

INSIDE: BONEFISH CONNECTIONS • CUBA COLLABORATION • BAHAMAS OUTREACH

A publication of
**Bonefish
& Tarpon
TRUST**



BONEFISH & TARPON

Journal

STEWARDSHIP THROUGH SCIENCE • FALL 2017



Tarpon Glory Days
BTT Retrospective



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Bonefish & Tarpon Journal

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2017 Events

Houston, TX - September 14, 2017
6th International Science Symposium,
Weston, FL - November 10-11, 2017

BTT's Mission

To conserve and restore bonefish, tarpon and permit fisheries and habitats through research, stewardship, education and advocacy.



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**Bonefish
& Tarpon
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BONEFISH & TARPON

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STEWARDSHIP THROUGH SCIENCE • SPRING 2017

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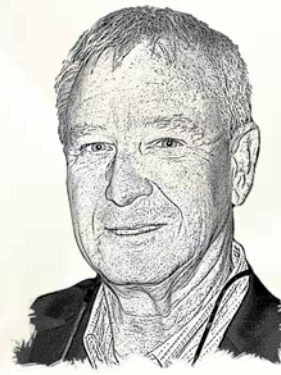
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Setting the Hook



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From the Chairman and the President

It's all about the water. The compound that's essential to all life is also the wet cornerstone of healthy habitats and a healthy flats fishery. Thanks to the steadfast support of our members, corporate sponsors, and partner organizations, we've made great strides over recent months in addressing water quality issues in South Florida. In a major victory for Bonefish & Tarpon Trust and our allies in the Now or Neverglades coalition, Florida Governor Rick Scott signed Senate Bill 10 into law in May, initiating a major step forward in the decades-long efforts to restore the Everglades. The measure expedites the planning and implementation of a new reservoir in the Everglades Agricultural Area, which will significantly reduce discharges down the Caloosahatchee and St. Lucie rivers, and provide the means of storing, cleaning and sending much needed water south to the Everglades and Florida Bay.

Our early advocacy on behalf of Everglades restoration and subsequent support of SB 10 was based on science—both a trademark of our organizational approach and the hallmark of our success over the years. Then as now, our scientists agree with The National Academy of Science that the hyper-saline conditions caused by the lack of freshwater flowing south from the Lake Okeechobee are doing irreparable harm to our fisheries in the Everglades and Florida Bay, while the excess freshwater being discharged to the east and west coasts of the state has damaged snook, redfish, and tarpon habitat and caused toxic algal blooms, threatening public health.


While we have a lot to celebrate in the passage of SB 10, there is still a long way to go. We cannot afford to be complacent. It's critical that our Now or Everglades coalition of anglers, guides and other stakeholders remains vigilant to ensure the proper and timely implementation of restoration plans outlined in this landmark legislation. Through our Fix Our Water initiative, we will continue to share updates about our ongoing efforts to advocate for Everglades restoration efforts, which are essential to the health of our fisheries and coastal communities.

Water and habitat are also at the core of many of other research projects underway now at BTT, including several highlighted in this issue of the BTT Journal. Through our Tarpon Acoustic Tagging Program, we're investigating tarpon movement and habitat uses across a large region, stretching from Texas to Florida, and north to the Carolinas. The project is also looking at how water quality and changes in freshwater flows affect tarpon movement. The answers will help us advocate for improvements in the management of the

tarpon fishery at local and regional scales. At the same time, new and fascinating findings on larval bonefish recruitment reveal a high level of connectivity between bonefish populations throughout Florida and the Caribbean Basin, highlighting the importance of managing our shared fisheries and protecting bonefish habitat on an international scale. The knowledge gained through The Tarpon Acoustic Tagging Program and the groundbreaking research on larval bonefish recruitment will serve to further our mission and strengthen our advocacy.

In addition to research and advocacy, education continues to be an important part of our mission, including educating the next generation of anglers and conservationists about the importance of healthy habitats to the flats fishery. In the Bahamas, we are developing a flats ecosystem curriculum in collaboration with Bahamas National Trust (BNT), which will begin later this year. The first conservation-based curriculum of its kind, which is featured in these pages, will be taught in the nation's schools and through BNT's Discovery Club program for high school students with a strong interest in marine sciences.

These and so many more science and conservation projects are made possible through your membership, generous support and advocacy. We hope you will enjoy learning more about them, and we invite you to come and celebrate them with other anglers, guides, scientists, conservationists, agency partners, industry leaders and friends at BTT's 6th International Science Symposium in Weston, Florida November 10-11, 2017. This global event, which is held only once every three years, is the world's premiere gathering focusing on science-based approaches to flats conservation. The 2017 edition includes presentations from the world's leading scientists on flats species; panel discussions by angling legends and guides; clinics on casting, fly-tying, photography; a film and art festival; and many other offerings.

The Symposium will also kick off BTT's 20th Anniversary celebration—an appropriate venue not only to showcase the scope of our science and conservation work but also how it has grown in 20 years. It is fitting then that we end this column at the beginning, if you will, by remembering the vision of BTT's founding members and the leadership they have shown in advancing our mission, all of which is chronicled in a superb piece by Monte Burke. 



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Bonefish & Tarpon Trust's 6th International Science Symposium

Bonefish & Tarpon Trust's 6th International Science Symposium will take place November 10-11, 2017, at the Bonaventure Resort and Spa, in Weston, Florida. Open to anglers, scientists, conservationists, and fishing industry representatives, this global gathering also marks the start of BTT's 20th Anniversary year.

"This year's Symposium promises to be the largest and most significant in our history," says BTT President Jim McDuffie. "We have assembled the foremost scientists in the 'flats' world to present their latest research findings on bonefish, tarpon and permit, and explain how newly acquired knowledge will benefit the conservation of our fisheries."

In addition to presentations by leading scientists, the Symposium will spotlight angling legends who will share their time-tested techniques for catching the iconic gamefish of the flats. Andy Mill, Chico Fernandez, C.A. Richardson, Steve Huff, and Rick Ruoff will be among the greats on hand to offer instruction on an indoor casting lane.

New to this year's symposium is a Flats Expo, showcasing the products and services of industry leaders, from the latest technical developments in the sport to world-renowned fishing lodges and outfitters. Fly tying and photography clinics, and an Art & Film Festival also highlight the schedule, along with a banquet honoring

conservation heroes. Dinner guests will have the chance to compete for auction items, including bucket-list destination trips, fine art, top-of-the-line spin and fly-fishing gear, and a special BTT 20th Anniversary trip to fish and conduct research with BTT-affiliated scientists.

As always, the role of science-based approaches to conservation will be the centerpiece of the event, featuring presentations and Q&A about the latest research on bonefish, tarpon, permit—the species, their habitats, and the larger fisheries they support—as well as panel discussions on how science is guiding BTT initiatives in Florida and across the Caribbean Basin. Of special note will be several recently concluded studies that aim to benefit the Florida fishery.

"One of the best things about the Symposium is that everyone is able to see how the research informs conservation, and how this helps to protect and restore flats fisheries," says Dr. Aaron Adams, BTT Director of Science and Conservation. "It really is unique to be able to participate in this process and see it at work, from start to finish."


To register for the 6th International Science Symposium, please visit: BTT.org/Symposium 



Photo: Justin Lewis

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Tippets

Short Takes on Important Topics



CHANGING OF THE GUARD IN THE FLORIDA KEYS

BTT is pleased to welcome Dr. Ross Boucek as the new Florida Keys Initiative Manager. Ross comes to BTT from the Florida Fish and Wildlife Research Institute, where he was part of a team overseeing the acoustic tracking network in the Gulf of Mexico. He earned his Ph.D. from Florida International University, where he studied the movement patterns of snook and other fishes in response to changes in freshwater flows. A native of Naples and avid angler, Ross grew up fishing for snook and tarpon out of Chokoloskee. He succeeds Brooke Black, who ably represented BTT in the Keys for 5 years, and will be based in Marathon. 🐟

OVER 500 BONEFISH AND 50 PERMIT TAGGED IN MEXICO IN TWO DAYS

Belizean Addiel Perez, a doctoral candidate at El Colegio de la Frontera Sur (ECOSUR) in Chetumal, Mexico, continues to work with fishing guides, fishing lodges, commercial fishermen and others to use tag-recapture to better understand the movements of bonefish along the Mexico-Belize border. On a recent tagging trip to the region, Addiel and his team tagged over 500 bonefish and 50 permit in two days! So far, Addiel has personally tagged more than 7,500 bonefish from Caye Caulker, Belize, to Xcalak, Mexico. The results of this project, supported by Bonefish & Tarpon Trust, will shed light on the connectivity of bonefish populations along the Belize-Mexico border and help improve the management and conservation of this culturally and economically important species. 🐟

TARPON ACOUSTIC TAGGING UPDATE

BTT's Tarpon Acoustic Tagging Project, generously sponsored by Maverick Boat Group, is well underway. The purpose of this study is to obtain scientific data necessary for tarpon conservation that will be used exclusively to protect tarpon and enhance their habitat through improvements in fishery management. Thus far, 47 tarpon ranging from 5-170 pounds have been acoustically tagged, from Georgetown, SC to Key West to Charlotte Harbor, FL. While some tarpon remain in a small home area, one 55-pound fish that was tagged near Charlotte Harbor was later detected as far away as Cape Canaveral. The team is seeking to tag 50 tarpon per year for a total of 200 over the life of the project. 🐟



Photo: Danny Flynn

BONEFISH PRE-SPAWNING AGGREGATION SITE IN ANDROS RECENTLY DISCOVERED

BTT scientists recently traveled to Mangrove Cay, Andros to work with guides at the Mangrove Cay Club to tag bonefish and look for bonefish pre-spawning aggregation sites. The team's dedicated efforts did not disappoint. They were able to tag over 100 bonefish and, even more exciting, located and identified a previously unknown bonefish pre-spawning aggregation site! The aggregation was comprised of approximately 2,000 adult bonefish, which were exhibiting pre-spawning behavior, like gulping air and porpoising. Bonefish exhibit this behavior at pre-spawning sites during the spawning season, which runs from October-April during the full and new moon phases. Thank you again to the Mangrove Cay Club for its support of this important research. 🐟



MARSH, MELLOW.

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TOURNAMENTS THAT SUPPORT

A huge thank you to the tournaments that supported BTT in 2016 by donating funds and raising awareness and support for our research. They included: The March Merkin Permit Tournament, The Cabin Bluff Tarpon Cup sponsored by Hell's Bay Boatworks, The Del Brown Permit Tournament, The WorldCast Anglers' Black Tail Invitational, The Lowcountry Tarpon Tournament, The Palometa Club Permit Tourney, and the Poonfecta Micro Tarpon Tournament. These events were fun for anglers and raised awareness and funds for BTT. 🐟

COLLABORATION

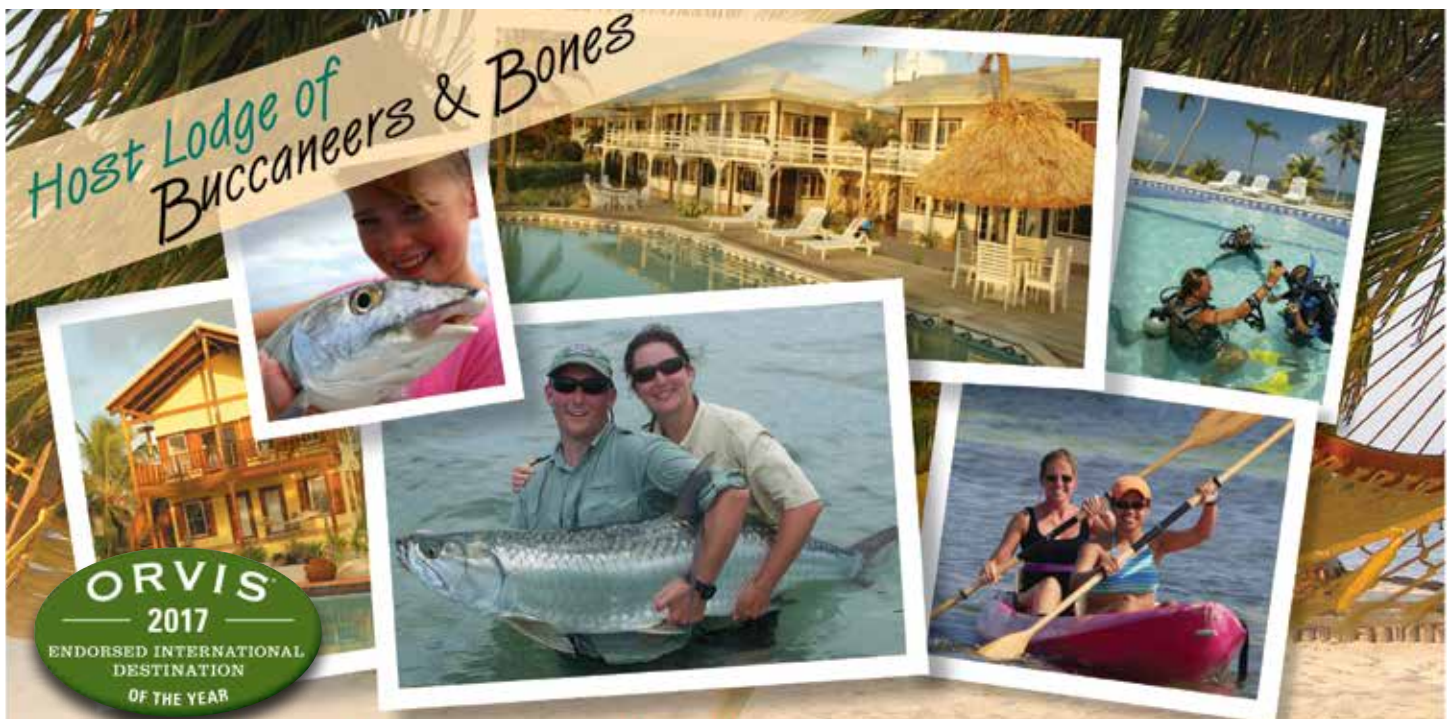
Much of BTT's success is due to collaboration. Fishing guides are an important partner in BTT's efforts—from recruiting members, donating trips for auctions, and assisting in research projects. They are too numerous to list here, but the Conservation Captains webpage at btt.org has the full list, and we hope you will consider booking a trip with one of them! Similarly, we have many sponsors in the fishing industry, lodges and beyond that donate much-needed funds, traveling angler trips, and auction items to support BTT's mission. We hope you will take a look at our corporate sponsor page on the website and consider supporting these important partners. 🐟

