

UPWELLING

Volume 2
November 2014





The Ocean Policy Working Group (OPWG) is a student organization at Duke University designed to facilitate cross disciplinary discussions on human interactions with the ocean. Throughout the academic year, the OPWG hosts a variety of events with the purpose of exposing the Duke community to pertinent issues in our oceans. This working group strives to be a hub for ocean resources.

Welcome to the second volume of the Ocean Policy Working Group publication, *Upwelling*. We are once again excited to share with you the thoughts, opinions, and research pertaining to the oceans by members of the Duke community.

This volume features abstracts from past Nicholas School Master's Projects, reflections on a fisheries workshop in Mexico, a how-to on shark tagging while keeping all your digits, and a narrative about sailing in the North Atlantic. We are especially honored to have a piece by Dr. Mike Orbach, Professor Emeritus of the Nicholas School, on his reflections on the Masters of Environmental Management program and how he saw it evolve over the course of his career at Duke. We hope you will use this publication to connect with your peers at Duke who are working in fields that interest you.

We would like to thank the Nicholas School of the Environment, the Duke University Center for International Studies, and the Graduate and Professional Student Council for their support of the Ocean Policy Working Group.

Scarlet Cheng and Jaya Ghosh
OPWG Publication Coordinators
dukeOPWG@gmail.com



Julia Livermore



Ian Markham

OPWG Leadership

Austin Allen *Seminar Coordinator*
Scarlet Cheng *Publication Coordinator*
Supriti Jaya Ghosh *Publication Coordinator*
Ellie Heywood *Symposium Coordinator*
Ashleigh McCord *Communications Coordinator*
Bette Rubin *Action Team Coordinator*
Erin Tomaras *Administrative Coordinator*

Publication Committee

Scarlet Cheng *Editor*
Supriti Jaya Ghosh *Editor*
Caitlin Adams
Alexis Bolton
Theophilos Collins
Shannon Switzer

Cover Photo by Shannon Switzer. This image was taken in Hawaii off the coast of Ni'ihau Island at Lihua Rock's key hole formation. The two girls, Jenny Kalmbach (left) and Morgan Hoesterey (right) are professional stand up paddlers and were on a celebratory free dive after having successfully paddled the entire chain of Hawaiian Islands — the first time females had completed the grueling expedition.

A vortex of silversides swirl around coral researcher Dr. Phillip Dustan as he surveys "The Crack" in Glover's Reef, Belize.

Ian Markham

In this edition

Are We Making Progress on Coastal and Ocean Issues?
Dr. Michael K. Orbach

Spotlight on Master's Projects
Kim Hernandez
Nichola Clark

Sustainable Fisheries Management in Latin America: A United Effort
Alexis Bolton

How to Tag a Shark (And Keep All Your Fingers)
Shannon Switzer

A North Atlantic Morning
Theophilos Collins

Are We Making Progress on Coastal and Ocean Issues?

Dr. Michael K. Orbach is Professor Emeritus of the Practice of Marine Affairs and Policy, Marine Science and Conservation Division at the Nicholas School of the Environment, Duke University.

On the occasion of my retirement from Duke in June of 2014, I have been asked by the editors to reflect on the state of coastal and ocean policy and management as it has unfolded in my time as a coastal and ocean professional. I will reveal the punch line: We have made fabulous progress!

When I began my dissertation research in cultural anthropology as a 'participant observer' with the U.S. high-seas tuna fishing fleet based out of San Diego, CA, in 1971, the National Environmental Policy Act (NEPA, 1969) was in its infancy. The Coastal Zone Management Act (1972), the Clean Water Act (1972), the Marine Mammal Protection Act (1972), and the Magnuson-Steven Fishery Conservation and Management Act (M-SFCMA, 1976) had not been passed into law. There was, essentially, no federal fisheries or coastal or ocean water quality and habitat management in the US. The old Bureau of Commercial Fisheries — a service agency to foster marine fisheries development — in the Department of Interior had just been moved into the new (1970) National Oceanic and Atmospheric Administration and did not yet have a regulatory mandate. Marine fisheries were managed, as they had been for most of the 20th century, by the states, coordinated by the Interstate Marine Fisheries

Commissions, which were formally interstate compacts. The National Sea Grant College Program, of which I was one of the first cohorts of graduate students, was in its infancy. The Third International Convention on Law of the Sea had not yet been convened (1973), and was over a decade from producing the UN Convention on the Law of the Sea (UNCLOS). The coastal and marine policy world was quite a different place in 1971, soon to begin transforming in the heat of the environmental and other societal movements of the 1960s and 1970s.

"This new, and different, group of coastal and marine policy professionals is rapidly filling the ranks of not only our government, but also our NGO and private industry communities, to the great benefit of all."

Proceeding rapidly through the 1970s, the above laws and policies were established, and, in many cases slowly and painfully,

progress was made on the effective conservation, management and development of our coastal and ocean resources and environments. Slowly — in the sense that the 'end to overfishing' in the US was not announced until 2012 (and some people do not believe it), 36 years after the passage of the M-SFCMA — these laws and policies have been implemented, subject to the vagaries of state and federal appropriations, philosophical and practical debates, and day-to-day management challenges. Beginning first with fresh and later extending into salt water, significant progress has been made in water quality and habitat protection and restoration. Pursuant to the federal Coastal Zone Management Act of 1972, all of the coastal US states developed state coastal management policies and plans. The National Estuary Program, emanating from the Clean Water Amendments of 1986, established the principle of what we now refer to as 'ecosystem management', attempting to break down the 'stovepipe' structure and mentality of single-sector laws and policies. The ocean policy reports of first the Pew Oceans Commission and shortly thereafter the US Commission on Ocean Policy led Presidents Bush and Obama to create the first attempts at a coordinated US national ocean



Shannon Switzer

Above: This image was taken during a research dive with the Marine Conservation Society of the Seychelles. The light illuminates the prehistoric looking back of the world's largest fish (nope, it's not a whale or a shark!).

policy. Have we addressed all of our coastal and ocean challenges? Certainly not. Have we made significant progress, and are we structurally better positioned to address them? Absolutely!

