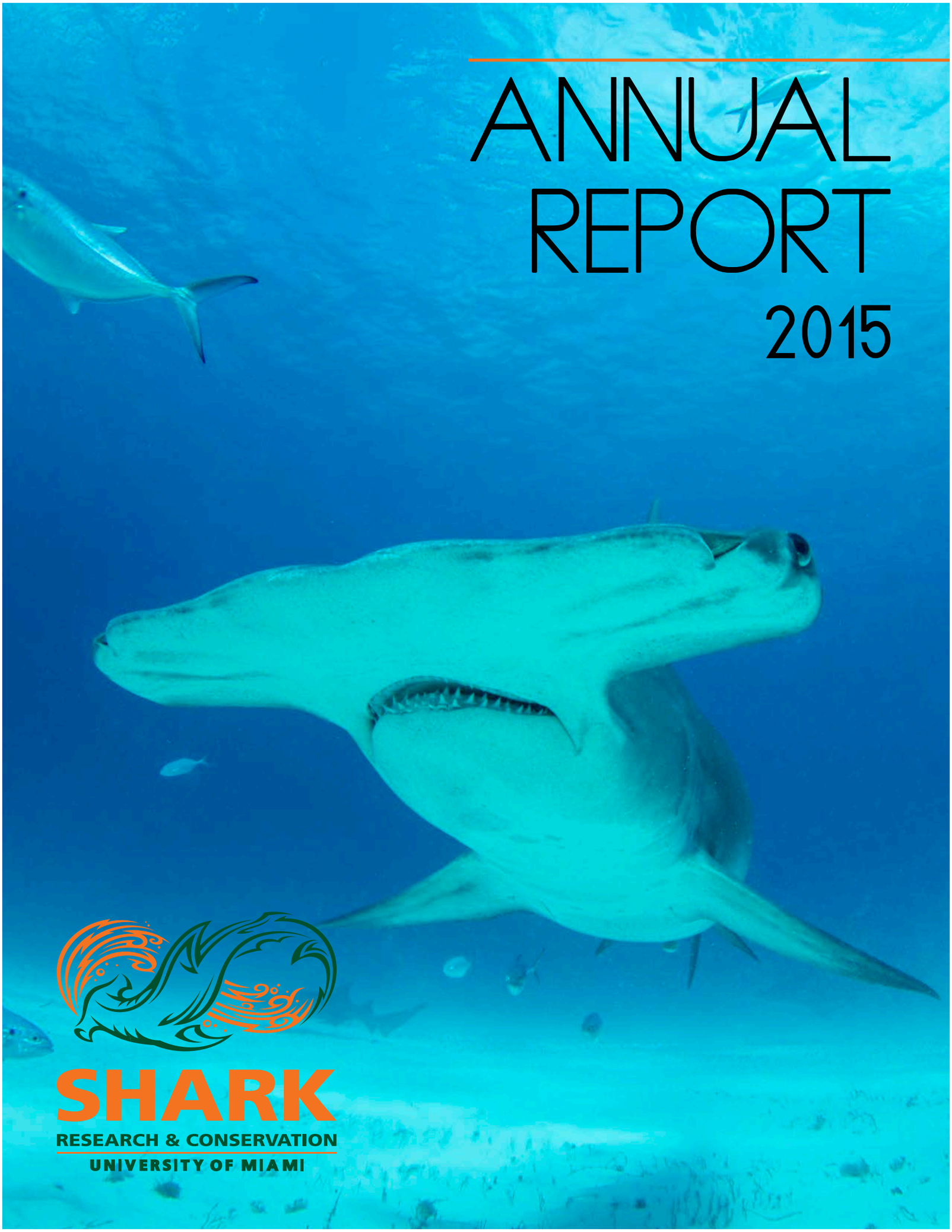

ANNUAL REPORT 2015

SHARK
RESEARCH & CONSERVATION
UNIVERSITY OF MIAMI

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SEE WHAT'S INSIDE

This document is a report summarizing the achievements and progress of the University of Miami's Shark Research and Conservation Program (SRC) in 2015.

UNIVERSITY OF MIAMI
ABESS CENTER for ECOSYSTEM SCIENCE & POLICY

UNIVERSITY OF MIAMI
ROSENSTIEL SCHOOL of MARINE & ATMOSPHERIC SCIENCE

SRC is a joint initiative of the Rosenstiel School of Marine & Atmospheric Science (RSMAS) and the Leonard and Jayne Abess Center for Ecosystem Science and Policy (CESP) at the University of Miami.

LETTER FROM THE DIRECTOR

Dear SRC Friends, Colleagues and Supporters,

This past year was one of our most successful to date. We continued our shark research surveys in Miami, Palm Beach, South Africa and the Bahamas. During 61 days of sampling in Miami, we captured, sampled, and tagged 323 sharks of 12 different species! We also started new shark research projects in Japan, the Galapagos, and Brazil. Our Rescue A Reef program also achieved great things – 8 expeditions, in which 77 citizen scientists out-planted 421 corals, creating 147 meters of new coral reef off Miami. We also published numerous scientific papers on a variety of research subjects in top journals including ***Ecology, Trends in Ecology & Evolution*** and ***Science***. Several of these papers were featured on the journal covers. Our satellite tracking data was used by the National Marine Fisheries Service to designate essential habitat for Atlantic highly migratory species. Our research was widely covered in the media, including Discovery Channel and National Geographic. We were also fortunate enough to once again participate in many community functions and festivals such as the Tortuga Music Festival and Frost Science Museum's Underwater Festival. Our students presented at numerous scientific conferences, including the American Elasmobranch Society annual meeting. In terms of public outreach, in 2015 alone, as part of our shark research trips, we brought 1000 Citizen Scientists out on research vessels with us to participate in our science and learn about local conservation issues. Participants ranged in age from 10 to 80, came from 41 states including Washington, DC, and 51 countries, and included representatives from 78 schools, community organizations and public corporations. These achievements could not have occurred without the dedication, passion and support of our students, staff, collaborators, donors, partners and institutions.
We thank you!

Neil Hammerschlag, Ph.D.

Director, Shark Research and Conservation Program
Research Assistant Professor
Rosenstiel School of Marine and Atmospheric Science (RSMAS) - Abess Center (CESP)

The mission of the University of Miami's Shark Research and Conservation Program (SRC) is to advance ocean conservation and scientific literacy by conducting cutting edge scientific research and providing innovative and meaningful outreach opportunities for students through exhilarating hands-on research and virtual learning experiences in marine biology. Focusing primarily on the study and conservation of sharks, the Program's full-immersion approach allows students to actively grow as future scientists.

What sets us apart?

The Shark Research and Conservation Program at the University of Miami (SRC) works in 3 unique ways to carry out important field research and outreach efforts in both the United States and abroad.

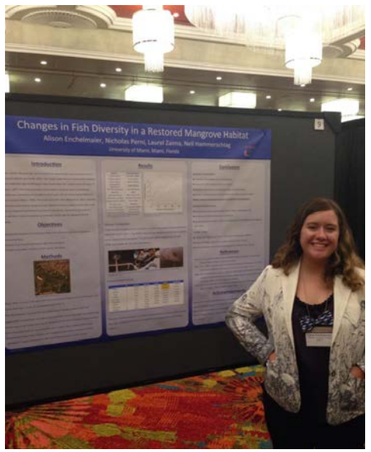
1
Our SRC team is made up of University of Miami faculty, staff, and students from a variety of disciplines such as science, communications, law, education, and engineering

2
Student interns are the backbone of our program, helping carry out tagging trips, training and leading high school student participation in the field, lab, and classrooms

3
We partner with exceptional scientists, policy makers, journalists, and educators to accomplish maximum effectiveness and reach of our conservation initiatives

HIGHLIGHTS

American Elasmobranch Society (AES) Conference



SRC had a number of students attend the annual AES conference in 2015. Emily Nelson presented data on variations in body forms of apex predators and how that influences their broad scale movement patterns and ecological performance.

