

INSIDE: HABITAT RESTORATION • BONEFISH GENETICS RESULTS • SAVING THE SILVER KING • PROJECT PERMIT

A publication of
**Bonefish
& Tarpon
TRUST**



BONEFISH & TARPON Journal

CONSERVATION THROUGH SCIENCE • SPRING 2019



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8th Annual NYC Dinner & Awards Ceremony
The University Club
April 9, 2019

BTT in New Orleans
Audubon Aquarium of the Americas
September 26, 2019

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

Journal

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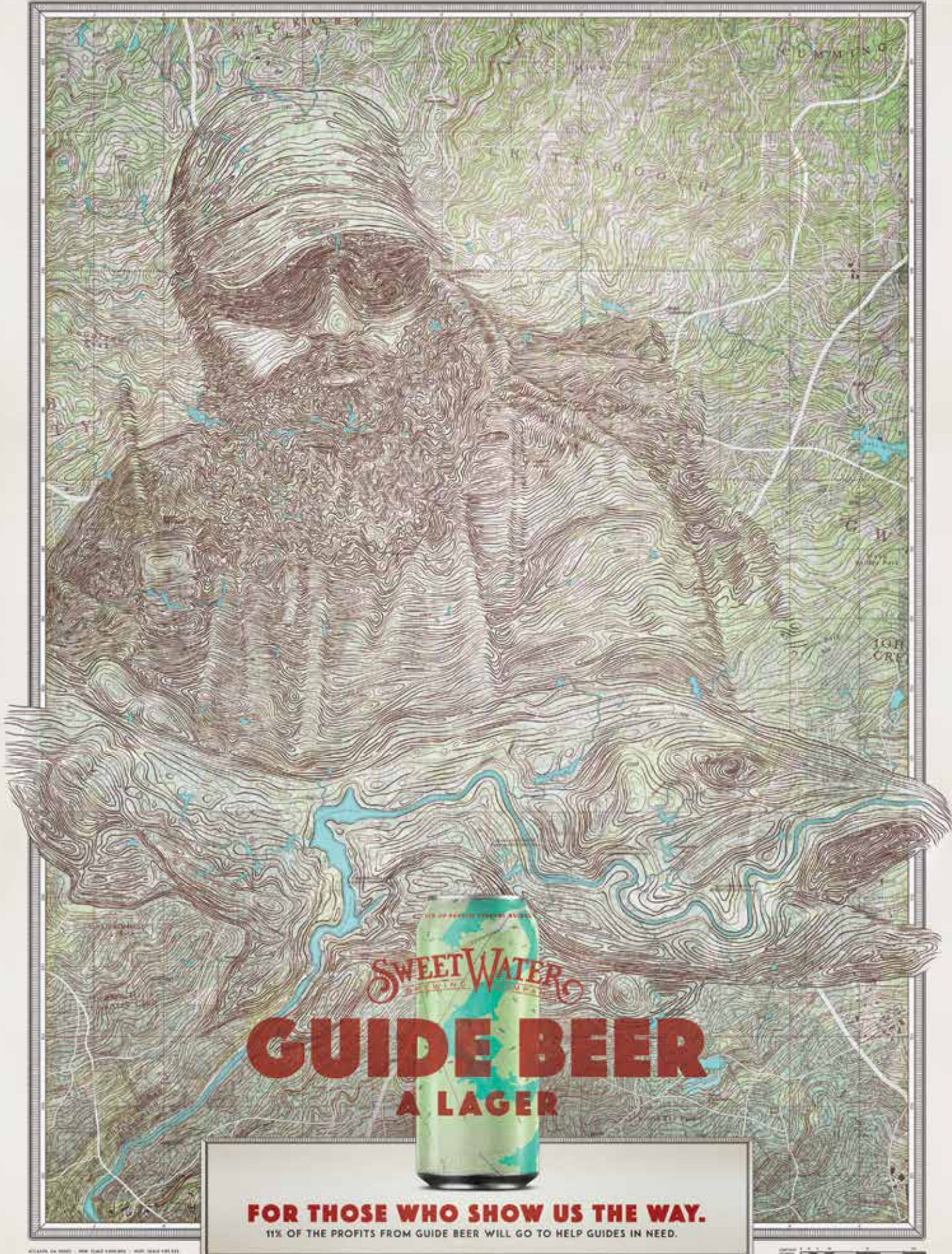
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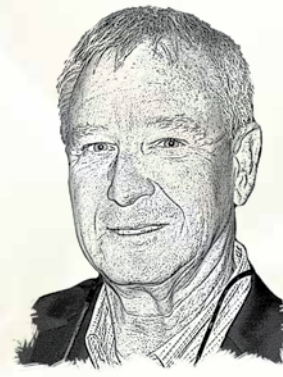
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Setting the Hook



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From the Chairman and the President

More fish in the water!

A friend of ours used these words recently to describe BTT's mission in simple terms. Whether the focus is on sustaining healthy habitats and populations of fish where they exist today or restoring them in heavily impacted systems, the goal remains central to our efforts—and we're making progress!

Examples of science-driven results being translated into conservation impacts abounded over the past year, and several are highlighted in this issue of the Journal.

BTT played a major role in the restoration of habitats critical to our fishery in 2018. In the Bahamas, we collaborated with Bahamas National Trust and a local community in East Grand Bahama to complete our first mangrove creek restoration. BTT scientists devised a plan and contracted work to cut three strategic passes through an old logging road that had blocked tidal flow and fish access on August Creek since the 1950s. Almost immediately, bonefish started using these cuts to access once blocked habitat and, as channelization continued, the creek stretched and meandered on its original path. This project is an excellent demonstration of what can be accomplished at such sites and inspires us now to tackle new creek restorations in 2019.


At the same time, BTT completed the restoration of a juvenile tarpon nursery habitat at Coral Creek Preserve in Southwest Florida. Working with the Southwest Florida Water Management District, we helped guide restoration of 20 acres at the site—an abandoned development with multiple canals and an inlet to the west branch of Coral Creek. The altered canals will provide improved habitat for juvenile tarpon and serve as a living laboratory for scientists to monitor fish growth rates and movements as well as assess the effectiveness of different restoration designs, all of which will inform future efforts.

Although still unfolding and years from completion, BTT and its partners also made excellent progress in 2018 on the largest and most significant restoration project impacting our fishery in Florida—the Everglades. Thanks to your support and advocacy, BTT joined

with its partners in the Now or Neverglades coalition to successfully advocate for passage of America's Water Infrastructure Act of 2018, which represents another major step in the decades-long battle to save the Everglades. The reservoir will send more clean fresh water south to the Everglades and Florida Bay while at the same time curtail damaging discharges from Lake Okeechobee to estuaries on Florida's east and west coasts. Much work remains as we shift our focus now to securing the federal appropriations needed to construct the reservoir, but we are heartened by the commitments made and actions taken by Florida Governor Ron DeSantis to support the effort and provide new hope for Florida waters.

In addition to these important restoration projects, BTT also posted science-driven results in other areas of conservation and fisheries management. There is no better example than Project Permit. To date, the project has acoustically tagged 113 permit, 69 of them in 2018, which have provided nearly half a million detections by our array of listening stations. These data points proved valuable in demonstrating that permit spawning aggregations were occurring earlier in the season than previously thought and helped convince Florida FWC to extend the spawning season closure to include the month of April. Likewise, our Tarpon Acoustic Tagging Project surpassed the threshold of 100 tagged fish in a study that no doubt will lead to similar outcomes in the future.

As we look to the future and chart a course for addressing conservation at scale, we are guided by the results of a major, multi-year bonefish genetics project that issued its final report a few months ago. A detailed analysis of 11,222 of bonefish fin clips, all provided by anglers, guides and partners, provides scientific evidence of a large and connected bonefish population across the Bahamas and Caribbean. Of particular note, some locations in the region have more direct, inter-related connections. For example, we know that Florida depends on spawns that occur in Belize and Mexico for a portion of its bonefish population. These findings make clear that our efforts to conserve any single location depend on conservation action at a larger scale.

We thank you again for your interest, advocacy and support, which are helping BTT conduct research and translate science-driven results into conservation impacts benefitting flats species, habitats and the larger fisheries they comprise. Or simply put, more fish in the water! 

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MARCUBA 2018: Conservation across Borders

Photo: Dr. Aaron Adams

BTT was honored to participate last October in MARCUBA 2018, the XI Congress on Marine Sciences, held at the Palacio de Convenciones, in Havana, Cuba. Jose Miguel Diaz Escrich, Commodore of the Hemingway International Yacht Club of Havana and a member of the MARCUBA 2018 Organizing Committee, extended the invitation to BTT to join representatives from 18 other countries at the triennial event. Commodore Escrich has been a champion of science-based conservation in Cuba and regionally. Just one year earlier, he attended BTT's 6th International Science Symposium, where he and BTT President and CEO Jim McDuffie signed an agreement to facilitate such exchanges.

For the first time in its history, MARCUBA included a symposium devoted to recreational fisheries. The spotlight shone brightly on BTT's mission, accomplishments, collaborative approaches, and current research efforts—all of which are aimed at ensuring effective conservation of species and habitats, locally and at scale. BTT's delegation included McDuffie, Dr. Aaron Adams, Director of Science and Conservation; Dr. Ross Boucek, Manager of BTT's Florida Keys Initiative; and Lucas Griffin, a collaborating scientist from the University of Massachusetts Amherst who leads BTT's Tarpon Acoustic Tagging Project.


The session's first presentation by Dr. Adams, "The Challenge that Ecological Connectivity Poses to Conservation of Coastal Marine Recreational Fisheries," set the stage for the day's productive exchange of information. The presentation pivoted on the message that effective conservation requires a comprehensive approach. As Dr. Adams explained, "Protecting bonefish, tarpon and permit is more than just protecting the habitats where we fish. We must also protect the spawning sites, juvenile habitats, and especially the connections between all of those habitats."

The importance of this theme was further illustrated by Griffin, who shared preliminary results from BTT's Tarpon Acoustic Tagging Project. The study, which has reached its halfway point, is beginning to provide data on tarpon movements and habitat uses, locally and at scale, including how these fish are crossing geo-political borders. The emerging picture will certainly influence the conservation of important habitats and fishery management at larger spatial scales.

Tarpon movement was also the topic of another presentation on the day's schedule. Zenaida Navarro, a BTT collaborator from the University of Havana, shared preliminary results from her study, "The Presence and Distribution of Tarpon in Cuba." BTT has provided support to the project. Not only will it enable the organization to be better informed when addressing future conservation needs in Cuba, but the resulting data will have applications to other locations.

"It's exciting to work with Zenaida and her colleagues to learn about Cuba's tarpon so she can apply this information to conservation," said Dr. Adams. "Working in pristine areas of Cuba also gives us an idea of what Florida looked like before we altered freshwater flows and developed our coastlines. By learning how tarpon use habitats in Cuba, we can better evaluate how our alterations of Florida's habitats have impacted tarpon, which can help guide our habitat restoration program."

In his presentation, Dr. Boucek outlined BTT's long involvement in the Bahamas, including the successful identification of important bonefish habitats and subsequent advocacy with the Bahamas National Trust to protect them. "In the Bahamas, we identified the habitats bonefish need throughout their lives and worked with our Bahamian collaborators to apply the scientific findings to habitat protections, including six national parks," Dr. Boucek said. "Now those habitats are safe and the fisheries in those parks should be healthy for the long-term. Institutions can apply our Bahamas model anywhere in the Caribbean." Dr. Boucek also represented BTT on a panel of experts who discussed biological connectivity across the Caribbean and how scientific results can be applied to regional conservation.

"MarCuba 2018 was a great opportunity to share our science and conservation successes, to learn from others doing similar work, and to forge new collaborations," said BTT President and CEO Jim McDuffie. "The more we examine the question of connectivity, the more we understand that premier angling locations across the Caribbean—Florida, the Bahamas, Cuba, Belize and Mexico—rely, to an extent, on other locations to sustain their healthy fisheries. We all have a stake in identifying and protecting pre-spawning aggregation sites, movement corridors between home ranges and spawning sites, and critical habitats. We're all in it together." 

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Three Join BTT Board

Bonefish & Tarpon Trust welcomed three new members of the Board of Directors in 2018—each distinguished in their commitment to conserving the flats fishery for the benefit and enjoyment of future generations.



Photo courtesy of Rich Andrews

Rich Andrews is a native of West Palm Beach, Florida, where he grew up fishing, sailing and diving. After earning undergraduate degrees in Business and Electrical Engineering at the University of Denver, Rich went on to a career in the Technical Division of the Adolph Coors Company where he developed and implemented methods of evaluating and maximizing the efficacy of the company's Research and Development portfolio. Rich has served on conservation, educational, healthcare and research related boards, including five years as Chair of The Billfish Foundation. He is also a current board member of the Guy Harvey Ocean Foundation. Rich has a special interest in the application of science to conservation.

"I believe non-government organizations are the only way to truly obtain non-biased understanding and action plans that have our natural resources as the genuine and ultimate priority," said Andrews. "Given that this blue ball we are riding around on is almost 80% water, along with my love of the outdoors and ocean, I have chosen to lend whatever efforts I can to organizations that embody these goals and ideals. Because the organization is positively influencing and impacting a multitude and wide variety of species and habitats, Bonefish & Tarpon Trust clearly grasps the concept of addressing and including all the stakeholders. The goals, the mission, and the impact are so much more than the name implies. I am excited to be a part of it."

“BTT’s success over the past two decades is due to the extraordinary leadership provided by our Board of Directors. We’re fortunate to have Jerry, John and Rich joining our ranks. Their leadership, commitment, and knowledge of the fishery will serve us well.”

-Jim McDuffie, BTT President and CEO



Photo courtesy of John Abplanalp

John Abplanalp was President and CEO of Precision Valve Corporation from 2003 to 2013 and served as Chairman of the Board (2013-2015). He has spent more than 35 years in manufacturing, including serving as Chairman of the Consumer Specialty Products Association. Since leaving Precision, John has applied his considerable expertise and experience to assist clients of his current company, Tight Lines Advisors. He earned a BS degree in Mechanical Engineering from Manhattan College and an MBA from Fordham University. An avid angler, John is a member of the Patroon Group and BTT’s 2019 NYC Dinner Committee. He previously served on the boards of the Billfish Foundation and Riverkeeper.

“I am grateful and humbled to have been considered and asked to join an organization that protects and supports species and an environment that I have been inexorably and passionately connected with for over 50 years when I was blessed to be first introduced to it all. It will be, and, truly is, my honor and pleasure to support Bonefish & Tarpon Trust and its efforts any possible way I can.”

Gerold “Jerry” Klauer is Managing Director of LakeWater Capital Management. A graduate of Fordham University and the Columbia Graduate School of Business, Jerry has had a Wall Street career that included positions at Laird, Inc., Mitchell Hutchins (later PaineWebber), and the highly regarded institutional research, sales, and investment banking boutique, Gerard Klauer Mattison Inc. During the 1990s, he was a regular guest host on CNBC’s *Squawk Box* show, and appeared often on Bloomberg, FOX Business News, and CNN, among other nationally recognized business news stations. Jerry has served as a trustee at Fordham University, including a term as chair of the University’s Investment Committee. He is an avid outdoorsman with a special interest in fly-fishing and bow hunting.

“I am honored to be part of a vibrant, dedicated and forward-thinking group of passionate fisher-people who recognize the importance of the environment,” said Klauer, who serves as Co-chair of BTT’s 2019 NYC Dinner Committee.



