

INSIDE: MEXICO & BELIZE SHARE BONEFISH • HURRICANE IRMA IMPACTS • BONEFISH RESTORATION UPDATE

A publication of
**Bonefish
& Tarpon
TRUST**



BONEFISH & TARPON

Journal

STEWARDSHIP THROUGH SCIENCE • SPRING 2018



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Beau Beasley

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Bonefish & Tarpon Journal

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7th Annual NYC Dinner & Awards Ceremony,
The University Club—March 13, 2018

BTT in Houston,

Gordy & Sons Outfitters—April 12, 2018

BTT in Bozeman,

The Emerson Center—August 23, 2018

BTT's Mission

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



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& Tarpon
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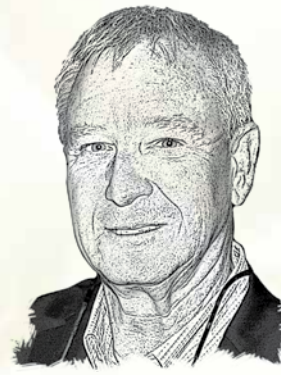
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Setting the Hook



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From the Chairman and the President

Healthy habitats are the foundation of healthy fisheries. As “citizen scientists” (a.k.a. flats anglers), we’ve all observed changes in fisheries where habitats have been compromised.

The work of conserving habitat is central to our mission at BTT. We protect. We restore. We educate and advocate. Our approaches, always guided by science, are determined by the diverse challenges we face in locations across the vast region in which we work.

In Florida, where our estuaries have been assaulted by large pulses of tainted water released from Lake Okeechobee—or left parched by the lack of fresh water in the case of Florida Bay—BTT has been active in the “Now or Neverglades” movement from its inception. Together with our partners, we successfully advocated for the construction of a reservoir south of the lake to store, filter, and send freshwater south to the Everglades and Florida Bay. This cornerstone in Everglades restoration is needed not only to restore natural flows through the “River of Grass,” but to reduce the damaging, and often deadly, discharges from Lake Okeechobee into the Calooshattee and St. Lucie rivers. The lack of clean, fresh water reaching Florida Bay has triggered cascading impacts on the flats habitat, beginning with hypersaline conditions, which have resulted in the loss of tens of thousands of acres of seagrasses.

The passage last spring of Florida Senate Bill 10 was a major achievement in the decades-long battle to restore the Everglades, yet there are many details in the state’s emerging plan for the reservoir and its implementation that require our close attention. For that reason, BTT remains actively engaged in the process and calls on our members to stay informed and make their voices heard.

Anglers visiting the Bahamas in pursuit of bonefish still find areas

of vast, pristine habitat—and a target-rich environment. BTT’s objectives there are largely focused on protection of critical bonefish habitats—those that form home ranges, spawning migration pathways, and spawning sites. Thus far in our collaboration with Bahamas National Trust and other partner organizations, BTT has assisted in establishing six national parks aimed at conserving the most critically important bonefish habitats surrounding Grand Bahama and Abaco. Our Bahamas-based program is hard at work now compiling additional data to help frame the next round of habitat protection recommendations, which will be submitted to the Bahamas Government later this year. At the same time, we are seeking to expand our scope of work in 2018 to include the restoration of

important mangrove creeks, vital to the health of the surrounding flats.

Whether the objective is restoration or protection, more is always needed to truly ensure the long-term conservation of resources as valuable—and as sensitive—as our flats habitats. To that end, we are working on both ends of the fishery, with those who manage and those who fish. We are collaborating with resource agencies to provide science-based methods of improving fisheries management

and to encourage them to include habitats in their management plans. We’re also working to build a broader flats conservation ethic among the next generation of anglers, which is taking shape through new educational outreach programs in schools in Florida and the Bahamas.


In this issue of the Journal, you will see the value and importance of healthy habitats in many articles, from the impacts of hurricanes and water quality on habitat to the more subtle implications in our cover story: permit as creatures of habit—habits associated with clearly defined habitats that must be conserved. We are making great progress, and we are grateful for your support and advocacy. 



Photo: Eric Estrada

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Bill Horn

Fix Our Water: It's Now or Neverglades

Decades of Florida's water mismanagement has brought Florida Bay and its bonefish, tarpon, and snook fisheries to the brink of irretrievable collapse. The Everglades, the source of freshwater for the Bay's productive brackish waters, has been dried out. Insufficient freshwater renders the Bay hyper-saline (too salty) killing thousands of acres of vital seagrass beds and fouling the water with vast mats of stinking, decaying grass. Rotting grass depletes oxygen, suffocating fish and prey, while feeding giant algae blooms, turning once clear waters into murky pea-green soup. The National Academy of Sciences worries that the Bay may not be able to recover from this latest assault. BTT recognizes that conserving tarpon and restoring bonefish is a non-starter if Florida Bay's waters remain a fouled mess.


Farther north, the freshwater needed in the Everglades and the Bay is discharged into the Caloosahatchee and St. Lucie river systems, wrecking those estuaries as well. Polluted Lake Okeechobee water, loaded with phosphorus from Big Sugar runoff, overwhelms these systems, growing slimy toxic algae and killing fish, seagrass, and oysters. Only the worst kind of water management can simultaneously decimate three historically great fisheries.

Compounding anglers' anger and frustration, this mismanagement has been recognized for years. In fact, the Federal and State governments approved comprehensive Everglades restoration plans in 1988 and 2000 to fix these very problems. Polluted Lake Okeechobee waters would be stored and cleaned in newly constructed treatment reservoirs (i.e.; Stormwater Treatment Areas (STAs) south of the Lake Okeechobee before being sent south through the Everglades to Florida Bay. Within the 'Glades, many of the dams, ditches and dikes would be removed, allowing cleaned freshwater to flow south as it did prior to mismanagement. While the 'Glades and Bay would finally get needed water, polluted Lake Okeechobee water would not be diverted into the Caloosahatchee and St. Lucie, allowing the fisheries and habitats to recover.

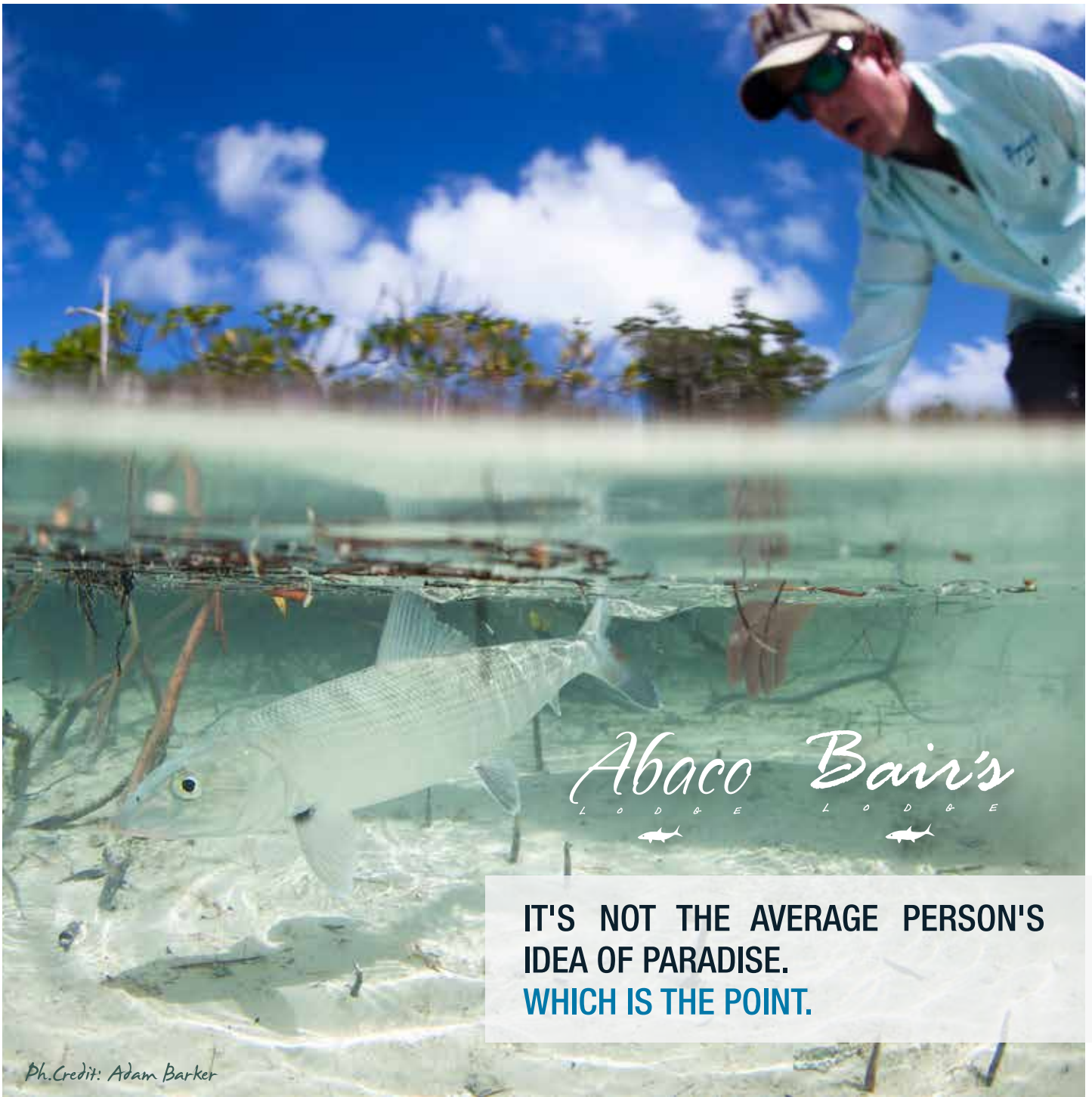
A lethal combination of entrenched opposition from two sugar companies, bureaucratic inertia, and flaccid political leadership (except in a few noteworthy cases) has stymied these restoration plans. Florida citizens are outraged at the delay and continued destruction of their fisheries. People are fighting back to reenergize

the restoration effort and letting the State's political leadership know that mere lip service to restoration is not enough. BTT is proud to be part of the Now or Neverglades coalition—a diverse collection of organizations, individuals, and companies dedicated to fixing the Everglades and Florida Bay.

This grassroots uprising produced a needed, and notable, win in 2017. Under the strong leadership of Florida Senate President Joe Negron, the State enacted SB 10 directing the construction of a large reservoir south of the lake. There was near unanimity among Everglades scientists that persistent pollution in Okeechobee and hyper-salinity in Florida Bay required more STA capacity than was originally approved in 2000. So the new legislation directed the South Florida Water Management District (SFWMD) to expedite development of a new STA to facilitate needed water flows into Florida Bay and curtail damaging water discharges into the Caloosahatchee and St. Lucie. Unfortunately, SFWMD is dropping the ball. Effective STAs must be large (so lots of water can be treated and released into the Everglades) and shallow so they can grow water weeds, such as cattails, that extract phosphorous from the water. SFWMD's recently released STA plan is unacceptable, calling for a small, deep (27 feet) reservoir. The agency, which answers to the Governor, objects to taking State land out of taxpayer subsidized sugar production to make the new STA large enough to produce real restoration benefits. BTT's Fix Our Water campaign will be working to educate Floridians, and others who care about the Bay, about the desperate need for an SB 10 compliant STA—one that is large and shallow.

The destruction of the Everglades and Florida Bay by water mismanagement policies that have failed for decades won't change unless the system changes. And the system won't change unless Florida's citizens, as well as those who travel to Florida to enjoy the state's natural resources, make their voices heard. We call on our BTT members, Floridians, and all who care about the Everglades and Florida Bay to stay informed and engaged throughout this important process and continue to advocate for an SB10 compliant reservoir and STA that can finally get the job done. 

