emissions, chemicals carelessly flushed into bays, urban runoff, and plastic garbage are all found in our oceans and along our beaches. Numerous studies have documented the effects of pollutants in the marine environment. It has been suggested that some organisms have evolved mechanisms for coping with constant exposure to some toxic chemicals. CMBC researchers are working at multiple levels, from cells, to physiology and behavior to whole communities, to understand contaminant effects, animal coping strategies and how they may benefit ocean and human health.

GEOGRAPHICALLY FOCUSED RESEARCH

Central Pacific Atolls
Remote and uninhabited atolls provide one of the few remaining opportunities to study marine ecosystems in the relative absence of human activities. Through a series of research expeditions, a team of researchers is developing conservation strategies based on studies of the biodiversity and structure of the reef communities, sampling all major taxonomic groups including microbes, algae, coral, other invertebrates and fish. The research has resulted in numerous peer-reviewed articles published in major scientific journals. Working with Science-to-Action, an organization that disseminates scientific findings, CMBC researchers contributed to the publication of the Coral Health Index, a tool to guide adaptive management of coral reef communities.

Gulf of California
The Gulf of California Marine Program is dedicated to generating and disseminating scientific information that has a direct, positive impact on conservation and management issues and policies in the region. To facilitate and improve access to the large body of information and data collected and insure a long-term archive, the group is developing DataMARES. The database will serve as a marine access repository to foster cooperation among institutions in the region and inform for decision making at various levels. Researchers investigate coastal and marine ecosystems, fisheries, marine reserves and climate change. The communications efforts of this research group make science fun and beautiful by sharing pictures and videos through its blog and media outlets. With Science-to-Action, CMBC researchers contributed to the publication Living with the Sea, a booklet that examines the role of marine managed areas in restoring and sustaining healthy oceans and the importance of local management efforts.

California Coastal Biodiversity
California coastal waters are some of the richest in the world and encompass varied marine ecosystems from coastal salt marshes, estuaries and sandy beaches to rocky shores, kelp forests, and deep submarine canyons. They provide a great diversity of marine life, productive nursery grounds for many species, and easy access to learn about the environment and investigate changes to these ecosystems. California coastal waters are also subject to climate-related oxygen loss and declines in pH and some areas are more vulnerable to human impacts from trampling, collecting, overfishing and urban runoff. The San Diego/La Jolla Coastal Collaboration was established to unite CMBC researchers who monitor and analyze the physical and biogeochemical dynamics of these ecosystems and link historical data with ongoing monitoring. The new Marine Protected Area on the south coast provides a special opportunity to conduct studies of long-term change in the environment and ecosystem while integrating outreach and public education.
CMBC Science for Solutions

The oceans are much more complex and much more fragile than was once thought. Marine ecosystems are suffering from chronic overfishing, pollution, and other damaging activities. When the natural balance of the marine environment is altered, inevitably so is ours. The possibly permanent changes in the ocean food chains globally reduce the availability of marine ecosystem benefits to humanity and potentially for generations to come.

Solutions cut across traditional academic disciplines and integrate science and policy to access environmental, economic, and social consequences. The ability to communicate complex science to a variety of audiences can lead to meaningful solutions. CMBC seeks to remedy the impact that humans and climate change have on marine protected areas. CMBC research investigates the role of sharks in marine ecosystems and is cited as an important source for legislation to ban the trade of shark fins in California.

GLOBAL RESEARCH ISSUES

Artisanal Fisheries Research Network (AFRN)
Small-scale fisheries for subsistence and local, small markets exist around the world and are vital to the livelihoods and food security of 150 million people. Collectively, these fisheries catch 30 million tons of fish for human consumption (the same amount as commercial fisheries). Given the increase in artisanal fishing effort with increasing population pressures, understanding artisanal fisheries is a priority for marine conservation. CMBC’s AFRN aims to facilitate knowledge-sharing and collaboration among researchers. This program fosters an improved understanding of socioeconomic and cultural drivers of these fisheries and their management implications.

Deep Ocean Sustainability
The deep ocean (>200 meter water depth), which covers more than half of our planet, is emerging as a new source of seafood, energy resources, commercially important metals, minerals, and pharmaceuticals. The deep ocean plays a critical role in the global carbon cycle and climate regulation and harbors enormously diverse ecosystems containing the evolutionary potential needed to adapt to a changing ocean environment. However, these functions and services are undermined by biota that are among the most poorly understood on Earth and they now face serious challenges from increased human activities. This initiative examines the complex biological, physical, and human linkages shaping biodiversity and ecosystem processes in the deep sea. It attempts to develop innovative and integrated multi-disciplinary management approaches that will enable sustainable human use while preserving vital ecosystem services, functions and diversity. Our focus is on integration of state-of-the-art science, modeling approaches and policy instruments into environmental and economically sustainable management of key deep ocean regions and resources, increased deep-ocean literacy and international capacity building.

Ocean Acidification Working Group
Anthropogenic carbon dioxide emissions are resulting in increased concentrations of CO2 in the world’s oceans. “Ocean acidification” could have profound impacts on marine ecosystems globally. This area of research requires a multidisciplinary approach to gain a better understanding of the interactions between atmospheric and ocean chemistry, physics, biogeochemistry and the interactions of these processes with marine organisms. Working across several disciplines, the CMBC ocean acidification working group facilitates interdisciplinary approaches to maintain the integrity of ocean ecosystems and manage their use in the face of rapid and inevitable global change.

—Lisa Levin, Director

CMBC promotes interdisciplinary approaches to maintain the integrity of ocean ecosystems and manage their use in the face of rapid and inevitable global change.

EDUCATIONAL SUCCESS
During the last decade over 100 UCSD masters and Ph.D. students have been trained in the interdisciplinary approach to address the world’s most challenging marine problems. Where UCSD provides disciplinary rigor, CMBC adds elements of marine policy, economics, management and communication skills. CMBC graduates can influence policy and practices through their work at major research and educational institutions, non-governmental and public service organizations and government agencies around the world.

RESEARCH SUCCESS
CMBC research impacts policy and practice. For example, results from research in Pacific Atolls are cited in policy documents that established the Pacific Remote Islands Marine National Monument and two other monuments in 2009. Gulf of California research confirms that damage to marine habitats can be reversed with marine protected areas. CMBC research investigating the role of sharks in marine ecosystems is cited as an important source for legislation to ban the trade of shark fins in California.

Climate and Economic Agreements
Managing the use of ocean ecosystems in the face of rapid and inevitable global change is one of the greatest challenges of this century. Changes in temperature, sea level, and ocean chemistry will have enormous implications for marine biodiversity and ecosystem function and for human exploitation of marine resources, human migration and national security. Electricity generation and land-use changes (such as deforestation, agriculture and transportation) are the largest sources of greenhouse gases. While climate research can provide useful insights, this is a much more complex economic, ethical and policy problem. Any response to climate change must be built on international collaboration, based on science, economic analysis and a shared understanding of the implications for all parties. Some of the questions for CMBC researchers: How will climate change affect economic growth? What are the costs of adaptation and mitigation? What incentives will provide behavioral shifts? Can energy production be shifted in a way that strengthens economic growth?

Contaminants and Ocean Health
Contaminants in the food chain can have significant impact on human health as toxins that find their way to the sea. Contamination from ruptured oil wells, rising ocean acidification due to carbon...