

Identifying freshwater inflow needs for estuarine fishes: a statewide perspective

Philip Stevens
FWC-FWRI-Fish Biology

Co-authors acknowledged throughout presentation

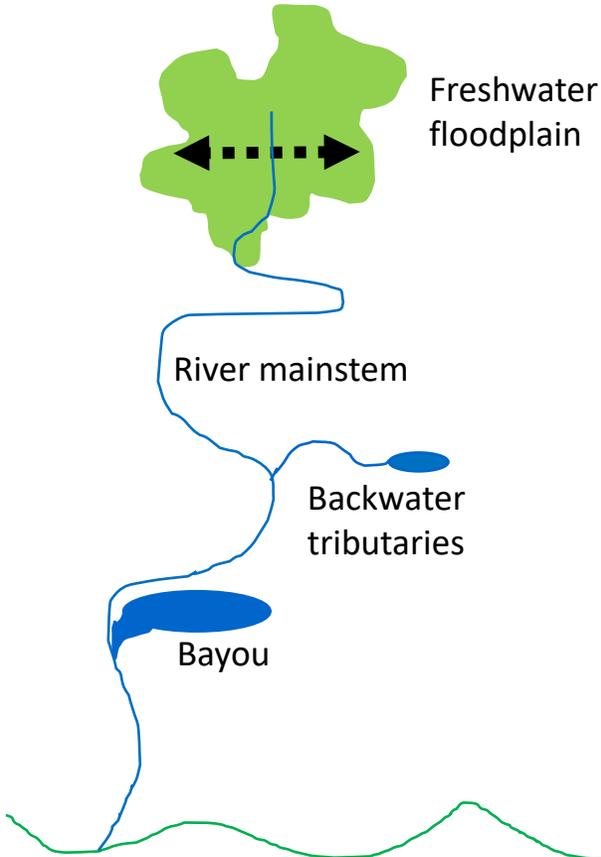


Florida Fish and Wildlife Conservation Commission, Fish and Wildlife
Research Institute