***Bill Horn** is former Assistant Secretary of the Interior for Fish, Wildlife and Parks, and a member of the BTT Board of Directors.*



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WHICH IS THE POINT.**

Ph. Credit: Adam Barker




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Welcome Aboard



New Members of the BTT Board of Directors

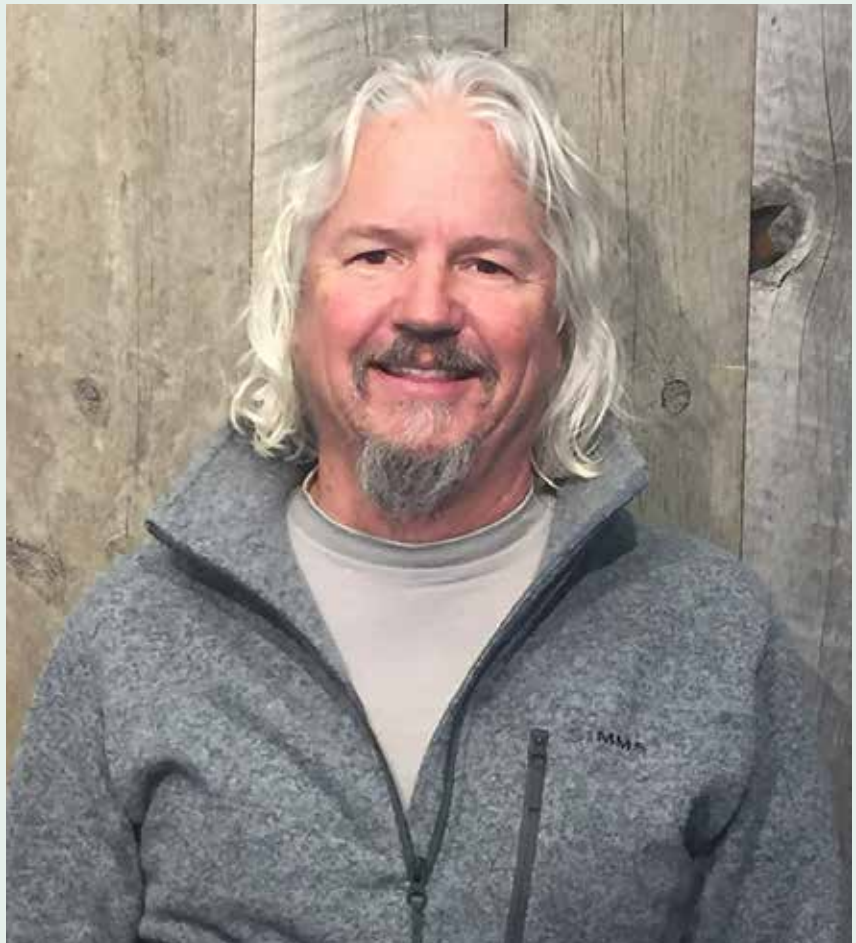
Bonefish & Tarpon Trust welcomed four new members of the Board of Directors in 2017—each distinguished in their careers and their commitment to the conservation of bonefish, tarpon, and permit.

Al Perkinson is the Executive Vice President of Marketing at Simms Fishing Products. Prior to joining Simms in 2016, Perkinson served as Vice President of Marketing for Costa, where he helped increase the company's sales 1500% during his 11-year tenure. He also created Costa Films and has produced nine short films, one of which won the sustainability award from Sundance in 2012.

"As fisheries and habitats face increased challenges from environmental issues and natural disasters, organizations like Bonefish & Tarpon Trust are more critical than ever," said Perkinson. "By spearheading cutting-edge research efforts, BTT is leading the way to make our most precious fisheries healthier. And that is good for all anglers who care about saltwater fishing."

Perkinson majored in sculpture at St. Andrew's University before earning a master's degree in Arts Administration from Columbia University. He began his career at Ogilvy & Mather Advertising in New York City. Before joining Costa, Perkinson was Vice President of Account Service at Henderson Advertising and VP Group Brand Manager at Bank of America.

Widely regarded as one of the most influential people in fisheries conservation, Perkinson received the Lefty Kreh Sportsman of the Year Award from Bonefish & Tarpon Trust in 2014 and was named Angler of the Year by *Fly Rod & Reel* in 2015. He is also a member of the Explorer's Club in New York City.



A freelance writer based in Key Largo, **Sarah Cart** hails from the Hudson Valley and is a graduate of Williams College, where she majored in English. After a brief stint in Tulsa, OK, Cart and her husband Ben settled in Youngstown, OH. There Cart began her career as a freelance writer, including a decade writing feature stories for *The Vindicator*, Youngstown's daily paper.

"Living in the Rust Belt was challenging; the local river had been so polluted that it was practically lifeless," said Cart. "In Ohio, I learned I have a visceral need to be on or near healthy water and, as a result, through the years I've agreed to all sorts of fishing adventures just get on a boat or wade in a stream. The journalist in me believes deeply in the power of living water, and the importance of research-based advocacy and education. I am honored to be on the Bonefish & Tarpon Trust Board of Directors."

Residents of Ocean Reef for a decade, the Cartes now split their time between Key Largo Anglers Club and the Blooming Grove Hunting & Fishing Club in Hawley, PA. A past member of The Woman Flyfishers, Cart is on the board of Ocean Reef's Bonefish Bonnies, writes for the local paper and is part of the team that drafts, edits and produces the catalog for Ocean Reef Community's annual auction.



Kevin Johnson is an Executive Director with Morgan Stanley Private Wealth Management in Naples, FL. Prior to joining Morgan Stanley in 1996, Johnson played professional golf on various tours throughout the U.S., including the Nike Tour, Hooters Tour, Golden Bear Tour and Tommy Armour Tour. Johnson holds a B.S. in Economics from Florida Atlantic University (1994), where he was a two-time All Academic Conference award winner (93', 94') and three time All Conference award winner in Men's Golf (92', 93', 94').

"As an avid angler having grown up fishing in the 10,000 Islands and Florida Keys, I am excited to be joining the BTT board and look forward to supporting the efforts to restore bonefish, tarpon and permit fisheries and habitats and to ensure a healthy fishery for many generations to come," said Johnson.

Johnson is an Eagle Scout and served as District Chairman in 2015 for the Boy Scouts of America, Southwest Florida Council. He has been a board member for The Immokalee Foundation since 2010 and has chaired their Charity Classic Pro Am (2011-2016), helping raise over \$3 million for the foundation. Johnson is also a trustee and Vice President of the Board of The First Tee Naples / Collier.



A resident of Islamorada, **Carl Navarre** is the former Publisher and CEO of Atlantic Monthly Press. He also founded and served as CEO of MyPublisher.com, a software and services platform for digital photography that was sold to Shutterstock. A leader in conservation, he has served on the board of The Wildlife Conservation Society, The National Audubon Society, The Atlantic Salmon Federation, The Peregrine Fund (past Chairman), and The Guides Trust Foundation (past Chairman).

"Over the years I've watched BTT grow into the well-

managed, science-based, fisheries conservation group that it is today. And I'm excited to join this board and I'm especially excited to be involved with the Bonefish Restoration Research Project," said Navarre. "I've been involved with successful species restoration for a long time—especially with birds of prey at The Peregrine Fund—and I think this project, and the science and technology that will come out of it, are key insurance policies to guarantee healthy populations of bonefish and tarpon in the future."

Tippets

Short Takes on Important Topics

MEMBERS-ONLY TRIP OF A LIFETIME

BTT congratulates BTT member, Bill Scheider, the lucky winner of the 2017 Trip of a Lifetime to historic Deep Water Cay in Grand Bahama. A resident of Beaufort, SC, Bill is a custom bamboo rod builder and has been a member of BTT since 2016. At DWC, Bill will have the opportunity to chase record-breaking bonefish and permit across 250 square miles of beautiful flats alongside expert local guides. 🐟

GUIDES TRUST FOUNDATION RECEIVES \$50,000

At BTT's 6th International Science Symposium, representatives of Ocean Reef Community Foundation, Ocean Reef Conservation Association, and Bonefish & Tarpon Trust presented a \$50,000 check to the Guides Trust Foundation (received by FL Keys Mayor George Neugent) for the Guides Relief Fund, established in the wake of Hurricane Irma. 🐟



Photo: (L to R) Andy Mill (Master of Ceremonies), Bill Nutt (ORCF), Tom Davidson (ORCA), Mayor George Neugent, Harold Brewer (BTT)

PROTECTING SPAWNING PERMIT IN THE SPZ

At its February meeting in Tallahassee, the Florida Fish and Wildlife Conservation Commission (FWC) voted unanimously to expand the spawning season closure for permit in the SPZ. We applaud the Commission for its commitment to conserving this important flats species.

Beginning in 2011, the FWC enacted new regulations for permit, creating a SPZ in the Florida Keys. The SPZ includes all state and federal waters south of Cape Sable on the Gulf Coast and south of Cape Florida on the Atlantic Coast. One of the new regulations in the SPZ was to close harvest during permit spawning season, which was identified as May through July. New data from Project Permit's Acoustic Tagging Project, a collaboration with Carleton University, University of Massachusetts, and FWC's Fish and Wildlife Research Institute, and observations of guides and anglers indicate that permit are showing up earlier on the reefs and wrecks to spawn—they are arriving in April. Based on this information, BTT requested that the FWC Commission expand the spawning season harvest closure to encompass April through July.

This action by the FWC Commission shows how collaboration between BTT, research partners, FWC, and fishing guides and anglers can provide the science needed to make informed management decisions that will benefit the fishery for the long term. We thank BTT sponsors, Costa and the March Merkin Permit Tournament, for their ongoing support of BTT's permit research. 🐟



Photo: Dr. Aaron Adams

INAGUA BONEFISH GENETICS COLLECTION TRIP

Bahamas Initiative Manager Justin Lewis recently traveled to Inagua—the best-kept secret in the Bahamas—to study the bonefish population, about which little is known. Over the course of the trip, Justin worked closely with Bahamas National Trust Wardens, Casper Burrows and Henry Nixon. The main purpose of the expedition, which was BTT's first research trip to the southern Bahamas, was to collect genetic samples for BTT's Bonefish Genetics Program, to help us better understand the connectivity of bonefish populations around The Bahamas, Florida, and greater Caribbean. Despite poor weather conditions early on, the team was still able to collect 336 fin clips from adult bonefish. The team was also able to identify important nursery habitat for juvenile bonefish, foraging grounds, and—to everyone's surprise—a bonefish spawning migration! We thank Bahamas National Trust for partnering with BTT on this eye-opening trip to Inagua. 🐟



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Tippets continued...

TOURNAMENTS THAT SUPPORT

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

FLORIDA TARPON BY ED ANDERSON

A portion of the proceeds from the sale of limited edition prints of *Florida Tarpon* by Ed Anderson will benefit BTT. Anderson was Patagonia's 2017 Featured Artist, and his work can be seen in *Gray's Sporting Journal*, the Orvis Flagship Store, and art festivals and sporting expos across the country. To purchase a print, please visit: www.edandersonart.com/florida-tarpon. 🐟



Photo: Ed Anderson

UPDATE ON TARPON ACOUSTIC TAGGING

To date, we've tagged 50 tarpon with acoustic telemetry transmitters across Florida, Georgia and South Carolina. While acoustic telemetry data takes time to collect, we have some exciting information on 24 detected tarpon ranging from 30 - 105 lbs. Overall, we are beginning to see a diversity of movements. For example, some fish have exhibited large northerly-southerly movements (Florida Keys to Apalachicola, FL or to the Chesapeake Bay), while other fish are remaining in relatively localized geographic areas. These acoustic telemetry transmitters have a 5-year battery life—a huge advantage when attempting to unravel the secrets of the Silver King.

In consecutive years, we've observed one 55 lb fish migrate from the Lower Keys to as far as North Carolina and the Chesapeake Bay. This fish averaged 20 miles per day—that's comparable to running 1 ½ marathons every two days for 52 days straight! Will this fish migrate to its northern latitudes year-after-year? We also have some fish displaying seasonal movements in a much less predictable fashion. For example, we've observed a 65 lb tarpon travel across southern Florida (Charlotte Harbor to West Palm Beach) during the summer, to the Everglades for the entire winter, and subsequently to the Keys in the spring. As we collect more data in subsequent years, we'll be able to understand the complexity and connectivity of these incredible fish, information which will help foster the conservation and protection this incredible species deserves. 🐟



Ogden M. Pleissner (1905-1983) PRICE UPON REQUEST

Lower Restigouche, c. 1960

signed "Pleissner" lower right
watercolor, 7 by 14 1/8 in.

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Bonefish Restoration Research Project: Spawning Induced in Wild Bonefish

JON SHENKER, PH.D.

Department of Biological Sciences, Florida Institute of Technology

PAUL WILLS, PH.D.

