



2017 ANNUAL REPORT



SHARK
RESEARCH & CONSERVATION

UNIVERSITY
OF MIAMI



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

UNIVERSITY OF MIAMI

ROSENSTIEL
SCHOOL of MARINE &
ATMOSPHERIC SCIENCE



UNIVERSITY OF MIAMI

ABESS CENTER
for ECOSYSTEM
SCIENCE & POLICY



Letter from the Director

Dear SRC Friends, Colleagues, and Supporters,

This last year was perhaps our most productive to date. We conducted over 99 days of shark surveys at sites across Miami and Palm Beach. Breaking last years record, we sampled and tagged 466 sharks of 11 different species! Also breaking an SRC record, we published 17 scientific papers in peer-reviewed journals on a variety of important topics. Our research was well covered in local, national, and international media. Our students presented at numerous scientific conferences, including the American Elasmobranch Society annual meeting. This year also saw our team travel to the Galapagos to conduct research while filming for a documentary that will be featured on Discovery's 2018 Shark Week. In terms of public outreach, this past year we brought 1,253 Citizen Scientists, mostly school children, out on research vessels to participate in our science and learn about local conservation issues. We were also fortunate enough to once again participate in many community functions and festivals. For the first time ever, we conducted a *Summer Research Program*, where 20 college students from across the US spent several weeks with us in the field and laboratory conducting research. This year also saw two of our Master's students defend their thesis. So all in all, a very busy year. These achievements could not have occurred without the dedication, passion and support of our students, interns, staff, collaborators, partners, institutions and generous donors.

We thank you!

Neil Hammerschlag, Ph.D.
Director, Shark Research
and Conservation Program



SRC's Mission

What sets us apart?

SRC at the University of Miami conducts cutting-edge research while fostering scientific literacy and environmental ethic in youth through unique public education and outreach



SRC brings out thousands of people, mostly school children, on our research vessels to gain hands-on experience in marine biology

SRC is comprised of UM faculty, students, and volunteers. SRC could not achieve this mission without its hardworking team, dedicated to the research and conservation of sharks



Graduating from SRC



Leila AtallahBenson

Leila's research focused on serum protein analysis of nurse sharks in South Florida. She found baseline reference ranges for protein electrophoresis fractions in this population. Leila also attempted to isolate proteins as potential biomarkers for immunological health. Sharks' immune systems are very strong, and an important area of research.



Drawing blood from a nurse shark



Cameron Perry

Cameron's research aimed to further understand the age and growth of whale sharks. Using non-invasive methods, Cameron would calculate the growth of whale sharks in the Maldives from measurements of free-swimming sharks, using a technique called laser photogrammetry. He found that male whale sharks mature around 25 years, and can live up to 135 years!



Photograph by Daniel Bruhlmann



Where Will You Find SRC?

Outreach

We interacted with over **2,500** people at **18** public events including some of the following:

- Sharkfest at the Sandoway Discovery Center
- MacArthur Beach State Park Naturescaping
- Deering Estate Seafood Festival
- Rock the Ocean Tortuga Music Festival
- Miami Science Barge Science Saturday
- Miami Sportfish Tournament
- Shark Week at the South Florida Science Center
- Hollywood Academy of Arts and Sciences STEM Career Day
- Miami-Dade Public Library
- Miami Seaquarium Sea Talk
- Science Cafe
- Riviera Day School Career Day
- RSMAS Woman in Science Day
- And many more!