BTT HONORARY TRUSTEE THOMAS MCGUANE RECEIVES AMERICAN MUSEUM OF FLY FISHING HERITAGE AWARD

The American Museum of Fly Fishing, in Manchester, Vermont, recently honored influential author and BTT Honorary Trustee Thomas McGuane with its 2017 Heritage Award. Guests of the event were treated to a special interview between Mr. McGuane and 2014 Heritage Award recipient Tom Brokaw. The author of over a dozen novels, including *The Bushwhacked Piano* and *Ninety-Two in the Shade*, McGuane is also the recipient of the Wallace Stegner Award and is a member of the American Academy of Arts & Letters. 🐟

BTT REPRESENTED AT THE LONDON FLY FISHING FAIR

Earlier this year, the inaugural 2017 London Fly Fishing Fair was staged over two days in the impressive main hall of London's Business Design Centre. Our UK representative Paul Sharman was on hand to fly the flag for Bonefish & Tarpon Trust. Hosted by Orvis UK in their booth, Paul reports that he had plenty of interest in BTT's work. The Fair is set to grow even larger next year with plans already underway for 2018. 🐟



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BTT at Twenty: A Retrospective

BY MONTE BURKE



Tom Davidson

The decline of the bonefish in the Florida Keys, as the old saw about bankruptcy goes, happened in two ways: Gradually, and then suddenly.

Tom Davidson witnessed both phases.

Davidson started fishing the Keys in the 1970s out of Key Largo, becoming obsessed with bonefish. Over the ensuing decades, the bonefishing remained respectable. But in the 1990s, a disturbing pattern started to emerge: Each subsequent year was a little less productive than the one before it. “I noticed it and started to get concerned,” says Davidson.

Then came March of 1997.

“I was fishing regularly then, really in tune with the fishery,” Davidson says. “That March, there was a three-week period when we saw practically zero bonefish on the flats around Key Largo. They were just empty.”

That’s when Davidson—a lifelong, go-getting entrepreneur whose business interests have ranged from nuclear reactors to real estate—sprang into action.

**

Russ Fisher, a Harvard MBA, former shirt-company owner and native Midwesterner, started fishing in Florida in the 1970s, as well. His first obsession was tarpon. “I was in Homosassa for ten years, just after the absolute prime there,” he says. “I had an awful lot of fun.”

In 1990, Fisher moved to Key Largo, where he chased both tarpon and bonefish. There, he met and befriended Davidson, the two men bonding over a shared flats-fishing obsession. By early 1997, Fisher, too, was beginning to worry about the state of the Keys bonefish.

And then one day that April, he received a call from Davidson.

**

After what he’d seen on the flats that March in 1997, Davidson began

to search for scientific literature about the Florida bonefish. He had questions: Had the population been through booms and busts before? Where did the fish spawn? Where were the juveniles reared?

There were no answers. “Because bonefish had never been a commercial fish, there was no governmental data about them,” Davidson says. “No one seemed to have any information at all about the fishery—its size, or what might be causing the decline or even about the life cycle of the fish themselves.”

So he decided he’d embark on a mission to find those answers. Davidson called Fisher and four other fishing friends—Dick Farmer, Roe Stamps, Mike Smith and Joel Shepherd—and explained his plan: All six of the men would pitch in \$10,000 to fund a University of Miami project to gather any existing information about bonefish and launch a bonefish tagging program.

From that well sprung a group that would, in due time, prove Margaret Mead right: A small group of thoughtful, committed citizens can actually change the world.

**

They called themselves Bonefish Unlimited. Davidson soon heard through Jeff Harkavy that Bill Curtis was thinking about starting a similar organization for tarpon, another flats species about which almost nothing was known (permit fit that bill, too, and would eventually come under the organization’s purview). Everyone decided to join forces, and the name of the unified group became Bonefish & Tarpon Unlimited (BTU).

BTU made enough progress with that initial University of Miami study to make it clear that much, much more needed to be done. So Davidson and Fisher and the others, with the help of Harkavy and Jeff Wilson, began to cast a wider net, searching for more conservation-minded anglers who could help out with the cause. The result was a little more than 60 people who agreed to become founding members of BTU, a list that included, among others, Billy Pate, Stu Apte, Chico Fernandez, George Hommell and Sandy Moret. Small but effective fundraisers were arranged with the help of people like Adelaide Skoglund.

With a foundation laid, BTU hosted its first research symposium (underwritten by Johnny Morris and Bass Pro Shops) attracting 20 scientists who discussed species of fish that had practically never been studied before. The number of scientists grew to 35 for the next symposium.

BTU was off and running, a small, young conservation organization making huge strides in what amounted to an entirely new field of study.

A giant leap happened to be just around the corner.

**

Matt Connolly has spent a lifetime in the conservation field. The Massachusetts native was his state’s Director of Fisheries and Wildlife. He’s held management positions in the North American Wildlife Foundation, Delta Wildlife, Ducks Unlimited (for 12 years) and the Theodore Roosevelt Conservation Partnership. He was semi-retired when he first heard of BTU. “I thought, ‘gee, I love to fish the flats and I could possibly speed up the success rate of BTU by providing them with the benefit of what I’ve learned from working at a number of not-for-profits,’” he says. Connolly would eventually meet with Davidson




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in Florida. At the time, BTU was in talks with a strategic planner. After meeting Connolly, that strategic planner bluntly told Davidson: “You don’t need a strategic plan if you have this fellow.”

Connolly joined BTU in late 2008 as the organization’s unpaid president, and everything seemed to accelerate at once. One of the first steps: Changing the organization’s name to Bonefish & Tarpon Trust (BTT). The “trust” part of the name communicated responsibility when approaching donors. It also had a more international feel, something that would soon come in handy.

Connolly brought along his wealth of knowledge. He also brought people with him, in the form of a more nationally diverse group of members and directors. Among those new directors was a friend of Connolly’s named Bill Klyn, who was then Patagonia’s director of fly fishing. It was Klyn, along with Chris Dorsey, the head of Orion Entertainment (now Dorsey Pictures), and Mike Cassidy, head of ESPN Outdoors, who came up with the idea for a television show that would change the trajectory of BTT. Originally called *Pirates of the Flats* when it aired on ESPN (and now called *Buccaneers & Bones* on the Outdoor Channel), the show featured well-known celebrities—Tom Brokaw, Thomas McGuane, Yvon Chouinard, Lefty Kreh, Michael Keaton and others—who fished for bonefish, tarpon and permit. “Having the celebrities and the fishing—the meat and potatoes of the show—allowed us to slip in the spinach, which was the conservation message,” says Connolly.

The show, which first aired in late 2010, boosted the visibility of BTT. Membership numbers soared, as did the organization’s national reach. BTT began to host fundraisers outside of Florida, in places like New York, Chicago and Jackson Hole. The Journal you are holding in your hands started the same year as the TV show with a circulation of 2,500. It now has a circulation of more than 20,000.

With that increased membership and growing profile, BTT began to flex its muscles on the legislative side of the ledger, approaching the Florida Wildlife Commission with a proposal to make bonefish, tarpon and permit catch and release species. To his credit, then-chair of the FWC, Rodney Barreto, immediately recognized the value of the species to the state of Florida, calling them “rock stars” and moving quickly on the designations. (Barreto has stepped aside from his duties on the Commission and is now on BTT’s board.)

But the bulk of BTT’s newfound influence and money went into science and conservation. That difficult, tedious and long-term work is perhaps the least sexy part of BTT’s mission. But it is undeniably the most important.

**

Dr. Aaron Adams, an environmental biologist who happened to love to flats-fish, first worked with BTT in 2003, when he received a grant to study juvenile bonefish and permit. A part-time job in 2006 eventually turned into full-time work in 2010. He is now BTT’s Director of Science and Conservation. His job is two-fold: To research the three flats species, and then put that research into action.

One of the first things that research and science did was transform BTT into an international organization. “Everyone initially believed with these fish that ‘every man was an island,’” says Adams. “That turned out to be untrue. These fish move. They migrate across international borders.” As a result, BTT now also studies bonefish, tarpon and permit in Cuba, Mexico, Belize and the Bahamas.

The latter country, in particular, has become a rich vein of scientific discovery about bonefish. BTT found the previously unidentified bonefish spawning grounds and some juvenile rearing grounds. Those discoveries were critically important: They allowed BTT to push for the protection of those areas, work that has resulted in national parks in Grand Bahama and Abaco. The Bahamas studies

have also been useful in a compare and contrast manner: All of those scientific discoveries in the Bahamas, where bonefish are relatively abundant, have been applied in the Florida Keys, where they are not.

BTT also discovered—to the surprise of many in the scientific community—that all tarpon are of one genetic population, and that they migrate greater distances than previously believed. As for permit, BTT has identified the juvenile staging grounds (sandy beaches) and has an ongoing acoustic tracking study that will eventually identify the species’ spawning grounds.

All of BTT’s research turns into action, an indispensable tool for the management and protection of bonefish, tarpon and permit. “Everything we fight for on the conservation front is backed by real science,” says Adams.

**

And so we return to the original question, the one that launched the organization that would eventually become known as Bonefish & Tarpon Trust: What happened to the Florida Keys bonefish and why?

“Restoring the Keys bonefishery is still our central goal,” says Davidson.


Huge strides have been made in recent years on the Keys bonefish question. Among them is one of BTT’s biggest and boldest actions yet: The beginning of a carefully-implemented bonefish stock supplementation program.

That goal in the Florida Keys, not yet reached, is vitally important. “We work on it everyday, and I remain convinced that we will get there,” says Davidson.

As in many other significant things in life, though, the pursuit of that destination—the journey—has been equally important and rewarding. BTT’s journey, in this case, has produced so much: The invaluable scientific discoveries about three previously unstudied species and all of the subsequent acts of conservation—catch and release designations, habitat protection—that have been earned from those discoveries.

These are important and utterly impressive wins in the conservation field. BTT remains much smaller than some of its contemporaries, like Ducks Unlimited and Trout Unlimited. But the organization has consistently punched well above its weight when it comes to scientific discoveries and conservation work.

In the last two years, Davidson and Connolly have stepped down from their respective positions as chairman and president of BTT. “It’s hard to underestimate what Tom did,” says Fisher. Same could be said for Connolly, of course, who took Davidson’s original vision and elevated it to new heights. Neither man is prone to tooting his own horn, but they are both “horns worth tooting,” in the words of Fisher. Davidson was replaced by Harold Brewer, a BTT veteran who previously served as President and Managing Director of the organization’s Bahamas Initiative. Jim McDuffie, who was hired as the organization’s first Executive Director, has spent more than 25 years working in the conservation world, at places like The Nature Conservancy, was promoted to President, following in the footsteps of Brewer and Connolly. “We are in very good hands,” says Davidson.

And the little conservation engine that could chugs on, 20 years in, growing stronger than ever and continuing to do its part in changing the world. 

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BY AARON ADAMS, PH.D.

*Director of Science and Conservation, Bonefish & Tarpon Trust,
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Bonefish Connections

Do you really know where your bonefish are from?

A lot has been learned about bonefish over the past 20 years. We know that there are four species in the Caribbean and western Atlantic, but that one species—*Albula vulpes*—supports the recreational fishery. We've learned about juvenile habitats, and that bonefish in the Keys grow faster than in the Bahamas and Caribbean. We also learned that bonefish have small home ranges for much of the year, but undergo long-distance migrations to spawn. And research in the Bahamas revealed information on when and where bonefish spawn. Leaving the relative safety of the shallow flats, bonefish spawn offshore, in water thousands of feet deep, at night, near the full (and sometimes new) moons between fall and spring.

Why would bonefish leave the safety of the flats, take the risk of migrating far from home to venture into the open ocean where they are vulnerable to a whole new suite of predators, like large sharks and billfish? The answer lies in the next life stage—the larval stage.