Finally, my retirement should also be the occasion to note what is perhaps the single most important phenomenon that has arisen in the period since the 1970s on coastal and ocean policy, and that is the creation of what is in essence a new profession, that of the coastal and ocean policy professional, exemplified by our own Coastal

Environmental Management Program at the Nicholas School. When I began my career in 1971, students were normally trained in single scientific disciplines and then later — depending on their individual interests and the availability of employment, primarily in government agencies — they learned the often-more-necessary skills of policy development and management 'on the job'. Now, as is evidenced by our CEM and other similar programs in the US and around the world, we train not only disciplinary scientists but also interdisciplinary coastal and marine

professionals who go into the world already armed with knowledge and skills in policy and management in addition to the familiarity with science. This new, and different, group of coastal and marine policy professionals is rapidly filling the ranks of not only our government, but also our NGO and private industry communities, to the great benefit of all.

I am pleased and proud to have been a part of this. Keep it up!

Spotlight on Master's Projects

As a prerequisite for graduation from the Nicholas School of the Environment, each student completes a Master's Project, an opportunity to apply knowledge from the classroom to real-world analyses. Here are abstracts from two graduates of the class of 2014.

Protecting beaches and sea turtles: An analysis of beach nourishment in North Carolina, the impacts on nesting loggerhead sea turtles, and how sea level rise will transform the status quo.

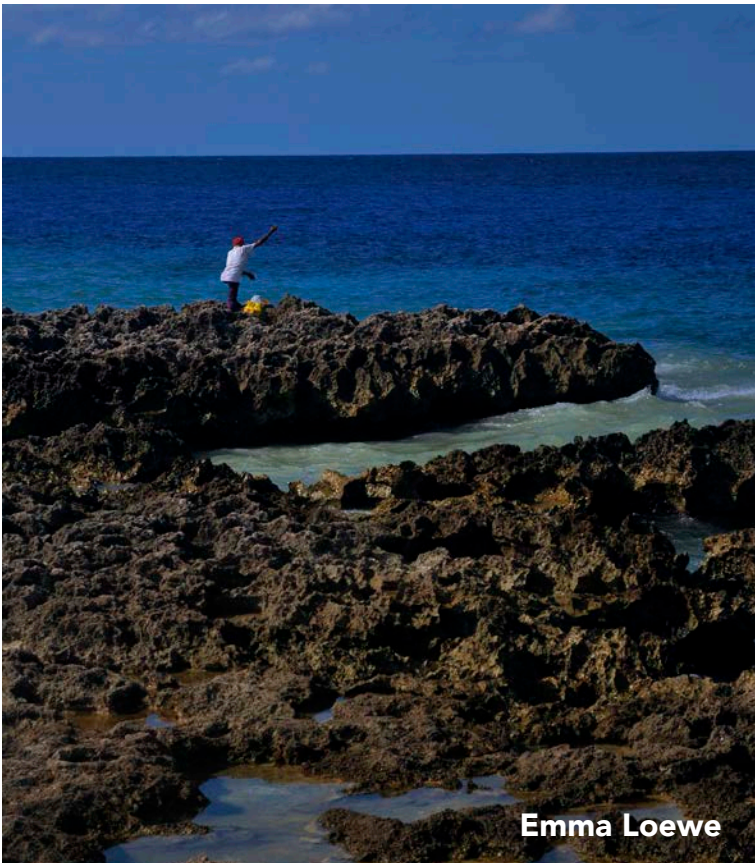
by Kim Hernandez MEM '14

Federally protected loggerhead sea turtles rely on wide sandy beaches for their terrestrial reproductive phase. Accustomed to hurricanes and erosion, North Carolina has taken to extensive beach nourishment efforts for shoreline protection. The majority of these efforts have been to benefit interests other than sea turtles, but given the recent loggerhead critical habitat proposals by USFWS and NMFS, their consideration warrants further attention. In this project, I explored historic nourishment data to understand the full costs of beach protection, hypothesizing

that sea level rise will exacerbate that cost in the future.

Through my research, I unveiled how nourishment efforts potentially both help and hinder the state and sea turtles. My analysis uncovered ways North Carolina can responsibly move forward with beach protection while taking both sea turtles and sea level rise into account. First, there must be state-level support for sea level rise planning – the Coastal Resources Commission should move forward with sea level rise discussions and define a rate of sea level change

for planning purposes. This rate, and associated increased need for sand, should be incorporated into future nourishment projects so the US Army Corps of Engineers does not underestimate costs and how much sand will be needed over the lifetime of the project. Finally, engineers and local sea turtle volunteer groups should continue monitoring nesting beaches for any changes post-nourishment to further understand how modified beaches impact loggerhead sea turtles.



Emma Loewe

Left: This photo, taken in the Cayman Islands, speaks to a pure relationship with the environment. This fisherman, standing alone off a patch of rocks, represents the more wholesome and unobtrusive fishing methods that are still practiced in less industrialized areas of the world.