Harbor Branch Oceanographic Institution, Florida Atlantic University

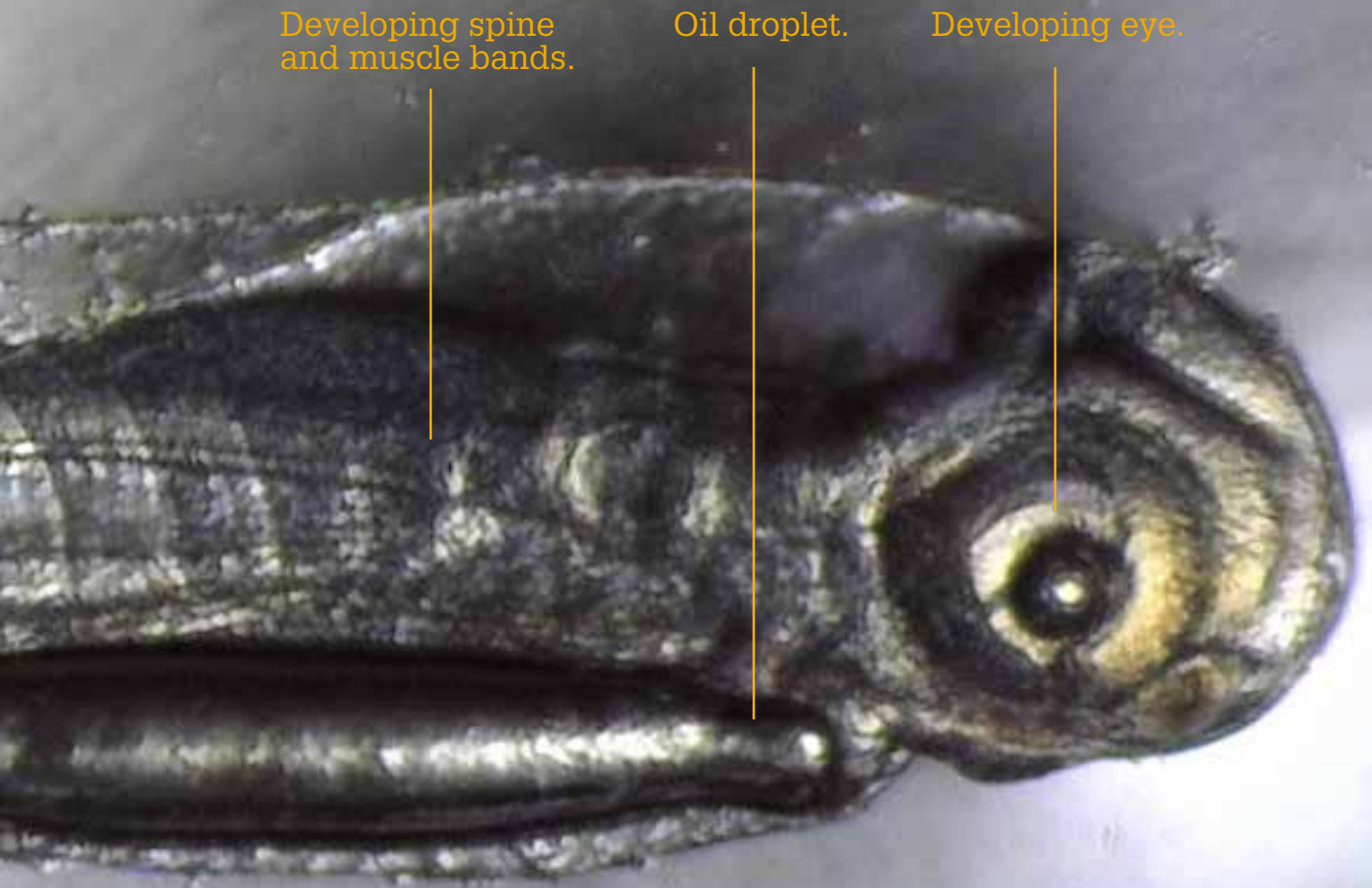
The decline of the bonefish population in the Florida Keys over recent decades has led to a variety of research projects to help determine the cause(s) of the decline, and possible ways to help reverse the population loss. Thanks to funding from the Bonefish & Tarpon Trust and the National Fish and Wildlife Foundation, we have embarked on a five-year Bonefish Research and Restoration Program (BRRP) to determine how to spawn and culture bonefish in captivity, and to use that knowledge to help conserve habitats and restore wild populations. Most of our work is based at the Florida Atlantic University's Harbor Branch Oceanographic Institute (HBOI) in Fort Pierce, FL, with additional studies being done at the Cape Eleuthera Institute (CEI) in the Bahamas.

There are two major challenges that we face. First, we have to learn how to get the adults to spawn under our control, and then we have to learn how to rear their unusual leptocephalus ("slender head")

larvae. As we achieve these objectives, we'll be able to understand how bonefish survive in the wild, how populations are connected across their Caribbean/Florida/Bahamas habitats, and how we can target population restoration programs in the Keys.

We recently took a major step forward: we were able to get bonefish captured from a pre-spawning aggregation in the wild to spawn in tanks in the lab, incubate their embryos, and grow the early larval stages. This success—inducing wild fish to spawn in a captive setting—taught us a great deal about the process, which we are applying to work on captive fish.

The HBOI team is leading the effort to bring bonefish into reproductive condition. While those fish are maturing and beginning to respond to manipulation of their reproductive hormones, the Florida Institute of Technology (FIT) team continues our work with



A bonefish larva, with a developing eye, spine and muscle bands. Nutrients in the yolk sac have been consumed, but the oil droplet for buoyancy and a last burst of energy is still visible. Photo: Dr. Jon Shenker

wild bonefish. On December 28, 2017, we took a research crew, consisting of Tony Cianciotto (one of Jon's old students, now with the BRRP), Jake Rennert, and Molly Wightman to CEI to try to spawn wild bonefish captured at a nearby pre-spawning aggregation site. Working with us were Danielle Orrell and Eric Schneider of CEI. A Skype call each evening with Paul Wills, Saher Mejri, Bob Halstead and Chris Robinson (HBOI) and Travis Van Leeuwen (Director of Research at CEI) helped maintain constant contact and discussions about research progress.

While at CEI for the full moon, we managed to catch six fish over a three-day period. By inserting a tube into their gonads to collect gamete samples, we determined that we had two females and one male close to spawning condition. Catching fish and placing them in fiberglass tanks frequently inhibits their reproductive behavior, so we administered reproductive hormones to induce the bonefish to

spawn while they were captive in the tanks. These hormone injection strategies were developed by our colleagues at HBOI (Dr. Paul Wills, Bob Halstead, Saher Mejri, and Chris Robinson), and having these captured fish at CEI gave us the opportunity to test the types and dosages of the hormones.

Two injections of the hormones, one on New Year's Eve and one on the evening of January 1, did the trick. By daybreak on January 2, one of the females had an abdomen full of ripe eggs. We "strip-spawned" her by gently squeezing her belly and collecting nearly a pint of eggs in a bowl. We then strip-spawned the male to release his sperm on top of the eggs. Gentle stirring mixed the gametes, then we added seawater to activate the sperm. Fertilization occurred during the next 30 seconds.

Fertilized eggs were then placed in aerated containers and watched carefully. Tony, Jake, Molly and Dani took photos and samples every

hour to document the pace of embryo development. Twenty-five hours after fertilization, the eggs started hatching into tiny, 3/16" long larvae at a very early stage of development. Each larva had a large yolk sac and oil droplet on its belly to provide food and buoyancy. No eyes, no mouth, only the beginning of tail musculature—all those structures developed during the coming days.

Larval development was very fast, compared to most other marine fish larvae. Thirty hours after fertilization the larva was 3/8" long and beginning to look like a fish—the eyes were large (but not yet pigmented and probably not functional), muscle bands and the backbone were clearly visible, most of the yolk had been consumed, and only a little oil remained. Still missing: the jaw and the digestive system. By forty-eight hours, the larvae still had not developed their jaws or started to feed, and we were beginning to lose them.

Although none of the larvae made it to the feeding stage, we learned a great deal about how to enhance our larval growth aquaria, and developed a variety of types of food to get them to grow after they use up their yolk reserves: squid paste, gelatin and fish oil.

What is this teaching us? First, we've shown that we can indeed induce bonefish to spawn while being held in tanks at the lab, and grow their embryos and early larvae. We can now begin to optimize hormonal induction of spawning for fish maintained for a long time in a controlled aquaculture facility. Second, we can begin learning how to culture the larvae up to the juvenile fish stage. As we complete these facets of our study, we can apply that knowledge toward conservation of bonefish in the Florida Keys and other habitats. 🐟



Jake Rennert mixing eggs and sperm that were strip-spawned from bonefish at the Cape Eleuthera Institute. Photo: Dr. Jon Shenker



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AARON ADAMS, PH.D.

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



Photo: Jared Zissu

Creek mouths often see the biggest changes after hurricanes, especially storms with heavy rains. The high volume of freshwater draining from the creek can stress the seagrasses.

Hurricane Irma

Hurricane Irma's impacts on the people and infrastructure of the Florida Keys and Everglades were reflected in the photos, videos, and personal reports that were all over the news and social media. A life-changing experience for many, and with a long road of recovery and rebuilding ahead. But even as the rebuilding begins, many are asking about the fish and fisheries—did the fish survive the hurricane, what will the fishery be like now? These are not idle questions—the fish and fisheries they support are the economic and cultural core of the Florida Keys and Everglades, so are as important to the vitality of the region as the infrastructure rebuilding that has already begun.

A valid response to questions about the hurricane's impacts is: "These ecosystems have been through hurricanes before, they'll be fine." And overall, this is likely to be the case. After all, the fish in Florida and the Caribbean have evolved in ecosystems with frequent hurricanes. Although there hasn't been research on the impacts of hurricanes on bonefish, tarpon, or permit, we can use other research and personal experiences to make an educated guess about the impacts of Hurricane Irma on these three species.

But before we consider how Irma affected the fish, it's important to understand how scientists assess hurricane impacts to an ecosystem



Backcountry brawlers, redfish, are resistant to changing weather—from cold fronts to hurricanes. Photo: Eric Estrada



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as a whole. There are three general categories: an ecosystem can be resistant, resilient, or undergo phase shift. An ecosystem that is resistant to the effects of a hurricane doesn't show any notable effects when a storm passes over it. Things return to normal quickly, on the order of days, weeks, or months. A resilient ecosystem is significantly affected by the hurricane (i.e. there is a decline in the bonefish population), but the system recovers over time, and returns to its previous function. Resilient system recovery can be on the order of years. Lastly, ecosystems can be significantly altered, and undergo a phase shift; in other words, the post-hurricane ecosystem is different, there is a "new normal." This framework is used by ecologists to study not only hurricanes, but the effects of other "disturbances," such as floods or wildfires.

Fish can be impacted by hurricanes directly and indirectly. Here is an example of a direct impact: after Hurricane Sandy, there were reports of bonefish washed ashore during storm surge flooding in the Abaco Marls. Since tag-recapture research of bonefish shows that they have small home ranges (>70% of recaptured bonefish are recaptured within 1 kilometer of the tagging location), it's unlikely the bonefish lost to the hurricane would be replaced by bonefish immigrating from other locations. Instead, the recovery relied on new bonefish larvae being delivered to the Marls by ocean currents. The bonefish population of the Marls is healthy today—the new arrivals of larvae helped the population recover to pre-storm levels—so this population would be classified as resilient; the population took a hit, but recovered after a few years.

The report from the Marls is similar to what ecologists have reported from studies of coral reef fish in the Caribbean and

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Photo: Craig Winter

Mangroves are the glue that holds shorelines together. When hurricanes kill large, old mangroves, shoreline changes often result.

In terms of the Keys flats fish, reports indicate that they did not suffer any direct impacts from Irma.

Pacific. There is often a loss of fish directly from the storm, but the populations rebound as new larvae arrive on the reef. In terms of the Keys flats fish, reports indicate that they did not suffer any direct impacts from Irma.

“We got reports of a few dead snook and small tarpon that probably got caught in the wrong place at the wrong time during the storm,” said BTT’s Florida Keys Initiative Manager Dr. Ross Boucek, “But in general, the handful of dead fish reported is just a drop in the bucket in terms of their overall population size in the Keys.”

More common are indirect impacts, such as changes in habitat or the amount and type of prey. Following Irma, there was a temporary shift in the Keys in the distribution of mullet, an important prey for tarpon. The predators may still be there, but they must adjust by finding habitats that are still healthy, or finding new sources of prey. The long-term effects of these indirect impacts can be difficult to sort out, and are frequently on the years to decadal time scale. In terms of mullet, the shift after Irma seems to have been short-lived; they are

already returning to normal numbers in the Keys. Captain John Hand noted that the mullet off of Everglades City “just vanished” after the storm, but on December 15 he spotted the first large schools of mullet he had seen since Irma.

