



# BBP in Brief

A NEWSLETTER OF THE BAHAMAS BIOCOMPLEXITY PROJECT

Produced by the American Museum of Natural History's Center for Biodiversity and Conservation (AMNH-CBC)

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## Welcome...

This is the newsletter of the Bahamas Biocomplexity Project, or "BBP," also available at <http://bbp.amnh.org/bbpinbrief/>. Here you can learn about the activities and progress of the BBP team and its partners. We welcome your submissions about research progress, upcoming field plans, meetings, or any other information you feel would be of interest to project partners. Submissions for consideration in future newsletters may be made to Kate Holmes ([kholmes@amnh.org](mailto:kholmes@amnh.org)).

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## Good News and Bad for Bahamian Reefs: Rich Reef Habitat Around Conception Island but Lionfish Continue to Invade

Alastair Harborne (University of Exeter)

In April and May 2007 Peter Mumby and I participated in a field survey program in the Exuma Cays and Conception Island. The trip was supported by the Khaled bin Sultan Living Oceans Foundation (U.S.) and built on work conducted by the Habitat Working Group of the BBP. The team of 11 scientists revisited the Exuma Cays Land and Sea Park (ECLSP) to assess how coral cover had changed inside and outside the park since a 2004 BBP survey of the area. The BBP has already established that reefs inside the ECLSP are healthier than other reefs in the Exumas with more predatory fish, more species of fishes, healthy grazing by parrotfishes, good coral recruitment, and less macroalgae that are damaging to reefs. Assessing the effect on adult coral communities is another important variable to measure and results will be available soon. At Conception Island, the team conducted a rapid ecological assessment to assist the Bahamas National Trust with plans for a proposed marine reserve in the area. By comparing the marine resources of Conception Island with other sites surveyed as part of the BBP, the team has been able to suggest a range of reasons for why the island should be protected. For example, a vast *Montastraea* reef lies to the north of Conception Island and is the largest continuous example of such habitat in the Caribbean, measuring 40 km<sup>2</sup> (more than four times larger than the island itself). *Montastraea* reefs are important because these habitats possess the highest diversity and density of reef organisms in the Caribbean. The lagoon also has mangrove stands and extensive beds of *Laurencia* red algae, many of which provide key nursery habitat for young Nassau grouper and spiny lobster. The waters surrounding the island host relatively large numbers of Nassau grouper and Caribbean reef sharks and we also saw a goliath grouper. The Nassau grouper stocks are particularly vulnerable to trap fishing. In general, the island's marine resources are unique, extensive, self-contained, and in exceptionally good health, having high levels of resilience to disturbance.



Indo-Pacific red lionfish have invaded Bahamian waters. A. Harborne © University of Exeter

While we were pleased to see such rich reef systems, other observations are cause for concern. At sites around both the Exuma Cays and Conception Island the team spotted numerous Indo-Pacific red lionfish (*Pterois volitans*). This species is alien to the Caribbean but has been spotted in many parts of The Bahamas (including Abacos, Andros, Eleuthera, Cat Island, San Salvador, and New Providence). The population probably started when fish were released from aquaria. They now appear to be breeding and pose a threat to other native fish species as they are voracious predators. Divers from dive boats often spear any lionfish they see but the population seems to be too large for this to be an effective way to eradicate the species from The Bahamas. In one week, the dive operators we were using during our research speared 53 lionfish!



This parrotfish, of the species *Sparisoma viride*, is grazing in a large patch of macroalgae. P. Mumby © University of Exeter

## The Importance of Parrotfish

Helen Edwards (University of Exeter)

A recent article by BBP researchers reveals how Caribbean reefs could soon be damaged beyond repair unless there is a campaign to protect the brightly coloured parrotfish that inhabit them. The paper, written by Peter Mumby, Alan Hastings, and me, and published in the journal *Nature* in November 2007, shows the capacity of reefs to recover from disturbances.

Caribbean reefs are being overrun by macroalgae since a plague in 1983 caused the near-extinction of the herbivorous sea urchin, *Diadema antillarum*. Along with parrotfish, this grazing urchin kept algae levels down, creating space for corals to settle and grow. With the sea urchins gone, parrotfish are now the sole grazers of algae on many Caribbean reefs, but their numbers are falling fast because of overfishing. Much of the coral in the Caribbean is therefore at risk of being killed because algae are growing over it faster than it can be removed by grazers.