Right: Inside Magnificent Frigatebird (*Fregata magnificens*) colony at Dry Tortugas National Park.

Laura Bennett



An Analysis of the Transparency of Marine Governance Organizations

by Nichola Clark MEM '14

The international environmental governance community began talking about transparency in the 1990s, and regional fisheries management organizations (RFMOs) in particular have been called upon to increase their transparency. Transparency is credited with a number of beneficial qualities, including encouraging compliance and increasing the accountability and responsiveness of governments. It is hoped that improving the transparency of marine governance organizations will lead to more effective conservation and management of the resources within their jurisdiction.

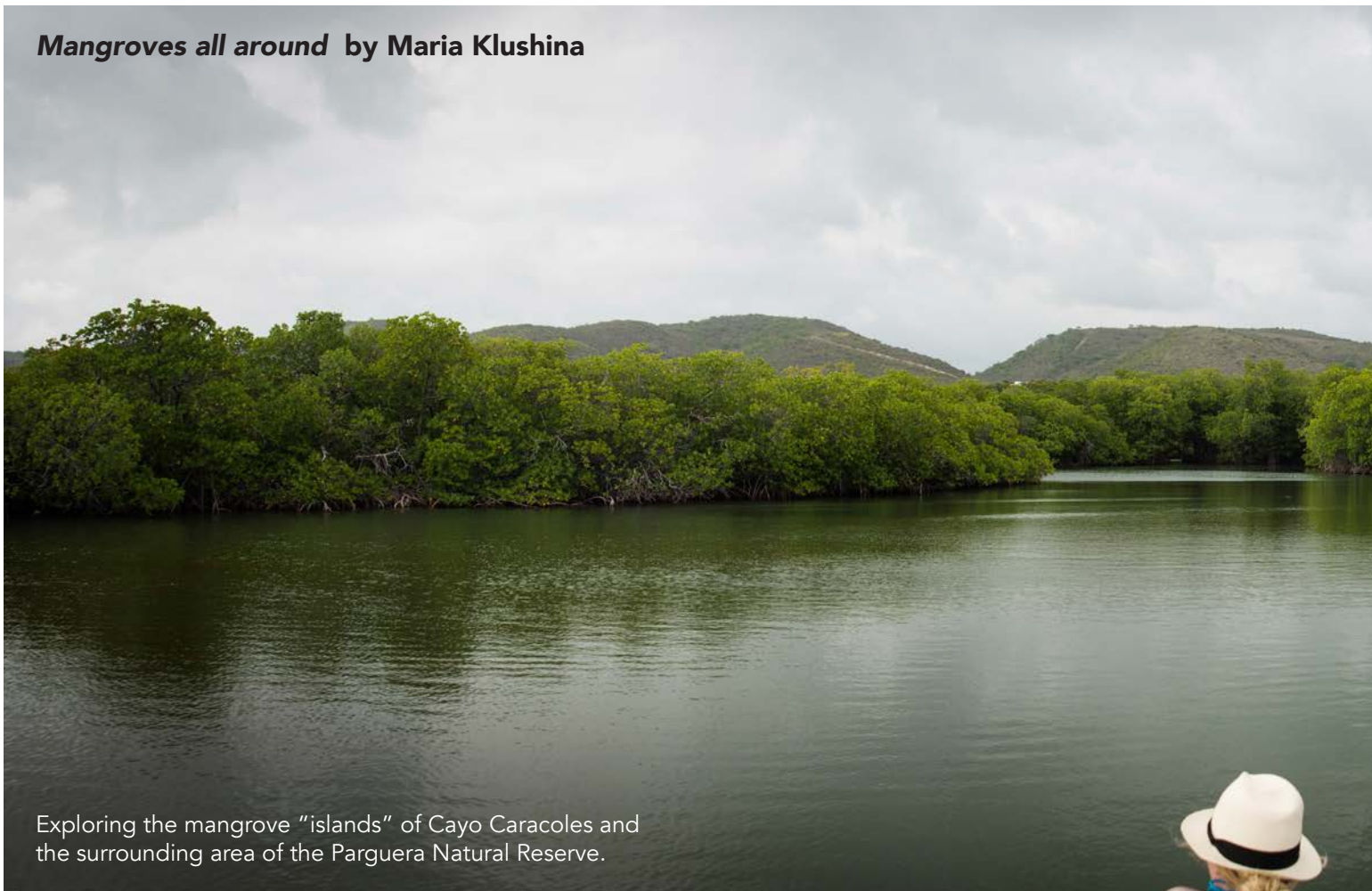
This project explores transparency in marine governance organizations first by tracking the use and legal weight of the term in international marine governing bodies, and then by assessing the degree to which RFMOs are transparent.

In order to evaluate the transparency of RFMOs, a questionnaire was developed based upon internationally recommended practices. The questionnaire divides transparency into three broad categories: availability of information, participation in decision-making, and access to outcomes. On average, RFMOs received 76 percent of

the total available points in the questionnaire.

