

Newsletter



Shark Research Institute Global Headquarters
 PO Box 40 • Princeton, NJ 08542 • USA • Phone: 609-921-3522 • www.sharks.org

The Whale Sharks of the Gulf of California

By Dr. Jennifer Schmidt, Ph.D., SRI Director of Science & Research



The dramatic landscape of the Gulf of California as seen from an ultralight plane.

The reduced visibility of the plankton-rich water kept her hidden until she was only 50 feet away, but slowly the distinctive pattern of white spots and stripes came into view. I've studied whale sharks for 15 years, and swimming beside them is a familiar but always exhilarating experience. This time was different, the shape was larger than I had ever seen. Rather than swimming full speed to keep up I unintentionally slowed down, and simply watched as the largest whale shark I had ever seen glided past me. She obscured everything else from view, her distended belly making her appear even larger than the 36 feet she eventually measured. (Photos cannot do justice to these magnificent animals, but read down to find out how you can meet them in person!)

I was in the Gulf of California, searching for the female whale sharks that frequent these waters. She was a 12-meter female, her bulging belly suggesting she was pregnant with many pups, yet she was not even the largest of the females seen in certain locations. The GoC is one of only a few regions on earth where adult females can be found...and amazingly, all of the females that come to these waters appear to be pregnant! The expedition that SRI Deputy Director Dave Grant and I joined this past May was led by our friend and collaborator Deni Ramirez of Tiburon Ballena Mexico, and supported by Panterra Eco-Expeditions. The comfortable *MV Adventure* was our home for a week spent plying the gorgeous blue waters and dramatic landscapes of the Gulf of California, searching for the big girls, and enjoying many other exciting wildlife encounters along the way.

Researchers believe that the adult female whale sharks found in the Gulf of California, as well as those in the Galapagos and a few other oceanic locations, are pregnant, because of their enlarged abdomens. We are scientists, however, and pregnancy must be proven, not just presumed. None of the females found in these regions have been observed giving birth, for example, which would be evidence of pregnancy. No female whale shark anywhere on earth has been observed giving birth - whale shark reproduction remains one of the greatest mysteries of these animals.

Scientists do not know where or when whale sharks mate (mating has never been seen), the length of whale shark gestation (it may be as long as two years), or where the females give birth to their pups. Several years ago I was able to study the only known litter of whale shark pups, which were collected in

Taiwan in 1995. At this time, fishing for whale sharks was legal in Taiwan, and an 11.6-meter female was caught and brought to the harbor. As the shark was being processed, the fishermen noticed something different about this animal, and researchers from the local university were brought in to examine the shark. Amazingly, they found that she carried more than 300 developing

IN THIS ISSUE:

<i>Our Supporters</i>	3	<i>Sea of Cortez Expedition</i> ..	11
<i>Shark Rescue</i>	3	<i>CMS</i>	12
<i>Winter Auctions & Events</i> ..	4	<i>Mako Shark Overfishing</i> ..	13
<i>Bookshelf</i>	5	<i>Federal Shark Fin Trade Bill</i> ..	13
<i>Marine Archeology Midwest</i> ...	6	<i>Journal articles</i>	14
<i>Summer Fun</i>	8	<i>Shark Shop</i>	16
<i>Djibouti Expedition</i>	10		

embryos, and the embryos were of widely varying developmental stage. Tools were not available to examine the pups genetically, and for a time the story ended there.

Forward 15 years, and I had the privilege to collaborate with one of the original researchers studying the Taiwan female, Dr. Shoou-Jeng Joung of the National Taiwan Ocean University. Dr. Joung kept some of the embryos in his laboratory, and I was able to examine these and take tissue samples for DNA analysis. In effect, we performed a “paternity test” on the embryos, which told us that the many pups were all fathered by a single male. What we know generally about shark reproduction led us to propose that female whale sharks are able to store sperm after a single mating, and fertilize their own eggs as they are produced. The varying ages found of the Taiwan pups support this hypothesis, and suggest an “assembly line” of whale shark development. Female whale sharks may be nearly constantly pregnant!

Despite the many years since the Taiwan embryos were collected, no other pregnant females have been examined. There are so many questions yet to answer about whale shark embryonic development. Is 300 pups a typical number for a female to carry, or might they have even more? The Taiwan female was 11.6 meters, among the smaller pregnant females seen, which can range up to 14 meters. How are the pups organized within the female? Are younger pups deeper within the body, while the older pups are nearer the cloaca from which they will be born? Performing an ultrasound examination “in-water”, to visualize developing whale shark pups, would be a huge step forward in answering many of these questions. Funds for the custom ultrasound machine and underwater housing for this experiment were raised locally, by Baja residents eager to learn more about their whale sharks.



Long-beaked common dolphins racing our panga back to the ship; one of five species of marine mammals seen on the expedition

meeting friends old and new, taking in the incredible scenery, feasting on Chef Omar’s wonderful food and falling asleep to the gentle rocking of calm water. When not scouting for female whale sharks, we spent our time on photo-identification of the juvenile males that also use these waters, taking measurements and tissue samples for our joint genetics project, snorkeling with sea lions, enjoying close encounters with humpback and sei whales, and jumping into the pangas to follow schools of mobula rays and pods of dolphins. I got my lifer blue-footed booby on the cliffs of Los Islotes! Key technical issues with the ultrasound were identified, and this challenging experiment will be attempted again on upcoming expeditions.