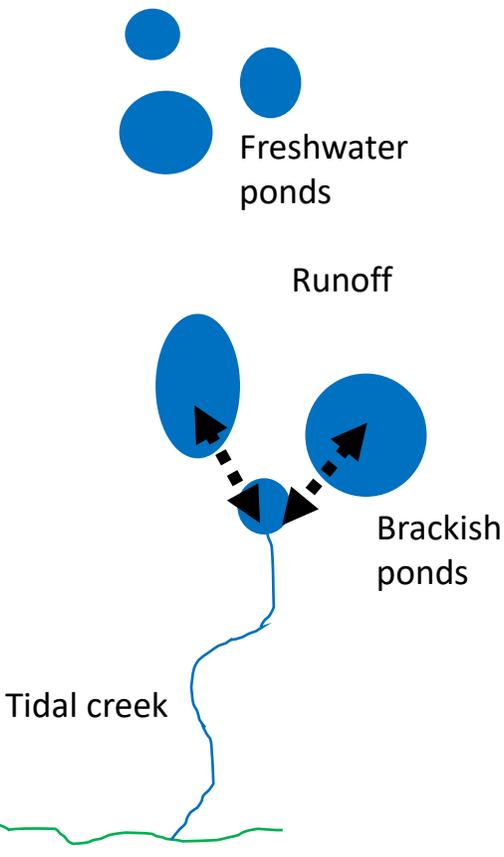


Florida's watersheds

Coastal River



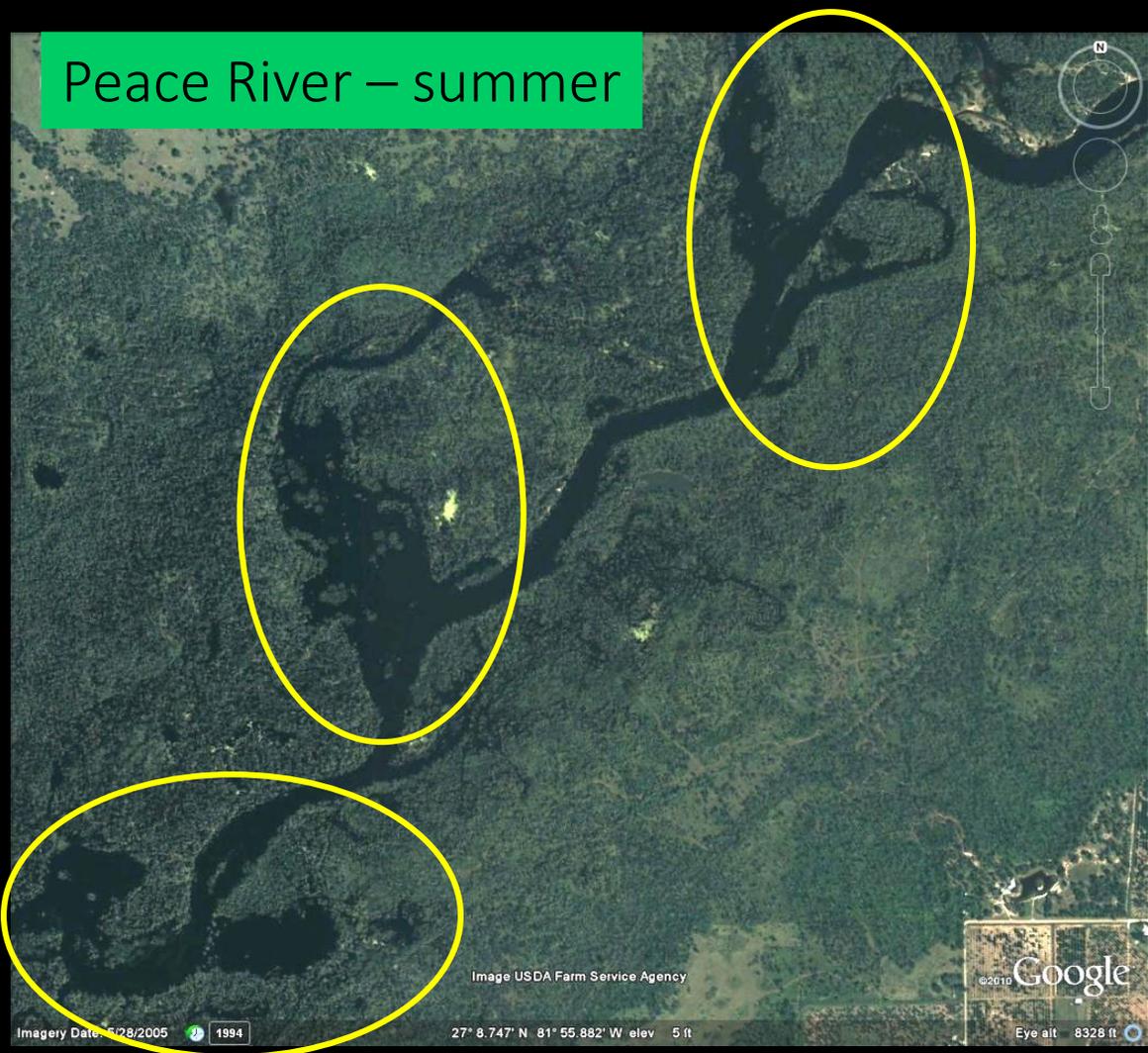
Tidal Creek



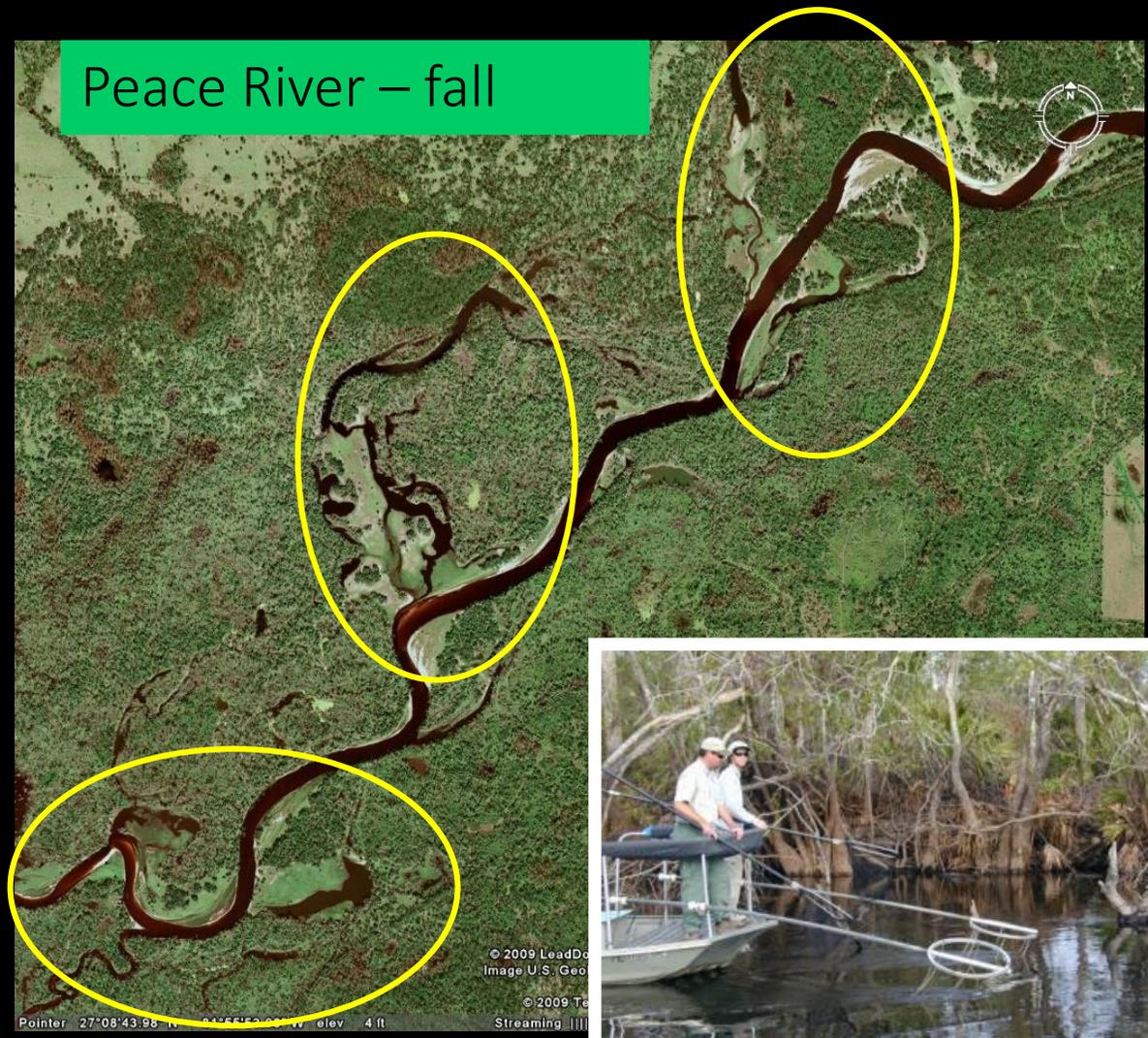
Estuary

Freshwater Floodplains

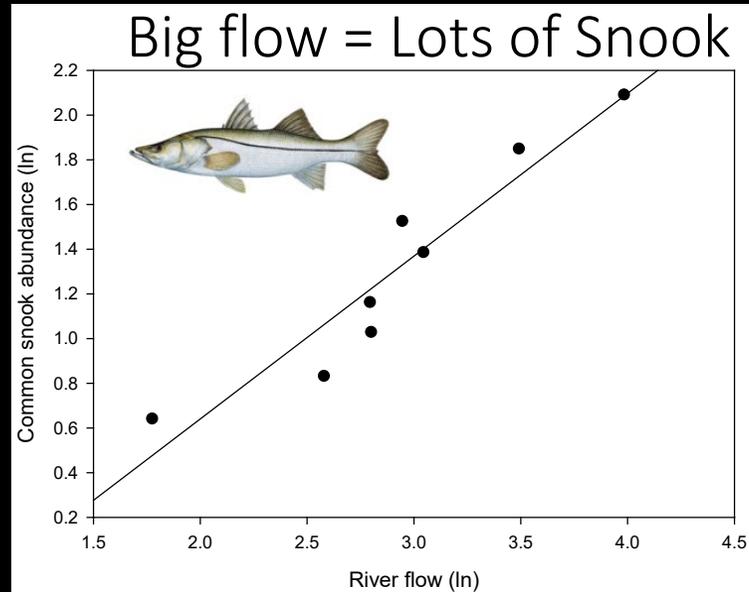
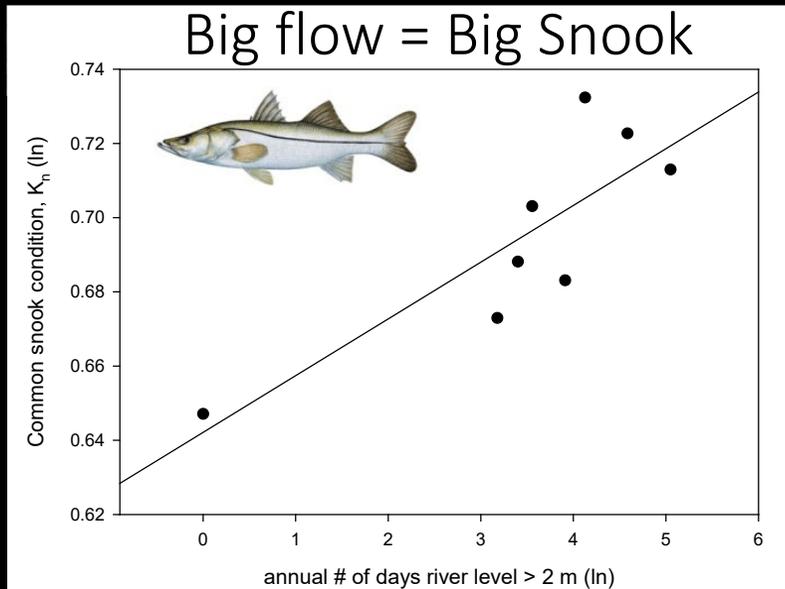
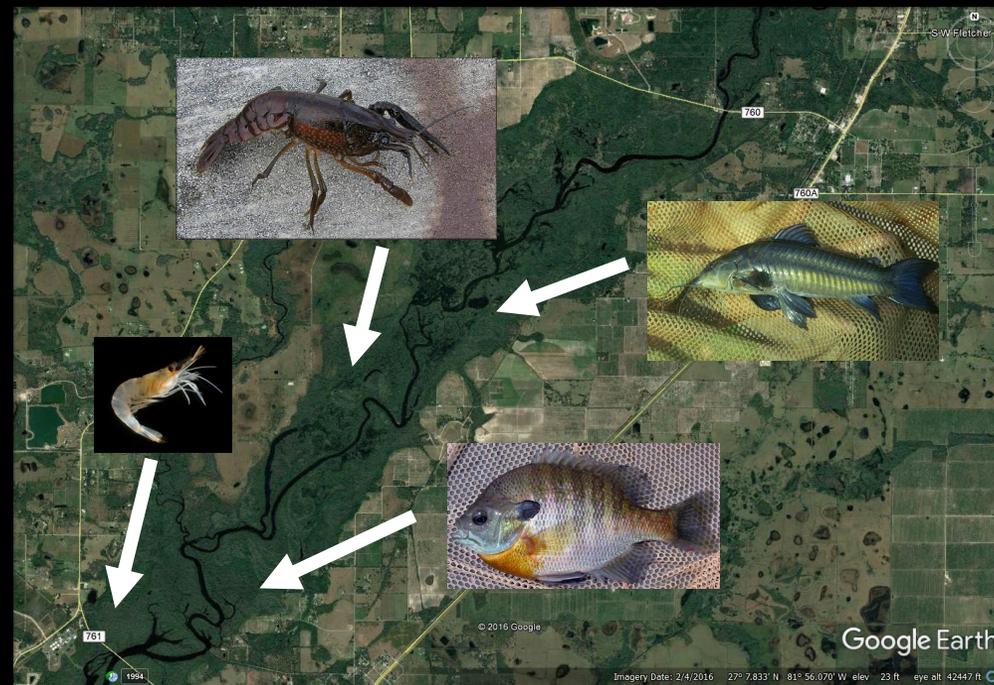
Peace River – summer



Peace River – fall



Prey pulse and condition of large-bodied fish

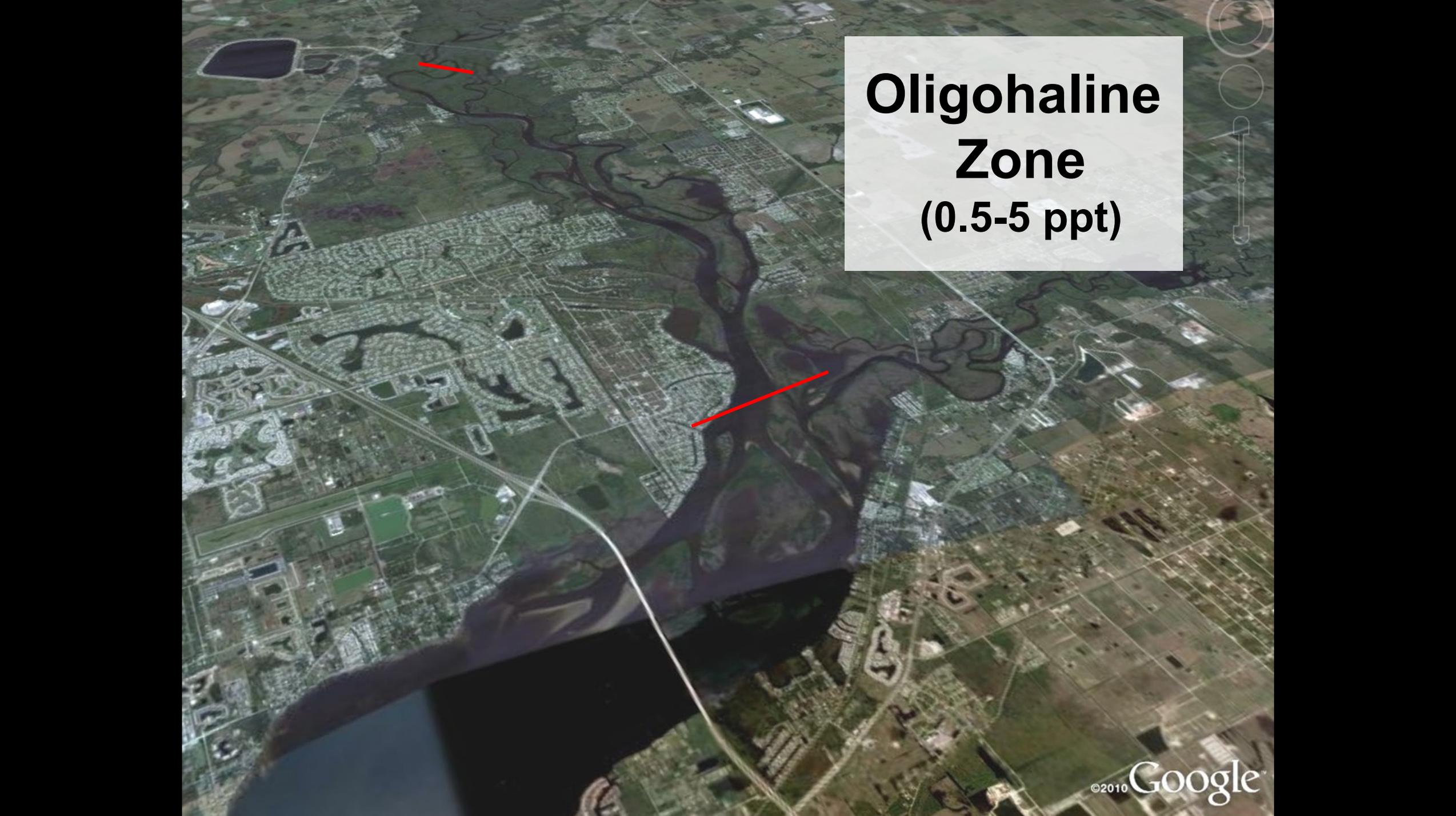


Blewett, D.A., P.W. Stevens, J. Carter. 2017. Ecological effects of river flooding on abundance and body condition of a large, euryhaline fish. *Marine Ecology Progress Series* 563: 211-218.

Promote seasonal floodplain inundation in river management

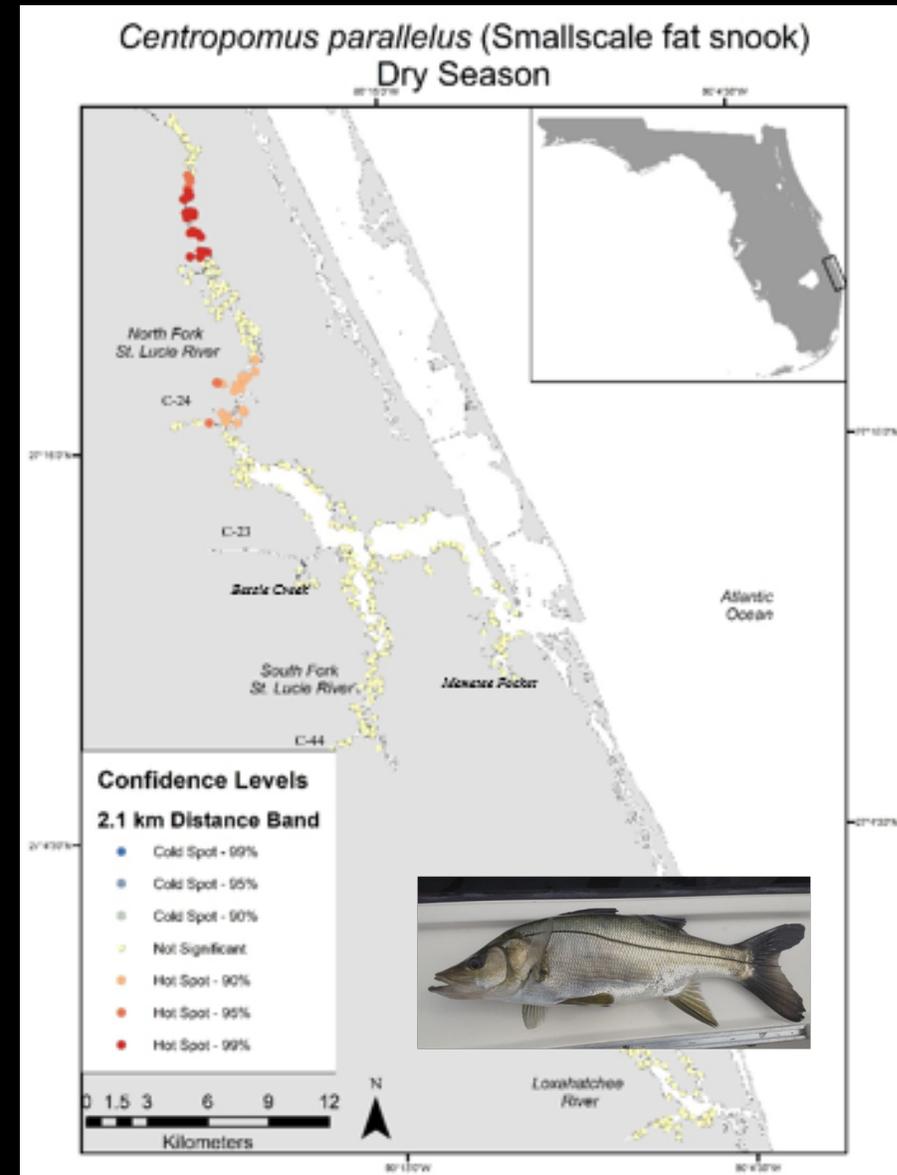
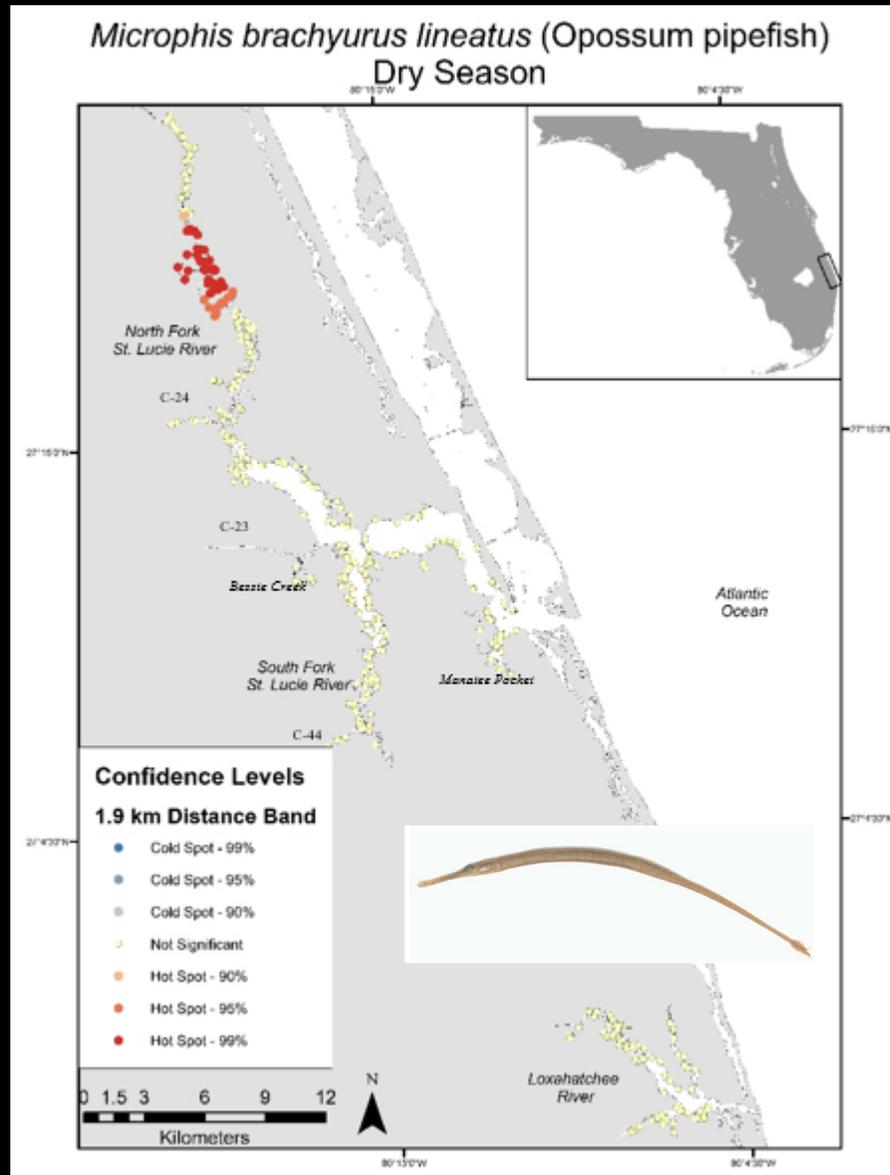
Oligohaline Zone: Common target for water management