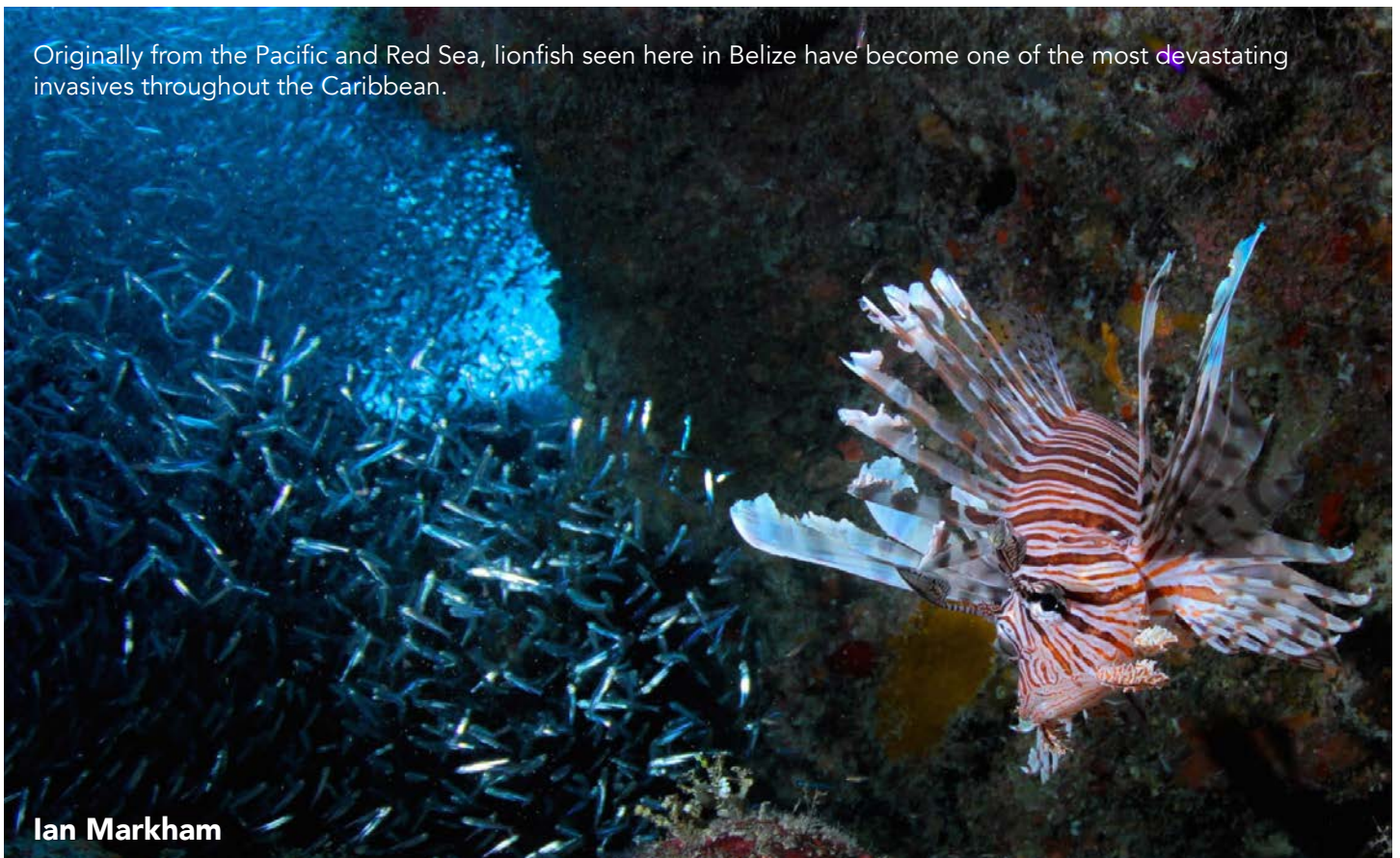
While no single RFMO stood out as having particularly good or bad transparency practices, at least one organization received the maximum number of points for all but one of the questions in the assessment. This indicates that there is a great capacity for RFMOs to improve their transparency simply by adopting best practices currently utilized by their peers. In so doing, RFMOs will increase their capacity to effectively manage the living resources under their authority.

***Mangroves all around* by Maria Klushina**



Exploring the mangrove “islands” of Cayo Caracoles and the surrounding area of the Parguera Natural Reserve.

Originally from the Pacific and Red Sea, lionfish seen here in Belize have become one of the most devastating invasives throughout the Caribbean.



Ian Markham



Sustainable Fisheries Management in Latin America: A United Effort

Alexis Bolton is a second-year MEM student at the Nicholas School of the Environment. Following her summer internship at Environmental Defense Fund (EDF), Alexis had the opportunity to travel to Mérida, Mexico to help coordinate the Tools & Techniques for Sustainable Fisheries Management in Latin America workshop organized by EDF this September.

Healthier oceans, higher profits and more seafood — three things on the minds of fisheries practitioners from across Latin America who came together in Mérida, Mexico September 27th through October 2nd for a workshop on sustainable fisheries management.

Environmental Defense Fund (EDF), a multidisciplinary non-profit organization, and The World Academy of Science (TWAS), a global science diplomacy program administered by the United Nations Educational, Scientific and Cultural Organization (UNESCO),

partnered for the first time to deliver the training. The workshop was designed to share analytical methods and strategies for successful management of small-scale fisheries, with sessions on everything from data collection and monitoring, to strategic planning and governance.

At first glance, the room was filled with differences. Fishermen, scientists, policy experts, government officials, NGO staff members, and community leaders hailed from Chile, Peru, Cuba, Mexico, Belize, and Brazil.

Participants had experience working in everything from finfish to clams, oysters, and kelp.

