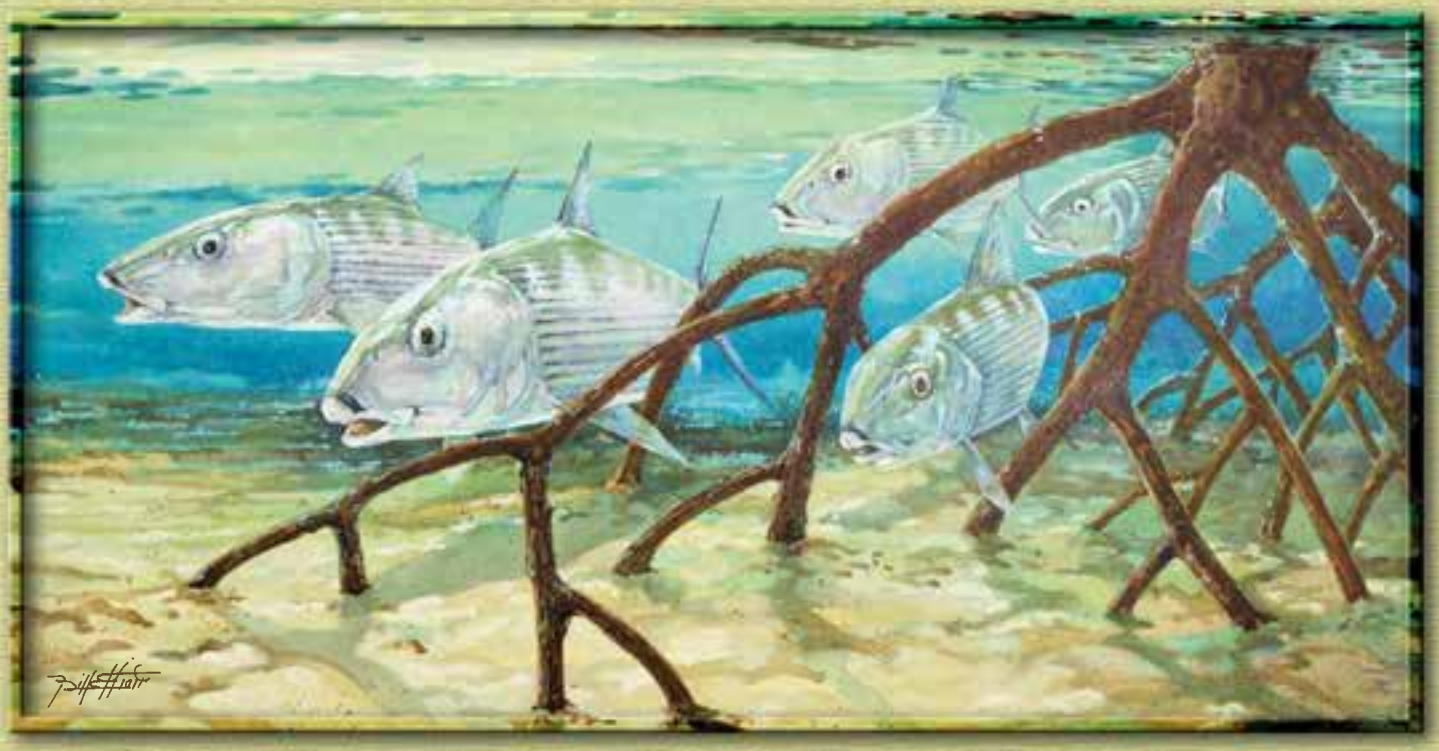
BONEFISH & TARPON JOURNAL

2009



- The Mystery of Bonefish Reproduction
- Bonefish in Hot Water
- Test Your Bonefish Release IQ
- Don't Stress Out the Silver Kings
- Discovering the Secrets of Tarpon Migration
- Living it Up, Tarpon Style

A publication of

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BTT would like to thank the many people and organizations who submitted photos for our Journal. Special thanks to Dr. Aaron Adams, Dr. Jiangang Luo, Dr. Jerry Ault, Dr. Andy Danylchuk, Chris Dorsey, Core Angling, Frontiers, Belize River Lodge, Barry & Cathy Beck, Bill Klyn, Chico Fernandez, Jeff Storm Harkavy, Bill Elliott, Megan Ratts, Michael Larkin, and Sally Davidson.

BTT is proud to announce John Swan will be our 2009 Artist of the Year.

LETTER FROM BTT

BONEFISH & TARPON TRUST
STEWARDSHIP THROUGH SCIENCE

The past year has been an exciting year of accomplishment for Bonefish & Tarpon Trust thanks to your generous support. As you will have noticed on the cover, we have a slightly modified name – "Trust" rather than "Unlimited". We hope you approve as we believe it accentuates our stewardship mission with greater clarity.

We have also been fortunate to add to our truly outstanding board of directors a number of well known and talented individuals who bring industry and conservation experience: Matt Connolly, former leader of Delta Waterfowl, Ducks Unlimited and the Theodore Roosevelt Conservation Partnership; Chris Dorsey, President and CEO of Orion Multimedia; Bill Klyn, Vice President of Patagonia; Mick Kolassa, founder and Managing Partner of Medical Marketing Economics; Michael Cassidy of ESPN Outdoors; Mike Fitzgerald of Frontiers Travel; Don Causey of the Angling Report; Adolphus Busch prominent conservationist; Charles Potter, CEO and president of Max McGraw Wildlife Foundation; and Jeff More, Washington DC public policy advocate. Our board brings great experience, wisdom and commitment to the challenges we face in the pursuit of our conservation mission.

BTT held its Third International Bonefish & Tarpon Symposium in November 2008 with over 40 scientists from around the world participating in various presentations. We give special thanks to one of our founders Johnny Morris and Bass Pro Shops who served as our lead sponsor for this event. We also thank FishAmerica Foundation and Pro Line Manufacturing for a grant supporting the symposium.The event was very successful, bringing forth several new and important advances in our knowledge of bonefish and tarpon. New discoveries were presented including the probable location of an Atlantic coast tarpon spawning location, location of a principal Atlantic coast juvenile tarpon nursery area, probable location of a Bahaman bonefish spawning area, identification of a new (4th) Caribbean bonefish species, and much additional knowledge on the effects of catch and release fishing as well as improved release techniques.

BTT's approximately $300,000 of research support in 2008 is playing a pivotal role in driving the knowledge base forward, bringing us closer to the day we can achieve our objective of more adult fish in the fisheries. We have also assumed a prudent yet forceful advocacy role for enlightened science based management — recently we initiated steps requesting that tarpon be declared a Federally protected gamefish, as well as seeking the designation of permit, bonefish, and tarpon as 'catch and release gamefish' in Florida waters. Both requests are still pending as we go to press.

Belize has recently completed an economic impact study on bonefish, tarpon, and permit, and the results were so impressive that the Belize government has boldly and commendably designated all three species as catch and release only.

BTT has also embarked on a major initiative to work with Bahaman regulators, the Bahamas National Trust and the major fishing lodges of the Bahamas to explore and develop techniques to sustain and enhance their critically important bonefish fishery.

As you can see, 2008 was a busy year, and we are committed to building on this momentum and progressing into the future. The purpose of this journal is to highlight recent BTT research findings and to salute and thank our many generous donors and sponsors who make our innovative and consequential work possible. Special thanks to our platinum supporters: Avantair, Citation Shares, Frontiers Travel, Robertson Foundation, Lucille S. Thompson Family Foundation, and the Ocean Reef Rod and Gun Club.

With your highly valued continued support please be assured that BTT will remain dedicated to the conservation of the flats ecosystem; to the best management practices for tarpon, bonefish and permit and toward the enhancement of opportunities for future generations of angler conservationists.

Matt Connolly
President

Tom Davidson
Chairman

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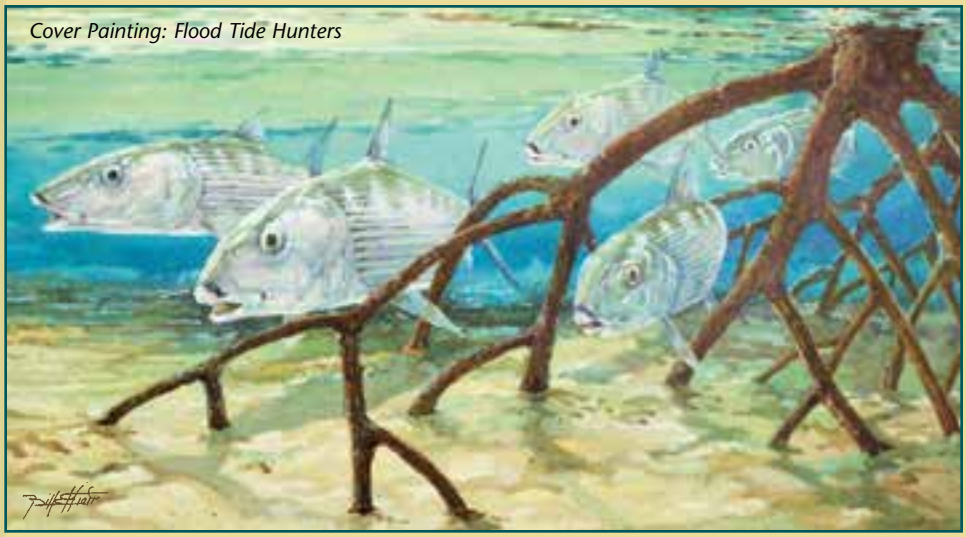
BILL ELLIOTT

When I received word that I had been chosen Artist of the Year for BTT, besides feeing the great honor of this Award I found myself looking back on what now was a 40 year career and thinking of all the things that had brought me to this point.

Not many people can truly say that they love what they do for a living but I am among those very few. For the past 40 years my work has taken me to some of the most remote and beautiful spots on this Planet to capture in my mind a subject that I would later be called on to paint or draw for a client or Magazine. On many of these trips I have had the pleasure of sharing these times with some of the finest people one could ever hope to know and to my good fortune some of them have become my life long friends.

Over these 4 decades I have done work for just about every major outdoor magazine and have Illustrated at last count a total of 38 books all dealing with the outdoors or related subjects. Prior to this I spent 5 and half years as the Art Director of the New York Zoological Society (Bronx Zoo, New York Aquarium).

My life seems to me to be one never ending trip filled with many wonderful high points, so I guess that saying is true (Time does fly when you are having fun).



Cover Painting: Flood Tide Hunters

There's something in the air (and water) worth preserving. And we need your help today.

For more than a decade, Bonefish & Tarpon Trust *(formerly Bonefish & Tarpon Unlimited)* has been pioneering research efforts to better understand the needs of bonefish, tarpon, and permit–the crown jewels of the flats. Sound science is guiding new initiatives throughout the ranges of these fish to preserve vital habitats and protect these species from exploitation. The threats to these fragile ecosystems and their inhabitants are accelerating; we urgently need your help to preserve the legacy of these wondrous gamefish. Visit us at www.tarbone.org to learn how you can make a difference.

Join BTT and join America's leading anglers in the race to save these great gamefish.