Like most marine fish species, bonefish spawn by a process known as broadcast spawning—the males and females eject sperm and eggs into the open water, which is where fertilization occurs. That is the end of parenting responsibility. Once the

eggs hatch, the larvae (called leptocephalus) live in the open ocean for between 42 and 72 days—averaging 53 days at sea. During this open-ocean phase, it's estimated that >99% of larvae perish. But since a female will have hundreds of thousands of eggs, and there are thousands of fish in a spawning school, even 1% is a big number. The surviving larvae find their way to shallow, protected, open-bottom bays, where they change into miniature bonefish.

This life-cycle strategy is essentially a bet-hedging strategy because it spreads the risk by spreading out the larvae. Once in the open ocean, the larvae are subject to the ocean currents. The larvae have some swimming ability, and they can migrate vertically to take advantage of different currents, but for the most part they go where the currents take them. They might get caught up in gyres or eddies (circular currents) that deposit them in the same general area where they were spawned. Or they might get caught up in currents that take them far from where they were spawned. For example, the strong currents that sweep through the Caribbean could easily transport bonefish larvae from Trinidad to Cuba. In other words, it's a way of spreading the risk so that overall chances of success are higher because not all the larvae will end up in the same place.



Juvenile bonefish. Photo: Jon Shenker, Ph.D.

Why would they want to spread out the risk? Let's say a strong hurricane comes through and not only wipes out a lot of bonefish (especially the juveniles), but also a lot of their prey and habitats. The first problem this poses is that because so many juveniles die, the parents' genes have not been passed along to the next generation. In contrast, if some of the larvae remained local while others found themselves in distant locations that didn't suffer a damaging hurricane, those distant larvae will carry on their parents' genes.

The second problem is that because the local population is now smaller, it will take a while for the population to rebuild itself via future spawning. But if the damaged population also receives larvae from spawning that occurs in other locations, the population can be rebuilt faster because of the new larvae that will help replace those that were lost.

Since most marine fish use this reproductive strategy, we know that in general it's been successful. But to what extent does this connectivity occur for bonefish? How many bonefish in, say, the Florida Keys were spawned in the Keys versus spawned in Cuba or Belize?

Why does this matter to bonefish conservation? Because it

helps us determine the extent that conservation strategies should be local versus regional, and indicates which locations are most likely to be linked, and thus managed collectively. So how do we study these potential connections? One way is to estimate how ocean currents transport the larvae. We recently conducted such a project, and the results suggest a high level of connectivity between some important bonefish locations. Because of the bonefish population decline in the Florida Keys, we were especially interested in the extent that Florida bonefish were self-sustaining or dependent on larvae from other locations.

For this study, we first identified known and likely bonefish spawning locations in the Bahamas, Caribbean, and Florida Keys. Then oceanic current data were incorporated into a computer program, and used to model (predict) where the larvae would be transported. We repeated these transport models for spawning moons between October and April over a five year period. These predictions were verified by comparing them to actual data from the five-year period that was the focus of this study. The oceanographic model and the actual data matched, so the model was valid.

Then every full moon between October and April for that five-

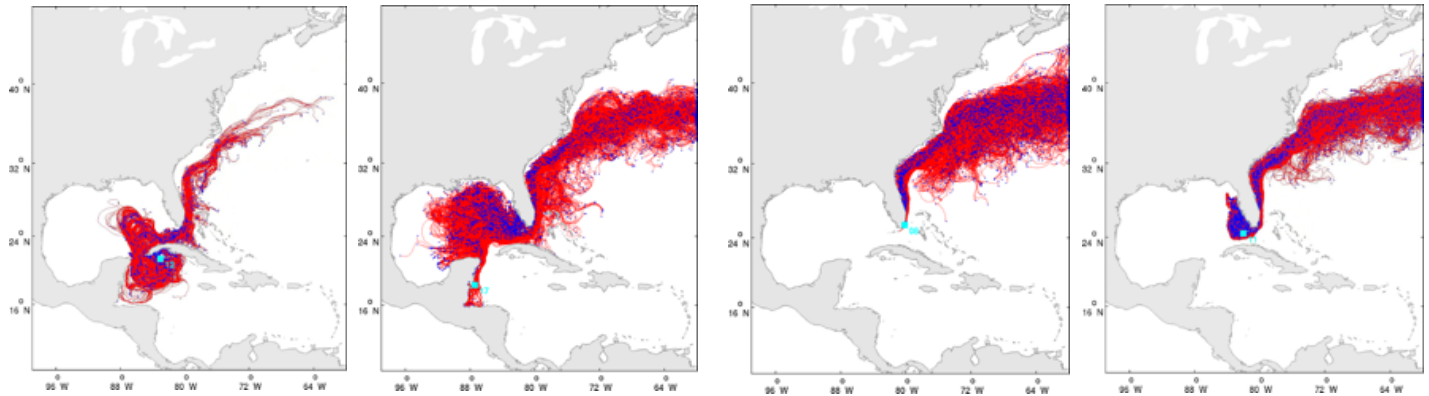


Bonefish Larvae. Photo: Jon Shenker, Ph.D.

year period, the computer model was used to release virtual larvae from each of the spawning sites, and then track where these larvae were transported after 53 days. The resulting data gave us an indication of which bonefish populations are most likely connected by larval transport, and which spawning sites are expected to be most important at providing larvae to a region, such as the Florida Keys.

The results are rather complex, but there are a few top conclusions:

- The north coast of Cuba and the Bahamas share a lot of connections. Surprisingly, this occurs in both directions—some of the larvae spawned in Cuba likely end up in the Bahamas, and some of the larvae spawned in the Bahamas end up on the north coast of Cuba.
- It is highly unlikely for larvae to be transported between the Florida Keys and Bahamas. The Gulf Stream is just too strong, and carries larvae north too quickly.
- Spawning locations on the southwestern coast of Cuba and the Yucatán Peninsula likely send larvae to the Florida Keys.
- Depending on where bonefish spawn in the Florida Keys (we are working now to identify spawning sites), the larvae may mostly stay in the Keys or be swept northward. If, for example, spawning occurs near Key West, many of the larvae will be retained in South Florida by the local ocean currents. In contrast, if spawning occurs off Key Largo, most of those larvae are transported northward well beyond the geographic range of bonefish. In fact, there have been reports of juvenile



This figure shows larval connection between spawning sites on the south coast of Cuba and the Yucatán Peninsula and Florida Keys, and underscores the importance of regional connections. The light blue squares are the spawning sites, the red shows all of the overlapping pathways along which larvae were transported by ocean currents, and the blue dots show where larvae ended up after 53 days. These figures show all of the models for the five-year period.

This figure shows the results from two spawning locations in the Florida Keys. If bonefish spawn off the coast of the Upper Keys, it's likely that the larvae are all swept northward and don't contribute to the Keys bonefish population. If bonefish spawn near Key West, the larvae have a high probability of remaining in the Keys and contributing to the local population.

During this open-ocean phase, it's estimated that >99% of larvae perish. But since a female will have hundreds of thousands of eggs, and there are thousands of fish in a spawning school, even 1% is a big number.

Background photos: Pre-spawning bonefish school. Photo: Aaron Adams, Ph.D.

bonefish captured along the sandy beaches of Long Island, NY, in summer. This is a one-way ticket for these bonefish—it's way too far for them to migrate south to Florida, so when winter arrives those that have not been eaten will die from the cold.

- The northeast Caribbean (Virgin Islands, Puerto Rico) seem to be in a zone of their own, suggesting these populations sustain themselves without much outside help. This may help explain why the St. Croix (US Virgin Islands) bonefish population has never really recovered from netting that occurred in the 1970s and 1980s.

We continue to analyze these data, and are already using the information to formulate conservation strategies. We are especially interested in the potential Florida-Cuba connection

because of the growing economic and resource management pressures in Cuba. As you will read in the article on Cuba in this issue of the Journal, in some locations in Cuba the harvest of bonefish from pre-spawning aggregations is very high. And this information is also guiding our efforts to identify spawning sites in the Florida Keys.

In the big picture, this new information underscores that we must mix local and regional approaches to bonefish conservation. We must continue to focus on habitat conservation, catch and release regulations at the local level, but must also take a strong regional approach because of the connections between different locations. 🐟

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Photo by Barry & Cathy Beck

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JACOB BROWNSCOMBE, PH.D. AND STEVEN COOKE, PH.D.

Institute of Environmental Science, Carleton University, Canada



Photo: Lenny Leonard

Filling the Gap: Using Acoustic Telemetry to Track the Movement Patterns of Atlantic Tarpon in the Gulf of Mexico and Western Atlantic

Atlantic tarpon are an extraordinary species—a combination of their size, mirror-like scales, and prehistoric nature has earned them their place as the Silver King of flats fish. The recreational fishery for tarpon has rapidly grown from its beginning in Charlotte Harbor, FL in 1885. In the years since, the fishery has expanded to the Gulf of Mexico, the Caribbean, and as far north as the Chesapeake Bay, with an annual net worth totaling millions of dollars. Considering their allure, wide distribution, importance to coastal economies, and potential ecosystem services, it is critical to continue to fill gaps in what we know about the biology and ecology of Atlantic tarpon so that we can promote the effective management of this recreational fishery for future generations to enjoy.

Recently, using genetic data collected from over 23,000 tarpon scales, Bonefish & Tarpon Trust researchers, in collaboration with the Florida Fish and Wildlife Conservation Commission (FWC), showed

that Atlantic tarpon sampled from the eastern seaboard of the U.S. to Brazil and Africa share the same genetic markers, indicating that there is only one distinct population throughout the entire geographic range! Population connectivity within the Atlantic is likely mediated by two tarpon life history traits: the long-distance migration capabilities of adult tarpon and the long-range transport of their planktonic larvae via ocean currents. These life history characteristics illustrate the critical importance of international conservation and management needs for Atlantic tarpon, ensuring the protection of this species across political jurisdictions and geographic boundaries.

Although the recent genetic data points to broad scale connectivity, there is still a considerable knowledge gap about how Atlantic tarpon move regionally and how they use habitat across various life stages (i.e., juvenile, sub-adult, adult). Such detailed information about the movement ecology is vital to informing conservation

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Photo: Tosh Brown

The tagging process involves surgically implanting acoustic transmitters that have a 5-year battery life into Atlantic tarpon after they are caught by anglers and guides.

efforts and prioritizing those that best protect the species and this valuable fishery. Recognizing this need, Bonefish & Tarpon Trust launched a long-term Tarpon Acoustic Telemetry Tagging Project in March 2016 in collaboration with research teams at the University of Massachusetts Amherst and Carleton University, as well as with the

generous support of the Maverick Boat Group. This project will help determine whether tarpon use the same spawning site each year or move among spawning sites, how changes in freshwater flows into coastal waters influence tarpon movements, and the movement patterns and habitat use of mid-size tarpon (30-50 pounds), which are the future of the fishery and very susceptible to being harmed by changes in coastal habitats and water quality.

The tagging process involves surgically implanting acoustic transmitters that have a 5-year battery life into Atlantic tarpon after they are caught by anglers and guides. Each transmitter emits a unique ultrasonic acoustic signal approximately every 90 seconds that can be detected by specialized autonomous receivers moored on the seafloor. A tagged fish must be within range of a receiver to be detected; this range varies from 50 to over 1000 yards depending on environmental conditions, such as water depth and



Photo: Danny Flynn



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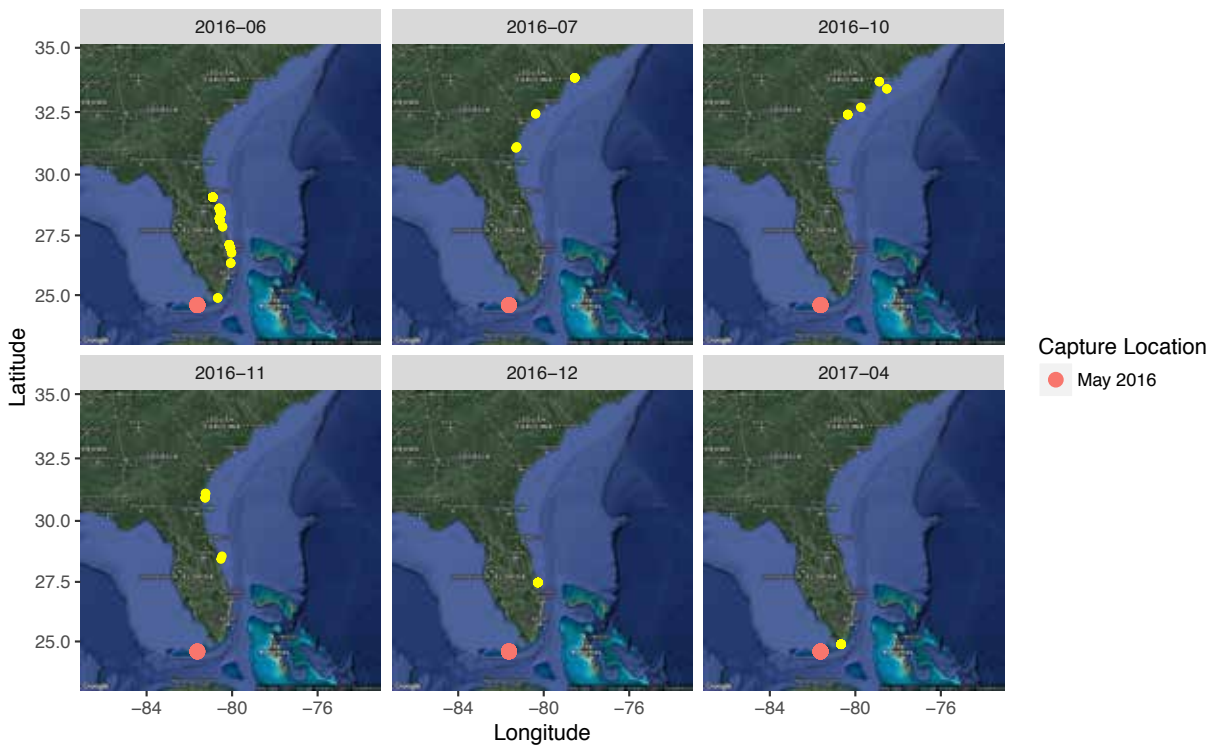
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wave action. When detected, the receiver also records the date and time, allowing us to track each individual tarpon for years to come. In collaboration with guides and anglers, receivers have been deployed in tarpon 'hotspots' in the Florida Keys, Charlotte Harbor, Apalachicola, Georgia, and South Carolina. Chances are that a few of your favorite tarpon spots likely have a receiver stationed nearby. In addition to the Bonefish & Tarpon Trust sponsored receivers, an extensive collaboration of state agencies and university researchers have deployed over 1,300 receivers across the Gulf of Mexico and over 3,000 receivers along coastal southeastern US. Since these receivers can detect any fish containing an acoustic transmitter, we are able to maintain extensive detection coverage of our tagged tarpon well beyond that of our own receivers. Given the distribution of the receivers, data from this network will not only reveal information about broader movement patterns, but also fill in critical gaps about the inshore 'spatial ecology' of Atlantic tarpon, including smaller individuals in the 30-80 lb range.