Photo courtesy of Gerold Klauer

Tippets

Short Takes on Important Topics



Lefty Kreh. Photo: IGFA

BTT, TU ESTABLISH KREH FUND

In memory of legendary angler and instructor Bernard “Lefty” Kreh, BTT has partnered with Trout Unlimited to establish the Lefty Kreh Memorial Conservation Fund. Kreh, one of the pre-eminent anglers of his day, was influential across freshwater and saltwater fly-fishing, beginning with paradigm-shifting casting techniques that revolutionized the sport. Through numerous books, articles, videos and public appearances, he became the most acclaimed fly-fishing instructor our sport has ever known, sharing his knowledge with countless anglers around the world. In addition to writing and teaching, Kreh played many other roles that further enhanced his legend and legacy. He was a former director of the famed Metropolitan Fishing Tournament in South Florida, a recurring cast member of the *Buccaneers & Bones* television program, creator of the popular “Lefty’s Deceiver” fly, and enshrined in the International Game Fish Association Hall of Fame. The Lefty Kreh Memorial Conservation Fund will provide support to important conservation projects advanced by BTT and TU, including joint projects by the two organizations that reflect the fishing continuum in most anglers’ lives, from coldwater fisheries to the flats and back again. To donate, please visit: BTT.org/leftykreh. 🐟

BTT ADDRESSES CAUSES AND IMPACTS OF RED TIDE AT CAPITOL HILL FORUM

Bonefish & Tarpon Trust was invited to participate in a special Capitol Hill Red Tide Briefing on September 27, 2018. Dr. Aaron Adams, BTT’s Director of Science and Conservation, addressed the likelihood that, although the organism that causes red tide is natural to the Gulf coast, human-introduced nutrients are enhancing red tide blooms. Dr. Adams also highlighted the deteriorating conditions along much of Florida’s coast—all due to water mismanagement. The panel was sponsored by the Ocean Conservancy and Citizens’ Climate Lobby, with Honorary Hosts Senator Marco Rubio and former Senator Bill Nelson. In addition to Dr. Adams, the panel included Rae Ann Wessel from the Sanibel Captiva Conservation Foundation, John Lai, from the Sanibel & Captiva Islands Chamber of Commerce, and Dr. Michael Crosby of Mote Marine Laboratory. 🐟

BTT RESCUES, RELOCATES TARPON

Responding to calls from concerned anglers, BTT acted quickly last September to rescue and relocate more than 60 tarpon from a construction site near Tarpon Springs, FL. Tarpon ranging in size from 12 to 40 inches were caught from an isolated and rapidly draining containment pond—a hard-won success after a day of seining and cast-netting in waist-deep mud and silt. After gaining permission from the developer and property owner, BTT Juvenile Tarpon Habitat Program Manager JoEllen Wilson was granted a permit by the Florida Fish and Wildlife Conservation Commission (FWC) to relocate the fish, allowing them to rejoin the regional tarpon population. “Tarpon use habitats degraded by development relatively frequently, but without a permanent connection from this pond to the estuary it’s unlikely that they would have been able to migrate,” said Wilson. “Our efforts to move them to a connected habitat gave them that chance.” Rather than making fish rescue a repeat performance, anglers and others need to work with BTT to prevent this scenario in the first place by protecting fish habitats. Stay tuned to BTT’s social media feed for more information on the Fish Habitat Management initiative. 🐟



Volunteers work to relocate tarpon. Photo: Randy Whitehead



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Mike and Meko Ginton. Photo courtesy of Meko Ginton

YOUTH AMBASSADORS WELCOME FIRST BAHAMIAN

Mike Ginton has joined the ranks of BTT's Youth Ambassador Program as the first Bahamian member of this group, created to inspire and encourage the next generation of flats anglers and conservationists. The ten-year-old Ginton is a third-generation flats fisherman from Grand Bahama. Mike was taught how to fish by his father Meko, who was taught by his father, Stanley Ginton. Mike and Meko spend plenty of time fishing in the pristine waters of Grand Bahama's East End and North Shore. Mike inherited his conservation ethic from his father and grandfather, who taught him that protecting the fish populations and marine environment is important for many reasons. "If we don't protect our local waters and environment by preventing overfishing and pollution, there will eventually be no fish left to fish for and no waters clean enough to swim in," says Mike. "And if the waters are polluted, no one will want to visit our beaches. It could also threaten my dad's job. If he's not able to make money guiding, he'll have less money to feed our family. Some people here also depend on being able to catch fish as a source of food. They could go hungry." 🐟

BTT SPONSORS BREEF WORKSHOP

BTT's Bahamas Initiative Manager Justin Lewis and intern Nina Sanchez participated last summer in the Bahamas Reef Environment Educational Foundation (BREEF) Workshop. The week-long workshop, held at the Royal Bahamas Defense Force base in Nassau, gave participants the opportunity to learn about marine conservation and fisheries regulations in the Bahamas. The diverse array of attendees included fisheries customs and defense force officers as well as school teachers from across the Bahamas. The group engaged in classroom lectures followed by field trip activities. Participants came to understand that, although fishermen and conservation organizations often have the same goals in mind, collaboration can be challenging, but absolutely necessary. BTT's collaboration with these groups has helped bridge the gap between stakeholders, bringing them together to work towards mutual goals. 🐟

MEMBERS-ONLY TRIP OF A LIFETIME

Congratulations to Richard Redd, the lucky winner of BTT's 2018 Trip of a Lifetime to southern Belize. A resident of Tampa, FL, Richard has been a member of BTT since 2015. He and a fellow angler of his choosing will be guided by famous permit master Lincoln Westby and his team of guides at Blue Horizon Fly Fishing for four days of permit fishing. They will also enjoy five nights in Dangriga at Thatch Caye, an all-inclusive Mu'Ono Resort. 🐟

BAHAMAS CONSIDERS ADDITIONAL HABITAT PROTECTIONS

BTT applauds the Bahamas National Trust for its ongoing efforts to protect important marine habitats in the Bahamas. BNT and partner organizations recently submitted a white paper to the Bahamian Government that identifies 43 areas for protection by 2020. Conservation action by the government in these areas will ensure that the Bahamas achieves the ambitious goal of protecting 20% of its nearshore marine environment by 2020. Included among the 43 areas are five priority sites supported by BTT that encompass important bonefish habitats. The sites include the expansion of The Marls of Abaco National Park and establishment of four new protected areas: Berry Islands-Pigeon Cay, Savannah Sound, Half Sound, and Long Island Marine Management Area. BNT's recommendations build on earlier national park and marine protected areas designated by the Bahamas, including six national parks named in 2015 with the assistance of scientific data provided by BTT. 🐟



Long Island. Photo: Justin Lewis

SPECIAL ISSUE: FISHES OF THE FLATS

BTT's 6th International Science Symposium in 2017 was the most successful ever and now the research presented there has been chronicled in the scientific journal *Environmental Biology of Fishes*. A total of 23 articles were published in the "Special Issue: Fishes of the Flats" after completing the scientific peer-review process. The articles detail the results of the many studies that were presented at the 2017 Symposium, as well as a few articles about research that were not presented. The Special Issue is significant because it updated both the scientific and conservation communities on the progress being made. This stimulates more research, adding even more important information to conservation and management. Publication of research in scientific journals also boosts the credibility of the work, providing additional leverage for including science in management plans. To view the full list of articles and request copies, visit BTT.org. 🐟

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Bonefish school. Photo: Cameron Luck

Making the Case for Bonefish Conservation as a Shared Resource

AARON J. ADAMS, PH.D.

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

As BTT and collaborating scientists build a better understanding of bonefish, it's becoming even more clear that a successful conservation strategy must be both local and regional. This means that we must enact conservation measures that protect local habitats that support juvenile and adult bonefish, the pathways that adult bonefish use to migrate from their home ranges to spawning locations, and their spawning areas. These habitats are subjected to many threats, including coastal development, poor water quality from pollution, heavy boat traffic, and dredging. These activities degrade habitats that are then less

able to provide the food and shelter required by bonefish, and negatively alter bonefish behavior. In addition, in some locations bonefish are targeted for harvest during their spawning migration and at the sites where they gather to spawn. Recent and ongoing research tells us that even as these threats must be addressed locally, the effects are regional.

BONEFISH BASICS

BIOLOGY

To set the stage for explaining how recent and ongoing research is leading us to a regional conservation approach, it's worth reviewing what we know about the bonefish life cycle. Throughout the article we'll circle back to this information to address the conservation consequences.

Tagging studies of bonefish in the Bahamas, Florida Keys, Belize, and Mexico show that adult bonefish live in relatively small areas for most of the year. For example, in Belize and Mexico, more than 70% of tagged bonefish that were recaptured were within one kilometer of where they were tagged. Results in the Bahamas were similar—60-80% (depending on the island) of recaptured bonefish were within five kilometers of the tagging location. In other words, bonefish have what we might call relatively small home ranges, so if a flat is lost or degraded it's unlikely bonefish "will just go somewhere else."

Adult bonefish break from this local existence when they migrate to spawn. Spawning season runs from late October through April, though it seems that peak spawning differs among locations. In the Bahamas, for example, the peak in Abaco appears to be October-



Fish kills, such as this one in the Indian River Lagoon, are the result of poor resource management practices. Photo: Marjorie Shropshire



November, while in South Andros it's December-January. In Belize, the peak seems to be December-February. And though spawning most frequently occurs near the full moon, we have documented spawning occurring at other stages of the lunar cycle. This variability is confusing since bonefish from a wide geographic range travel to a spawning site—migrations of 70 kilometers from home range to spawning site and back are common. So how do bonefish from distant flats know when it's time to migrate to spawn? That's a question we don't yet have the answer to, but we're working on it.

When bonefish finally reach the spawning area, they frequently stage on a flat for half a day or so, then move into deeper water (typically depths of 4 to 20 feet) and form what we call Pre-Spawning Aggregations (PSAs). These PSAs frequently have many thousands of bonefish. In the afternoon, the bonefish in the PSAs begin behaviors that we don't see on the flats: they jump out of the water, which is called porpoising, and bump into other fish, referred to as ventral nudging). There are numerous theories on what these behaviors mean—we're working on that one, too.

At dusk, the bonefish in the PSA migrate offshore. Over many hours, they slowly make their way into water that is thousands of feet deep, though they remain at the surface. When they are ready to spawn, they descend as deep as 200 feet. It's believed that spawning occurs at this depth or as the bonefish rush back toward the surface. They then return to the PSA site, and either remain there to go out and spawn again, or head home. One reason we don't yet know the details on the actual spawning act is that it occurs at night, in water thousands of feet deep, where plenty of large predators could potentially be feeding on these large aggregations. On a recent trip to track bonefish as they moved offshore to spawn, our boat was



One year after this bonefish was tagged, it was recaptured in the exact same location. Photo: BTT

circled on two consecutive nights by two tiger sharks, one on each night, estimated to be seven feet and nine feet long. That's a pretty strong deterrent to getting in the water to try to observe spawning.

Like most marine fishes, bonefish spawn by a method known as broadcast spawning. The aggregation is mixed males and females that eject their eggs and sperm into the water, where fertilization occurs. The eggs hatch in about 24 hours, and then the larvae that hatch from the eggs live as plankton in the open ocean for 41 to 71 days. The larvae that are lucky enough to survive and make it inshore to shallow



Inserting an acoustic tag into a bonefish to track the fish's movements.
Photo: Dr. Aaron Adams

areas transform into miniature versions of what we would recognize as bonefish. Research in the Bahamas has shown that juvenile bonefish require protected bays with sandy or sandy-mud bottoms.

ECONOMICS

Even people who don't fish for bonefish should be concerned about bonefish conservation because they are worth a lot of money. An economic study in 2009, for example, found that the recreational bonefish fishery in the Bahamas has an annual economic impact greater than \$141 million. The fishery is responsible for a high portion of the local economies on many of the Family Islands of the Bahamas. A study to update this estimate for the Bahamas is ongoing. The flats fishery in the Florida Keys has an annual economic impact of more than \$465 million, and more than \$50 million in Belize. This supports many thousands of jobs, and forms an important cultural component of these communities.

SPAWNING: CREATING THE NEXT GENERATION

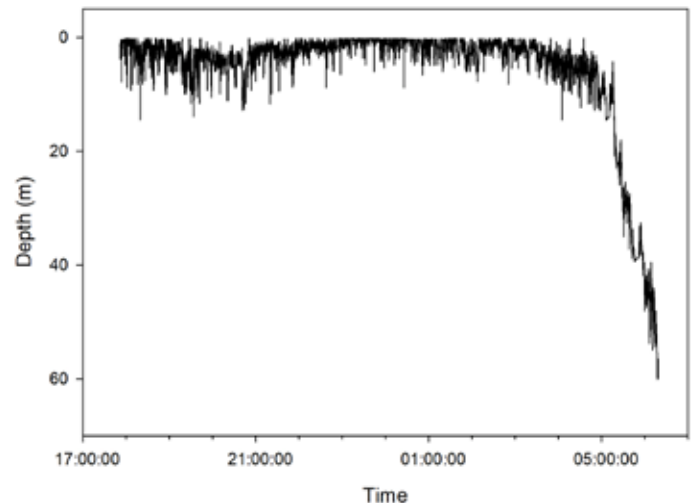
Research of the spawning process for bonefish has been ongoing since about 2009, when Dr. Andy Danylchuk and colleagues at the Cape Eleuthera Institute first documented that bonefish migrate from their home flats to PSA sites, and then migrate offshore at night to spawn. Since that time a great deal of effort has gone into determining the locations of other bonefish PSA sites, and to develop a better understanding of the spawning process. A recent trip to the Bahamas aboard the *M/Y Albula*, sponsored by the Fisheries Research Foundation, provides a glimpse at the progress being made.

A common method scientists use to track fish is acoustic telemetry. An acoustic tag that emits a supersonic ping is surgically implanted in a fish. The tag sends out a ping at regular intervals. The ping is detected by an underwater receiver (a.k.a. listening station) that is typically anchored to the bottom. The receiver records the tag number, date, and time of day. Alternatively, to track fish in real time, the tags are programmed to send out pings every few seconds, and the listening station is mounted on a boat that then follows the pings to track the fish.

On the recent research trip, a crew tagged three bonefish from a large PSA (more than 5,000 bonefish), and tracked them for more than 12 hours. When the crew first spotted the PSA and captured the bonefish to tag, the PSA was near the surface in 35 feet of water. At dusk, the PSA slowly began their offshore migration, and were soon in water more than 1,000 feet deep. Nearly 12 hours later, at 4:18 a.m., at a spot three miles from nearest land, in total water depth of nearly 5,000 feet, the bonefish descended to 200 feet, where they remained for at least an hour. Due to rough seas the crew lost the fish after an hour. But previous research tells us that after an hour or two at depth, the bonefish rushed back toward the surface. The next day, the crew found a PSA in the same inshore site, but the fish they had tagged the previous day were not detected—they likely had already headed home. This work revealed a few firsts:

- The distance the fish migrated from the nearshore pre-spawning site to the offshore spawning site (approximately eight miles) was longer than any previous tracks at this location;
- The distance from shore of the spawning site was farther offshore than previously documented;
- The depth to which the bonefish descended to spawn was deeper than previously documented;
- The total water depth at the spawning site was deeper than previously documented.

By this point you're probably wondering why bonefish would migrate from the safety of the flats, move offshore into extremely deep water



Depth profile of a tagged bonefish showing it going down to 60 meters (about 200') at 4 a.m.

The oceanographic study results showed that Belize and Mexico likely provide a lot of larvae to the Florida Keys, and even the likelihood of larvae from southwest Cuba reaching the Keys.