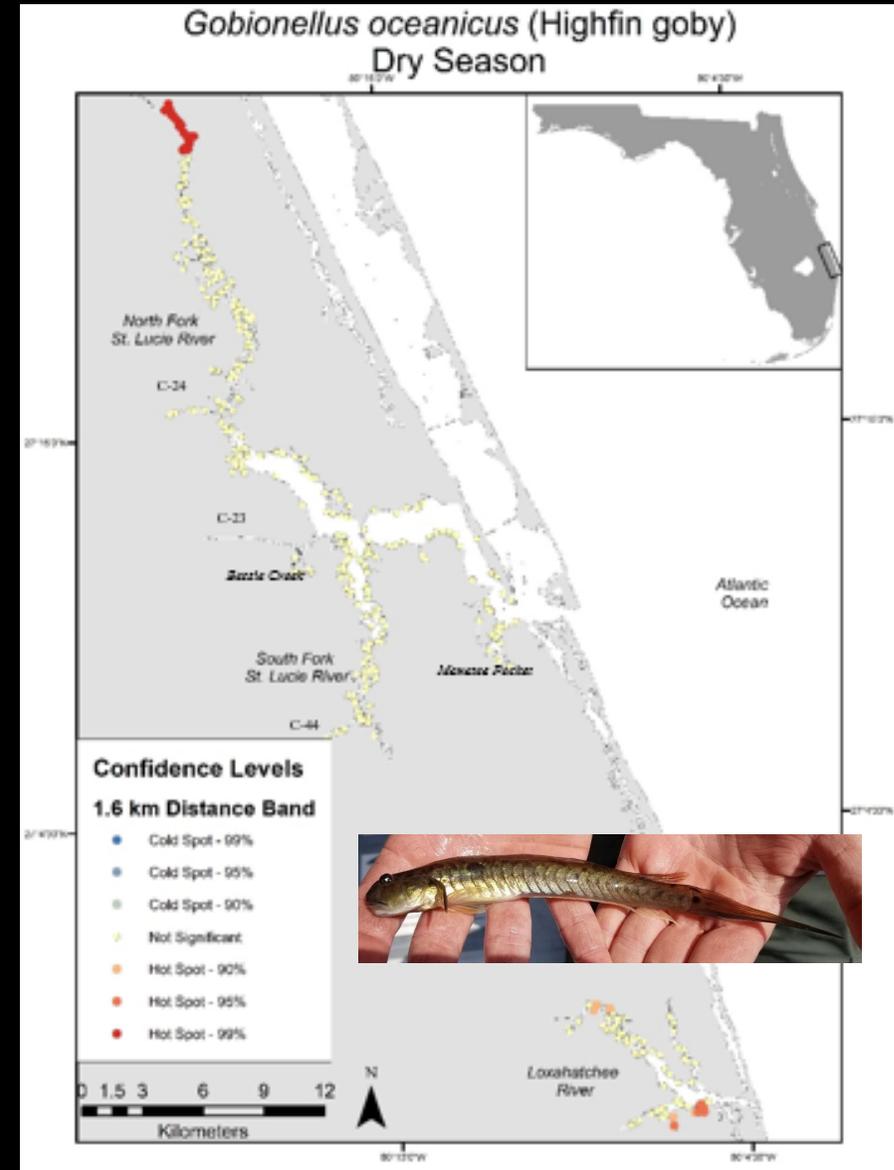
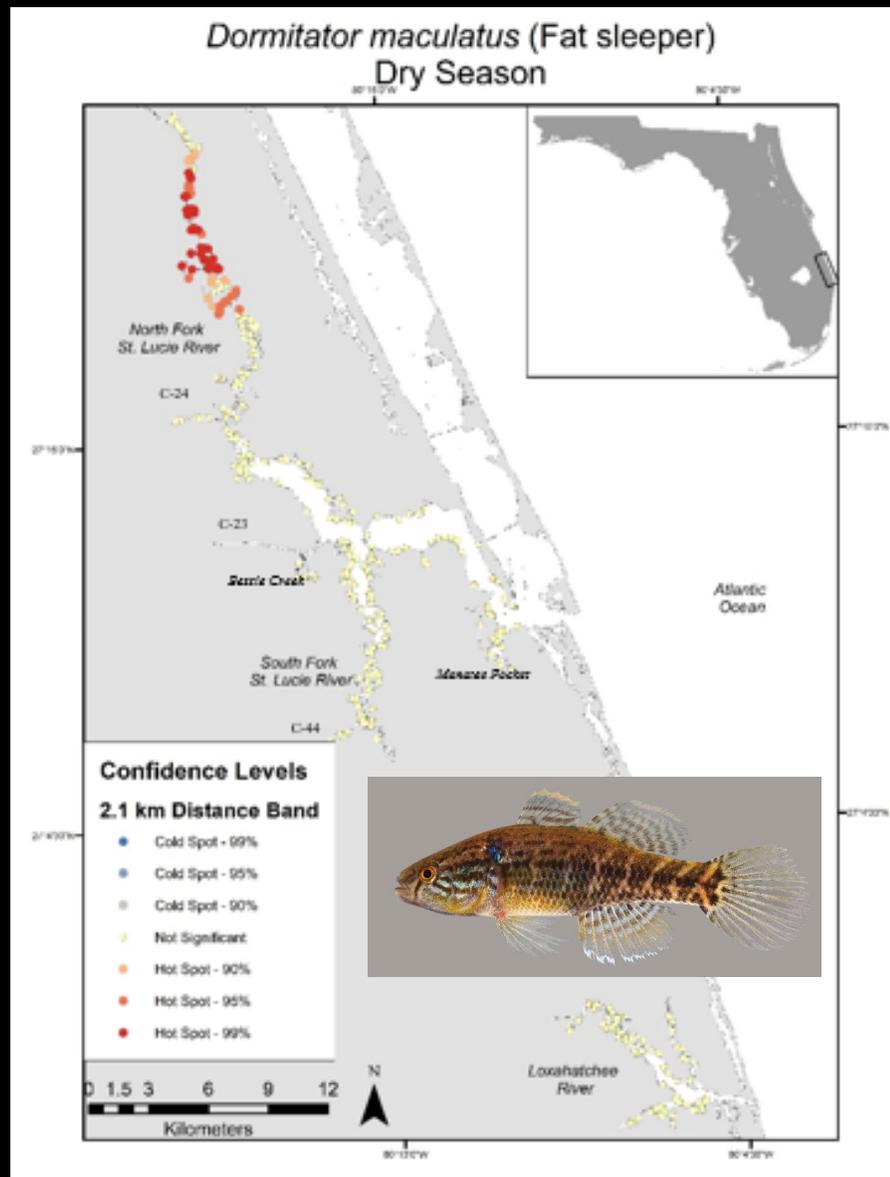


**Oligohaline
Zone
(0.5-5 ppt)**

Oligohaline fishes as indicators



Oligohaline fishes as indicators

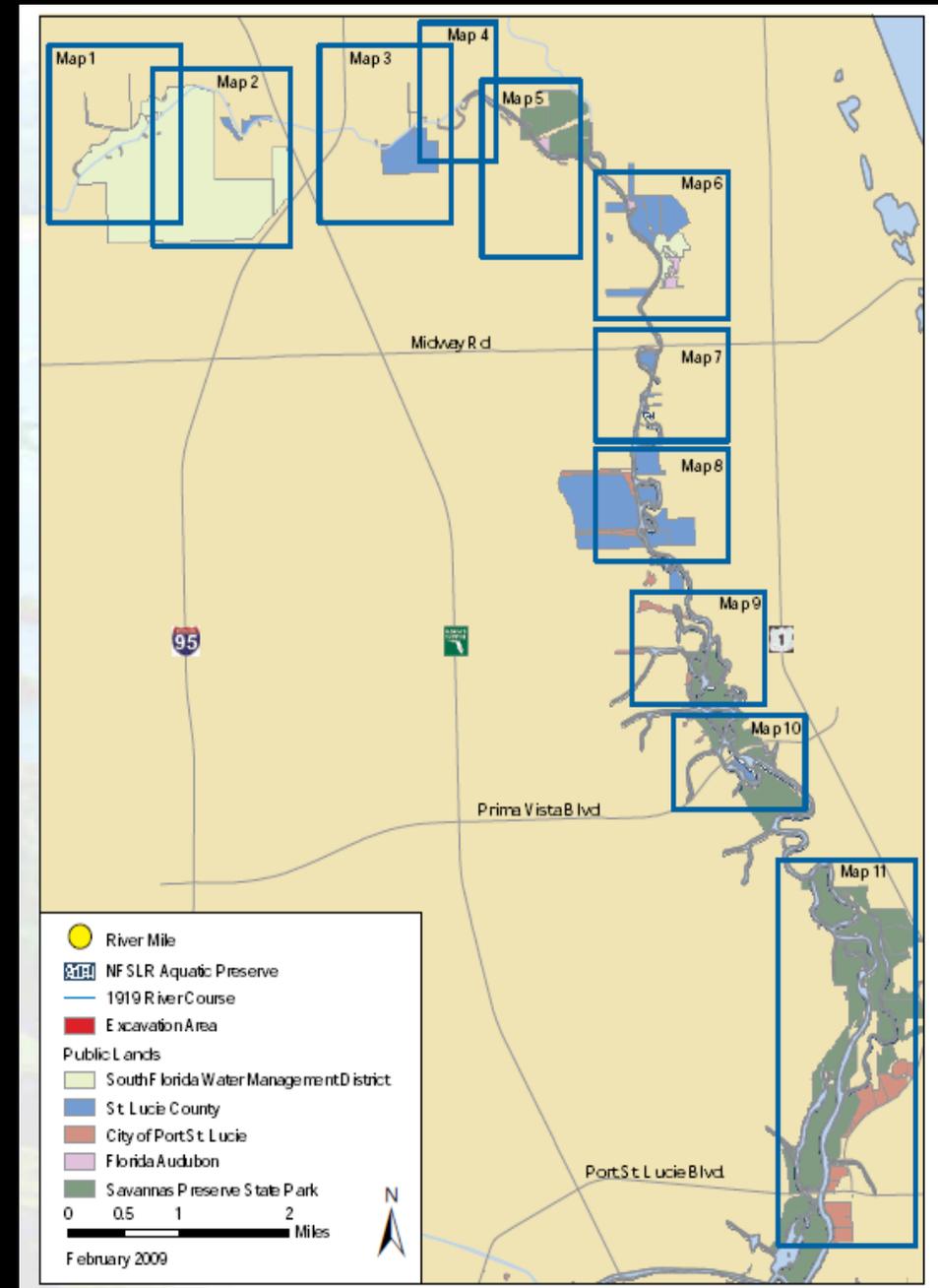


Identification of fish hotspots help to prioritize restoration

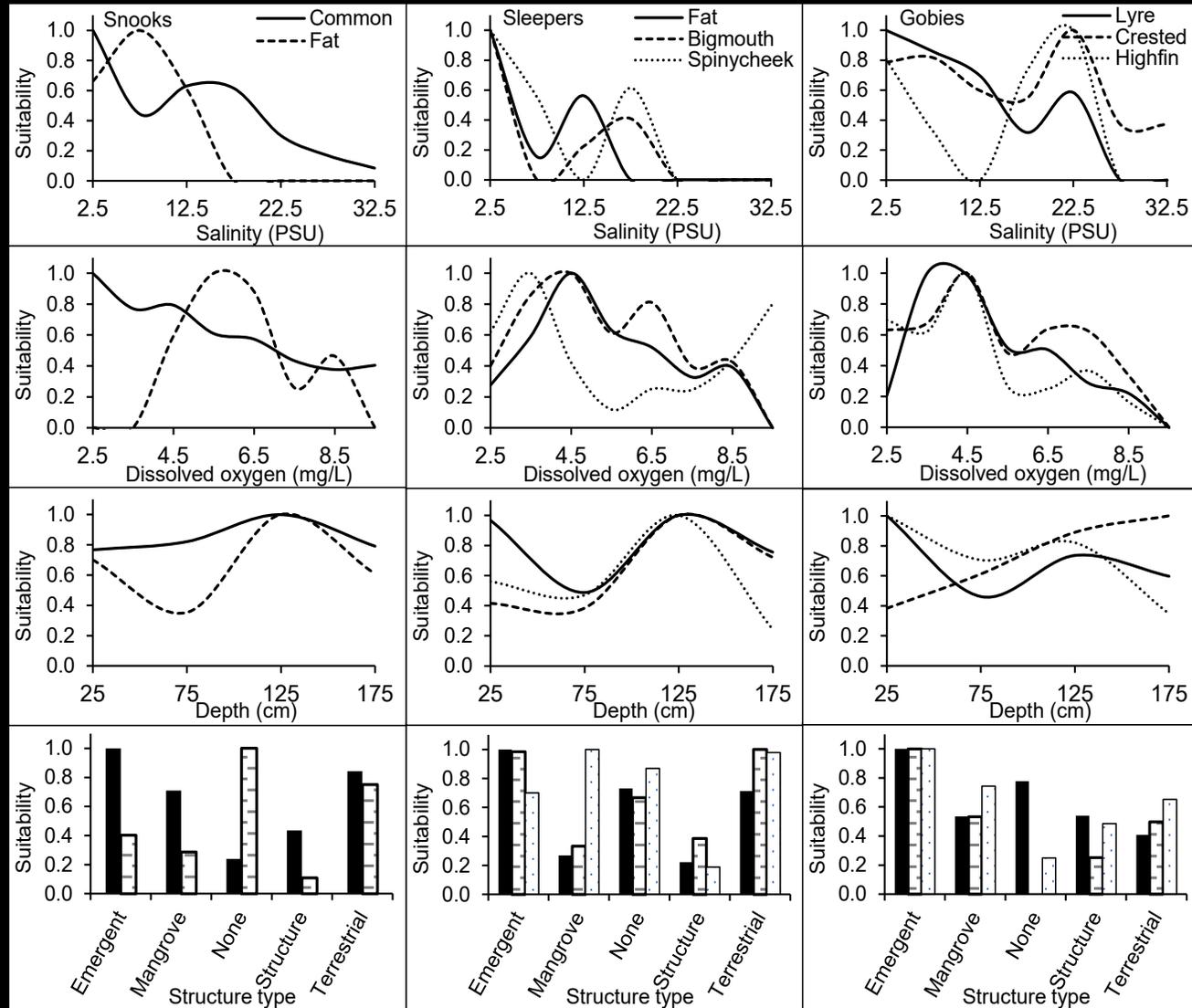
Staff from cities, counties, FWC, FLDEP, water managers...