When Hurricane Charley passed over Charlotte Harbor, FL in 2004, the category 4 winds completely defoliated large tracts of mangroves. This had two indirect impacts. First, the creeks and shorelines were full of mangrove leaves that began to rot. The decay process consumed all the oxygen in the water, which caused massive fish kills. These weren’t the type of fish kills that you read about in the news, with dead gamefish floating on the surface. Instead, it was the small prey fish—killifish, mosquitofish, gobies, and blennies—that the snook, redfish, and juvenile tarpon relied upon. Scientists doing research in some of these creeks during this time didn’t see the prey populations return to normal for a few years. Second, after Charley, red mangroves couldn’t provide very good habitat. The prop-roots were damaged, so they didn’t provide structure, and the lack of leaves meant that the plants couldn’t provide any shade. Not only did the remaining prey fish have no place to hide, neither did the snook, redfish, and tarpon. Many miles of mangrove shoreline became essentially fishless.

The good news is that the snook, redfish, and juvenile tarpon seemed to do fine, but their patterns changed. When anglers fished these areas, they had to learn new hot spots, travel lanes, and even different fly patterns to imitate the new top prey. It was roughly five years before some of the old hot spots became productive again. And a full ten years before the mangroves again provided fully functional habitat. Some spots never recovered—numerous mangrove islands slowly degraded and no longer exist. There were similar reports from the Everglades after Hurricane Wilma in 2005. The fish and the habitats would be classified as resilient—they took a hit, but were able to recover.

Larger permit in the Keys seemed to be resistant to the impacts of Irma. “Big Permit were back on the flats pretty soon after Irma,” said Lower Keys guide Will Benson. The word is still out on the impact of Hurricane Irma on small permit.

All of this suggests that the guides and anglers in the Keys may have to learn some new locations, fish behaviors, and fly patterns, but they’ll be able to adjust just as well as the fish.

**

A caveat to this discussion of resilience is the effect of humans on the ecosystem. The same scientists who have studied natural disturbance events like hurricanes, floods, and wildfires have found that human impacts on the environment can affect how the system responds to natural events. In short, an ecosystem that is stressed from human activity, such as pollution or changes in water flows, is less able to resist or be resilient to an event like a hurricane. Think about this in terms of your own health—if you are sick, say with a cold, you are less likely to be able to fight off the flu than if you are healthy. If you’ve been paying attention, you know that Florida Bay isn’t healthy. Water mismanagement in the Everglades has caused a large-scale seagrass die-off—tens of thousands of acres of seagrass have been lost. How will this influence the ability of the system to recover? The seagrass was healthy when Wilma blasted through in 2005, but that is not the case today.

Seagrass helps to hold the sediment (mud and sand that make up



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Photo: Dr. Aaron Adams

It's amazing that the fragile backcountry can handle hurricanes, but it can. Soon after a hurricane, it's common for predators like tarpon and snook to take advantage of the roiled waters and altered habitats, and feed voraciously.

the bottom) in place. Without seagrass in Florida Bay, how much sediment was moved by Irma's winds and currents? When that sediment is suspended in the water, it carries with it a lot of organic material (like decaying plants and animals), which consumes oxygen as it decays. When the sediment finally sinks back to the bottom, will it cover still-healthy seagrass? Some of the seagrass that remains in Florida Bay was likely already stressed prior to Irma. Did it survive the storm, will it be healthy enough to recover?

What about all the nutrients flowing into the system with the extensive freshwater runoff? Will these additional nutrients fuel another algae bloom?

A cautionary tale is in the change that has occurred on many Caribbean coral reefs. Many reefs in the Caribbean are not healthy. Living coral has been replaced by algae. Human-caused nutrient and sediment runoff and overfishing are among the many causes of the decline. This has led to a degradation of reef structure—without live corals to build the reef, many reefs are slowly crumbling. One result has been a shift in the fish populations—on many reefs there are fewer species, and the populations are often dominated by smaller species that are able to take advantage of degraded habitats. These changes mean that the reefs are less able to handle hurricanes. In other words, there is a “new normal” on these reefs.

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The take-home message? The fish species that support the flats fishery have been through this before. So have the habitats. It will take some time to figure out for Hurricane Irma, but research on other hurricanes suggests that the fishery will be resilient. Fish behavior patterns may change, and we may have to learn some new nuances, but that is a small price to pay.

All in all, it seems like our flats habitats did okay. “The reefs took a real beating,” said Benson, “but the flats did fairly well.” There are even positive ecological effects from Irma—seagrass habitats get cleaned of excess sediment and harmful macro-algae that shades them out. Benson also reported that off of Big Pine Key pieces of mangrove

islands were re-deposited on flats, which creates great habitat for prey and flats fish. Likewise, hurricanes like Irma bring in much needed freshwater to places like Florida Bay and Everglades National Park.

“I am totally optimistic and really think the hurricane was a positive for the Everglades system,” said Captain Jason Sullivan, who guides out of Flamingo and Florida Bay. “Three months after the storm, there was still a ton of fresh water pouring into Taylor slough and Shark River slough. I believe that having this amount of freshwater in the system will benefit all fish, as the ecosystem is getting the amount of fresh water it’s naturally supposed to get.” Storm surge from Hurricane Irma seemed to have a positive impact on the numbers of baby snook, and likely baby tarpon. Florida International University researcher, Dr. Jennifer Rehage, who has monitored snook populations in Everglades National Park for over a decade, said, “There are now twice as many 1-2 inch snook than we have ever measured in our 13 years of monitoring.” Since baby snook and tarpon share the same habitats, and are affected by the same factors, it’s a safe to say that there are a lot of baby tarpon around as well.

The one concern comes from the ecosystem’s ability to respond to the hurricane as it also deals with human-caused impacts. How will the habitats respond, especially seagrass, and will the habitats be able to support fish recovery? We won’t likely know the answer to this for years. But at the very least, this should energize efforts to restore the Everglades—once that is done, we can rely on a resilient ecosystem to support healthy fisheries through future hurricanes. 🐟



Photo: Dr. Aaron Adams

Bonefish populations in the FL Keys have lived through countless hurricanes, and should be fine after Irma. But the impacts of the added stress from water mismanagement and habitat loss are tougher to predict.



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What did they say?

Translating science presentations from the symposium

Keepemwet Fishing and Bonefish & Tarpon Trust have teamed up to make the science that was presented at the BTT Symposium last November accessible to a wider audience. A selection of presentations has been summarized and “translated” into non-technical language that is easily understood by non-scientists. Several of the translations are below and more are available on the Keepemwet Fishing website (www.keepemwet.org).

Keepemwet Fishing is about releasing fish in the best condition possible. It’s a motto for minimizing air exposure, eliminating contact with dry surfaces, and reducing the handling of fish that are released. The goal of Keepemwet Fishing is to minimize the impact of catch-and-release angling on fisheries by uniting conscientious anglers, organizations, and companies to promote science-based practices for handling fish. At our core is the belief that recreational anglers are a key component of fish conservation and can help create healthier fisheries. 🐟



Where do babies come from? Populations of bonefish (*Albula vulpes*) in the Greater Caribbean

PRESENTATION BY DR. ELIZABETH M. WALLACE
Florida Fish and Wildlife Conservation Commission

Bonefish populations in Florida have been declining for many years. While finding an explanation for fish declines is sometimes obvious (for example, the recent damming of a river), oftentimes it is much more obscure. The decline of bonefish in Florida falls into the latter category.

While some scientists study whether declines in habitat health has impacted bonefish in the Florida Keys, other research is focusing on where bonefish in the Florida Keys come from. Bonefish spawn in huge aggregations (see below) in a process called broadcast spawning—males and females eject eggs and sperm into the open water, where the eggs are fertilized. The eggs, and then the larvae that hatch from the eggs float in ocean currents for 40 to 70 days. Because bonefish have such a long larval stage, ocean currents play a huge role in how far they travel. While one location could have self-recruitment (larvae end up in the same area as where their parents live), another location could depend on external sourcing (larvae that end up at a location are the offspring of adults from another area). The question for the Florida Keys—does the bonefish population depend on larvae from Keys bonefish or do the larvae come from other sources? One way to address this question is through genetic analysis.

What did they do?

- Collected bonefish larvae and fin clips from adults (a small piece of fin similar to a fingernail clipping that can be used for genetic analysis) from five countries (US, Bahamas, Belize, Mexico, Cuba).
- In the Bahamas, there was intensive collection from nine different islands.

What did they find?

- 2,380 larval bonefish were collected in the Bahamas, while 360 were collected in Cuba, and 26 in Mexico.
- In Florida, despite a huge effort and time dedicated to sampling, only 16 larvae were collected.
- It’s important to remember that this was only the first year of collection and that larval recruitment (the number of larvae arriving to a location) can vary from year to year for any given location.
- The fin clips are in the final process of being analyzed and will help shed light on why recruitment to Florida is so low and whether this is a self-recruitment or external sourcing issue.

Why is this study important?

- Understanding larval recruitment rates is an essential piece in the Florida bonefish decline puzzle.
- No matter how well we protect adult bonefish in Florida, if there is low larval recruitment the population may never recover.
 - If larvae are coming from another location (southwest Cuba, for example) then Florida fisheries managers will need to collaborate with managers in those other locations to ensure their bonefish populations remain healthy.
 - If larvae are coming from local spawning in the Florida Keys, then scientists need to determine why spawning is not producing enough larvae to sustain the population. 🐟

Swirling, jumping, burping, and farting: bonefish spawning behaviors

PRESENTATION BY DR. ANDY J. DANYLCHUK
University of Massachusetts Amherst

Until several years ago there was still a lot of mystery surrounding how and when bonefish spawn. Early studies indicated that it was during the winter in the northern hemisphere and corresponded with particular moon phases. Information from anglers and guides suggested that bonefish form large schools or aggregations around the new and full moons.

Using this collected information and detailed tracking, researchers found and observed an aggregation of bonefish on Eleuthera in the Bahamas. The bonefish formed a large school that moved offshore into very deep water at night and it was hypothesized that this was when they spawned (no release of eggs or sperm was observed during the day). Very unique behaviors were also observed. Several

years later, based on tips from fishing guides, several other of these 'pre-spawning aggregation sites' were studied to learn more about bonefish spawning. Their study and results are described below.

What did they do?

- Monitored pre-spawning aggregations of bonefish in the Bahamas.
- Used electronic tags to monitor how deep fish were diving at night.

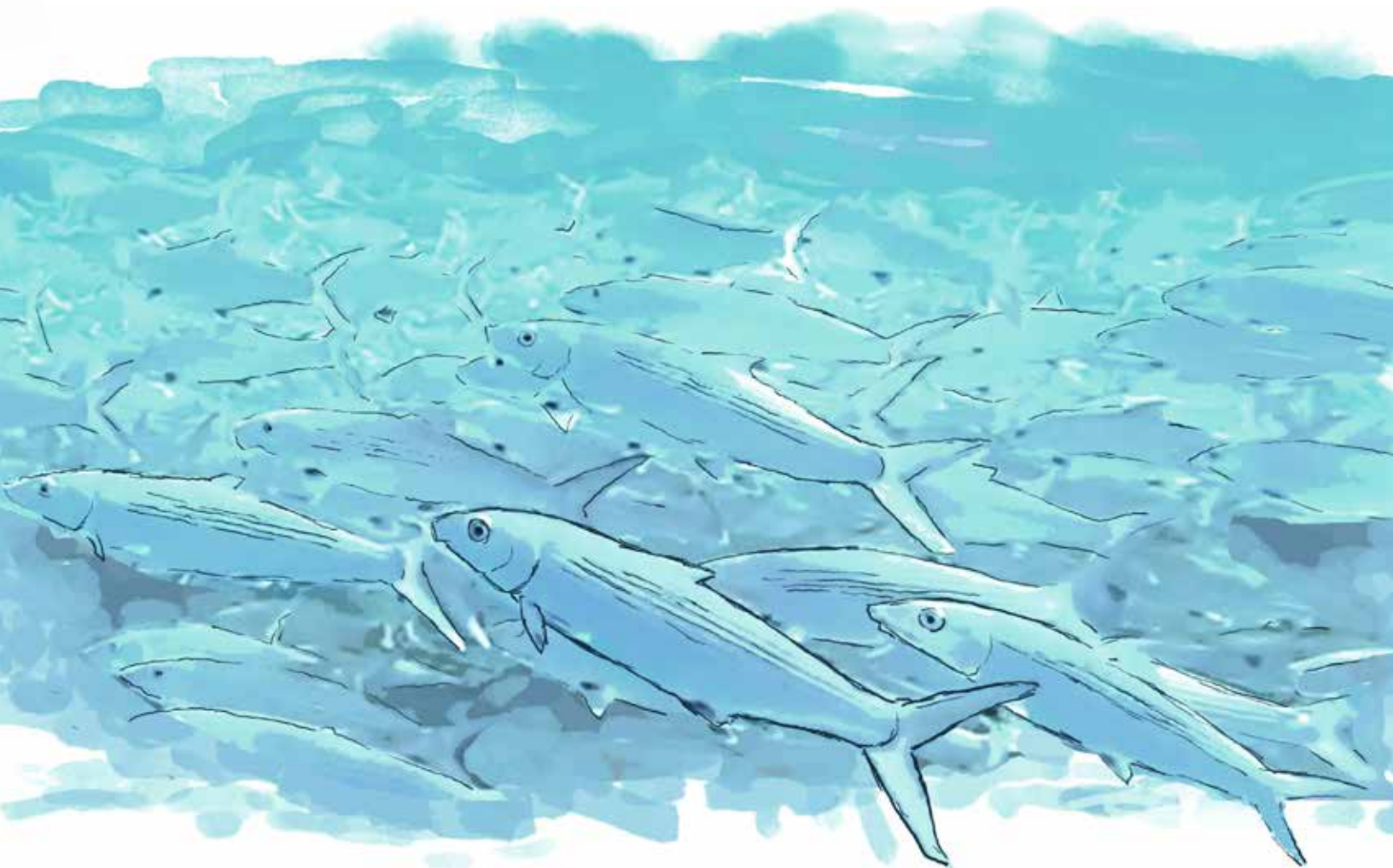
What did they find?