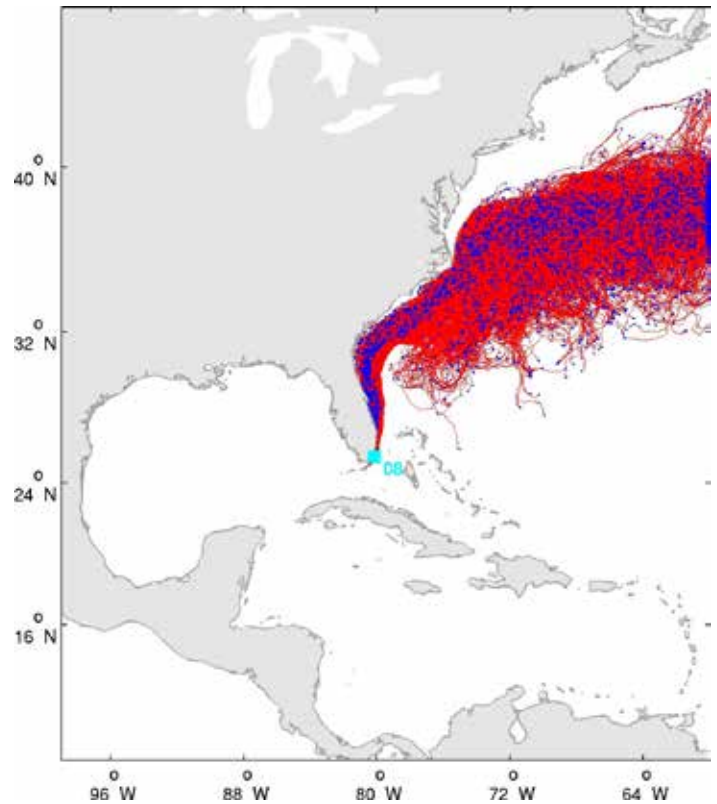
at night, and then descend to 200 feet to spawn. Remember that bonefish larvae live as plankton in the ocean for 41-71 days? By going offshore, the bonefish are putting their larvae into the location that gives them the best chance to use the currents to find a good juvenile habitat. So then the question becomes, where do the currents take the larvae? BTT funded research to address this question in two ways: oceanography and genetics.

REGIONAL CONNECTIONS: OCEANOGRAPHY AND GENETICS

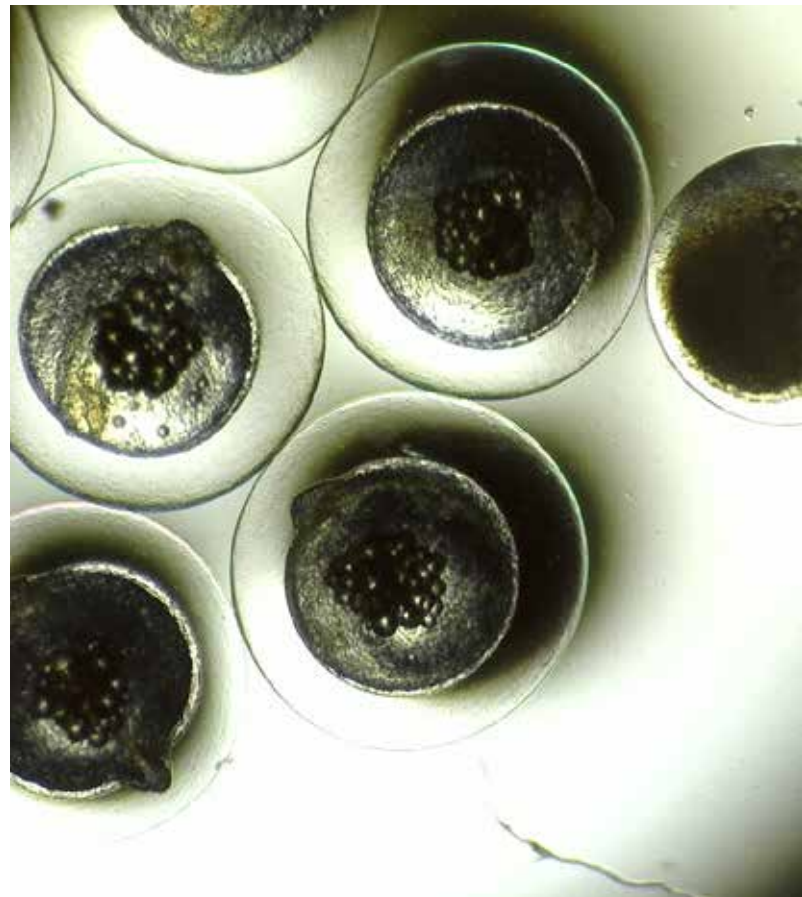
Recent technological advances have allowed oceanographers to achieve a much better understanding of ocean currents. BTT recently collaborated with a group of oceanographers to get a better idea of where bonefish larvae are likely to end up. We provided a map showing known and likely PSA sites for bonefish throughout the Caribbean. The known sites are where we had observed PSAs. The likely sites were either where PSAs had been reported by guides and anglers or where the geography matched what we had documented for the known sites. This included sites in the Bahamas, Cuba, Florida Keys, Belize, Mexico, Puerto Rico, U.S. Virgin Islands, and Vieques, Venezuela—all locations with known recreational bonefish fisheries.

The oceanographers then used computer models that are based on real readings of ocean currents to inject 100 'virtual bonefish larvae' into the water at these sites at the full moons between November and April for a five-year period, and kept the larvae in this virtual ocean for 53 days. This resulted in the paths of thousands of larvae being estimated by the computer models. The computer model study concluded that many larvae remain in the vicinity of where they were spawned, but that many are transported to distant locations—the ratio of staying local vs. distant travel differed among locations. In other words, to some extent, some local bonefish populations are responsible for a large portion of producing the next generation. But all populations receive larvae from other locations, and some populations receive a lot of larvae from other locations.

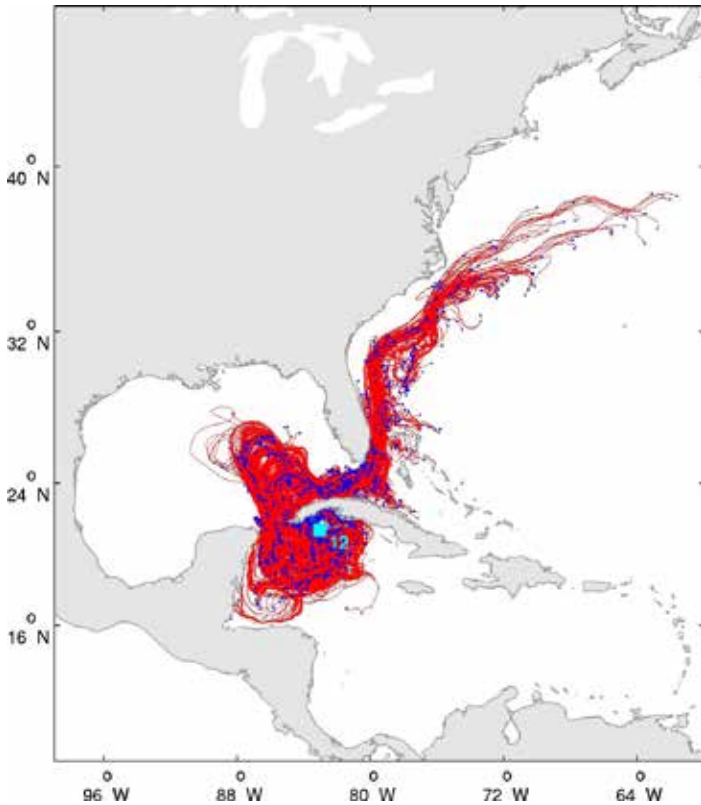
The oceanographic study results showed that Belize and Mexico likely provide a lot of larvae to the Florida Keys, and even the likelihood of larvae from southwest Cuba reaching the Keys. The study also estimated that depending on where bonefish in the Florida Keys spawn, the Keys bonefish population could depend almost entirely on larvae from elsewhere or provide a lot of its own larvae. As you might expect, there is a high level of connectivity among the



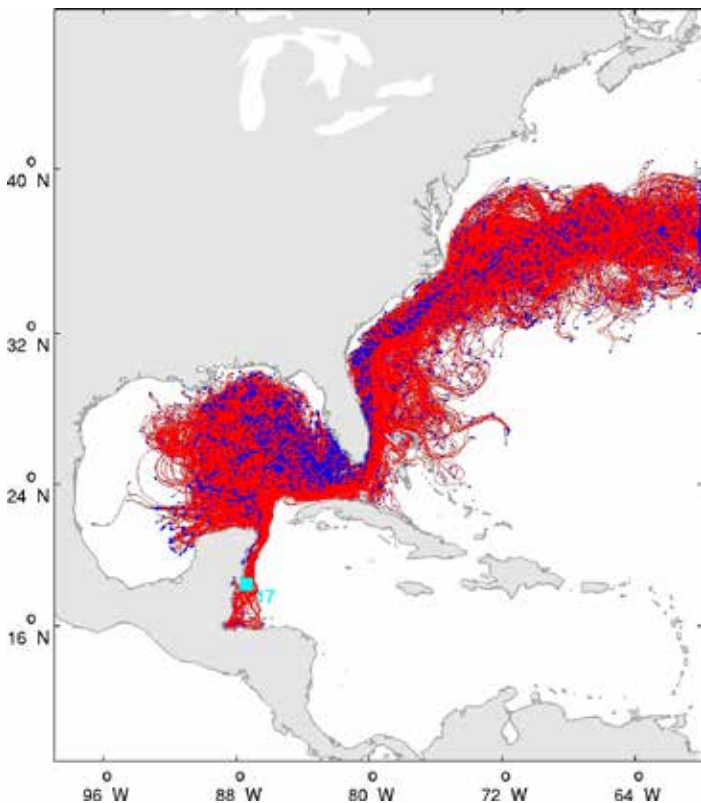
The overlapping pathways of thousands of virtual larvae are depicted in red. The blue dots are where the virtual larvae end up at 53 days. If bonefish spawn in the middle or upper Keys, it's likely that most of the larvae are lost to the Gulf Stream.



Fertilized bonefish eggs developing into larvae. Photo: Dr. Jon Shenker



Bonefish larvae spawned in southwest Cuba can populate Cuba, Mexico, and the Florida Keys.



It's likely that a significant portion of larvae entering the Florida Keys originate in Mexico and northern Belize.

islands in the Bahamas, as well as between the Bahamas and the north coast of Cuba. And because the currents are so strong, it's even likely that larvae from spawning in the eastern Caribbean, at Vieques, reached bonefish populations in the western Caribbean. This oceanographic study was the first ever of bonefish larval transport by ocean currents, and gives us a good framework for creating a regional conservation strategy. But it won't be the last. This study treated bonefish larvae as passive particles in the surface waters of the ocean, entirely at the whim of ocean currents. Though this provides a very good approximation of where these larvae will end up, it's not 100% accurate. This is because bonefish larvae—like all marine fish larvae—are capable of a limited amount of swimming. They don't have enough swimming ability to swim against strong ocean currents, but they can move up and down in the ocean. For example, some species can move a couple hundred feet down from the surface during the day and back to the surface at night. Since deeper ocean currents can differ somewhat than surface currents, knowing larval behavior can modify and improve the oceanographic model estimates.

This brings us back to the recent research trip to the Bahamas aboard the *M/Y Albula* to study bonefish spawning. We also continued research to understand bonefish larval behavior. We did this by catching bonefish from a PSA, placing them in large tanks on the liveaboard vessel. When these bonefish spawned we collected the fertilized eggs, were able to get some to hatch, and used special tanks to grow the larvae. On the recent trip, we were able to grow the larvae for 66 hours—the longest this has been done for bonefish. In fact, it was only last year that, for the first time ever, the team spawned bonefish and hatched eggs to larvae. By the time the larvae reached 66 hours old, they were still mostly hovering motionless in the water, but were showing swimming abilities. As this research continues, the team will eventually be able to grow larvae for the entire larval period, and learn enough about their behavior to improve the oceanographic models.

As the oceanographic study was ongoing, many of you were helping us collect fin clips from bonefish around the Caribbean for the Bonefish Genetics Study.

The genetics study provided another way for us to estimate the level of connectivity between bonefish in different locations. The oceanographic study suggested that bonefish in separate locations were connected by larvae being transported by ocean currents. But would this be reflected in bonefish genetics? Would we be able to determine that bonefish in the Florida Keys are genetically related to (as in, they have relatives in), say, bonefish in Belize and Mexico, or even Cuba? Are enough larvae being transported that bonefish in separate locations are closely connected, and even interdependent?

Thanks to your efforts, more than 13,000 bonefish fin clips were collected from Florida, the Bahamas, Cuba, Mexico, Belize, Cayman Islands, Honduras, Nicaragua, Puerto Rico, U.S. Virgin Islands, Turks and Caicos. The results reflect the findings of the oceanographic study. On the broad scale, bonefish throughout the Caribbean share

enough genetic similarities that we can consider the region to have a connected population. This doesn't necessarily mean, however, that locations are directly connected. For example, it's highly unlikely that a larva spawned in Vieques reaches the Florida Keys, much less the Bahamas. Instead, the relationships are probably step-by-step: a larva spawned in Vieques, for example, reaches the Cayman Islands; a larva spawned in the Cayman Islands reaches Mexico or southwest Cuba; a larva spawned in Mexico or southwest Cuba reaches the Florida Keys. Thus, locations that are closer together are likely more connected—by *closer together* I mean close in space, like northern Cuba and the southern Bahamas, or seemingly made closer by strong currents (the stronger the currents the faster larvae are transported), like Mexico and the Florida Keys.

Now that we know that bonefish in Mexico, Belize, Cuba, and Florida are connected, we can envision some of the possible connections as we plan the next level of oceanographic and genetic research.

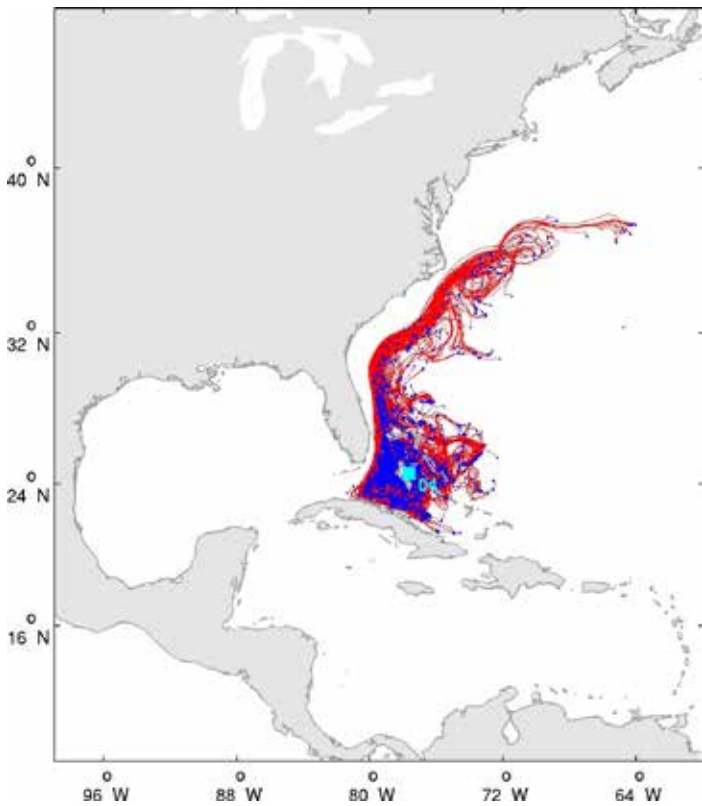
For example, the relationship between Mexico and Belize and the Florida Keys is a one-way street because of the strong currents, with larvae from spawning in Belize and Mexico reaching the Florida Keys. We might also envision larvae from southwest Cuba reaching the Florida Keys. Or perhaps larvae are transported from Cuba to Belize and Mexico, then grow up to spawn and send larvae to the Florida Keys. And as you might expect, the islands in the Bahamas are strongly connected, and there are even connections between the Bahamas and Cuba. Additional, ongoing analyses of the genetic and oceanographic data, as well as future studies, will further reveal these relationships.