Alison Enchelmaier presented a poster on her ongoing masters work looking at changes in fish diversity of a restored mangrove habitat. The purposes of the annual meetings are to conduct society business, to hold technical sessions for oral presentations, posters and symposia, and especially to provide opportunities for continuing and new colleagues to meet and socialize.

Indeed, the annual meetings are the best venue for members to keep informed about each other's work, and for students to enter the scientific community of ichthyologists and herpetologists.

4th Annual miami underwater festival

Frost Science Museum's Underwater Festival

The Frost Science Museum's Underwater Festival, held for the 4th time in 2015, was devoted to educating the community on understanding more about what lies underneath out city's surrounding 84 miles of water. This year's theme was "Coasts, Reefs, and Open Oceans" and held in celebration of the global World Oceans Day and in honor of the oceans that link the world together and to help raise awareness of the current challenged faces. One of our own, PhD candidate, David Shiffman, represented the lab at the #Underwaterfest Twitter chat where he joined other marine experts to field questions from the public to discuss issues ranging from lionfish to sharks. Other fun events included a habitat restoration project and beach cleanup at Virginia Key where volunteers learned how to use marine conservation apps to document animals and plants inhabiting the beach.

Taste of the Sea

For the 2nd annual Taste of the Sea event, held in Miami, the SRC team was proud to share our research and conservation programs yet again with over 300 South Floridians. This event offered guests the ability to savor the finest responsibly sourced seafood dishes created by South Florida's chefs and also participate in a chef "fish off" where guests voted on their favorite seafood creations. All proceeds from the event helped further marine conservation programs led by the Sea Delight Fund, dedicated to the conservation and protection of our oceans and promoting sustainable seafood. SRC was proud to join other incredible leaders in marine conservation such as the Marine Stewardship Council, World Wildlife Fund, the Loggerhead Marine Life Center, and Shark Team One.

Rock the Ocean

Our lab was thankful to be invited back to Ft. Lauderdale's annual Rock the Ocean Tortuga Music Festival. This event is the perfect culmination of music, sunshine, and marine science-themed outreach, and what's even better is that a portion of tickets sold goes to helping save our oceans. Hundreds of thousands of dollars have been given to The Rock the Ocean Foundation, an organization that helps conservation organizations both locally and globally. Our team is especially grateful to be a part of this event since it is known for hosting a Conservation Village, where festival patrons can learn about the marine environment and what role they can take to help the cause. The SRC team was able to meet with concert patrons and teach them about our research projects, and how they can be a part of shark conservation. It only seemed fitting to be a part of this great cause as 2015's 5 core issues involved: shark conservation, turtle conservation, marine pollution, overfishing, and coral reef degradation. SRC was proud to join a stellar list of other organizations working towards shark conservation such as: Bimini Biological Field Station, the Guy Harvey Research Institute, and Oceana.

PUBLICATIONS

Creel S, Becker M, Christianson D, Dröge E, Hammerschlag N, Haward MW, Karanth U, Loveridge A, Macdonald DW, Wigganson M, M'soka J, Murray D, Rosenblatt E, Schuette P. (2015) **Questionable policy for large carnivore hunting.** Science, 350(6267): 147-1475

Gallagher AJ, Cooke SJ, Hammerschlag N. (2015). **Risk perceptions and conservation ethic among recreational anglers targeting threatened sharks in the subtropical Atlantic.** Endangered Species Research, 29, 81-93 000

Thaler, A.D.T. and Shiffman, D.S. (2015). Fish tales: **Combating fake science in popular media.** Ocean and Coastal Management

Nguyen VM, Haddaway NR, Gutowsky LFG, Wilson ADM, Gallagher AJ, Donaldson MR, Hammerschlag N, Cooke SJ. (2015) **How Long Is Too Long in Contemporary Peer Review?** Perspectives from Authors Publishing in Conservation Biology Journals. PLoS ONE 10(8): e0132557.

Gallagher AJ, Hammerschlag N, Cooke SJ, Costa DP, Irschick DJ (2015). **One size does not always fit all: a reply to Stroud and Feeley.** Trends in Ecology and Evolution, DOI:10.1016/j.tree.2015.03.011

Hammerschlag N, Broderick AC, Coker JW, Coyne MS, Dodd M, Frick MG, Godfrey MH, Godley BJ, Griffin DB, Hartog K, Murphy SR, Murphy TM, Nelson ER, Williams KL, Witt MJ, Hawkes LA (2015). **Evaluating the landscape of fear between apex predatory sharks and mobile sea turtles across a large dynamic seascape.** Ecology, 96(8): 2117-2126.

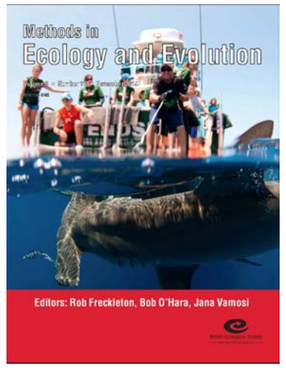
Gallagher AJ, Vianna GMS, Papastamatiou YP, Macdonald C, Guttridge TL, Hammerschlag N. (2015). **Biological effects, conservation potential, and research priorities of shark diving tourism.** Biological Conservation, 184: 365-379

Gallagher AJ, Hammerschlag N, Cooke SJ, Costa DP, Irschick DJ (2015). **Evolutionary theory as a tool for predicting extinction risk.** Trends in Ecology and Evolution, 30(2): 61-65

Fallows C, Benoit HP, Hammerschlag N. (2015). **Intraguild predation and partial consumption of blue sharks *(Prionace glauca)* by Cape fur seals *(Arctocephalus pusillus pusillus)*.** African Journal of Marine Science, DOI: 10.2989/1814232X.2015.1013058.

D.S. Shiffman, A.J. Gallagher, J. Wester C.C. Macdonald, A.D. Thaler, S.J. Cooke, and N. Hammerschlag. (2015). **A letter of clarification from the authors of "trophy fishing for species threatened with extinction."** Marine Policy 53, 213-214.

To read all of SRC's scientific publications, please go to:
https://sharkresearch.rsmas.miami.edu/research/scientific-publications



Evolutionary theory as a tool for predicting extinction risk.

We published a paper using evolutionary theory to predict extinction risk, and it was featured on the cover of ***Trends in Ecology & Evolution***. Often, timely and proactive wildlife conservation requires strategies for determining which species are at the greatest risk of extinction. Trying to quantify extinction risk of a species is an important, yet difficult task for researchers, especially when introduced to human-induced changes to the environment which were not traditionally part of a species' evolutionary past. The authors here suggested that evolutionary theory, particularly the concept of specialization, can be a useful tool to inform conservation assessments and could have significant role to play in aiding the ability of scientists to predict the vulnerability of a species in the face of anthropogenic impacts.

Intraguild predation and partial consumption of blue sharks (*Prionace glauca*) by Cape fur seals (*Arctocephalus pusillus pusillus*).

Another highlight for the SRC team was a feature on the cover of the ***African Journal of Marine Science*** looking at top-down effects of predators on ecosystem structure and dynamics. This paper examined the often-overlooked nature and consequences of interactions between upper-trophic-level predators. The research documented predation by a pinniped (seal) predator on a mid-size predatory shark. Using direct observations in South African waters, free-swimming blue sharks were seen captured and partially consumed by Cape fur seals. The significance of this study will help researchers understand the interactions between these two species but also the implications these interactions have in understanding the tropic ecology of pinnipeds – of which many populations have increased while numerous shark populations have declined.