Left: SRC at the West Palm Beach Naturescaping



Right: SRC at Tortuga music festival



Left: Reef Resilience at Miami Seaquarium



Right: Sharkfest at Sandoway Discovery Center

Public Social Events



SRC at Show No Shark Fear in the New Year at the Butcher Shop



SRC at Lets 'Taco Bout Sharks at American Social



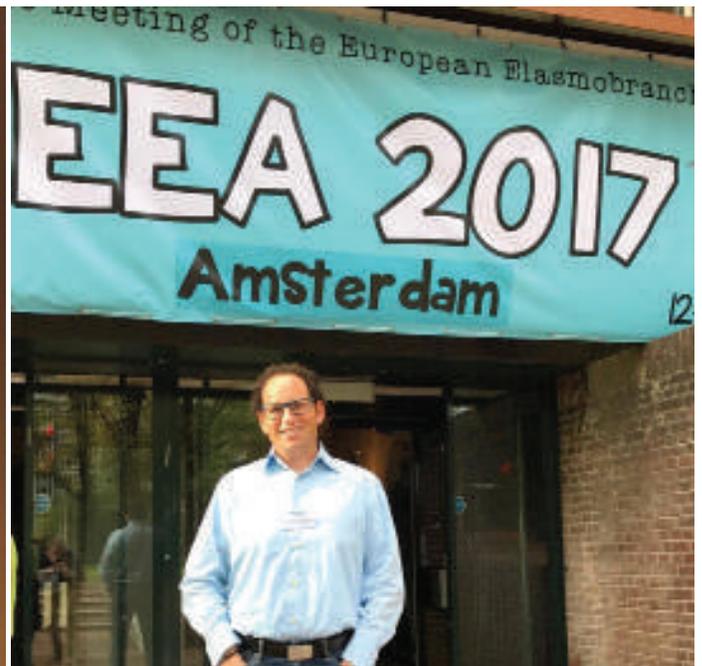
SRC at Tap Takeover at UM Rosenstiel School's Wetlab

Conferences

SRC presented at two international conferences this year:



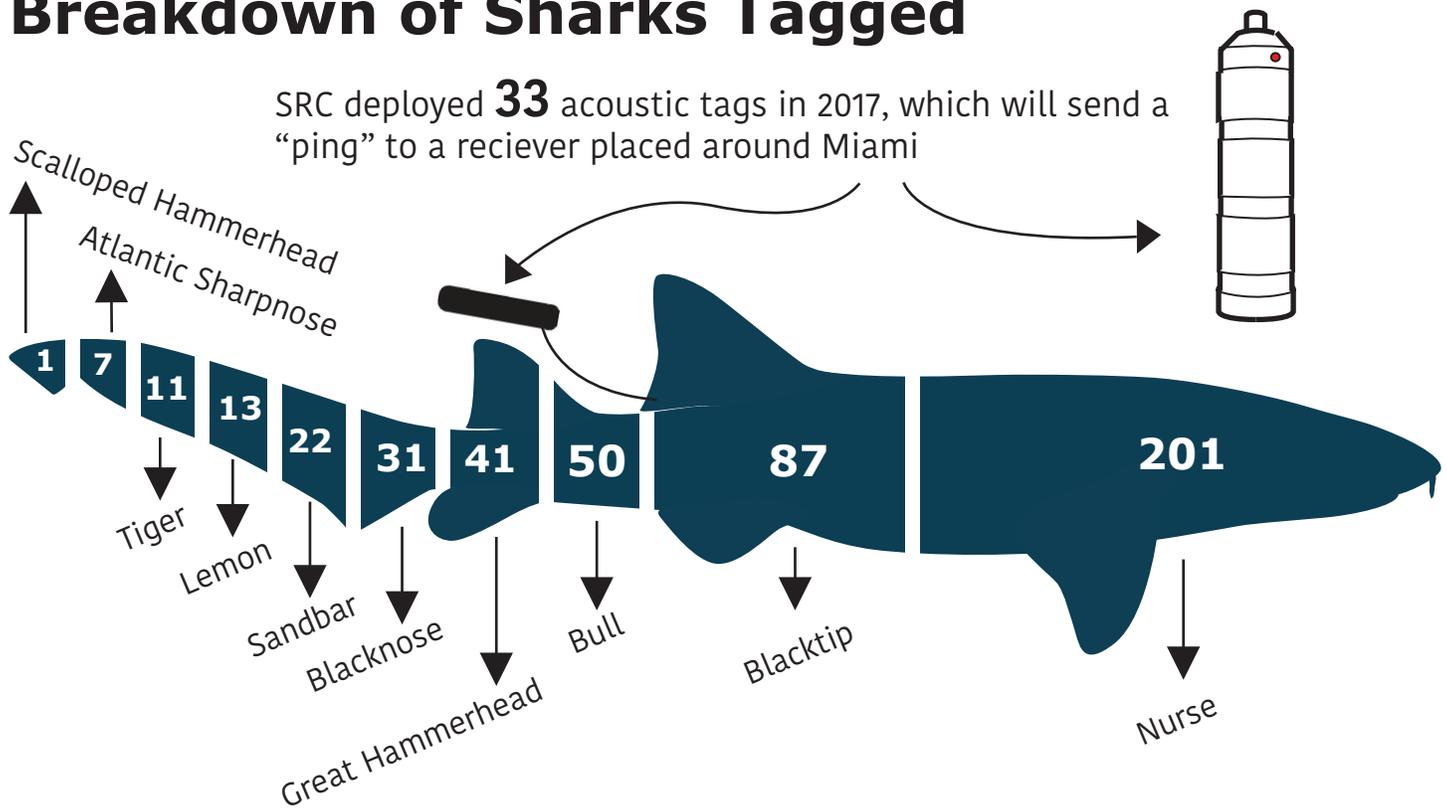
Students Rachel Skubel and Cameron Perry presented at the American Elasmobranch Society in Austin, Texas.