CIRCLING BACK FOR IMPROVED DATA

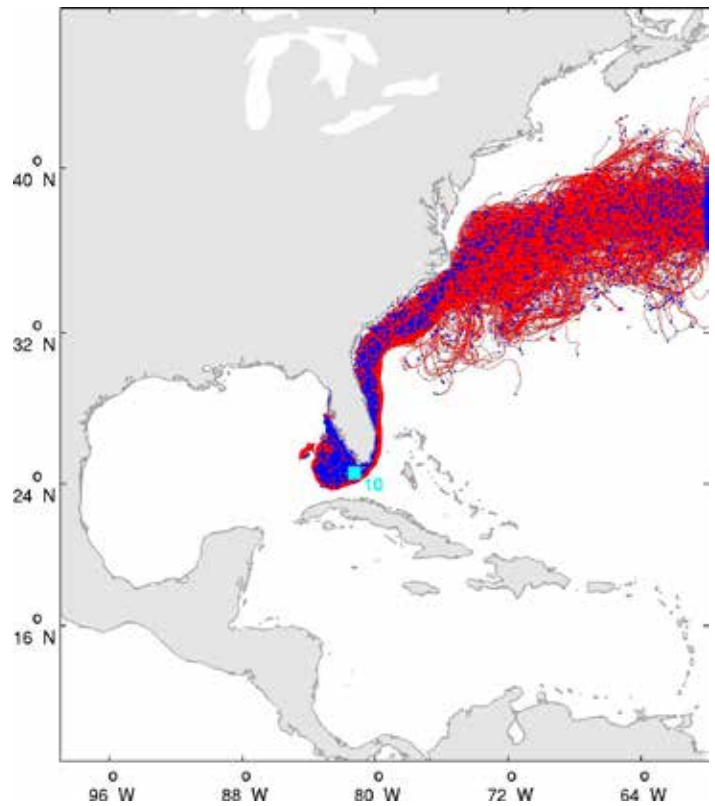
This new information not only helps us revise and improve our conservation strategy, it guides the next steps in research. As we get a better idea of what bonefish require for spawning, we'll get better at finding additional PSA sites. This has already been the case in Belize,



A 66-hour-old bonefish larvae. Photo: Dr Jon Shenker



Spawning in the southern Bahamas likely contributes larvae throughout much of the Bahamas as well as northern Cuba.



If bonefish spawn in the Lower Keys, it is more likely that larvae will remain in the Keys.



Bonefish being released after being tagged. Photo: Dr. Aaron Adams



A bonefish fin clip ready for the sample envelope. Photo: Dr. Aaron Adams

where a combination of local knowledge and tracking research have identified a PSA site. And we are getting closer to finding PSA sites in the Florida Keys and Cuba. The fact that bonefish are willing and able to go three miles offshore to spawn further increases the likelihood that the larvae are being carried to distant locations, further supporting our findings of connectivity. But this also means that as we revise the oceanographic models to include new information about bonefish larval behavior, we might have to move some of the spawning sites used by the computer model farther offshore. We'll also continue the research to figure out how bonefish know when to migrate to spawn so we can get a better idea of the peak lunar spawning times. Given that ocean currents can differ among moon phases, which might cause larvae to be transported different distances, this is another important piece of the puzzle.

ACT LOCALLY, BE REGIONALLY AWARE: FOCUS ON HABITATS

A common misperception among resource and fisheries managers as well as policymakers is that since the bonefish fishery is catch and release, no real management action is needed. Fish aren't being harvested, so there are no worries. This couldn't be further from the truth. As go the habitats, so go the fish. The amount and quality of habitat influences fish population size. This means that as habitats are lost, the ecosystem loses its ability to support fish and their prey. So as we lose habitats, the maximum possible size of a fish population also declines. This means that areas where large amounts of habitat have been lost or degraded will never have fish populations as large as they were historically, even if fishing stops. Fish need healthy habitats to survive—it's that simple. This is why so much of BTT's focus is learning how fish use habitats and then using this information to protect and restore these habitats.

Most threats to bonefish and their habitats are common to all locations, but may have local twists on the theme. Habitat loss and degradation are top on the list. In the Bahamas, this takes the form

of coastal development—some of which has already occurred, some is ongoing, and some is planned. There have been proposals for everything from mining for sand on sand flats to constructing a deepwater port at a PSA site. The twist on this in Belize is that ongoing coastal development includes everything from building over-the-water resorts on flats to dredging flats to build up the amount of land on mangrove islands that are then developed. Sadly, Leonardo DiCaprio's proposed resort, Blackadore Cay, set a precedent by obtaining first-of-its-kind permission to build over-the-water structures in Belize. Although the resort plan appears to be abandoned, other resorts have used that precedent to their advantage, to the detriment of flats habitats. Florida's fishery is suffering from the legacy of water and land mismanagement and related ills including seagrass die-offs, harmful algae blooms, and fish kills. In Cuba, overfishing outside of the protected areas where the flats fishery occurs is a top concern.

The take-home message should be clear: as we learn about habitats used by bonefish, we need to enact regulations to protect these habitats. This is a local issue. Whether larvae are being produced locally or are coming from a distant source, the bonefish in our home area (wherever we may be) need healthy habitats to be successful: larvae need clean water to survive and healthy sandy bays to change into juveniles; juveniles need healthy habitats and plenty of food to grow quickly; adults not only need healthy habitats to forage, but safe passage for spawning migrations and unfettered access to spawning sites. But we also have to make sure that others are doing the same, because we're all connected, at least to some extent—some more than others. A fishery collapse in one location can have unforeseen consequences in another location.

The encouraging news is that we've brought enough new scientific information to the table to clearly demonstrate that a focus on habitat is essential to the future of flats fisheries wherever they occur. With this information in hand and strong advocacy from the fishing community, we can be successful. 🐟



Nursery Habitat Restoration: Worth the Wait

JOELLEN WILSON

BTT Juvenile Tarpon Habitat Program Manager

The “patience of a saint” is an essential virtue for those engaged in habitat restoration. After four long years, the tarpon nursery habitat restoration project at Coral Creek Preserve in Southwest Florida has been completed. Coral Creek was originally planned as a residential community with saltwater access, then abandoned. Six adjacent canals are connected by a main canal that has an inlet to the west branch of Coral Creek. The original habitat restoration plan was to fill in the canals, returning them to their natural pine flatwood topography. But after discovering the presence of juvenile tarpon, the Southwest Florida Water Management District (SWFWMD) changed their plans.

The six canals, with close proximity to the famous Boca Grande Pass, serve as the perfect location to test various tarpon nursery habitat designs. From previous studies, we have identified the habitat characteristics that are appealing to juvenile tarpon, but we don’t know which are the most important. With the help of scientists from the Charlotte Harbor National Estuary Program (CHNEP) and the Florida Fish and Wildlife Conservation Commission (FWC), we settled on three different experimental designs to be duplicated and tested in the six canals.

The first design features a shallow mouth (also called a “sill mouth”) at the connection to the main canal, which acts as a restrictive barrier during low tides. Restricted access to nursery habitats benefits juvenile fish by preventing large predators from entering. Our previous juvenile tarpon research at nearby Wildflower Preserve revealed that the majority of juveniles migrated from the nursery habitat during the summer months. The summer months in southwest Florida typically coincide with the highest water levels, therefore the sill mouths would not impede the juvenile tarpon from leaving. In the first design, we also included a deep hole followed by a shallow creek. Juvenile tarpon spend multiple seasons and potentially multiple years in the nursery habitat. The deep hole serves as a temperature refuge by providing warm water during winter cold snaps and cooler water in summer. Juvenile tarpon can also be seen rolling at the surface to “gulp” air because of the low dissolved oxygen in these backwater habitats. Although the low oxygen content helps to keep large fish out of these habitats, the rolling behavior likely rings the dinner bell for wading birds that can frequent these habitats. Research suggests that tarpon can hide in the deep holes to evade avian predators.

The second design also includes the deep hole, but instead of a sill mouth we included an open, flowing connection that is continually accessible to fish. This will give us a chance to test the hypothesis that the sill mouth prevents predator access and is in fact an essential characteristic of nursery habitat. Although this connection will provide access to predators, it will also allow tarpon to move in and out of this particular habitat treatment throughout the year. Studies on juvenile snook show that, like humans, some have a preference for travel while others are “homebodies.” If this is the case for tarpon, that is vital information that we need for future design plans.

The third design includes the tidally exclusionary sill mouth of Design #1, but forgoes the deep hole and follows the topography of a meandering shallow creek. This treatment will allow us to compare the importance of the deep hole as a necessary nursery habitat element; it may not be necessary if the dark estuarine water with mere inches of visibility provides enough cover from predatory birds looking for an easy meal.

The flexibility of SWFWMD to change tactics created an unprecedented research opportunity, which will provide a better understanding of the habitat needs for Southwest Florida’s



Tagging a juvenile tarpon. Photo: BTT

economically important fish species. The already drastically reduced amount of habitat in Florida and globally, coupled with continuing habitat decline, means that habitat restoration gives us the best opportunity to increase the amount of nursery habitat and improve the overwhelming amount of degraded habitat.

In January 2016, BTT began its Juvenile Tarpon Habitat Mapping Project, which uses anglers to identify nursery habitats harboring tarpon 12 inches or less and assess them as natural or altered/degraded. Over 65% of the angler reported habitats that were inhabited by juvenile tarpon were classified as altered or developed. One question we’re occasionally asked is, “If tarpon are there, doesn’t that mean it’s a good habitat?” The answer: “Not necessarily.”

The presence of juvenile tarpon appears to be a false indicator of habitat quality. This came to light at the Wildflower Preserve, an altered habitat in southwest Florida. Although we found large numbers of juvenile tarpon there, their growth rates, a reliable measure of habitat quality, were extremely slow: one inch per year at Wildflower versus 10 inches per year in other studies, indicating that Wildflower was not a good quality juvenile tarpon habitat. Therefore, we can’t use the presence or absence of a species as the sole determinant of habitat health. Most importantly, this reminds us that we can no longer sit idly by as vital nursery habitats are impacted by coastal development, changing water flows and increasing nutrient runoff. Habitat restoration is the solution for cleaning up the mess we’ve created, even as we ramp up efforts to protect the healthy habitat that remains.

Over the next 12 to 18 months, we will be sampling monthly at Coral Creek, including PIT-tagging all captured juvenile tarpon with Passive Integrated Transponder (PIT) tags. We’ll also construct antennae that

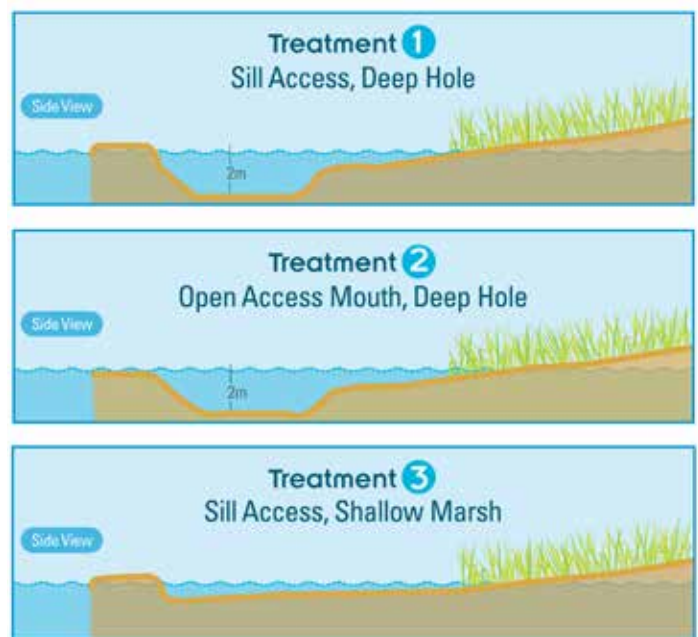


Canals during restoration. Photo: SWFWMD

detect PIT-tagged tarpon, similar to the way that automatic toll booth systems work. When a PIT-tagged tarpon swims past an antenna, the antenna records date, time, and PIT identification number. This will allow us to track tarpon as they use the different restored creeks, and eventually leave the system to Coral Creek. We'll also be able to estimate juvenile tarpon growth rates, survival rates, and abundance by recapturing tagged fish over the 18-month study period.

The completion of the nursery habitat restoration project at Coral Creek Preserve will not only increase the amount of quality nursery habitat in the region, it will also give us a better idea of what juvenile tarpon need. BTT's mapping project has compiled a list of priority sites that make excellent candidates for habitat restoration. Once we know what tarpon want, we'll be able to replicate those design elements in future habitat restoration projects and slowly change the ratios of "degraded" nursery habitats to "restored."

Monitoring at the Coral Creek site is underway. In a December sampling, BTT scientists captured and tagged six juvenile tarpon. We'll be tracking these tarpon over the next couple of years to study their movement patterns, survival and growth rates, and detect when they leave the nursery habitat and emigrate into the estuary. 🐟

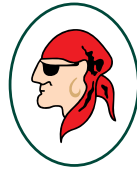


The Coral Creek Habitat Restoration Project will feature three different habitat designs to test which nursery habitat elements are best suited for juvenile tarpon. Diagram: Thrive Creative Labs



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Betsy Bullard

Making No Bones About Salt, Snook and Snacks

BY KRIS MILLGATE

Swing a wide left and tuck in tight behind the mangroves. Get way back in there. Way back where the wind lays down and so does the water. Back where it's so steamy hot, your eyeballs bake when the boat slows from transit to hunt.

Now quiet your conversation and steady your stance for a solid throw of line. Better yet, hold your hand and let Betsy Bullard throw first. Her best casts unfold on flats where bonefish comfortably hang and so does she.

"It's like my world shrinks down into a visual tunnel on those tails and that's all that's in my head," says Bullard, a BTT Honorary Trustee. "Make a decent cast to tailing fish. That's all that exists in that moment. I don't hear anything else and I don't see anything else."

SALT

Post hook-up, tunnel vision releases and Bullard sees the sea for what it is, a struggling estuary she's helped keep afloat for decades.

From her days of running a fishing lodge in Costa Rica through her tournament years in Florida, Bullard's efforts to keep fishing are relentless.

"She's really delved into the sport in a big way," says Jeff Storm Harkavy, a BTT founding board member. "She's been a constant giver for 20 years and she can always be counted on to fill a table or invite a friend to join our cause."

BTT's cause soaks in saltwater. It's the same type of water Bullard grew up fishing with her dad in Virginia, but it's her son Jesse who sent her farther south in 1998. He moved to Florida for college. She moved to Florida for fish.

"Saltwater fishing is my whole world," Bullard says. "I told myself I would spend as much time, effort and money as I could to help it."

When Hurricane Irma swamped Florida in 2017, guides needed work. They found it in fishing tournaments organized by Bullard. When



Betsy wading flats. Photo courtesy of Betsy Bullard

a freeze tanked bonefish numbers in 2010, she added redfish to spring tournaments and permit to fall tournaments to keep the sport afloat. And farther back, around 2000, when circle hooks first hit the market, Bullard's lodge was one of the first to switch regardless of the suspected catch rate reduction. Now circle hooks are standard and tournaments have waiting lists while Bullard herself is changing course. She retired from hosting tournaments in 2018.

"I just woke up one morning and said, 'I'm going to retire,'" she says. "I still host fishing trips, but it's kind of hard to call that work."

SNOOK

Bullard has two fin favorites: snook and bones. She officially holds a record with International Game Fish Association for a 37-pound snook caught in Costa Rica in 2008 and she unofficially spends a record amount of time chasing bonefish. The former International Women's Fishing Association president is an opportunist so she throws to whatever fish are eating to increase her odds of a take. Those takes tug less and less as snook and other saltwater fish decline.

"I caught two snook and one redfish in one day," she says. "That's the only fish I saw all day and that's considered a great day. Three fish for this area is not right. The opportunity is nothing like it used to be."

The downgrade is happening so fast, Florida fishers easily remember days in recent years that live up to the state's famous fishing reputation, but that reputation is drifting away.

