

mpa connections

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Special Issue Focused on Climate Change

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Changing Climate, Changing MPAs

-By Matt Dozier, NOAA's National Marine Sanctuaries (adapted by Abby Gray, MPA Center)

As the body of research on the impacts of global climate change continues to expand, marine resource managers — especially marine protected area managers — have found themselves faced with a growing list of causes for concern.

Climate change's effects on the marine environment, including warming seawater temperatures, ocean acidification, sea level rise, and changes in currents, upwelling and weather patterns, have the potential to cause fundamental changes in the nature and character of marine and coastal ecosystems. NOAA's National System of Marine Protected Areas includes a diverse subset of 254 MPAs, bringing together National Marine Sanctuaries, National Parks, Fish and Wildlife Refuges, National Estuarine Research Reserves, and state and locally managed MPAs. With MPAs spanning from Alaska to the Northwestern Hawaiian Islands, to the tip of the Florida Keys, the national system includes some of the most diverse collections of marine life and habitats on the planet, providing a natural venue for researchers to study the impacts of climate change.

Ocean Acidification

It has become clear that the ocean plays a critical role in regulating the amount of carbon dioxide (CO₂) in Earth's atmosphere, absorbing nearly a third of the CO₂ produced by humans since the Industrial Revolution. In 2007, the International Panel on Climate Change (IPCC) reported that atmospheric CO₂ has increased by 31 percent since 1750, primarily due to human activities like burning fossil fuels and deforestation.

As the ocean is absorbing increasing amounts of CO₂ from the atmosphere, a related reduction in seawater pH is taking place. The IPCC 2007 report stated that this process, known as ocean acidification, can hurt the ability of corals, plankton, shellfish and other invertebrates to build the calcium carbonate shells or skeletons they need to survive. The resulting losses in biodiversity could have disastrous consequences for marine ecosystems, coastal economies and communities.

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Changing Climate, Changing MPAs (continued)

Warming Seawater Temperatures

It might seem like a minor increase, but even small changes in water temperature can affect the growth, feeding behavior and reproduction of marine organisms, many of which are sensitive to thermal increases of just a degree or two above normal.

Ocean warming has also been linked with outbreaks of marine disease. According to a 2002 study by University of California researchers, populations of black abalone in the warmer southern waters of Channel Islands National Marine Sanctuary were decimated by a bacterial disease known as “withering syndrome” between 1986 and 2001, while cooler waters appear to have suppressed the disease in abalone populations farther north along the California coast.

Sea Level Rise

Global sea level has risen at an average rate of 0.18 centimeters per year from 1961 to 2003, with this rate increasing between the years 1993 to 2003 to about 0.31 centimeters per year, according to the IPCC 2007 report.

For coastal MPAs, sea level rise has several potential consequences. Marine life in the intertidal zone is likely to experience shifts in abundance and distribution, and possibly widespread habitat loss as the shoreline moves inland. Animals like sea turtles could suffer serious population declines if rising sea level causes the sandy beaches where they nest to shrink or even disappear.

The tiny atolls and islets of the Northwestern Hawaiian Islands, encompassed by the Papahānaumokuākea Marine National Monument, are particularly at risk from sea level rise. A 2006 study published in the journal “Endangered Species Research” predicted that these small volcanic islands may shrink by as much as 65 percent with a 48-centimeter rise in sea level, threatening the survival of the endangered Hawaiian monk seal, which requires sandy beach areas to rest and recuperate, and numerous other species found nowhere else on Earth.



Channel Islands National Marine Sanctuary
(photo credit: Claire Fackler/NOAA)



A coral bed in the Northwestern Hawaiian Islands Marine National Monument
(photo credit: Claire Fackler/NOAA)

Changes in Currents and Upwelling

Scientists have found that ocean temperature has a major influence on currents and upwelling activity, which are fundamentally important to marine ecosystems around the world.

It is difficult to predict how warming sea surface temperatures will alter upwelling and currents, but any changes in ocean circulation are likely to have serious consequences for marine life. Without the influx of nutrients from deep water, sites like Cordell Bank and Stellwagen Bank National Marine Sanctuaries could see devastating collapses in marine communities, with declines in tiny organisms like plankton and krill at the bottom of the food web leading to starvation for fish, seabirds, whales and other high-level consumers.