- Bonefish formed schools of thousands of fish in shallow areas close to deep water around the new and full moon.
- These aggregations were at or near the surface, not on the bottom where anglers typically see bonefish.
- At dusk, the bonefish began porpoising (jumping out of the water) and gulping air. It's possible that this fills their swim bladders with air.
- Shortly after, bonefish moved into deep water, dove over 50 meters, and then ascended quickly. The team proposes that these behaviors help females release eggs during spawning and for their larvae to disperse.

Why is this important?

- Knowing when and how bonefish spawn is critical for their protection.
- There is evidence that bonefish travel long distances to reach spawning aggregations, which means that protecting those movement corridors is also critical. 🐟

— continued on next page.



Could disease be a factor in the decline of Florida bonefish?

PRESENTATION BY DR. TONY L. GOLDBERG
University of Wisconsin-Madison

Disease can play a bigger role in animal populations than one might guess. In some cases it can be the primary influence on population size. For example, in the last 20 years Tasmanian devil populations have declined by 90% due almost entirely to an infectious cancer. While some diseases are obvious, others can leave no outward signs that an animal is sick and persist unnoticed for years. Finding and managing disease outbreaks in wild animal populations can be difficult, expensive, and take time.

All the above apply to fish too, of course. Many anglers know about Whirling Disease, a parasite that infects trout and salmon. The unexplained decline of bonefish in the Florida Keys gives someone like Dr. Tony Goldberg pause; he's a "disease hunter" who has worked all over the globe on epidemiological issues. The fact that other flats species have not experienced the same sort of decline as bonefish suggests to him that disease could be a culprit in the bonefish decline. His preliminary study into bonefish disease is described here.

Changes in Florida Keys Guiding

PRESENTATION BY TIMOTHY J. ADKINS
University of Illinois at Chicago

We spend a lot of time talking about and focusing on fish, but it's important to remember that fishing is an interaction between two groups of animals—humans and fish. And, quite often the interaction involves at least two people—an angler and a guide.

The insight and knowledge of fishing guides should not be underestimated. Many of them spend hundreds of days on the water every year, year after year. They know the fishery they work in fully and are often the first people to notice changes. For far too long fisheries science has overlooked fishing guides as a source of information, but I'm relieved to say that this is slowly beginning to change. As anglers have known for decades, if you want to know what's going on, ask a guide.

In communities like the Florida Keys, which rely heavily on fishing-based tourism as a major economic driver, fishing guides can play an even bigger role. Understanding and assessing the collective guide mind on issues ranging from their industry to changes in the environment can help inform regulations and policy, as well as research topics. This presenter did exactly that. Over the course of two-and-a-half months in Summer 2017, Tim Adkins interviewed flats fishing guides throughout the Keys in order to help paint a better picture of the state of flats fishing.

What did they do?

- Interviewed 61 flats fishing guides in the Florida Keys.
- Interviews lasted between 0.5 and 3.5 hours (but typically 1 to 1.5 hours).
- Questions covered topics on work, changes in work, and the industry over time.

What did they do?

- Looked at bacteria communities in bonefish using gill swabs
- Looked for viruses in blood samples
- Both methods of sampling were quick and non-lethal
- Bonefish were sampled in the Florida Keys and two locations in the Bahamas (Eleuthera and Inagua) to form comparisons.

What did they find?

- The bacteria community of bonefish differed considerably for each location.
- There was some overlap between the two locations in the Bahamas, but almost none with the fish from the Keys.
- Florida Keys bonefish had a bacteria that is associated with diseases in other species of fish.
- A bonefish virus was discovered, which appears to be a form of retrovirus.
- Certain retroviruses in fish and other animals cause "slow" diseases, such as cancers.
- The impacts of these infections are still unknown.

Why is this study important?

- Disease could be a very important piece of the Florida bonefish decline puzzle.
- If disease is responsible for bonefish declines, then disease management and prevention will be critical for bonefish populations.
- More research is needed to discern the extent to which infections may be compromising bonefish health. 🐟



What did they find?

- Guides reported declines in several fisheries in the Florida Keys, most notably bonefish, tarpon, and snook, and in particular in Florida Bay.
- Guides now market and book trips differently. They used to rely on word of mouth, and now many incorporate online booking sites and social media apps.
- Guides reported an increase in family tourism to the Keys.
- Many guides have moved from solely using flats skiffs to adding or switching to bay boats because of the increase in family tourism (bay boats can hold more people and fish a diversity of waters), and because they now see the Keys as a multi-species fishery (due to the decline in fisheries mentioned above).

Why is this study important?

- Paying attention to changing dynamics in the guide community can give us insights into what is happening with the resource (i.e. populations of fishes and fishing pressure).
- Changes in the Keys tourism industry (such as new kinds of tourism) influence how flats guides do business, and, in turn, affect fisheries.
- Accounting and accommodating for these changes is necessary for successful conservation efforts. 🐟

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The Everglades and Florida Bay 2015-2017: It's Been a Rough Few Years

PRESENTATION BY DR. STEPHEN E. DAVIS
Everglades Foundation

For those not familiar with the issue, the Everglades and Florida Bay are in rough shape. Decades of ecosystem modifications have drastically changed the hydrodynamics of south Florida.

How the system is supposed to work:

Fresh water from Lake Okeechobee flows south in a river that is miles wide and inches deep, known as the "River of Grass" that is the Florida Everglades. The water flows through sloughs and marshes and swamps and eventually into Florida Bay where it mixes with ocean water in a huge system of mangroves and seagrass beds. These habitats are critical for many species of fish.

How the system works now:

Water from Lake Okeechobee is diverted west (into the Caloosahatchee River) and east (into the St. Lucie River) and almost no freshwater flows south into the Everglades.

The repercussions of changing the water flow have been drastic. In the Everglades, the sawgrass marshes and sloughs are drying up and the peat in the marshes is collapsing. Further south, salt water is starting to creep north, which is killing many freshwater species. Florida Bay has become hyper-saline (the amount of salt in the water is too high) and this has led to mangrove and seagrass die-offs, which then lead to algal blooms and fish kills. The Everglades now depends almost entirely on rainfall for fresh water, and when there's a drought (as there was in 2015 and 2017) the issues get exacerbated.

The Caloosahatchee and St. Lucie Rivers have also been severely impacted by the changes in water flow. Decades of agriculture around Lake Okeechobee have led to its waters containing high levels of fertilizers. When the water is discharged into the rivers the fertilizers


go to work and create algae blooms of cyanobacteria that smothers seagrass, kills fish, and sometimes even makes it toxic for people to swim. These rivers lead to estuaries that are important nursery areas for many fish and bird species. People have taken a hit too as real estate prices have decreased.

Hurricanes Irma Impacts:

As hurricane Irma tore through the Keys and up into the Florida mainland, it pushed a huge amount of dead organic matter (leaves, seagrass blades, etc.) known as 'detritus' up against the coastline in Florida Bay. This detritus, including the remnants of the 2015 seagrass die-off, fueled a large and intense algae bloom in Florida Bay, which has been moving slowly south into the Keys and offshore towards the reef tract. The algae bloom in late 2017 was so large that it could be seen on satellite images of Florida Bay.

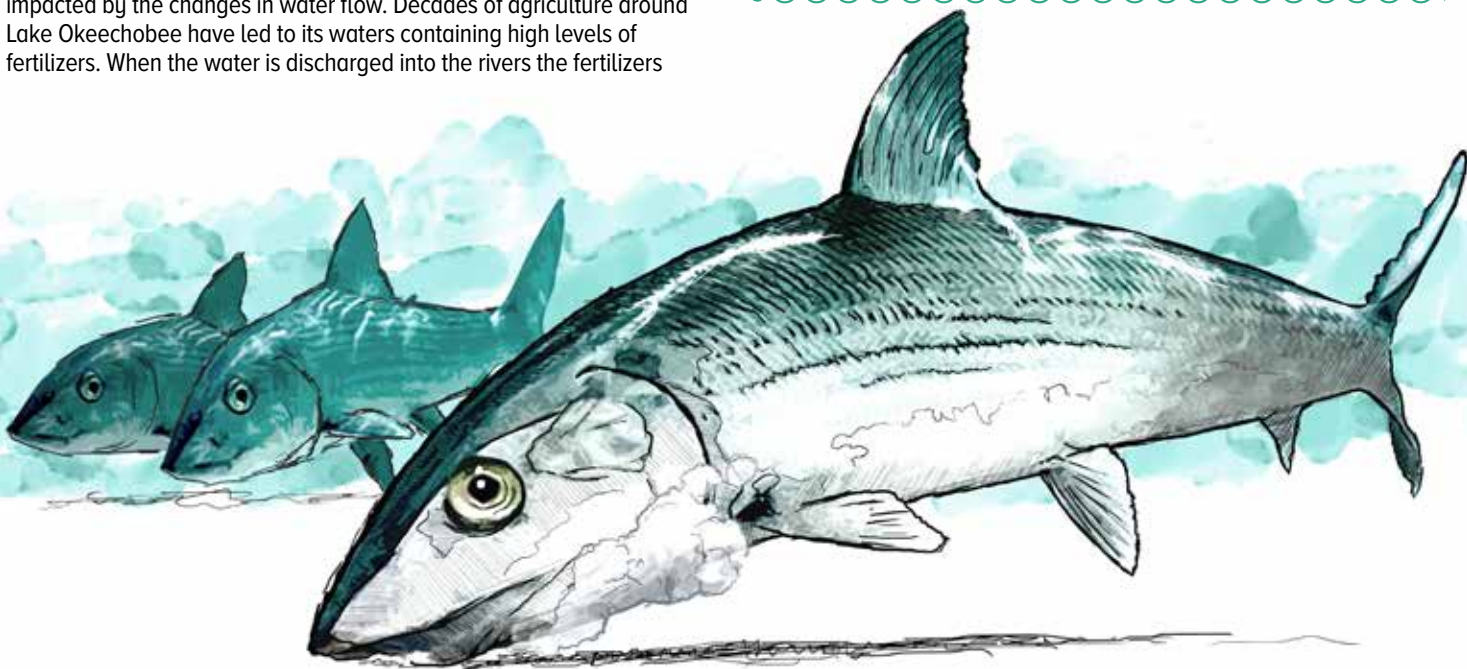
Fixes:

It's a scary thing when you hear a scientist say, "We don't need to do any more science; we know what the problem is and we know how to fix it." Very rarely is there complete agreement in the scientific community, and when there is, and there still isn't movement on an issue you know that something is very wrong. Well, this is where we are on the issue of water management in the Everglades. The lack of fixes being implemented is purely due to political reasons and not because of any holdups from the science.


There is, however, some light at the end of the tunnel. Currently a bridge is being constructed on the Tamiami Trail, which will allow for increased water flow south. 

Acknowledgements

A special thanks to Ed Anderson who donated the artwork accompanying this article. Thank you to the presenters and their collaborators for the work that contributed to these presentations, and for allowing us to represent them in these summaries. Thank you as well to Natasha Viadero, Alora Myers, and Jordan Massie who provided assistance during the symposium.



