

# ROCKET SCIENCE ON THE FLATS AND REEFS



Tarpon & Bonefish Research Center (TBRC), University of Miami RSMAS, 4600 Rickenbacker Causeway, Miami, FL 33149 <http://femar.rsmas.miami.edu> [nzurcher@rsmas.miami.edu](mailto:nzurcher@rsmas.miami.edu) 305-421-4164

**Wishing you and yours a very happy and healthy Spring from the TBRC at the University of Miami.** This is the first in a series of occasional newsletters that will keep you up to date on our scientific research on tarpon, bonefish, and other important coastal and coral reef fishes.

## RESEARCH HIGHLIGHT

### Tarpon as Meteorologists

Our evolving research on satellite-tagging and -tracking of tarpon over the past decade has provided unprecedented insights into the mysteries of tarpon migrations. These space-age tags attached to the backs of tarpon continuously gather data on the fish's position and corresponding water temperature, depth, light-level, salinity, which revealed that the tarpon populations in the Gulf of Mexico, Florida, and the southeastern U.S. are interconnected. Recently, physical scientists have discovered the exceptional value of this same animal-derived environmental data. Each day, hurricane scientists like our UM colleague Professor Nick Shay, plot the depth and position of the 26°C isotherm—a zone of warm ocean water equal to 78.8°F, known as *ocean heat content* (OHC). OHC data are extremely useful for forecasting hurricane strength, since hurricanes are known to intensify after passing



*Dr. Jiangang Luo tagging a tarpon with a TBRC satellite tag*

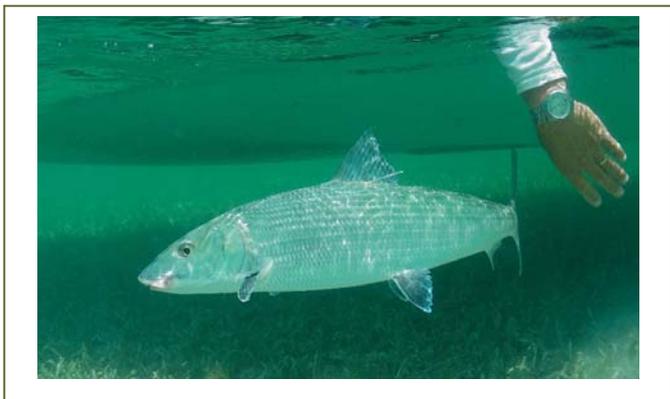
over pools of warm water that often extend deep into the water column. Thus, it is the depth of the 26°C isotherm that sets the value of OHC. Typically OHC is measured by satellites or profilers deployed from research aircraft flying into tropical storm paths. We discovered from our satellite tagging data that tarpon adhere to the 26°C isotherm during their annual migrations through the Gulf of Mexico, coastal Atlantic and Caribbean Sea. The beauty of tarpon is that they provide data in coastal areas where satellite OHC measurements aren't reliable. By using tagged-tarpon to gather temperature and depth data about the 26°C isotherm, we could essentially fill in the gaps in OHC coverages currently not available. The fish in other words could help scientists build more accurate ocean-atmosphere models to predict hurricane intensity.

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Our findings on tarpon have since led to “deeper” discoveries of hidden connections between OHC and migrations of other species, including yellowfin and bluefin tuna, white and blue marlin, and tiger sharks. As crazy as it may sound, Dr. Jerald Ault is now involved in implementation efforts of a national Animal Telemetry Network (ATN) with a host of federal agencies and ocean scientists that will use data from 1000's of tagged fish to reliably map the ocean environment in real-time. These new observations will provide essential data for improved modeling of ocean dynamics, defining critical ocean habitats, and sustaining our fisheries.



*Bonefish being released after tagging*

## FEATURE ARTICLE

### **A Watershed Year for TBRC**

After years in development, the TBRC was officially launched in 2014. The Center was born out of need to ameliorate inadequacies in the data and models of fisheries science and management, in general, and to sustain our precious sportfisheries, in particular.