As it turned out, however, common ground was not difficult to find, even amongst such a diverse set of participants. Too many fishermen chasing too few fish... lack of resources for planning and management... long supply chains resulting in decreased profits for fishermen... policymakers too far removed from the fisheries they work with... a lack of scientific information accessible to fishermen. These were just a few of the challenges common to small-scale fisheries management identified by the group.

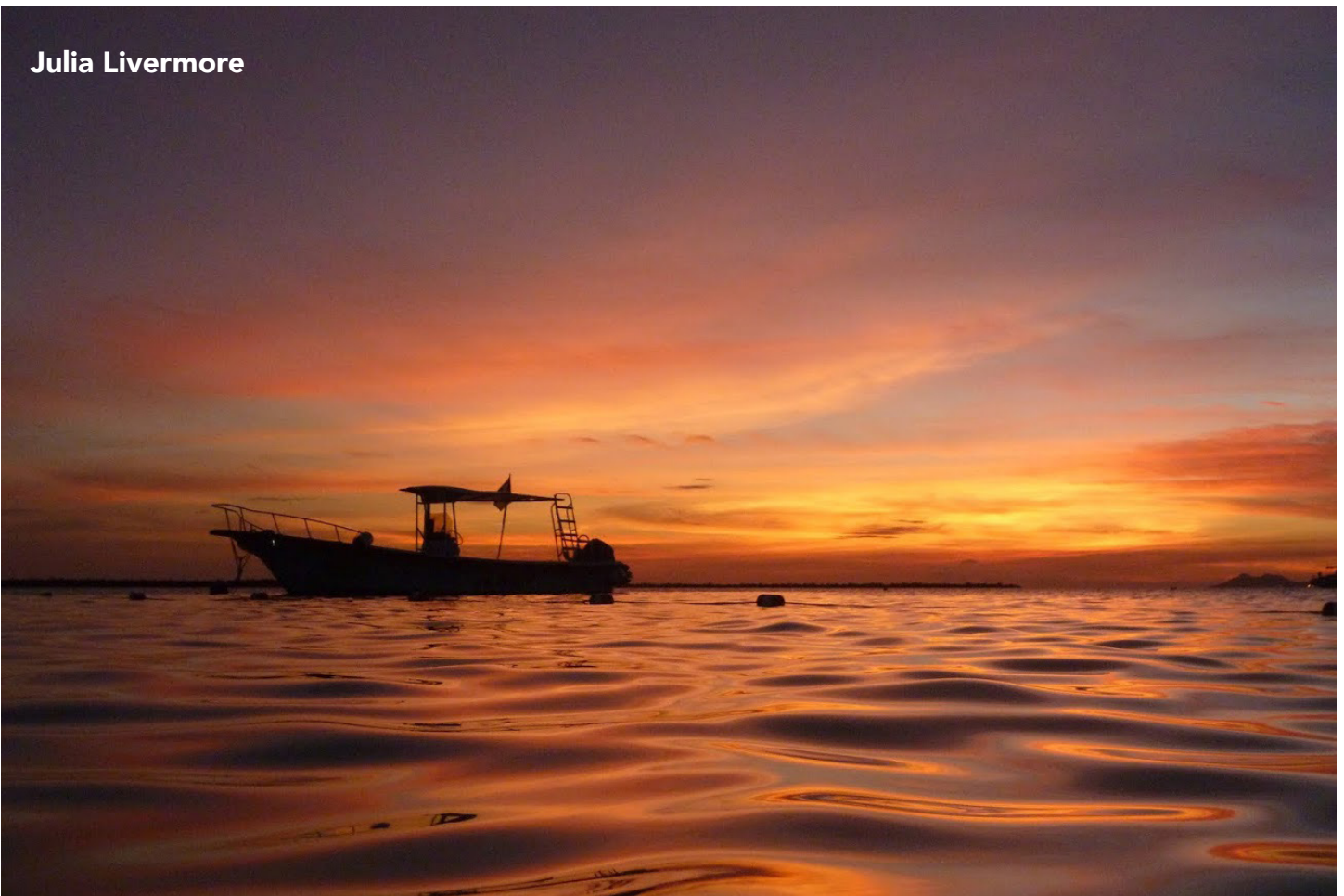
The workshop aimed to address many of these shared challenges. Sessions on management and governance emphasized the need to empower fishermen and shift management responsibility to organizations that are closely tied to the fishery. Other sessions focused on techniques for designing and implementing effective rights-based management systems to incentivize compliance by fishermen. On the science side, participants were introduced to tools for assessing fisheries with limited data and technical capacity, including EDF's Framework for Integrated Stock Assessment and Habitat Evaluation (FISHE). The workshop included several hands-on, practical training sessions to give participants the opportunity to apply the skills and knowledge

Small-scale fishing vessels in Progreso, a coastal fishing town located 40 kilometers from Merida, where the group met with local fishermen to discuss fisheries challenges.



Alexis Bolton

Julia Livermore



learned throughout the week to relevant fisheries in each country.

While the participants all returned home with a newly developed toolkit for sustainable fisheries management, the newfound energy and excitement for collaboration

among the participants was equally important. New bonds were created between scientists, policy makers, and fishermen. Experts in one country connected with experts of another country. Stories, ideas, and suggestions were shared all around. The camaraderie

generated through the experience was unmistakable. The workshop was only the beginning for this new network of fisheries professionals dedicated to sustainable and profitable fisheries in Latin America.



Left: Participants from Chile, Peru and Mexico work through an exercise in designing a rights-based management area for a fishery.



Right: EDF fisheries scientists help a team of participants from Belize and Mexico with fisheries assessment tools.