Fish at Night Symposium

Our director, Dr. Neil Hammerschlag, served on the scientific advisory committee of the 2015 Fish at Night Symposium, hosted by the *Bulletin of Marine Science*. The symposium received over 50 abstracts from Australia, Canada, China, Mexico, South Africa, Spain, and the US. The purpose of the symposium was to stimulate the exchange of new knowledge, data, and ideas on behaviors, patterns, and processes operating underwater, in darkness. Relevant topics include nocturnal fish activities, technical aspects of night fishing/fisheries, diel fish distribution and abundance comparisons, and strategies adopted by fish and

BY THE NUMBERS

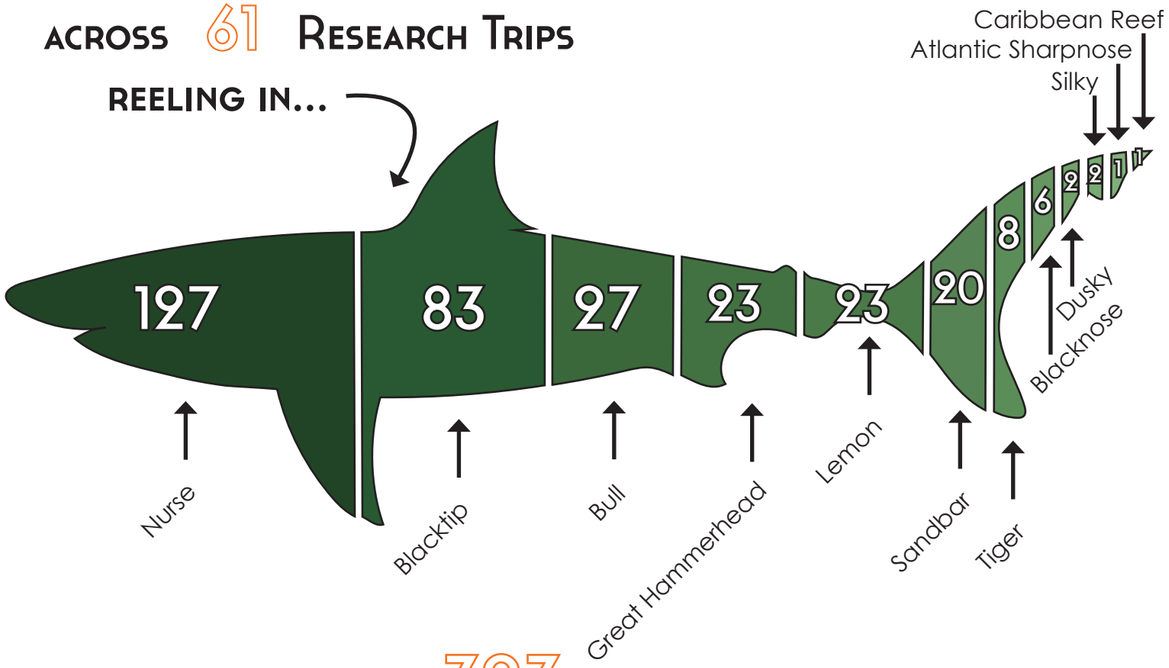
IN THE FIELD

This year we had

1,961 **Drumlines Deployed**

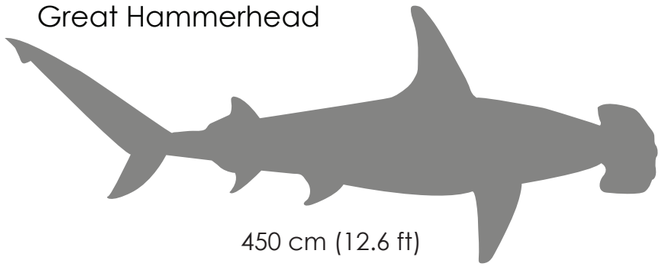
across 61 **Research Trips**

reeling in...



for a total of 323 **sharks caught in 2015**

Largest shark tagged:
Great Hammerhead



450 cm (12.6 ft)

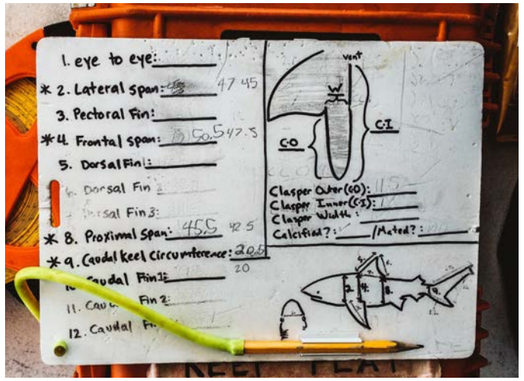
Smallest shark tagged:
Atlantic Sharpnose

76cm (2.3ft)

What a 'Typical' Shark workup looks like:

The SRC team participated in 61 shark research trips during 2015. During these trips, the team collected as much data as possible from the animals while still ensuring shark health and safety. Once back on shore, we brought the samples back to the lab for additional processing and analyses.

Stable Isotope Analysis: We use a technique known as stable isotope analysis to examine various aspects of shark feeding patterns. By using a very small amount of shark blood, fin, or muscle we can determine the chemical signatures of these tissues that provides insights into shark diet. For example, if a shark were to eat all barracuda its tissues would have a chemical signature indicative of eating barracuda, or if a shark ate all tuna its tissues would have a chemical signature indicative of eating tuna. This data may reveal what different sharks eat and how they share resources between species, which is critical for understanding how predators influence marine food webs.

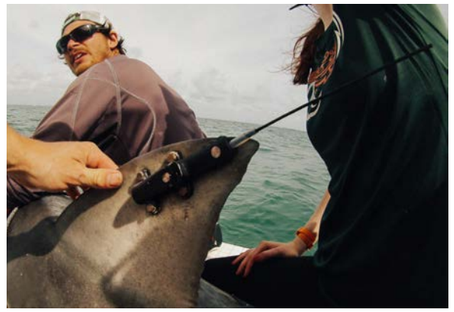


Measurements: The SRC team takes a series of over 10 measurements during shark workups. These measurements can be used to examine growth patterns, estimate age, and determine body condition of the sharks. One of our collaborators, Dr. Duncan Irschick, analyzes the photos we take using computer programming to calculate metrics such as fin area and body shape.

RESEARCH

Blood Work: SRC conducts research to understand and minimize shark stress. Using our onboard laboratory, we are able to analyze blood samples within minutes of taking them. One of the blood parameters we assess is glucose levels. This allows us to gain a better understanding of the energy or fuel circulating in the blood during capture. When compared to how long the animals have been on the line, we can start to see how time spent on a fishing line impacts glucose levels across multiple species. This is important because the sharks rely on this energy, among other things, to power their muscles efficiently for survival. With that same onboard lab, we are able to get an idea of the red blood cell count, or hematocrit, that each shark has. This allows our team to get an idea of how the volume of red blood cells changes while a shark is on a fishing line. Additionally, we are able to separate plasma from the blood drawn from each animal to be later analyzed back at the lab. From the plasma we can get a variety of information from stress level indicators to hormones to see if female sharks are pregnant!

Satellite Tags: Every time the satellite transmitter of tagged shark breaks the surface of the water it sends a signal to a satellite, which records the shark's location. These locations can then be analyzed using programs such as Google Earth and ArcGIS. The satellite tracks are a critical component of ongoing research by SRC to better understand residency patterns and migratory routes of tiger, hammerhead, and bull sharks. In addition, other satellite tags we use provide information including light levels, earth's magnetic field, depth, and acceleration of the shark. This is important as we start to ask WHY our sharks undertake the movement patterns they do.



