

What did they say? Translating science presentations from the symposium

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

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



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

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

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

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

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

What did they do?

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

What did they find?

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

Why is this important?

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

— continued on next page.

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

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

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

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

What did they do?

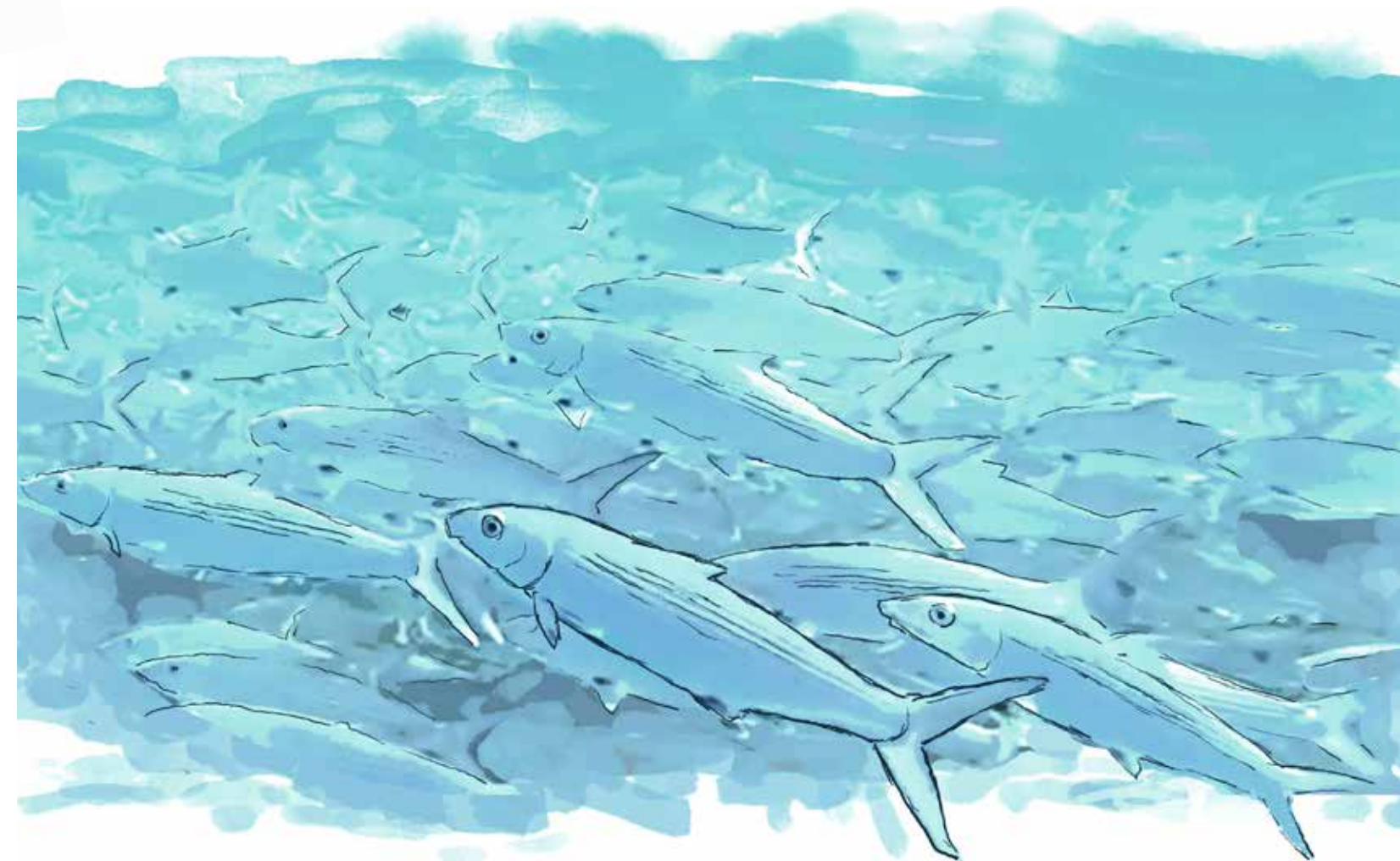
- Collected bonefish larvae and fin clips from adults (a small piece of fin similar to a fingernail clipping that can be used for genetic analysis) from five countries (US, Bahamas, Belize, Mexico, Cuba).
- In the Bahamas, there was intensive collection from nine different islands.