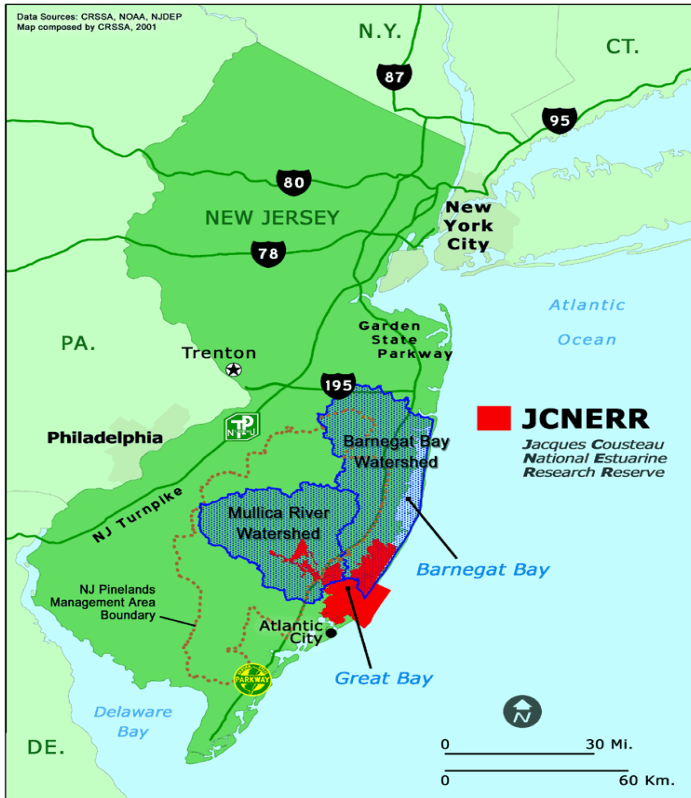
Looking to the Future

The National System of Marine Protected Areas is looking ahead as climate change poses an increasingly grave threat to the health of the world’s oceans. Through sound science, public outreach and partnerships, national system partners and programs are developing management strategies that will help us to adapt to the changing marine environment and that will continue to protect the nation’s natural and cultural resources in the face of climate change.

This article originally appeared in the Spring 2009 edition of Sanctuary Watch, published by NOAA’s Office of National Marine Sanctuaries. It was modified slightly for this issue of Connections. To access the original article, visit: <http://sanctuaries.noaa.gov/news/pdfs/sanctuarywatch/sw0609.pdf>.

Interview with the Barnegat Bay Program and the Jacques Cousteau National Estuarine Research Reserve on the Climate Ready Estuary Program

- Interview conducted by Abby Gray, National MPA Center



The Jacques Cousteau NERR encompasses more than 114,000 acres in southeastern New Jersey, including a great variety of terrestrial, wetland and aquatic habitats

The Barnegat Bay Partnership (BBP) has participated in the EPA's Climate Ready Estuaries Program (CRE), which works with the National Estuary Program to assess climate vulnerabilities, facilitate climate change adaptation, and promote partnerships and information sharing. The Jacques Cousteau National Estuarine Research Reserve (JC NERR) is one of 28 National Estuarine Research Reserves – areas that are protected for long-term research, water-quality monitoring, education and coastal stewardship, and is a member of the National System of Marine Protected Areas. Together, these two programs have partnered on a variety of climate change initiatives. The National Marine Protected Areas Center sat down with Martha Maxwell-Doyle from the BBP and Lisa Auermuller at the JC NERR to discuss the benefits of collaboration, specifically when tackling a large scale threat such as climate change.

What is the Climate Ready Estuaries Program and what was BBP's initial interest in the program?

BBP: The Environmental Protection Agency developed the CRE program in partnership with the National Estuary Programs (NEP). CRE was established as a competitive grant among the NEPs and

offered financial and technical support. In the first year of funding, six NEPs received funding support. BBP was funded during the second round of funding. The BB estuary is a shallow coastal lagoonal system that has been experiencing the effects of climate change as it relates to sea level rise, storm surge, loss of wetlands, invasive species, etc. So we were very interested in participating in the CRE program and the opportunities it could afford us.

