision emphasizes the importance of trust, access, and exchange across ocean-minded communities. By innovating research opportunities and connecting with a diversity of constituents, the impacts of CMBC are continuing to be noticed; by building and maintaining relationships with these constituents, the impacts will multiply. We look forward to the year ahead, a year in which new opportunities are already upon us and the challenge will be to secure the capacity to facilitate this growing demand.

We are appreciative of the engagement of the CMBC community and of all of our partners, and for the support and infrastructure needed to make these efforts successful. Thank you all!

Stuart Sandin,
Director CMBC
Oliver Chair