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Through the Guides: Conservation Captain Q & A



Capt. Newman Weaver

Kingfisher Guide Service – Georgetown, SC and Florida Keys

How long have you been guiding in South Carolina and Florida?

13 years. I spend most of my time in Georgetown, but April and May in the Keys.

What would you say is the biggest difference between the two fisheries?

The Keys are more predictable. In South Carolina, tides and currents are much more variable. The fish are migrating and the windows are small; they're sometimes miles apart.

In what ways have you seen those fisheries change?

Twelve years ago in South Carolina, tarpon fishing was a 'go put a piece of cut mullet on the bottom and wait' kind of game. Now, it involves learning and calculation. And with social media being what it is, more people find out about when and where fish are biting.

What BTT projects have you helped with?

JoEllen Wilson worked with scientists at University of South Carolina on an awesome study of juvenile tarpon in the impoundments in South Carolina. She's also working with University of Massachusetts on tarpon acoustic tagging. It'll be cool to see the results, since there's still so much mystery there: Do all tarpon spend winter in the Keys? Do some stay offshore year-round? And does that rule apply every year? How many of these fish have I seen in Florida and, 48 hours later, see in South Carolina? Asking those relevant questions and being able to investigate them is so interesting to me.

As a guide, you're on the "front lines" when it comes to monitoring the patterns in our fisheries. What are some things the everyday angler can do to support conservation?

Become a member of BTT! Right now it's the most effective usage of someone's resources in that way, since you're the ones with the real science, which is so vital to the success of our fisheries. I always encourage those people who love fishing but just never got around to joining.

From the BTT Science Team

The great thing about fishing with Captain Newman is that he's always asking questions. We are constantly feeding off of each other—Newman with everyday observations and us with the science. This also makes him a great guide since he's always willing to adapt and evolve. With so many unknowns about this incredible South Carolina tarpon fishery, we rely on guides like Capt. Newman for his experience and ability to locate, catch and tag tarpon.

- JoEllen Wilson, BTT Juvenile Tarpon Habitat Manager; Lucas Griffin, UMass Amherst, Dept. of Environmental Conservation



Steve Friedman

A Fishing Guide – Florida Keys

How long have you been guiding in South Florida?

About 17 years.

You must have developed a solid understanding of South Florida's fishery.

It's interesting because you can go out one day and really feel like you have a feel for it, then the next day it's like you know nothing. The fishing can change in a heartbeat no matter how much you know.

How did you first get involved with BTT?

When I moved to Florida, I was working part-time at Florida Keys Outfitters, Sandy Moret's shop in Islamorada. I first heard about BTT around that time. As soon as I got a whiff of the idea that I could tag a bonefish and someone could catch the same one, I couldn't wait to start helping out. I'm a catch-and-release fisherman, and the tagging program proved that you can enjoy the process of catching the fish, taking some measurements, and releasing it—then know another angler gets to experience the excitement of encountering that same fish.

What is one thing you want to tell our readers—not just the ones in South Florida?

Science is the key. It's important to participate in and own the science. I'm about to help Dr. Steve Davis with a water collection study so I'll be able to get my clients involved. We start with the data points that are translated to us laymen, so that we can adjust. We've found that the sunblock we're wearing is introducing dangerous chemicals into the water, so we'll wear a different sunblock. We adjust. It's as simple as that. That's just one example to show that if you go on thinking, 'That's just the way it is' and no one asks the questions that BTT is asking, we won't catch those problems until it's too late—if at all. Everyone needs to be informed and involved, and not just in South Florida.

From the BTT Science Team

Steve Friedman is a true leader, and a champion for the guide community and flats conservation. Steve is one of the biggest advocates for restoration—he has recently made several trips to Tallahassee pushing for Senate Bill 10. Likewise, he was instrumental in halting the recent proposed park guide fee increases. On top of all this, he is always willing to support and partner with us and the Everglades Foundation in our fight to protect the flats. We are lucky to have Steve in the Keys.

- Dr. Ross Boucek, BTT Florida Keys Initiative Manager



Captain Jason Sullivan

Rising Tide Charters

What area do you guide mostly?

I try to fish all of the southern part of the Everglades. Everywhere from Lostman's River, all the way up to Florida Bay. It's probably the most unique and most diverse fishery in South Florida, and it's some of the best tarpon fishing—in my opinion—on the planet.

How long have you been a guide in the Glades?

Seven years.

Have you seen the fishery change during that time?

I definitely have—some good, some bad. The fishing in Florida Bay outside of Flamingo, called “out front,” has gone through cycles, but right now it's probably as bad as I've seen it—mostly because of water conditions. But some of the backcountry fishing in Whitewater Bay and Hell's Bay—some of those pretty far-back bays—is some of the best fishing I've ever experienced. It's just been so consistent.

What research projects have you been most involved in?

I've helped Ross with the acoustic tags, and Luke Griffin and I tagged tarpon in 2015. I've also helped FIU with putting the same acoustic tags on snook and smaller tarpon.

What advice would you give to the everyday angler who wants to be involved in the conservation of their favorite fishery?

I think the number one most important thing is education, because a lot of recreational anglers don't really understand how the entire system works. The second most important thing is that everyone needs to be on the same page. I think that's how you get things done, with legislation and policy especially. So BTT is the absolute ideal voice for all that. You guys have such a good backing and you're very well-established.

From the BTT Science Team

What separates Jason from other captains is that Jason spends his free time learning about and advocating for Everglades restoration. Very few anglers, guides, and even scientists are as knowledgeable as Jason is. We need more captains like Jason who really go out of their way to learn about and push for resolving our freshwater crisis in Florida if anything is going to get done.

- Dr. Ross Boucek, BTT Florida Keys Initiative Manager



Buddy & Cindy Pinder

Pinder's Professional Bonefishing – Marsh Harbour, Abaco, Bahamas

How long have you been an independent guide and where?

Buddy: I've been guiding in the Marls of Abaco National Park for 25 years.

During that time, how would you say the fishery has changed?

Buddy: We've had some population decreases because of hurricanes, but we still have a great number of fish and the fishery as a whole is healthy. What I have seen is a little too much pressure.

How did you initially become involved in BTT?

Cindy: Dr. Aaron Adams had published his bonefish research in a popular magazine so I invited him to give a presentation at a community meeting. He was on Abaco to film the first season of *Buccaneers & Bones*. He talked to the guides about bonefish tagging, which is how Abaco Fly Fishing Guides Association (AFFGA) became involved. Buddy went on to tag at least 2,000 of the 3,000 bonefish on Abaco over the next several years. The research provided much of the evidence which led to the island's three new national parks. In 2009, AFFGA partnered with BTT to tag bonefish and conduct research on Abaco, so we did a week-long Bonefish Rodeo to kick off the tagging venture. We then did another event where we seined the spawning run for tagging to prove the link between the Marls and Cross Harbour. We did yet another tagging event as part of the Rapid Ecological Assessment of Cross Harbour for the national park proposal.

What do you love most about guiding?

Buddy: I like meeting new people, and over the years many clients have become lifelong friends. I like watching people have a good time—having a good day on the water, catching fish and enjoying themselves. I also want people to come to the Bahamas, have a good time, and come back!

From the BTT Science Team

Cindy and Buddy Pinder have been an integral part to success of the Bahamas Initiative, especially on their home island of Abaco. Whenever BTT requests assistance, the Pinders have always been there to help in any way they can—from taking BTT scientists out to conduct research, to bringing together guides and anglers for presentations. The Pinders' hard work and dedication to flats conservation helped create three national parks in Abaco dedicated to the conservation of bonefish and other flats species.

- Justin Lewis, BTT Bahamas Initiative Manager



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

Are Permit Creatures of Habit?

Photo: Jordan Carter

On the flats, permit are one of the most elusive gamefish on the planet. Yet on nearshore reefs and shipwrecks, catching one is a far less challenging endeavor for anglers. This begs the question: Are the permit we see on the flats the same fish that we see on the reefs and shipwrecks? This is not only a common musing among permit guides and anglers, but also an important piece of information for permit conservation. This is because permit fishing on the flats is almost entirely catch-and-release, but on deeper-water structures harvest is more common and predators more abundant, making permit angling potentially harder on the population. These nearshore structures also serve as essential spawning habitats for permit, where large aggregations of spawning fish can be easily targeted by anglers during this important time in their life cycle. For this reason the Florida Fish and Wildlife Conservation Commission (FWC) established the Special Permit Zone (SPZ) in 2011, spanning from Biscayne Bay south through the Keys. Within the SPZ harvest is more restricted than in the rest of Florida, and the initial regulations completely prohibited harvest from May through July to protect spawning fish. The spawning season closure was selected based on data from an FWC study in the 1990s that estimated spawning from seasonality of females with eggs. Missing from the FWC study data,

however, was information on whether permit traveled between flats and reefs, and actual measures of when and where permit are in spawning aggregations.

In order to address some of these knowledge gaps, BTT and science partner Carleton University, in collaboration with FWC, began a long-term tracking project in 2016 to determine the connectivity between the flats and reefs, whether permit remain within the SPZ, and to better estimate when the peak spawning season occurs.

To accomplish this, we are monitoring the spatial movements of individual permit using a high-tech approach called acoustic telemetry. This involves tagging permit with acoustic transmitters that emit ultrasonic signals through the water, which are detected by specialized receivers when tagged permit are in range (50-1000 yards depending on conditions such as water depth and windspeed). By placing acoustic receivers in diverse regions and habitats, we are learning about their movement patterns between the various flats, reefs, and shipwrecks throughout South Florida, which will help inform Permit management plans.

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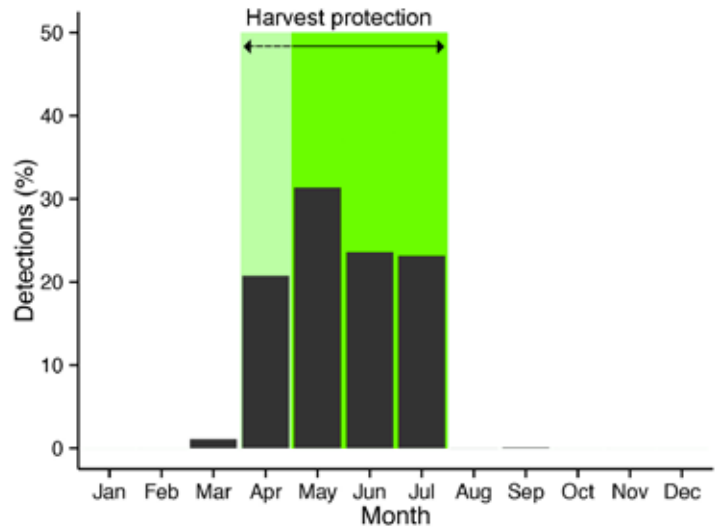
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Photo by Barry & Cathy Beck

To date, we have tagged 44 permit in the Lower Keys with acoustic transmitters, from which we have amassed over 40 thousand detections. So far, none of the permit tagged in the Lower Florida Keys have been detected outside of the Keys (e.g., to visit Biscayne Bay). Perhaps most interesting is how much permit stick to specific flats, which they visit over and over again, week by week, month by month. It seems permit are a highly habitual fish when it comes to the flats they visit to look for a meal. What this means for permit anglers and guides is if you fish the same locations repeatedly, you are likely seeing the same group(s) of fish. This leads us to more important questions such as: How quickly do fish get wise to anglers and become more difficult to catch? How much fishing pressure will a group of permit tolerate before changing their behavior or abandoning a flat? Most permit anglers would probably agree, the last thing we want is to make permit fishing even more challenging than it already is. From a conservation perspective, it is also important to allow permit the opportunity to freely access the flats, which provide important sources of food.

While permit have an incredible loyalty to specific flats, they do not remain there full time. Permit from diverse regions of the Lower Keys travel upwards of 50 miles to visit specific locations on the Florida Reef Tract (which is on the Atlantic side of the Keys), often multiple times, throughout the spring and summer months. To date, 41% of the fish detected in our tracking system have visited both the flats and the Florida Reef Tract, indicating significant connectivity between these habitats. However, the fish that visit the northern edge of the Lower Keys in the Gulf of Mexico do not use the Florida Reef Tract, while one individual tagged on a shipwreck 15 miles into the Gulf of Mexico was detected on the flats in this region. Until now our tracking system has had poor coverage on Gulf shipwrecks, but we hypothesize that these structures represent important habitats for a subset of permit that occupy the flats in the Lower Keys. In other words, there may be distinct groups of permit that visit the Reef Tract, and others that visit shipwrecks in the Gulf exclusively.