We used computer simulations to predict whether reefs could bounce back once the algae had taken hold. We found that a reef can reach a point after which it becomes extremely difficult for it to recover. This would be devastating to the Caribbean's rich marine environment, which is home to a wide range of species as well as central to the livelihood of millions of people. The key message of the study is that we have to act fast. The future of some Caribbean reefs is in the balance, and if we carry on the way we have been, reefs will be damaged forever. We cannot wait until reefs are in a degraded state – we need to stop reefs becoming unhealthy in the first place. The good news is that we can take practical steps to protect parrotfish and help reef regeneration. To secure a future for coral reefs, particularly in light of the predicted impacts of climate change, we need to protect parrotfish by managing them as a fishery and maintaining large numbers of these fish.

Mumby, P.J., A. Hastings, and H.J. Edwards. 2007. Thresholds and the resilience of Caribbean coral reefs. *Nature* 450: 98-101.

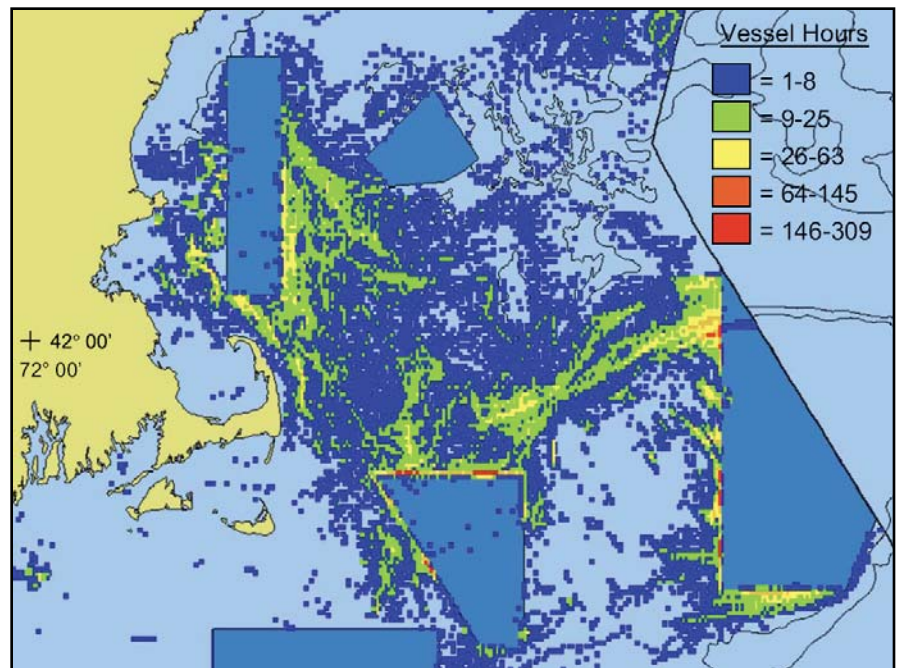
## Implications of “Fishing the Line” near Marine Reserves

Julie Kellner (University of California, Davis)

At many no-take marine reserves worldwide, fishermen concentrate just outside the reserve boundaries. This practice of “fishing the line” takes advantage of the movement, or spillover, of fishes from protected areas into surrounding waters.

I have been working with a team of researchers to examine the ecological and fisheries management implications of “fishing the line.” In a recent article in *Ecological Applications*, we demonstrated that boundary fishing is an optimal fishing strategy when marine reserves are a part of management, and can strongly affect the spatial patterns of fish density, yield, and catch per unit effort (CPUE) inside and outside marine reserves. Fishing the line strategies for both competitive and cooperative fisheries can increase catch compared to a uniform distribution of fishing effort outside marine reserve boundaries, but can have considerable impacts on the distribution and standing stock of fish both within and outside reserves. Therefore, consideration of this common harvesting strategy should be factored into the design of marine reserves.

Kellner, J.B., I. Tetreault, S.D. Gaines, and R.M. Nisbet. 2007. Fishing the line near marine reserves in single and multispecies fisheries. *Ecological Applications* 17(4): 1039-1054.