If all of this sounds like a fantastic trip (it was!), we have spaces available for SRI members to join the next Shark Research Institute/Tiburón Ballena Mexico expedition in May 2018! Contact me at jennifer@sharks.org for more information, or view the expedition details on our website <https://www.sharks.org/expeditions/women-researchers-in-science-journey-to-the-sea-of-cortez-expedition>.

After boarding the ship in La Paz we were off, searching for pregnant female whale sharks. Unlike the juvenile males that tend to aggregate in large numbers, adult females are solitary. Even with the support of an ultralight plane (which took trip participants up for gorgeous views of the Gulf) we located only one female during the week. While Deni and her assistant, Maritza, made a valiant effort to perform the ultrasound, issues with the buoyancy of the device complicated their efforts.

Despite a shortage of females and some technical difficulties, we had a fantastic week

Thank You to Our Supporters!

We are very grateful for the continued support of:

- Adventure Aquarium
- AfriOceans
- Apex Shark Expeditions
- Atlantis Resorts
- Atlantis Oil & Gas
- Michael Aw
- Howard Azer & Associates
- Barcelo
- The Bennett Family Foundation
- Clive Branson
- William Bunting, Jr.
- Nick Calyonis
- Angus Campbell
- Caradonna Dive Adventures
- Andy Casagrande
- Grant Christensen
- Cathy Church
- Ralph Collier
- Dr. Leonard J. V. Compagno
- Kathy Coyle
- Sandra Critelli
- Christy Crossley
- Seth Davidson
- Deep Blue Resort
- Dive Experience, St. Croix
- Dive Pro International
- Dive Voyager
- Diving with Sharks, SA
- David Doubilet
- Dr. Sylvia Earle
- Epic Diving
- Ben Fackler
- Chris & Monique Fallows
- Robert & Deena Ferrara
- Rochelle Fernands
- Dean Fessler
- Lynn Funkhauser
- Susan Galli
- Mike Gerken
- Steven Gold
- Max & Victoria Goodwin
- Dave Grant
- Craig & Susan Grube
- Patrick Haemmig
- Kenneth Hanczrik
- Joshua Hankes
- The Horgan Family
- Dr. Gordon Hubbell
- Kids Sea Camp
- Jupp Baron Kerkerinck Zur Borg
- Jeff Kurr
- Sharon Kwok
- Pascal LeCocq
- The Levine Family
- Tom Lipkin
- Lotus 333 Productions
- Jenkinson's Aquarium
- Caroline & Guy Merison
- Allison Martinez
- Brandon McCloskey
- Nancy McGee
- Beth & Tom McKenna
- The McNally Family
- Microwave Telemetry
- Rich Miller
- Paul Mischenko
- Carolyn Monier
- Amos Nachoum
- Ocean Geographic Society
- Ocean Ramsey
- Occidental Cozumel
- Olympus Dive Center
- Margo Peyton
- PADI Foundation
- Rodney Palmer
- The Philanthropic Group
- Pindito
- Pro Dive International
- Michelle Pugh
- Shiloh Pyne
- Bahman Rabaai
- Reef & Rainforest Adventure Travel
- Ripley's Aquarium of Canada
- Mike Rissi
- Lesley Rochat
- The Roddenberry Foundation
- Michael Rodricks
- The Rohauer Collection Foundation
- Rolex Watch USA
- Roots
- F. Peter Rose
- Wiltraud Salm
- Dr. Jennifer V. Schmidt
- San Diego Shark Diving
- The Shark Finatics
- Marty Snyderman
- Greg Sparks
- Liz Sparks
- Paul Spielvogel
- Richard Stewart III
- Donald Nichols Storch
- Heather Stork
- Rick Stratton
- Studio 1143
- Oakleigh B. Thorne
- Barbara & Donald Tober Foundation
- Jim Toomey
- Undersea Images
- Joyce Van den berg
- My Virtual Solution
- Phil Watson
- Winston Park K-8 Center
- The Whole Earth Center

"Hi Fives" to SRI member Jessica Siebert and Jenkinson's Aquarium!



On Sunday September 23rd, when this juvenile sandbar shark washed ashore on the NJ shore, Jessica quickly enlisted help from Jenkinson's Aquarium. The dazed young shark was taken offshore and the boat stood by until the shark recovered. Sandbar sharks don't present a significant danger to humans. Their diet consists of small fish, crustaceans and mollusks. Although they have large mouths, their teeth are small and they rarely bite anything larger than the prey on which they feed. Along the east coast, pregnant sandbar sharks give birth in nurseries such as bays and estuaries. The young sharks remain in shallow waters close to shore until cooler temperatures set in. Then they move to deeper waters.

Upcoming Events

SRI's Two Winter Auctions - December 1st to 15th

Go to our website - www.sharks.org - to enter and bid!

Or enter the auctions directly at:

Web: www.charitybuzz.com/sharkresearchinstitute

Web: <https://www.biddingforgood.com/Shark>

or Mobile: <https://bforg.com/Shark>

Bid on diving Indonesia's remote Islands aboard the luxury sea-going safari *MV Pindito*. Or how about some spectacular and exotic diving with Atlantis Philippines? Would you rather relax at Occidental Cozumel and dive with Pro Dive International? Or the Bahamas with Epic Diving, or dive with sandtigers in North Carolina? Art lovers could even own a mural by the famed Cathy Church or an Award-winning image by Amos Nachoum. There are also items for Trekkies, books, clothing, surprising stocking stuffers from shark adoptions to admission tickets for kids' attractions, and so much more!