What was the beginning for collaboration between JC NERR and the BBP?

JC: The JC NERR and the BBP share a watershed boundary, so it simply makes sense that we work together on issues of shared importance. We also both received outside funding to work on climate related activities, so by working together our projects are able to complement each other.

BBP: JCNERR has been a leading partner with BBP since its inception as a NEP. Our study areas and some of our research priorities are overlapping and have had a strong history of collaboration. JCNERR also has developed a very successful "Coastal Decision Makers" program and is affiliated with Rutgers University's Institute for Marine and Coastal Science and the Grant F. Walton Center for Remote Sensing and Spatial Analysis (CRSSA). Our partnership was a given.

What did you hope to get from the "Preparing Your Community in the Face of Climate Change" workshop, held jointly with the BBP in April 2010?

JC: We hoped to get a better sense of the needs of the decision makers in the watershed. The afternoon was really structured as a listening session so that we would have better direction on where the stakeholders need the most assistance. The outcomes have been an increased level of awareness for the issue of sea level rise and the need to start to think about how we adapt. The conference also resulted in a pilot living shoreline project at the Edwin B Forsythe Wildlife Refuge, and a community in Cape May County taking the lead on educating their citizens on becoming a "Smart Coast" community.

BBP: As part of our CRE request we were looking for three outcomes from the workshop: 1) To bring in recognized experts (local, regional and national) and coastal stakeholders to focus in on the current and future impacts to coastal NJ; 2) To gain a better understanding of the needs and knowledge level of our stakeholders so that collectively we could develop regional

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Interview with BBP and JCNERR (continued)

specific educational and outreach materials; and 3) to help better inform future public listening sessions.

What are the main benefits of collaboration? Could similar partnerships be developed elsewhere, building on the strengths of the National Estuary Program and National Estuarine Research Reserve System?

BBP: Absolutely, where the opportunities are geographically feasible. NEPs are seasoned experts at coalition building and are being recognized as being neutral unbiased leaders that utilize good science in helping to frame policy and management decisions. The NERRS are known for their strong research capabilities which are also very critical as we develop local strategies for adapting to the impacts of climate change.

JC: The main benefits of collaboration are (1) not duplicating efforts, (2) speaking to stakeholders from a common voice, (3) sharing the workload, (4) working with combined financial resources and (5) being able to do more than either one of us would be able to do alone. I think that areas where there is geographic overlap between federally funded estuary programs, there should be a real effort to partner on the projects where it makes strategic sense to do so.

Can you describe current resilience-building activities of BBP/JCNERR, and other partners in the watershed?

JC: We are working with Ocean County, NJ to incorporate climate adaption and planning into their multi-hazards mitigation plan. We are working with the Rutgers Center for Remote Sensing and Spatial Analysis to create a sea level rise vulnerability visualization website. We are starting to discuss a 2011 Climate Adaptation workshop which will provide examples and lessons learned from other communities around the country who have started to work on issues of climate and sea level rise adaptation.

BBP: BBP and JCNERR, along with a number of key partners are pooling their resources and leveraging opportunities to undertake needed research, assessment, planning, and outreach activities to address future local impacts of climate change. Key partners include: New Jersey Coastal Management Office, New Jersey Department of Environmental Protection, Rutgers University, Richard Stockton College Coastal Research Center, United States Fish and Wildlife Service, NJ Sea Grant/NJ Marine Science Consortium, and Monmouth University Urban Coast Institute.

What are the next steps for continuing to build resilience to climate change at the JC NERR and BBP? Are there words of wisdom you'd convey to other programs just beginning to think about climate change adaptation?

JC: My words of wisdom for other programs are: listen to the needs of the stakeholders that you are reaching out to. They are the ones that will make decisions and policies on community-based climate adaptation. If you don't know what information they need to make the best decisions, you are going to be talking to deaf ears from the beginning. Listening to them and understanding the world that your stakeholders come from takes time up front, but pays dividends in terms of final results.