To date, we have tagged nearly 50 tarpon ranging from 30-160 lbs. While movement data collected by acoustic telemetry takes time to collect and must be physically downloaded from the receivers, we are already beginning to gather a considerable amount of preliminary data. From the first 12 fish tagged and tracked, we are beginning to

map a diverse range of movement types. Notably, we have observed fish tagged from multiple locations overlapping in areas along the Florida Keys, such as the Bahia Honda Channel. One fish tagged in northeastern Florida even wintered inside this channel as well. For fish in the 50-70 lb size range, preliminary analyses are revealing that their movement patterns are a combination of extensive migrations and localized 'breaks' for extended periods of time. For example, a 60 lb Atlantic tarpon (named Helios) traveled 800 miles from the Lower Keys to North Carolina in just 41 days (an average of 20 miles per day)! Helios was detected heading south in the fall and winter, and most recently detected again in the Keys. Another 60 lb Atlantic tarpon (#04) tagged in Charlotte Harbor, underwent an impressive migration from western Florida to eastern Florida and back west to the Everglades where it made routine 2-12 mile forays into tidal rivers between December and March.

While this information only reflects a small portion of our preliminary findings, we are already very encouraged by the incoming data and how it will contribute to the management and conservation of Atlantic tarpon. We are also incredibly inspired by the far-reaching collaborative efforts between guides, anglers, donors, and cross-institutional research colleagues that are helping us with this study. Stay tuned for much more to come!

We thank donors for their critical support and sponsorship of individual tarpon tags or receivers. Donors are now able to sign-on to a private web portal to view general movements of their sponsored fish. This project would not be possible without the support of the many fishing guides across the Gulf of Mexico, the Florida Keys, and up the southeastern coast.

We thank Captains Carl Ball, Will Benson, Shelby Bentley, Jordan Carter, Bruce Chard, Scott Collins, Brandon and Jared Cyr, Joel Dickey, Danny Flynn, Ron Gibson, Kevin Grubbs, Travis and Bear Holeman, Adam Hudson, John Jackson, Brian Jill, Rob Kramarz, Austin Lowder, David Mangum, Augie Moss, Gabe Nyblad, Jordan Pate, Albert Ponzoa, Zach Stells, Jason Sullivan, J.R. Waits, and Newman Weaver. 🐟



Photo: Tosh Brown



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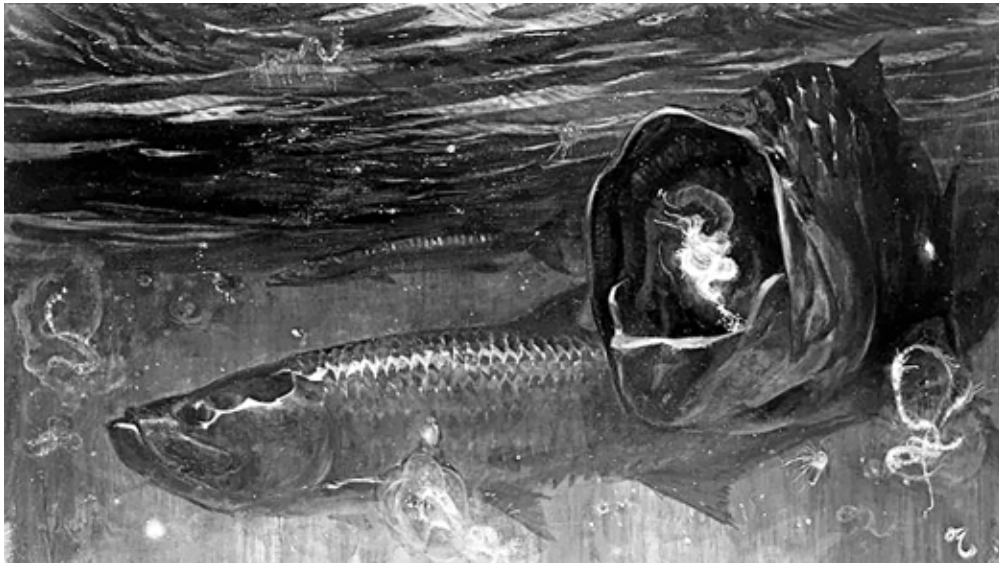


Photo courtesy of Silverfish Press

Bonefish & Tarpon Trust will auction Stanley Meltzoff's *Moon of the Polychaetes*, a monochromatic painting depicting tarpon feeding at night, at the 6th International Science Symposium, with a percentage of the proceeds benefitting BTT's conservation mission. This work was commissioned by *National Geographic* in 1969 and appeared on the magazine's cover.

BY MIKE RIVKIN

Universally regarded as the finest painter of apex saltwater gamefish, Stanley Meltzoff (1917-2006) was born in Brooklyn during the climactic year of WWI. He was an early prodigy both in public school and later at CCNY. During WWII, he served as a correspondent for *The Stars and Stripes* army newspaper, sitting alongside such luminaries-to-be as two-time Pulitzer Prize winner Bill Mauldin. After the war, Meltzoff taught briefly at New York's Pratt Institute before mustering the artistic courage to branch out on his own. After that, he never looked back.

Beginning in the late 1940s as one of Madison Avenue's original "Mad Men," Meltzoff's illustration career quickly took off. His work appeared regularly in books, national magazines, corporate annual reports, and advertising materials. Among other things, the artist did cover work for *National Geographic*, *Saturday Evening Post*, *Scientific American*, *The Atlantic*, and many others. His 64 covers for *Scientific American* remain a record to this day.

In 1960, a commission from *Sports Illustrated* changed Meltzoff's life. Always an avid diver and by now a celebrated artist, his series of

paintings of striped bass conveyed a heretofore unimaginable degree of realism. Thrilled with the rave reviews, *SI* commissioned more series of gamefish paintings, as did the entire sporting media. Cover artwork for *Field & Stream*, *Gray's Sporting Journal*, *Sporting Classics* and *Sports Afield* quickly followed. By the time of his death, Stanley Meltzoff's artwork had appeared in virtually every major sporting magazine. His death in 2006 at age 89 stilled a brush that will never be equaled.

Today Meltzoff's artwork is sought by museums and collectors around the world. His paintings are owned by such institutions as the Folger Shakespeare Museum, Getty Museum, National Baseball Hall of Fame, National Geographic Society, National World War II Museum, and the Smithsonian Institution's National Gallery. A recent series of one-man exhibitions has just concluded a three-year nationwide run, and leading periodicals have published an array of retrospective articles. Perhaps most significantly, Meltzoff's paintings of gamefish have achieved fine art status, elevating him to a level that precious few sporting artists ever achieve. Of all the fish painters before or since, there has simply never been an equal to the late great Stanley Meltzoff. 🐟

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Bahamas Initiative: Educational Outreach



Photos: Nick Roberts

BY NICK ROBERTS
Director of Marketing & Communications, BTT

In the decade since Bonefish & Tarpon Trust launched the Bahamas Initiative, the organization has made great strides in conserving bonefish populations and their habitats. Working in conjunction with lodge owners, fishing guides, NGOs, and the Bahamian Government, BTT has successfully used research findings to produce meaningful conservation outcomes. Most notably, the collaborative research contributed to the designation of six new national parks that protect adult and juvenile habitats, as well as spawning sites. BTT is currently in the process of identifying more spawning sites and vulnerable bonefish habitats, with the aim of including this information in a pending proposal for additional parks.

Actionable research is central to BTT's mission, as is educational outreach. As part of its Bahamas Initiative, BTT has educated guides and anglers, who make up the core of the flats fishery, about the best handling practices for bonefish, since handling the fish properly increases its chance of survival post release. BTT is now taking steps to expand the educational component of the Bahamas Initiative by working with Bahamas National Trust to develop a new flats ecosystem curriculum for Bahamian students, many of whom have not had the opportunity to explore a flats habitat or see a school of tailing bonefish. While several marine-based education programs are available in The Bahamas, none focus on flats ecology and conservation, making the new flats curriculum truly unique.

"The flats environment is often overlooked and easily dismissed, compared to the charismatic coral reefs and other marine environments," says Shelly Cant-Woodside, BNT's Director of Science & Policy. "But this area where the land meets sea is so vital to many commercially important species, such as bonefish, as well as to

"...this area where the land meets sea is so vital to many commercially important species, such as bonefish, as well as to endangered species of shore birds, like the piping plover. There is a great gap in knowledge across the country in this topic, therefore the Bahamas National Trust was pleased to partner up with Bonefish & Tarpon Trust to develop such a curriculum."

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The new flats curriculum builds on earlier educational outreach efforts by Bahamas Initiative Manager Justin Lewis, who frequently gives flats ecology and conservation presentations at schools across the country, leads field trips for students, and participates in teacher workshops. The curriculum, designed for students 10 to 17 years



old, focuses on the cultural, economic and historical significance of the bonefish fishery, the importance of healthy habitats, habitat conservation, and the best catch and release practices. It also includes field research and projects to further engage students in the content and deepen their appreciation for the environment. The curriculum will be taught through BNT's Discovery Club, an afterschool program for students who are interested in environmental science and conservation, with 70 club chapters spread across the archipelago, and in Bahamian schools.

"Bonefish & Tarpon Trust has been a tremendous partner, who has had an impact on our Discovery Club program on several levels," says Portia Sweeting, BNT's Director of Education. "Justin Lewis has lectured and led field trips and now the grant from BTT will cover the cost of educational materials. The new flats ecosystem curriculum will allow young people to learn the ecological, economic and cultural value of the flats."

On a Saturday in late April, Lewis gave a presentation on the importance of bonefish to the Bahamian economy to a group of 14 student "Navigators" in the Freeport chapter of the Discovery Club, led by BNT Outreach Officer, Cheri Wood. Following the presentation, Lewis took the group to a remote bonefish flat on the north coast of Grand Bahama, along the way pointing out a tangled, barnacle-covered net—likely washed up by a storm—that had killed countless fish, including bonefish. Providing the Navigators with a real-life example of the threats facing the nation's bonefish fisheries, worth over \$141 million annually, underscored his earlier lessons about the importance of properly managing the resource and protecting flats habitats.

According to Ms. Wood, it's not only the students who will benefit from the new curriculum—so will their teachers. "When students and teachers of The Bahamas begin to understand the cultural and economic importance of our delicate ecosystems, such as flats, they are more likely to care about these areas rather than view them as expendable," she says. "This leads to a healthy, caring society that is more likely to engage in sustainable practices that benefit the local community as well as contributing to the overall sustainability of the nation."

The students weren't just on a field trip to view the flats, they were also put to work using a large seine net to capture bonefish as part of BTT's tagging program. During this sampling, they caught two tagged bonefish. One of the bonefish had been tagged by Lewis on the same flat only two weeks earlier, illustrating for the students how small the home ranges of bonefish are, meaning that any damage done to a flat directly impacts the fish that live there. The opportunity to assist Lewis with his fieldwork has given students like Gareth Kirkby, a senior at Bishop Michael Eldon School in Freeport, greater insight into the economic and environmental value of the flats ecosystem and the country's bonefish fisheries.