An example of “fishing the line” near areas closed to fishing. Otter-trawl fishing vessel effort off the northeast U.S., 2003, is estimated using vessel monitoring systems (VMS) with satellite tracking. Warmer colors (yellow to red) denote more intense activity. (Murawsky et al. 2005. *ICES Journal of Marine Science* 62: 1150-1167).

## Seabed Protection at Exuma Cays Land & Sea Park

Tom Barbernitz (Bahamas National Trust)



The first boat to use one of the new moorings in the Exuma Cay Land & Sea Park. T. Barbernitz © Bahamas National Trust

Park staff and dedicated volunteers at the Exuma Cays Land & Sea Park have completed installation of almost 100 additional moorings throughout the park over the last year. In total, over 140 moorings are now in place in popular dive and snorkeling sites and anchorages.

The park, one of 25 national parks and protected areas managed by the Bahamas National Trust, encompasses 176 square miles of land and sea in the central Exuma island chain. Visiting boat traffic has been increasing steadily over the past ten years, raising concerns over the amount of damage caused to the seabed from repetitive anchoring in selected areas. Original moorings at the Warderick Wells location and dive sites were established 15 years ago through a cooperative effort with dive boat operators. These original moorings have proven very successful at allowing the seabed to recover from past damage and preventing additional damage, and have also improved the visitor experience in the park. With funding from the U.S. National Fish & Wildlife Foundation, Mr. & Mrs. Jim & Barrie Loeks, the Lyford Cay Foundation, the Moore Foundation, and a variety of other private donors, the park expanded the program to make moorings available to visiting boats in all areas of the park.



An aerial view of the original Warderick Wells Mooring Field. In the image, 5 of the original 22 moorings are occupied by boats. P. Harding © Safari Seaplanes

### Abaco Science Alliance Conference “A Conference to Share Scientific Knowledge of Abaco and the Bahamian Environment” Marsh Harbour, Abaco, The Bahamas January 3 - 5, 2008



The 3rd Annual Abaco Science Alliance, sponsored by Friends of the Environment, will take place January 3 - 5, 2008 in Marsh Harbour, Abaco, Bahamas. First held in 2004, this conference occurs every two years. Its goal is to provide a forum for networking and sharing scientific information among researchers who work in Abaco. Friends of the Environment hopes to encourage more research in the area for educational purposes, and to stimulate the use of these findings in local environmental management decisions.

This year's featured speakers include Dr. John Durban (“Two Decades of Bottlenose Dolphin Research on Little Bahama Bank”), Diane Claridge (“Visual and Acoustic Surveys for Beaked Whales in the Great Bahama Canyon”), Dr. Craig Layman (“What Do We Really Know About our Bahamas Tidal Creeks?”), Charles Kwit (“Spatiotemporal Patterns of Rainfall throughout the Bahamian Archipelago”), and Dr. David Campbell (Interpreting Columbus' Diario”).

Visit the Friends of the Environment website (<http://www.friendsoftheenvironment.org/>) for registration information.

## New Resource for Bahamian Educators Explores Our Marine Treasures

Lynn Gape (Bahamas National Trust) and Meg Domroese (AMNH-CBC)

From crafts, games, and stories to experiments and coastal clean-ups, a new guide offers teachers a variety of ways to explore The Bahamas' marine treasures with their students. Through a partnership that grew from the Bahamas Biocomplexity Project (BBP), the Bahamas National Trust (BNT), the Ministry of Education, Youth, Sports and Culture, and the American Museum of Natural History's Center for Biodiversity and Conservation developed *Treasures in the Sea: Our Bahamian Marine Resources*.

This educator's guide to teaching marine biodiversity complements the Ministry of Education's curriculum guidelines for grades 3 – 6, though many activities may be adapted for other levels in both formal and nonformal education settings. Marine biodiversity – the variety of life found in oceans, coastal waters, and estuaries – is an ideal topic for interdisciplinary studies, touching on science, social studies, language arts, mathematics, and the creative arts. To encourage students to discover, cherish, and protect their sea and all of its treasures, *Treasures in the Sea* introduces marine conservation concepts by focusing on some of The Bahamas' most important marine species, the Nassau grouper, queen conch, and spiny lobster (crawfish). These familiar species will help students understand life cycles, critical habitats, cultural and economic connections, and the urgency of conservation and management.