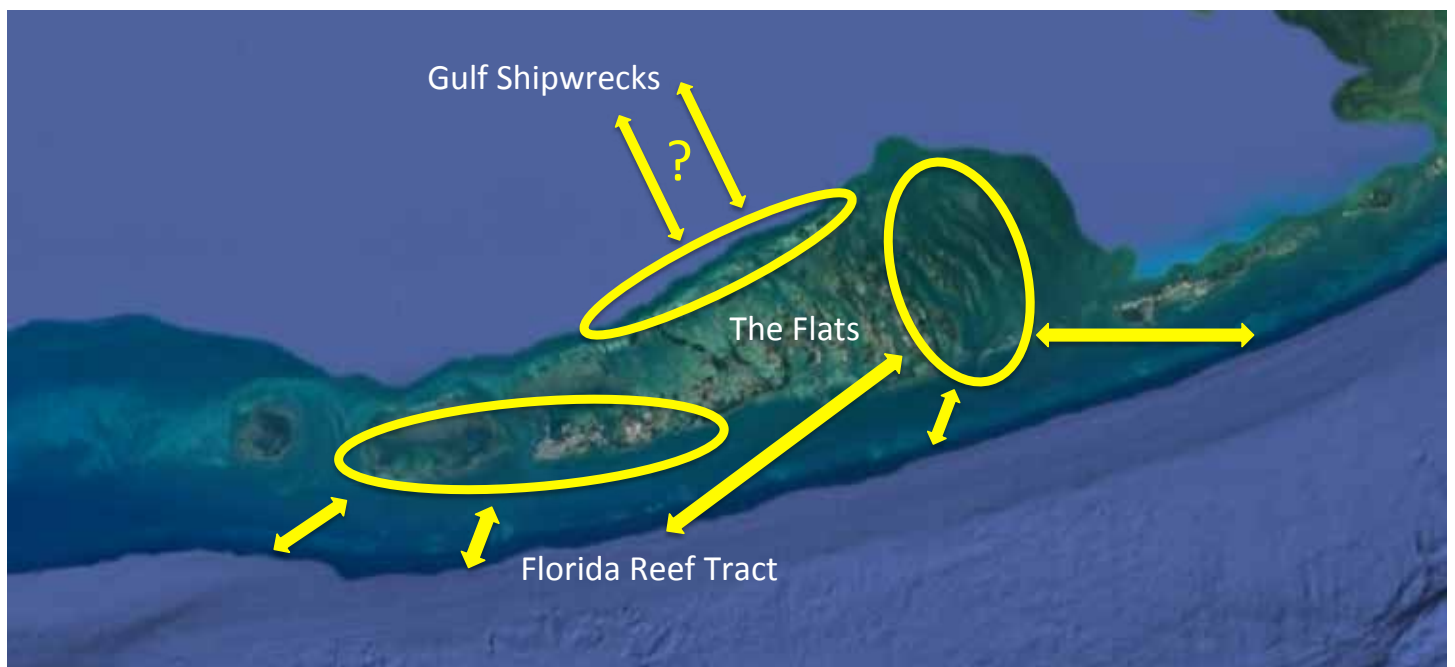
We are especially concerned about those permit using the Florida Reef Tract because it is home to well-known spawning aggregation sites. Our findings show that the fish occupy the Reef Tract



For permit detected on offshore reefs, this graph shows the months they were detected as a percentage. During the spawning season, 20% of the detections occurred in April. The darker shade of green represents the original spawning season harvest closure from May through July. The lighter green shows the expansion of the spawning season closure to include April.

extensively from April to July, and we also visually observed large spawning aggregations throughout April 2017. This is significant evidence that permit are occupying the reef to spawn outside of the current harvest protection period of May to July. Within the SPZ harvest is more restricted than in the rest of Florida, and the initial regulations completely prohibited harvest from May through July to protect spawning fish.

We have learned a lot about permit movements in the first two years of this four-year tracking project. Beginning in 2018, we will expand our research to a broader region of south Florida including the Middle and Upper Keys, Biscayne Bay, and beyond, to determine how often permit move across SPZ boundaries, and better understand movements between the flats and shipwrecks in the Gulf of Mexico. This project is generously supported by Costa Del Mar, The March Merkin Fishing Tournament, Hell's Bay Boatworks, and private donors. 🐟



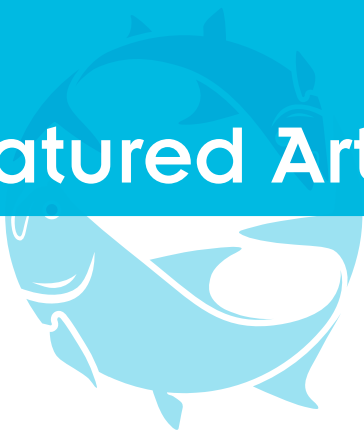


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"Bonefishing" by Chet Reneson was sold by Copley Fine Art Auctions on February 14, 2018, with 50% of the proceeds benefitting Bonefish & Tarpon Trust.

An avid hunter and angler since boyhood, Reneson grew up on a farm in Colchester, Connecticut and studied art at the University of Hartford, graduating in 1960. His art teacher, Henrik Mayer, emphasized the importance of simplicity and taught the values of light, dark, and strong, which laid the foundation for Reneson's unmistakable style. His illustrious career began with the sale of a painting at the Crossroads of Sport, Inc. in New York in 1965. Reneson's formal training, natural talent, and extensive outdoor experience established him as one of the premier sporting artists.

"We are really pleased to have Chet Reneson as this year's Artist of the Year," said Bill Legg, who serves on the BTT Board of Directors. "I, more so than most, because the first piece of sporting art that I purchased (circa 1971) was a Reneson watercolor of a flock of blue bills tolling in on one of his classic wind driven, cold snowy days. I

am now the proud owner of several Renesons, both duck hunting and flats fishing. Chet, thank you for supporting BTT."

For the past 50 years, Reneson's painting has remained true to his early mentor's teaching, encompassing many subjects including wildlife, duck hunting, upland bird shooting, big game fishing, fly fishing, and Bahamian scenes. His work has graced the covers of *Sporting Classics*, *Gray's Sporting Journal*, and *Sports Afield*, among others. He was named Ducks Unlimited Artist of the Year in 1982 and the Atlantic Salmon Federation Artist of the Year in 1982 and 2001. Additionally, he is a past member of the Connecticut Watercolor Association and the Old Lyme Art Association. Two books have been published on Reneson's work: *Shadow on the Flats* and *The Watercolors of Chet Reneson*. 



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Talking Tarpon at the BTT Science Symposium



BY BEAU BEASLEY

Andy Mill demonstrates proper line management during his Tarpon Clinic. Photos: Pat Ford

One of these things was not like the others. Marine scientists from all over the country had flocked to Fort Lauderdale to present or listen to colleagues' presentations on bonefish, tarpon, and permit conservation at the Bonefish & Tarpon Trust's 6th International Science Symposium. The audience for this morning's panel discussion, however, looked a little different from the rest: younger anglers filled the room and pressed as close as possible to the panel headliners, while their older, more seasoned counterparts hung toward the back of the room, presumably out of respect for the fishing rock stars up front. Why all the jostling and the hushed tones? This wasn't about statistics or science at all; for these strictly recreational anglers, this was a chance to hear from and even meet some of the best known saltwater anglers in modern history.

Among the living legends participating in the tarpon panel was Stu Apte, retired Navy fighter pilot and Korean War veteran who flew for Pan Am for 30 years after his military service. Apte eventually tired of flying planes and decided "against all common sense," he says, to leave flying for good and become a professional saltwater guide. "I spent about six months finding out where all the good fishing spots were," he told the BTT crowd gathered to listen to him. "Then the big day finally came: I got a paying customer, and I made a whopping \$35!" Apte began guiding in the Florida Keys in the 1940s; his passion for tarpon paid off when he became the first world record holder for the species. In 2005, Stu Apte was inducted into the International Game Fishing Association (IGFA) Hall of Fame.

Saltwater guide Steve Huff, Stu Apte's fellow IGFA Hall of Famer on the panel, has guided more anglers to world records and major tournament wins than all other professional skiff guides combined. Alongside Huff sat BTT founding member and fishing icon Sandy Moret, who can boast multiples wins of the Gold Cup Tarpon Tournament and the Islamorada Invitational Bonefish Fly Championship. Moret is an avid conservationist, leading

the charge to clean up the Everglades through the Now or Neverglades coalition. He also served on the Everglades National Advisory Board at the appointment of Governor Bob Graham. Rounding out the panel were famed guide Randolph "Bouncer" Smith; Rick Ruoff, host of *The Orvis Sporting Life* on ESPN2; and author and tarpon guru Andy Mill.

Former Olympic skier Mill knows tarpon like the back of his hand, having won the prestigious Gold Cup and the Golden Fly Tarpon Tournament an amazing five times each. "I'll never forget the first time I had a tarpon on the line," says Mill. "It literally changed my life. I thought once I left professional skiing, I'd never find anything that would fuel my passion for competition like that. But tarpon fishing really got into my blood." Mill does more than compete in fishing tournaments: he has also invested a great deal of time in studying tarpon and how they respond to various conditions. His observations are recorded in his award-winning book, *A Passion for Tarpon*.

Mill insists that most anglers make the same mistakes in their pursuit of tarpon—and he knows this because he has made those mistakes himself:

One mistake anglers make is pulling their flies out of the fish's mouth too soon, and as a result, not allowing for the chance of a good hook set. Then to make matters worse, they lift their rods straight up to try and set the hook. Instead, anglers should keep their rods low to the water and pull sideways as if they are sweeping across their bodies from left to right, or vice versa. This puts much, much more pressure on the fish. It also allows anglers to use the butt of the rod to pressure the fish, which is what rods are designed to do. I'm a pretty healthy guy with good upper body strength, but your arms soon tire if kept up and out. Keep your arms down; sweeping the rod across your body allows you to use the mass of your body to fight the fish.

“You need to consider taking a kid with you the next time you go fishing. We need to get more young people on the water, and then we need to set a good example for them.”

Bouncer Smith shared his insights with the crowd, including this old-school common sense: “There’s no getting around it; you simply have to put in your time. You have to pay your dues, and that means being on the water...a lot.” Though he is one of the most respected guides in Florida, Smith was surprisingly transparent, saying, “I don’t know if I’d be as well-known or have had the success I’ve enjoyed if I had to start today. When I began guiding, quite frankly there were a lot more fish and fewer guides. Nowadays there are no secret honey holes,” thanks to the ubiquitous GPS. “Folks can find nearly any place on earth, and once they catch fish and mark a place on their digital map, returning is pretty easy. There is no substitute for experience; you just have to get it when and where you can, and that takes time.”

The audience walked away with tarpon tips and tricks from some of the best tarpon anglers in the world. First, and perhaps counterintuitively, avoid fishing for tarpon with big flies, which are hard to cast and which result in large splashes that often spook the fish. Second, as tempting as it may be to cast right into the middle of a daisy chain of tarpon—a school of tarpon swimming in a tight circle—don’t do it. Instead focus on the fish closest to the outside ring of the circle as these fish are more likely to respond. Third, set a small amount of drag on the reel and use a strip strike. The panel agreed that strip strikes are easier, allow the angler much more control, keep the rod low if executed correctly, and enable the fly line to go through the angler’s hands and then on to the reel with a much smaller risk of breaking off the fish.

Stu Apte took the discussion beyond angling skills. “You need to consider taking a kid with you the next time you go fishing. We need to get more young people on the water, and then we need to set a good example for them.” Then he shared a cautionary tale about angling etiquette: Several years ago Apte was anchored up at a productive spot when another boat came so close that “I could have pitched a baseball underhanded and landed it” on the other boat’s deck. “You know, in Florida it is customary to give the first angler on location a pretty wide berth,” Apte admonished the newcomer, keeping a civil tongue in his head when he spotted the teenage guest in the other angler’s boat.

“Why don’t you mind your business, buddy?” the newcomer shot back. “After all, who in the hell do you think you are? Stu Apte?” “Yeah,” replied Apte tartly, “that’s exactly who I am.” The angler was so embarrassed that he immediately fired up his motor and took off.