L to R: Chico Hernandez, Diana Rudolph, Flip Pallot, Lefty Kreh, Rick Ruoff and Joan Wulff

BONEFISH & TARPON TRUST

STEWARDSHIP THROUGH SCIENCE

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Photos Courtesy BTT supporter & Yellowstone Adventures

BONEFISH STOCKS HOLD STEADY

If you scan all the flats for bonefish from Miami to the Marquesas Islands, expect about 321,000 to choose from. While that figure is down slightly from the average of previous censuses, researchers speculate that's only due to an increased number of those doing the counting.

On October 29, 2008, the University of Miami's Rosenstiel School of Marine and Atmospheric Science and Bonefish & Tarpon Trust (BTT) conducted the sixth annual fall Florida Keys bonefish census. The project involved fishing guides, scientists and graduate students in 64 flats boats throughout 19 geographical zones covering 1,575 square miles.

"It's true the numbers are down slightly," said Dr. Jerry Ault, Rosenstiel School professor of marine biology and fisheries, and co-founder of the census along with Sandy Moret of BTT. "However, statistically there's no significant difference year to year. The slight decrease could be variations in where the bonefish showed up this year, the weather on census day or more guides scouring the Lower Keys than in previous years."

Capt. Joe Gonzalez releases a tagged bonefish during the census. The voluntary efforts of Florida Keys guides associations have been integral to the success of the annual bonefish census.

Ault and BTT started the annual census in 2003 to determine a baseline for scientifically evaluating changes in the Florida Keys bonefish population. Flats guides and their customers counted the quantities of bonefish observed and caught. It resulted in a population estimate of 320,961 bonefish (+/- 41,091 for a 12.8 percent coefficient of variation) or about 204 bonefish per square mile. Another calibrating census in spring of 2008 showed much the same thing, all of which reveals a generally consistent count year after year.

"Bonefish are an excellent indicator of ecological change," Ault said. "It's easier to assess their populations than smaller creatures in the ecosystem on which they prey. When bonefish thrive, it can be assumed the entire coastal ecosystem is in good shape."

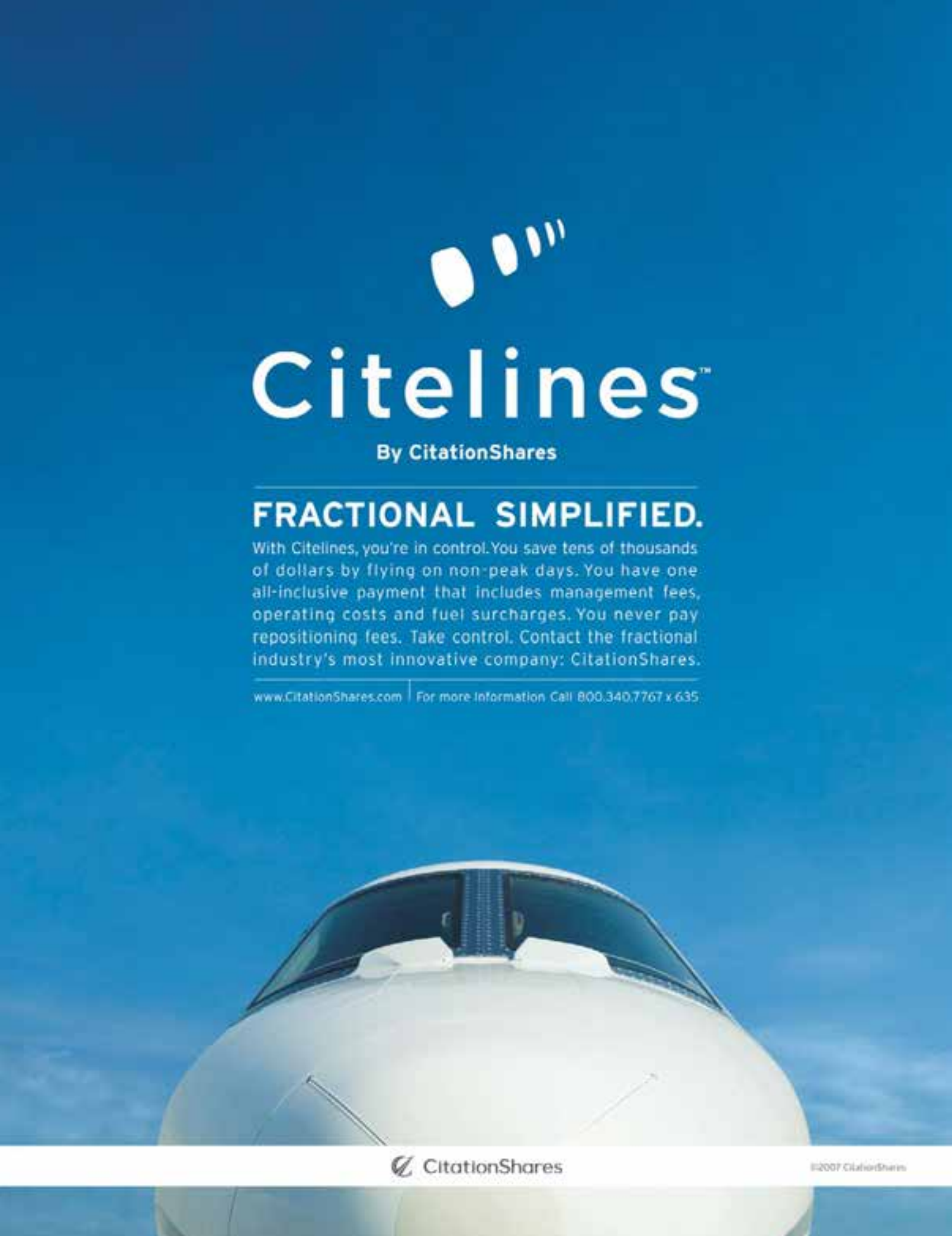
Long-time bonefish anglers often remark on the dramatic decreases they've observed from yesteryear in this popular sport fish's population. Rapid coastal development and significant ecological restoration programs like the Comprehensive Everglades Restoration Program can produce substantial impacts on premium Florida coastal fisheries resources like bonefish and tarpon. The bonefish census thus provides a quantitative baseline against which population changes can be measured.

These fish provide a significant amount of tourism to South Florida. Bonefish sport fishing contributes about $1 billion annually to the Florida economy — more valuable than commercial fishing in today's market. Seventy percent of world-record bonefish catches have been set in the Florida Keys.

So how much is a single bonefish worth to the Florida economy? Would you believe $75,000? That's the tourism and research value of every Florida Keys bonefish larger than 14 inches, making it perhaps the most valuable fish in the world. It's no wonder why bonefish are so dear to guides who live by them and anglers who enjoy playing and releasing the speedsters.

• • •

Jerald S. Ault, Ph.D. is a Professor in the Division of Marine Biology and Fisheries and Director of the Bonefish & Tarpon Conservation Research Center, Michael F. Larkin is a Ph.D. candidate in MBF/BTCRC, and Barbra Gonzalez is the Communications Director at the University of Miami's Rosenstiel School of Marine and Atmospheric Science.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BECOME A TRAVELING ANGLER

Spaghetti tags are easy to put in, though sometimes an extra pair of hands can be helpful.

While researchers would love the cushy job of traveling throughout the tropics to collect information about bonefish, tarpon and permit, that's just a dream and not a reality. That's why angler participation is essential to BTT-supported research. In addition to maintaining membership, you can help in research data collection. The research projects most in need of angler assistance are bonefish genetics, bonefish tagging, bonefish growth rates, tarpon genetics and tarpon tagging.

If you enjoy exotic fishing trips periodically and you might do battle with any of our three flats benefactors, join the Traveling Angler Program at one of these levels.

Level I: Do-it-yourself

Obtain tissue samples of bonefish or tarpon. For bonefish, this means taking a small clip of about a 1/4-inch triangle of fin tissue; with tarpon, use a rough sponge to scrape some skin off the jaw. This will help us determine which of the three known bonefish species are present and the extent that bonefish and tarpon populations around the region are related. We'll send you a fin clip kit and/or tarpon kit with all that's needed and the instructions — it's simple and easy.

Level II: Group Travel

Here's a great way for friends fishing together to support research at the same time. A group of five or more anglers visit a lodge participating in this project. Pay the normal price for the trip plus a little extra to cover the travel and research costs of a scientist — the lodges provide help too by providing food and lodging to the scientist for free.

You can participate in the research or simply enjoy the trip with the knowledge you're helping BTT's research efforts. The accompanying scientist will give presentations about bonefish or tarpon during the trip. Participating lodges include: Turneffe Flats (Belize), Pelican Bay, (Grand Bahama, Bahamas), Casa Blanca (Yucatan, Mexico), Peace and Plenty (Exuma, Bahamas), North Riding Point (Grand Bahama, Bahamas), Flamingo Cay (Andros, Bahamas), Andros South (Bahamas) and Belize River Lodge (Belize).

Level III: All Inclusive

This will appeal to those interested in a completely different fishing vacation experience. In partnership with Core Angling, you're taken to where scientists are already conducting intensive research on bonefish and other flats species. You fish and interact with scientists to help address some of the most pertinent questions related to catch-and-release angling.

All of Core Angling's trips are currently being held on Eleuthera, The Bahamas, in conjunction with the Cape Eleuthera Institute — a major hub for bonefish research. During the 2-day, 3-night all-inclusive Core Angling fishing

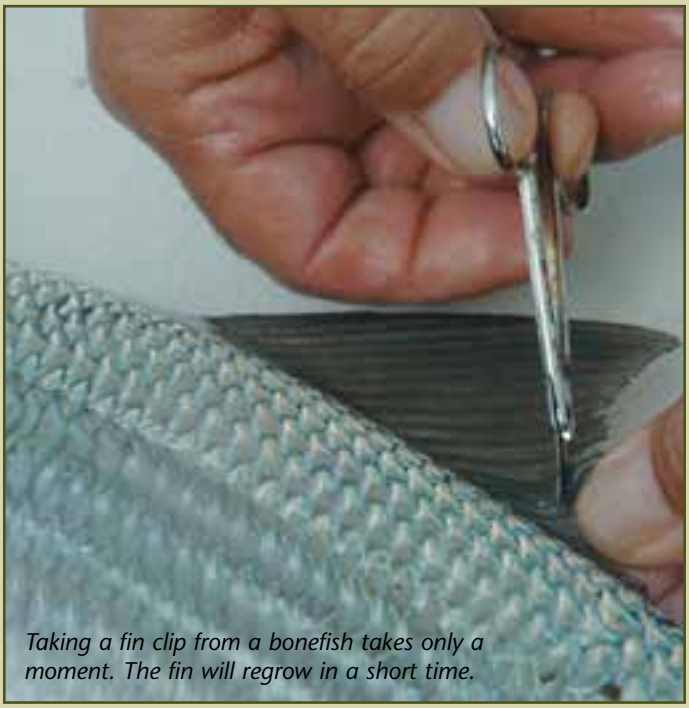
trip, you'll participate in studies on catch-and-release survival, predator-prey interactions and seasonal movement patterns.

If you're not already a member, participating in Levels II and III provides a BTT membership — a gift that will help remind you of the active conservation legacy to which you're contributing.