BBP: Strong partnerships are the key; i.e. New Jersey Coastal Management Office, New Jersey Department of Environmental Protection, Rutgers University, Richard Stockton College Coastal Research Center, United States Fish and Wildlife Service, NJ Sea Grant/NJ Marine Science Consortium, and Monmouth University Urban Coast Institute. Collectively, we as a group have spent a great deal of time looking at who is doing what or who is in the best position to carry-out certain activities. I also believe it's imperative to utilize existing planning tools (i.e. FEMA natural hazards mitigation plans) as we move forward with developing resiliency and adaptation strategies for our coastal areas. We also need to better engage emergency management personnel into our collective activities.

For more information regarding the Barnegat Bay Partnership or the Jacques Cousteau National Estuarine Research Reserve please contact: Martha Maxwell-Doyle at mmdoyle@ocean.edu or Lisa Auermuller at auermull@marine.rutgers.edu.



The Jacques Cousteau NERR (photo credit: JCNERR)

Marine Protected Areas Federal Advisory Committee Recommends Actions to Build Ecological Resilience to Climate Change Impacts

The threats to marine resources from climate change impacts in the ocean are increasingly clear. To better understand how marine protected areas (MPAs), and the National System of MPAs can help address those threats, the Departments of Commerce and the Interior called on the Marine Protected Areas Federal Advisory Committee (MPA FAC). The MPA FAC is a 30-member stakeholder committee made of up representatives from diverse perspectives, including natural and social scientists, resource managers, conservationists, ocean industry and commercial and recreational fishing. The following recommendations for management agencies were made by the MPA FAC in April 2010:

- design MPA sites, MPA networks and the National System of MPAs** to be as ecologically resilient as practicable to the impacts of climate change; and
- evaluate and adaptively manage MPA sites, MPA networks and the National System of MPAs** in response to climate change.

Designing MPAs and Networks of MPAs for Ecological Resilience

MPAs, networks of MPAs and the National System of MPAs have an important role in addressing the increased uncertainty regarding the responses of organisms and changes to ecosystems resulting from the effects of climate change in the ocean. In the face of climate change, MPAs can help to maintain and restore ecological resilience and capacity to provide ecological goods and services. MPAs can be used alone or as part of an integrated suite of measures to achieve one or more of the following objectives:

- Reducing non-climate stresses** that exacerbate or interact negatively with climate change to increase ecosystem integrity and resilience.
- Protecting the least exposed ecosystems** by siting MPAs where the effects of climate change are expected to be less severe due to local conditions.
- Protecting the most resistant and adaptable ecosystems** by siting MPAs where organisms are expected to be naturally more resistant or adaptable to climate change impacts.
- Protecting the most valuable resources** by siting MPAs to contain unique, rare, or ecologically, culturally, historically, socially or economically important resources.
- Protecting resilient populations** by designing MPAs and MPA networks to protect sufficiently large effective population sizes.

- Making MPAs dynamic** by siting, designing, and modifying MPAs and MPA networks to maintain protection of populations in anticipation of potential habitat or species range shifts in response to climate change.

- Maintaining connectivity** by siting and designing MPAs to create ecologically connected and functional networks that take into account the range shifts of populations and the movements of individuals and genes in response to climate change.

- Spreading risk** by siting and designing MPA networks to spread the risk of catastrophic loss due to the more extreme impacts of climate change by protecting a range of habitats, including replication.

In light of climate-change impacts that have the potential to drive large numbers of species to extinction, reshuffle biological communities, significantly alter habitats, and degrade ecosystems, application of the approaches above will create MPAs and networks of MPAs that have the potential to become climate-change refugia and ecological buffers to uncertainty in a rapidly changing ocean.

Evaluating and Adaptively Managing the National System of MPAs

Time is of the essence in developing the capacity of MPA managers to anticipate, detect and respond to the impacts of climate change. Impacts of climate change in the ocean are occurring now and are expected to become increasingly severe in the coming decades. The following recommendations are focused providing MPA managers with the capacity to address climate change impacts that have already occurred or are predicted to occur:

- Monitoring and Evaluation** – Build and enhance capacity to monitor and evaluate the physical and chemical effects of climate change on MPAs and their impacts on the biological systems protected by those MPAs.

- Predictive Capabilities** – Foster the development of new ecosystem models that interface with climate change models to predict the impacts of climate change in the ocean on the National System of MPAs at appropriate regional and sub-regional scales.