Shark Satellite Track Spotlight

Finn the Tiger Shark

Sand Creek Intermediate (SCI) School in Fishers, Indiana voted to change their mascot from the Aggies to the Sharks. In response to this change, students and staff felt they needed to do something to make their mascot more "real." Through the leadership of a 6th grader, SCI launched "Mission Finn" (Finn being the name of their mascot). The school held a number of fundraisers including selling Finn T-shirts, bracelets, and even hosting a student vs. staff basketball game to raise money to adopt a shark. After months of fundraising, SCI became the proud sponsors of a 245 cm tiger shark. Finn quickly became famous, as the story of Finn's adoption made it onto the local news station in Fisher, Indiana.

"We have fun tracking Finn around the Atlantic. He is very active and has surfaced all over the place. We are glad that we participated in such a cool and worthy cause. "
-Bryan Alig, Assistant Principal Sand Creek Intermediate

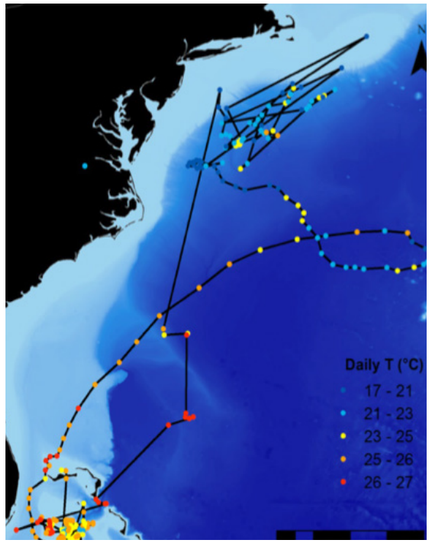
"Living in Indiana, there are not sharks around! I discovered the SRC Adopt a Shark program on the Internet and decided to we need to make it happen for our school!"
-Student Council Member, Sand Creek Intermediate

To track Finn and other sharks that we have tagged, please go to: *http://sharkresearch.rsmas.miami.edu/education/virtual-learning/tracking-sharks*

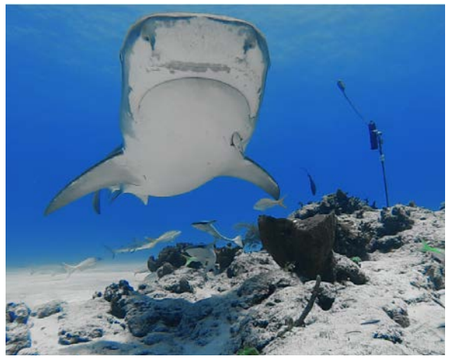
How does climate change affect sharks?

By: Rachel Skubel, SRC PhD Graduate Student

Climate change has the potential to impact the health and behavior of various marine life, from corals to sharks. At SRC, we are investigating the capacity of tiger and great hammerhead sharks to withstand increasing temperatures projected for our region as the 21st century progresses. Human-induced climate change is altering ocean chemistry at an unprecedented rate. By 2100, ocean temperatures in South Florida and the Caribbean are projected to rise by as much as 4°C, while ocean acidity also rises but oxygen levels drop. Most sharks move to waters that are better suited for optimal performance, so understanding a shark's relationship with temperature is critical for predicting changes in its habitat. We are conducting one of the first studies to understand how an apex predatory shark's energy usage and movements change in response to temperature during their migrations. Satellite tags combined with sensors for temperature, depth, and acceleration enable us to estimate the optimal temperature range for these species, and in what environmental conditions their performance starts to decline.



To date, we have been able to calculate the energy usage, in relation to temperature, of a tiger shark over a year-long migration. And when looking at combined data from multiple tiger sharks, we found that this species spent a great deal of time above its optimal temperature range, most likely to take advantage of feeding and reproductive opportunities. Our director, Dr. Neil Hammerschlag, and colleagues have had the chance to observe first-hand tiger shark behavior in the Bahamas which supports this evidence. Annually, visits are made to Tiger Beach, where the researchers find pregnant female tiger sharks gestating. This is important to note since the temperature of the waters surrounding the Bahamas are some of the warmest along the shark's entire journey.

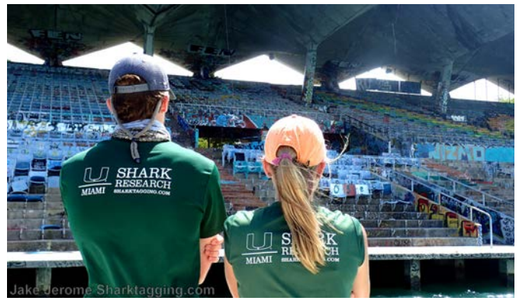


This research project is just beginning! Over the next few years, our aim is to tag and sample many more tiger and great hammerhead sharks, giving us strong projections of the risks posed to these important apex predators from climate change as it continues to alter their environment.

Urban Shark Project

By: Robbie Roemer, SRC Master Student

Just recently I went sampling for my research project. I deployed drumlines, ten per set, with a one hour soak time – normal protocol for any of our shark research projects in Florida. However, the film crew joining us kept having to pause recording. Party yachts were playing electronic dance music too loud, and the bass was interfering with the microphone. It was Miami Music Week, and between the dance music, ongoing construction, and Boeing 737's making their final approach into Miami International Airport, the film crew was starting to get frustrated. I mentioned to them, "It's always going to be like this, it's an urban ecosystem at its finest."



Ironically, the inception of the urban shark project started when Dr. Austin Gallagher and Dr. Neil Hammerschlag were making a final descent over downtown Miami, and the question arose, "What sharks are living here?" When I entered the lab just over a year and a half ago, unaware of interest in the lab about urbanized sharks, I presented Dr. Hammerschlag with a proposal to investigate sharks in urban, fragmented ecosystems. We integrated important ideas, and the final version of the urban shark research program was born. While this project is very new, we currently center around four main questions:

- **Where do sharks move in urban ecosystems?**
- **How long do they stay in human altered environments?**
- **What factors influence urban shark movements?**
- **Does the ecological fitness of urban sharks differ from sharks in more pristine environments?**

Acoustic biotelemetry, we investigate movement patterns and residency times of sharks in human-modified areas. By surgically implanting an acoustic transmitter within a shark we can monitor localized movements and how long certain individuals stay within a specific area. We currently have an underwater acoustic receiver system, placed on the benthic substrate of Biscayne Bay that listens for unique ultrasonic transmissions given off by the acoustic transmitter tags within our sharks. Through the cooperation of the Atlantic Cooperative Tagging Network, and the Florida Cooperative Tagging Network, we can even track these individuals if they leave Biscayne Bay or Floridian waters altogether. Additionally, we collect blood samples from sharks surveyed, allowing our team to compare the health of sharks in urban versus more pristine locations.

Results will provide our lab with important insights as to why sharks venture into these degraded habitats, and general health of the sharks that spend extended time in urbanized environments. Such data can be valuable for delineating zones of critical habitats, more informed conservation initiatives, and influencing future policy implication.

While our team awaits the first round of preliminary results, the most memorable experience I've had while researching was capturing, sampling, and tagging a juvenile great hammerhead shark off the Brickell seawall of Miami. This shark was also fitted with a satellite tag, giving us very valuable information as to where juveniles move and how long they stay in a degraded system such as downtown Miami. Many people do not realize that if a body of water is connected to the ocean, there is a chance a shark is swimming in those waters, no matter how improbable. Sharks have no boundaries, nor are they confined by fences.