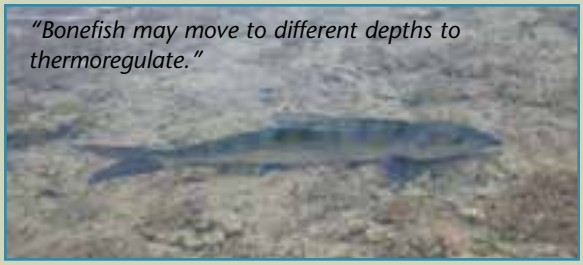
Another option whenever you're fishing Florida waters: Tag bonefish or tarpon with external 'spaghetti' tags. Just get in touch via email for this or any of the three levels and we'll send corresponding materials and information.

• • •

Aaron Adams, Ph.D., Director of Operations, bonefish@mote.org



Taking a fin clip from a bonefish takes only a moment. The fin will regrow in a short time.



"Bonefish may move to different depths to thermoregulate."

BONEFISH IN HOT WATER

Living in an environment with changing conditions presents many challenges for residents such as bonefish. The tropical ocean coast can be just as harsh as northern coasts. As water temperature has been found to be more important than any other single factor, it can also be considered a source of stress to fish when temperatures change.

Daily fluctuations in water temperature can be dramatic in tidal flats environments with up to a 15.5°C (60°F) change over a 24-hour period. These changes, in turn, influence oxygen concentration as warmer waters hold less oxygen. How a fish will respond to such environmental changes will depend on whether they've had a chance to get used to the conditions. Unfortunately, environmental factors such as how temperature influences bonefish have barely been addressed until now.

As part of the ongoing studies conducted by the Flats Ecology and Conservation Program at the Cape Eleuthera Institute in The Bahamas, we're investigating the temperature tolerance of bonefish. The first part of the puzzle is determining the maximum water temperature bonefish can withstand. To do this, the lab study exposes fish to a constantly increasing water temperature. When the water reaches a temperature that a fish in unable to tolerate, it loses equilibrium (i.e., rolls over). Once this happens, the fish is quickly removed, sampled for blood and placed back in its original temperature tank to recover.

This experiment provides us with what exact water temperature a bonefish can handle with no other stressors involved. However, since it's common for more than one stressor to act on a fish at one time, it's useful to see how bonefish respond in the field to exercise at different temperatures. In addition, by examining the movements of transmitter-implanted bonefish in areas where temperature data loggers are placed, we can attempt to understand the strategies bonefish use to cope with changes in temperature.

Results of our lab study found that bonefish conditioned to water temperatures around 27°C (80.6°F) can tolerate a maximum temperature of 36.4°C (97.5°F), whereas fish acclimated to a temperature of around 30°C (86°F) can tolerate a maximum temperature of 37.9°C (100.2°F). Temperature loggers placed in tidal flats recorded water temperatures of over 38°C (100.4°F) at the mouths of tidal creeks and over 41°C (105.8°F) in the backwaters of creeks.

When we compared the blood from fish exposed to high water temperatures to bonefish that did not undergo the experiment, it was clear that exposure to increasing temperatures was physiologically stressful. Outside the lab where bonefish were exercised for either short or long periods of times at both cooler and warmer temperatures, similar results were found with higher temperatures being more stressful to fish in addition to the duration of exercise. Conversely the shortest duration of exercise at the lowest water temperature resulted in the least amount of stress on bonefish.

Preliminary examination of the movements of tagged individuals seem to show that bonefish spend less time in nearshore tidal flats/creeks in the warmer months than they do when the water is cooler. This suggests that bonefish do indeed thermoregulate by avoiding potentially stressful warm water.

The implications of our findings to bonefish apply to both their basic ecology and also to understanding the potential impacts of recreational angling. In light of predicted climate change models, if water temperature within flats environments continues to increase gradually, this may affect the amount of time bonefish can spend feeding in nearshore areas. With regards to recreational angling, the field survey demonstrated that combined stressors such as temperature and exercise duration had a greater effect on fish physiology. Shorter fish fights when water temperature is high will reduce stress.

Future research into the influence of water temperature on bonefish physiology and behaviour will continue to strengthen our ever-growing knowledge about them.

• • •

Karen J. Murchie is an NSERC Ph.D, student in the Fish Ecology and Conservation Physiology Laboratory at Carleton University in Ottawa, Canada where she is co-advised by Drs. Steven Cooke and Andy Danylchuk. She is also a member of the Flats Ecology and Conservation Program at Cape Eleuthera Institute in The Bahamas where she conducts field studies.

Permit 101

"In the mid-1960s if you arrived inside the Marquesas just at dawn it looked like picket fences where the dorsals of sleeping permit and tarpon dotted the quiet lagoon." This image is from the vivid memory of Lefty Kreh. Every time I read this quote I can feel my blood pressure rise and my casting arm start to tighten, for while my favorite fish on fly is tarpon, permit have cost me many sleepless nights.

My fly fishing relationship with permit is as Don Quixote's was to windmills. Countless times I thought I had the upper hand on permit, only to be knocked off the horse. Call it persistence or thick-headedness, I keep getting back on the horse. Time wasted or time invested, depending on your perspective. Fortunately my other relationship with permit, as a fish ecologist, is a bit more respectable.

Back when Lefty scanned the horizon and saw so many permit tails breaking the calm water surface, we knew nothing about permit ecology — where they spawned, where the juveniles live, what they eat, how long they live. In fact, we didn't know much about their ecology until recently — the first scientific study on permit wasn't published until 2002, and even now there are less than five scientific articles on permit. Many of you are probably saying — so what, those scientific studies won't help me catch permit, and don't affect me. But I disagree — knowing your quarry will increase your chances when pursuing them on the water, and the more we know about permit ecology, the better chance we have of making sure they're around for the next generation of anglers.

I spend much of my research time on the water working on the second item — gathering information that can be applied toward conservation. In this case, we've been able to define which habitats are essential to juvenile permit, and how old they are when they first appear. First, a summary of what we know: Permit spawn around reef promontories — either natural reef drop-offs (Caribbean) or artificial reefs (Florida) – near the full moon. In Florida, they spawn during summer months. In the Caribbean, they spawn all but a couple months during winter. They 'broadcast spawn' — gathered in large groups, the fish eject eggs and sperm into the open water where the eggs are fertilized. Within a day, the eggs hatch, and the resulting tiny larvae float in the open ocean as plankton. Once the larvae find the right coastal bottom habitat, they transform into miniature versions of their parents, and do their best to grow to adulthood.

Until recently, we didn't know how long the larvae lived as plankton, or what habitats were required by the juveniles. Thanks to research funding from Bonefish & Tarpon Unlimited (www.tarbone.org), we now know this important information. Permit larvae live as plankton for about 15-18 days. We know this because we can examine growth rings in their ear bones (ear bones are called otoliths) that we extract from their inner ear. Fish less than 1 year old have daily rings, and older fish have annual rings — just like a tree. Although we think that many permit larvae that survive (more than 99% die) don't travel very far, some certainly do. For example, permit larvae spawned in Belize could easily make it to the Florida Keys by traveling on the Loop Current, that starts near the Yucatan Peninsula, and loops through the Gulf of Mexico, ending in the Florida Keys. This type of connectedness is just as likely throughout the Caribbean, so no matter where you are, 'your' permit are also likely 'their' permit.

During our research, we sampled a variety of shallow water habitats in the Florida Keys and Belize to figure

out which were most important to juvenile permit. With more than 98% of juvenile permit caught in one habitat, we can safely conclude that juvenile permit require medium energy sandy beaches — beaches with some wave action. Juveniles of other species seem able to use a variety of habitats, but for juvenile permit it's very specific — sandy beaches, usually right up in the swash zone.

So why is this important to anglers? First, any conservation and management plan for permit has to become regional. Over-harvest of permit at one location may have negative effects on populations at other locations. Second, since loss and degradation of juvenile habitats can have profound negative effects on fish populations, we must be vigilant about ensuring clean and healthy beaches as juvenile permit habitats. Anglers can have a strong influence in this by becoming active in fish and habitat conservation issues, and by letting lodges know that you care.

More information on ecology of permit (and tarpon and bonefish), as well as research that is ongoing and planned, is available at www.tarbone.org/tagging_programs.htm. Since it's inception in 1998, BTU has been the leader in funding research of bonefish, tarpon, and permit.

A future program I'm particularly interested in will examine what permit eat… time to get back on that horse.

• • •

Aaron Adams, Ph.D., Director of Operations,
bonefish@mote.org

A budding conservation angler who will be a strong BTT supporter for the future

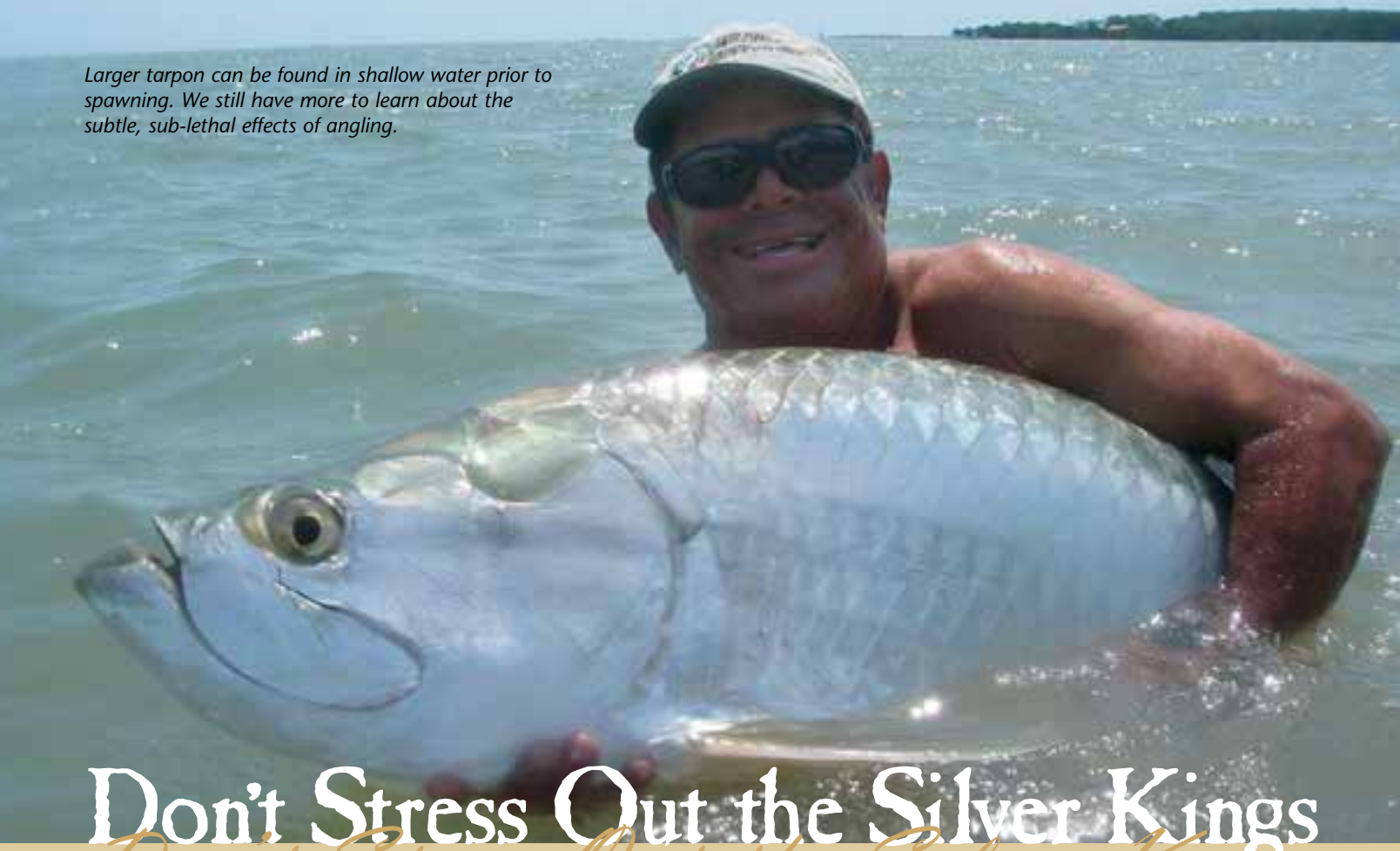
HEATHER HARKAVY: *Future Fisheries Steward*

Thirteen year old Heather Harkavy loves to fish and intends to be a marine biologist after attending college. Her first fishing tournament was the 3rd annual Dania Beach IGFA Jr. Angler Club event in September of 1999. She had just turned four. Heather describes her days on the water as one of the most fulfilling aspects of her youthful life. This poem, written by Heather, reminds us all why we're fighting to protect bonefish, tarpon, permit, and other flats species.