Dr. Neil Hammerschlag presented at the European Elasmobranch Society in Amsterdam, Netherlands.

By the Numbers

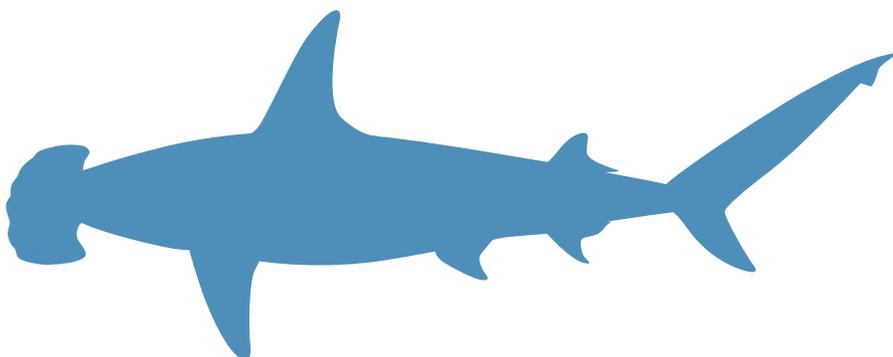
Breakdown of Sharks Tagged



Grand Total: **466** sharks caught, tagged, and released

The largest shark tagged:

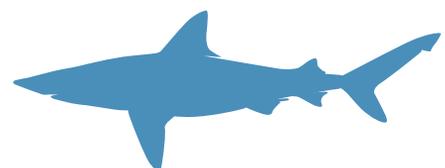
Great Hammerhead



400 cm (13 ft)
About the size of a small car!

The smallest shark tagged:

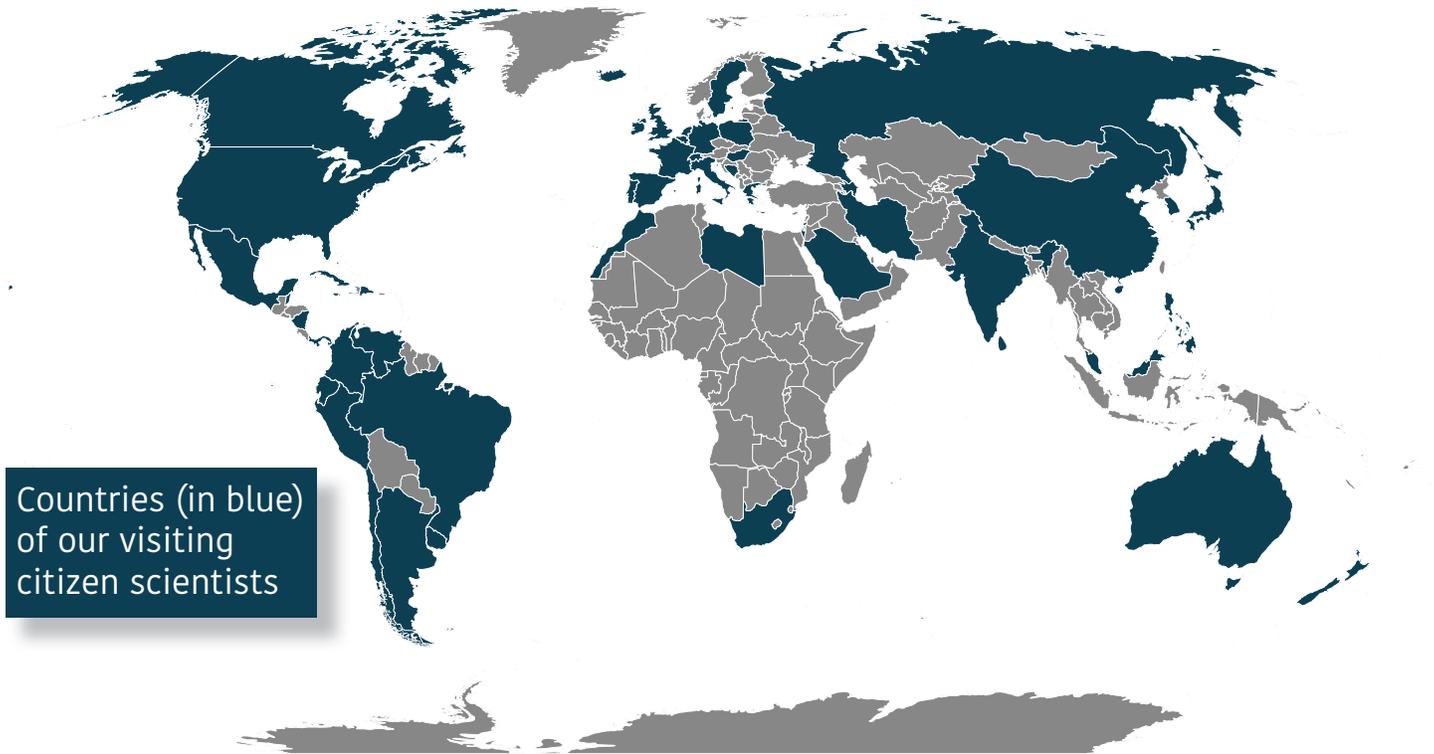
Atlantic Sharpnose



50 cm (1.6 ft)
About the width of
an armchair!

Citizen Scientists

Breakdown of participants that joined our research team in the field:



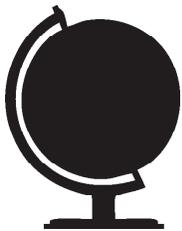
Countries (in blue) of our visiting citizen scientists



1,172
Participants

Oldest Participant:

74



53
Countries

Youngest Participant:

10



42
States

Scientific Publications

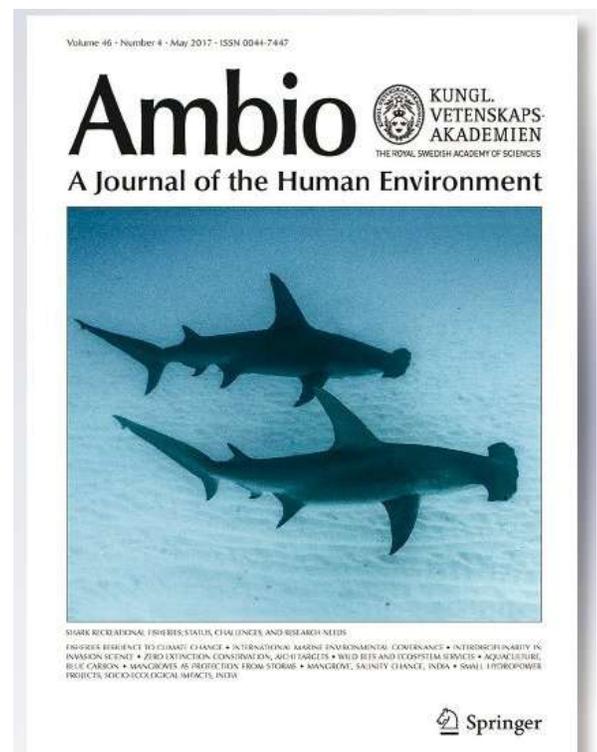
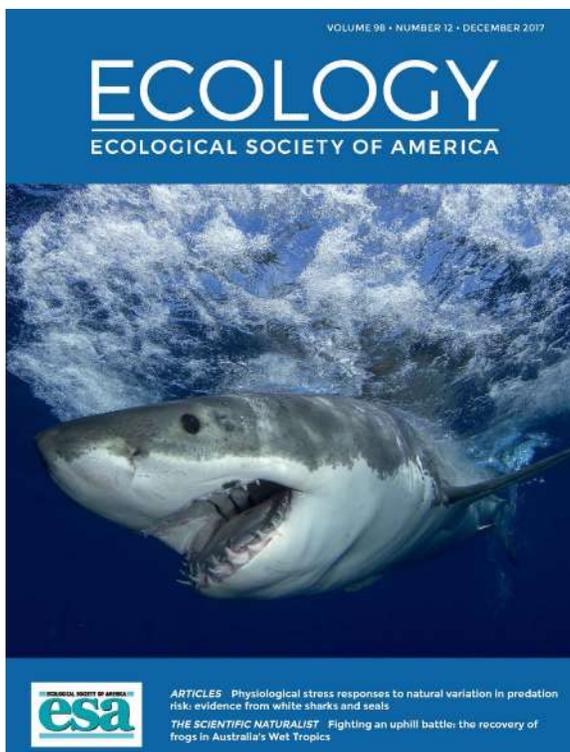
Hammerschlag N, Mejer M, Seakamela S M, Kirkman S, Fallows C, Creel S. (2017). **Physiological stress responses to natural variation in predation risk: evidence from white sharks and seals.** Ecology, 98: 3199–3210.