SE Florida: North Fork St Lucie River

Stevens, P.W., R. Paperno, J.L. Beal, T.C. MacDonald, H. Nathan Miller, P.A. Klarmann, C.R. Malinowski. In Press. Identification of fish habitat for use in prioritizing conservation and restoration projects in coastal rivers. Environmental Biology of Fishes.

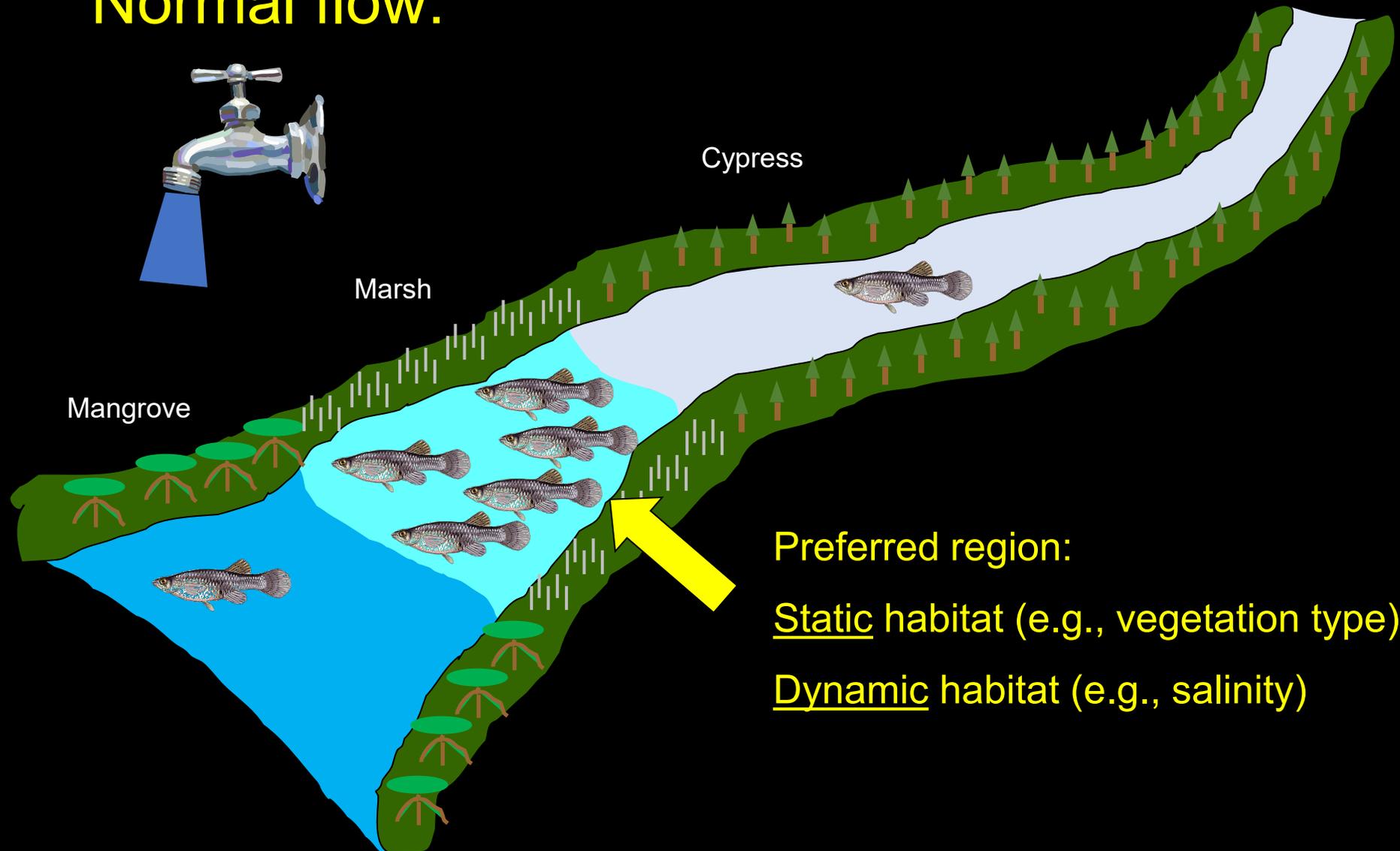


Protect low salinity water in North Fork St Lucie River



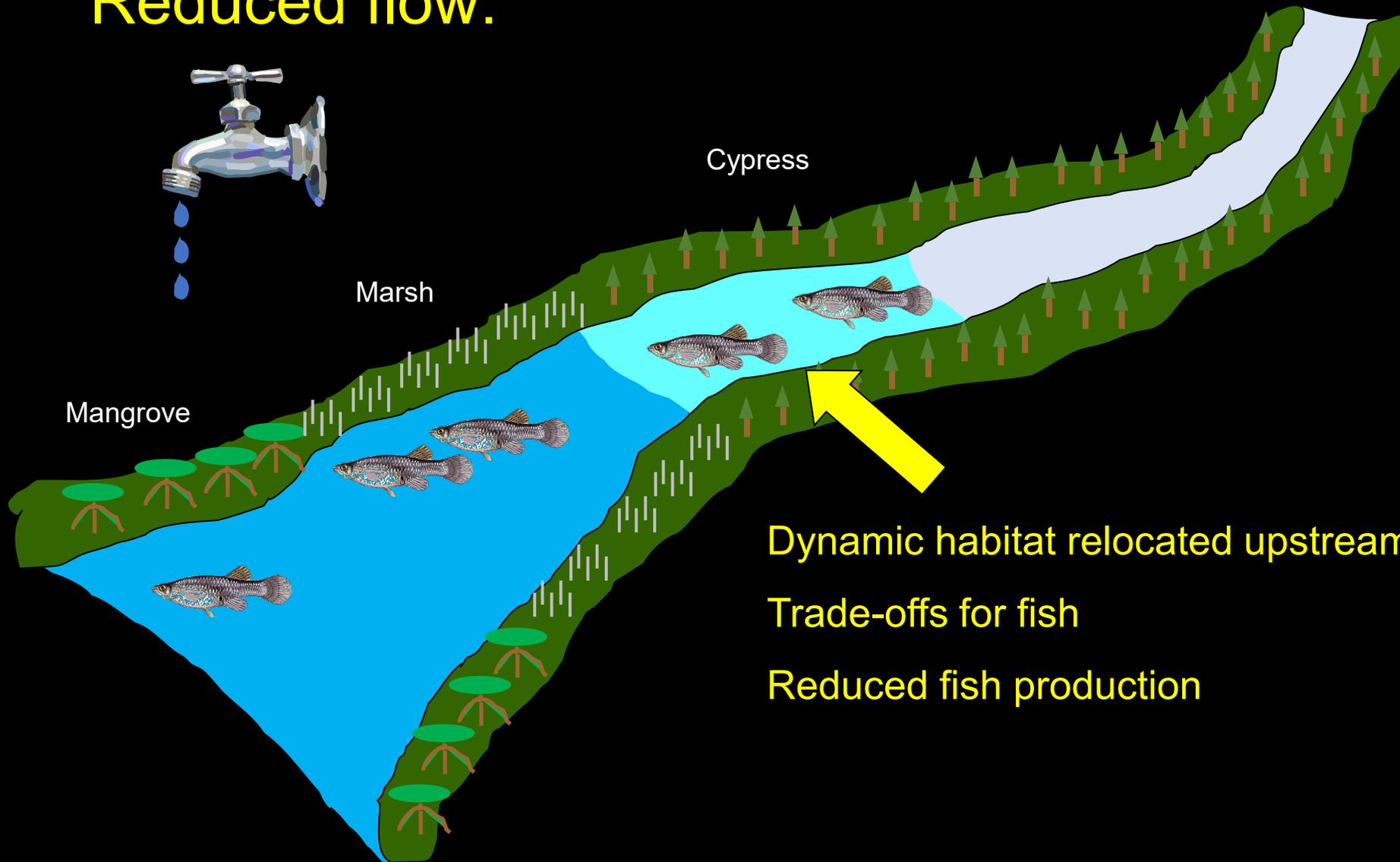
Conceptual Model: Sklar and Browder 1998

Normal flow:



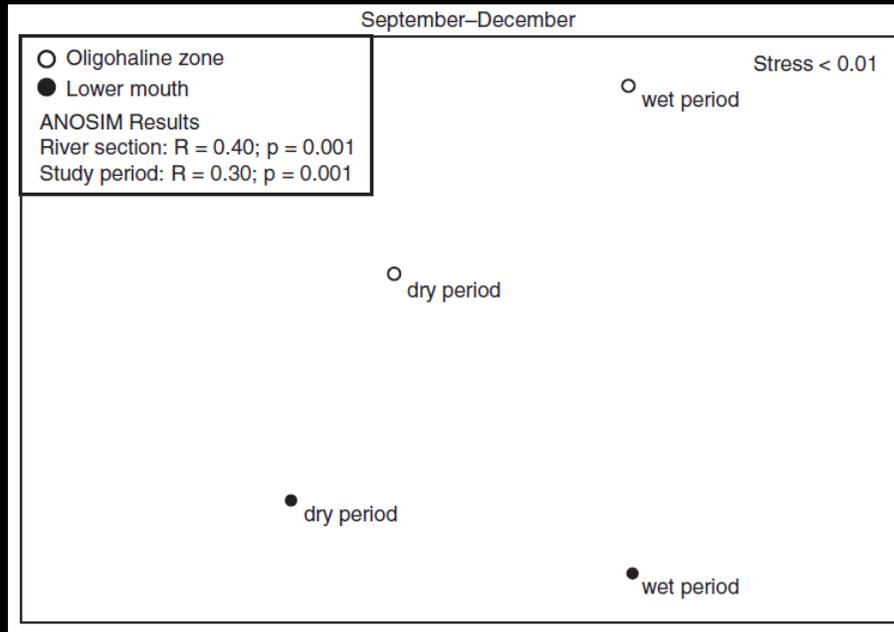
Conceptual Model: Sklar and Browder 1998

Reduced flow:

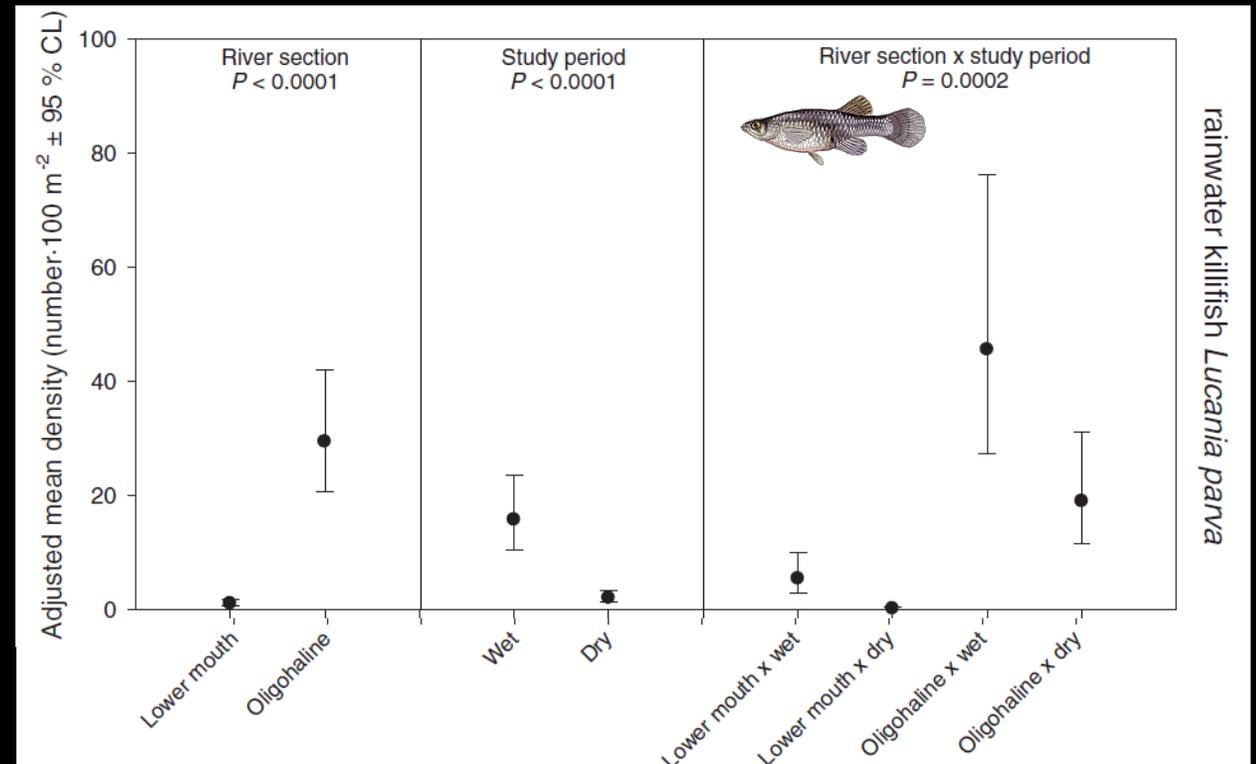


Dynamic habitat relocated upstream
Trade-offs for fish
Reduced fish production

Example of mismatch between static and dynamic habitat



Stevens, P.W., M.F.D. Greenwood, and D.A. Blewett. 2013. Fish assemblages in the oligohaline stretch of a southwest Florida river during periods of extreme freshwater inflow variation. *Transactions of the American Fisheries Society* 142:1644-1658.