#### *The Current State-of-the-Science and Its Deficiencies*

Fisheries science, a branch of renewable resource management, focuses on the long-term sustainability of fish species that are exploited by humans. When the

rate of removals (i.e., catches) exceeds the rate at which a population can replenish itself, the fishery is deemed unsustainable and corrective measures (i.e., catch or size limits) are put in place. In theory, this sounds good, but in practice a key problem with the science and management is that only one threat to sustainability is typically addressed, namely directed fishing. For species like tarpon, bonefish, and coral reef-fishes, there are also intensive fisheries targeting their main food sources, such as crabs and shrimps. To exacerbate the problem, inshore nursery grounds and other critical habitats of these species, both fish and shellfish alike, are also being impacted by coastal development and declining water quality. The current science for determining sustainable use limits doesn't account for threats from loss of prey or degradation of habitats. Furthermore, problems of overfishing and environmental impacts are treated as independent issues by separate management agencies. The reality is that a species could be “perfectly managed” for mitigating the impacts of directed fishing on long-term sustainability, but could still decline precipitously from other impacts that were not considered.

This situation is particularly germane for tarpon and bonefish. Sportfisheries for tarpon and bonefish in US waters are primarily catch-and-release, and have been for decades. However, by all accounts tarpon and bonefish population sizes are substantially lower than they were 50 or so years ago. It is likely that these declines have less to do with the impacts of catch-release fishing and more to do with impacts from overfishing of prey species, habitat degradation and declines in water quality.

**THREE STRIKES AGAINST TARPON AND BONEFISH**

1. Loss of prey and “habitat” degradation is not accounted for in contemporaneous fishery stock assessments.
2. Traditional data for assessments is not available (No catches of “dead fish” to sample at the dock for catch-and-release fisheries!).
3. Lack of federal and state funding for sportfishes.

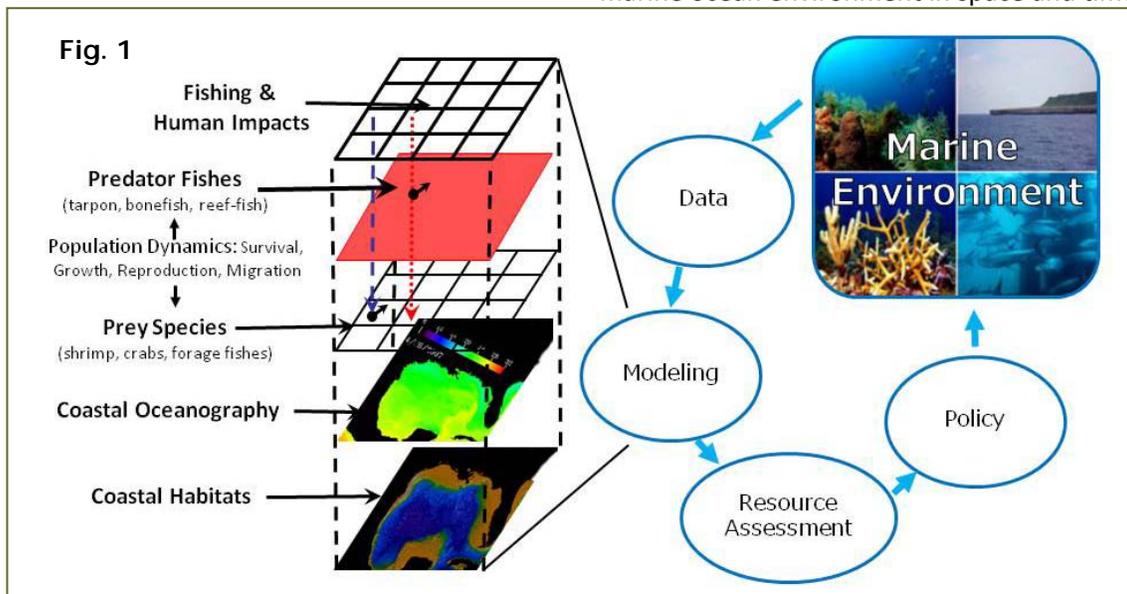


*Goliath grouper in the Dry Tortugas*

*Pioneering Research in Fisheries Ecosystem Science*

A little over 20 years ago, Dr. Jerry Ault assembled a unique team of like-minded researchers at the University of Miami committed to transforming both the theory and practice of fisheries science towards a more holistic ecosystem-based approach that

sustainability, including: fishing on both predators (e.g., tarpon, bonefish, reef-fish) and prey (e.g., pink shrimp, blue crabs); and, changes in environmental quality (habitats, water management, etc.). The modeling system directly links population demographic processes to key biological and physical features of the coastal marine ocean environment in space and time.