- Agency Coordination and Governance** – Promote a higher level of coordination among resource and environmental agencies, including consultation with interested stakeholders, to expedite the design and implementation of MPAs, in a way that meets the complex challenges that are likely to result from climate change in the ocean.

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FAC Recommendations on Climate Change (continued)

•**Education and Public Engagement** – Facilitate education and engagement with decision makers, managers, stakeholders, and the public in order to expand overall awareness and understanding of the relationships between climate change in the ocean and the National System of MPAs.

•**Policy Action Thresholds** – Identify ecological thresholds related to the effects and impacts of climate change that would trigger the implementation of MPA management actions to ensure timely and appropriate responses.

•**Ecosystem Characterization** – Support the ecological characterization of the National System of MPAs in order to promote the improved understanding of the impact of climate change on the structure, diversity and function of MPA ecosystems. The development and use of ocean observing systems, sensors, geospatial tools, marine spatial planning, and other predictive capabilities will all contribute to effective ecosystem characterization.

•**Targeted Scientific Research** – Support adaptive management of the National System of MPAs and networks of MPAs by closing critical gaps in scientific knowledge of climate change in the ocean. In particular, research should target understanding ecosystem structure and functioning.

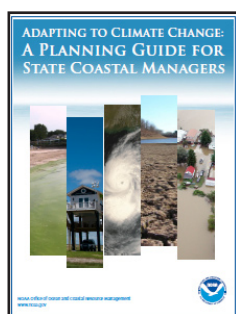
The full MPA FAC recommendations can be found at <http://www.mpa.gov/fac/products/>.

OCRM Releases Climate Change Adaptation Planning Guide

NOAA's Office of Ocean and Coastal Resource Management (OCRM) has released a coastal climate adaptation guide to help state and territory coastal managers develop and implement adaptation plans to reduce risks of possible climate change impacts.

Adapting to Climate Change: A Planning Guide for State Coastal Managers was written in response

to requests from state coastal managers for NOAA guidance on adaptation planning. Created specifically for state-level coastal management programs, the guide is intended to be an aid, not a prescriptive directive, for developing and implementing adaptation plans. The guide is available online only at <http://coastalmanagement.noaa.gov/climate/adaptation.html>. For more information, contact Josh Lott at Josh.Lott@noaa.gov.



ICES Study Group on Designing Marine Protected Areas in a Changing Climate Meets

- By Robert Brock, National MPA Center

From November 15-19, the International Council for the Exploration of the Sea (ICES) Study Group on Designing Marine Protected Area Networks in a Changing Climate (SGMPAN), working at the request of the North American MPA Network (NAMPAN) facilitated a workshop at the U.S. Geological Survey's Marine Science Center in Woods Hole, Massachusetts. The objective of the workshop was to provide high level overviews on what is currently known about the long term status and trends in ocean currents, plankton, fish, marine mammals, sea turtles, benthic habitats, seabirds, highly migratory species, and ecological processes along the Atlantic coast of North America, Gulf of Mexico, and the Caribbean (Puerto Rico and U.S. Virgin Islands), and how these are projected to change in the future in the context of climate change. The SGMPAN consisted of invited subject experts from Canada, Mexico, and the United States. Dr. Robert Brock, Senior Marine Biologist for the MPA Center, is the SGMPAN Co-Chair.

The report developed at the Woods Hole workshop will be peer reviewed by two ICES expert groups this spring. This report will provide valuable information to the three countries comprising NAMPAN (Canada, Mexico, USA) in evaluating the potential vulnerability of living marine resources to climate change, where important ecological areas may be located in the future, and whether these areas are currently protected or not. For more information, contact Robert.Brock@noaa.gov.