"Searching for the bonefish and then catching and tagging them was an amazing experience," says Gareth. "I believe it is very important to educate young Bahamians, like myself, about our flats, since they bring in a lot of revenue for the island, and we will soon be the ones in charge of taking care of them." 🐟

The Evolution of Tarpon Fishing

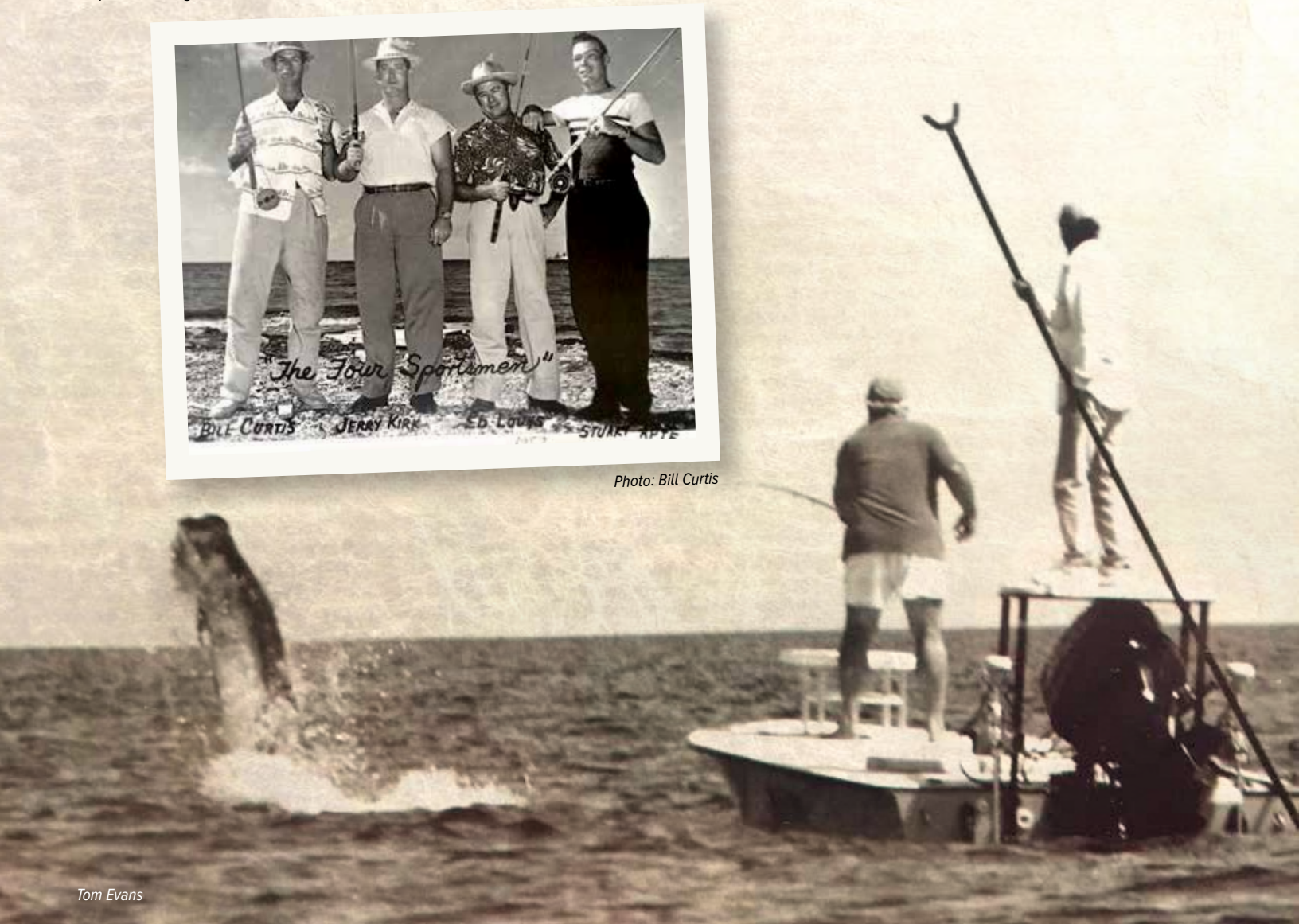
BY PAT FORD

The first records of tarpon being caught on a fly rod are usually credited to Dr. James Henshall during the winter of 1878-79. Can you even begin to imagine the numbers of tarpon inhabiting Florida's waters at that time? Fast forward to the 1930s when G.D.B. Bonbright designed the first "Tarpon Fly," aptly named the "Bonbright Special." It was basically a salmon fly on steroids, but it was a start. Tackle consisted of bamboo rods and salmon reels and very few people paid attention to this absurd niche in fly fishing. As late as 1950, the general feeling was that it was impossible to catch a 100 lb tarpon on a fly rod.

Tarpon abound in many waters, but the heart of fly-fishing for tarpon is the Florida Keys. In the late 1950s the likes of Stu Apte, Bill Curtis, Homer Rhode, Jimmie Albright, Cecil Keith and George Hommell appeared on the scene. Many of these legends helped shape BTT's early development as a "flats" conservation organization, and Apte still serves as a board member. Curtis spoke about fishing off Elliot Key in Miami back in the early 60s when, in the spring, there would be a school of 50 to 1000 tarpon every quarter mile along the key's outside flats.



Photo: Bill Curtis





Billy Pate. Photo: Pat Ford



Bill Curtis. Photo: Pat Ford

In 1961 Stu Apte guided Joe Brooks to a 148.5 lb IGFA world record on 12 lb tippet. Stu accidentally stepped on Joe's Orvis bamboo rod, thus forcing him to use a new prototype material that Stu was testing—it was called fiberglass. This day was also one of the first times an angler used a "shock" tippet, which opened a whole new world for tarpon anglers.

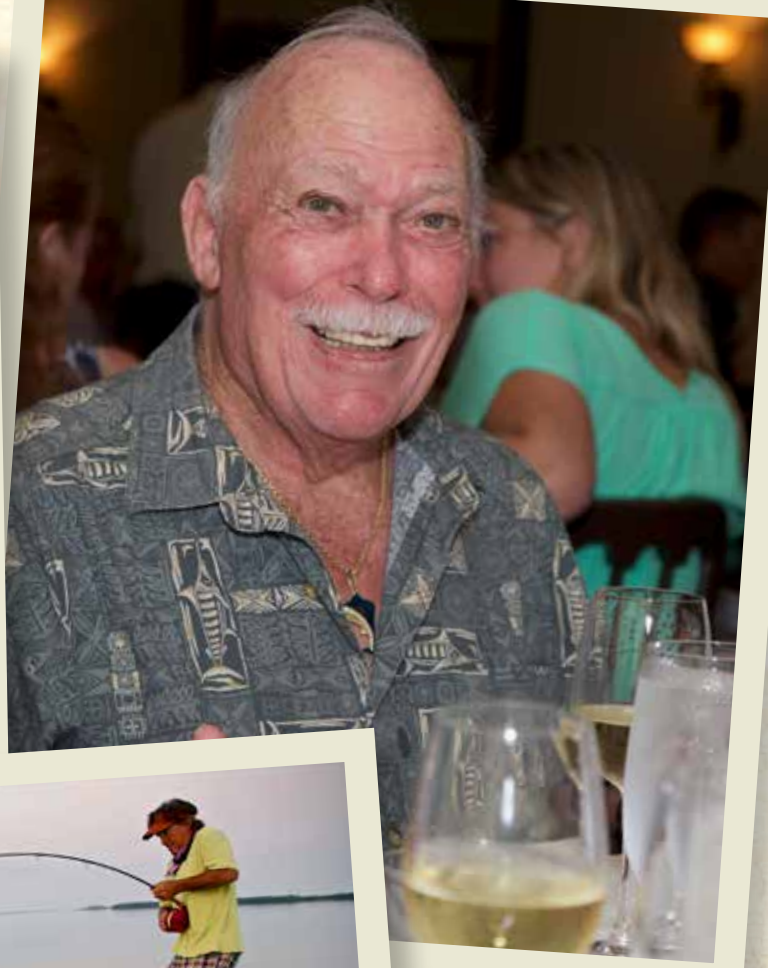
Fiberglass rods became the standard when Fenwick and Scientific Anglers developed rods specifically designed for fighting tarpon. Stu Apte went on to personally set records on 12 lb (164lbs), 8 lb (91lbs) and 6lb (82 lbs) tippets as the tackle and techniques continued to develop. At this time, Lefty Kreh, a BTT Honorary Trustee, was the manager of the Metropolitan South Florida Fishing Tournament. For almost 75 years, that event, along with the Miami Beach Rod & Reel Club, determined who was who in the world of sport fishing. To this day, Lefty's influence continues to permeate the design of efficient fly rods, lines, flats boats, and fly patterns, as well as casting techniques. Lefty has introduced more people to fly fishing and the need to release what you catch than anyone else on the planet.

In the early 70s graphite rods appeared on the scene. Lighter, faster, stronger, they quickly took over the fly fishing for big fish market, but the reels took a while to catch up. The landmark Tycoon/Fin-Nor "wedding cake" and the Seamaster line, developed in the late '50s, were the gold standard for years. They were constructed from superior materials and had the best drags in the business, but they were small. There was limited space for Dacron backing and a 12 weight fly line and the retrieval rate might as well have been three inches per turn—not a good thing when your tarpon is 100 yards away. Then one day John Emery, a well known South Florida guide, designed a bigger reel. It was so much bigger than the Seamasters that anglers thought it was too big, and its price tag of \$300 back in the 70s was unheard of. But it was the first of a trend that revolutionized fly reels. Reel manufacturers Tibor and Abel led the push for bigger reels that held 300 yards of backing, had a large diameter spool, a foolproof

drag, and were specifically designed for tarpon. Today there are dozens of excellent reels on the market. Imagine what could have been accomplished in the 1960s with today's high-tech equipment.

As equipment progressed, so did the quest for fly fishing's Holy Grail: a 200 lb tarpon on fly. The quest for giant tarpon on fly was personified by Billy Pate in the early 80s. Many people don't remember that Billy had set multiple fly rod records for almost every species of billfish before he became obsessed with catching a 200 lb tarpon. He first discovered the Key's tarpon migrations in the mid-60s and in 1968 he started World Wide Sportsman in Islamorada. Billy set multiple IGFA tarpon records; his most enduring was a 188 pounder caught in 1982 on 16lb tippet. That record held till June of 2001, but Billy didn't feel it was his most notable catch. He was most proud of a 173 pounder that he hooked and landed while fishing alone in his boat.

For decades, if you wanted a giant tarpon you went to Homosassa. All the legends fished there. Billy Pate spent the month of May there from 1974 thru 2000. He and Stu Apte both report hooking tarpon that they estimated in the 250 lb range, but their Holy Grail continued to escape. Then in 2001 Jim Holland, Jr. landed a 202 lb monster on 20 lb tippet. At its peak Homosassa was a magnet for giant tarpon. Stu Apte tells of jumping a dozen fish a day over 100 lbs and Billy used to pop off "rats"—a "rat" was anything under 125 lbs, but all that changed. Now anglers are happy to average one bite a day. Tarpon have abandoned Homosassa, at least in the numbers this spot once enjoyed, and the debate rages as to why. Some say pressure, others say food supply. Some have suggested that subtle changes in fresh-water flow over the past 20 years might have played a role. Master angler Tom Evans is one of the last to pick up a giant tarpon from Homosassa, landing a 190 pounder on 16 lb tippet in 2003. In 2010 he made possibly the most amazing catch in tarpon history when he boated a 194 lb brute on 12lb tippet. Tom and Stu have incredible skills in fighting giant tarpon on fly tackle. They believe the key is an emotional attack—teach the fish who's boss right from the beginning.



Stu Apte. Photo: Pat Ford



Andy Mill and Guide Doug Kilpatrick. Photo: Pat Ford

Keep the pressure on at all times. If a tarpon thinks it can control the situation, you're in for a long fight.

Today the tarpon migration along the Florida Keys is changing too. When Bill Curtis retired from guiding in 2001, he said that there were less than 10% of the tarpon that he saw in the '70s. Each year that passes there are fewer fish than the year before and they are smarter—just getting a bite is now a goal in itself. Capt. Jake Jordan has guided out of Marathon for over 40 years. Lately he has been fishing at night near the Bahia Honda Bridge on outgoing tides. He usually hooks an incredible number of fish on big black flies. He says that 2016 was his worst year ever for numbers of bites and he keeps exact records. However, his numbers for 2017 were down 60% from 2016. Not Good! What's happening? Florida Bay has hardly any tarpon moving through any more. If what happened to Homosassa happens to the Florida Keys, it will be a disaster of epic proportions.

BTT Honorary Trustee Andy Mill is more optimistic. Andy has won more flats fly-fishing tournaments than probably anyone else and no one has more experience in analyzing what it takes to convince a finicky tarpon to suck in your fly. He lectures all over the country on how to catch tarpon, and his book *A Passion for Tarpon* was an instant classic. Andy thinks two things have happened. First, the numbers of fish on the flats are down. Tarpon live for over 50 years and they learn. Too much fishing/boat pressure along the flats moves them offshore. There may still be good numbers of tarpon traveling the Keys; we're just not able to see them. Second, the tarpon that stay on the flats get more sophisticated each year. It takes a lot more angling skill to get a bite. Your cast has to be perfect. Clear tip fly lines, 15' leaders, 40 lb fluorocarbon shock tippet and tiny flies are needed. It's a lot harder to catch a tarpon today than it was 10 years ago, but in another decade, these may be the good old days—something to think about. 🐟



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Can Recreational Anglers Help Save Mangrove Habitats?