THE SILVER KING

We went out fishing in paradise,
With birds a chirping, it was really quite nice.
Then zzzzzzzzzzzzzzzzzzz, the line went singing,
And this way and that the rod went swinging.
The fish ran a great distance,
Like a cheetah chasing prey for instance.
Then all of a sudden the line went slack,
The fish had suffered an energy lack.
I reeled in fast till the line went tight,
The fish fought back with all of its might.
It made another astonishing run,
As I watched it swim off in the afternoon sun.
While I made a big tug and pumped up and reeled down,
The fish jumped from the water and showed me its crown,
Oh my! It was a 100 plus lb. silver king on the end of my line,
I was more determined then ever to make the tarpon mine.
I fought the fish for fifteen minutes more,
Then we finally came to the end of our angling war.
We took pictures and tagged this magnificent fish,
And as we released him I made a wonderful wish
For he and his fishery to live on and to last,
To never become a thing of the past...

— Heather Harkavey



Larger tarpon can be found in shallow water prior to spawning. We still have more to learn about the subtle, sub-lethal effects of angling.

Don't Stress Out the Silver Kings

Don't Stress Out the Silver Kings

Fish get stressed just like humans do. And with human influence on natural systems ever increasing, the more productive fishing grounds become even more crowded due to information shared via electronic bulletin boards, cell phones, magazines, television and so on. Tackle strike also evolves as do advances in communications and navigation. Pressure specifically on tarpon populations is no exception, and this affects tarpon behavior.

We need to learn more about the subtle, sub-lethal effects of angling on tarpon at all life-history stages. The trauma of being caught can cause physical and physiological damage to tarpon. Physical damage includes hook wounds, excessive bleeding and torn tissue. Over-handling or holding the fish out of water can cause injury. Through all this, a tarpon must change its internal chemistry and body systems to adapt to the ordeal of being caught. The resulting stress can be acute (intense and short-term) or chronic (long-term).

The ultimate negative effect of an angling battle is of course death. A long fight may spell the end of a tarpon, and some studies on fish show such a correlation. Even if a tarpon survives, it may not get back to normal. In time, subtle changes could affect the tarpon population by reducing growth and maturation rates, reducing reproductive success or affecting overall fitness.

Large tarpon over 75 pounds are caught throughout Florida as part of a seasonal fishery that targets sexually mature fish in saltwater environments. This is especially true when they feed in shallow water or when they can be found milling or daisy-chaining along beaches or gathering in passes and under bridges before going offshore to spawn.

Fishing pressure in Florida on large tarpon is heaviest from May to July, which is their peak spawning season. The largest tarpon landed (over 200 pounds) tend to be ripe females. At that time of year tarpon put more energy into reproduction and their lower energy reserves can result in more difficulty recovering from the stress of a fight. Warmer summer and early fall water temperatures have also been shown to cause more pronounced stress than cooler temperatures.

Smaller and sexually immature sub-adult tarpon (under 20 pounds) reside in inshore creeks, canals and ponds and can be caught year-round. Catch-and-release mortality studies using sonic telemetry

indicated that large adult tarpon recover well from angling if not attacked by large predators and handled with care. However, smaller tarpon may be more likely to die after release because their size makes it easier to handle and remove from the water than with larger fish.

The stress effects of angling on Atlantic tarpon are unknown and may differ at various sizes. Studies show that the stress response of an animal may be related to its body size or age. Female tarpon take 10 to 12 years to reach sexual maturity and one that age is about four feet long — a decent-size fish to target even though still considered a sub-adult.

We need to learn more about catch-and-release effects on all sizes of tarpon to make sound management decisions and their conservation. To achieve this, Bonefish and Tarpon Trust (BTT) has partnered with the federal Wallop-Breaux Sportfish Restoration Fund, the University of South Florida, and the Florida's tarpon-possession permit program to fund a new tarpon-research program by the Florida Fish and Wildlife Conservation Commission, Fish and Wildlife Research Institute..

The methodology included sampling sub-adult and adult tarpon that were at rest to establish control values for their conservation then doing the same after stressful angling events. Blood samples were drawn from the caudal (tail) vessel. Additional sub-adult tarpon were caught and bled, but prior to drawing blood these tarpon were held in the air for 60 seconds — about the time needed for a photo or tagging. Half of the tarpon were held vertically by the jaw and the other half held horizontally.

Hematocrit (the ratio of red blood cells to plasma or packed cell volume) and hemoglobin content were measured on whole blood that was sampled from the tarpon. Hemoglobin is the red blood cell pigment that carries oxygen to tissues. The remaining sample of whole blood was then immediately processed to separate red blood cells from plasma, which was then frozen until analyzed for glucose, lactate, the stress hormone cortisol, and electrolytes (salts).

Electrolytes are an important concern. To be able to move freely between saltwater and brackish or fresh water, a fish controls the amount of electrolytes in its system by a process called osmotic or ionic regulation. These mechanisms help fish maintain a relatively consistent level of salt in the blood and in the cells.

Marine fish such as tarpon naturally ingest a lot of seawater (freshwater fish don't need to do this.) When stressed, marine fish drink even more to balance the amount of water they lose across the gills. Such ionic regulation must take place when a tarpon is stressed because the internal salt balance of the fish is disrupted. If the fish cannot self-regulate back to equilibrium with its environment, routine biological functions of the fish can be disturbed enough to cause harm.

It's thought that during a fight, tarpon may switch from aerobic respiration (breathing through the gills) to anaerobic respiration, in which energy stored in the white muscles is used to enable faster swimming bursts. In turn, lactate levels increase and blood pH drops (the blood becomes more acidic). Levels of enzymes, glucose and stress hormones in the blood will also be affected by the change in activity. By evaluating the magnitude of such responses in a tarpon's blood chemistry, biologists can deduce how tarpon of different sizes are affected by the exhaustive exercise of the fight, exposure to air and being handled.

- We hope the analysis now taking place will answer questions such as:
- Do smaller tarpon have a more extreme response to physiological stress than adult tarpon?
- Are there size-related differences in the blood composition of tarpon at rest?
- Are there size-related differences in the blood composition of tarpon after the stress of being caught?
- Does tarpon blood chemistry show a significant difference in the way sub-adults and adults respond to the stress of angling?
- Do fight time, water temperature, dissolved oxygen and body size have an effect on the stress response of angled tarpon?
- Do sub-adult tarpon show stress effects from prolonged exposure to air?
- Do sub-adult tarpon show stress effects from vertical and horizontal handling?
- Are sub-adult tarpon able to survive the stress of exhaustive exercise?

This ongoing research will help BTT educate anglers on the best practices for catch and release handling of tarpon, which will enhance the conservation of tarpon populations and the fishery. BTT members should take pride in supporting research that determines the best practices to ensure that tarpon can survive the all stresses — the results of the studies will be disclosed to you soon.

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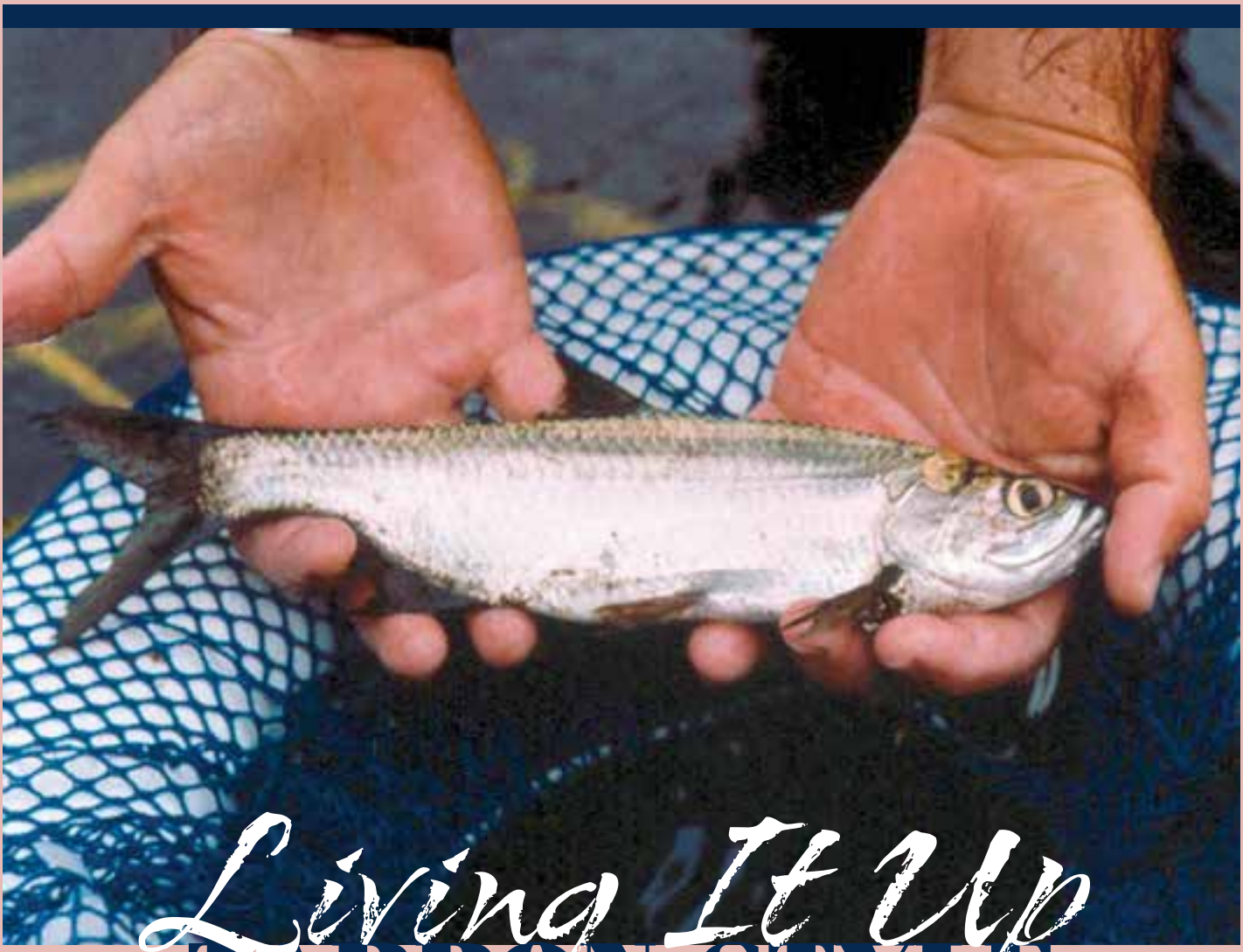
Kathy Guindon, Florida Fish and Wildlife Conservation Commission, Fish and Wildlife Research Institute



Living It Up TARPON STYLE

Tarpon possess complex life histories and use different habitats during their larval, juvenile and adult life stages. Although we have enough information to paint a general picture of their life histories, we still lack many of the specifics needed for effective conservation and management. It's imperative that research concentrate on documenting and understanding patterns of habitat use and connections between these habitats.