BTT is working on why. Dr. Aaron Adams, BTT's Director of Science and Conservation, met Bullard during her lodge hosting days in Costa Rica. She offered to let researchers follow her bait man for collection of bonefish fin-clip samples. Those 17 samples supported scientific identification of a new bonefish species, *Albula pacifica*, found in the tropical eastern Pacific. It's now one of 12 bonefish types found worldwide.

"She's super energetic about fishing and helping with conservation," Adams says. "A lot of people like to fish, but don't have an interest in conservation. She gets both sides of that coin."

SNACKS

No one starves when they're tucked back in the mangroves with Bullard. That's one of the reasons Steve Thomas likes to fish with her. He's a backcountry flats fishing guide in the Keys and Florida Bay. He's lost count of how many times he's watched Bullard hunt bones in backwater, but he knows he's had great snacks every time.

"She brings fancy hors d'oeuvres and good stuff," says Thomas, The Natural Fishing Charters guide. "Not just plain potato chips. She brings crackers with fancy seeds and gourmet cheese."

She also brings a lively attitude and a competitive arm. She's seen just about any scenario salt sprays at anglers and she keeps her head every time.

"She's well rounded about everything because she's been around fisheries a long time," Thomas says. "She sees the critical need to protect water and she has a really good grip on how fragile the environment is."

In contrast to the fragile fisheries she heralds, Bullard is confident and sturdy. She'll step up on the bow of any boat while her eyes zoom in on that tunnel of tails. She'll toss out something for those

tails to eat while everyone else on the boat eats her snacks and laughs at her jokes.

"She's as adept in backcountry as she is offshore," Harkavy says. "Not a lot of anglers fish well in both realms. Plus she laughs a lot, tells a lot of jokes and catches a lot of fish."

Florida fish specifically, and Bullard is worried about them. The water issues drowning the Sunshine State boggle her mind. The dying Everglades break her heart. That's why she's not resting even though she's retired.

"Being on the water is like being in church for me," she says. "I'm a swamp girl at heart. I love being between mangroves and flats. That's when I'm in heaven. 🐟"

Outdoor journalist Kris Millgate is based in Idaho where she runs trail and chases trout. Sometimes she even catches them when she doesn't have a camera, or a kid, on her back. See more of her work at www.tightlinemedia.com.



Photo courtesy of Betsy Bullard

When one tugs at
a single thing in
nature, he finds
it attached to the
rest of the world.
-John Muir



tail

FLY FISHING MAGAZINE

DEDICATED TO SALTWATER FLY FISHING AND OUTDOOR LIVING



DR. ANDY DANYLCHUK AND LUCAS GRIFFIN
UNIVERSITY OF MASSACHUSETTS AMHERST

DR. JACOB BROWNSCOMBE AND DR. STEVEN COOKE
CARLETON UNIVERSITY

To Save The King

In the eyes of the Silver King (aka Atlantic tarpon), what is the extent of its kingdom? We have a good idea where tarpon reside when we actually see them—they are quite obvious to the naked eye, especially when doing acrobatics on the end of a fly line—but where do they go the rest of the time? Past scientific research suggests that adult Atlantic tarpon in excess of 100 pounds are able to make extensive migrations, from places like the Florida Keys to the upper panhandle and the mid-Atlantic, but this does not fully align with anecdotes from guides and anglers who chase the King from day to day, across seasons and years. Do all tarpon make seasonal migrations? Do their movement patterns change as they grow in size? What cues do tarpon use to know when and where to move? Do they return back to the same place where we caught them some time later?

How can we help save Silver Kings for future generations of anglers to enjoy if we do not have a complete picture of where the fish live and how they use their kingdom? Given that our oceans and their coastal waters face myriad natural and human-based threats, tarpon likely run a gauntlet of risks in the places where we frequently see them, as well as in the places we don't. As we embrace the concept of regional connectivity for conservation, it is important to fill the knowledge gaps in our understanding of the movement patterns and essential habitats of the Silver Kings. Doing so will allow us to develop effective conservation strategies, form collaborative partnerships, and press accordingly for regulations that match their spatial ecology.



Photo: Adrian Gray

To address this critical need, we have embarked on a multi-year tagging study using acoustic telemetry to learn more about the movement patterns of Atlantic tarpon in the waters of the Gulf of Mexico and Southeastern United States. An advantage of acoustic telemetry is that the transmitters are relatively small and they can be surgically implanted in a wide size range of tarpon. For example, in our study the transmitters are 2.5 inches long by 0.7 inches in diameter, and they can be implanted in tarpon as small as about 10 pounds. The five-year battery life of these transmitters means that we can track one individual across many seasons and years.

Once implanted in the tarpon, these tags transmit individualized codes at regular intervals that are detected and stored in fixed

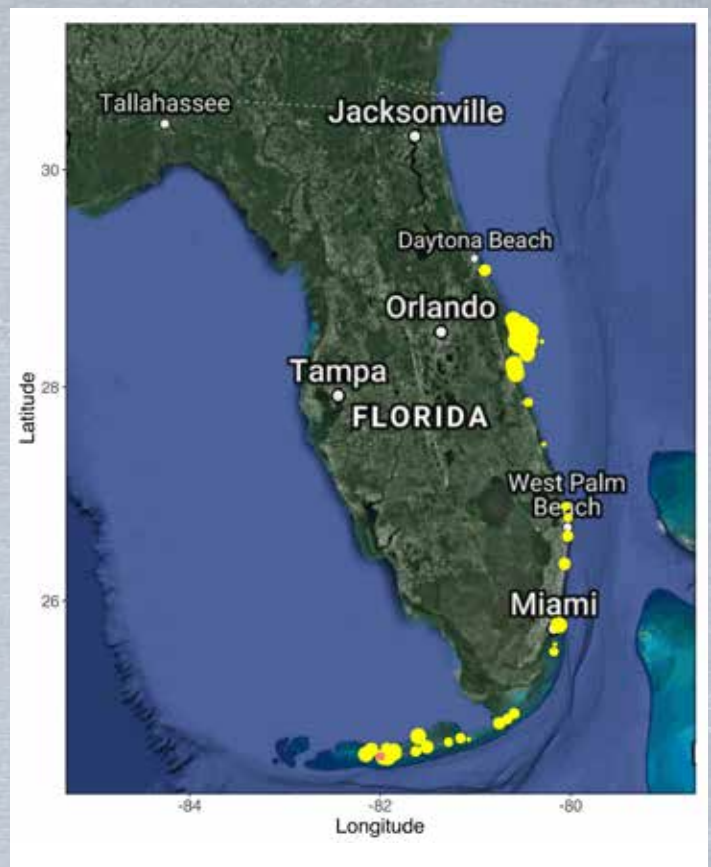


Figure 1

receivers that are deployed in coastal waters. Many scientists and management agencies are using the same receivers to track other marine life thanks to cooperation agreements and partnerships. With thousands of acoustic receivers deployed in the Gulf of Mexico and off the Atlantic coast of the United States, including nearly 100 receivers that we manage ourselves, this allows us to map the extent of the Silver King's kingdom.

Since May 2016, we have tagged more than 100 Atlantic tarpon ranging in size from 10 to 160 pounds. Thanks to the invaluable help of guides and anglers, tagging efforts have spanned a region including South Carolina, Georgia, along both coasts of the Florida peninsula, up and down the Florida Keys, and as far west as Apalachicola along the panhandle. In 2018 alone, more than 300 tarpon were hooked and jumped; if you have ever fished for the King, however, you know getting them to the boat is always a challenge. When they do get boatside, tarpon are put in a sling to control movements and safely implant an acoustic transmitter. This process has become much easier thanks to the generous support of Maverick Boat Group.

To date, we have more than 65,000 detections from nearly 60 of the tagged tarpon, with detections coming from nearly 500 unique receiver locations. We have also tracked some individual Silver Kings for over 700 days, far exceeding the duration that Atlantic tarpon were tracked in previous studies relying on satellite tags. Although the study is still ongoing, data from the first few years are revealing both expected and surprising movement patterns. Most strikingly, there is a huge diversity of movement patterns among individuals, while each tarpon often repeats similar movement patterns from one year to the next. Broadly speaking, many of the tagged tarpon are detected in the Florida Keys between April and early June, which is consistent with what is likely related to spawning. Beginning in



A tagged tarpon ready for release. Photo: Wyler Gins

June, the majority of tarpon from the Florida Keys migrate north towards productive estuarine and river systems such as Charlotte Harbor, Tampa Bay, and Apalachicola, to the west, and Indian River Lagoon, Winyah Bay, SC, Pamlico Sound, NC, and the Chesapeake Bay in the east. We even had a 55-pound male detected in the Lower Keys in May and June 2018 show up near Ocean City, Maryland, the next month! Some of the tarpon that move northward in the summer months, likely following Atlantic menhaden and striped mullet, eventually return south from October to December to overwinter in places like Cape Canaveral or farther south in the Everglades or Florida Keys.

Although many of our tagged Kings exhibit this general latitudinal movement pattern, some remain within the Florida Keys for the entire summer and only begin to migrate northward with the onset of late summer and early fall to overwinter. Furthermore, other tarpon are moving between the west and east coast of Florida rather than going north. We even have some tarpon overwinter in the Florida Keys and only start to migrate in the spring—a pattern that is consistent with what we have heard from several fishing guides.

The tarpon with the longest tracking history in our study so far is a 65-pound male tagged in the Lower Keys in July 2016 (Figure 1). With detections spanning over 750 days, this individual returns to the Lower Keys each spring and then moves north along the east coast of Florida in late summer. What is unique about this King is that it moves north later in the summer than other tagged tarpon, and only goes as far as Cape Canaveral, where it overwinters.

With a similar, but not identical, pattern is another 65-pound male

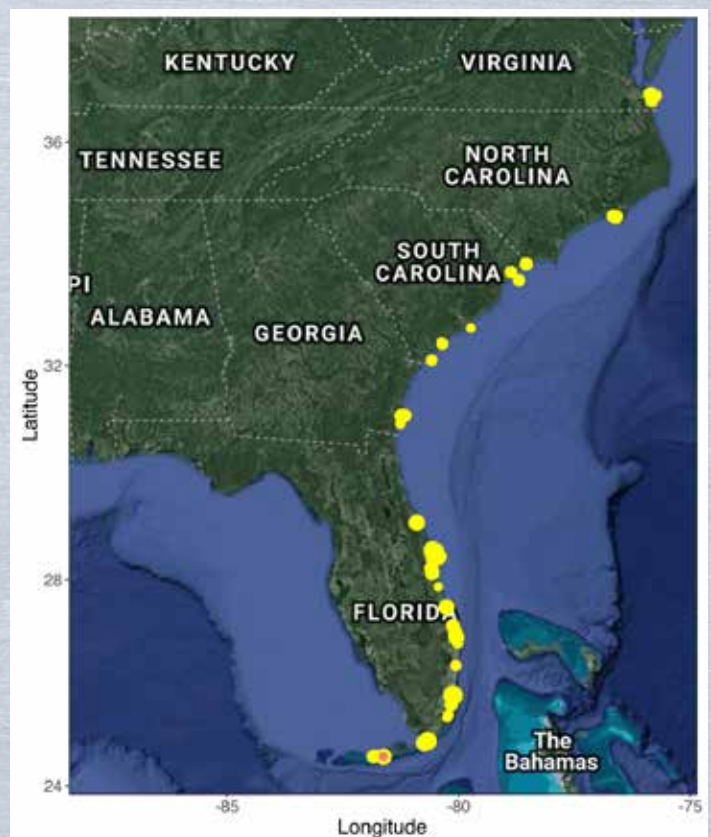


Figure 2

tagged in the Lower Keys in May 2016, with an equally impressive detection history of over 700 days (Figure 2). During the first season we tracked it, this tarpon quickly moved up the east coast of Florida beginning in July, reaching Virginia Beach in 52 days (over 1000 miles covered, or over 21 miles per day). A similar pattern was observed in the second season, but it only moved as far north as North Carolina. In both years, however, this fish overwintered in the waters near Miami before returning to the Florida Keys in the spring.

Still a mover, but with a different pattern is an 85-pound tarpon tagged in the Lower Keys in May 2017 with the assistance of Capt. Travis Holeman (Figure 3). This King spent two months in the Keys before moving along the west coast of Florida where it spent the summer near the Suwannee River. It then moved south to Sarasota in November, spent January to May in the Keys, and then visited both Cape Canaveral and Miami in mid-May before swimming past the Keys and returning to the Suwannee River in July. This is not the only tarpon that moves between the east and west coasts of Florida. Another tarpon that moves, but to different beat, is a 65-pound individual that was caught by Jay Derredor in South Carolina in September 2016, with Capt. Jarod Pete as guide. This King has made seasonal movements between Georgetown, SC, in the summer months, and Cape Canaveral, FL, during the winter.

A purely west coast tarpon is a 50-pound male tagged in Apalachicola in July 2017 with Capt. Adam Hudson and his client Gene Wilson (Figure 4). Not long after being tagged, this King moved to the west, being detected near Mobile Bay, AL. This fish was not detected again until early May when it showed up in Charlotte Harbor, and then less than three weeks later was back near Mobile Bay after passing through Apalachicola.

As we continue to tag more tarpon through 2019 and track them for longer periods of time, we will be able to use weather and oceanographic data to model whether the movement patterns of tarpon are impacted by factors such as water temperature, the frequency and intensity of cold fronts, and seasonal changes in nearshore current patterns. To date, our data is already showing that not all tarpon behave the same. As our dataset grows, we will also be able to determine the extent to which tarpon are exposed to areas of poor water quality, areas of physical habitat degradation, and red tide algal blooms. Since our study already shows tarpon ignore state borders, a broader perspective is needed when developing management plans and associated regulations aimed at reducing risks to the Silver King. 🐟

In addition to those mentioned above, BTT and its collaborating scientists greatly appreciate the time, effort, and trust of our ever expanding network of guides: Nick Angelo, Justin Bachert, Carl Ball, Will Benson, Shelby Bentley, Jordan Carter, Cody Cash, Bruce Chard, Bryant Cole, Scott Collins, Ryan Clase, Brandon and Jared Cyr, Joel Dickey, Court Douthit, Danny Flynn, Ron Gibson, GT Gonzalez, Kevin Grubbs, Travis and Bear Holeman, Adam Hudson, John Jackson, Chuck Jenks, Brian Jill, Matt Johnson, Rob Kramarz, Austin Lowder, Warren Marshall, David Mangum, Augie Moss, Gabe Nyblad, Jordan Pate, Greg Peterson, Albert Ponzoa, Frank Praznik, CA Richardson, Tray Rodriguez, Chris Slattery, Zach Stells, Jason Stock, Jason Sullivan, J.R. Waits, Newman Weaver, and Chad Will. This would also not be possible without those involved in the collaborative tracking networks, through which we obtain tarpon detections beyond those from our own receivers. Many thanks to Maverick Boat Group for its generous support of the Tarpon Acoustic Tagging Project. For in-kind support, we also thank Thomas & Thomas fly rods, Nautilus Reels, Cortland lines, Patagonia, and Costa Del Mar Sunglasses.