BY AARON ADAMS, PH.D.

*Director of Science and Conservation,
Bonefish & Tarpon Trust, and Senior
Scientist, Florida Atlantic University,
Harbor Branch Oceanographic Institute*

Much the same way that duck hunters have been instrumental in saving wetlands, recreational anglers can lead the charge in saving mangroves and other habitats that are essential to our fisheries. Without healthy habitats, we can't have healthy fisheries, no matter how much fisheries managers try. And like the duck hunters who helped save wetlands, the benefits will be much greater than just our fisheries—they will extend to a healthier overall coastal environment. Though many coastal habitats that support our fisheries are under threat, mangroves top the list.

Mangrove forests are among the most threatened coastal habitats worldwide, decreasing an estimated 35% globally over the past 50 years, with continuing annual declines of 2%. Some estimates show that Florida has already lost 50% of its mangroves. Ongoing and planned coastal development in Belize, Mexico, the Bahamas and other locations in the Caribbean and worldwide, pose serious threats to mangroves. All this habitat loss and destruction has direct negative effects on our fisheries.

Rather than despair, we owe it to ourselves to follow the model of duck hunters and make habitat conservation and restoration a battle cry, because as go our habitats so go our fisheries. We have a lot going for us.

Tarpon make a great poster-child for this effort because juvenile tarpon depend on mangroves as nursery habitats. If we lose the nurseries, we lose the fishery.

Juvenile tarpon use mangrove wetland habitats that are

typically low in oxygen. This reduces the number of predatory fish that swim in these backwaters, which increases juvenile tarpon survival. Common nursery characteristics include: mangroves that provides structure and protection from bird predators; a mixture of depths—primarily shallow with some deeper pools for fish to congregate when water levels decrease; tidal exchange through narrow, shallow passages that inhibits access by predatory fishes; freshwater inflow; calm backwaters. As they grow, older juveniles widen their use of habitats to include lagoons, creeks, canals and sloughs, and coastal bays. And they share these nursery habitats with juvenile snook, so by helping tarpon we help snook too.

In fact, we may already be behind the 8-ball on habitat: a recent International Union for the Conservation of Nature scientific assessment classified the Atlantic tarpon population as “Vulnerable,” in part due to historical and ongoing habitat loss and degradation.

But we have more in our quiver than we know—our fisheries give us ammunition in the fight for habitats.

First, tarpon are charismatic. Leaping tarpon have graced the covers of countless fishing magazines, not to mention the focus of stories in non-fishing newspapers and magazines. “Fishing for dinosaurs” has a broad appeal. And they occur in picturesque locations that are regularly featured in travel magazines.

Second, tarpon are economically important. The annual economic impact of the tarpon fishery in southwest Florida exceeds \$110 million, and exceeds \$19 million in the St. Lucie



Photo: Nick Roberts

Most important, the anglers and guides who chase tarpon are passionate about the fish and fishery. And we can say the same about those who fish for bonefish and permit.

It was the economic and cultural importance of duck hunting, combined with the passion of duck hunters, that created the movement that saved and continues to protect wetlands. These same traits bless our fisheries. We just need to harness them. 🐟



Photo: Jack Davidson

Estuary in southeast Florida. Tarpon account for a significant part of the flats fisheries in the Florida Keys, the Everglades, and Belize, which have annual economic impacts exceeding \$465 million, \$990 million, and \$56 million, respectively. Tarpon are also very important to flats fisheries in Cuba, Costa Rica, Nicaragua, Puerto Rico, and other locations that have not been quantified.

Third, the fishery for tarpon in these locations is catch and release. And with high post-release survival, the fishery is sustainable. This means that if the habitats are healthy enough to support a tarpon population, and the fishery is catch and release, a low environmental impact and sustainable economy is possible.

Fourth, the fishery is culturally important. In many locations, the fishery and those that participate in it are central to the region's culture. In Belize, for example, the occupation of tarpon guide is passed from father to son, uncle to nephew.

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Photos: Jorge Alberto Angulo Valdes, Ph.D.

Collaborating on a New Vision for Cuba's Coastal Fisheries

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AARON ADAMS, PH.D. *Director of Science and Conservation, Bonefish & Tarpon Trust, and Senior Scientist, Florida Atlantic University, Harbor Branch Oceanographic Institute*

Cuba, the crown jewel of the Caribbean, harbors 55% of the Caribbean's endemic species and 50% of the region's coastal ecosystems. It is rare to find the comparable ecosystems (with regard to ecological health and integrity) anywhere in the Caribbean, and perhaps in the Western Hemisphere. In terms of ecological connectivity, Cuba is inextricably linked to its neighbors, including Florida, and actions in one country can have a profound influence on resources in another. Because of this connectivity, it is fortunate that Cuba is a leader in the region in Marine Protected Area (MPA) designation. However, effective management continues to be a concern: although nearly 23% of the island continental shelf has some level of protected status, many protected areas are at risk due to lack of enforcement.

Marine Protected Areas are not only important as a general conservation tool, they are essential to the health of the flats fishery. This is because the locations where flats fishing occurs in Cuba are

all within MPAs where only catch and release fishing and highly regulated lobster harvest are allowed. The combination of healthy and protected habitats and catch and release regulations is essential to the long-term health of the Cuban flats fisheries. Despite these protections, however, there are concerns.

Cuba's coastal habitats are fairly well preserved, but fish populations are heavily exploited and presumed threatened by both commercial fisheries and sport fisheries. Currently, 88% of Cuban fishery resources are in critical condition. In many coastal communities, for example, private and sport fishermen depend on fish for subsistence, but also supplement their incomes with the sale of fish on the black market. Although the pressures on targeted species are believed to be substantial, there are currently no data available to quantify the extent and magnitude of these impacts on fish populations or ecosystems more broadly. Some species have suffered most of the damage: (e.g. Nassau grouper, mullets, lane snapper, spiny lobster).

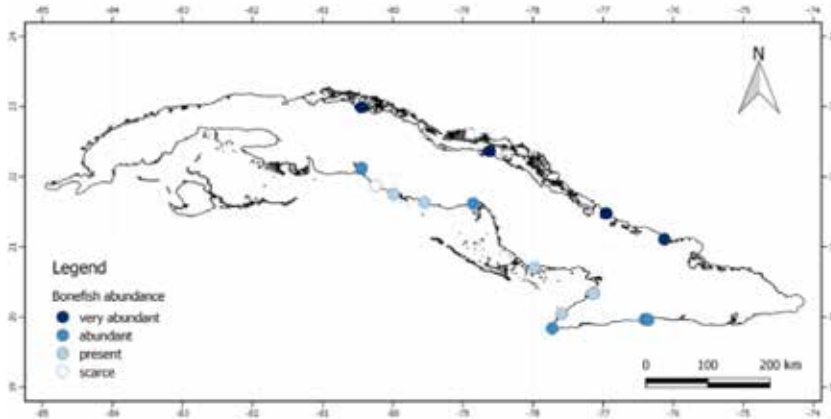
Sometimes it feels like it's the fish that's hooked.



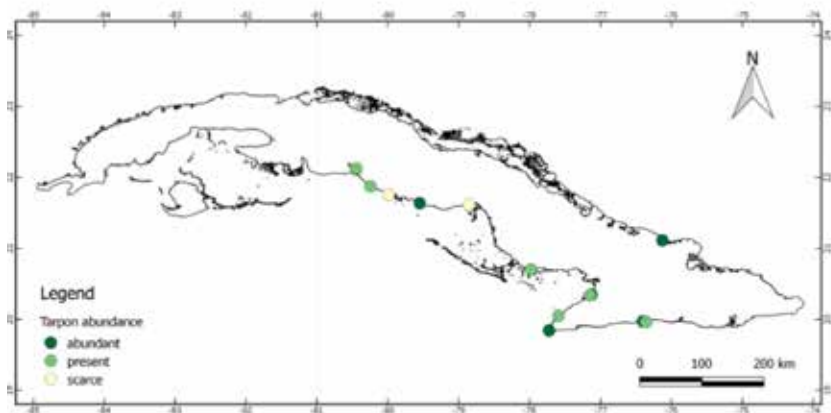
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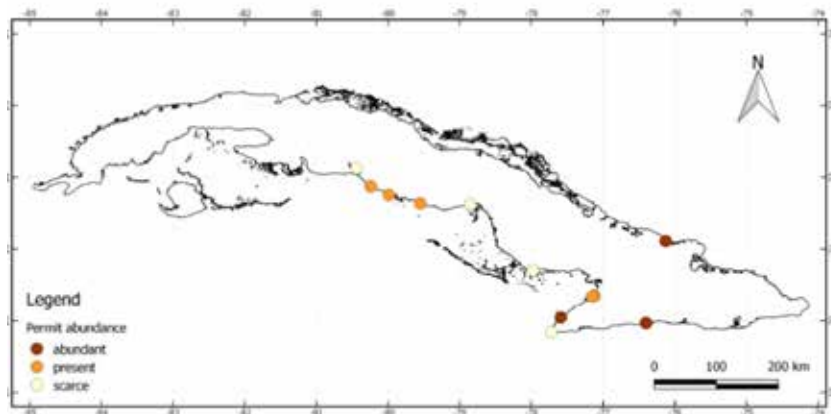
Bonefish Relative Abundance (based on interviews)



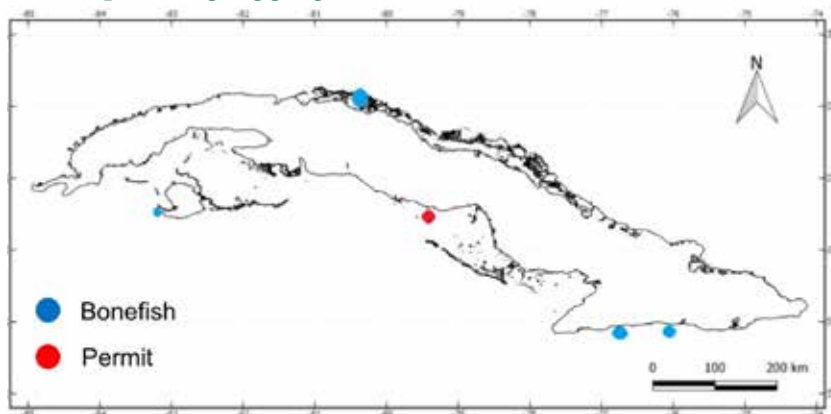
Tarpon Relative Abundance (based on interviews)



Permit Relative Abundance (based on interviews)



Spawning Aggregation Sites (based on interviews)



Others, including bonefish, tarpon, permit and snook are also targeted and have not been fully evaluated.

BTT, the University of Florida and the Center for Marine Research at the University of Havana (BTT-UF-CIM) have started a multi-partner collaboration to address research, conservation, and education needs as they relate to Cuba's coastal fisheries, with an emphasis on sportfishing activities. Our assessment is that the flats fisheries are protected sufficiently within the MPAs, so our focus is on the local fisheries that are likely impacting flats species.

The Fisheries of Cuba

The fisheries in Cuba are divided into three categories. The commercial fishery is state-owned and controlled, and responsible for the largest share of catches and ecosystem/population impacts in Cuba. The sport fishery, originally recreation or hobby-based by Cuban nationals, has become a subsistence activity due to serious economic constraints. Only hook and line is allowed by law. Harvest has not been properly assessed. The private fishery is conducted by Cuban nationals who were sport fishermen prior to 2009 and then became private fishermen thanks to government measures allowing for the designation. Private fishermen are permitted to use large non-selective fishing gear, and make a living from fishing. Therefore, fishing activity has increased. The impact and harvest have not been properly assessed.

Among the objectives of the BTT-UF-CIM partnership are to:

- Characterize sport fishery activities in Cuba.
- Collect socio-economic information about the fisheries and fishermen.
- Establish relationship with fishermen and fishery officials.
- Identify key persons that could function as collaborators.
- Explore the occurrence of tarpon, bonefish, and permit in the areas.
- Determine spawning aggregation sites for bonefish.

Two scoping trips have been conducted to address these objectives—one each to the north and southeast coasts of Cuba. During these trips, a total of 20 sport fishing ports were visited, and over 100 fishermen were interviewed. Our preliminary findings reveal that the sport fishery in Cuba is primarily a subsistence type of fishery.

There are 169 recognized sport fishing ports, with over 36,000 registered fishermen. The actual number of people participating in this fishery is likely much higher given serious enforcement limitations. There are over 1,240 boats, from 9 to 15 feet long, most of which are not in good condition and have very limited capabilities regarding time at sea, distance they can travel. Sport fishermen can only use hook and line.