addressed a broader range of threats to the sustainability of coastal and coral reef fisheries. Their “fisheries systems science” approach integrates data, statistical methods, and mathematical models into a risk assessment framework (Fig. 1). This “system” has enabled simultaneous evaluation of multiple threats to

This pioneering research in data assimilation, modeling and forecasting goes far beyond traditional measuring of dead fish on the dock to greatly improve management decision-making. This innovative system has been applied to Biscayne Bay, FL; Florida Keys coral reef; and, the U.S. Atlantic Coast (ACES).

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### *Launch of the TBRC*

The logical next step in our research endeavors is to build and implement a full-scale modeling, assessment and risk analysis system for real world applications to sustain tarpon, bonefish, and reef fish fisheries of the coastal ecosystem. However, although federal agencies have provided over 95% of our research funding to date, they have been reticent to step forward to support focused sportfisheries research. Part of this reluctance stems from a true lack of understanding of the importance of sportfisheries, and from the highly inter-disciplinary and complex nature of this complex research, which involves expertise from many fields of study and novel University-agency partnerships. Fisheries agencies primarily fund fisheries scientists, oceanographic agencies primarily fund oceanographers, etc.; unfortunately, the twain never meet.

*“The research plan for the first two years, 2015–2016, includes a number of projects that rely on funding support from private foundations and individual donors such as you.”*

To overcome this scientific impasse, the TBRC was launched in spring 2014 along with a detailed 5-year research plan, starting in 2015, to build and implement parallel modeling and analysis systems in three focal regions: southern Florida, Texas, and the Bahamas. TBRC research will focus on a slightly different mix of predator and prey species for each region, and address key regional threats to sustainability. The research plan for 2015-16 includes a number of projects that rely on funding support from private foundations and individual donors like you. Concomitantly, we also anticipate



*School of tarpon in the Florida Keys*

receiving continued federal agency funding for specific projects to refine some data collection and modeling components of the analysis system, and for application to species such as reef-fishes that support both commercial and recreational fisheries.

Bold ventures are often fraught with bumps in the road, but can yield big rewards. The TBRC arose from a long-term collaborative relationship between the University of Miami (UM) and Bonefish Tarpon Trust (BTT). However, in early 2014, BTT took a decided tack towards advocacy, veering away from objective science on which it was built. As a consequence, UM terminated their relationship with BTT and took sole responsibility for the TBRC. While we regret the loss of our longtime friend and valued partner, we wish BTT well. We at TBRC firmly believe that sound conservation policy is derived from solid scientific understanding. With your help, together we can achieve a new era of discovery that ensures the conservation of these storied fish and their sportfisheries. We have no doubt that TBRC’s unique science efforts will drag the entire field of fisheries science and management kicking and screaming into the 21st century.

## RESEARCH PLAN 2015-2016

<i>Region</i>	<i>Species</i>
South FL	<p><b>Focus Species:</b> Tarpon, Bonefish, Permit, Reef Fish (Grouper, Snapper), Spotted Seatrout</p> <p><b>Prey Species:</b> Pink Shrimp, Mullet &amp; Forage Fishes</p>
Texas	<p><b>Focus Species:</b> Tarpon, Red Drum</p> <p><b>Prey Species:</b> Brown &amp; White Shrimp, Blue Crabs, Menhaden &amp; Forage Fishes</p>
Bahamas	<p><b>Focus Species:</b> Bonefish, Reef Fish</p> <p><b>Prey Species:</b> Forage Fish &amp; Shellfish</p>
Planned Agency-Sponsored Projects: 10 → 4 funded, 6 pending	
Planned Donor-Sponsored Projects: 18 → 2 funded, 16 awaiting funding	

## CENTER NEWS

### ***Dr. Ault Goes to Washington (and Texas, and Belize, and The Bahamas, and...)***

During 2014, Dr. Ault crisscrossed the country and the Atlantic and Pacific Oceans to advise US and foreign governments on the science and policy needs for achieving sustainable marine fisheries. In particular sportfisheries for tarpon, bonefish, and coastal gamefishes in the southeastern US and the Bahamas, and coral reef fisheries in Florida, Hawaii, and the Caribbean (Bahamas, Puerto Rico, US Virgin Islands, Dutch Antilles). In December, as part of a delegation sponsored by the National Parks Conservation Association, Dr. Ault met with multiple members of the US Senate, US House of Representatives, and also the senior administration of the Departments of Interior and Commerce to present scientific and economic rationale for building sustainable sportfisheries in south Florida's National Parks (Biscayne, Everglades, and Dry Tortugas) and coastal marine ecosystem.