The ICES Study Group on Designing MPAs in a Changing Climate

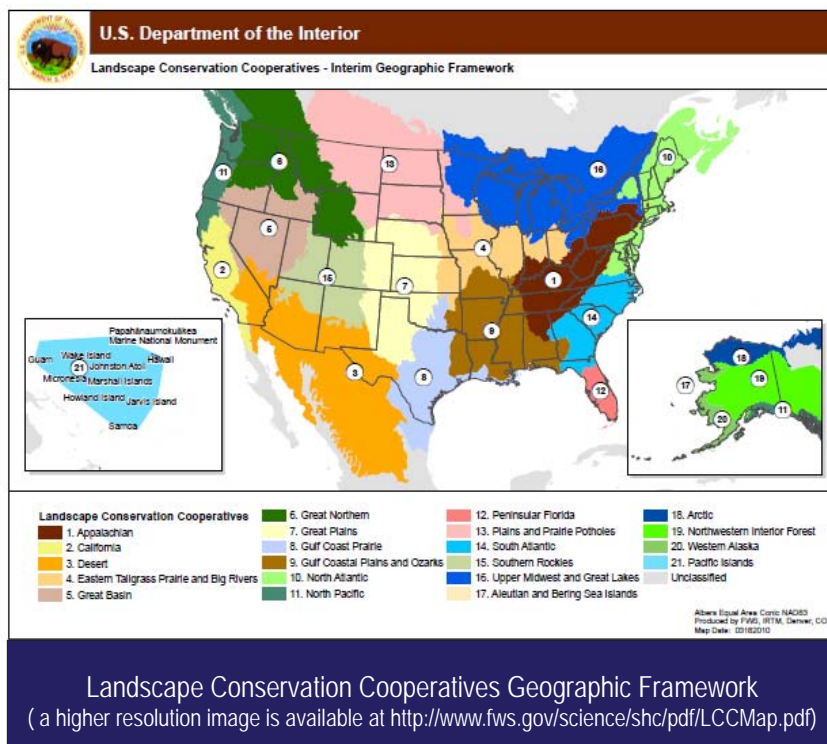
Additional NOAA Climate Resources

- NOAA's Climate Services Website
<http://www.climate.gov/#understandingClimate>
- *Climate Literacy: The Essential Principles of Climate Science*
http://climate.noaa.gov/index.jsp?pg=/education/edu_index.jsp&edu=literacy
- NOAA's Coral Reef Watch
<http://coralreefwatch.noaa.gov/satellite/index.html>
- CZMA Climate Change and Coastal Hazards E-News Update
<http://coastalmanagement.noaa.gov/news/climateneewsletter.html>

Landscape Conservation Cooperatives Help Promote Efficient and Effective Conservation

-By Bret Wolfe, USFWS

In response to the shared challenges presented by climate change, the U.S. Fish and Wildlife Service (USFWS) is working with a diverse group of partners to establish a national network of applied conservation science partnerships. These partnerships, called landscape conservation cooperatives, or LCCs, are composed of federal agencies, states, tribes, non-governmental organizations, universities and stakeholders within geographically defined areas. As the centerpiece of the Department of the Interior and USFWS climate change strategies, LCCs will leverage resources and build shared science capacity to inform conservation decisions and actions. They will provide resource managers with adaptive conservation strategies that will anticipate changes in habitat and the abundance and distribution of species. LCCs will also provide a forum for partners to identify common goals and priorities to target the right science in the right places for efficient and effective conservation. Rather than create a new conservation infrastructure from the ground up, LCCs will build upon explicit biological management priorities and objectives, as well as science available from existing partnerships, such as the National System of Marine Protected Areas.



With an initial federal investment of \$25 million in FY2010, the USFWS has begun forming eight LCCs across the country. As partner interest and funding permits, others will be formed with the eventual goal of creating a “seamless national network” of 22 cooperatives. At the core of each LCC will be a scientific and technical staff with an applied resource-management focus. That staff and capacity will operate under the direction of a steering committee, composed of representatives from governmental entities (federal, state, tribal and local), as well as non-governmental organizations who are prepared to contribute to the joint effort. The unique role of the LCCs is to provide a clear focus on climate change modeling and adaptive conservation design with solid management decision-support tools and evaluation of resource monitoring data. Collectively, LCCs will support landscapes capable of sustaining abundant, diverse and healthy populations of fish, wildlife and plants. All products and services will be shared openly among partners and other interested parties for conservation.

By functioning as a network of interdependent units rather than independent entities, LCC partnerships can accomplish a conservation mission no single agency or organization can accomplish alone. The USFWS will play key leadership roles in developing each LCC by assisting in initial planning, partner coordination, assembling core staff and meeting associated needs for operational support. However, the LCCs themselves will be partner driven. The FWS is inviting all federal, state, tribal, local government and non-governmental management organizations to become partners in their development.