To get a clearer perspective of where we are, here's a summary of basic facts and likely assumptions we've learned so far about the life cycle of *Megalops atlanticus:*

- Tarpon occur in warm temperate, subtropical and tropical waters of the western Atlantic, Gulf of Mexico, Caribbean Sea and along the coast of tropical West Africa.
- Genetic research indicates tarpon are a single species throughout their range, but show genetic isolation between the West African and Western Atlantic populations. It also appears that the Costa Rican tarpon population is relatively isolated from the rest of the Caribbean.
- Tarpon spawn in offshore waters between April and September in subtropical waters such as Florida, but may spawn year-round in tropical waters like Costa Rica. In northeast Brazil, spawning occurs from October to January.
- Off the Gulf coast of Florida, it's believed that tarpon spawn 100 to 200 miles offshore.
- Tarpon spawn near the new and full moons — probably mostly around the full moon. The likely spawning dates are calculated from counting daily growth rings on the otoliths (inner ear bones) of juvenile tarpon.

- After hatching, tarpon larvae (leptocephalus) remain in the plankton in open water for approximately 50 days (but as short as 15 to 26 days if pushed by inshore hurricanes) before entering shallow coastal habitats and undergoing metamorphosis into miniature versions of their parents.
- After hatching, tarpon larvae (leptocephalus) remain in the plankton in open water for approximately 15 to 26 days before entering shallow coastal habitats and undergoing metamorphosis into miniature versions of their parents.
- Juvenile tarpon depend upon habitats within brackish marshes that tend to have poor water quality with correspondingly few natural predators. Juvenile tarpon are able to survive in these waters because they can get oxygen by gulping air.
- Marsh ponds seasonally connected to estuarine or ocean water only during extreme spring tides and/or seasonal rains appears to be especially important juvenile habitats.
- The loss of coastal wetland habitats in Florida and other locations may be having strong negative impacts on tarpon populations.
- Tarpon are approximately 14 inches long at one year old and 24 to 30 inches at age two.
- Juveniles migrate from early nursery habitats at 24 to 32 inches in length.
- Tarpon grow rapidly during their first 12 years of life.
- In the Florida Keys, tarpon mature at approximately 10 years of age.
- Female tarpon can reach at least 55 years of age and males at least 43, but some recent research suggests that some fish may reach 70 years.
- In general, female tarpon grow larger than male tarpon. The majority of tarpon over 110 pounds are females.
- Like many species of fish, some tarpon are travelers and others are homebodies.
- Of course much more is yet to be known. Some of the ongoing tarpon research supported by BTT includes:
- Migratory patterns, habitat preferences, and survivorship of Atlantic tarpon
- Examining the effect of catch-and-release fishing on tarpon physiology
- Examining the importance of the Florida Everglades as juvenile tarpon habitat
- Tarpon genetics
- Determining where tarpon spawn so these locations can be protected
- BTT members and supporters can help us learn more through monetary donations and by actively participating in our many research programs.

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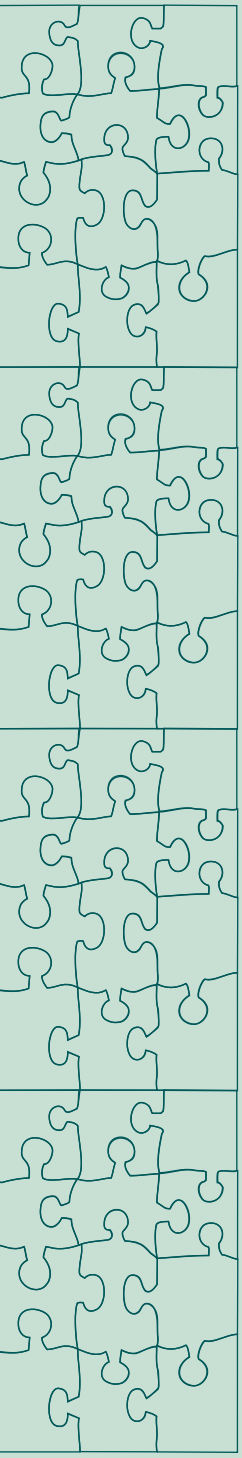
Aaron Adams, Ph.D., Director of Operations,
bonefish@mote.org

PIECING TOGETHER THE PUZZLE

Bonefish research is much the same as fishing for them: Just when you think you've got them all figured out, they humble you. Even so, Bonefish & Tarpon Trust's scientists remain focused and persistent — and it's paying off.



It wasn't very long ago that everyone believed the Caribbean-Western Atlantic population of bonefish targeted by anglers was only one species – *Albula vulpes*. All that changed in 2001 when another species of bonefish was identified known as *Albula* species B, more popularly called *Albula garcia.* In late 2008, BTT-supported scientists using fin clips learned of a third species of bonefish on the flats of the Caribbean. This species is so new, it's not yet named.

When you consider that the three species appear to be identical in physical appearance, the long-term confusion becomes understandable. Only by using genetics can we differentiate them and begin to understand which species is most important to the recreational fishery.

We've been collaborating with the Florida Fish and Wildlife Conservation Commission by sending fin tissues to their Fish and Wildlife Research Institute lab. Liz Wallace, the geneticist working on the project, has found that more than 90 percent of the bonefish tested are *Albula vulpes*. The other two species have also been caught during the study, and amazingly on three occasions *Albula vulpes* and one of the other species were caught by the same angler — in one case from the same school of fish. Those incidents make research and conservation even more challenging, because it's easier to manage one species in a fishery rather than three.

More genetic samples are needed in additional locations, so please help out if you can. We've received fin clippings from the Florida Keys, The Bahamas, Virgin Islands, Cayman Islands, Belize, Puerto Rico, Cuba, Mexico and Turks & Caicos. We need more samples from these areas, and samples from new areas will give us a better determination of how often each of these species is caught by recreational anglers. We can also begin to learn how bonefish populations throughout the Caribbean are related, which is essential information for bonefish conservation and management. More information on how anglers can participate in this fin clip collection is available in the article titled "Becoming a Traveling Angler".

As if trying to figure out which bonefish species support the fishery isn't difficult enough, recent research threw another wrench into the mix. In order to determine habitats used by juvenile bonefish, we caught a lot of the youngsters along sandy beaches in the Florida Keys and Belize. But when we tested them genetically, we discovered that over 95 percent were the *second* species – *Albula* species B.

If we still believed only one species of shallow-water bonefish inhabited the Caribbean, our discovery of juveniles would have seemingly solved the puzzle. But going down that road would've focused conservation efforts on sandy beaches as important juvenile bonefish habitats. In so doing, the actual habitats of juvenile *Albula vulpes* may never have been discovered. Thanks to the genetic work, we're instead moving in the right direction.

In 2009 we're resuming our search for juvenile *Albula vulpes*. We're especially concerned about finding juvenile bonefish habitats because the young ones usually take the brunt of coastal habitat degradation that threatens coastal gamefish. Our research will take place in the Florida Keys, The Bahamas and Belize. Hopefully we can find juvenile *Albula vulpes* this time around and get to work on protecting their habitats.

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Aaron Adams, Ph.D., Director of Operations, bonefish@mote.org

The Mystery of Bonefish Reproduction

Fish have some of the most diverse ways of reproducing in the animal kingdom. From males creating nests and caring for eggs, to females bearing live young, to both sexes broadcasting gametes into the water column so that fertilized eggs can drift for days in the ocean's currents, fish have evolved a wide range of reproductive strategies to maximize the likelihood that their offspring will survive, disperse, grow, and eventually reproduce as well. Since the 'success' of a fish's life is tied to its ability to contribute young to the next generation, understanding the detailed reproductive ecology of each fish species is critical to developing conservation strategies that help sustain their populations — populations that play important ecological roles in aquatic ecosystems as well as support valuable commercial and recreational fisheries around the world.

Bonefish represent one of the most sought aftergroup of marine recreational fishes inhabiting subtropical and tropical flats.

Bonefish (*Albula*) represent one of the most sought after group of marine recreational fishes inhabiting subtropical and tropical flats. Despite contributing greatly to the enjoyment of many anglers as well as to the economy of many regions, it might come as a big surprise that we still know very little about the life history of bonefish, especially their reproductive ecology. Anglers and guides who spend a great deal of time on the water are able to make important observations about the seasonal movement patterns of bonefish, and some have even provided anecdotal information about where, when, and how bonefish reproduce. Several scientific studies tend to confirm some of these observations, yet most of the evidence is still quite circumstantial regarding the reproductive activity of bonefish. For instance, we have a fairly good idea about what time of year bonefish spawn, but we still do not know exactly where spawning occurs or how bonefish behave during spawning bouts. One small confounding factor in understanding the reproductive ecology of bonefish is that there are now over 10 known species worldwide, and each may have its own particular timing and mode of spawning.

In 2004, a group of scientists from Carleton University, the University of Illinois, and the University of Wisconsin converged at the Cape Eleuthera Institute and formed the Flats Ecology and Conservation Program (FECP) — a research initiative that has been using bonefish as a model species to study the integration and complexity of shallow marine ecosystems. Fortunately, unlike other regions in the Atlantic, all bonefish that have been sampled for genetic analyses thus far have been identified as a single species, *Albula vulpes,* meaning that it is possible to complete a relatively accurate picture of this species' life history and ecology. Not long after the FECP formed, we began using remote telemetry to measure the movement patterns of bonefish inhabiting the shallow tidal creeks and flats of Eleuthera. Remote telemetry uses an array of receivers affixed to the sea floor that 'listen' for fish implanted with transmitters. Each time the receivers are downloaded we are impressed by the hundreds of thousands of detections, or 'hits', generated by tagged bonefish swimming within range of our receivers. These hits allow us to put together maps indicating movements, schooling patterns, and site preferences of bonefish in the detection area.

Data from our tagged bonefish clearly show seasonal differences in their movement patterns.