Dr. Ault was also able to share some of our exciting research findings on tarpon, bonefish, and reef-fish, and talk about the launch of TBRC with avid sportfishers in southern Florida, Texas, The Bahamas, New York, Belize, and California. A very exciting development was the creation of a formal partnership between the University of Miami's Rosenstiel School of Marine and Atmospheric Science and the Bahamas Agriculture and Marine Science Institute (BAMSI) to develop scientific research and education programs for the conservation and sustainability of fisheries resources in the The Bahamas. If you have met Jerry, you will immediately realize that airplane seats weren't really designed for a person with his physical stature (6'7" tall). Kudos, Dr. Ault, for really EARNING all those frequent flier miles!



*The Prime Minister of The Bahamas, the Rt. Honorable Perry Christie (center), is presented with Dr. Jerald Ault's books on Atlantic tarpon and bonefish biology, management and sustainable sportfishing at a meeting exploring collaborative efforts between The Bahamas and the TBRC.*



*Whirling school of spawning permit, Dry Tortugas, Florida*

## **IN THE NEWS AND IN PRINT**

### **Television News Stories**

CBS News, BBC and Weather Channel - AMHQ with Sam Champion: *Sharks as hurricanes forecasters*;  
Bass2Billfish Television Program: *Satellite-tagging of tarpon in the south Florida ecosystem*

### **Magazine Articles**

Florida Sport Fishing Magazine: *Tomorrow's Meteorologist: satellite tags provide unexpected insight from migrating tarpon*. May/June 13(3): 73-78.

### **Scientific Journal Articles**

Luo, J., Ault J.S., Shay L.K., Hoolihan J.P., Prince E.D., Rooker J.D. 2015. Ocean heat content reveals secrets of fish migrations. PLOS ONE, *in press*.

Ault, J.S., Smith, S.G., Browder, J.A., Nuttle, W., Franklin, E.C., DiNardo, G.T., Bohnsack, J.A. 2014. Indicators for assessing the ecological and sustainability dynamics of southern Florida's coral reef and coastal fisheries. *Ecological Indicators* 44 (2014): 164-172.

Farmer, N.A., Ault, J.S. 2014. Modeling coral reef fish home range movements in Dry Tortugas, Florida. *The Scientific World Journal*, Volume 2014, 14 pages.

Farmer, N.A., Ault, J.S., Smith, S.G., Franklin, E.C. 2014. Methods for assessment of short-term coral reef fish movements within an acoustic array. *Movement Ecology* 2014: 1-7.

Hoolihan, J.P., R.J.D. Wells, J. Luo, B. Falterman, E.D. Prince, J.R. Rooker. 2014. Vertical and horizontal movements of yellowfin tuna in the Gulf of Mexico. *Marine and Coastal Fisheries* 6: 211-222.

Mansfield, K. L., J. Wyneken, W. P. Porter, and J. Luo. 2014. First satellite tracks of neonate sea turtles redefine the "lost years" oceanic niche. *Proceedings of the Royal Society B: Biological Sciences* 281:20133039.

Moustahfid H., M. Weise, S. Simmons, B. Block, K. Holland, J. Ault, J. Kocik, D. Costa, S. T. Lindley, B. Mate, S. Hayes, C. M. Holbrook, A. Seitz, M. Arendt, J. Payne, B. Mahmoudi, C. Alexander, P. Moore, J. Price, D. Wilson. 2014. Meeting our Nation's needs for biological and environmental monitoring: Strategic plan and recommendations for a National Animal Telemetry Network (ATN) through U.S. IOOS. U.S. Department of Commerce, NOAA Technical Memorandum NMFS, NOAA-TM-NMFS-SWFSC-534, 7 p.