In the coming months, our team hopes to retrieve, download, and redeploy the first round of acoustic receivers, run bioassay assessments of blood plasma samples, deploy roughly 20 more acoustic receivers and surgically implant more acoustic tags thanks to support from the Save our Seas Foundation. Stay tuned to see what our findings are!

Rescue A Reef

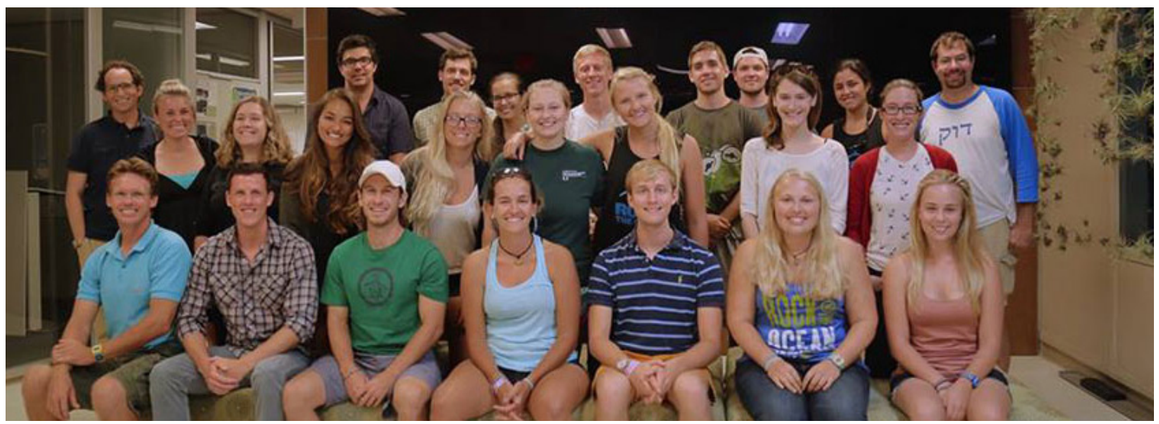
By: Dalton Hesley, Rescue A Reef Research Assistant

In 2013, SRC partnered with the University of Miami's coral restoration program led by Dr. Diego Lirman to initiate a unique program called Rescue A Reef. The University's coral restoration lab focuses on propagating threatened staghorn coral in underwater nurseries to create a sustainable source of healthy coral colonies for use in restoration activities. The lab's research is complemented by Rescue A Reef, a citizen science program that educates and engages the community in coral reef conservation and restoration. Citizen scientists have the opportunity to join the University's coral researchers on open-water coral restoration expeditions to receive an interactive learning experience in coral conservation. They learn about the ecological importance of coral reefs as well as the benefits of active restoration, all while assisting the Rescue A Reef team in their ongoing research.

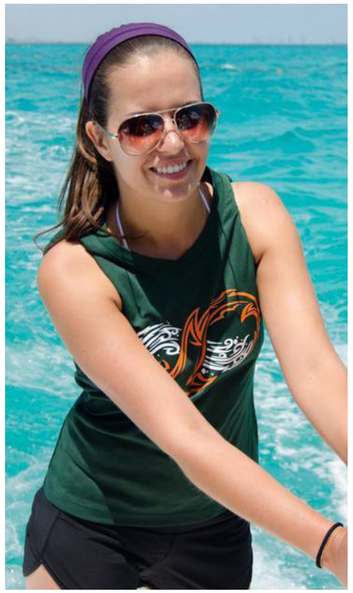
The Rescue A Reef Program was officially launched in May of 2015 and hosted eight coral restoration expeditions with 77 citizen scientists during its first year. With the help of those citizen scientists, the Rescue A Reef team was able to outplant over 420 staghorn coral colonies equating to nearly 150 meters of hard coral structure transplanted back onto degraded reefs of the Florida Reef Tract. These colonies provide important habitat for other species and help return healthy structure to our reefs, so the efforts of our citizen scientists represent an ecologically significant impact on local coral reefs. Additionally, in 2015, Rescue A Reef hosted 17 educational events and seminars, reaching nearly 700 community members, including over 500 students! The program is still expanding its outreach in South Florida, collaborating with the newly built Frost Science Museum and the Miami Science Barge. In year two, Rescue A Reef plans to surpass these impressive efforts by outplanting 1,500 corals on 20 expeditions, while working to increase our reach in the community through outside events and seminars.

INSIDE SRC

Meet some of the SRC Students and Interns



SRC Master Student Hannah Calich



I have had the pleasure of working with the enthusiastic, hard-working, and passionate people in the SRC lab for almost three years and I cannot imagine working with a better team. While working in this lab I have had the opportunity to go on countless shark research trips (including one to the British Virgin Islands to tag sharks with Sir. Richard Branson) and have been able to interact with and collect data on some of the most fascinating species on the planet. In addition to being out on the water, I have also participated in many of SRC's outreach initiatives including teaching students from the U.S. and Canada about marine conservation!

My research is primarily focused on the behavioral ecology of marine organisms. For my masters thesis I am currently studying when and where great hammerhead, tiger, and bull shark habitats overlap with U.S. longline fisheries. To do this, I recently completed a large literature review to identify the factors that influence the habitat use of the study species and I am currently using this knowledge to develop habitat suitability models for each species. These models will be used to identify critical habitat areas as well as to identify where and when these species are vulnerable to interacting with U.S. longline fisheries. The results of this study aim to help managers develop effective management strategies for great hammerhead, tiger, and bull sharks.

SRC Intern Shannon Moorhead

I had the privilege of joining the SRC program in August as an undergraduate intern and I can already say it is one of the best experiences of my entire life. It has truly been an honor to be a part of this group of amazing people doing amazing research. My favorite days are spent on the boat collecting data with a team that I am lucky enough to call my friends, which is why I am so excited that after I graduate, I will be continuing my work here as a Master's student in the fall of 2016! My primary interests lie in shark habitat usage and predator-prey interactions. With my Master's research I hope to identify nursery habitats of lemon sharks, as well as other large coastal shark species. Many juvenile sharks, especially lemons, utilize coastal habitats such as mangroves while they are still small and vulnerable to larger predators. Due to the high rate of coastal development in South Florida it is important to identify these critical habitats for sharks before they are destroyed.

SRC Intern Chris Brown

I am fortunate enough to have been the first undergraduate student to hold a dual position with the SRC Program as a research and photography intern. My responsibilities include conducting field research techniques on several different coastal shark species in addition to documenting the events of each shark tagging trip through a series of underwater and field photography albums. However, what really makes the entire experience unforgettable is working alongside an amazing team of talented undergraduate and graduate students. My internship with the SRC program provides me with the opportunity to apply my previous experiences in marine biology and wildlife photography with an organization that is exceptional at producing great research and excellent scientific communication skills across a range of platforms. One of the best parts of working with the SRC Program is taking high school students out on our shark tagging trips. These trips provide students with a full day of experiential learning and research techniques, an education on the importance of shark conservation, and the chance to see what kind of opportunities await students that pursue career paths in marine biology and conservation. As an intern, I could not be more grateful for all the training sessions and hands on experiences I am provided with by the SRC Program. The instruction and mentorship I received from the graduate students during my internship greatly benefited my undergraduate career and I believe I am now better prepared to pursue a career in marine biology and science communication.