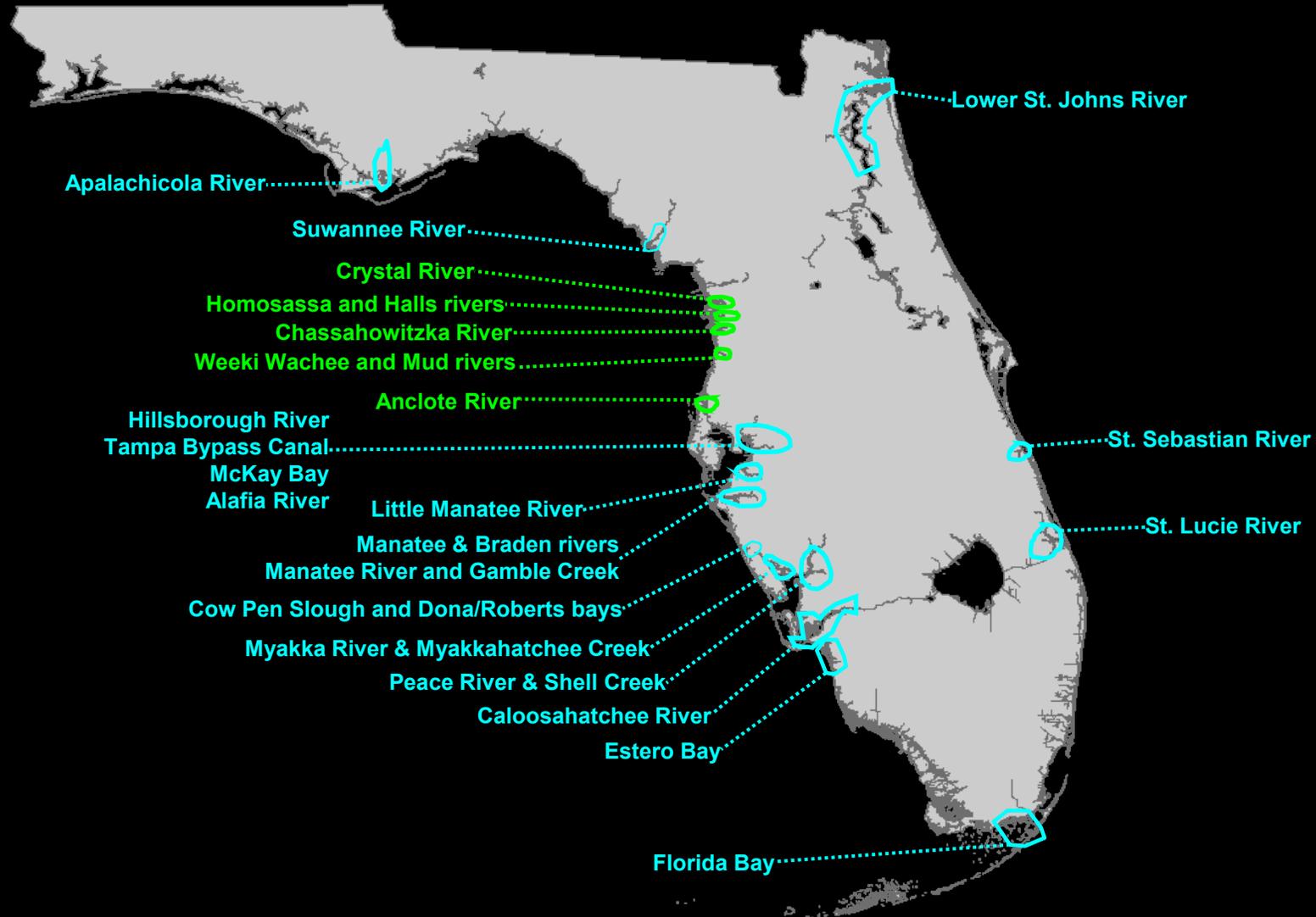
Resident fish abundance decreased during worst drought on record (2007)
Oligohaline fish assemblages more similar to those of the lower river mouth



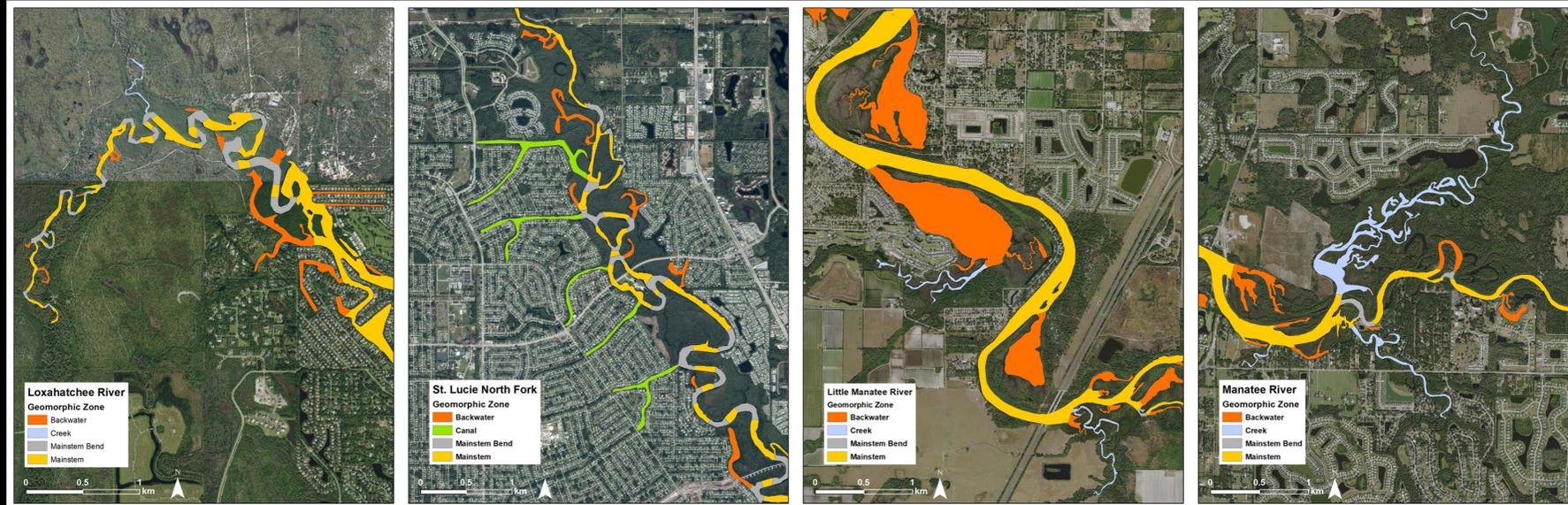
**Lower
River**



Rivers sampled by the FWC FIM program



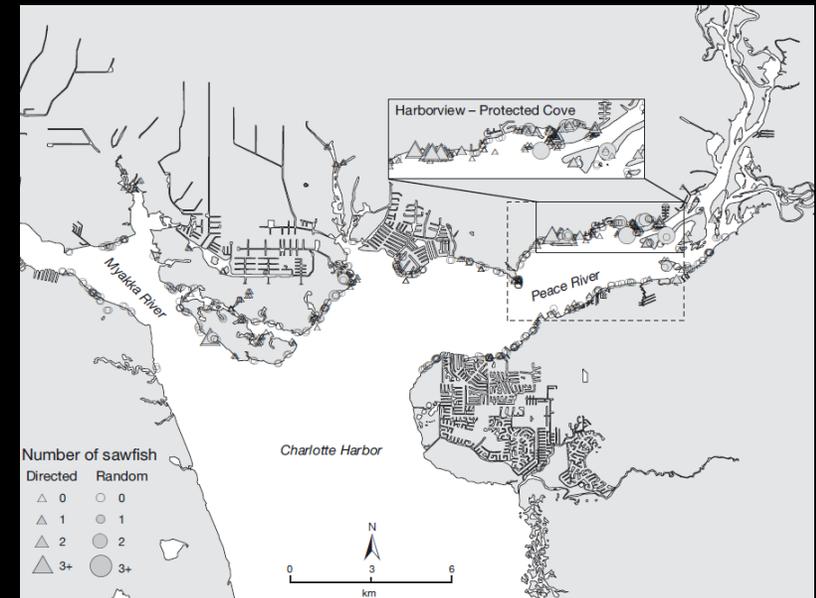
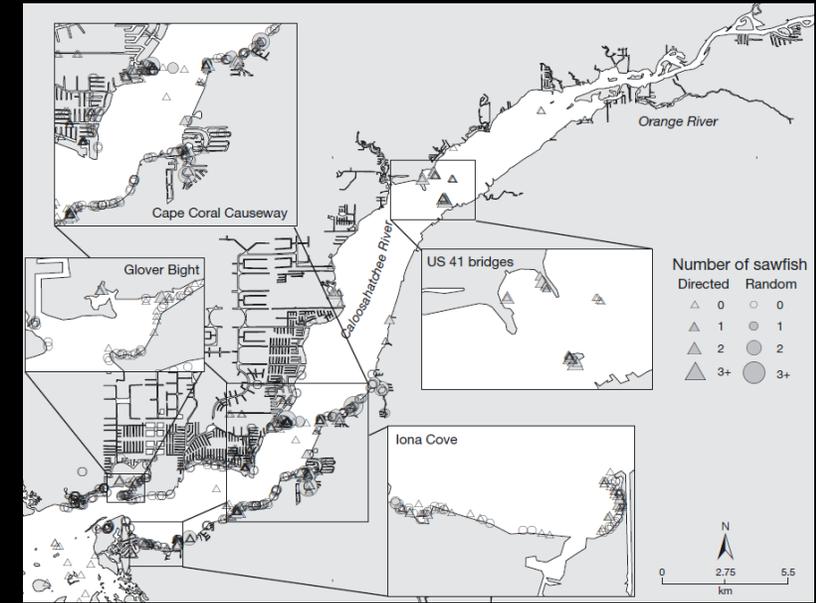
Coastal Geomorphology



