

What can MPAs do for sharks?

by Danielle Knip

I had the opportunity to attend the annual American Elasmobranch Society (AES) conference this year, which was held here at the University of British Columbia from August 8-14. The conference was very well attended and attracted researchers from all over the world. The sessions covered topics in elasmobranch anatomy, development and physiology, genetics, ecology, conservation, and behaviour.

Some of the highlights for me included talks from Chris Lowe (California State University, Long Beach), who is using autonomous underwater vehicles equipped with hydrophones and receivers to define fine-scale movement patterns of sharks while simultaneously characterizing the sea floor and water column – referred to as “smart shark-tracking robots”; Steve Campana (Department of Fisheries and Oceans, Canada), who is using satellite tags to examine the long distance migrations of Greenland sharks (*Somniosus microcephalus*) both in the Canadian Arctic and off the east coast of Canada; and John Carlson (NOAA/National Marine Fisheries Service) and Lucy Harrison (IUCN Shark Specialist Group), who are conducting research on the seven Critically Endangered sawfish species.

Another feature of the conference was the Deepwater Chondrichthyan Symposium, where I was encouraged to see the amount of research being



Danielle Knip releasing a juvenile pigeye shark (approximately 2 years old) after surgery to insert a tracking device. (Photo: Fishing and Fisheries Research Centre, James Cook University)

done on these deepwater shark species that we know so little about. Cassandra Rigby (James Cook University) gave a new and insightful review on the life history differences between species using shelf, oceanic and deepwater habitats. In addition, Jim Gelsleichter (University of North Florida) and Dean Grubbs (Florida State University) presented preliminary results on the effects of the Deepwater Horizon oil spill on deepwater shark species in the Gulf of Mexico. They are comparing shark assemblages throughout the

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Gulf including community structure, species richness, and relative abundances, as well as examining the effects of toxins from oil exposure.

I used presence and movement data to quantify the degree of shelter MPAs offer coastal sharks

I gave a talk as part of the Elasmobranch Conservation Session on the effectiveness of marine protected areas (MPAs) for sheltering shark species using coastal habitats. The question of how MPAs can be used to protect sharks and potentially contribute to fisheries management was first addressed more than a decade ago. In 1999, Ramón Bonfil reviewed the protection status of sharks and the applicability of MPAs for their species and concluded that MPAs could be effective for some species and key life stages, though they are likely not a sole solution but rather an aid for management [1]. Since then, MPA research on sharks has been limited. Most MPA-related shark research has focused on coral reef-associated species living on insular reef systems (for examples see [2] and [3]), and MPA research on sharks using coastal habitats has been pretty much non-existent.

The results I presented were from my PhD, which I completed last year. For my research, I used an array of 58 acoustic receivers to track two coastal shark species, the pigeye shark (*Carcharhinus amboinensis*) and spottail shark (*Carcharhinus sorrah*), within two MPAs in Cleveland Bay, which is a part of the Great Barrier Reef Marine Park in north Queensland, Australia. Using passive acoustic telemetry, I

identified factors influencing the distribution and movement patterns of pigeye and spottail sharks in this coastal region, and evaluated the effectiveness of MPAs for sheltering their populations from exploitation, such as fishing pressure.

I used pigeye and spottail sharks as my study species because of the differences in their life histories and ecologies. For example, pigeye sharks are slow-growing, large-bodied fish that use coastal habitats mostly as juveniles, whereas spottail sharks are fast-growing, medium-bodied fish that use coastal habitats during all life stages. Both species are susceptible to fishing pressure and are taken in the commercial net fishery that operates along the east coast of Australia. However, the spottail shark is much more heavily targeted than the pigeye shark, as it is a commercially valuable species and makes up the second largest component of shark catch in the net fishery [4].

My over-arching research question for this study was, "Are MPAs effective at protecting sharks in coastal regions?" I used presence and movement data to quantify the degree of shelter MPAs offer coastal sharks. Specifically, I calculated how much time sharks spent inside MPAs, how many times and where they crossed the boundaries, and the amount of MPA space they used [5].

To summarize, I tracked 37 juvenile pigeye sharks and 20 adult spottail sharks over the course of two years (2009-2011). These species were at different life stages due to the opportunistic nature of sampling; pigeye sharks were most prevalent as juveniles and spottail sharks as adults in this coastal region.

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The *Sea Around Us* Project website can be accessed at www.seaaroundus.org and contains up-to-date information on the Project.



The *Sea Around Us* Project is a scientific collaboration between the University of British Columbia and the Pew Environmental Group that began in July 1999. The Pew Environmental Group works around the world to establish pragmatic, science-based policies that protect our oceans, wild lands and climate. Pew also sponsors scientific research that sheds new light on the dimensions of and solutions to the problems facing the global marine environment.



Measuring and tagging a spottail shark. (Photo: Fishing and Fisheries Research Centre, James Cook University)

However, all sharks were of the same size range. Both juvenile pigeye and adult spottail sharks were in Cleveland Bay for long periods (some for more than 600 days), and they tended to spend a large part of their time inside MPAs (mean ~30%; for more detailed information on the methods and results of this study please refer to [5]).

Overall, these results demonstrate that MPAs in coastal regions may have conservation benefits for shark populations by providing protection across different species and life stages. A subsequent study found that both pigeye and spottail sharks have very low rates of mortality in Cleveland Bay [6], which suggests that MPAs in this region may provide both targeted and non-targeted coastal shark species with some shelter from fishing pressure. Perhaps most interesting, it appears that MPAs might have benefits for the protection of not only juvenile sharks that tend to use coastal habitats as nursery areas, but also for adults of species that have a relatively high degree of residence within them.