The BNT's more than twenty years of experience working with Bahamian educators, and the depth of the AMNH's expertise in education for a variety of audiences, were further strengthened by the input of many reviewers over the course of three years, including BBP scientists and a dedicated team of science curriculum planners for the Ministry of Education. Representatives of the Department of Marine Resources, the BEST Commission, BREEF, The Nature Conservancy, Friends of the Environment, and Dolphin Encounters as well as public and private school teachers participated in workshops held to review the activities.

In July and August some 50 teachers from Abaco, Andros, New Providence and Grand Bahama were introduced to the new resource at workshops at the BNT's Retreat on New Providence and Rand Nature Centre on Grand Bahama. The workshops were three full days of demonstrations, peer teaching, and field trips. Participants were highly enthusiastic, and offered overwhelmingly positive feedback, for example:

"I would like to say thank you for opening my eyes further to the vast marine environment that exists. Many times we are aware of certain aspects but we need to have more information to enable us to place our priorities into perspective."

"I feel that the book is an excellent resource and I cannot wait to start implementing the activities in my classroom. I really, really, really enjoyed the field trips. A job well done!!"

Hands-on experience with *Treasures in the Sea* prepared participants not only to take the activities to their students, but also to train additional teachers in the use of the resource. Participants in the initial workshops have since led four workshops, three in Freeport at the start of the school year, and one during the midterm break led by Friends of the Environment in Abaco. More than 150 teachers in The Bahamas have received the book. Monique Sweeting, environmental educator and a member of the *Treasures in the Sea* development team, has helped to facilitate all of the workshops to date. She reports, "Teachers welcomed the new resource, *Treasures in the Sea*. They were very enthusiastic about the activities, materials, and posters. The workshops also gave teachers the opportunity to network and collaborate with each other across school boundaries."

In addition to providing a valuable resource for educators, the production of *Treasures* also represents an important model for partnership among researchers, educators, and government and non-governmental agencies. According to Dan Brumbaugh, conservation scientist at the AMNH's Center for Biodiversity and Conservation and principal investigator of the BBP, "the BBP is really proud of its role in catalyzing the *Treasures* collaboration. *Treasures* uses fun activities to teach a lot of fundamental concepts in marine and conservation science, and the approach is something that educators and researchers can continue to build on in the future."

To provide additional information and distribute *Treasures in the Sea* broadly, a website was launched in November. Visit the site to download the book or sections of the book, link to resources related to the activities, find out about training workshops in The Bahamas, and share teaching ideas and experiences in marine conservation education: <http://treasures.amnh.org?mid=37>



Teachers tested "Crawfish Critters", "Grouper Race for Survival", and "Real Estate for Royalty", a few of *Treasures in the Sea's* hands-on activities that explore the form and function, life cycles, and habitat requirements of marine species. Top left, L. Gape © BNT and bottom left and right, M. Domroese © AMNH-CBC

## Nassau Grouper Closed Season

The Nassau grouper closed season runs from **December 15, 2007 to February 28, 2008**. The closed period helps sustain this important species for future generations by protecting populations when they are most vulnerable during their spawning aggregations. The Bahamas Reef Environment Educational Foundation (BREEF) has launched a campaign urging Bahamians to support fishermen by purchasing other fish during the closed season. For more information about Nassau grouper and efforts to conserve the species, check out BREEF's website: <http://www.breef.org>

## BBP Collaborators and Partners



## What is BBP?

The Bahamas Biocomplexity Project (BBP) investigates the complex environmental and social factors that affect the design, management, and effectiveness of networks of marine protected areas (MPAs). Researchers involved in the project include oceanographers, biologists, and social scientists from nine institutions working in collaboration with various governmental and non-governmental groups in The Bahamas. Ultimately, the main goal of the project is to integrate studies of natural and human processes, leading to a more sophisticated understanding of how individual MPAs work, and how they could work as part of a network throughout The Bahamas and in other coral-reef ecosystems. Other important goals include the integration of this research with education and decision-making. Initial stages of the BBP were primarily funded by the U.S. National Science Foundation.

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