From May through late November bonefish spend nearly all of their time moving between shallow tidal creeks and flats, likely because of the high food abundance and ability to avoid predators in these 'skinny' waters. In December, however, bonefish broaden their movement patterns to include deeper water near the end of a peninsula of land that is adjacent to deep water. Snorkeling in these deeper waters revealed bonefish in extremely large schools (we can't tell you how much fun it is so swim with 500 bonefish, but that is a story for another day!) and fish caught from these schools showed signs of spawning readiness. To our surprise, bonefish held in tanks at the Cape Eleuthera Institute also showed signs of reproductive activity at exactly the same time — to our knowledge this is the first time bonefish have attempted to spawn in a controlled environment. Interestingly, both of these observations were soon followed by 'hits' on remote receivers positioned up to 3 km offshore. Bonefish were also detected at the end of the peninsula and on offshore receivers in 90 ft of water in March and April right on the edge of an undersea canyon that drops to over 1000 feet deep. The proportion of tagged bonefish using these areas ultimately exceeded 75% of all tagged fish indicating that March and April may be peak spawning times for bonefish. Also of interest is the fact that these movements coincided with both the full and new moons. Full and new moons are periods within the lunar cycle when the tides and tidal currents are the greatest, and it is potentially advantageous for bonefish to spawn during these times as a way to maximize the dispersal of their fertilized eggs.

Given that we tagged a relatively small proportion of the population and that bonefish reside in large schools, we estimate that there must have been thousands of bonefish using deep offshore waters during the spawning season. Following their visit to offshore waters, our tagged bonefish abruptly returned inshore and resumed their more recognizable behavior of moving in and among shallow tidal creeks and flats. Thanks to the continued support of the Bonefish & Tarpon Trust, along with other supporting organizations, such as Patagonia, we will continue to examine the where, when, and especially how bonefish spawn in the waters off Eleuthera through 2009. Collectively this information will help identify other potential spawning sites throughout the Bahamian Archipelago as well as the rest of the Caribbean.

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Andy Danylchuk, Chief Scientist, Flats Ecology and Conservation Program, Cape Eleuthera Institute

An underwater camera captures great shots of bonefish without exposing them to air.

TEST YOUR BONEFISH RELEASE IQ

You probably already know good basic methods for properly releasing gray ghosts, but recent studies by several BTT-associated research authorities sheds additional light on the subject.

What was found to be the number one culprit contributing to bonefish angling mortality? Air exposure. Leave a gray ghost out of water for only a minute and its heart becomes starved of oxygen. Force yourself to remove the hook, grab a quick photo and release the fish without exposing it to air for more than a few seconds.

Speaking of the importance of time, work a bonefish to the boat without unduly prolonging the stress on the fish. Using tackle that's too light for your quarry will over-tire it and lessen sufficient recovery. A dragged-out fight also ups the odds of a shark or barracuda taking advantage of the situation; if you see a predator, horse your bonefish to the boat quickly and release it after ensuring your own safety and letting it fully revive.

Since bonefish released in poor condition obviously have a higher risk of being attacked by predators, we wanted to know if releases close to cover such as a complex of mangrove prop roots would make a difference. Surprisingly, we found no benefit as bonefish tended to stay on open flats rather than darting for cover.

Another important time factor involves water temperature that exceeds 25°C (77°F). Bonefish tend to fare more poorly in warmer water, so take that into consideration when choosing gear and playing the fish (warmer water means heavier gear and shorter fight times).

Besides air exposure, handling time and water temperature, the loss of equilibrium to a bonefish after release makes it six times more likely to be attacked by a predator than one released without losing equilibrium. To reduce the affects of all those factors, just leave the fish in the water when unhooking and releasing it.

Make sure you give the fish time to recover before releasing it.

A good way to get a nice photo of your fish without removing it from the water.

Study results don't reveal undue physical damage to the mouth and gills upon hook-setting, which means circle hooks aren't needed for this species. Bonefish possess hard crushing plates on the roof of their mouth and tongue, making hooking injuries less likely. Even so, barbless hooks remain a good idea because they make for easier and faster removal.

A common question is whether there's an advantage in using mechanical lip-gripping tools. A recent study we performed reveals that these tools can actually cause significant injury to the lower jaw of bonefish and therefore impair feeding. It's better to wet your hands to hold a fish or ideally use a pair of pliers or a hemostat to remove the hook.

With these study results in mind, take extra care when playing and releasing this amazing species and encourage your friends to do likewise. After all, you're the first line of defense when it comes to the conservation of bonefish populations.

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Condensed from an article by Dr. Steven Cooke, Professor of Biology at Carleton University in Ottawa, Canada; Dr. Andy Danylchuk, Chief Scientist of the Cape Eleuthera Institute, The Bahamas: Dr. Cory Suski, University of Illinois.

DISCOVERING THE SECRETS

Atlantic tarpon have reigned supreme for more than a century as one of the most sought-after inshore game fish. The popularity of silver kings soared when President Franklin D. Roosevelt battled them in 1937 off Port Aransas, Texas, and the excitement started years earlier via the exploits of Zane Grey, Charles Holder and a host of other legendary anglers in the Florida Keys.

Despite the longstanding interest anglers have exhibited in the species, we've only recently begun to learn more about tarpon migrations and spawning areas in the Gulf of Mexico, southeastern U.S. and the Caribbean Sea.

Are Our Tarpon Their Tarpon?

Anglers have long wondered from where big tarpon come and go. Do populations of the species migrate internationally? And why have tarpon populations declined or increased over years in different regions? These questions are fundamental to determining the unit stock appropriate for management that ensures sustainability of the fisheries. Unfortunately but typically, much more is known scientifically about food fish than species far less desirable for human consumption.

Some eight years ago, Billy Pate — an IGFA Hall of Fame inductee — asked at a Bonefish & Tarpon Trust board meeting, "Are our tarpon their tarpon?" Billy had observed firsthand the slaughter of large mature tarpon in various Latin American countries by commercial and subsistence fisheries. He surmised that those impacts may have caused the substantial declines of the tarpon fisheries off Port Aransas and more recently at Homosassa, Florida. Billy's question stimulated much discussion and resulted in a scientific quest to utilize new technologies and to develop stronger collaborations to learn the secrets of the population dynamics of migrating tarpon.

Since that time, unprecedented collaborations undertaken among scientists and anglers have spawned state-of-the-art techniques. Guided by biologists from the Bonefish & Tarpon Conservation Research Center at the University of Miami's Rosenstiel School of Marine and Atmospheric Science and by funding sources such as Bonefish & Tarpon Trust (BTT), research doors are opening more and more.

Perhaps the most unique innovation: space-age Pop-Up Archival Transmitting (PAT) tags. They track tarpon migrations and evaluate habitat use along the way. The PATs, which cost $6,000 per unit and utilize satellite technology, are relatively small computerized sampling devices attached to the back of a tarpon via a titanium dart. A PAT contains electronic sensors that every 10 seconds records the fish's depth, light level, temperature and salinity of surrounding water (Figure 1).

Unlike conventional anchor tags that require the recapture of tagged fish, PATs can be pre-programmed to automatically release from the fish at a specific date and time (usually about six to eight months after deployment). At that moment the tags "pop-up" to the surface and transmit compressed versions of the stored information to a network of orbiting satellites. All the information is forwarded to our computers at the University of Miami's tarpon conservation research laboratory for detailed analyses. While physical recoveries of deployed PAT tags aren't necessary, when they can be found via ARGOS locator devices it allows downloading of the entire data archive. A comparison of environmental data allows estimated locations of the tagged fish along their migration routes.

FIGURE 1: *A satellite PAT tag and anchoring mechanism.*

OF TARPON MIGRATIONS

Funds for this tagging research have been provided by anglers and funding partners from organizations principally led by BTT. Other contributors include the Sanctuary Friends Foundation of the Florida Keys, Tarpon Tomorrow, Texas Parks and Wildlife Department, Florida Fish & Wildlife Conservation Commission, Marine Ventures Foundation and the Texas Saltwater-Fisheries Enhancement Association. Others contributing much time and resources to the effort include: Scott Holt at University of Texas Marine Science Institute, Tad Burke and the Florida Keys Fishing Guides Association, Angel Requejo and the Veracruz Yacht Club, Scott Alford and the Tarpon Tomorrow Texas Pro-Am, Lance "Coon" Schoest in Louisiana, Bruce Ungar and the Stuart Fishing Club, Joe Mercurio and the ProTarpon Tournament Series, Eduardo Perusquia and the Coatzacoalcos Yacht Club, Sport Fishing Magazine and the Trinidad Tarpon Bash.

Through 2008, about 110 PAT tags have been deployed in Florida and the Florida Keys, Louisiana, Mexico, Texas, Alabama, Georgia, the Carolinas, Mexico, Trinidad BWI, and Angola, Africa. The results show that sexually mature tarpon — at least 100 pounds and a 5.5-foot fork length — are the ones that migrate. Tarpon are sexually dimorphic, with the largest being females that may exceed 300 pounds.

Solving the Migratory Puzzle

In the intervening time since Billy Pate's posit, we've learned a great deal about migration and travel patterns of mature tarpon. They frequently travel hundreds to thousands of miles between seasonal spawning and feeding sites. For examples, tarpon tagged in the southern Bay of Campeche, Mexico, in May have reached Louisiana and Mississippi waters by July and August; tarpon tagged in Trinidad have ventured north of Martinique in the Windward Antilles Islands.

Tarpon tagged in south Florida and the Keys in April and May have migrated to Chesapeake Bay and others to the Mississippi River by July and August. Both of the latter groups presumably are searching oil-and-protein rich menhaden stocks to rebuild the gonads after late spring to early summer spawning. This prepares their bodies for the long return migrations ahead (Figure 2), as the various connection points relate to seasonally available, energy-rich food resources.

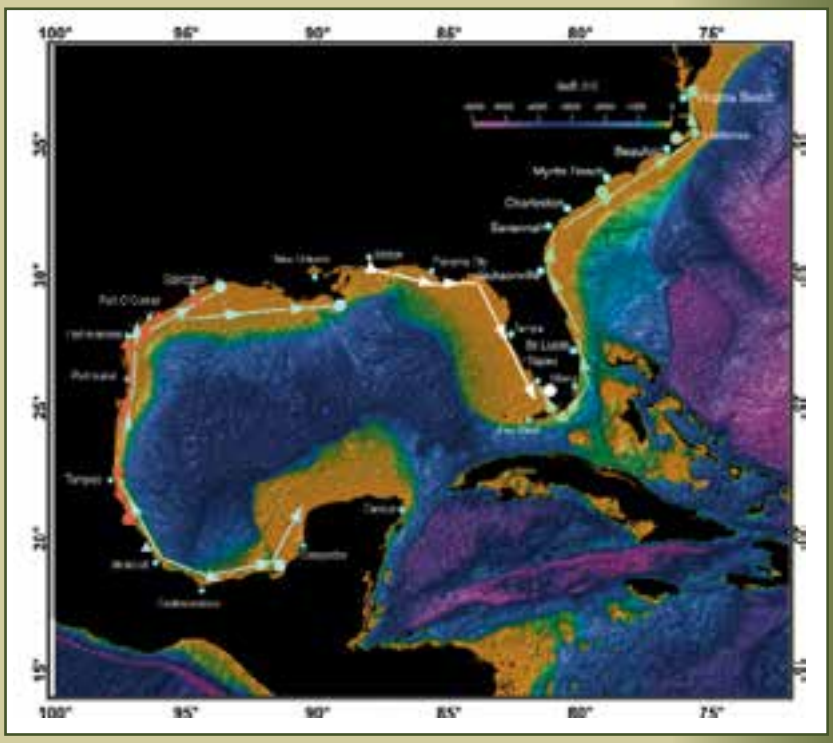

FIGURE 2: *Summary of tarpon migrations in the Gulf of Mexico and southeastern United States in 2007. PAT-tag deployment locations (triangles) and pop-off locations (solid dots) of PAT tags, and modeled migratory paths of tarpon are shown for Florida (green), Texas (red), Veracruz, Mexico (light blue) and Mobile, Alabama (white). Green and turquoise tracks represent May to September while red and white tracks are September to late November. Trinidad tarpon are not shown in Figure 2.*

With the tarpon's propensity for international travel and long lives (up to 80 years), they're especially susceptible to even low levels of exploitation. Tarpon migration distances can also be impressive, with surprisingly large distances covered per day (up to 50 miles). Therefore, extractions from the populations in Mexico, the Caribbean or Central America may directly impact U.S. tarpon populations. This downturn in tarpon numbers could have a huge negative U.S. economic impact,

as recreational fishing in Florida alone has surpassed the economic impact of that state's citrus industry. Trinidad, the Dominican Republic and even Cuba share tarpon migrations with U.S. tarpon.