There are many elasmobranch species found in Cleveland Bay in addition to pigeye and spottail sharks, and there are other studies currently using the same acoustic array as I did. Look out for results from other students and researchers who are tracking scalloped and great hammerhead sharks (*Sphyrna lewini* and *S. mokarran*), blacktip reef

sharks (*Carcharhinus melanopterus*), giant shovelnose rays (*Glaucostegus typus*), whitespotted guitarfish (*Rhynchobatus australiae*), and creek whalers (*Carcharhinus fitzroyensis*), among other species.

The entire AES conference was live-tweeted on Twitter, and the tweets were organized using Storify by David Shiffman (University of Miami). To access these tweets, see: <http://www.southernfriedscience.com/>.

For more information about AES, see: <http://www.elasmo.org/>.

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MPAs in this region may provide both targeted and non-targeted coastal shark species with some shelter from fishing pressure



The Sea Around Us Project returns to West Africa

by Duncan Copeland and Dyhia Belhabib

Healthy and well-managed marine environments are essential for ensuring food security, reducing poverty and promoting marine conservation in West Africa. Yet the region faces enormous challenges in achieving these goals, not least of which are poor or even non-existent data relating to fisheries, biodiversity and the impact of human activities.

The region has seen limited national and international resources put towards adequate assessments of marine capture fisheries and biodiversity

The *Sea Around Us* Project is increasingly focusing on data-deficient regions of the oceans, particularly in the developing world. West Africa has been highlighted as a priority region, and in the past few months, the “*Sea Around Us* Project and PRCM: Marine Conservation Research, Collaboration and Support in West Africa” has been launched. Funded by the MAVA Foundation, the project will address the serious deficiency of adequate data in areas such as capture fisheries and biodiversity at the local, national and Large Marine Ecosystem levels in West Africa.

The Regional Marine and Coastal Conservation Programme for West Africa (PRCM) brings together an important coalition of non-governmental organizations to work with local and regional stakeholders and coordinate efforts to preserve the littoral zone of coastal countries in the region, which includes Mauritania, Senegal, The Gambia, Cape Verde, Guinea-Bissau, Guinea and Sierra Leone. Crucially, the PRCM has promoted cooperation with public sector and civil society organisations to achieve marine conservation, fisheries and integrated management support goals.

However, the challenges facing the success of these initiatives are significant. Limited government capacity and poor regulation; illegal, destructive and over-fishing by industrial fleets; high local dependence on marine resources for livelihoods and food security; and the limited number of marine protected areas in the region all contribute to a difficult environment for achieving effective fisheries and marine conservation. Yet perhaps the



Both artisanal and industrial fisheries in West Africa are poorly regulated and reported, and have the highest rates of illegal fishing in the world. As a result, the region is considered one of the most data-deficient globally. (Photo: Duncan Copeland)

greatest impediment to sustainable fisheries management and marine conservation in West Africa is the current deficiency, accessibility and usage of adequate data.

The region has seen limited national and international resources put towards adequate assessments of marine capture fisheries and biodiversity. As a result, decision-making in fisheries management at the local, national and regional levels, as well as in a variety of conservation projects, is often based on limited science. The imperative is to improve the data upon which fisheries management and conservation depends, and ensure that PRCM stakeholders receive support in the utilisation of data within specific marine conservation and fisheries management initiatives.

The *Sea Around Us* West Africa programme aims to accomplish three complementary objectives, all directly contributing to regional marine conservation, fisheries management and integrated management support objectives. These are to:

- Increase the quality of available data relating to existing and new initiatives promoting marine conservation and fisheries management in West Africa through the development of catch and effort reconstructions.
- Develop strong collaborative relationships between the *Sea Around Us* Project and proposed project partners; engagement of a wider number of government, research and non-governmental partners will be achieved.
- Raise broader international awareness and support for marine conservation in the region via the publication of peer-reviewed articles and engagement of media.

To achieve these aims, the project is supporting targeted research on catch, effort and catch values, biodiversity, marine protected areas, and other related issues. Crucially, this information will be developed within a partner support framework, ensuring that PRCM member and partner initiatives benefit not only from the generated data, but also have improved organisational expertise to integrate the data into existing and future initiatives. These partners include the Sub-

Regional Fisheries Commission (SRFC), local research institutions and the members of the PRCM (WWF, IUCN, Wetlands International and International Foundation for the Banc d'Arguin). Data analysis and visualisation models will be used to achieve these goals in collaboration with PRCM members and other relevant stakeholders.

Through these partnerships, the *Sea Around Us* Project and PRCM project provides an innovative and supportive approach that will directly contribute to strengthened national, regional and international cooperation in the short and longer term. The programme is specifically designed to offer potential extension beyond the initial proposed two-year period and a model for replication in other regions of the developing world with data-deficient fisheries. In addition, the project will work as much as possible with individuals that are nationals of the target countries, improving expertise in the region.

Marine habitats in West Africa are considered among the most data-deficient globally. With an increased focus on the developing world and growing experience working in the West African region, the *Sea Around Us* Project is uniquely placed to collaborate with project partners to generate strategic data and support that will directly benefit conservation, fisheries and management goals.

The Sea Around Us West Africa programme aims to accomplish three complementary objectives



The Sea Around Us Project's new programme in West Africa will work with local partners to address the data-deficiency challenges, which should ultimately contribute to their marine conservation and fishery management initiatives. (Photo: Duncan Copeland)