What did they find?

- 2380 larval bonefish were collected in the Bahamas, while 360 were collected in Cuba, and 26 in Mexico.
- In Florida, despite a huge effort and time dedicated to sampling, only 16 larvae were collected.
- It's important to remember that this was only the first year of collection and that larval recruitment (the number of larvae arriving to a location) can vary from year to year for any given location.
- The fin clips are in the final process of being analyzed and will help shed light on why recruitment to Florida is so low and if this is a self-recruitment or external sourcing issue.

Why is this study important?

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



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

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

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

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

Changes in Florida Keys Guiding

PRESENTATION BY TIMOTHY J. ADKINS
University of Illinois at Chicago

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

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

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

What did they do?

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

suggests to him that disease could be a culprit in the bonefish decline. His preliminary study into bonefish disease is described below.

What did they do?

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

What did they find?

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

Why is this study important?

- Disease could be a very important piece of the Florida bonefish decline puzzle. 🐟



What did they find?

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

Why is this study important?

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

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

PRESENTATION BY DR. STEPHEN E. DAVIS
Everglades Foundation

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

How the system is supposed to work:

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

How the system works now:

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

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


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

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

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

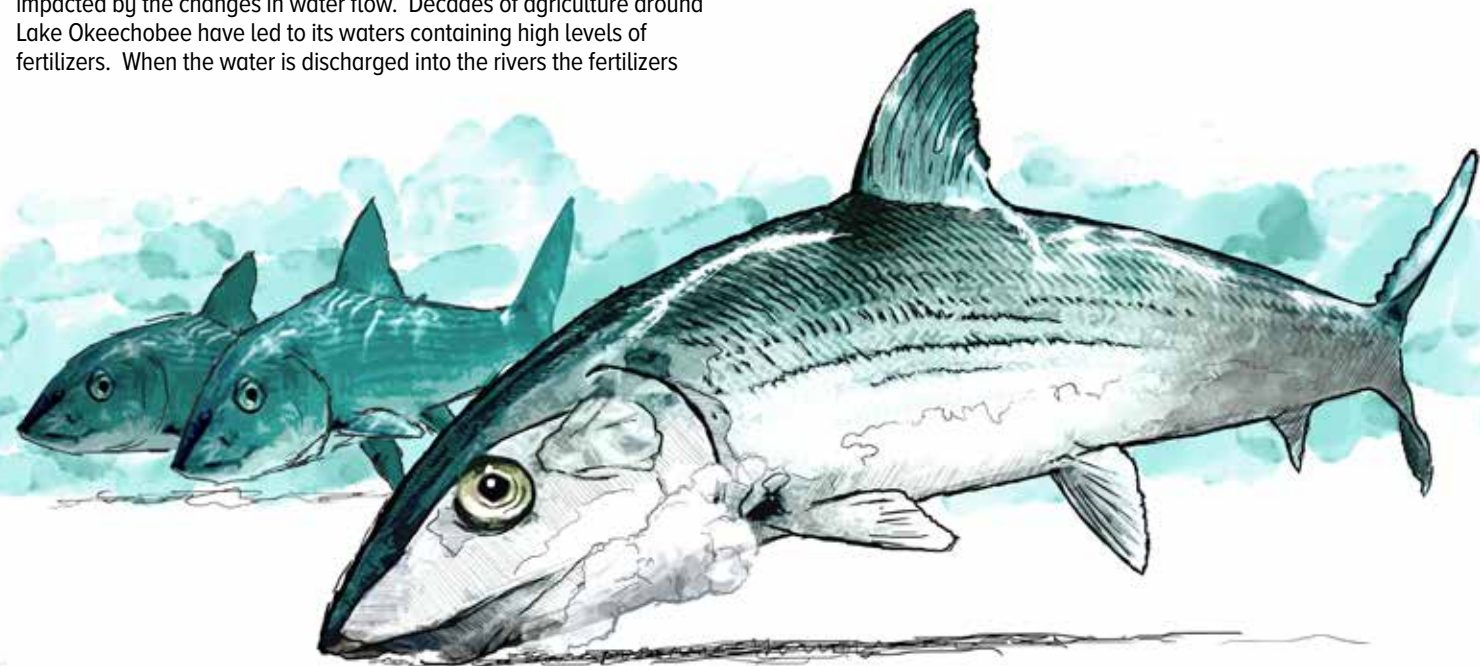
Fixes:

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

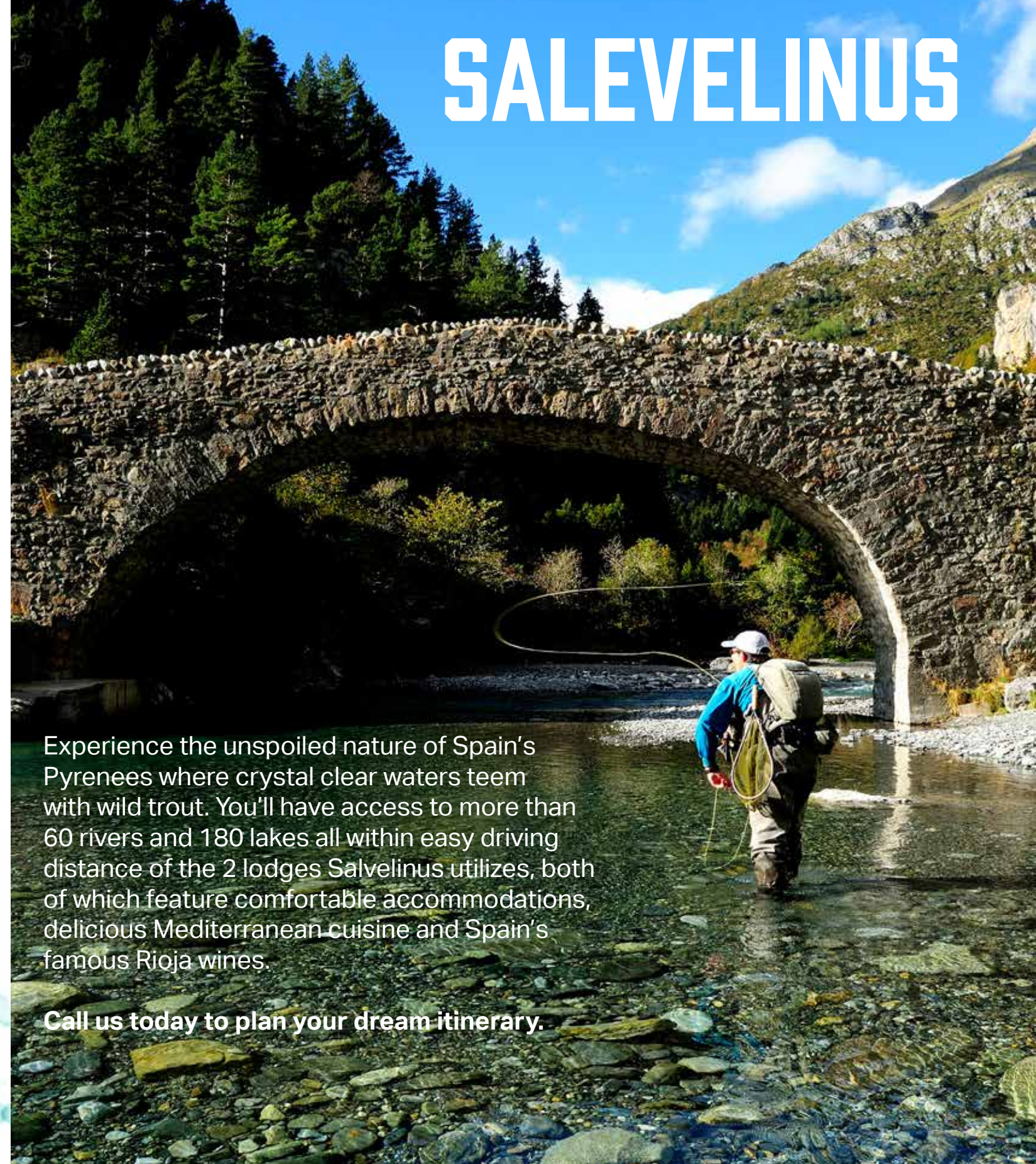
There is, however, some light at the end of the tunnel. Currently a bridge is being constructed on the Tamiami Trail, which will allow for increased water flow south. 

Acknowledgements

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