Loads of great gifts for the Holidays and the whole year long!



December 1/2/3, 2017: The Great Shark Swim. Madswimmer is set to attempt the fastest 100 km swim Port Shepstone KZN to Mbotyi on the Wild Coast of South Africa's Eastern Cape. Funds raised will support Madswimmer children's local charities in South Africa and raise awareness to the plight of sharks. SRI-South Africa asks local members to come in numbers in support, and consider donating to the charity that will be supported in this massive swim. It's all for a worthwhile cause and sharks need your voice on their behalf as a matter of urgency. See you there.....

<http://madswimmer.com/swim/great-shark-swim/>

January 25-27, 2018: Surf Expo - The world's largest and longest-running board sports & beach/resort lifestyle trade-only show with 2,500 booths, 9,500 store fronts & 28,600 attendees. Venue: Orange County Convention Center, North Halls A-B, 9899, International Drive, Orlando, Florida 32819 <https://www.surfexpo.com/>



January 27-28, 2018: Our World Underwater. Venue: Embassy Suites Dallas-Frisco Hotel, Convention Center, 7500 John Q. Hammons Drive, Frisco, Texas 75034. SRI's Dr. Jennifer Schmidt will present a seminar at the show. <http://ourworldunderwater.com/texas/>

March 23-25, 2018: Beneath the Sea America's largest consumer Scuba and Travel Show, Venue: Meadowlands Exposition Center, Secaucus, New Jersey. <http://www.beneaththesea.org/>



March 30-April 5, 2018: Celebrate the Sea Festival Manado with Sylvia Earle, David Doubilet, Jennifer Hayes, Michael Aw to celebrate the prohibition of single-use plastic and shark fins in North Sulawesi, Indonesia — and stay 5 days to enjoy Bunaken Marine Park. The festival features Keynote speakers, ocean film festival, photo exhibition and childrens' art competition. cts@OGSociety.org

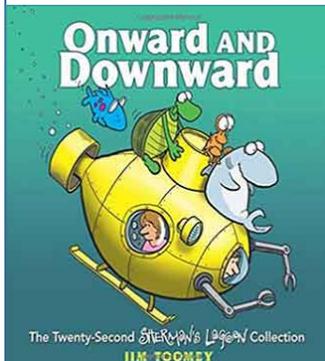
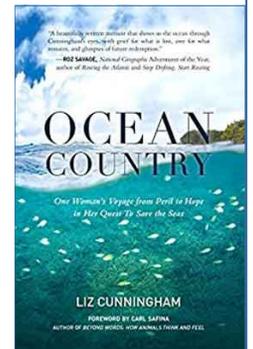
Bookshelf



Shark, by *Brian Skerry*. Order through AmazonSmile.com. Get closer to the beauty and power of sharks with award-winning National Geographic photographer Brian Skerry as he illustrates their remarkable evolutionary adaptations and their huge importance to marine ecosystems around the world. For decades, acclaimed underwater photographer Brian Skerry has braved ocean depths and the jaws of predatory giants to capture the most remarkable photographs of sharks around the world. In this collection of the best of those pictures, Skerry draws on his growing personal respect for these animals to share intimate stories of their impact. Focusing on four key species — white, whitetip, tiger, and mako sharks. With additional text by top National Geographic

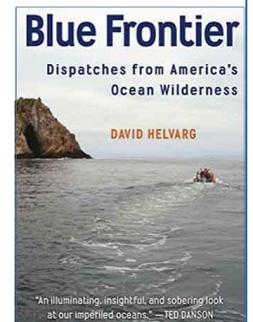
writers, Skerry's images and stories encourage a change in attitude toward these top predators, ultimately showing how they are the keys to the healthy balance of nature underwater.

Ocean Country by *Liz Cunningham*, \$16.00 Paperback, \$11.99 Kindle Edition. Order through AmazonSmile.com. The author has traveled the oceans and seen first hand the damage that has been done to marine life. The fate of our oceans depends on our choices and the fate of our species is inextricably tied to the health of our oceans. Yes, there are huge challenges, but we are rescuers and heroes at heart!



Onward and Downward: The Twenty-Second Sherman's Lagoon Collection by *Jim Toomey*. \$14.99 paperback. Order through AmazonSmile.com. Meet the new fish on the block in the latest collection of *Sherman's Lagoon*

Blue Frontier by *David Helvarg*. \$6.99 kindle. Order through AmazonSmile.com. All proceeds go to Blue Frontier's activist work. This book initially came out in hardcover in 2001, followed by two paperback editions and has now been updated and re-released as an ebook. Helvarg fuses his passion for the sea and his reportorial savvy into a panoramic chronicle of America's maritime history and the challenges that our coastal and marine environments face today While some consider it a text on the state of the ocean the Sacramento Bee's review says it "reads like a scientific detective novel."