How to Tag A Shark (and Keep All Your Fingers)

This article originally appeared on the Duke University Research homepage and was written by second year CEM **Shannon Switzer** after she attended the ScienceOnline conference in Miami, Florida. The conference was focused on harnessing social media and other forms of communication to spread the word about ocean issues. Part of the conference involved going shark tagging, a life long dream of the author's (and yes, she managed to keep all her fingers).

My first year at Duke was a fruitful one, full of new experiences and challenges. One of these "firsts" occurred at the ScienceOnline Oceans conference held at the University of Miami, which I was able to attend with the help of conference funding from the Career and Professional Development Center. It was here that I got the chance to do something I've always wanted to do: tag sharks.

All of the ScienceOnline conferences are unique in their discussion-oriented structures. Not only do attendees shape each session during the conference with their contributions, but they also have the opportunity to suggest topics through an online wiki prior to the event. ScienceOnline Oceans and its predecessor ScienceOnline Climate have been successful offshoots of the original ScienceOnline conference, which launched in 2007 and is held annually

in Raleigh. Many of the organizers have local ties: executive director Karyn Traphagen is a Durham resident, and founder Anton Zuiker is the Director of Communications for the Duke University Department of Medicine.

The conference had unconventional discussion sections, with titles like Fight Club: Conflict and Conservation in Social Media; Hacking the Ocean: Open Source Oceanography, DIY Data, and Science as Art; and How to Make Your Science Sing: the Use of Short Film as a Communication Tool. While each session was led by an expert on the topic, attendees also colored the discussion with their own experiences.

But most unusual by far was the opportunity on the last day of the conference to go shark tagging.

Our guides were doctoral students

Austin Gallagher and David Shiffman (Duke undergrad 2007) from the RJ Dunlop Marine Lab, which is affiliated with the University of Miami. The lab has been running educational shark tagging trips for four years now, with groups ranging from private corporations to underserved Title I public schools.

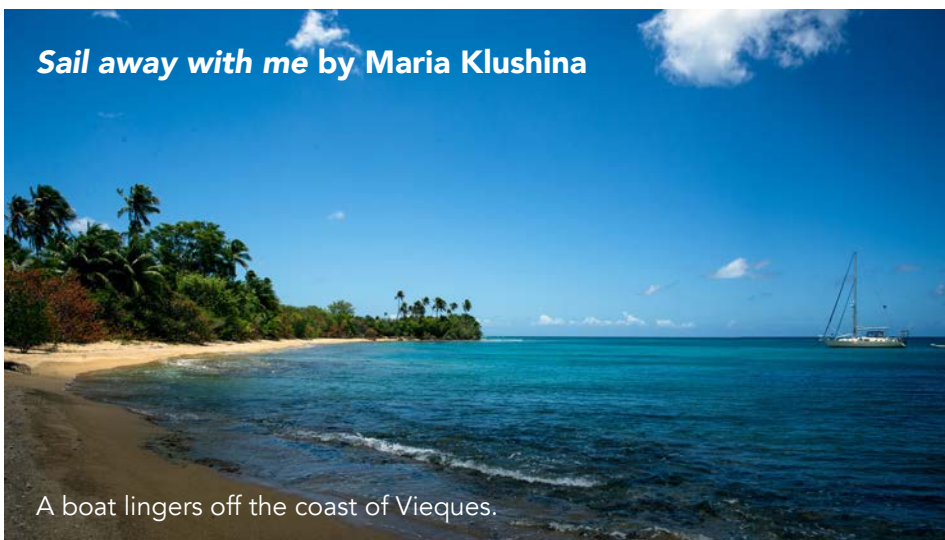
We greeted the morning group of shark-taggers at the dock, as they disembarked. The morning trip had proven sharkless—a rarity for the lab, which tags 450-500 sharks per year and averages three to six sharks per day on the water.

Austin was enthusiastic that we would be more successful in the afternoon, assuring us that their trips usually involved a veritable smorgasbord of sharks (not that they eat them!)—anything from nurse sharks to scalloped hammerheads to bulls, tigers, or lemons. He also emphasized the minor threat sharks present to people. I'd heard stats before like coconuts kill more people than sharks do, but Austin's was new to me:

"Every year, more people are bitten by other people on the New York subway system than by sharks," he said as we pulled out of the marina.

Austin also explained that sharks keep things in balance as the apex predators of the sea, holding their ecological communities together. But despite their importance, shark populations have declined over

Sail away with me by Maria Klushina



A boat lingers off the coast of Vieques.

90% since the 1970s, largely due to the consumption of shark fin soup in booming Asian nations.

"This is real research funded by the outreach component that you're a part of today," Austin said. And the lab's research doesn't just sit on a shelf and collect dust. In 2012, their work using tags and stress physiology tests to intuit the movement ecology of sharks informed the Florida law that prohibits the harvest of hammerhead and tiger sharks in state waters. According to Austin, this is just one of many examples in which their research has influenced policy.

Next, Austin ran through the steps of shark tagging with David Shiffman, who, in addition to being a PhD student at the lab, is senior correspondent for the popular Southern Fried Science blog and co-organizer of this conference. David acted as our "dummy." Using this rare species of Shiffman shark, Austin demonstrated how to tag a shark (while keeping all your fingers). It went like this:

1. Perform stress test. Use a needleless syringe to squirt water into the shark's eye and watch for the nictating membrane (shark's version of an eyelid) to react. If it reflex-fires, we have a healthy shark.