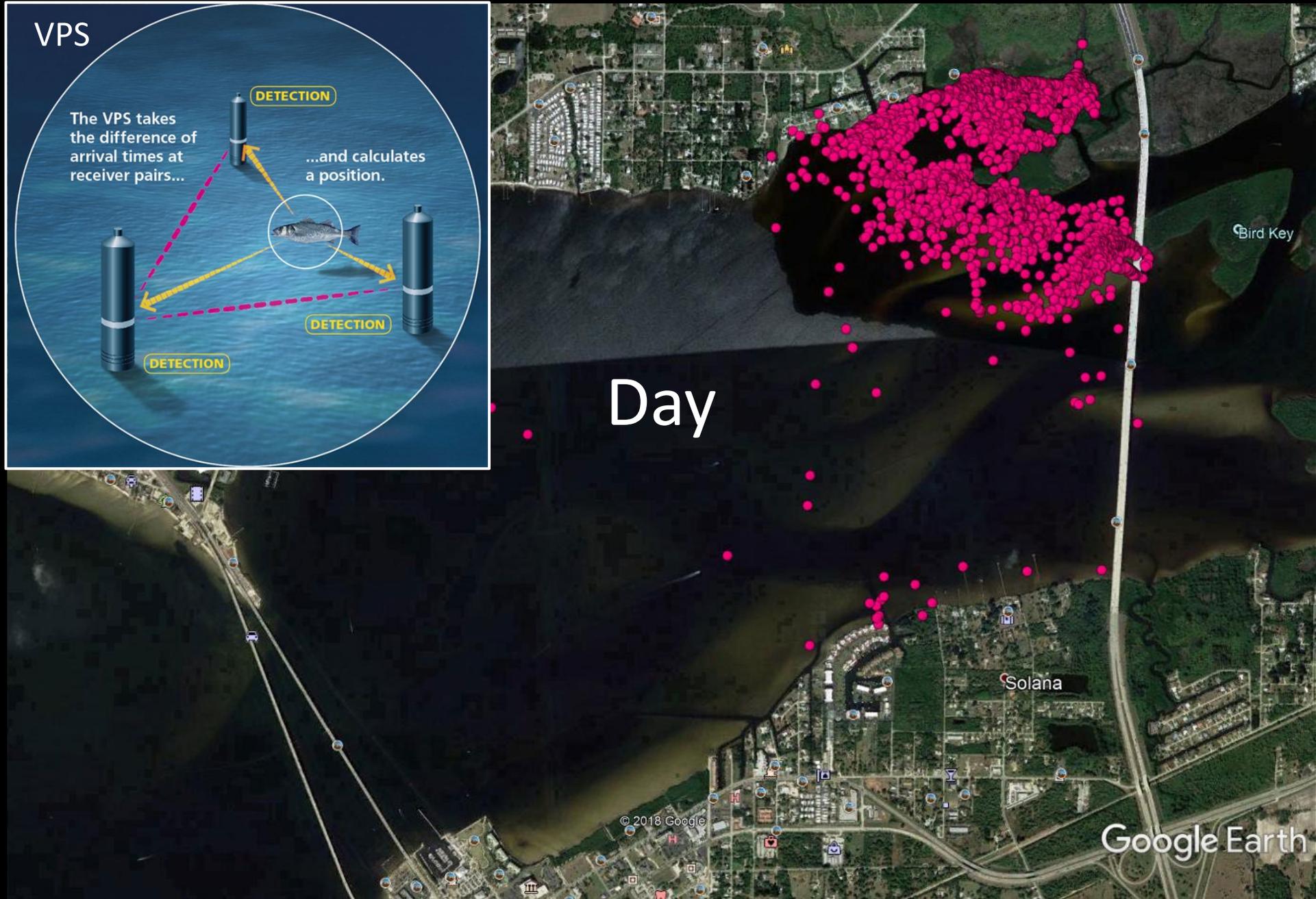
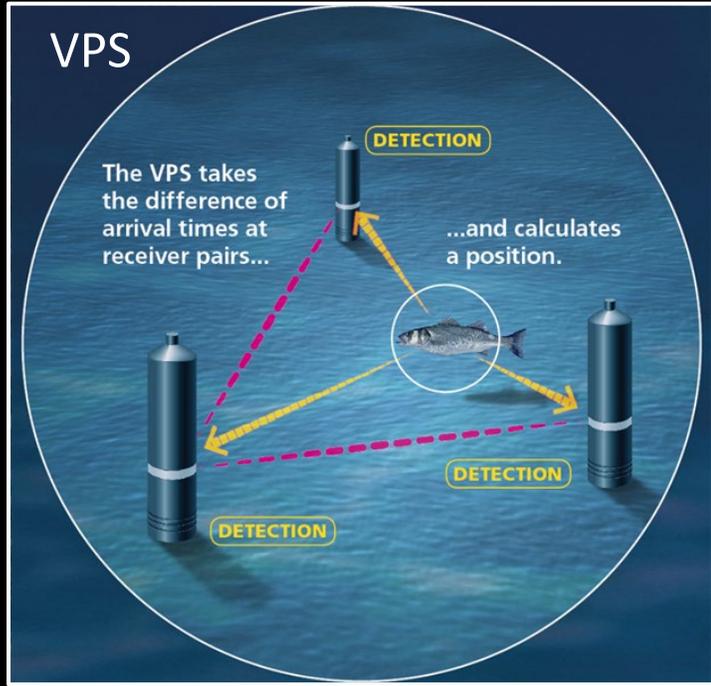
Context is important

Caloosahatchee (long tube,
4 hotspots)
60-day lagged flow:
 $R^2=0.35$

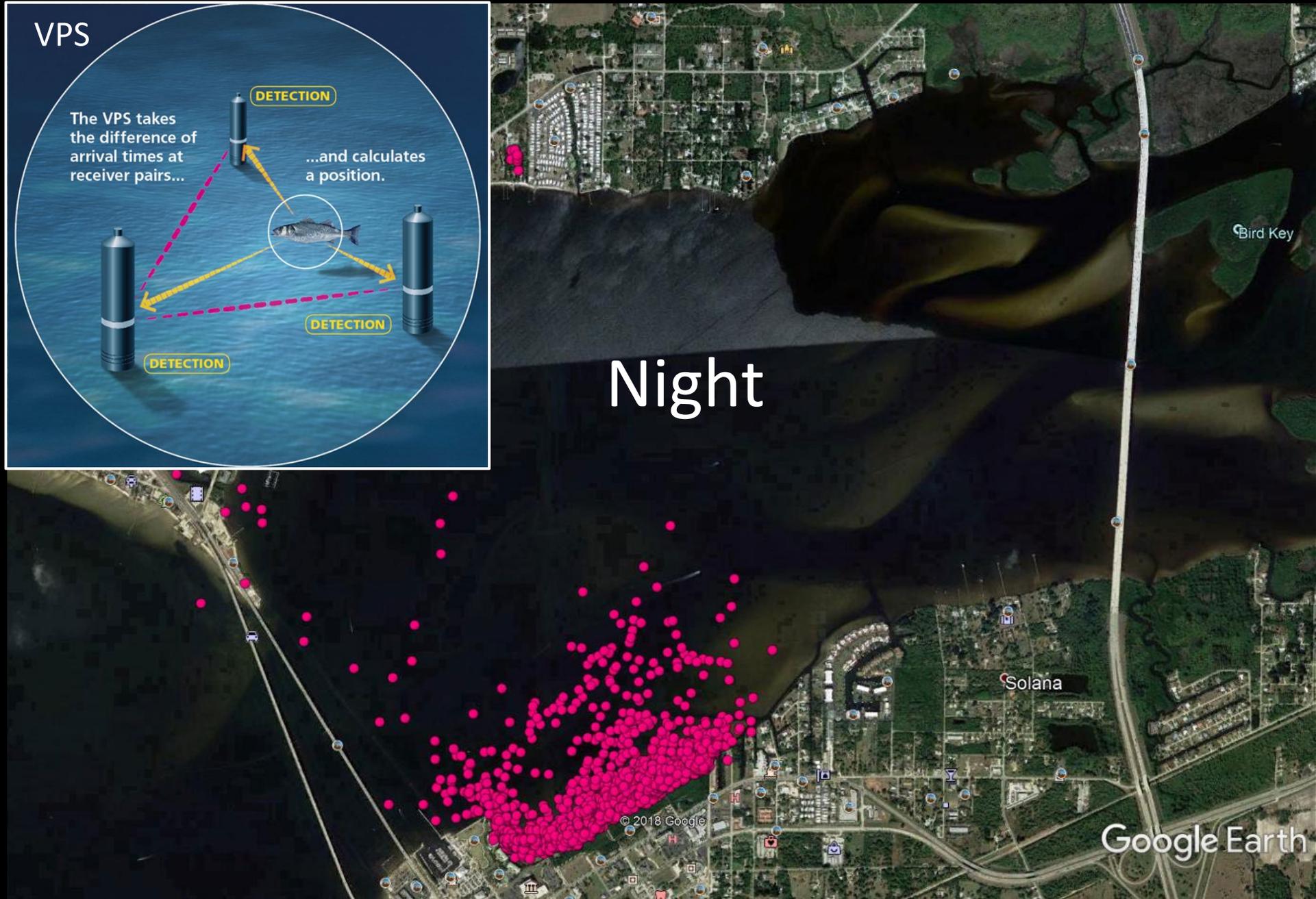
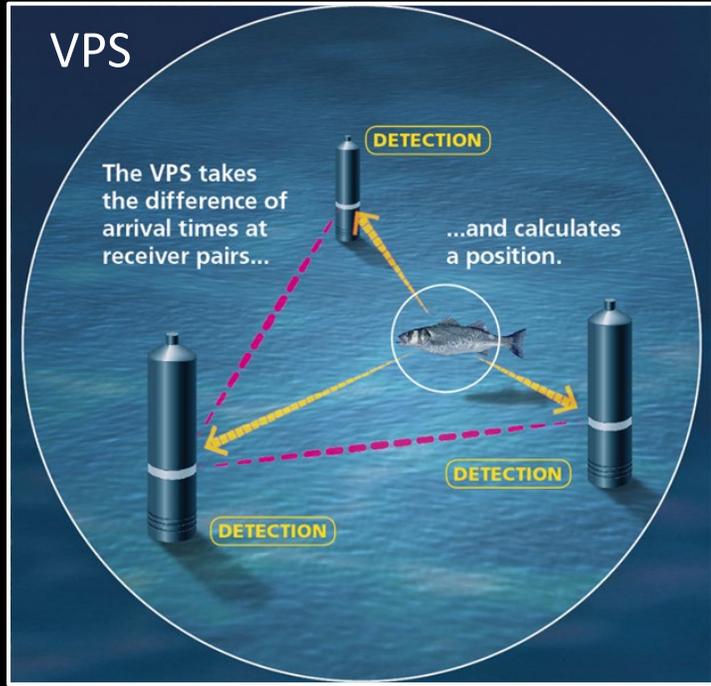
Peace River (short tube,
1 hotspot)
3-day lagged flow:
 $R^2=0.22$