In contrast, private fishermen are allowed to use non-selective fishing gear—such as gill nets (200 meters long, 40 mm mesh size), fish traps (up to four), and long lines (up to 200 hooks)—and stay out fishing for longer

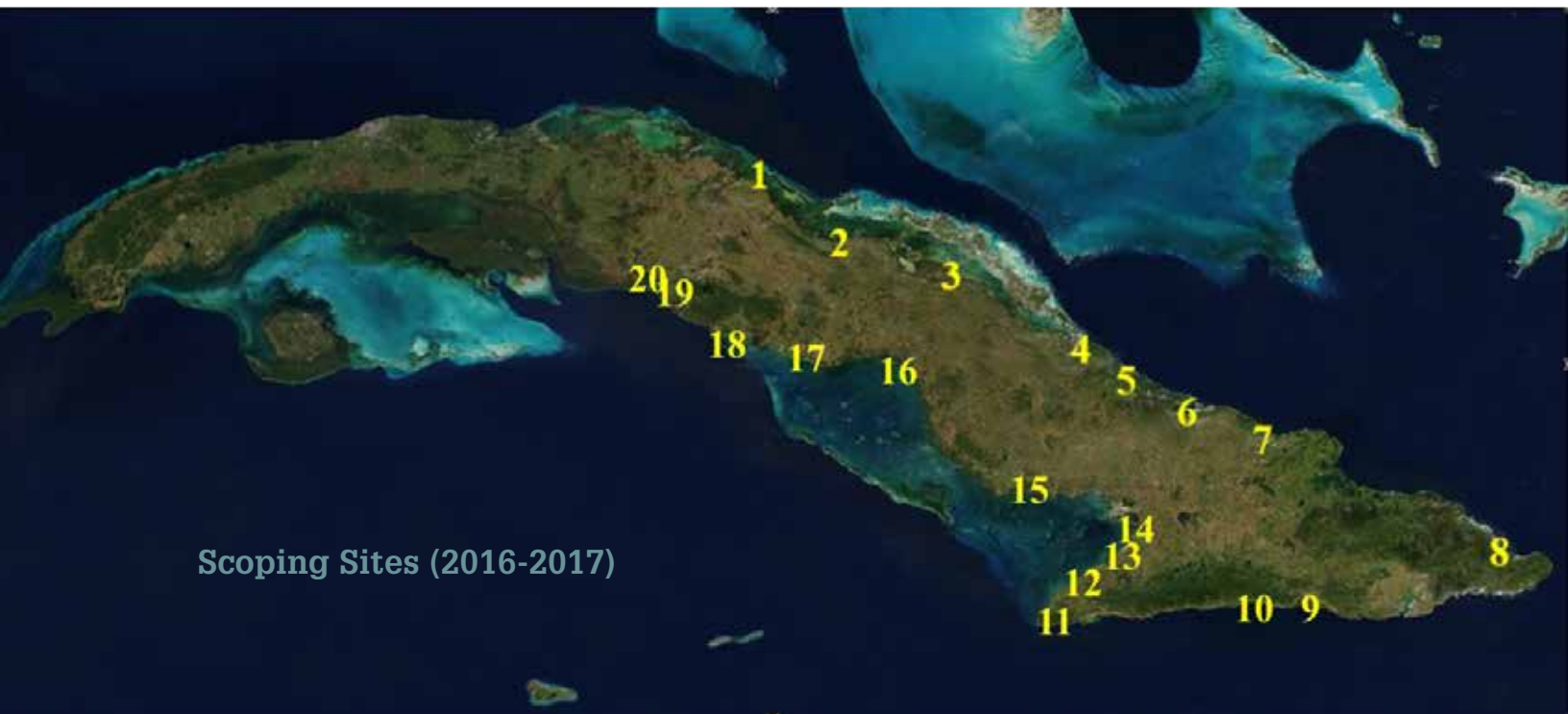


Millie Jo Painsi releases a gray ghost back to its old haunt. Jardines de la Reina, Cuba. **Rich Painsi** © 2015 Patagonia, Inc.

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Scoping Sites (2016-2017)

periods of time (approx. 4 to 7 days). According to their contracts, fishing quotas are established based on the size of the boat, and these quotas must be fulfilled monthly. Monthly quotas per fisherman average from 50 to 95 kg of total fish (of any species), with no record of which species are harvested.

Main target species vary from zone to zone, and with fishery type. Bonefish, tarpon and permit are important targets in some areas. For example, in Boca de Manati-Turiguano, commercial fishermen specifically target bonefish in pre-spawning aggregations, and, using gill nets (800 meters long, 40 mm mesh size), have reached landings exceeding 20 tons per season. Tarpon are also targeted, but we have not yet been able to determine the amount harvested. Bonefish are mostly used as bait for long lines and other fishing gear, while tarpon is mostly used for direct consumption or processed to be sold in the market as a different product (i.e., ground fish meat).


Fish use depends on the species. By law, private fishermen must sell all their catch to the state, but this is not happening. Instead, low quality fish are used to fulfill mandatory government quotas, while good quality fish are used for personal consumption and sold in the black market. We believe that the main reasons for this are related to the lack of trust between fishermen and the government, payment delays, low prices, miscommunication, and a weak legal framework.

Two spawning aggregation sites for bonefish were identified, and according to the fishermen both are receiving fishing pressure during spawning season. The level and extent of this fishing impact remain unknown, although anecdotal information from fishermen revealed a figure for one of the sites (20 tons). We consider this a very important issue that needs to be addressed soon to obtain accurate numbers and develop a suitable system for data collection and sharing.

Visits to fishing ports allowed us to meet new people, learn about

the fisheries, and begin to understand the perspective of the people in these fisheries. Most fishermen expressed concern about the lack of fish in the ocean and were keen to collaborate in taking conservation actions. They recognized that overfishing can indeed affect fisheries and that doing so would be detrimental to their own future. When asked if they would like to change from a subsistence to recreational fishery (assuming the recreational fishery can provide a living), the majority answered “yes.” This finding is very important because it provides a foundation from which a collaborative network for recreational fisheries can be developed for the well-being of Cuban coastal communities and recreational anglers in Florida. And given the high harvest of flats species in some areas, it is likely that these unsustainable harvests are having an impact on the economically important flats fisheries. So the more we can learn about these fisheries and collaborate with the fishermen, the better the future will be for everyone.

We see a promising future for this collaboration. Cuban scientists are eager to tackle these issues and we are already planning other projects, including surveying the rest of the country, conducting telemetry studies of tarpon, and creating recreational fishing clubs at select sites. We also plan on educating fishermen about the value of conservation and sustainable fishing and generating business opportunities for Cuban coastal communities. Ultimately, this collaboration will create a new way of thinking about coastal fisheries that will benefit the fisheries and the communities that depend on them. The desire to maintain the cultural connection to the ocean in a sustainable way is already there—this collaboration will provide the information to make it a reality. 🐟



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Exhibit A.

Photograph by Benjamin Cossett

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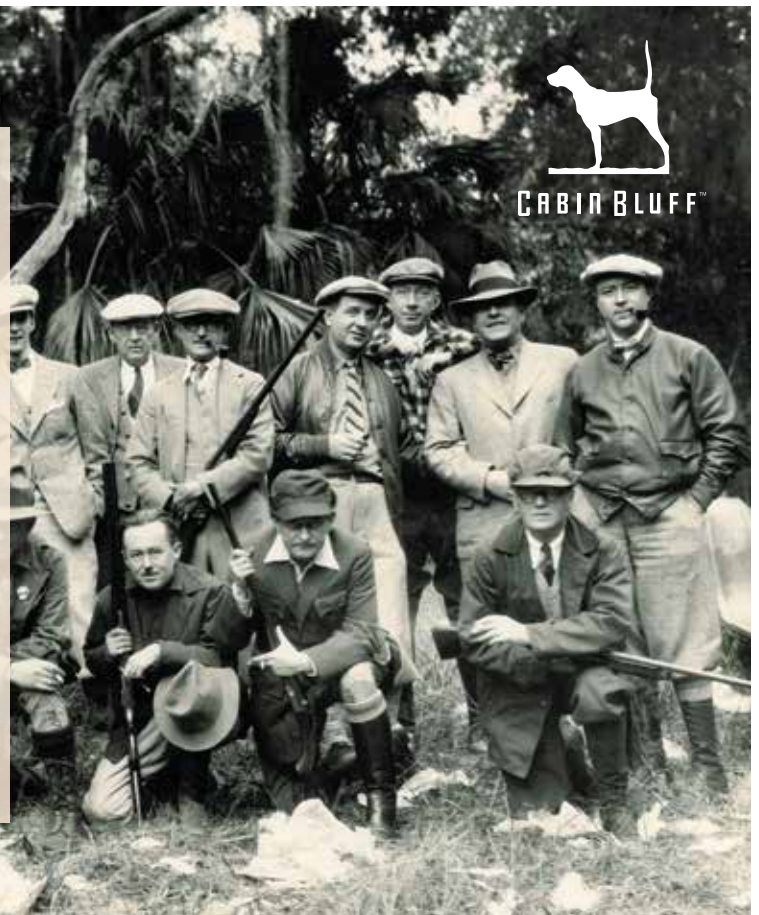
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Guide Profile: She's The One

Bahamian Dana Lowe, 27 years old, has been fishing for longer than she can remember, and guiding a flats boat professionally since graduating high school. The only female bonefish guide in the Commonwealth, fishing and guiding are in her blood.

BY SARAH A. CART



“Fishing with Dana is a delight. She poles her skiff so silently that I had to look over my shoulder from time to time to see if she was still on the platform,” notes BTT Board of Directors member, Mona Brewer. “Hardly a word other than a calm ‘Fish coming at 2’ or ‘Fish tailing at 10.’ Skiff perfectly positioned for the shot. Never any criticism, she always encourages you to enjoy every minute of the day.”

“Fishing has always been a passion of mine,” says Dana, who with her identical twin Danielle is the youngest in the family. “From as far back as I can remember, my three sisters and I would sit with hand lines out on the end of our dock trying all day to catch as many snappers as would bite.”

Fishing was a bonding experience for all the sisters, and their father Donnie was there to show them ropes, helping to untangle their lines and re-baiting their hooks.

“The fact that we were all girls made no difference at all,” says Dana. “We were always included in all the adventures, from diving to spearfishing.”

A Family Affair

Dana’s father has guided on Abaco since the 1980s and out of the Delphi Club on Rolling Harbour since its founding eight years ago.

“What a dynamic father and daughter team we have in Donnie and Dana Lowe,” writes Club member Dr. Margaret Downes of Dublin, Ireland. “Donnie is an astute, experienced guide, and Dana is a gifted young guide with an innate ability to read the water, weather and fish activity.”

Father and daughter both grew up on the east coast of Abaco in the isolated village of Cherokee Sound, named for the Native Americans of North Carolina. The Lowe family’s roots reach back to 1783 when colonial families loyal to the Crown fled to the Bahamas after Britain agreed to exchange the southeastern seaboard of the newly formed United States for the archipelago.

“It is likely that no one knows the waters and the always nervous bones of Cherokee Sound and the eastern Marls better than Donnie,” says BTT Chairman Harold Brewer. “For the last several years he has been passing decades of accumulated knowledge on to Dana with amazing results. She is one special young lady who has grown into the business.”

In the Beginning:

“The sea has always been the biggest part of me,” says Dana’s father. “At about age eight, one of my favorite hobbies was to get a couple hermit crabs, a hand line, slip shot, and a few good hooks and head to the water.” He relishes the memory of landing bonefish with that gear, “burning my fingers as I pulled them in.”

As a teenager, he picked up a spinning rod, but he didn’t learn how to fly fish until he’d been guiding professionally for several years. When the saltwater fishing world was introduced to the technique in the late 1980s, Donnie embraced the new challenge and found a new favorite means of catching bones.

At about the same time, he began “my lifelong career as a father to my girls.” Fast forward to 1999 when daughter Dana’s passion for fishing, particularly for bonefish, became apparent. She could always be found holding a spinning rod or baiting a hook, demanding ‘Daddy, you have to show me how!’”

Initially, Donnie was overwhelmed at answering all the child’s questions and teaching her what he knew, but seeing her catch on so quickly, he realized that “a skill I knew I was born with was something she was born with, too.”

Following in her father’s wake, at age eight or nine Dana caught her first bone on a hand line. From there she quickly progressed from mastering a spinning rod to learning how to fly fish at age 10.

Following in her father’s wake, at age eight or nine Dana caught her first bone on a hand line.



Photo: Dana Lowe

“Dad was an excellent teacher, even if a little impatient at times,” she says. “He always encouraged me to try again. I remember the first time I landed a bonefish on a fly rod while blind casting off the dock as he led me step by step. I was so proud and I knew he was, too.”

Dana details the learning that followed: “How to pole and control the flats boat, understanding the behavior of the fish, the areas they frequented and the benefits of wading,” and although her father hadn’t begun poling from a platform himself until 1996, Dana poled up there from the first as her father fished from the bow.

Concurrently, she was absorbing life lessons: Persistence. Never give up. “Find what inspires you and get after it!”

All in a Day’s Work

Dana became a professional guide at her father’s suggestion, and his logic was unassailable.

“She knew how to pole and loved bonefishing,” Donnie says. “And she was good at it; she’d go with the flow, and she fit in as soon as people saw and experienced how natural it was for her.”

Peter Mantle, owner of Delphi, recognized her potential, too, and brought her aboard. And her father’s fellow guides had watched Dana grow up, so they accepted her right away. Dana never looked back.


“In the beginning, I mainly worked the east side of Abaco, where I built my skills and started to make a name for myself,” Dana says. “But let’s be honest: Some fishermen were skeptical, to say the least, of booking a new guide and a girl at that. I knew I had a lot to prove.”