Jerome JM, Gallagher AJ, Cooke SJ, Hammerschlag N. (2017). **Integrating reflexes with physiological measures to evaluate coastal shark stress response to capture.** ICES Journal of Marine Science; fsx191, <https://doi.org/10.1093/icesjms/fsx191>

Macdonald C, Gallagher AJ, Barnett A, Brunnschweiler J, Shiffman DS, Hammerschlag N. (2017). **Conservation potential of apex predator tourism.** Biological Conservation; 215: 132-141.

Klimley AP, Flagg M, Hammerschlag N, Hearn A. (2017). **The value of using measurement of geomagnetic field in addition to irradiance and sea surface temperature to estimate geolocations of tagged aquatic animals.** Animal Biotelemetry; 2;5(1):19.

Two SRC research papers were featured on journal covers, viewed below:



Glynn PW, Coffman B, Fuller MPC, Moorhead SG, Williams MK, Primov KD, Fortson TN, Barrales RN, Glynn PJ. (2017). **Benthic ctenophores (Platyctenida: Coeloplanidae) in south Florida: environmental conditions, habitats, abundances, and behaviors.** *Invertebrate Biology* x(x): 1-15. <https://doi.org/10.1111/ivb.12189>

Acuña-Marrero D, Smith ANH, Hammerschlag N, Hearn A, Anderson MJ, Calich H, et al. (2017). **Residency and movement patterns of an apex predatory shark (*Galeocerdo cuvier*) at the Galapagos Marine Reserve.** *PLoS ONE* 12(8): e0183669. <https://doi.org/10.1371/journal.pone.0183669>

Irschick DJ, Fu A, Lauder G, Wilga C, Kuo C-Y, Hammerschlag N. (2017). **A comparative morphological analysis of body and fin shape for eight shark species.** *Biological Journal of the Linnean Society*; blx088, <https://doi.org/10.1093/biolinnean/blx088>.

Residency and movement patterns of an apex predatory shark (*Galeocerdo cuvier*) at the Galapagos Marine Reserve.

Based on electronic tracking of tiger sharks, this study found that tiger sharks show a pattern of movement that was concentrated near areas with abundant prey. For example, larger tiger sharks moved towards green sea turtle nests in the Galapagos Marine Reserve.

This year, SRC published a record **17** peer-reviewed papers. A few highlights are listed.



Shiffman DS, Macdonald C, Ganz HY, Hammerschlag N. (2017). **Fishing practices and representations of shark conservation issues among users of a land-based shark angling online forum.** Fisheries Research; 196: 13-26.

Kough AS, Cronin H, Skubel R, Belak CA, Stoner AW. (2017) **Efficacy of an established marine protected area at sustaining a queen conch *Lobatus gigas* population during three decades of monitoring.** Mar Ecol Prog Ser 573:177-189. <https://doi.org/10.3354/meps12163>

Hammerschlag N, Gutowsky LFG, Gallagher AJ, Matich P, Cooke SJ. (2017). **Diel habitat use patterns of a marine apex predator (tiger shark, *Galeocerdo cuvier*) at a high use area exposed to dive tourism.** Journal of Experimental Marine Biology and Ecology, 495: 24-34.

Hammerschlag N, Gallagher AJ. (2017). **Extinction Risk and Conservation of the Earth's National Animal Symbols.** BioScience; 67(8): 744-749.

Gallagher AJ, Shiffman DS, Byrnes EE, Hammerschlag-Peyer CM, Hammerschlag N. (2017). **Patterns of resource use and isotopic niche overlap among three species of sharks occurring within a protected subtropical estuary.** Aquatic Ecology; 1-14.