Surf Creatures by *Shaun Tomson*. Available for the iPhone on the App Store. Beautifully illustrated catchy and crazy rhymes for kids about 26 friendly and fierce creatures that live under the surfboard of this world champion surfer. His two books: **Surfer's Code** and **Bustin' Down The Door - The Surf Revolution of '75** are highly recommended and available through

AmazonSmile.com. Listed as one of the 25 most influential surfers of the century and one of the 10 greatest surfers of all time, Tomson is a board member and ambassador for Surfrider Foundation, the world's largest environmental group dedicated to protecting the world's oceans, waves and beaches.

Marine Archaeology in the Midwest

Dave Grant – Deputy Director, Shark Research Institute

“Down beside where the waters flow. On the banks of the Ohio” - Traditional folk song

When asked about my deep interest in the sea, I sometimes jest that I was "homeschooled" 𐄂 which actually, is fairly close to the truth. Our family always owned boats and both of my grandmothers encouraged the study of natural history with books and outings, so I thrived on their interest and guidance.

When I was quite young, Grandmother Grant 𐄂 visiting from Columbus, Ohio – presented a handful of arrowheads to my older brother, and to me, a fossilized shark tooth as big as my hand. All I remember about the cache is that she said it was collected by our father from the family farm in Ohio, and until last summer I pictured him as a youth, carefully sifting creek sediments, searching for fossil shark teeth like we do here in New Jersey.

Courtesy of the National Endowment for the Humanities, I returned to Ohio this summer to study the mysterious Indian mounds of the ancient Hopewell Culture, and to my great surprise discovered that sharks' teeth 𐄂 fossilized or otherwise 𐄂 are not found naturally in Ohio. Shark remains have been recovered only from prehistoric burial and ceremonial knolls like the celebrated Great Serpent Mound and contoured landscapes that early archaeologists discovered are a result of Native Americans' occupation and alterations.

(Shark trivia: In case you are curious, the only shark ever known to be swimming anywhere near Ohio was a wayward bull shark captured in 1937 on the Mississippi River near St. Louis, by a pair of bewildered commercial fishermen – Herbert Cope and Dudge Collins; so it is unlikely the mound builders had any idea of what a shark was or looked like. However, one Ohio teacher did show me a curious artifact – a small piece of shale, scratched with an image she insists is the representation of a shark-like creature. To me, it looked like something, which if indeed represents a shark, would make Picasso proud!)



*Early surveyor's sketch and postcard
of the Great Serpent Mound. Adams County, Ohio*

Curiously, fossilized and extant shark teeth in the mounds originate from coastal areas like the Chesapeake Bay. Over a thousand years ago, they were transported hundreds of miles up river routes to Ohio by ancient inhabitants and traders 𐄂 who preceded by centuries 𐄂 the Indians that European settlers encountered as they drove West.

Sharks' teeth from the coast, as well as ritualistic artifacts from throughout much of North America (Michigan copper; Canadian silver; North Carolina mica; beautiful

obsidian wealth blades and grizzly bear teeth from Yellowstone; and conch shells, pearls and alligator teeth from the Gulf of Mexico) have been recovered from these enormous and enigmatic earthen structures found throughout the Mississippi river drainage area. Some of them were the largest prehistoric construction projects in the Western Hemisphere 𐄂 built by community labor and by the basketful of soil – and I suspect, by the daily labor of women and children. In fact, the Newark Earthworks State Memorial in Ohio preserves remnants of the largest system of connected geometric earthworks built anywhere in the world.

Few things in nature are as durable as sharks' teeth, and for a dozen millennia they have been utilized



The Hopewell Culture trade network

as ornaments, tools and weapons by prehistoric peoples in North America. They were trimmed, notched or drilled and modified into projectile points, knives, scraping tools, and religious accoutrements; or like my father's find, simply shared as curios. Regardless of their origin or ultimate use, Native Americans were quite selective in what was traded and adapted.

Geologists report that beachcombers searching for fossil teeth along the Chesapeake's Miocene age shoreline deposits can expect about half to be from gray sharks (*Carcharhinus spp.*), about 20% from tiger sharks (*Galeocerdo spp.*), 13% from the snaggletooth shark (*H. serra*), 5% from sand tiger sharks (*Carcharias spp.*), 4% from makos (*Isurus spp.*), and less than 1% from both the extinct giant white shark (*Carcharocles megalodon*) and the extant great white shark (*C. carcharias*).

Archaeologists have recovered six species of shark teeth from midden piles that were left by native groups around Chesapeake Bay, including:

- The great white shark, *Carcharodon carcharias*
- The "giant" white shark, *Carcharocles megalodon* (Extinct)
- A mako, *Isurus hastalis* (Extinct)
- The snaggletooth shark, *Hemipristis serra* (Extinct)
- A species of sand tiger shark, *Carcharias* (Extinct)
- A species of gray shark, *Carcharhinus egertoni* (Extinct)

In contrast, throughout the Ohio Valley region, only a few of these species were preferentially collected and disproportionately traded and utilized [≠] particularly the rarest types: Megalodons, white sharks and makos (*C. megalodon*, *C. carcharias*, and *Isurus*). The teeth of these three species [≠] comprising over 90% of such material recovered from the mounds [≠] are larger, lancet-shaped or serrated, and not surprisingly, better suited to be fashioned as tools, weapons and embellishments.