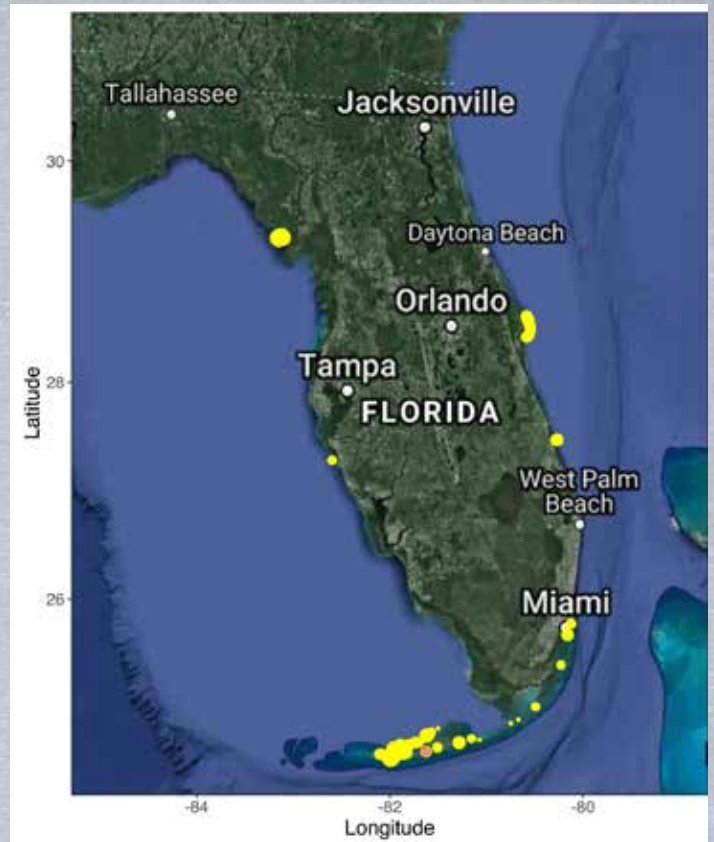


Figure 3



Figure 4

Trip of a Lifetime: Deep Water Cay

Photo: Bill Scheider

Imagine Bill Scheider's surprise when he received a call from BTT staff notifying him that he had won BTT's 2018 Trip of a Lifetime to historic Deep Water Cay on Grand Bahama Island. As a dues-paying BTT member Bill was automatically entered for the drawing. Upon receiving the exciting news, Bill and his wife Dell began to make plans for their flats-fishing getaway.

"We were truly honored to be the recipients of this prestigious trip," said the Scheiders. "And for being acknowledged as supporters of BTT's work."

Their love for bonefishing led Palm Beach guide Gil Drake Sr. and *Field & Stream* editor A.J. McClane to the now legendary flats off the East End of Grand Bahama, where they established Deep Water Cay in 1958. Soon after, they were joined by other iconic anglers and their families, as well as some of the top guides in the Bahamas. The catches made over the years have become part of the history of the legendary lodge. While Deep Water Cay has continued to evolve into a premier Bahamas fishing resort, the bonefishing hasn't changed a bit since DWC's inception.

Bill and Dell, residents of Beaufort, South Carolina, arrived for their four-day, five-night stay with good weather on their side: light wind and clear, sunny skies. A custom bamboo rod builder, Bill had the chance to put his fly rods to the test with accomplished guide David Tate across miles upon miles of pristine flats.

"We turned quite a few heads with my bamboo bonefish rods," said Bill. "I got to try out two new designs, which both performed well. I always try to have my guide cast the rods and solicit honest feedback. We caught plenty of fish and scared a few more." 🐟



Photo: Dell Scheider

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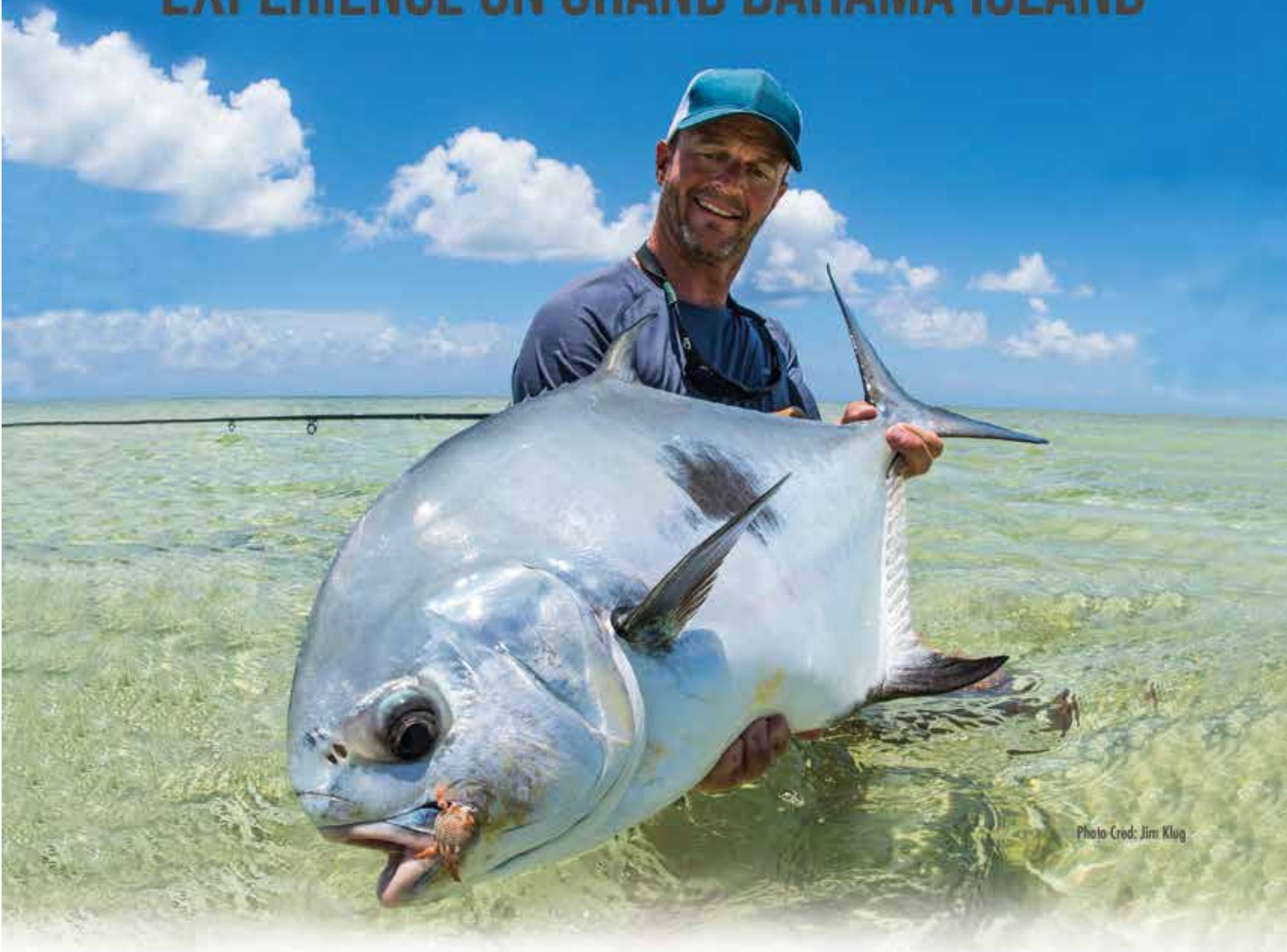


Photo Cred: Jim Klug

East End Lodge is a premier Bahamas bonefishing Lodge. Located on the east end of Grand Bahama Island, the fishery surrounding East End Lodge boasts some of the most productive flats in the entire world. We are just a twenty-five minute plane ride from Fort Lauderdale and a beautiful forty minute drive to the lodge.



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Creek Restoration Success

**BTT, BAHAMAS NATIONAL TRUST TEAM UP TO RESTORE AUGUST CREEK FLOWS
BY CHRIS SANTELLA**

If you visited the flats around the north fork of August Creek on the East End of Grand Bahama last year, you would have found many ingredients for a productive fishery. Clean sand. Ample stands of mangroves. One thing was missing, however.

Flowing water.

This was not always the case. Until the 1950s, tides flowed freely into August Creek and the surrounding flats. But the pine trees that thrived in the limestone strata on August Cay attracted the attention of logging companies, including Georgia Pacific and Abaco Lumber. To facilitate harvest and the passage of logging trucks, a causeway was built connecting August Cay to the main island. The causeway effectively blocked the flow of August Creek, leaving the flats devoid of clean, moving water.

“August Creek has traditionally been a large system,” said Justin Lewis, Bonefish & Tarpon Trust’s Bahamas Initiative Manager. “But the logging road—which runs 600 yards and is three to four feet tall—blocked off the creek’s north branch. There had been no flow for 60 years except during especially large storms. The idea for reconnecting the north branch to the larger system came from some of the local fishing guides.”

“The Snapper Island area [which encompasses August Creek] had extremely decreased biodiversity based on reports from older residents, who recalled swimming in the area as kids,” said Ellsworth Weir, Grand Bahama Parks Manager. (The parks are administrated by Bahamas National Trust, a non-profit that also advocates for environmental stewardship.) “Any water in there was stagnant. The creek had silted in.”



August Creek, post-restoration. Photo: Nick Roberts

The importance of connecting fish habitat is well recognized by fisheries biologists. Take fresh water environs: Trout need to move depending on river conditions, and sections of a river system may be cut off from each other by low water flows, dams or ill-designed culverts that don't allow for steady water passage. Preserving habitat for fish movement is equally important in the salt.

"We strive to maintain or restore what we call the coastal habitat mosaic," said BTT's Director of Science and Conservation, Dr. Aaron Adams. "This mosaic encompasses the many habitats and influences that make up a healthy coastal ecosystem, the habitats required to fulfill the life cycle of bonefish and other species. The mosaic includes habitats necessary for spawning, nursery, foraging, and migration pathways. A pristine habitat mosaic is made up of interconnected habitats that allow fish to move freely among them."

It's hard to overstate the importance of sport fishing—particularly the pursuit of bonefish—to the Bahamian economy. Estimates suggest that traveling bonefish anglers contribute over \$140 million annually. On some of the outer islands, bonefishing tourism is the major economic driver. In Andros, for example, flats fishing comprises a whopping 81% of the island's total tourism expenditure. It's no wonder that bonefish are emblazoned on the Bahamian 10 cent piece.

"We have 14 full-time employees from Mclean's Town," said Robert Neher, who owns and operates East End Lodge, a fly fishing lodge near August Creek that can accommodate 10 anglers at a time. "For a village of 140 or 150 people, that's significant. It's important to me to employ local folks. Deep Water Cay Lodge also employs a number of Mclean's Town residents. People here are really beginning to understand how the well-being of our bonefish populations benefits everyone, and are ready to support initiatives that contribute to that well-being."

Within hours of the cuts being made, there were fish using all three channels.

structure.” Bahamas National Trust signed off on the plan, and work began soon after.

“The process took roughly 10 days,” Lewis recalled. “The first five days our crew had to clear the logging road so we could bring the earthmoving equipment in. Then we made the cuts. Within hours of the cuts being made, there were fish using all three channels.



Photo: BTT

The idea of returning historic flows to the north fork of August Creek and the surrounding flats eventually reached the Bahamas National Trust. “Residents appealed to us to assist in the re-opening of the creek, as they didn’t have the capacity to do it on their own,” Weir continued.

“We were already working on expanding the national park for East End of Grand Bahama, so it made sense. Two other restoration projects were also identified—the Mclean’s Town Causeway and The Gap.” Bahamas National Trust met with local government officials for their approval, and received a letter of “no objection” from the Bahamas Environment, Science & Technology Commission (BEST). BTT then stepped in with the funding and expertise.

Lewis and Adams identified the best approach. “The three cuts were chosen to open the main mangrove-lined creek on the north side, and to maximize flow to the secondary southern portion to restore what we think was the original tidal flow pattern,” Adams described. “In time, we expect the tidal flows to equilibrate in a new creek

I counted 15 different species, including jacks, sharks, cubera snapper...and bonefish. Several of the guides came out to check out the restoration work, and they were really happy with the outcome.”

BTT and Bahamas National Trust continue to monitor the water flows and fish populations at August Creek through boat observation, snorkeling and aerial photography. Given the success of the Snapper Island restoration, there is positive momentum to tackle the other proposed restoration projects.

“I think the restoration on August Creek was an excellent idea,” commented Cecil Leathen, head guide and partner at East End Lodge. “We’re starting to get more and more bonefish back there. One of our guides is even fishing those flats now, which we haven’t been able to do for years.” 🐟

Chris Santella is the author of 21 books, including the popular “Fifty Places” series from Abrams. He’s a regular contributor to The New York Times, The Washington Post, American Angler and Trout.



Before restoration. Photo: BTT



August Creek restored. Photo: Nick Roberts



On a trip to the Cargados Carajos shoals, Millie Paimi finds a thriving bonefish population not far from where the dodo went extinct. RICH PAINI © 2018 Patagonia, Inc.

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Through the Guides: Conservation Captain Q & A



Photo courtesy of Bear Holeman



Photo courtesy of Travis Holeman

Captain Bear Holeman

Lower Keys, FL

How long have you been a guide? Where do you guide?

Almost 20 years—I've been a guide longer than I thought I was going to be. I guide in Key West, Florida and Louisiana.

Did you and Travis fish a lot growing up on the Texas coast?

Yep, we fished mostly for bass, redfish, and trout. We got to do a lot of cool stuff together. Travis is four years older, so there was a lot of, "Here, watch me do this..."

What's your go-to fly for bonefish and tarpon?

Bonefish: a crabby-shrimpy-looking thing.

Tarpon: something big and black.

How has Florida's tarpon fishery changed since you began guiding in the Keys?

I remember sitting on the ocean a long time ago and the tarpon just kept coming and coming. They might have stopped for 20 or 30 minutes, but then they started pouring again and it was like that all day long. Now it's like parts of a tide. I definitely remember more fish being around.

Can you speak to the changes you've seen in Florida's water quality and tarpon habitat?

I've seen too much change in the short amount of time I've been a fishing guide—I don't consider almost 20 years to be a long time. The things that I've seen change...it's heartbreaking. It's a tough, tough deal.

Why did you decide to help BTT with tarpon research?

I love tarpon. I've jumped tarpon in Texas, Alabama, Mississippi, Florida, Georgia, and North Carolina—I have not jumped one in South Carolina...yet. I love 'em and I hope they're around for my kid to play with when he's my age. I think the more we learn, the more we know, the better we can help protect them. I want to give back to them what they've given me.

What is your #1 tip for catching Keys tarpon on fly?

Be patient. People tend to throw the fly at them too early. Wait for a good shot and take it. 🐟

Captain Travis Holeman

Lower Keys, FL

How long have you been a guide? Where do you guide?

About 19 years. My guiding career started off with redfish in Louisiana. After Hurricane Katrina, I spent a little time in Corpus Christi. After that, I started guided seasonally in Boca Grande and other parts of the west coast of Florida, and the Keys.

Where did you grow up fishing?

The coast of Texas. I learned to fly-fish when I was five. I was 14 the first time I went to the Keys—my little brother Bear was 11.

What's your go-to fly or lure for redfish, tarpon, and permit:

Redfish: any reject permit fly.

Tarpon: worm fly or black fly.

Permit: definitely a shrimp fly.

How has Florida's permit fishery changed over your life?

I would say that there's been a 50% degradation of the flats as far as holding fish. This is significant because we know now from the data that BTT's Dr. Jake Brownscombe and I have collected that a high percentage of adult permit that live offshore venture back to the flats. I would attribute the degradation to the algae issues that are throughout the Keys and to the lack of water coming down through the Everglades, which is a manmade problem.

Why did you decide to help BTT with permit research?

With BTT, I saw an opportunity to step in and share my knowledge. I see stuff on a daily basis and unless I tell someone, it doesn't do any good. When Dr. Jake Brownscombe and Lucas Griffin (BTT Research Associate) came down, I showed them what was going on. With the new acoustic tagging, we get to find out what the permit are doing in different temperatures and different depths at different times of year and on different moons.

Why should anglers care about and support conservation efforts, like the ones you've helped with?

As far as conservation goes, the only people who have a dog in the fight are the people who participate. So everyone who participates should be involved—all the way from the guides to the manufacturers, and definitely the anglers.

What is your #1 tip for catching permit on the flats?

Don't put them on a pedestal. 🐟



Photo courtesy of Jason Stock



Photo courtesy of Andy Smith

Captain Jason Stock

Bradenton, FL

How long have you been a guide? And where?