SRC ALUMNI

Christine Shepard

In 2010 I was introduced to Dr. Neil Hammerschlag, a young, passionate and innovative scientist who had just founded the Shark Research and Conservation Program. It was clear that he was blazing a new trail for marine science research and experiential outreach, something I was very much excited about! I had been looking for my final undergraduate internship opportunity, and the SRC Program seemed like a perfect fit. I asked Dr. Neil if he would ever consider having a media intern, to which he quickly responded, "Absolutely!" and put me to work. Over the course of those six months, we explored the possibilities for visual media at SRC: field photography, educational brochures, promo videos and an interactive multimedia project called Virtual Expedition. Little did I realize that his passion and deep-seated appreciation for sharks would be so contagious, turning me into an avid shark photographer and lifelong shark conservation advocate.

After graduation, it was clear that neither Dr. Neil nor I were ready to part paths, and so I joined the team as a full-time staff member, becoming the SRC Media and Virtual Learning Manager for the next three and a half years. It was a dream come true. The team was more like family than colleagues – supportive, encouraging, fun, and 100% trustworthy. I'm so proud of the work we were able to do together – establishing a visual identity for the program, creating a unique, information rich and highly engaging website, developing a central and organized multimedia library, exploring new methods for outreach and education, offering on-going media internships to undergraduate and graduate students, and positioning the lab as an industry leader for innovative uses of science multimedia.

In 2014 I began my next chapter out on the Big Island of Hawaii, starting a media production company called Coral Cove Imagery, which offers a variety of photo and video services from topside, to underwater to aerial. Some of my favorite projects continue to be in the marine conservation and biotech fields. In addition to commercial production, I also have an online fine art photography gallery (with plenty of toothy shark images) that donates 30% of all proceeds to environmental research and conservation, with SRC as a primary beneficiary! To view my portfolio and purchase prints, visit: www.ChristineShepard.com.

Reflecting back on my time with SRC, it was not only foundational for my career, but also transformative for my life. I have so much appreciation and respect for Dr. Neil and the entire team at SRC. Congratulations on your continued success!

Austin Gallagher PhD

In January 2015, lab member Austin Gallagher successfully defended his Ph.D. at the Leonard and Jayne Abess Center for Ecosystem Science and Policy. His dissertation comprised several years of data on sharks and fisheries, focusing on the vulnerabilities of shark species to the process of capture and release with a focus on the factors that affect their survival. Austin's defense marks him as the first student to complete a Ph.D. as a member of the Shark Research and Conservation Program while a student at the Abess Center for Ecosystem Science & Policy at the University of Miami. During his Ph.D., Austin published an astonishing total of 25 peer-reviewed publications, and spent over 250 days in the field tagging sharks and serving as a trip leader. His work has already had an influence on policy for threatened species such as hammerhead sharks, a focus of his dissertation.

He also founded and developed his own non-profit organization, Beneath the Waves, a research and media NGO which has grown to global acclaim and impact. Since his graduation, Dr. Gallagher has been very active as a researcher and has honed his skills as an entrepreneur. He began his first postdoc in May 2015 with Dr. Steven Cooke at Carleton University, working on how natural environmental and human-induced stressors affect wild animals, with a focus on fish. He has also substantially grown his NGO, including launching of a research branch of the organization that has since supported research on sharks in Asia and the Atlantic. For his work with Beneath the Waves, he was also recently honored on the prestigious Forbes 30 Under 30 List in Science, where he was the first marine biologist to grace the list. He still remains an active research collaborator, mentor, and close friend of the lab, and has also accepted a position as an Adjunct Assistant Professor in the department of Marine Ecosystems and Society at UM's Rosenstiel School of Marine and Atmospheric Science.

SCIENCE SPOTLIGHT

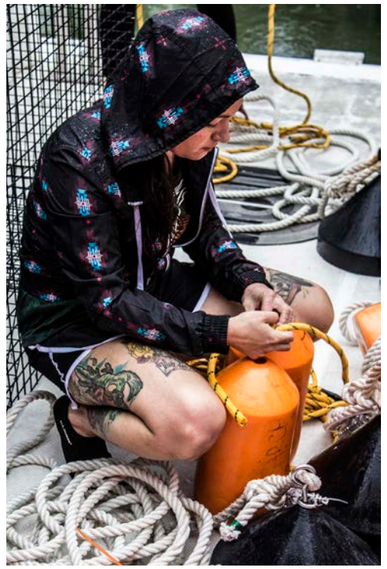
Reporting their findings the prestigious journal *Science*, an international group of biologists that included SRC's Dr. Neil Hammerschlag, found that policies regulating the hunting of large carnivores do not always align with basic scientific data, which can undermine conservation efforts. The study revealed that current harvest levels following the recent de-listing of Northern Rocky Mountain population of gray wolves from the US Endangered Species list has led to decreased survival and reproduction, smaller packs, social disruption and a reversal from population growth to decline. This research has now been used to petition the U.S. Department of the Interior and the U.S. Fish and Wildlife Service to extend the Endangered Species List post-delisting monitoring period for the gray wolves for an additional five years to ensure their survival and recovery.

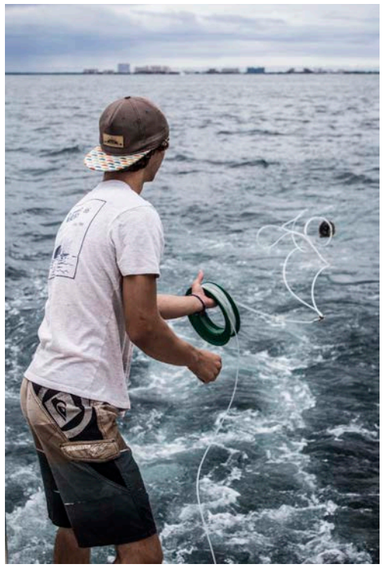
Supporting Management of "Highly Migratory Sharks"

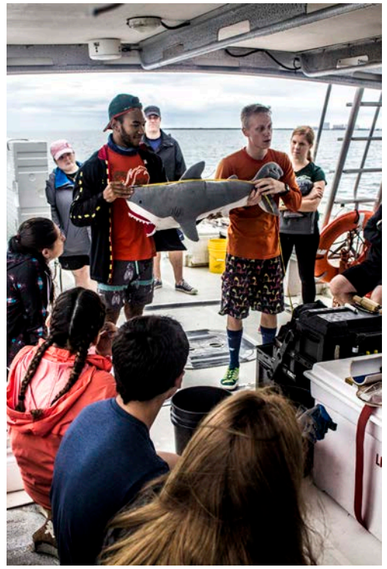
Our Satellite tracking data was used by the National Marine Fisheries Service to designate essential fish habitat (EFH) for Atlantic highly migratory species. A number of scientific papers published by SRC were referenced in the decision by NOAA, National Marine Fisheries Service (NMFS) into the report 'Essential Fish Habitat 5-year Review for Atlantic Highly Migratory Species.' - released June 2015. In addition to identifying and describing EFH for managed fish species, a review of information available on EFH must be completed at least once very 5 years. This review takes into account published scientific literature, unpublished scientific reports, information solicited from interested parties, and previously unavailable or inaccessible data. The data collected from our field research helped identify information gaps and research needs and was used to update current EFH ranges, including the investigation into the survival of great hammerhead sharks. Using SRC'S research, NOAA NMFS found that these sharks are inherently vulnerable to capture stress and mortality resulting from fisheries interactions.

Photo Story by Chris Brown

This photostory highlights a day of tagging sharks as seen through pictures. It begins by prepping our gear, setting lines, and educating our guests on what to do once we catch a shark, to the actual workup, data collection, and careful release of tagged sharks.