An area of historical importance is Port Aransas. Historical data indicates that tarpon fishing was excellent along that portion of the Texas coast until the early 1960s. While south of the border commercial fishing for tarpon likely was the most insidious culprit for the fishery's tragic decline, other factors such as water diversions, the shrimp industry and other impacts may have destroyed habitat and impacted juvenile tarpon. Add to that coastal development, the oil trade and commercial over-fishing, and it's not hard to see how tarpon populations off Port Aransas — and anywhere — can soon be devastated.

Bellwethers of Climate Change?

PAT-tagging has shown that migrating tarpon have an innate desire for water temperatures of 26° C (about 79°F). It's an almost magical temperature band that tarpon seek, and they suddenly can materialize, almost overnight, in good habitats with that particular water temperature. That figure is also, surprisingly enough, the lower-bound temperature that tropical storm forecasters use to predict hurricane generation. Their temperature preferences might suggest that tarpon may be one of the first and most prominent species to be affected by climate changes.

How tarpon know where and when to locate such specific temperatures is quite another mystery. Undoubtedly it's a physical signal that dictates when and where to spawn, and what types of food may be available for consumption along their annual migration route. It's not that temperature provides a specific limit per se, as tarpon can be found in waters as warm as 90°F. They also often make seasonal feeding sorties into very warm waters pursuing oil-rich prey like menhaden, an extremely important food for silver kings. In any case, this temperature has undoubtedly been imprinted into the tarpon's genetic makeup.

Tarpon exceeding 100 pounds are well-known shallow-water inhabitants, especially in the Florida Keys and Caribbean. PAT tagging has shown that migrating tarpon are deep-water fish too. Tarpon spend a lot of time in waters depths of 30 to 100 feet, and we've documented dives over 450 feet. Their deepest dives usually occur at night. Some of the deepest diving tarpon have been documented during migrations north from Mexico, during presumed spawning off Florida, and also fish from Trinidad crossing between islands in the Antilles chain. We think that most deep dives relate to spawning activities, but perhaps it's instead for safety or a reaction to currents or prey abundance.

Migrating tarpon also seem to follow well-defined deep-water paths. We documented offshore tarpon up to 50 to 100 miles apart rising and diving synchronously in the water column, which may indicate some bizarre natural order to their behaviors.

The more information collected, the more questions arise — it's like a giant, never-ending jigsaw puzzle. Nonetheless, a critical scientific mission is being pursued to ensure sustained regional fisheries for the valuable and powerful silver king.

Help us Help Tarpon

FIGURE 3: *At boat side, a PAT tag is placed on the dorsal region of a 150-pound tarpon.*

To become involved in this new and exciting conservation adventure, you can Adopt a Tarpon by picking up the cost of one or more satellite PAT tags and even joining us on an expedition to observe tag deployment. All donations will go directly to the purchase, testing, programming, deployment and recovery of the tags.

Donations involving sponsorships of tags are handled by Bonefish & Tarpon Trust for the Center for Tarpon and Bonefish Conservation Research at the University of Miami. BTT provides the UM Center a dollar-for-dollar match of your donation. All donors receive a handsome commemorative plaque and a letter documenting their tax-deductible gift. In addition, participants receive timely updates of research results by visiting our website, reachable through tarbone.org's conservation tab. Just click on Tagging Program.

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Jerald S. Ault, Ph.D., is a Professor in the Division of Marine Biology and Fisheries and Director of the Bonefish & Tarpon Conservation Research Center; Jiangang Luo, Ph.D., is a Research Scientist in MBF/BTCRC at the University of Miami's Rosenstiel School of Marine and Atmospheric Science.

WHAT MAKES A TARPON TICK?

Catch-and-release fishing is a valuable management tool, but the reality is that many released fish don't survive. While in the U.S. people don't generally harvest tarpon, it still occurs in association with breaking state and world records, fish mounts and tournaments.

Tarpon fishing in Florida has been regulated by Florida Statute 370.062 since 1989, which allows for harvest via a permit (tag) program managed by the Florida Fish and Wildlife Conservation Commission (FWC). Any angler wanting to harvest or possess a tarpon must purchase a permit now costing $51.50 at a county tax collector's office. Each permit entitles an angler to harvest or possess one tarpon during the year.

The permit requires anglers to attach a numbered tag to the tarpon's lower jaw. If it's released alive, the tag is removed from the jaw before release; if instead the fish is kept, the tag must remain. Although 2,500 permits may be issued statewide each year (half to guides, half to anglers), sales are low — the average number sold per year is 332 and many of those aren't even used. The tag statute therefore has greatly reduced the number of tarpon kept by anglers.

Fortunately most anglers understand the economic importance of a large recreational fishery and ensuring a successful post-release survival. But we didn't have a handle on the actual survival rate. That prompted scientists with the FWC's Fish and Wildlife Research Institute (FWRI) to conduct a catch-and release mortality study along Florida's Gulf Coast. Sonic telemetry was utilized to better understand the percentage of tarpon that survive release.

A Sonic & Tagging Approach

During the FWRI sonic telemetry study conducted from 2002 to 2007, landed tarpon from Boca Grande Pass and the Tampa Bay estuary were tagged with acoustic transmitters by biologists, released and immediately followed by tracking the underwater signal using a directional listening device (hydrophone). Scientists were able to trace each tarpon's location with GPS positions and bearings for several hours. This provided direct evidence of immediate, short-term post-release survival. In addition, some sampled fish were located again — even up to weeks later – providing direct evidence of long-term survival.

The results indicate that tarpon are survivors when handled carefully. Survival rates estimated during the study were greater than 85 percent. Of the 81 tagged and tracked tarpon, 11 tarpon suffered mortality as inferred from movement patterns or by visual confirmation, yielding a combined total estimated catch-and-release mortality rate of 13.6 percent. The overall survival rate exclusive of predation was estimated to be 94.6 percent. It's important to note that studies like this provide only an estimate of fishing mortality rates and not an absolute number.

With this new evidence of relatively high release survival, researchers added a genetic tagging component to look at recapture rates of tarpon in Florida waters. Short-term telemetry methods don't allow scientists to discern the frequency that tarpon travel in and out of the passes or estimate how often they are recaptured, but a tagging program supported by anglers can do so. We therefore hope to soon learn the answers to several basic questions:

- If a caught tarpon is released and it lives, how often can it be recaptured?
- Does the same tarpon leave and return to the same area within a fishing season or year after year?
- When do tarpon return and with what frequency?

The FWC's genetic study, also assisted by Mote Marine Laboratory and Bonefish & Tarpon Trust, is supported by volunteer anglers who sample DNA from tarpon they catch. Of the nearly 2,000 individual tarpon DNA samples received by the end of 2007, four tarpon

showed a genetic tag-and-recapture event, yielding an estimated recapture rate of 0.365 percent. By evaluating the recaptured tarpon over time, we will learn more about the success of tarpon stocks and the connectivity of tarpon between different bodies of Florida waters and beyond.

The results are exciting and promising. DNA fingerprinting techniques — the same as those used with human forensics — mark and identify individual tarpon with remarkable accuracy. DNA lasts forever and will not break, fall out, foul with algae, malfunction or stop working due to technical failure. It's therefore an ideal way to keep track of an individual tarpon that may live for over 60 years.

Join the Tarpon Recapture Team

Rather than employing the fin-clipping methods to obtain DNA that's more successful with smaller species, in 2007 we implemented a new jaw-scrape technique for tarpon. This requires less manipulation of the fish and in most cases can be performed by a single person while the tarpon is still in the water.

We want your help. To assist you can request a free tarpon DNA sampling kit and instructions by calling toll free 1-800-367-4461 or e-mailing TarponGenetics@MyFWC.com. Put the kit in your boat and sample every tarpon you catch no matter where or the size – it's easy to do and extremely important to the cause.

In addition to Florida we've received samples from tarpon off Texas, Louisiana and North and South Carolina as well as Mexico, Trinidad, The Bahamas, Puerto Rico, French Guyana and Angola. Other kits have been sent to Panama, Nicaragua, Guatemala, and Costa Rica.

Your tarpon samples will be catalogued and used to determine movements of individual fish as well as recapture and survival rates. If you catch a tarpon already tagged or someone recaptures a fish you tagged, you'll be notified by letter that contains a link to "Google Your Tarpon."

• • •

Kathy Guindon, Florida Fish and Wildlife Conservation Commission, Fish and Wildlife Research Institute

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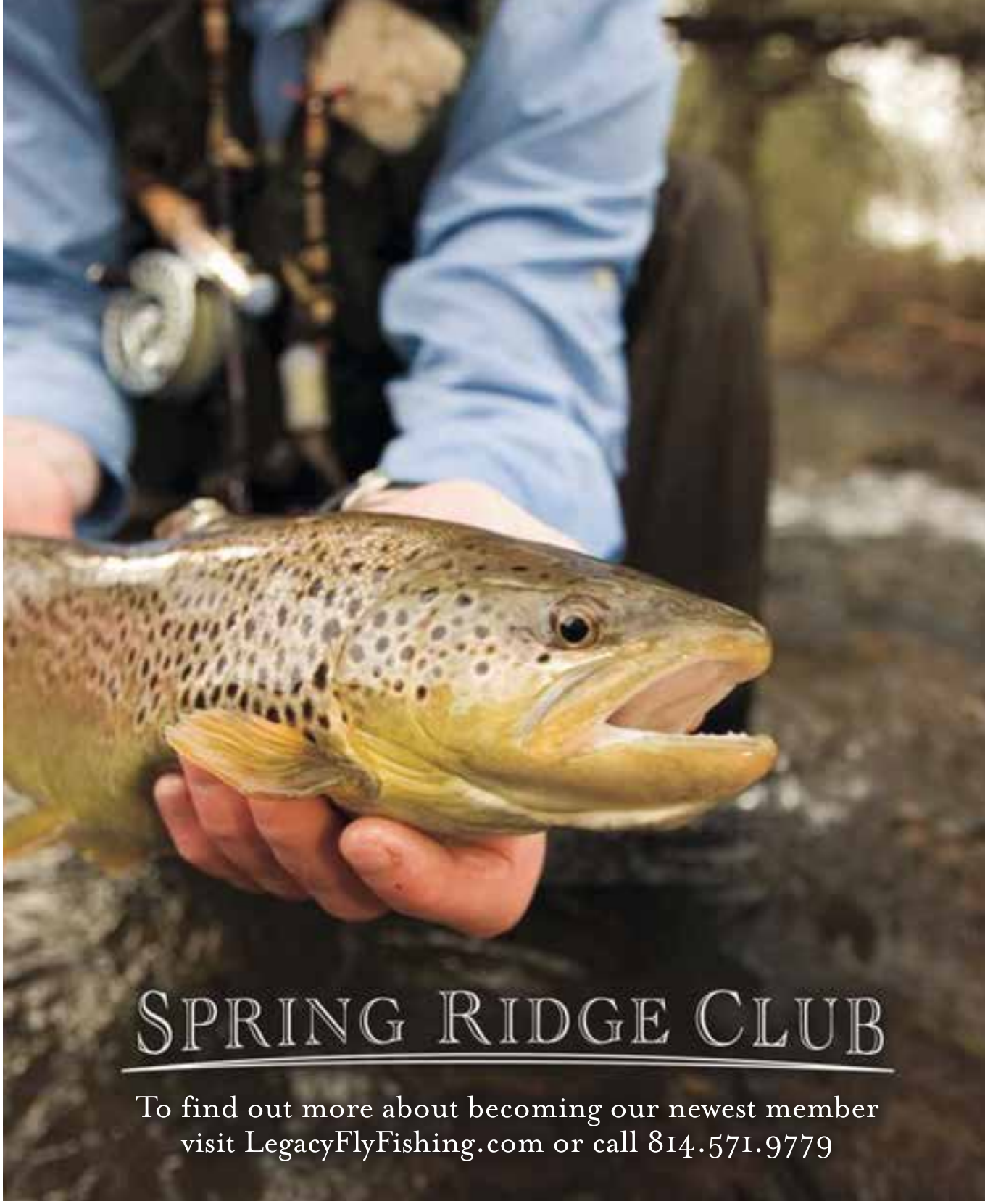