I've been fishing my entire life, but professionally guiding off of the west coast of Florida for the past 10 years. I'm currently based in Bradenton and specialize in inshore, nearshore, and offshore trips.

What is your favorite permit bait?

Live crabs—the permit love them.

What pressing environmental issues have you faced off the west coast of Florida?

This summer has been interesting because of the red tide blooms. During late summer, the red tide pushed the permit 15-40 miles farther offshore than usual. But we still caught big permit in high numbers when they were actively feeding.

Why did you decide to help BTT with its permit research and how have you been involved?

I decided to help BTT tag permit because I was curious to see their travel routes and to help uncover their patterns. The crazy thing is that we've only had three recaptures so far and each one has been found at least 20 miles from where it was originally tagged. I'm really interested in finding out where the larger permit that I've helped tag migrate to. Clients also love the aspect of being involved in the research efforts: catching a permit, tagging it, reviving it, and letting it swim away. They feel like they're contributing to something much greater.

As a guide, why do you feel that conservation of our state's fisheries is important?

It's important for me to have a target species that's fun to catch. Proper protection of our state's fisheries ensures that any of my clients have a shot at catching their "bucket list fish." And I can bring out new clients the following day, week, or year that might have a shot at recapturing that same prized gamefish.

Any advice when it comes to properly handling permit?

After reviving a fish, always keep an eye on them as they swim away. 🐟

Captain Andy Smith

Fresh Creek, Andros Island, Bahamas

How many years have you been guiding and where?

I started fishing at Behring Point when I was 11 and began guiding professionally in Andros Island's North Bight when I was 15. I'm 51 now. How time flies.

What is your go-to fly?

I hunt big fish, strictly. So a #2 Clouser with at least 16-pound test.

Had it always been a goal of yours to establish your own lodge?

I never really wanted to build a lodge. I grew up around the lodge business because my father had a lodge. But I started a lodge to satisfy a demand for a quality product. Now I'm able to supply that on both the guiding and hosting side of things. Striking a balance of this combination establishes a standard of operation across the board.

Why did you decide to become involved with BTT? And what research have you assisted with?

We're trying to sustain a way of life which is only possible with conservation. The lifespan of our livelihoods depends on the lifespan of the environmental system. In terms of research, I was there from the beginning. We started out with establishing protections for the entire west side of the island by founding a national park. And then doubled back to gather the funding to get the Environmental Impact Assessment done in order to lay out why it needed to be protected. BTT came in later to aid the process: doing the tracking for the bonefish migrating from the west side of Andros out of the east entrance of North Bight. We have known about that migration for generations—that story got handed down to us. But you have to put the science behind the stories.

What is the most pressing concern for the flats fisheries in The Bahamas today?

We have a lot of creek blockages that need to be addressed, like culverts that have been put in over the years and collapsed because no one was maintaining them. And red mangroves growing across some of the creek mouths cutting them off from the marshlands. A lot of land needs to be opened back up so that the fish can get back into the wetlands when the tides come in. 🐟



JACOB BROWNSCOMBE, PH.D.
RESEARCH ASSOCIATE, INSTITUTE OF ENVIRONMENTAL SCIENCE,
CARLETON UNIVERSITY, CANADA

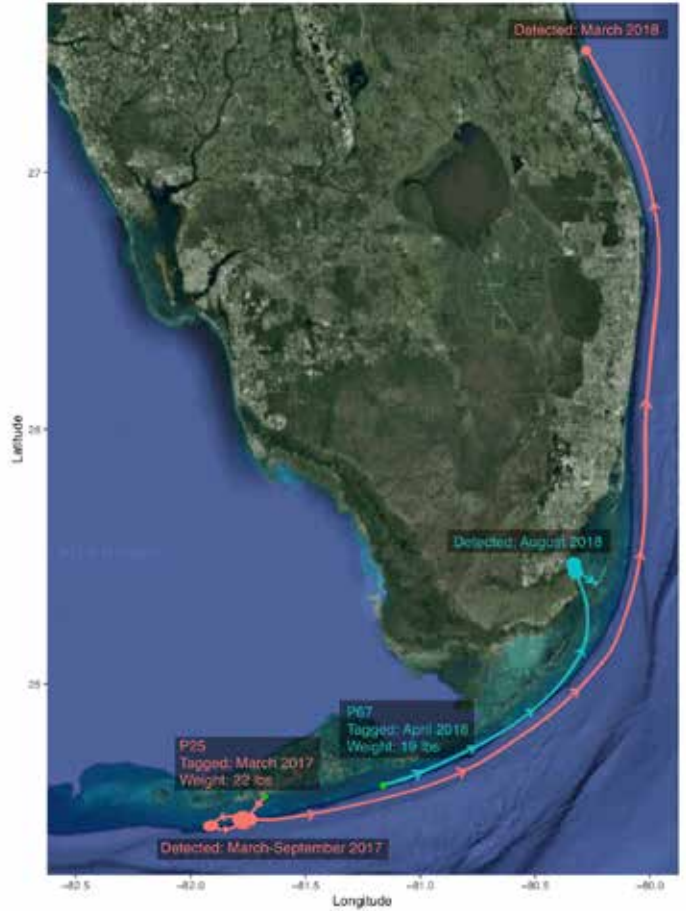
FLATS PERMIT AND OFFSHORE PERMIT:

ARE THEY THE SAME FISH?

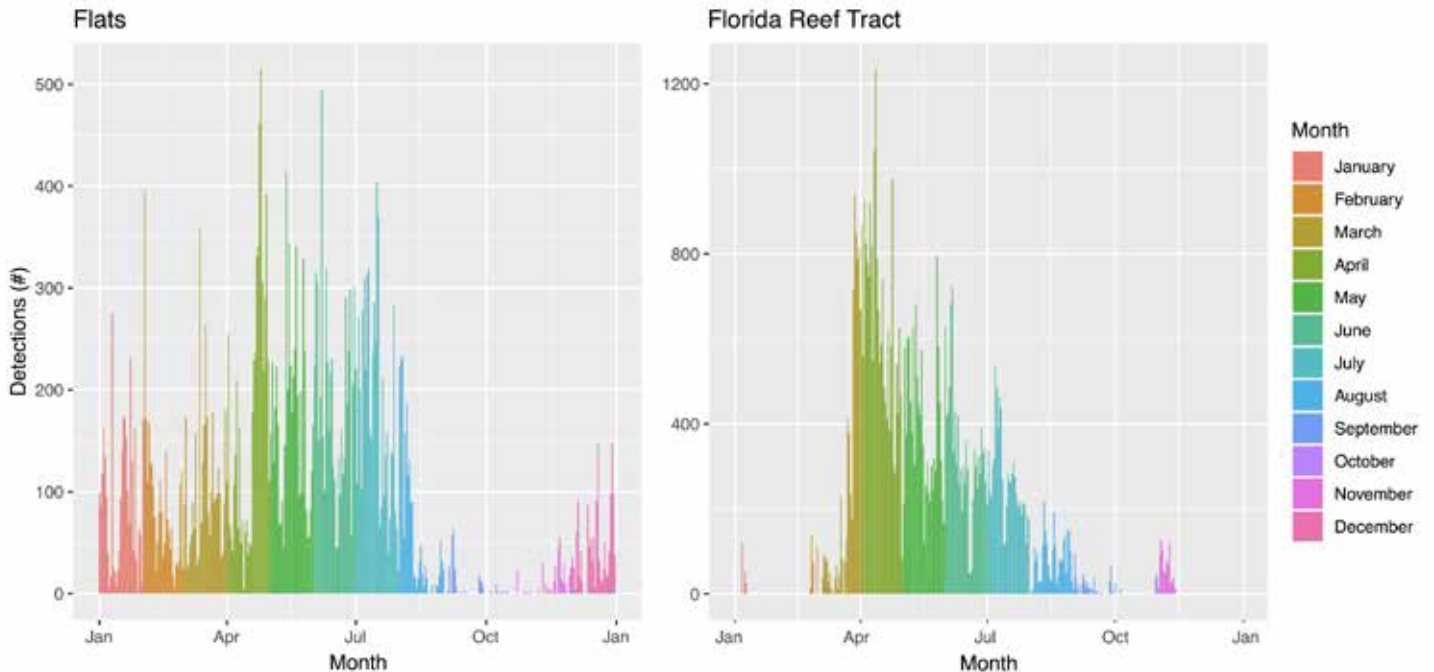
Photo: Jordan Carter

It is a slick-calm sunny morning in the Florida Keys as BTT researchers head out from Key West in a Hell’s Bay Boatworks skiff. Their goal is simple—in theory: to catch permit and tag them with acoustic transmitters, which, in conjunction with acoustic receivers placed in the ocean throughout the region, will track permit movement patterns for up to five years. After a 20-minute run, they arrive at a shallow seagrass bar. Without a whisper of wind, the flats mirror the blue sky. The incoming tide flows gently, bending the seagrass toward the skiff. The mirrored surface is broken by black, sickle-shaped fins dancing around as the permit root for invertebrates. This is exactly what the researchers were looking for—feeding permit are catchable permit. But every time they pole the skiff or get out and wade within 100 feet of the feeding fish, the permit spook, scurry off, and resume feeding farther away. Frustrated and outsmarted in the calm conditions, the researchers plot a new strategy and head out to a nearshore patch reef in 25 feet of water. A group of permit, stationed on a large coral head, take no notice of the boat, and soon two fish happily gobble up two live crabs cast in their direction. After a quick surgical procedure in the boat to implant the acoustic transmitters, the permit are released, now part of the group of 114 individuals being tracked for Permit Project.

Anglers and fishing guides are well aware of this distinct difference in permit temperaments between habitats. In deep water, permit are easy enough to catch, but on the flats they are hypervigilant, making permit flats fishing one of the most challenging and exciting fishing experiences on earth. This has led anglers and researchers to ask many of the same questions, such as: are flats permit the same individuals as deep-water permit? Does their behavior change based on their environment, or are they different fish with distinct



Movement patterns of two individual permit (unique colors) that moved outside of the Florida Keys from their tagging locations (green dots).



The total number of tagged permit detections on the flats (left) and Florida Reef Tract (right) habitats in the Florida Keys throughout the year. Data are summarized from 2016-2018.



Map of the core permit habitats in proximity to the Florida Keys, with red arrows indicating the habitats permit often move between.

The information gained from our tracking efforts has already proven valuable for permit conservation.

temperaments? The answers to these important questions inform permit conservation strategies. By tagging and tracking permit since 2016 in the entire range of habitats they occupy around the Florida Keys, Project Permit has begun to unravel this mystery.

HABITAT CONNECTIVITY

The short answer to the overarching question is that flats and deep-water permit populations are largely the same fish. There is a high level of connectivity amongst the flats, nearshore reefs, shipwrecks, and the Florida Reef Tract, with 78% of fish detected on the flats also detected on reefs or shipwrecks. However, tracking data to date suggests there is a distinction between the Florida Keys fish and those occupying offshore shipwrecks farther north in the Gulf of Mexico. Further, the vast majority of fish tagged in proximity to the Keys have remained within the region, with the exception of two individuals. Permit P67 was tagged on the Florida Reef Tract near Marathon in April 2018 and made its way onto the flats in Biscayne Bay in August 2018. Permit P25 was tagged on the flats in the Lower Florida Keys in March 2017, after which the fish spent the summer offshore on the Florida Reef Tract. In September 2017, it began an extended journey northward, traveling at least 280 miles to Fort

Pierce, where it arrived in March 2018. Although most permit appear to remain within a more constricted area, some rare individuals live a more nomadic lifestyle.

WHEN ARE PERMIT ON FLATS AND REEFS?

The fact that permit travel frequently between habitats indicates that these fish do not spend all of their time in a single place, which begs the question: When are permit on the flats? When do they move off to the Florida Reef Tract to spawn? The tracking data from the Lower Keys indicate that permit frequent the flats throughout the year, with the exception of September to November, when flats detections decrease dramatically. On the Florida Reef Tract, permit begin to arrive in spawning locations in highest numbers in late March through the end of April, and remain there in moderately high numbers through the end of August. How can there be high occupancy on both the flats and the Reef Tract in March through August? Permit often move back and forth between these habitats for days to weeks at a time during this season, likely gorging themselves in between spawning sessions. In my experience tagging these fish throughout the year, the spawning season is one of the best times to catch permit on the flats—they are hungry and have something else on their mind that makes them less vigilant on the flats.

PERMIT CONSERVATION

The information gained from our tracking efforts has already proven valuable for permit conservation. The data indicated that the fish were arriving at spawning locations prior to the harvest closure period, which corroborated reports from guides and anglers who fish the reefs and wrecks. When the Florida Fish and Wildlife Conservation Commission (FWC) was presented with this information by BTT in 2018, the Commission promptly extended the permit harvest closure period within the Special Permit Zone to include April in addition to May-July. It is now very clear that in order to conserve productive permit fisheries in all of their habitats, permit regulations must operate at a multi-fishery and multi-habitat scale. What is happening on nearshore reefs and shipwrecks, where permit experience greater

harvest and predation pressure, is relevant to the flats fishery. Extending the harvest closure period was a great step for permit conservation, but other concerns remain. One concern is the effectiveness of catch and release for the permit fishery. In other words, are permit surviving? Preliminary data show that when predators are not present, permit survive catch and release very well. The issue comes with predators. When on the flats, predation of permit is rare—in fact, during this entire study, not a single permit was eaten by a predator. It's a different story on the reefs and wrecks. On some reef and wreck locations, there appear to be few predators and few if any permit are taken by predators. But at other locations as many as 80% of permit are taken by predators either during the fight or after release. Since much of the fishing on reefs and wrecks is done during the spawning season, there is concern that these high

levels of predation might have an impact on spawning, which then impacts the number of young permit coming into the fishery.

PROJECT SUPPORT

There are still some conservation concerns for Florida permit, but BTT's Project Permit is making great strides to identify these issues and implement actions to resolve them. This work would not be possible without key partnerships with FWC and the Lower Keys Guides Association. We extend a special thanks to all the fishing guides and anglers who have donated their time and expertise to advance this project; this vital work would not be possible without them. Project Permit is supported by Costa Del Mar, the March Merkin Permit Tournament, the Del Brown Permit Tournament, Hell's Bay Boatworks, and numerous private donors. 🐟



BTT researchers surgically implant an acoustic transmitter. Photo: Dr. Andy Danylchuk

“We are pleased to have Ewoud de Groot as the 2019 BTT Artist of the Year,” said Bill Legg, who serves on the BTT Board of Directors. “Each year we recognize a great nature painter or sculptor, usually someone who is connected to the saltwater world of the species that we are trying to protect. I have marveled at Ewoud’s bird paintings and was thrilled when Steve O’Brien told me that Ewoud would donate a large-scale painting of terns. Many thanks to Ewoud de Groot for helping to support our research.”

Ewoud de Groot lives and works in Egmond aan Zee, a coastal village in the Northern Netherlands. After receiving a degree in illustration and painting from the Minerva Academy of Art, he began illustrating nature books for a period before pursuing painting full-time in 1999. Today, de Groot is recognized as a rising star in wildlife painting, bringing a truly unique perspective to the genre.

His work strives to find both a balance and a tension between the representational and the abstract, the traditional and the contemporary. For de Groot, painting wildlife is not an exercise in rendering all the exact details. Instead, his work is an ongoing experiment of composition, color, and technique, concerned with conveying a sense of mood and atmosphere found in the natural world.

“To me, as an artist, producing a good painting is about exploring all the different facets of composition, color and technique and not just reproducing an image in a photorealistic way,” said Mr. de Groot. “Although I consider myself a figurative painter, I always try to find that essential balance and tension between the more abstract background and the realism of the subject(s). In a way you could say that I am on the frontier between figurative and non-figurative, or the traditional and the modern.”