Locations of an individual sawfish



Locations of an individual sawfish

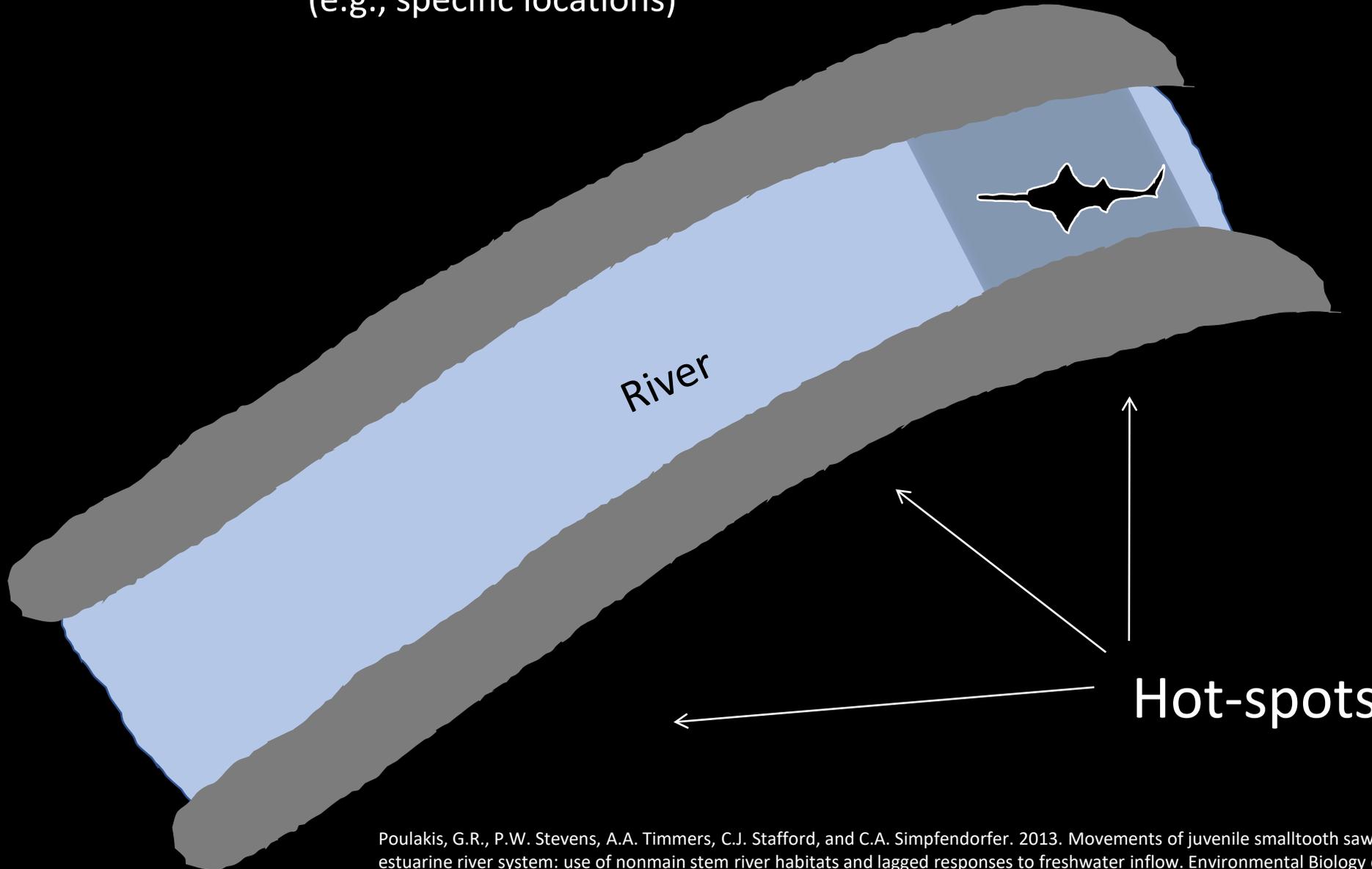


Sawfish

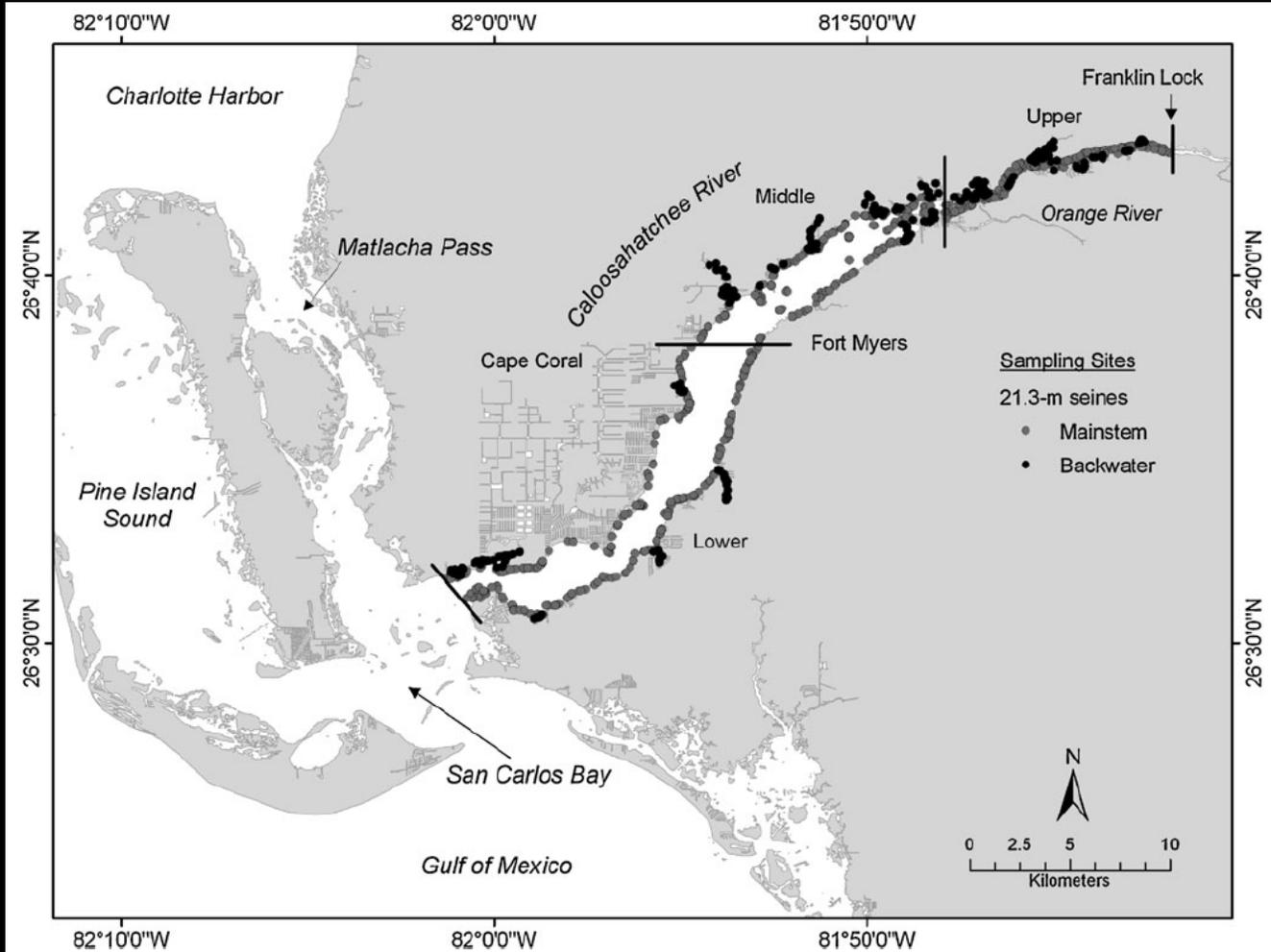
Movement response that favors static habitat (e.g., specific locations)

$R^2 = 0.40$;
60-day lagged flow

Affinity for salinity 18-30



Mainstem vs. Backwater

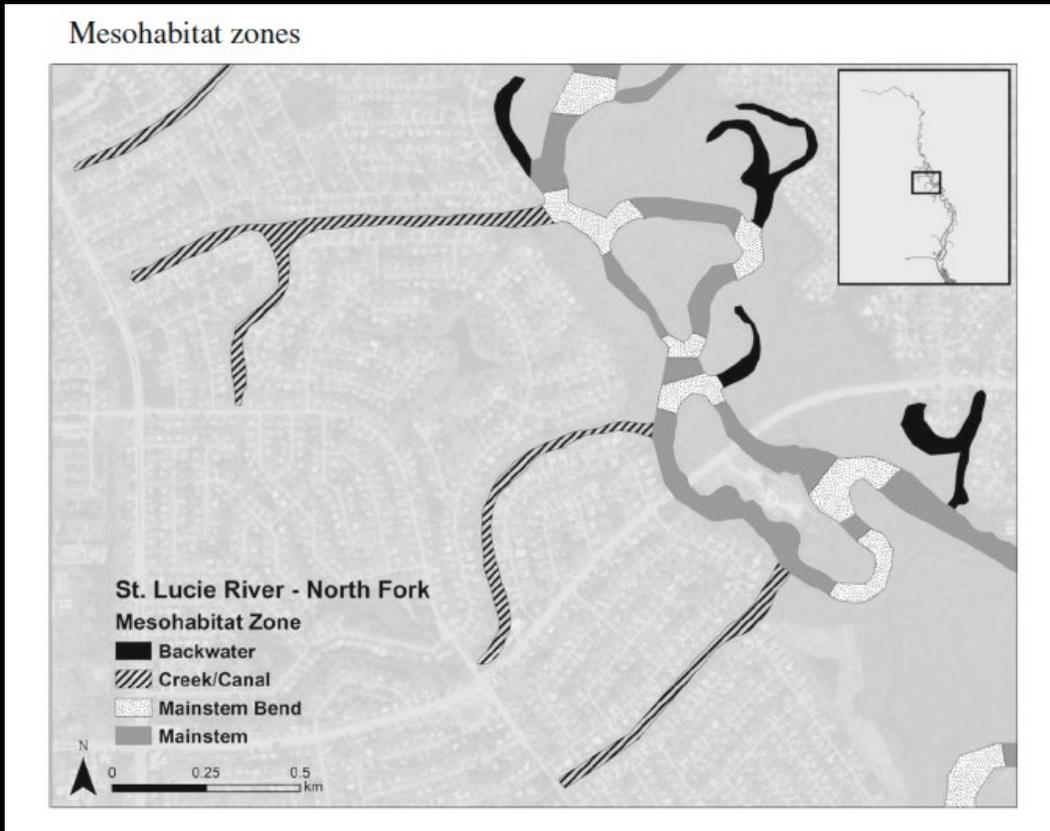


Species more abundant in backwaters
Sailfin molly, rainwater killifish, eastern mosquitofish, **common snook, bluegill, striped mojarra**

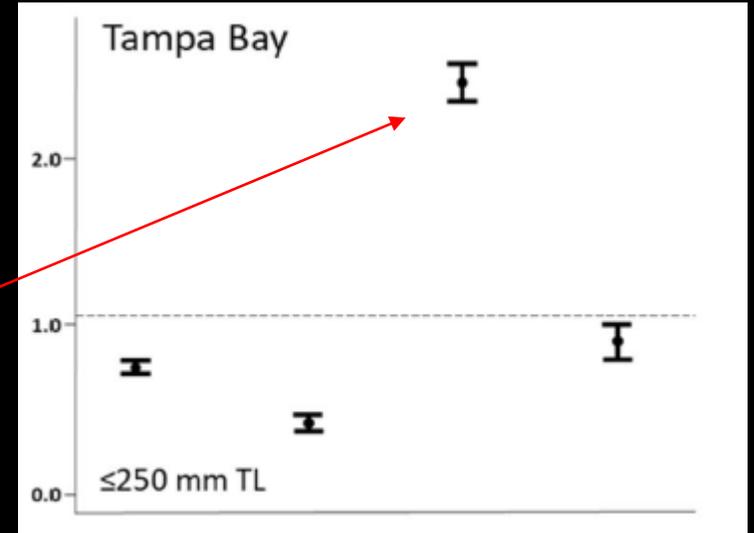
Species more abundant along mainstem
Striped anchovy, spot, Atlantic thread herring, silver jenny, **striped mullet**, menhadens, silver perch

Species showing no difference
Bay anchovy, silversides, tidewater mojarra, **red drum, blue crab**

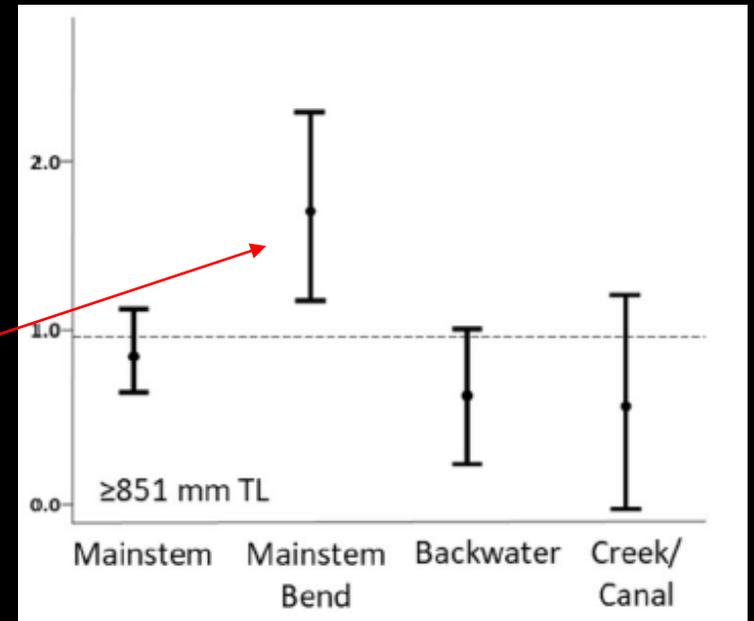
Fish often shift habitat as they grow



Juvenile snook use backwaters

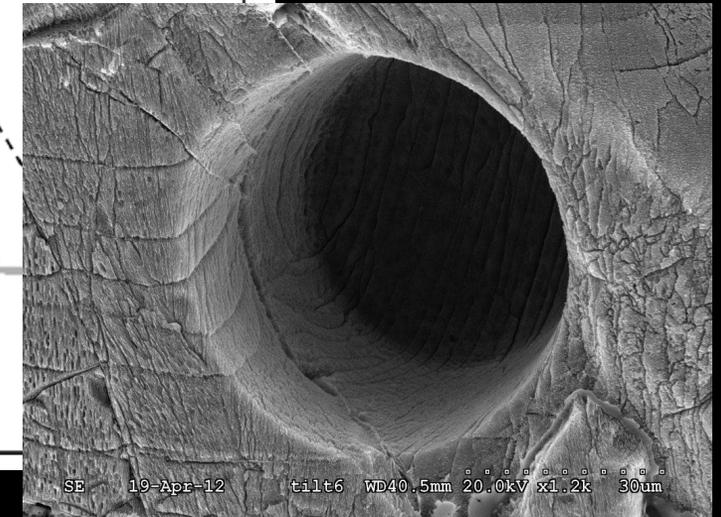
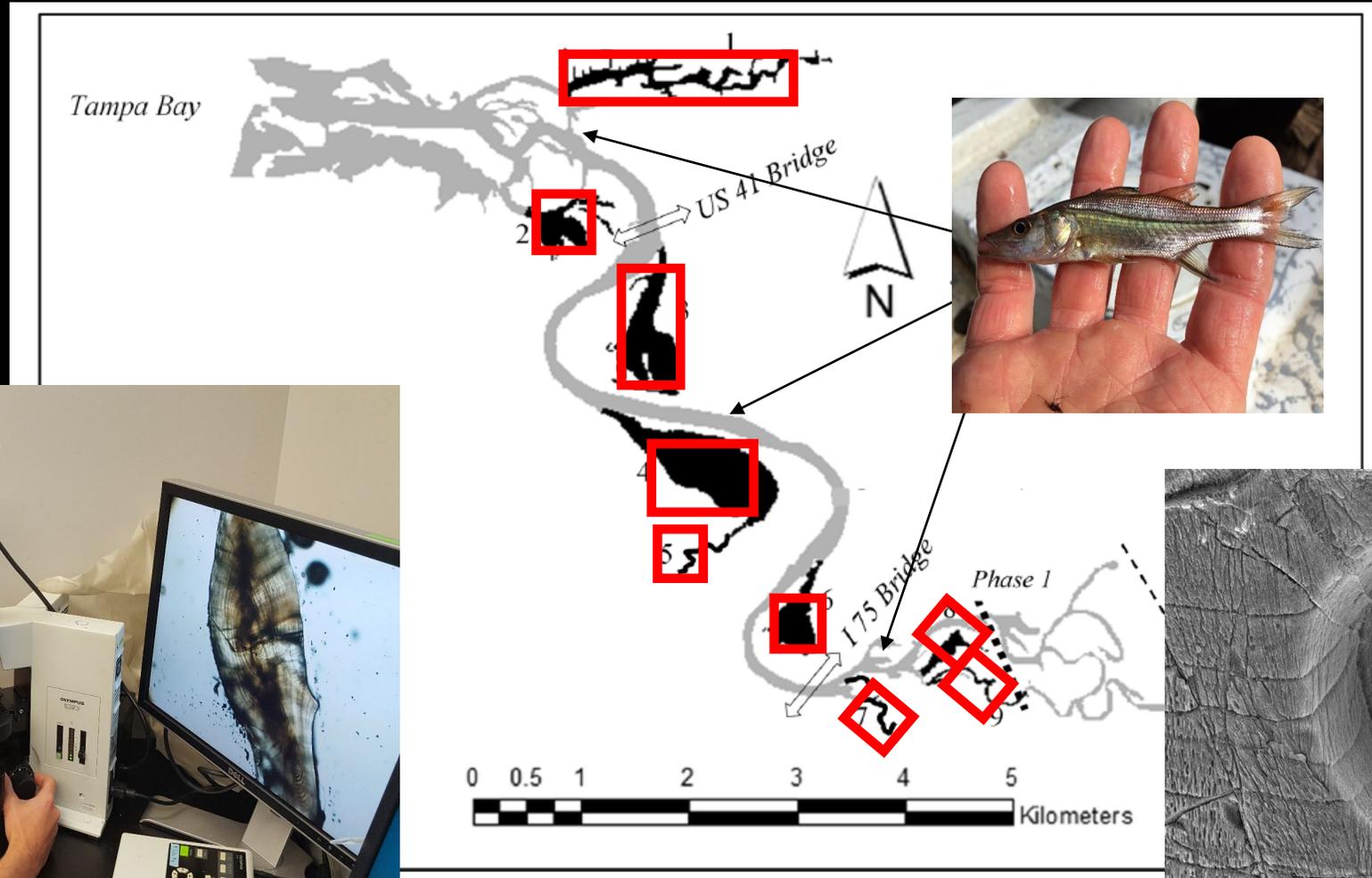


Larger adults use river bends



Trotter, A.A., J.L. Ritch, E.J. Nagid, J.A. Whittington, J. Dutka-Gianelli, and P.W. Stevens. 2021. Using geomorphology to better describe habitat associations of a large-bodied fish, Common Snook *Centropomus undecimalis*, in coastal rivers of Florida. *Estuaries and Coasts* 44: 627-642.