Conventional wisdom among researchers in the field places the peak of this vast North American trading network and mound-building culture between about 100 B.C. until A.D. 500, and scholars describe central Ohio as a trading and ceremonial mecca of sorts for inhabitants of an immense portion of the continent. After that period, construction and trade diminished, and as one writer describes it: The most remarkable prehistoric Indian civilization that ever existed north of Mexico vanished forever from the sites on which it had risen.

The mysteries surrounding the great Hopewell earthworks and culture may never be fully understood; but the small Megalodon mystery from the Miocene surrounding my father's discovery on the family farm seems to be solved.

* * * * *

NOTES: The Shark Research Institute is planning a collecting trip to the fossil-rich Calvert Cliffs area of Maryland next year; or you may search for fossil teeth with us next summer on one of our stream-walks in Monmouth County, NJ. If interested, contact expeditions@sharks.org

Special thanks to the National Endowment for the Humanities for funding the 2017 project: Following in Ancient Footsteps: The Hopewell in Ohio; and Dr. Betsy Hedler, Dr. Brad Lepper, and Dr. Linda Pansing of the Ohio History Connection www.ohiohistory.org for their insight, expertise and assistance.



Museum specimens of excavated sharks' teeth



Large fossil shark tooth modified with a Native American flint bow drill

Shark Research & Educating People about Sharks & Ocean Conservation!

It is who & what we are, it's our passion

JULY: Dave Grant, Marie & Melissa spent Shark Week at Jenkinson's Aquarium on the Jersey Shore. They educated visitors about sharks throughout the day, and Dave gave talks about sharks in the evenings.

Dean Fessler gave three presentations for children at Crayola Experience in Easton, PA. Between Dean's shows, Marie Levine & Melissa Rogers helped young artists draw and paint pictures of their favorite sharks. The events drew large crowds and were thoroughly enjoyed by all!



SRI Summer Research Expeditions

Afuera Expedition July 27th to 31st: Team I at the port in Cancun, Quintana Roo, Mexico, leaving for the last of three amazing days on the water. We had a great group of people, perfect weather, and most importantly....lots of whale sharks! Many thanks to Martha Luisa Zapata of Caribbean Connection and our fantastic captain and guide Joseph and Raoul. — Jen McCoy; Robin Ernst; Bob Perinetti; Nathan, Bradley & Tracy Ernst Fredericksen; Andrew Miller; Cynthia Braund;



Dr. Jennifer Schmidt and Jennifer Walker.



Afuera Expedition August 1st to 5th: Team II — Rosa Cardoso; Dr. Jennifer Schmidt; Will Schmidt; Jennifer Liebman Schmidt; Emma, Pete and Charlie Schmidt; Vincent Evans-Lucy and Ian Leighton — had to WORK for their sharks this week! Braving 5-foot swells was worth the effort, with 200 whale sharks seen. Over the last three days we had sharks vertical feeding, and were even pooped on by a whale shark!

Harbor Fairs & Waterfront

SUBMERGE!

NYC Marine Science Festival

Hundreds of children (and grown-ups) from the tri-state area visited the SRI booth at the SUBMERGE Marine Festival in New York on September 16th.



This is an annual event. Mark your calendars for 2018!

At left: Melanie challenges a skeptical spaniel to wear a 'dogfish' costume



SRI team photo-bombed by octo-girl

Young ExplorersPhotos by Martin Graus



Chain mail gloves & megamouth teeth



For over 110 years the Explorers Club has served as an international multidisciplinary professional society dedicated to the advancement of field research and the ideal that it is vital to preserve the instinct to explore. As new generations continually redefine exploration, the benefits of fostering the curiosity of young explorers are apparent. Time and again, Explorers Club members credited their ambitious expeditions with ideas conceived in their childhood. James Cameron in his movie *Deep Sea Challenge* tells how he was inspired as a child by the 1960 voyage to the bottom of the Mariana Trench, which led him to build cardboard submarines and imagine going to the places he is visiting today. Sylvia Earle describes the beach, at her childhood vacation home in New Jersey as "heaven" and in her movie *Mission Blue*, she talks about how those memories have fueled her connection to nature and her love of the ocean. The tradition lives on with the Young Explorers Program which brings together families of Explorer Club members. The purpose is to nurture their children's (aged 4-7) sense of curiosity and instinct of exploration via lectures, activities, and programs. On September 23rd, Dean Fessler, Education Director, ignited a love of sharks in the Young Explorers!



Hurricane & our Amazing Field Trips



SRI members maintain a stretch of beach on the Bolivar Peninsula of southeast Texas. Hurricane Harvey knocked down our sign and tossed a lot of debris on the beach, but the General Land Office soon had the sign upright again and clean-up continues.



In September, during one of SRI's monthly fossil shark tooth hunts, these two girls hit a mother-lode of fossil sharks' teeth in Big Brook !

In our last newsletter we polled our members, asking what you'd like from SRI. The overwhelming response was the opportunity to join our field research expeditions. Here are descriptions of two upcoming expeditions open to SRI members.

DJIBOUTI WHALE SHARK RESEARCH EXPEDITION

JANUARY 5th - 13th, 2018



Spaces are available for a few intrepid travelers to join this expedition led by the Shark Research Institute and Sharkwatch Arabia, supporting the ongoing research of the Marine Conservation Society Seychelles. The week-long expedition will study the whale sharks that aggregate in the Gulf of Tadjoura.