Photo courtesy of Copley Fine Art Auctions



“Resting Terns” by Ewoud de Groot was sold by Copley Fine Art Auctions on February 16, 2019, with 50% of the proceeds benefitting Bonefish & Tarpon Trust.



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Belize and Mexico: Conservation Challenges and Opportunities

AARON J. ADAMS, PH.D.

DIRECTOR OF SCIENCE AND CONSERVATION, BONEFISH & TARPON TRUST
SENIOR SCIENTIST, HARBOR BRANCH OCEANOGRAPHIC INSTITUTE,
FLORIDA ATLANTIC UNIVERSITY

ADDIEL U. PEREZ

EL COLEGIO DE LA FRONTERA SUR (ECOSUR), CHETUMAL, MEXICO



Collecting bonefish for tagging in Xcalak, Mexico. Photo: Patrick Williams

The coastal habitat mosaic of the Caribbean coast of Belize and Mexico stretches to the horizon as a multi-hued quilt that weaves together the barrier coral reef, seagrass flats, sandflats and backcountry mangrove lagoons. Many secrets are hidden among the folds. If you know where to go, you can stand in shin-deep water within sight of a Mayan temple as you cast to tailing bonefish. What makes the fishing in this region so special is the unique combination of habitats, fish, and culture.

The uniqueness of this region is but one motivation for conservation. Another is the regional economy's reliance on healthy natural resources. Flats fishing, subsistence fishing, commercial fishing, and ecotourism all depend on healthy natural resources.

Though not as well traveled as the long-famous flats of the Florida Keys and the Bahamas, this region of the western Caribbean is climbing up the must-do list of many anglers. And how can it not—a grand slam is a realistic pursuit on most days, and the diversity of habitats keeps anglers engaged on even the slowest of fishing

days. The flats fishery attracts a type of tourist that understands the interaction between habitats, fish, and angler, which helps to reinforce the sustainable characteristics of the fishery.

In Belize, the economic importance of the fishery is clear. A 2013 study found that the annual economic impact of the flats fishery exceeds \$50 million (USD), supporting thousands of jobs. The sustainability of this catch and release fishery makes it even more valuable because as long as the habitats that support the fishery remain healthy, the fishery's economic value continues in perpetuity. The importance of the fishery is reflected in the fact that years ago the legislature passed a bill making bonefish, tarpon, and permit catch and release only.

Though the economic importance of the flats fishery in Xcalak, Ascension Bay and surroundings of Mexico hasn't been quantified in a study, a visit to the region is revealing. The town of Punta Allen, for example, might survive on commercial lobstering, but the economic benefits provided by anglers fishing with the numerous lodges and independent guides is evident to any visitor. In Xcalak,

Among the top challenges for the flats guides and lodge owners of Mexico is that fishing for bonefish, tarpon and permit is unregulated.

the importance of the flats fishery is demonstrated by agreements among flats guides and other local fisherman to curtail the use of traditional nets that would impact the fishery. In other words, the people who live here understand the value of a sustainable fishery. They get it. Unfortunately, many outside of this area don't get it. Indeed, extensive gillnetting, which frequently targets migrations of many species along the coast, continues in the region. Given that we know bonefish and permit undertake migrations from the flats to spawning sites along the coast, these gillnetting activities are certainly impacting flats species on their way to spawn.

CHALLENGES ABOUND

Despite the social, cultural, and economic importance of the flats fishery, challenges and threats abound. In Belize, the sustainable flats fishery is stressed by three main threats: habitat loss and degradation, gillnets, and lack of enforcement. On the habitat loss

front, recent and ongoing coastal development to support a brand of tourism akin to that of Cancún has sprung up, especially in the northern region of Belize. This includes construction of over-water structures by resorts, structures that are built over the flats important to bonefish, tarpon, and permit, and long used by the flats fishery. This also includes dredging the flats for sand that is used as fill to increase the amount of land that is deemed buildable along the coast and on mangrove islands, on which are built more resorts.

There is a growing movement, both domestic and international, to address the long-debated issue of gillnets. Gillnets are indiscriminate when set across river mouths after heavy rains, and harvest snook, tarpon, and even manatees. When deployed on the flats, gillnets can wipe out entire schools of bonefish, with recovery of the local population taking years. Related to both the coastal development (much of which is either unpermitted or unwise) and use of gillnets (some of which is legal, some of which is not), fishing guides are concerned about the lack of enforcement, which allows the threats to the fishery to mount.

Among the top challenges for the flats guides and lodge owners of Mexico is that fishing for bonefish, tarpon and permit is unregulated. Among the top destinations for flats fishing—the chief competitors with Mexico for flats fishing tourism dollars—this lack of protection is unique. Bonefish, tarpon, and permit are catch and release only in Belize. Bonefish and tarpon are catch and release in Florida, and permit are tightly regulated in the Florida Keys. In the Bahamas, bonefish are catch and release only, except for subsistence harvest for personal use.



Bonefish in Xcalak held in preparation for tagging. Photo: Patrick Williams



BTT Research Associate Addiel Perez tags a bonefish in Xcalak, Mexico. Photo: Patrick Williams

A second challenge to the flats fishery's long-term health is encroaching development. Though the region of Mexico to the north—Cancún and surroundings—has more tourists and a larger economy, its sustainability is in question. Indeed, the aquifers of the Cancún area are already polluted to the point of concern. The saving grace for the fisheries of the central and southern areas of Mexico's Yucatán Caribbean coast is the Sian Ka'an Biosphere Reserve, which encompasses Ascension Bay and so far has halted the southward migration of Cancun's largesse, and the remoteness of the southern region near Xcalak. However, there is trouble on the horizon. There are plans to apply the model of extensive coastal development that has occurred in Cancún, Playa del Carmen, and Tulum to Xcalak. This type of development would destroy the flats fishery in the area. In fact, a proposed channel dredging project would interrupt a known bonefish spawning migration.

A CONSERVATION STRATEGY

Though the challenges to flats conservation in Belize and Mexico are many, the rewards of protecting the fishery are large. The economic and job benefits will continue in perpetuity if the habitats and fishery are healthy, and in a manner that serves to preserve the social and cultural integrity of the coastal communities. The good news is that the community of fishing guides, lodge owners, and anglers realize their action is needed to ensure a healthy future.

In Belize, there is an ongoing effort to phase out the use of gillnets so that in a few years' time they will no longer be in legal use in Belizean waters. The coalition pushing for this change includes the flats fishing community, conservation organizations, and fishing organizations representing inshore, reef, and offshore fisheries. In concert with the gillnet effort is a renewed push for enforcement. Enforcement will be much easier once gillnets are banned—use of a gillnet will be an offense. The flats community is also becoming more vocal and forceful in opposition to irresponsible coastal development practices, like over-water structures on the flats. With lifetimes of experience on the water, the guides understand the relationship between healthy habitats and healthy fisheries—their livelihood.

In Mexico, the flats fishing community is focusing on pushing to create regulations for bonefish, tarpon, and permit. This will require persistence because the regulations can't be created at the state level, they have to be at the federal level, but given the stakes the flats guides and anglers look to be ready for the battle. The cherished status of bonefish, tarpon, and permit disappears once the fish leave the Xcalak and Ascension Bay regions, and reports of harvest (often from netting) pop up too frequently on social media. The threat of encroaching or proposed development in these areas has also become a source of concern, and conversations are ongoing about the best strategy to address this moving forward.

It's encouraging to see that the flats fishing communities in Belize and Mexico are becoming more engaged in activities that will enhance conservation. And like the guides, lodge owners, and anglers in the Florida Keys and the Bahamas, these activities need and deserve your support. Consider becoming part of the support team for the newly emboldened conservation push in this region, and make a donation to the program.

The regional importance of flats conservation in Mexico and Belize can't be overstated. This is especially true for flats anglers in Florida. As you will read in this issue's article, "Making the Case for Bonefish Conservation as a Shared Resource," bonefish that spawn in Belize and along the Caribbean coast of Mexico send a significant amount of larvae to the Florida Keys. Previous research on permit, whose larvae are in the open ocean as plankton for a few weeks, found that many permit larvae reaching Florida's shores also come from this area. And since tarpon larvae are in the open ocean as plankton for about a month, tarpon spawning in Belize and Mexico certainly provide larvae to Florida. Indeed, given the amount of habitat loss that has already occurred in this region, it's likely that fewer larvae are now reaching the Florida Keys. This means that protecting the habitats and fish populations that remain is not only essential for the flats fishery of Belize and Mexico, but for the Florida Keys as well. 🐟

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BTT 2019 Events



6th Annual FL Keys Dinner and Awards Ceremony, Islamorada, Florida

At the Islander Resort on January 17, BTT joined with members, friends, and the guide community in honoring Captain Steve Huff for 50 years of guiding in South Florida. All proceeds raised support the BTT George Hommel Florida Keys Habitat Fund as well as local conservation efforts. 

Photos: Dan Decibel



Steve Huff and his wife Patty arrive.



BTT Chairman Harold Brewer (third from left) and BTT President and CEO Jim McDuffie (second from right) present Captain Huff (center) with an award to commemorate his illustrious career as a Florida fishing guide. Captain Huff was joined by Chico Fernandez (second from left), Paul Tejera (far left), Craig Brewer (third from right), and BTT board member Sandy Moret (far right).



Captain Huff with his sons, Dustin and Chad, Florida fishing guides.



Ted Juracsik, founder of the Tibor Reel Corporation, introduces his longtime friend, Captain Steve Huff.



BTT Vice Chairman Bill Horn and his wife Jeannette with angling legend Andy Mill.



BTT Honorary Trustee Betsy Bullard (center) with Brooke Black (left) and event committee member Carmen Perez-Padron (right).



Captain Tommy Locke celebrates with his wife Kelly and his children Marshall, Wyatt, and Wesley.
Photo: Mark Rehbein

10th Annual Boca Grande Event

On February 1, anglers and guides from Southwest Florida gathered at the Gasparilla Inn Beach Club to honor Captain Tommy Locke for his continued support of BTT's work to conserve tarpon through scientific research, habitat improvement, and clean water advocacy. 🐟



Captain Tommy Locke and BTT President and CEO Jim McDuffie
Photo: Rich Hirsch



Captain Chris Wittman, Captain Locke, BTT board member Rick Hirsch, and Captain Daniel Andrews. Photo courtesy of Rick Hirsch

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STANLEY MELTZOFF (1917-2006)



Bonefish 26, Two Bonefish and Coral Clump with Crab at Chub Cay, oil on mounted canvas (20"x28")

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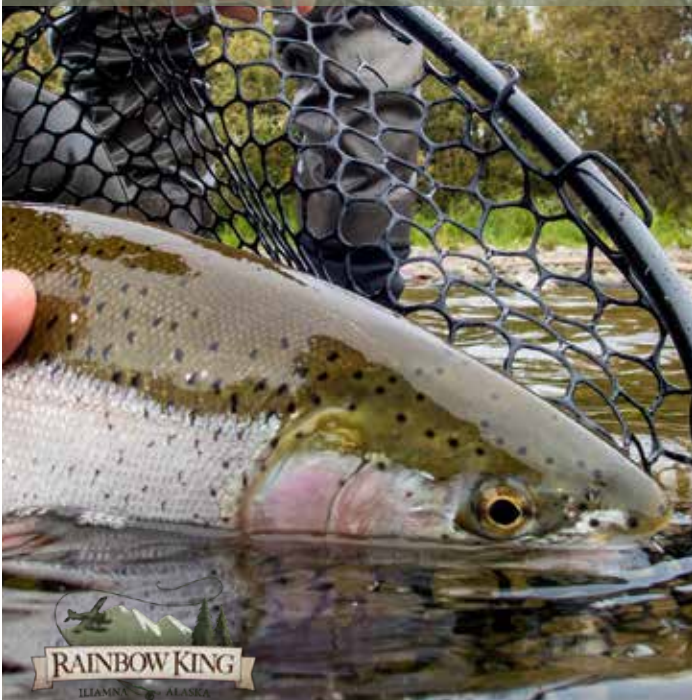
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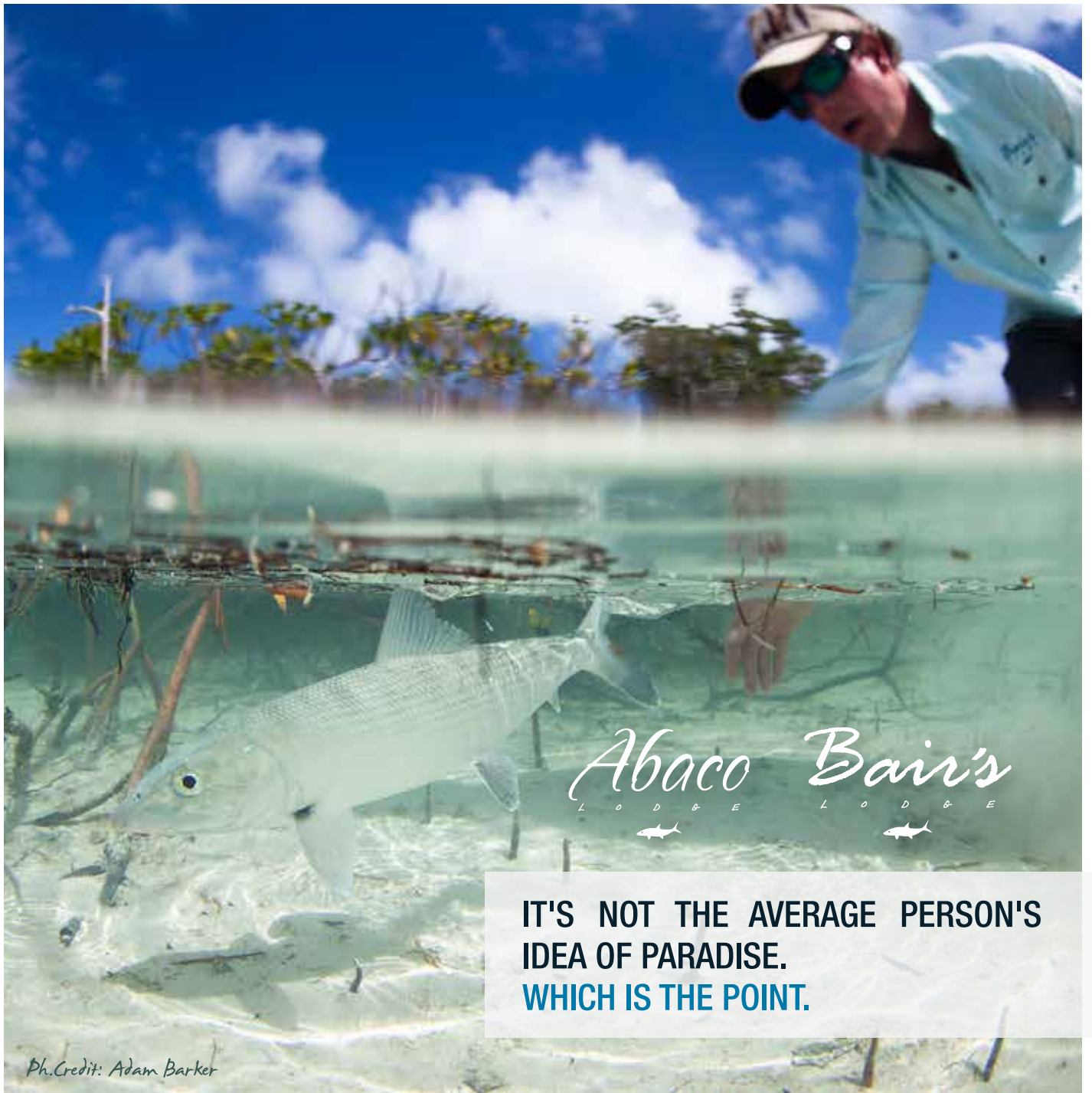
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