Rick Ruoff echoed the importance of drawing a new generation to the water. “I know some of you fathers are really busy and might not get to fish as often as you would like. I encourage you—even with your limited time—to take your kids fishing with you. You won’t regret it.” Ruoff, who also gave a very well attended casting clinic, insisted that as sportsmen we still have a lot of outreach to do. “Unfortunately there are still some old-school guys who think that BTT is an organization exclusively for fly anglers or those who don’t think you should ever harvest fish. This simply isn’t the case. There are lots and lots of traditional anglers heavily involved with BTT. I know because I’m one of them.” 🐟



Steve Huff in 1984
Photo: BTT Archives



Tarpon Legends Panel at the 6th International Science Symposium (left to right): Stu Apte, Paul Dixon, Tommy Locke, Paul Tejera, Bill Horn, Jay Robertson, Bouncer Smith, Andy Mill, and Lucas Griffin. Photo: Pat Ford



Rick Ruoff poles the flats.
Photo: BTT Archives



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BY NICK ROBERTS

The Bonefish of Chetumal Bay: A Shared Fishery

Photo: Patrick Williams

The Yucatán Peninsula's Chetumal Bay stretches from southeastern Mexico to northern Belize and is home to populations of bonefish, tarpon, and permit that draw anglers from around the world, supporting the economies of both countries. The bay's varied habitats form an immense mosaic comprised of seagrass beds, sand and mud flats, mangrove-lined shorelines, mangrove lagoons, and tidal creeks. Knowledgeable guides, anglers, and fisheries biologists know where and when the fish can be found: permit forage on crustaceans along the deep edges of grass beds and tend to follow the contours of shorelines on incoming tides; on falling tides, tarpon meander from tidal creeks onto sand flats in search of baitfish and shrimp; bonefish ride the tide onto and off of flats through small troughs that are barely discernable. But it is still unclear to what extent bonefish travel from one section of Chetumal Bay's vast flats habitats to another. If they move, how far do they go? And do they return to a home area or bounce from one flat to the next? The answers to these questions will help determine to what degree the flats fisheries of Belize and Mexico are shared, and enable BTT to help the local guides

and lodges develop and advocate for conservation measures that are necessary to ensure that these valuable natural resources will be sustainable for future generations.

In an effort to better understand the movement and habitat use of bonefish throughout the border region, Belizean biologist, Addiel Perez, a Ph.D. candidate at El Colegio de la Frontera Sur (ECOSUR) in Chetumal, Mexico, is working with fishing guides, fishing lodges, commercial fishermen and others to tag fish and collect genetic samples. Despite the socio-economic importance of bonefish to the two nations, little research has been conducted in Chetumal Bay.

"The study will fill in gaps in knowledge about the ecology of this shared resource and will improve the management and conservation of bonefish and its habitats for both countries, which currently have different fishing regulations," says Perez, whose work is supported in part by Bonefish & Tarpon Trust.

In Mexico, fishing for bonefish is largely unregulated and they can be caught for consumption or sale in artisanal and

subsistence fisheries. The good news, Perez points out, is that many local communities have begun to see that the fish are more valuable alive than dead and so have started to informally manage their bonefish fisheries as catch and release for fly-fishing. In Belize, bonefish, along with tarpon and permit, are catch and release nationwide, although there is still some netting that takes place and lax enforcement. Belize's flats fishery, part of which occurs within a protected marine area, is worth more than \$50 million (US dollars) annually.

Perez and his research team, comprised of his ECOSUR colleague Roberto Herrera and Belizean fly-fishing guides Omar Arceo and Jose "Chepe" Polanco, have been conducting monthly fieldwork from Caye Caulker, Belize, to Xcalak, Mexico for more than two years. To collect bonefish for tagging, Perez and his team corral schooling fish using two 50-meter-long nets and then gather them into submerged holding tanks. One by one, Perez measures each fish and inserts beside the dorsal fin a tiny plastic tag, each coded with a unique number. This way, if the fish is recaptured, either by Perez's research team or a recreational angler, he is able to determine how far the fish traveled from the location where he tagged it and how much it has grown. Since Perez began his study, he has tagged over 8,000 bonefish and more than 200 permit, the latter caught as "bycatch."

"My preliminary findings are interesting," he says. "There

seems to be a seasonal migration of bonefish between bay areas of Mexico and Belize into an area of the Caribbean Coast of Belize from November through January. This area is likely a pre-spawning site, meaning the spawning site could be near. During the rest of year, bonefish can be found in the same area where they were tagged."

The existence of a spawning site shared by bonefish from Mexico and Belize further highlights the need for the countries to take a collaborative approach to conservation. The more Perez continues to learn about the habitat use, seasonal movements, and spawning patterns of the region's bonefish, the better he and BTT will be able to advocate for improvements to the management and regulations of the fisheries. When the study concludes in 2018, BTT and Perez will use the data as a foundation to work with local guides and lodges to propose new and revised habitat protections and regulations in the region, such as a ban on nets. This is similar to BTT's science-based approach to conservation that has proven to be instrumental in bringing about new and improved protections and regulations in the Bahamas—the same model can be applied to Mexico and Belize's shared fishery of Chetumal Bay.

"I'd like to see Mexico adopt the same catch and release laws as Belize," says Perez. "That would go a long way toward helping conserve the bonefish of both nations." 🐟



Photo: Patrick Williams

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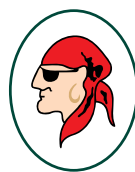
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BTT's 6th International Science Symposium and Banquet

Photos courtesy of
Dan Decibel & Pat Ford

By all measures, Bonefish & Tarpon Trust's 6th International Science Symposium was our largest, most comprehensive Symposium yet. Over the course of two action-packed days, we brought scores of internationally recognized scientists together with resource managers, industry leaders, and the angling community to collaborate on the conservation of bonefish, tarpon, and permit. With more than 600 participants, the scale of the event was remarkable, but what was most impressive was the collaboration evident among our partners and its impact on our mission. The weekend culminated with a memorable Awards Banquet, hosted by tarpon fishing legend Andy Mill, and honoring BTT founders Tom Davidson and Russ Fisher, as well as Dorsey Television, creators of *Buccaneers & Bones*.

We were proud to recognize founding BTT Chairman Tom Davidson with the Lefty Kreh Sportsman of the Year Award for his contributions to the establishment and continued effectiveness of the organization. We were equally proud to present founding member and longtime Vice Chairman Russ Fisher with the Flats Stewardship Award for his leadership and dedication to the health of the saltwater flats fishery. The Curt Gowdy Memorial Media Award, given to those who advance the cause of conservation through media outreach, was presented to Chris and Amy Dorsey who together built Dorsey Pictures, the world's largest producer of outdoor adventure television. 🐟



From left to right: Founding members Jeff Harkavy, Tom Davidson, and Russ Fisher enjoy a memorable evening at the BTT Symposium Banquet and Awards Ceremony.



Chris and Amy Dorsey and Dorsey Pictures, creators of *Buccaneers & Bones*, received the Curt Gowdy Media Award, presented to individuals who advance the cause of conservation through media and outreach to others. *Buccaneers & Bones* cast member and BTT Chairman of Marketing Bill Klyn presented the award to Amy, who accepted on behalf of Dorsey Pictures alongside the couple's children Luke and Nate. (Left to right) Amy Dorsey, Bill Klyn, Nate Dorsey, Luke Dorsey, Andy Mill



Legends Panel included (from left to right): Steve Huff and Sandy Moret. Jeff Harkavy (far right) served as the moderator.



Founding BTT Chairman Tom Davidson receives the Lefty Kreh Sportsman of the Year Award, given to an individual who has demonstrated an enduring commitment to the conservation of bonefish, tarpon and permit—the species, their habitats and the larger fisheries they comprise—through leadership, innovation, education or advocacy. Left to Right: Harold Brewer, Tom Davidson, Jim McDuffie, Andy Mill.



Bahamas National Trust Executive Director Eric Carey served on the Bahamas Panel alongside Dr. Aaron Adams (moderator), Justin Lewis, Buddy Pinder, Cindy Pinder, Benjamin Prat, Shelley Cant-Woodside, Jason Franklin, and Mark Cartwright.



From left to right: BTT New York Committee Member Alex Powers, founding member and Board Member Adelaide Skoglund, and New York Committee Co-Chair Paul Dixon.



BTT President Jim McDuffie shares his opening remarks at the Symposium Banquet and Awards Ceremony.

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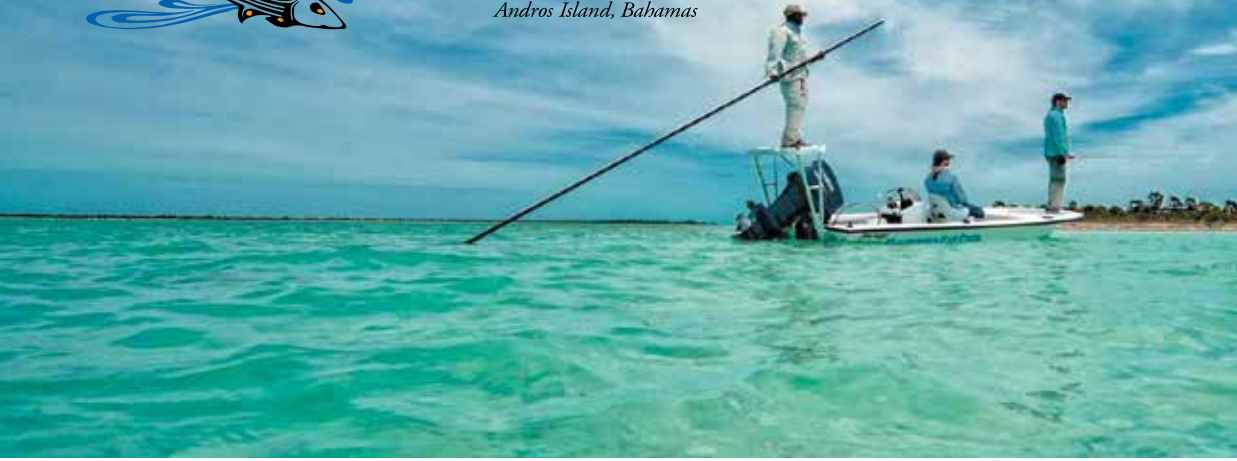
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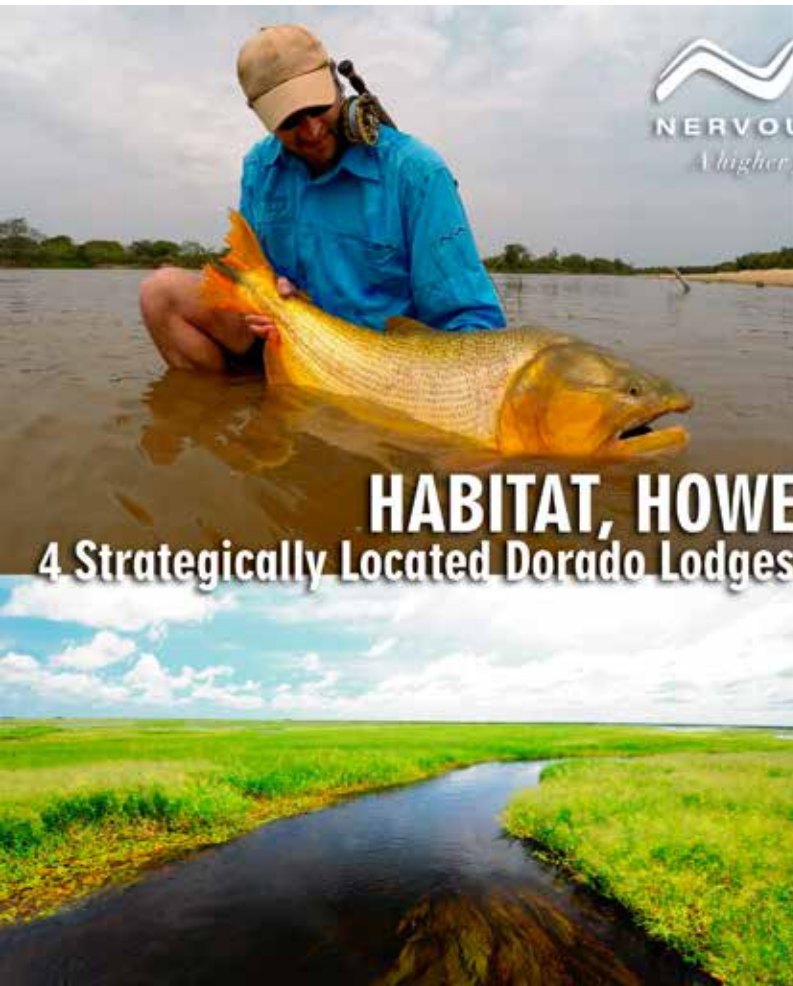
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