2. Measure the pre-caudal length from the nose to pre-caudal pit.

3. Measure fork length from the nose to the fork of the caudal fin (or tail).

4. Measure total length of the animal from nose to tip of caudal fin.

5. Obtain dorsal fin clip. Snip a small piece of fin off for later analysis to determine heredity, stable isotopes, and the presence



Photo courtesy of Christine Shepard

of harmful compounds which can cause neurodegenerative diseases (with further research, this may be able to deter the eating of shark fin soup).

6. Obtain biopsy sample. Use biopsy tool to dig out small sample of skin. Have to be aggressive, because the denticles, or dermatological teeth of the shark's skin, make it tough.

7. Tag the shark. Attach a spaghetti tag with a unique ID anterior to the trailing edge of the dorsal fin, up and into the fin rays of the dorsal fin. If fishermen catch a tagged shark, they can call the phone on the tag and get a reward for reporting its location.

8. Take blood from leading edge of tail. Use a syringe to collect blood, which can later be centrifuged and analyzed for pH levels, CO₂, lactic acid, and isotopes to learn about feeding ecology, among other things (according to Austin, "blood is amazing").

9. Perform final stress test. Repeat step 1 to make sure the shark is still all good.

10. SET FREE!

After the rundown, we were off, dropping a series of baited hooks,

lines and buoys to hopefully snag a Shiffman...er, a shark. As it turned out, luck was on our side—on the second line we set, we pulled up a four-foot bull shark, which I named Ferdinand. One team got to perform all of the tagging steps with the aid of the lab assistants, and we all got to touch our new friend and feel those denticles. I noted with amusement a motorboat, pulling kids behind on an inner tube, just 200 yards from where we hooked Ferdinand. That's the irony: sharks are always there, 99.9% of the time just going about their daily business without our notice.

In the end, he was our only catch of the day, but seeing the process live was fascinating. As we returned toward the Miami skyline on the horizon, I asked David why he was so passionate about fusing communications, and specifically social media, with science.

"All these new social media technologies make it easier than ever before for experts to share their information with the public," he explained.

And after all, that's who needs to hear it the most.

A North Atlantic Morning

Theophilos Collins is a 2015 MEM candidate studying coastal and ocean management at Duke's Nicholas School of the Environment. He has been a sailor and educator on several large traditionally rigged sailing ships, teaching marine science and nautical science.

FEBRUARY 21, 2012

"Mr. Collins? Mr. Collins?"

I'm awake. That insistent cadence to his whisper annoys me.

"Hey Elliot."

"It's 0330 this is your wake-up you have watch in a half hour. It's clear out, uhhh, really windy and really cold. I'd suggest sweatshirts and coats."

"No surprise there, thank you Elliot."

He starts away from my bunk, but then pauses and places his head on the opposite side of the curtain from my head, breathes awkwardly.

"Oh, and we're making 9 knots."

I quietly celebrate in my head. We're in for a sleigh ride tonight!

"You all set, you up?"

"Yes thanks Elliot. See y'soon."

Trying to shake a dream away, I dress in my coffin-sized bunk. It's difficult, barely sitting up to squeeze a shirt and ripped sweater over my head, lying down to pull some stiff, paint splashed jeans up over my long underwear. I raise my hips and pull them up to rest there. Button and belt fumbings. Grab the hat, find the water bottle at 0335.

Successfully dressed with two pairs of heavy socks, I pull my curtain back and quietly as possible find my peacoat, boots, and harness. We're going to need the harnesses still,



Laura Bennett

Walkway surrounding Fort Jefferson.

judging by the jarring slams of the bow against the waves. The perilous, bracing rebounds bouncing back up, listing to starboard, coming to a stop at its peak, then crashing back to the pounding waves. I woke up once earlier in mid-air. Shoes slide on the sole; mismatched drying socks lie strewn desperately around the fo'c'sle. I sit on the sole next to the mast and brace one foot against a settee bunk to tie shoelaces.

I try to put on my harness just sliding it over my head without opening the chest clip — bad idea. I end up with my arms bent behind my back fighting to put the harness on. This always happens. Every time I put it on, my harness seems a different size than before and twisted like a Mobius strip. It's like some cruel magic trick.

It's now 0338, and with my harness on I'm ready. The cold morning air blows across my face, poked out of the fo'c'sle hatch. I hoist myself

the rest of the way out and walk the deck. A vicious cold front hit us as we left Port Royal Sound earlier in the night; one of those mothers that you swear looks green at the advancing edge with a wild grey in the thick of it. When it hit with a wall of 40 knot wind, hail, rain, and lightning, we stood by on deck as our schooner Spirit of South Carolina yanked its anchor chain, ready to start hauling back if we started dragging. We held, and once the worst was past, immediately hauled back, fired up the engine, rode offshore, set sail, and turned northeast for Charleston. We hoped for a strong west wind on the back end of the front to drive us up the coast.

It's working to better effect than anyone dared to hope. Only twenty miles from land, Spirit of South Carolina coasts along in the early morning darkness, a powerful wooden beast in the water responding to the biting 35 knot winds. It extinguishes all warmth from my face. But it feels good;

a welcome refreshment from the stifling smell of teenagers down below.

We're carrying very little sail on a 140 ft long, 150-ton boat and still screaming along between 9 and 10 knots. Our shortened sails harness the energy of the wind, transfer it to our vessel. We're going where we want to, not where the boat wants to, and you can feel the boat chomping at its proverbial bit. It fights to get loose. This is sailing! This is special, for all of us. The lines for all sails still hang coiled on their pins, so it seems there's no immediate plan to take anything in soon.