Djibouti boasts the smallest and youngest whale shark population found anywhere; most animals are between 3 and 5 metres in length, with 2 meter animals occasionally seen. Participants will serve as research assistants, documenting whale sharks by photo identification, collecting and analyzing plankton samples and observing night feeding behavior of the whale sharks. Our research goal is to better understand these young animals, where they come from and why small whale sharks congregate in the area.

Our home for this liveaboard expedition is the *M/V Deli*, a Turkish gulet that accommodates 12 people in shared rooms with individual baths. Whale shark interactions are snorkel only, but excellent diving is available from the boat at sites such as Ras Korali, Moucha Island and La Faille, a convergence of tectonic plates.

Expedition cost is US\$2000 per person (estimated) double occupancy, and includes shared accommodation on the boat, double occupancy hotel for the night of January 12th at the Sheraton Djibouti, all meals on the boat, transfers to and from the port, and a tax-deductible donation to the Shark Research Institute. Not included are airfare to Djibouti, Djibouti visa, soda and beer on the boat and meals off the boat. Post-expedition activities are available to explore the geologic formations and salt lakes of the East African rift.



The research site is remote, and accommodations are basic, but the experience is unmatched. Share this unique expedition to a stark and beautiful corner of the world with a great group of people and animals you simply cannot see elsewhere.

For additional details or to reserve your space, contact expedition leader Dr. Jennifer Schmidt at jennifer@sharks.org

SHARKS AND RAYS OF THE GULF OF CALIFORNIA

Women Researchers in Science - Journey to the Sea of Cortez

MAY 4 - 13, 2018 — 10-day expedition

Expedition cost is US\$2995 and includes airport transfers, accommodations on the boat, meals, drinks, equipment, ships library). Space is limited to 12 spots.

Not included: Air transportation to La Paz, travel insurance (required), crew gratuity, evening meal in La Paz and cost for ultralight flights.

Expedition Highlights:

- Expedition leaders: Dr. Jennifer Schmidt, Dr. Deni Ramirez Macias and Lela Sankeralli.
- 10 days/9 nights onboard the ship *MV Adventure*
- Whale sharks, carcharhiniform sharks and mobula ray research
- Whale shark research will include: documenting whale sharks by photo ID, recording size, injuries and scars, collecting and analyzing plankton samples and tissue sampling.
- Shark and mobula research will include; capture, species measurements, tagging and release.
- The expedition offers a rare opportunity to work alongside scientists studying sharks, rays and whale sharks, all in one program.
- Guests will be assisting in the various stages of the research.



- Additional activities: hiking, snorkeling (with sea lions), kayaking & visit to remote communities.

For more information or to reserve your space, contact co-expedition leader:
Dr. Jennifer Schmidt at Jennifer@sharks.org



A Life-Line for More Sharks from CMS



Sharks were the biggest winners at the Convention on the Conservation of Migratory Species of Wild Animals. Whale sharks made it onto Appendix I, indicating they are not only vulnerable but their populations are falling worldwide. The 126 member countries of CMS have agreed to prohibit their killing or capture and safeguard their habitats, particularly along their migratory routes off East African coasts of Tanzania, and Mozambique as well as Madagascar and Peru.

Blue sharks, the most highly fished sharks in the world, made it on to Appendix II, which obliges countries within a species' migratory range to collaborate on measures to protect them. For sharks, this implies regulating fishing or banning finning. Blue sharks are highly migratory and are at risk in fisheries throughout their range.

Dusky shark and angel shark were also listed on Appendix II, along with the common guitarfish and the white-spotted wedgefish.

Brazil, Benin, Ecuador and Sri Lanka also joined the Shark Memorandum of Understanding, an agreement already signed by 41 countries to coordinate protection for sharks. It is hoped CMS members will provide additional protect for sharks, as well as other migratory species, when they migrate through their waters and land. Unlike CITES, CMS decisions are not enforceable.



Whale Shark (*Rhincodon typus*)



Blue Shark (*Prionace glauca*)



Dusky Shark (*Carcharhinus obscurus*)



Angel Shark (*Squatina squatina*)



White-Spotted Wedgefish (*Rhynchobatis australiae*)



Common guitarfish (*Rhinobatos rhinobatos*)

To Them It Was "Sport" —For Mako Sharks, It Was Tragic



On July 21st, the *Jenny Lee* a six-man charter boat caught this 926-lb, 12 foot mako shark 100 miles from the Manasquan Inlet and a few miles east of the Hudson Canyon. The shark surpassed the state record 856-pound mako shark that was set in 1994. The death of a large breeding female is unacceptable.

The study by the Guy Harvey Institute of shortfin mako sharks described below indicates mortality rates of mako sharks have been dramatically underestimated.

Mako shark fishing mortality rate is far higher than previously thought.

Satellite Telemetry Reveals Overfishing of Mako Sharks

Michael E. Byrne, Enric Cortés, Jeremy J. Vaudo, Guy C. McN. Harvey, Mark Sampson, Bradley M. Wetherbee, Mahmood Shivji (2017) **Satellite telemetry reveals higher fishing mortality rates than previously estimated, suggesting overfishing of an apex marine predator**, *Proceedings of the Royal Society B (Biology)*, Published August 2, 2017.