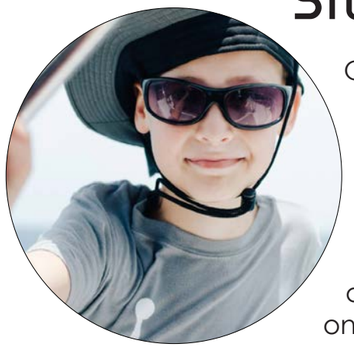




EDUCATION

SRC staff and interns work closely with local educators to give high school students a chance to experience scientific research in marine biology. These experiences both promote environmental stewardship and foster scientific career pathways. Additionally, face-to-face teaching builds relationships between high school and college students.

Student Field Trips



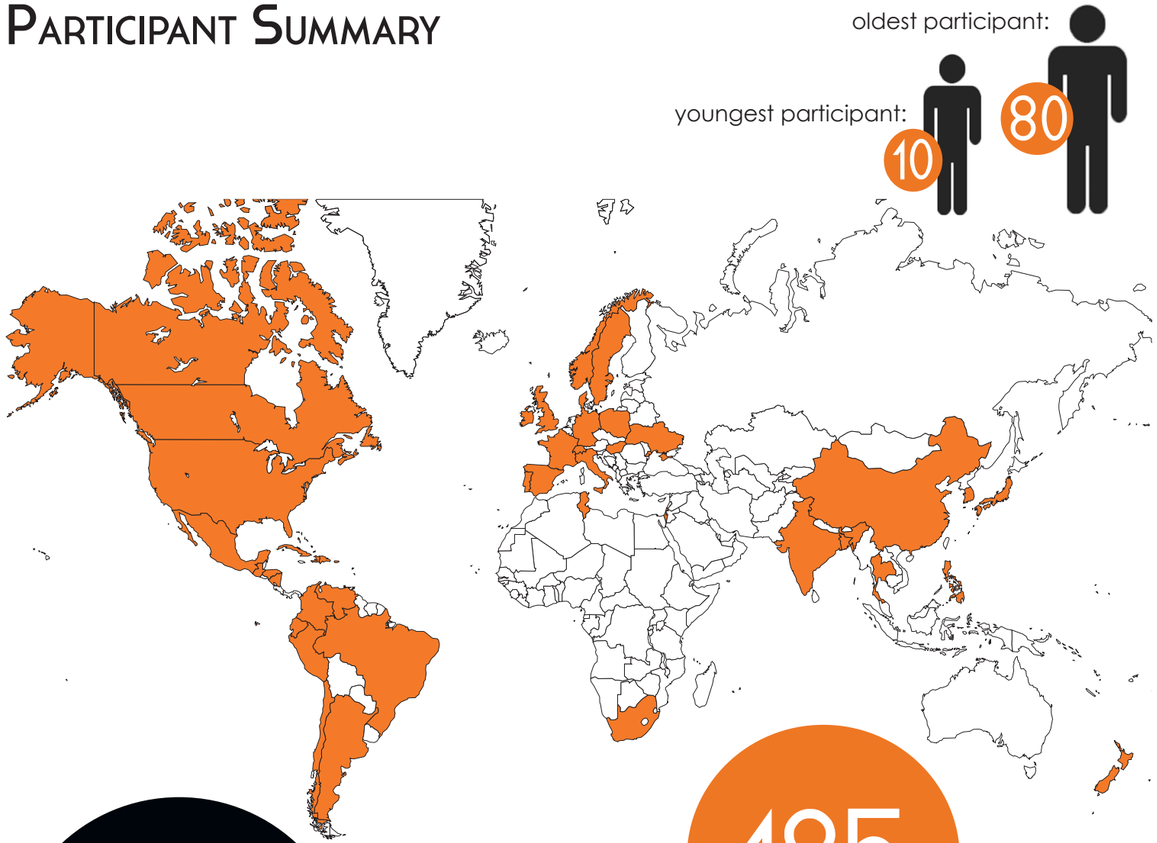
One of the core components of the SRC Program is providing experiential learning opportunities to young adults. SRC offers empowering and inspiring educational experiences to groups of high school students throughout the year. Classes take an active role in research projects, learn the scientific method, and assist in protecting some of the world's most threatened animals. Within the 2015 season, the team was able to embark on **61** research trips bringing over **1,380** people on the water to participate in hands-on science.

Public Presentations

SRC scientists and educators gave over **20** public presentations in 2015 to **800+** audience members ranging from elementary school children to leading marine scientists and communicators.

OUTREACH

Participant Summary



1381 individuals participated in SRC shark trips during the 2015 season

195 new participants

51 countries represented

41 states represented

Community Outreach

By: Rachel Skubel, SRC Intern

Community outreach is a core component of SRC's work. In the United States, there is a lack of students entering STEM (science, technology, engineering and math) fields, particularly for minorities and women. Reaching youth across socioeconomic statuses is a priority for SRC - it allows us to share our exciting research, what it's like to be a scientist, and share paths to education and careers in STEM. In 2015, our graduate students visited and video-chatted with classrooms all across Florida, teaching students of all ages about shark biology and threats facing sharks worldwide, the research projects our lab conducts to understand sharks in South Florida, and how the students can engage in marine conservation in their day-to-day lives.

We have also been a presence at conservation-oriented events around Miami - such as the Tortuga Music Festival in Ft. Lauderdale, the Underwater Festival at the Patricia and Phillip Frost Museum of Science, and Taste of the Sea in South Beach even as far as the Jacksonville Zoo for the North Florida Shark Festival. At these events we are able to engage with all ages about our program's research and outreach, and create education opportunities with individuals we would not have otherwise reached.

The outreach highlight of my year was the **Women in Science day** in November, held at RSMAS. Seventh and eighth grade girls from the Miami-Dade area came to our campus on Virginia Key, where they took part in hands-on activities across a huge variety of disciplines in ocean science. Many of SRC's talented female graduate students and researchers came together to share our personal journeys within shark science, and taught the girls about shark biology and conservation. It's not a surprise that girls of this age can sometimes be discouraged from pursuing a career in STEM because of a lack of female role models. Myself and the other female researchers hope that by reaching these talented, potential future scientists and engineers, we can show them science is accessible, exciting, and full of strong, innovative women!

Q: Do your tags cause fin damage?

A: All tags are not permanent. They fall off over time and the application point heals back quickly. Some of our satellite tags are temporarily attached to the shark's dorsal fin. However, sharks have minimal nerves within their fins. We've also recaptured satellite tagged sharks after months at liberty, and their fins appeared in good condition. The potential effects on the sharks are minimal considering the research and education it provides, which will help protect these threatened species.

SPECIAL GUESTS

Dominic Monaghan

In late February, the SRC crew was lucky enough to be joined by Dominic Monaghan, host of Wild Things, a U.S. TV show that travels the world looking for the largest, weirdest, and most intense creatures alive! With a special on South Florida, Dom and his crew headed out on the boat from Key Biscayne for two days in search of sharks. The first day was quite successful with a total of 9 nurse sharks wrangled to the side of the boat, sampled and released! We even had a giant bull shark take our bait, but sadly the shark bent our hook before we could get it to the boat. On the second day, we managed to catch 2 huge bull sharks. Besides the normal work-up procedure that all of our animals experience, these two sharks received a special tag each, one acoustic and one satellite. The acoustic tag placed in the 219 cm female bull shark will allow researchers in our lab to see how she is utilizing urban environments through an array of receivers that we have anchored along the coast of Biscayne Bay. On a larger scale, the even bigger 290 cm female bull shark with the satellite tag will allow us to pinpoint her location each time she comes to the surface. With this technology, we can take a look into the secret life of this species and start to better understand where they are spending time. Overall, we had an amazing time with Dom and the rest of the SRC crew. Dom's enthusiasm for sharks and all animals was contagious and we cannot thank him enough for joining us for two days of shark tagging!