My students aren't on deck yet. They're probably still putting clothes on in their bunks, layering up.

No visible traffic. We're all alone out here.

Vega sparkles low in the eastern sky — the approach of spring off the South Carolina coast. I've already checked our position and heard the plan for the next four hours from the off-going mate when I hear one of my students announce himself: "Stiles on deck!" Now here come three more of them popping up through the midships hatch, hats on and snacks in hand. Then another one and finally the last one, eyes all only partially open. They all march back aft to me. They look tired, unfocused, like they need a little reminding of what they need to do. My deckhand Shannon is amazing — she steps in. "Morning folks! Seems like you're all here relatively on time. What should we be doing right now? You feel you're ready to take the deck here?"

"No, not yet. We need to read night orders and do a deck walk."

"You got it. And check the chart as

well. Gotta know where we are and where we're goin'. Why don't you go relieve the helm Jules; Stiles you take over lookout, and the rest of us will get busy with logs, weather observations, and navigating. Aaaaaannnnnnndddd go!"

I take a student aside. She and I talk about how to approximate where we are. She knows how to find distance from speed and time, but she's never put it together to deduce an estimate of a boat's position before. By moonlight we splash a line over the side to measure speed through the water, retrieve it and talk with the helmsman to find out what direction he's been steering us. She calculates how far we've gone since the last position on the chart half an hour ago, and hurries below to put our reckoned position down on the chart. She'll probably hang below for a little longer than usual to sap up some warmth. This is my life. This is right.

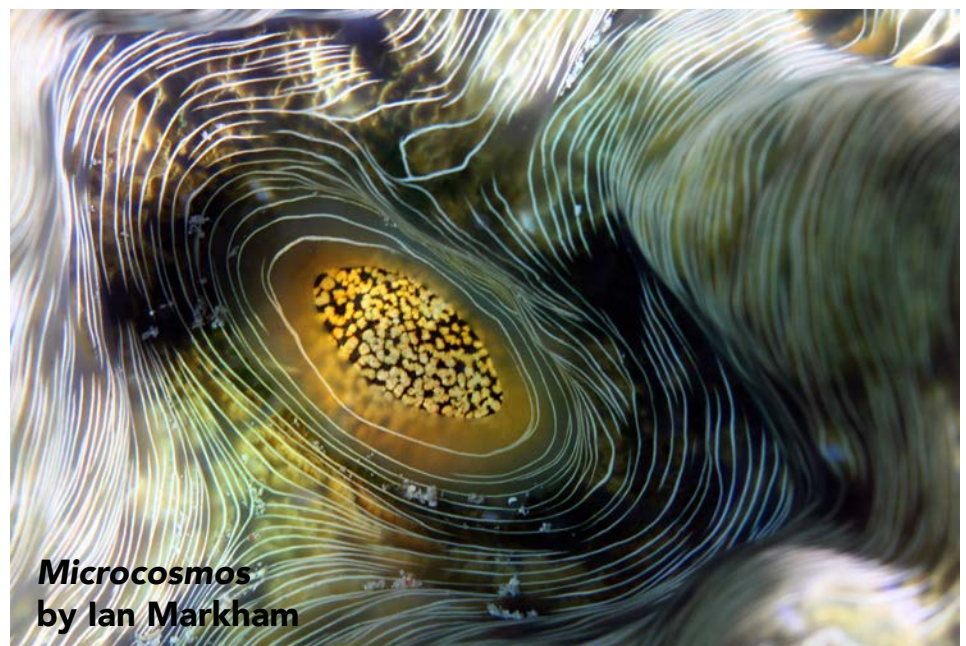
I sail schooners. We're introducing students to ocean science, to the oceans themselves, and to how we as people interact with them. Many are here because they want

to learn about oceans or sailing, but maybe regular classrooms never cut it for them. Some just wanted a vacation and thought this would be a good idea. Suckers. I remember why I'm here. Here, only weather, water, and ship exist. And shipmates. Lights scar the margin of the continent twenty miles to the west. A life on land wouldn't ever take. It's a lie, a place I never belonged. The itch still burns like an open salt-chafed blister: to go further, forget my entire past, somehow to fall off the face of the world.

The trip is actually going well so far. The students are alive and seem happy. Under the steel-glint stars and the moon's cold washlight, bitten by the North Atlantic's winter winds, wild dark waves chase Spirit's quarter, crashing, foaming around us. I am alive and happy. And there's breakfast to look forward to in four hours at the end of the watch.

END

Below: The siphon of a giant clam off the coast of Komodo, Indonesia seems to hold the secrets of the universe.



Microcosmos
by Ian Markham

A local surfer throws an air during a sunset session at the Carlsbad State Campgrounds in San Diego, California. The waves were small but that didn't dampen his fun.



Shannon Switzer

Get Involved

The Ocean Policy Working Group publication, *Upwelling*, is a semi-annual publication with the purpose of showcasing the work of members of the Duke community as related to the oceans. We are interested in any short research articles or OpEds (500 words or less for both) on ocean policy-related subjects as well as any ocean-related pictures to publish. We welcome work from graduate students, researchers, alumni, and professors. If you are interested in contributing to the upcoming edition, or if you have any questions about the publication, please contact us at **dukeOPWG@gmail.com**.

For more information, visit: **<http://sites.duke.edu/opwg/publication>**.



With support from