<http://rspb.royalsocietypublishing.org/content/284/1860/20170658> DOI: 10.1098/rspb.2017.0658

Multiple insults to shark populations are interacting to cause steep declines in the numbers of many species. It is difficult to estimate the population size of pelagic sharks, and more difficult to tease out the individual contributions of each process to shark declines. Fisheries certainly play a role, with many sharks either intentionally targeted or taken as bycatch. One way scientists estimate shark population numbers is from data supplied by these fisheries, which self-report the sharks they catch. There is an inherent bias in having the industry that is most impacted by shark fishing regulations providing the information that determines those regulations.

One shark species of conservation concern is the shortfin mako (*Isurus oxyrinchus*). Shortfin makos are listed as Vulnerable on the Red List of the IUCN, indicating a species whose numbers should be managed to prevent a critical decline. A recent study was designed to tag shortfin makos to determine their migratory patterns. Forty sharks were satellite tagged off the coast of Mexico and the USA, and were followed for one year. The authors realized that their tracking also allowed them to see interactions of the tagged sharks with fisheries, and to determine the number of sharks caught, independent of fishery self-reporting. When a tagged shark was captured, for example, the satellite track would show that tag traveling straight towards the port.

Of the 40 study animals, 12 were taken by fisheries in the 1-year lifetime of the tags, and 10 of the 12 sharks were caught on long-lines. When the researchers extended their study to overall fisheries self-reporting data, they found that the catch of shortfin mako sharks had been under-reported by as much as 10-fold. The authors determined that the true number of mako sharks being caught exceeds sustainable levels -- mako sharks need additional international protections against overfishing.

SRI Strongly Disagrees with this Article

D.S. Shiffman and R.E. Heuter (2017) **A United States shark fin ban would undermine sustainable shark fisheries**. *Marine Policy*, Vol 85, pp138-140.

<https://doi.org/10.1016/j.marpol.2017.08.02>

SRI disagrees with the authors and instead fully supports the Shark Fin Trade Elimination Act of 2017 (S.793). The bill passed through the Senate Committee and was sent to the House. One hundred and twenty six US House members have voiced their support for this bipartisan bill.

We ask all our members to contact your Senators and Congressmen and urge them to support this bill. The bill must be passed by both the House and Senate in identical form ... and then be signed by the President to become law. *"Conservationists are optimists (and*



Djibouti - A Whale Shark Kindergarten

Leblond STR, Rowat DRL. **Studying spatial distribution of the whale shark in the Gulf of Tadjora, Djibouti.** QScience Proceedings (The 4th International Whale Shark Conference) 2016:iwsc4.29 <http://dx.doi.org/10.5339/qproc.2016.iwsc4>.

In 2006, it was realized that a substantial aggregation of very small juvenile whale sharks occurs along the coastlines of Acacia and Arta with sharks forming more significant/dense clusters in the afternoons. The hot spots occur over areas of healthy coral reef with many branching and tabulate acropora corals while the cold spots form near the 45 degree rubble slopes with little or no coral cover. The westerly winds in the gulf drive plankton into the coves of Acacia and Arta which accumulate around coral reefs intensifying whale shark feeding behavior in these areas.



Sharks Follow the Food

Ryan JP, Green JR, Espinoza E, Hearn AR (2017) **Association of whale sharks (*Rhincodon typus*) with thermo-biological frontal systems of the eastern tropical Pacific.** PLoS ONE12(8): e0182599. <https://doi.org/10.1371/journal.pone.0182599>

Satellite tracking of 27 whale sharks in the eastern tropical Pacific, examined in relation to environmental data, is yielding additional insights into the demographics and ecology of this species within some of the most productive habitats in the global ocean.

The study showed preferential occupancy of thermo-biological frontal systems. In the Galapagos 80% of shark positions in northern equatorial upwelling habitat and 100% of positions in eastern boundary upwelling habitat were located within the upwelling front. Off Peru sharks tracked upwelling frontal positions within ~100–350 km from the coast. Off Central America, the largest tagged shark (12.8 m TL) occupied an oceanic front along the periphery of the Panama wind jet. Seasonal movement from waning equatorial upwelling to productive eastern boundary habitat is consistent with underlying trophic dynamics. Persistent shallow residence in thermo-biological frontal zones suggests the role of physical-biological interactions that concentrate food resources.

As is true of other shark species threatened by exploitation, protection of this species requires understanding of its ecology. This study integrates advances in technology—tags with accurate long-duration tracking and environmental sensing capabilities, and multidisciplinary environmental sensing from satellite borne sensors and autonomous platforms and advances knowledge needed to secure their protection.

It is now Mobula, not Manta

William T. White, Shannon Corrigan, Lei Yang, Aaron C. Henderson, Adam L. Bazinet, David L. Swofford and Gavin J.P. Naylor (2017) **Phylogeny of the manta and devilrays (Chondrichthyes: Mobulidae), with an updated taxonomic arrangement for the family.** Zoological Journal of the Linnean Society, XX 1-28.

DNA sequence data from mitochondrial genomes and c. 1000 nuclear exons were analysed for a complete taxon sampling of manta and devilrays (Mobulidae) to estimate a current molecular phylogeny for the family. Members of the genus *Manta* were found to consistently nest within the *Mobula* species and consequently the genus *Manta* is placed into the synonymy of *Mobula*. Results of this study are used to revise the taxonomy for the family Mobulidae. A single genus is now recognized (where there were previously two) and eight nominal species (where there were previously 11).