We also had the honor of being filmed for feature shows documenting our research for National Geographic and Discovery Channel that will air in 2016.

Notable Organizations that joined SRC's trips in 2015:

NOAA National Oceanic and Atmospheric Administration U.S. Department of Commerce

IDEXX Laboratories

Liberty Mutual

The International SeaKeepers Society www.seakeepers.org

Duke University

The Pew Charitable Trusts

SCUBA NATION Diving Centre

National Geographic

Cadillac Fairview

Beneath the Waves

AutoZone

SUPPORT

Contributors

Thanks to the ongoining support of our donors, and granting organizations, we have been able to conduct cutting edge research while simultaneously reaching thousands of students and individuals to educate and inform them on the oceans and shark conservation. All support for this work is greatly appreciated.

Significant contributions in 2015 were made by amazing **organizations, institutions** and **corporations** including: The Batchelor Foundation, Save Our Seas Foundation, Leonard & Jayne Abess, Heffner Fund, Alma Jennings Foundation, The International SeaKeepers Society, TD Bank, The Rock the Ocean Foundation, University of Miami Citizens Board, and all the generous individuals and groups who have adopted sharks and made donations

2015 Group Photos from Student & Citizen Science Field Trips

CREDITS

Adopt a Shark

Researching these apex predators is neither easy nor cheap. So to ensure SRC's satellite tracking study of sharks continues, the program accepts donations in the amount of $2,500, which covers the cost to purchase one **new satellite tag.** In return, donors are given the opportunity to name the adopted shark and **follow the shark's movements on our website** using an interactive Google Earth map. Classes and entire schools are also welcome to collectively adopt sharks. The University of Miami is a Florida not-for-profit corporation and all donations are tax deductible as appropriate by law.

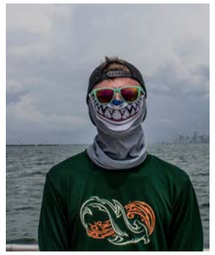
Our team of scientists and interns proudly wear the SRC field shirts during each trip!

Please visit our online store to grab your own SRC themed sharks gear at:

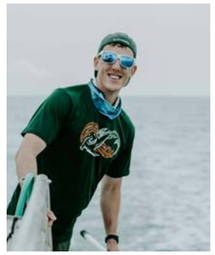
www.VarsityShop.com/Sharks

To pledge your support for SRC visit the "Donate" section of our website: ***SharkTagging.com.***

The 2015 SRC Annual Report has been a collaborative effort between these primary contributors:



Chris Brown



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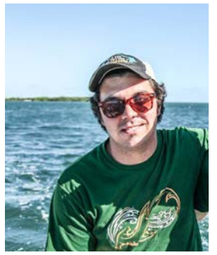
Hannah Calich

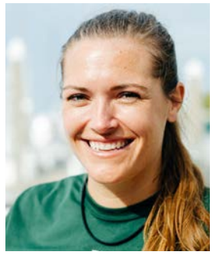


Austin Gallagher

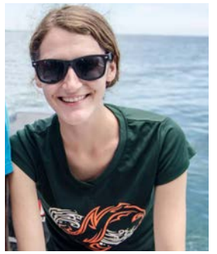
Neil Hammerschlag

Dalton Hesley

Sarah Hirth



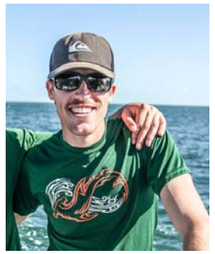
Lindsay Jennings



Catherine Macdonald

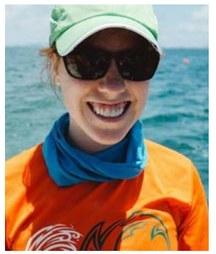
Emily Nelson

Christian Pankow

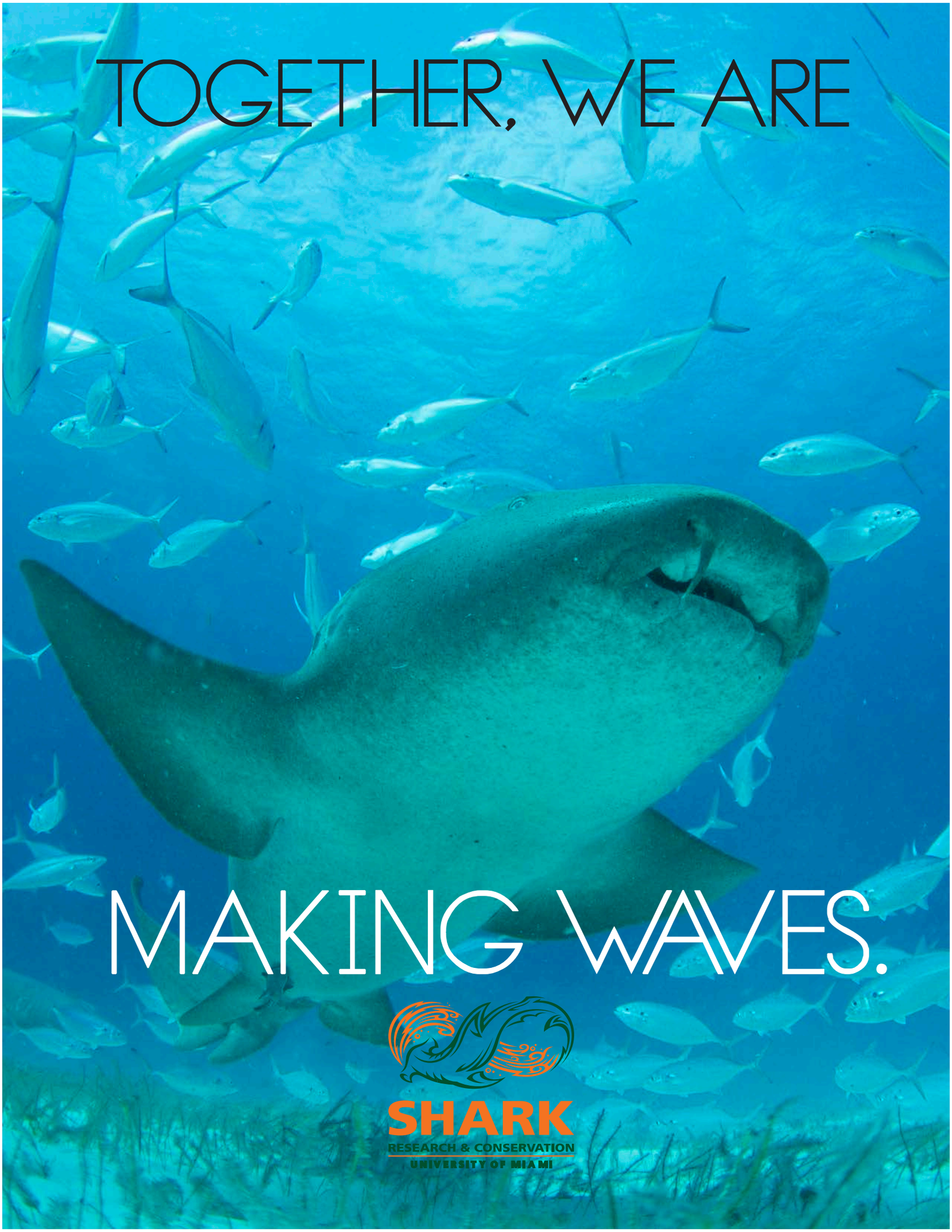


Robbie Roemer

David Shiffman



Rachel Skubel


TOGETHER, WE ARE
MAKING WAVES.
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