She soon found her voice and sea legs, though, and “felt comfortable enough to accompany my dad on trips to the Marls, where he taught me a whole new area. While the rules of bonefishing are all relatively the same, I learned quickly that these fish tend to set a few rules of their own.” While her father’s favorite flies are the Gotcha and the Crazy Charlie, as her confidence grew, Dana became partial to the spawning shrimp.

Eight years on, whether guiding for the Delphi Club or taking out a private charter on her 17-foot Mitzi skiff, Dana’s workday entails rising before dawn for an in-depth check of the weather, driving her truck to meet the angler(s), trailering the skiff, donning sun protection,

and when necessary, teaching techniques from sighting to casting to stripping to keeping the fish wet.

“She’s got the boat skills, patience, great eyes and can see a mile,” says Delphi Club manager Max Woolnaugh. “Dana’s exceptional” because “she understands that there’s always more to learn. She is one of the best.”

For Dana, nothing is as thrilling as “helping someone who’s never done it before find the target, get the cast together, and then catch their first bonefish—I love seeing the excitement on their face.” 


The Lodge:



Photos: Sarah A. Cart

The Delphi Club at Rolling Harbour is a 20-minute drive from the Marsh Harbour airport. The plantation-style lodge and its jewel-like freshwater pool nestle in a low-key tropical Eden flowered with bougainvillea and frangipani and attended by a natural soundtrack of surf, birdsong and woodpeckers, and the steady breeze.

Comfortably relaxed while simultaneously elegant, the Club was fashioned by its owner/founder Peter Mantle as a sister to his Delphi Lodge in Ireland, a private 1830s country house in Connemara’s Delphi Valley famous for salmon and sea trout. Mantle is an old-style gentleman in the truest sense of the word, and an incredible host. At dinnertime guests gather

for cocktails and hors d’oeuvres, then sit together at one huge table for culinary delights paired with appropriate wines and punctuated with fish tales and laughter. 





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6th Annual New York City Dinner and Awards Ceremony

Photos courtesy of Rick Bannerot

Bonefish & Tarpon Trust was honored to present legendary angler Joan Wulff with the Curt Gowdy Memorial Award at the 6th Annual New York City Dinner in May. Former Federal Reserve Chairman Paul Volcker joined with more than 150 guests in making the tribute to recognize Wulff's commitment to conservation and outreach to others through teaching. The late Bill Andersen, a former BTT director, was also honored for his many contributions to the life and achievements of the organization. 🐟



Legend Joan Wulff receives the Curt Gowdy Memorial Award from Paul Volcker and Jim McDuffie.



BTT friends from across NYC fill the Union League Club Library for a special silent auction.



Joan Wulff visits with friends Edgar Cullman and Susan Waterfall.



Clark Van Nostrand, Paul Volcker, Walt Noonan and Aaron Kennon enjoy the evening.



Bidding is hotly contested among NYC Dinner guests.



BTT Director Dave Nichols with guests Tom Stoneback and Leigh Seippel.



Will Andersen pays tribute to his late father, Bill Andersen, BTT board member and former chair of the NYC Dinner Committee.

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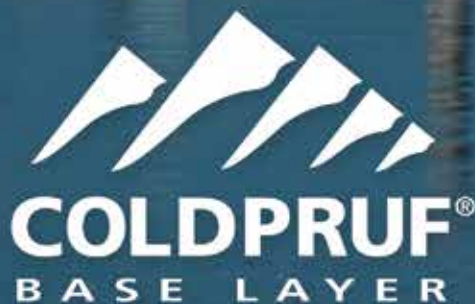




Photo: Justin Lewis

Is Urban Development Changing Bonefish Genes?

BY ANDY DANYLCHUK, PH.D.

Department of Environmental Conservation, University of Massachusetts Amherst

Since the late 1960s, the allure of the Sunshine State has drawn millions of people to Florida, particularly to the areas around Miami, Homestead, and the Florida Keys. Interestingly, along the same timeline, declines in the bonefish population of the Florida Keys have tracked with South Florida’s urban and industrial growth, including the hydrological reengineering of the Everglades.

Urbanization and industrialization can result in a myriad of contaminants entering the environment, ranging from heavy metals, such as aluminum and mercury, to organic compounds such as PCBs—all of which can impact the health of coastal fishes. Recent advancements in the field of molecular ecology called, epigenetics, could prove to be a valuable diagnostic tool for quantifying the impacts of contaminant exposure on the health of bonefish.


Epigenetics is the study of heritable changes in gene activity that are not caused by changes in DNA sequences, but rather from long-term alterations in gene expression caused by changes in DNA methylation. In simple terms, if DNA is the “hardware” of our bodies, then DNA methylation is the “software” that turns genes on and off. When contaminants in the environment affect gene expression through epigenetics, these changes can be passed on from generation to generation. This means that genetic-related impairment in today’s bonefish could be linked to what their great grandparents were exposed to. Moreover, depending on what genes are turned on and off, the impacts can influence growth, reproduction, egg viability, and even survival.

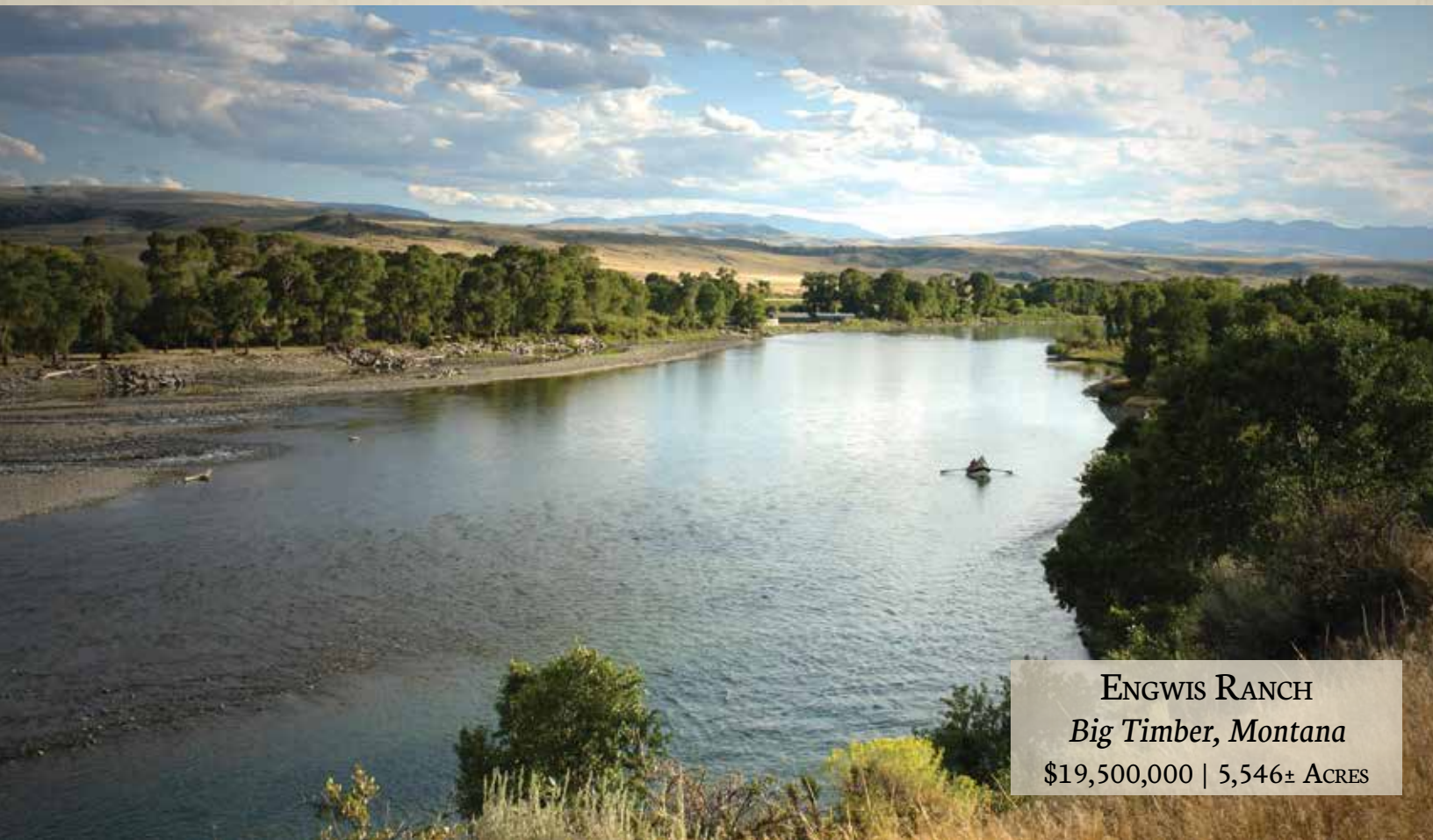
Since bonefish in South Florida have been exposed to a range of urbanization stretching from Miami to Key West, it is important to identify the possible impacts on the region’s bonefish. In a recent study, BTT relied on an epigenetics approach, which allowed our research team—Lucas Griffin, Dr. Jacob Brownscombe, Elizabeth

Punaska, and Dr. Kathleen Arcaro—to use a non-lethal and relatively inexpensive approach to addressing this important issue. For this study, we compared bonefish living near urban centers, such as Miami, to more pristine, remote locations, such as the Family Islands of the Bahamas.

In order to sample bonefish DNA non-lethally, we developed a method for taking blood samples instead of harvesting fish for tissue samples as was required in earlier studies. With this new technique, we were able to work with anglers and guides ranging from upper Key Biscayne (urbanized) to South Andros, Bahamas (remote, pristine) to capture and take small, non-lethal blood samples from bonefish, and then take these samples back to the University of Massachusetts Amherst for processing.

To date, the project has collected 75 non-lethal blood samples from bonefish from South Florida and South Andros ranging in size from 26-77 cm (10-30 inches). The results show that there is no significant difference in the global DNA methylation levels in bonefish whether they were caught in the shadow of Miami’s high-rises or the pristine backcountry flats of South Andros. What this suggests is that if there are any impacts of urbanization on bonefish, they are not occurring through altered gene expression caused by changes in DNA methylation.

One caveat is that, by chance, all of the bonefish sampled from upper Key Biscayne tended to be smaller than those collected elsewhere. However, given that epigenetic alterations work across generations, current body size and age should not skew the results. This bodes well for any potential restoration efforts for the bonefish population in South Florida. 



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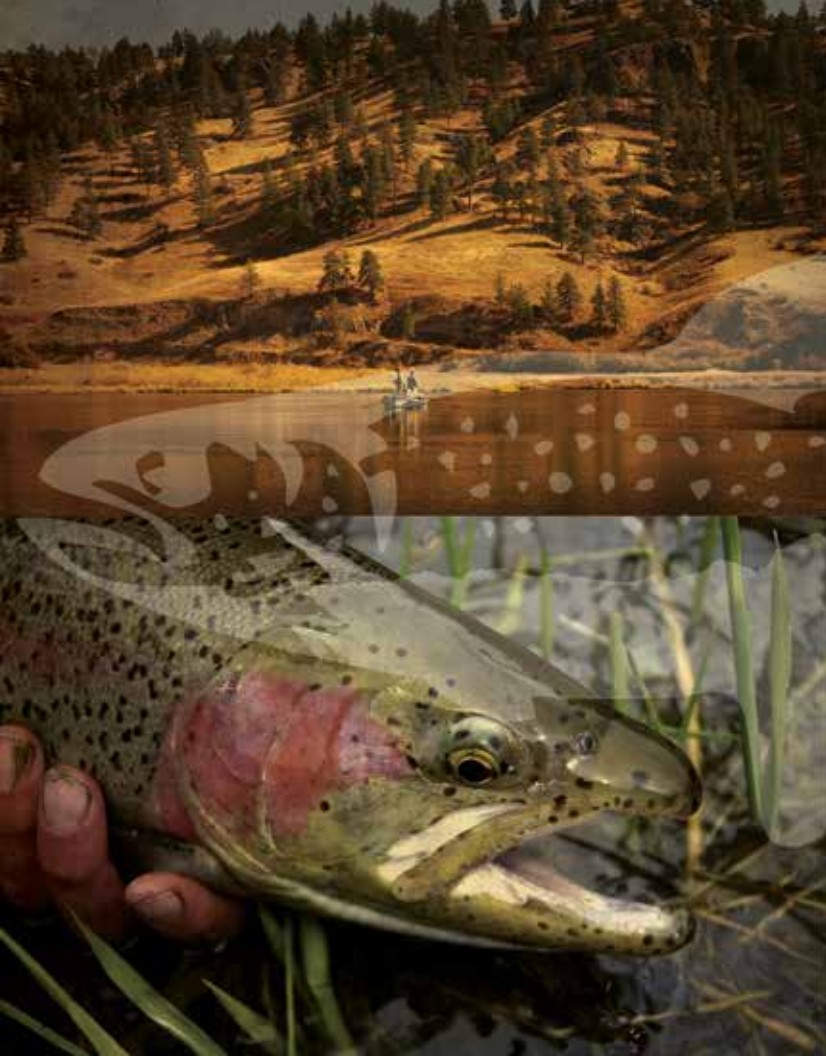
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