Diel habitat use patterns of a marine apex predator (tiger shark, *Galeocerdo cuvier*) at a high use area exposed to dive tourism



Tiger sharks that frequent the famous Tiger Beach in the Bahamas are commonly exposed to dive tourism. In this newly published study, we found that daily habitat use of tiger sharks was not significantly impacted by dive tourism activities

Cooke SJ, Gallagher AJ, Sopinka NM, Nguyen VM, Skubel RA, Hammerschlag N, Boon S, Young N, and Danylchuk AJ (2017). **Considerations for effective science communication.** FACETS 2: 233-248. doi: [https://dx.doi.org/10.1139/facets-2016-0055]10.1139/facets-2016-0055

Gallagher AJ, Skubel RA, Pethybridge HR, Hammerschlag N. (2017). **Energy metabolism in mobile, wild-sampled sharks inferred by plasma lipids.** Conserv Physiol; 5 (1): cox002. doi: 10.1093/conphys/cox002

Matulik AG, Kerstetter DW, Hammerschlag N, Divoll T, Hammerschmidt CR, Evers DC. (2017). **Bioaccumulation and biomagnification of mercury and methylmercury in four sympatric coastal sharks in a protected subtropical lagoon.** Marine Pollution Bulletin; 116(1): 357-364.

Hammerschlag N, Meyer C, Grace M, Kessel S, Sutton T, Harvey E, Paris C, Kerstetter D, Cooke SJ. (2017). **Shining a Light on Fish at Night: an overview of patterns and processes operating in fish and fisheries at night and in the perpetual darkness of deep and polar seas.** Bulletin of Marine Science; 93(2): 253-284.

Hammerschlag N, Skubel R, Calich H, Nelson ER, Shiffman DS, Wester J, Macdonald C, Cain S, Jennings L, Enchaeta A, Gallagher AJ. (2017). **Nocturnal and crepuscular behavior in elasmobranchs: a review of movement, habitat use, foraging, and reproduction in the dark.** Bulletin of Marine Science; 93(2): 355-374.

Nocturnal and crepuscular behavior in elasmobranchs: a review of movement, habitat use, foraging, and reproduction in the dark.

While it has been speculated that sharks are primarily active at night, this study shows that sharks don't actually show more activity during night, including reproductive behavior and habitat foraging. Instead, there seems to be a gap in what we know about shark behavior at night versus the daytime from current literature.



SRC in the Media

Shark Days of

Summer: SRC was joined by Discovery Family Channel to show kids all about sharks and SRC research through a day of tagging and field work.



Discovery Shark Week:

SRC director Dr. Neil Hammerschlag joined a team to test who would be a faster swimmer: a shark or Michael Phelps.



315 Million

People reached around the world in online news and broadcast media.

Summer Programs

This year, SRC conducted several programs over the summer of intensive field and lab research, while hosting participants from around the world.



- 17 Participants
- 10 days in the field
- 10 days in the lab
- Triglyceride assays on 85 sharks
- 20 fish traps deployed
- 115 fish studied in the field from fish traps
- 85 hours of BRUV (Baited remote underwater video) footage analysed

Sponsors

2017 Primary Contributors:

- The Batchelor Foundation, Inc.
 - Canon Solutions America
 - Disney Conservation Fund
 - Heffner Fund
 - Reynolds Family
 - E.I. Medical
 - William J. Gallway, III, Esquire
- The Alma Jennings Foundation
 - Give Back Brands Foundation
 - Rock the Ocean Foundation
 - Interphase Materials
 - **All generous individuals and groups who have adopted a shark**

Supported and Printed by:

elite flyers
GRAPHICS & PRINTING



The Team



Thank you to the SRC team for their dedication and outstanding hard work in making this one of the best years yet.

SRC Awardees

Andriana Fragola - Fabien Cousteau Ocean Learning Center Grant

Jeffrey Palumbo - M.P.S. Award for Ocean Excellence and Stewardship

Photographs by:

- Alex Anstett
- Gammon Koval
- Josh Liberman
- Nicole Lin
- Chris Schenker
- Matthew Barnanke
- Neil Hammerschlag





Thank you to all of our 2017 tagging participants!





Annual Report made in collaborative effort by Alex Anstett, Gammon Koval, Abigail Tinari, Neil Hammerschlag, Diana Udel, and Stephen Cain



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