In the face of accelerated climate change and other 21st-century conservation challenges, LCCs will regularly evaluate the effectiveness of scientific information and conservation actions and support necessary adjustments as new information becomes available. This iterative process of information sharing will help scientists and resource managers deal with uncertainties on the landscape and provide tools to compare and contrast the implications of management alternatives.

For more information on LCCs, visit <http://www.fws.gov/science/shc/index.html>

Researchers at the Guana Tolomato Matanzas Research Reserve Map Marching Mangroves to Better Understand Climate Change

-By Susan van Hoek, GTM Research Reserve, Environmental Specialist

After two severe freezes in 1983 and 1989, the black mangrove trees (*Avicennia germinans*), once prominent in the southern portion of St. Johns County, Florida, died. Over the ensuing decades the trees gradually reappeared in salt marshes along the coastal estuary and are now spreading in patchy communities in St. Johns County as far north as St. Augustine. Researchers at the Guana Tolomato Matanzas National Estuarine Research Reserve (GTM Research Reserve) are mapping and studying the mangroves in their quest to learn more about these trees and how their march from tropical to 'subtropical-to-temperate' zones relates to global climate change.

The Research: In addition to looking at mangrove distribution and climate change, a number of researchers want to know what effect, if any, the spreading mangroves are having on the salt marsh habitat. By dropping sprouting seeds into the wet soil around them, the mangroves are managing to walk right into cordgrass (*Spartina alterniflora*) marsh territory, which serves as home for young fish and shell fish such as clams, oysters, crabs and shrimp.

Mangrove roots provide food and shelter for a great variety of other marine organisms which could out-compete or eat some of the original salt marsh inhabitants and change species composition. The pressing question is, if warmer weather is motivating the mangroves to move northward taking with them their own variety of marine life, how will that change cordgrass-marsh-dependent communities?

Researchers are wondering if the entire ecology is in the process of change. They want to know if southern marine plant and animal communities are slowly migrating northward in mass, if non-native species are competing with and possibly overtaking native species, and if this potential turnover is a valid indicator or product of global climate change.

Dr. Rick Gleeson, Research Coordinator for the Reserve, says it's hard to know at this stage if the movement of the mangroves is related to warmer conditions and/or changes in rainfall patterns caused by global climate change, or if the trend is indicative of some sort of regional cycle. He and his research team are compiling temperature and water quality data from the Reserve's weather station at Pellicer Creek, monitoring short term variations, long term trends and how the climate influences change over time.

How long the black mangrove trees inhabit cooler zones and how far and wide they spread can be important indicators in a larger study of human-caused, rising carbon dioxide levels in the atmosphere, which is thought to raise temperature levels. To measure and map the spread of the trees the Reserve has turned to high technology.

The Mapping: Reserve team member, GIS Specialist Randy Altman, is teaching his computer to assist in mapping the expanding mangrove communities. His focus is within the southern boundaries of the Reserve from south of St. Augustine in St. Johns County to Pellicer Creek just north of Flagler County. Isolating black mangroves in aerial imagery allows Altman to develop regional maps indicating their precise population size and distribution at specific moments in time. "Our aim," Altman says, "is to quantify and characterize the current state of the black mangrove within the Reserve boundary in such a way that it can be repeated in the future, comparing apples to apples to measure how populations are expanding over time."



Mangroves are an important habitat for many estuarine and marine species, and protect coastal areas from erosion and storm surge

Altman relies on sophisticated computer classification models developed by Coastal Services Center, a NOAA (National Oceanic and Atmospheric Administration) facility in Charleston, SC, to identify and isolate mangrove images from water and other ground cover.

To test for accuracy, researchers go into the marshes and randomly 'ground truth' decisions made by the computer, seeing if it correctly predicted the presence of mangroves. They also want to make certain that the 'thinking' computer is properly differentiating between large, mature trees and fairly close to the ground shrubs from just-sprouted seedlings.

The Whole Picture: By bringing fragmented bits and pieces of the marsh vegetation puzzle together to form a more complete picture, scientists are beginning to get a better understanding of what is going on with the marching mangroves, how they affect the existing marsh habitat and how temperatures are changing over time.