Shark Attacks on Réunion Island in the Indian Ocean

Ballas R, Saetta G, Peuchot C, Elkienbaum P, Poinot E. (2017) **Clinical features of 27 shark attack cases on La Réunion Island.** *J. Trauma Acute Care Surg.* 2017 May; 82(5):952-955. doi: [10.1097/TA.0000000000001399](https://doi.org/10.1097/TA.0000000000001399).

Between January 2000 and September 2016, there were 27 documented shark attacks on La Réunion Island. The insular nature of La Réunion has allowed the authors to perform an extensive survey of these attacks. The objective was to describe the clinical features of these shark attacks, as only case reports were published up to now.

This was a retrospective observational study of the 27 cases of nonprovoked shark attacks that occurred between January 2000 and September 2016. Post-humate predation, provoked attacks, and isolated attack on devices were excluded. All bone and vascular injuries were documented in the 21 remaining cases. Prehospital tourniquet use was specifically recorded.

Among the 21 victims, eight died (38%) despite rapid use of resuscitation techniques in five cases when it was feasible; these techniques were not needed in the survivors. Thirteen patients were immediately treated in the operating room. Amputation or disarticulation occurred 13 times in 10 victims, five of whom died. Twelve injuries to major vascular structures were found in 11 victims, six of which died. A prehospital tourniquet was applied in four of the five surviving victims who had injuries to major vascular structures (including one victim with major humeral and femoral artery damage) and in one victim who died (the very proximal wound was not controlled).

The study found that quickly applying a tourniquet to the injured limb(s) contributes to the victim's survival. Disarticulation is a particular feature of shark attacks. The number and severity of shark attacks at La Réunion Island are worse than in the rest of the world.

Hybridization of Greenland Sharks & Pacific Sleeper Sharks

Ryan P. Walter, Denis Roy, Nigel E. Hussey, Björn Stellbrink, Kit M. Kovacs, Christian Lydersen, Bailey C. McMeans, Jörundur Svavarsson, Steven T. Kessel, Sebastián Biton Porsmoguer, Sharon Wildes, Cindy A. Tribuzio, Steven E. Campana, Stephen D. Peterson, R. Dean Grubbs, Daniel D. Heath, Kevin J. Hedges and Aaron T. Fisk (September 2017) Origins of the Greenland shark (*Somniosus microcephalus*): Impacts of ice-olation and introgression, *Ecology and Evolution*, DOI: [10.1002/ece3.3325](https://doi.org/10.1002/ece3.3325)

To test the hypothesis of early Quaternary emergence of the Greenland shark from ancestral sleeper sharks in the Canadian Arctic-Subarctic region, genetic data from 227 sleeper sharks was used. Results show Greenland sharks and Pacific sleeper sharks are genetically distinguished but hybridization with Pacific sleeper sharks has been going on at the edge of their distribution in warmer waters and suggests that a continuing warming Arctic may further reduce the genetic integrity of both species.

Sharks & Stingrays & Alligators



Alligator eating a nurse shark. U.S. Fish and Wildlife Service Photo by J.N. "Ding" Darling

James C. Nifong and Russell H. Lowers. (Sep. 2017). **Reciprocal Intraguild Predation between *Alligator mississippiensis* (American Alligator) and Elasmobranchii in the Southeastern United States.** *Southeastern Naturalist.* Vol 16, 3, pp.383-396. DOI.org/[10.1656/058.016](https://doi.org/10.1656/058.016)

It is known that orcas feed on sharks, but since the 19th century there have been reports of American alligators foraging in estuarine and nearshore marine ecosystems occasionally prey on sharks. In a recent study by Kansas State University scientists, the stomach contents of 500 American alligators were examined. The researchers found the alligators, had fed upon four different species of sharks, including the nurse shark, and even stingrays.

Shark Shop



SRI shirts from Bonfire.com in a variety of colors and styles from v-neck unisex, premium unisex, crewneck sweatshirt, long-sleeve tee and warm pullover hoodies that keep the cold of winter at bay.

Order them through our website or our Facebook page. Shipping dates vary depending on when your order is placed but usually arrive within three weeks.

Adopt a Whale Shark

For a unique gift, consider an adoption of a whale shark tracked by SRI researchers. Although our researchers have tagged +600 whale sharks, only sharks that have been seen recently are available for adoption. Guardians are notified as sharks are re-sighted. Annual Adoptions are \$50. Lifetime Adoptions do not need renewal and are \$150. All adoptions include an adoption certificate, fact sheet on whale sharks and a photo of the shark.

<https://www.sharks.org/support/whale-shark-adoption>



Flags to Alert Beachgoers



Recognizing that municipalities which permit shark fishing and surf fishing off swimming and surfing beaches attract marine predators, possibly putting people at needless risk, Jerry Taggart has designed a series of flags to alert marine resources users when such hazards are present. For more information or to order flags contact

tagchum@gmail.com

Let us join you!

Would you like a guest speaker at your company, Rotary Club meeting, organization or school, or want to learn about careers in marine science?

Or do you want one of our staff to lead a field trip for your school, teach a class how to use a seine net, organize a clean up of a beach?

Contact SRI at info@sharks.org