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The Heart & Soul of BTT

In the mid-1960s, Lefty Kreh scanned the flats inside the Marquesas as the sun cracked the eastern horizon. "It looked like picket fences where the dorsals of sleeping permit and tarpon dotted the entire lagoon," he said.

Back then we knew nothing about tarpon, bonefish, and permit ecology — not even where they spawned, where juveniles lived, what they ate, how long they lived and most other facts. Fast-forward to the 1990s, and images such as Lefty's were rarely seen anymore. By many accounts the bonefish population in the Florida Keys had dropped to 80 percent fewer than the 60s. Tarpon weren't as plentiful either, and although permit as a flyrod quarry was just coming into its own, trouble lurked on the horizon for them as well.

Something needed to be done, and people needed to step up to the plate. And that's exactly what happened in 1998 when a group of concerned anglers and guides came together to form Bonefish & Tarpon Unlimited.

Now known as Bonefish & Tarpon Trust, the original founders of the organization quickly recognized that very little was known about either species. Although experienced anglers had fished the flats for generations, no scientific data existed about even basic behaviors or genetics. In 1998 only a few scientific studies on bonefish and tarpon had been published — and none on permit — so the reasons as to why these species showed declined and the remedies needed to reverse that trend begged attention.

The Founding Members committed BTU to a proactive approach in order to learn and obtain specific information. They wanted to compile reliable data that would lead to better management and conservation of the valuable bonefish and tarpon resources. It was evident that this formidable task would require the funding of research so a science-based approach could build on its own findings. This initial vision and purpose remains the principle objective of BTT to this day.

Funding provided by memberships and donations fuels the cause. Although BTT is a member-driven organization, unlike many other conservation groups it doesn't offer a social theme. There are no monthly meetings, member outings or board meetings in exotic locations to distract from the dollars needed to achieve sound scientific objectives. BTT's resources are allocated toward the mission of learning about bonefish, tarpon and permit so ultimately everyone can enjoy enhanced and healthier populations in the future.

Ten Years Later

BTT now follows a well-planned Research Framework that summarizes the status of what we do and don't know about bonefish, tarpon and permit. A separate Research Framework is set for each species based on a review of scientific studies, and these are closely reviewed annually so the status of knowledge and research remains current.

The strength of the Research Framework is that it allows BTT to prioritize funding and to plan for future needs. For example, one of the top priorities is to determine which types of habitats are most important to juvenile bonefish. Once these types of habitats are identified, the next priority involves mapping them with an eye toward habitat conservation.

BTT is also dedicated to angler education — better anglers make better conservationists. Accordingly, when BTT supports research, one important objective is to be sure that the scientific information enhances angler education. A recent example is the culmination of studies that formed the basis of a brochure called "Best Practices for Bonefish Catch and Release." Using this valuable information, anglers have been able to modify their fighting and handling of bonefish to enable even better chances for release survival.

The establishment of the International Bonefish-Tarpon Symposium has elevated BTT as the world's preeminent research organization for bonefish, tarpon and permit. The biannual symposium co-hosted by BTT provides a venue for scientists from around the world to come together to present the results of their research and to share data. Many anglers also attend to offer their on-the-water observations and to learn about new breakthroughs and study objectives.

BTT collaborates with researchers, public and private industries to achieve common goals. An example is the recent effort in conjunction with Belize on a study that revealed the tourism-related expenditures in their country by anglers fishing for bonefish, tarpon, and permit. The Belize government then passed legislation making those species a catch-and-release fishery only.

Last but not least, BTT is unique in that legendary anglers, fishing guides, leaders in the business world, celebrities and others add their experiences to the scientific effort. This combination of sound research effort and practical knowledge puts everyone on the same side of achieving conservation goals.

New Paths to Follow

Much has been accomplished since BTT's inception in 1998 — and there's still a long way to go. BTT hopes to continue to revise the Research Frameworks as more research is supported and more knowledge is gained. BTT will also continue to propose and support better management regulations for bonefish, tarpon and permit.

Some recent accomplishments sponsored in part or solely by BTT include:

- Determining that juvenile permit require sandy windward beaches as nursery habitat
- Determining that after hatching from eggs, larval permit float in the open ocean for 15 to 18 days, and that some of the larvae arriving in the Florida Keys likely come from spawning in the Caribbean
- Demonstrating that three species of bonefish occur on the flats of the Caribbean
- Documenting that tarpon migrate as far north as Chesapeake Bay and throughout the Gulf of Mexico
- Documenting the migration of two bonefish from the Florida Keys to Andros Island, The Bahamas
- Documenting that bonefish are able to migrate the length of the Florida Keys

Ongoing goals include:

- Obtaining federal game fish status for tarpon, which will greatly increase the possibility of creating a regional management plan
- Working toward important coastal habitat protections
- Continued support of Belize's new regulations for making bonefish, tarpon and permit strictly catch-and-release species in their waters
- Trying to make those same species catch-and-release game fish in Florida and similarly in other locations in the Caribbean
- Determining where tarpon and bonefish spawn
- Determining which habitats are required for juvenile bonefish
- Examining why bonefish grow at different rates in the Florida Keys than they do in the Caribbean
- Determining the effects of leaving hooks in bonefish after release
- Continuing angler education based on research findings

In order to continue with these ambitious programs, we need your support. Increasing our membership and obtaining your active assistance in bringing aboard at least one new member cannot be emphasized enough. Please help us help the fish, because ultimately it's the enhancement and improvement of our flats fishing resources that binds us all.

• • •

Aaron Adams Ph. D., Director of Operations, bonefish@mote.org

Only with the support of our members can we continue our important research to protect bonefish, tarpon, and permit.

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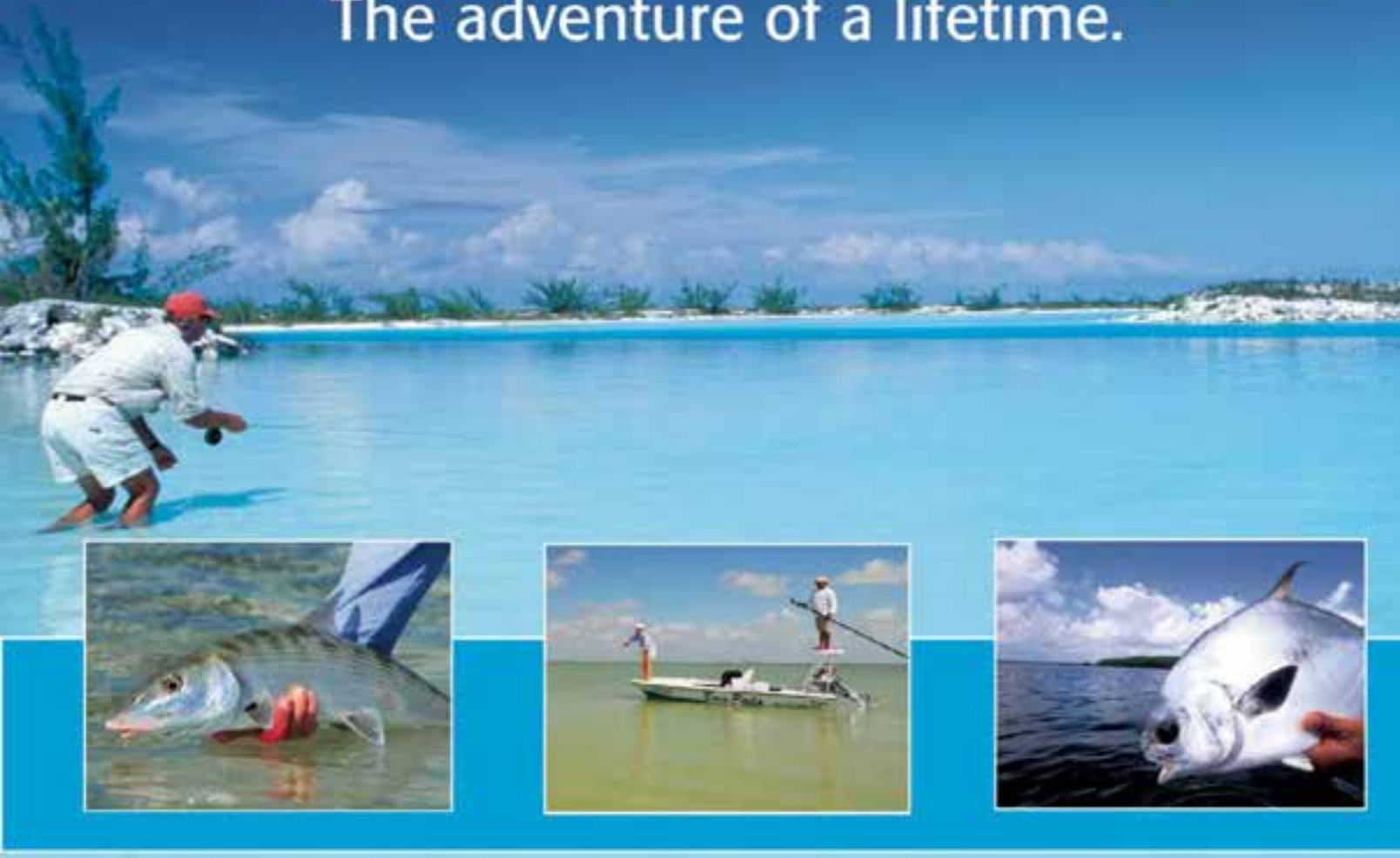

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