As Dr. Gleeson summarizes, "It is these sorts of collaborations of expertise and data gathering here at the Reserve, and within the National Estuarine Research Reserve system in general, that will help us better understand how the complex dynamics of coastal ecosystems might be altered by climate change. Such studies serve as important foundations for the wise management and protection of our coastal habitats."

Recent Additions to the MPA Virtual Library

A report published by IUCN, the UN Environment Programme, the Nature Conservancy, and others assesses the current state and future opportunities of marine conservation around the world. The report finds that global ocean protection levels fall far short of international goals and recommends more comprehensive implementation of coastal and marine spatial planning to adequately protect global marine resources.

Global Ocean Protection: Present Status and Future Possibilities. (2010). IUCN, Gland, Switzerland; The Nature Conservancy, Arlington, USA; UNEP-WCMC, Cambridge, UK; UNEP, Nairobi, Kenya; UNU-IAS, Tokyo, Japan; Agence des aires marines protégées, Brest, France. <http://data.iucn.org/dbtw-wpd/edocs/2010-053.pdf>

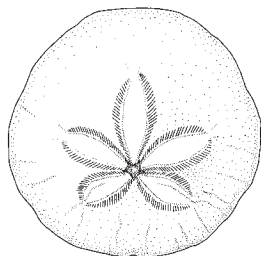
The United Nations University Institute for Water, Environment, and Health has published a handbook assisting managers of coral reef MPAs to understand and apply the concept of marine connectivity in their work. The handbook recommends implementing networks of smaller MPAs to account for connectivity in and through coral reef ecosystems.

Sale, P. F., Van Lavieren, H., Ablan Lagman, M. C., Ateama, J., Butler, M., Fauvelot, C., . . . Stewart, H. L. (2010). Preserving Reef Connectivity: A Handbook for Marine Protected Area Managers: Connectivity Working Group, Coral Reef Targeted Research & Capacity Building for Management Program, UNU-INWEH. <http://gefcoral.org/LinkClick.aspx?fileticket=wUelZOi-9QI%3d&tabid=3260>

A report published by Conservation International, in collaboration with the Science-To-Action Partnership, has published a report synthesizing a number of social science studies in order to assess the effects of marine managed areas (MMAs) on human wellbeing. The report finds that individuals with direct ties to an MMA have higher incomes, more diversified livelihoods, and greater appreciation for the benefits of MMAs.

Samonte, G., Karrer, L. B., & Orbach, M. (2010). People and Oceans. Arlington, VA, USA: Science and Knowledge Division, Conservation International. http://www.conservation.org/Documents/CI_MMAS_Science-to-Action_People_and_Oceans.pdf

The **mission of the National Marine Protected Areas Center** is to facilitate the effective use of science, technology, training, and information in the planning, management, and evaluation of the nation's system of marine protected areas.



MPA Connections was launched to meet continuing calls by agency and external stakeholders for information about MPA Center activities and to feature other actions that address Executive Order 13158 goals.

The next issue of **MPA Connections** will be published in Spring 2011. Comments, suggestions and news items can be sent to the editor, Kara.Yeager@noaa.gov.

MPA Center Science and Stewardship

(A continuing series from the MPA Center)

MPA Center Partners with PRBO on Project to Identify MPAs and Wildlife Hotspots in the California Current: The MPA Center has partnered with the Point Reyes Bird Observatory Conservation Science (PRBO) to assess the conservation status of important seabird foraging habitats in the Pacific Ocean off the coasts of Washington, Oregon and California. Using GIS techniques, staff at the MPA Center and PRBO combined data on west coast MPA boundaries (from the Center's MPA Inventory) with foraging seabird hotspots (a PRBO database). Results showed that more than 100 MPAs containing seabird hotspots within the study region restrict some resources from being extracted, while other extractive and non-consumptive uses are allowed. Future work will focus on more detailed evaluation of MPA restrictions and management of hotspot areas, and on the types of human uses occurring throughout the study region and within MPA boundaries. A fact sheet detailing the project is available on www.mpa.gov. (Rondi.Robison@noaa.gov)

www.mpa.gov