Habitat and contribution to adult population



Ley, J.A., and H.J. Rolls. 2018. Using otolith microchemistry to assess nursery habitat contribution and function at a fine spatial scale. *Marine Ecology Progress Series* 606: 151-173.

Take home messages

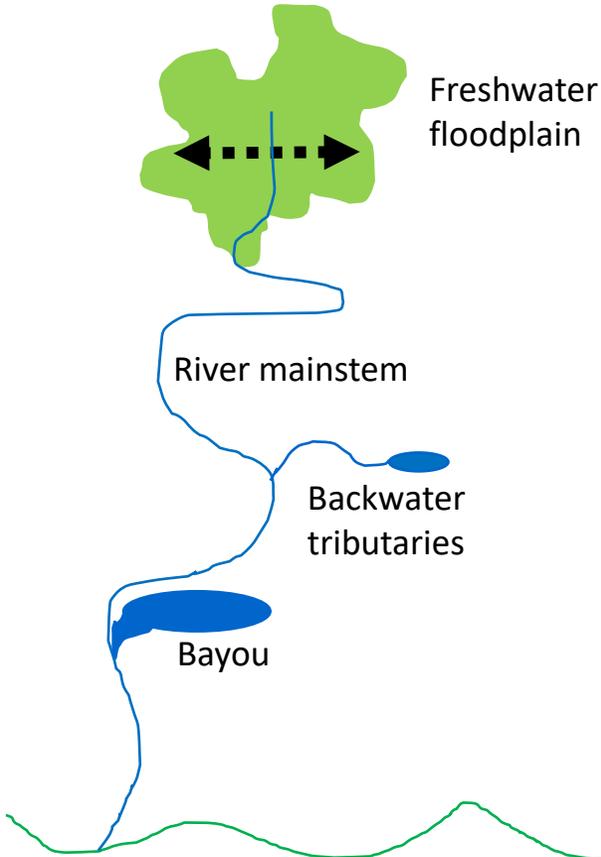
Need to identify the species that tend to use each system

Cross-site comparisons help to understand species plasticity

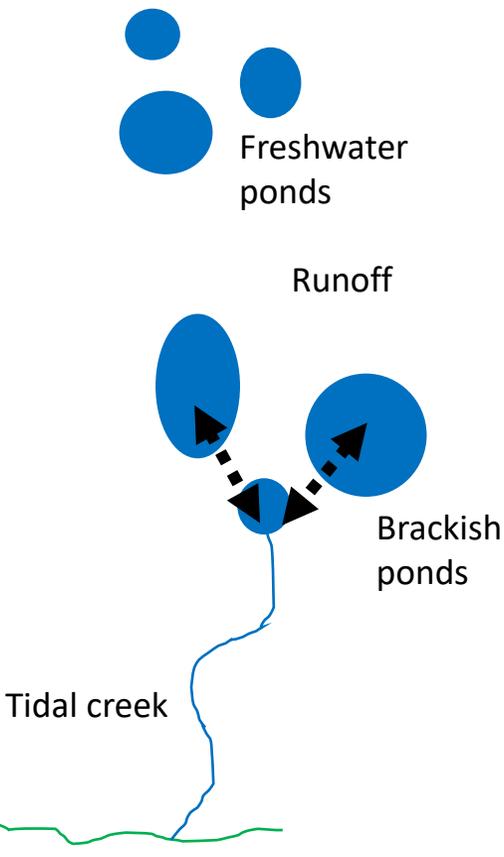
Conservation of habitat equally important as conservation of freshwater inflow

Florida's watersheds

Coastal River

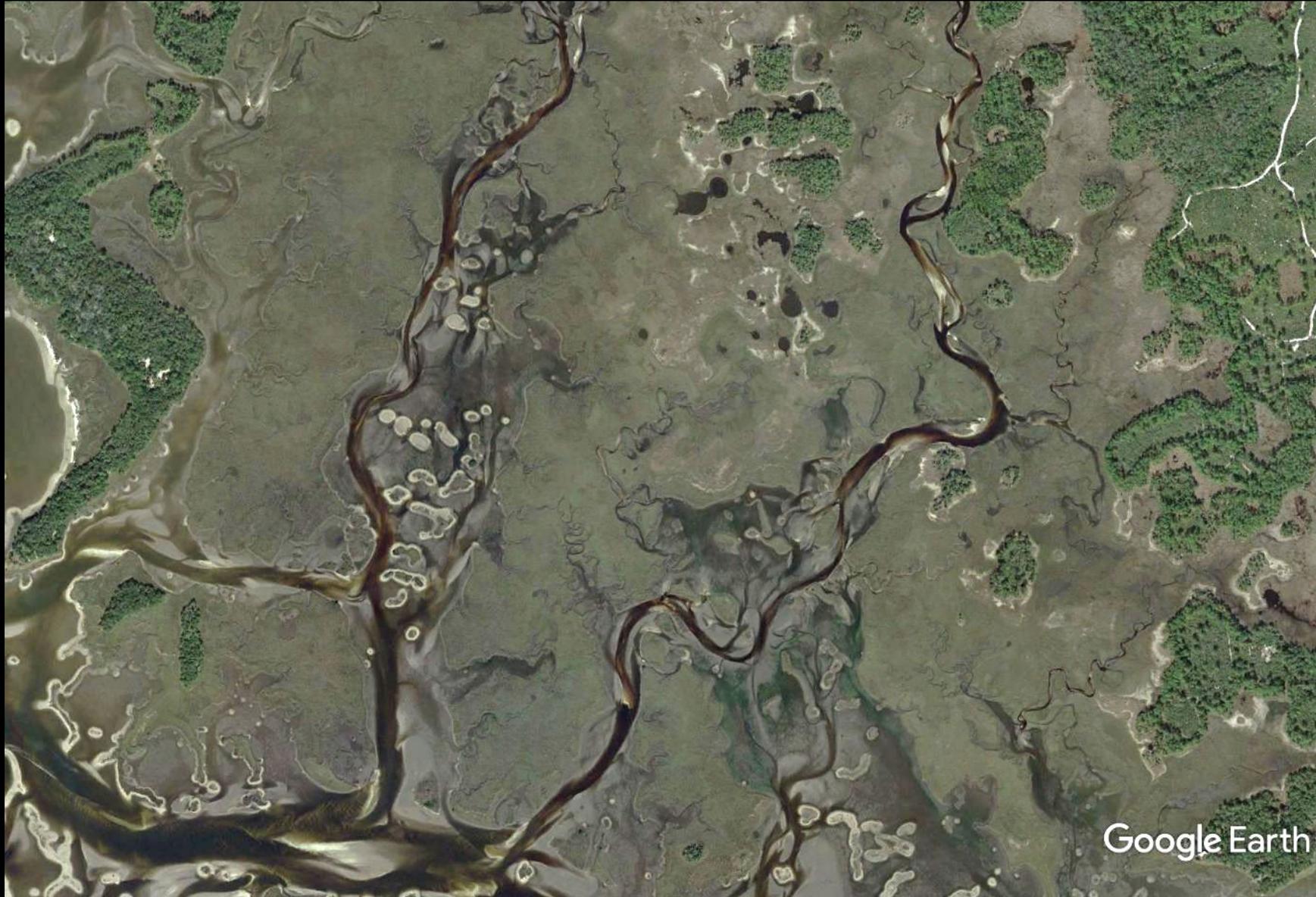


Tidal Creek

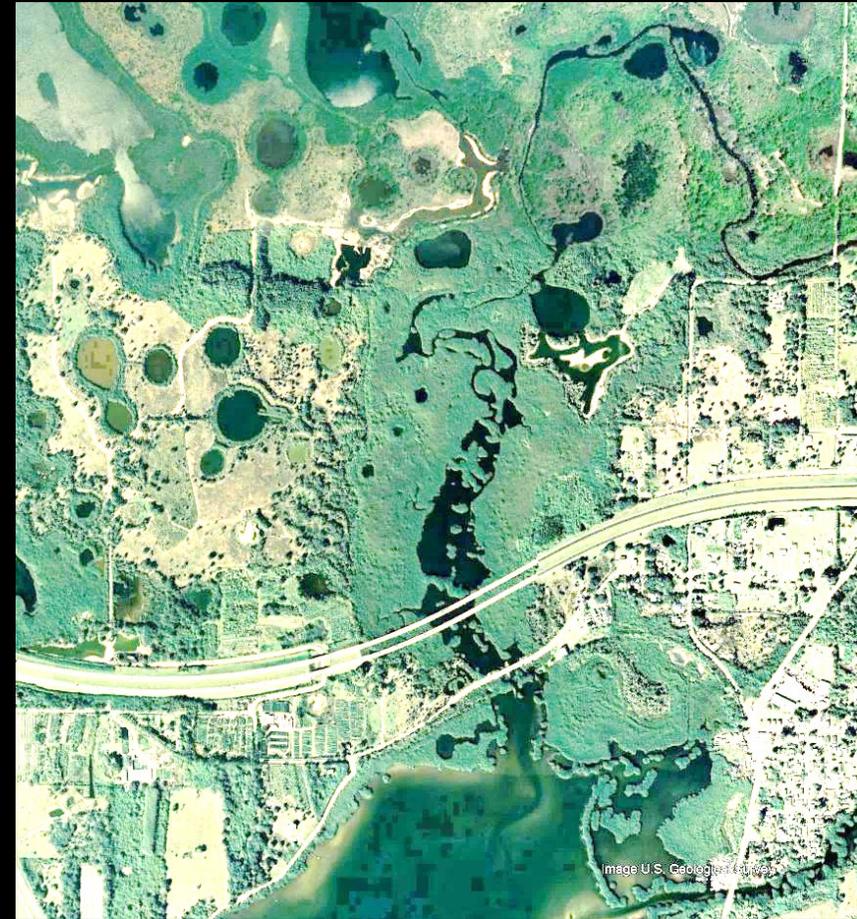
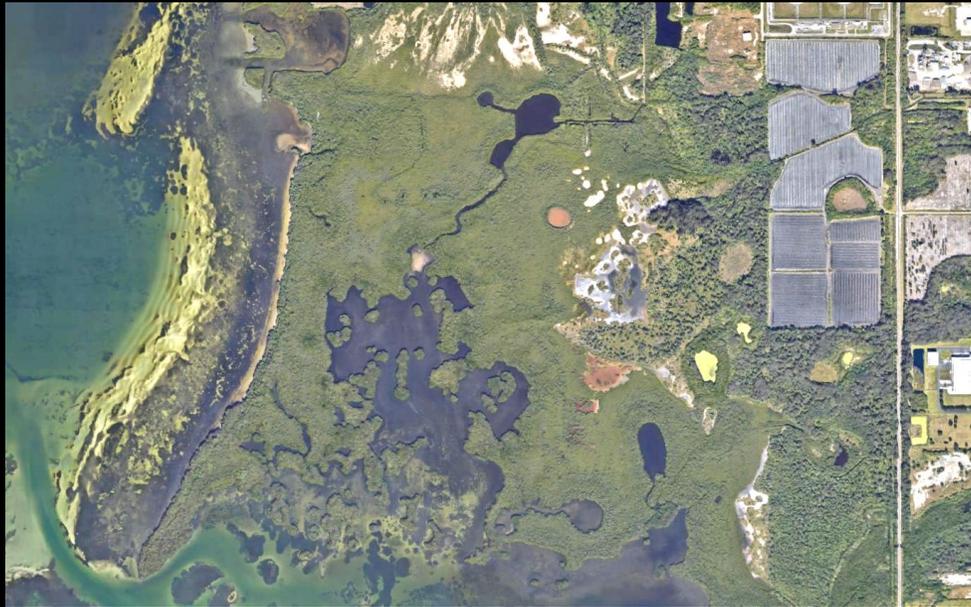


Estuary

Examples: Northern Florida



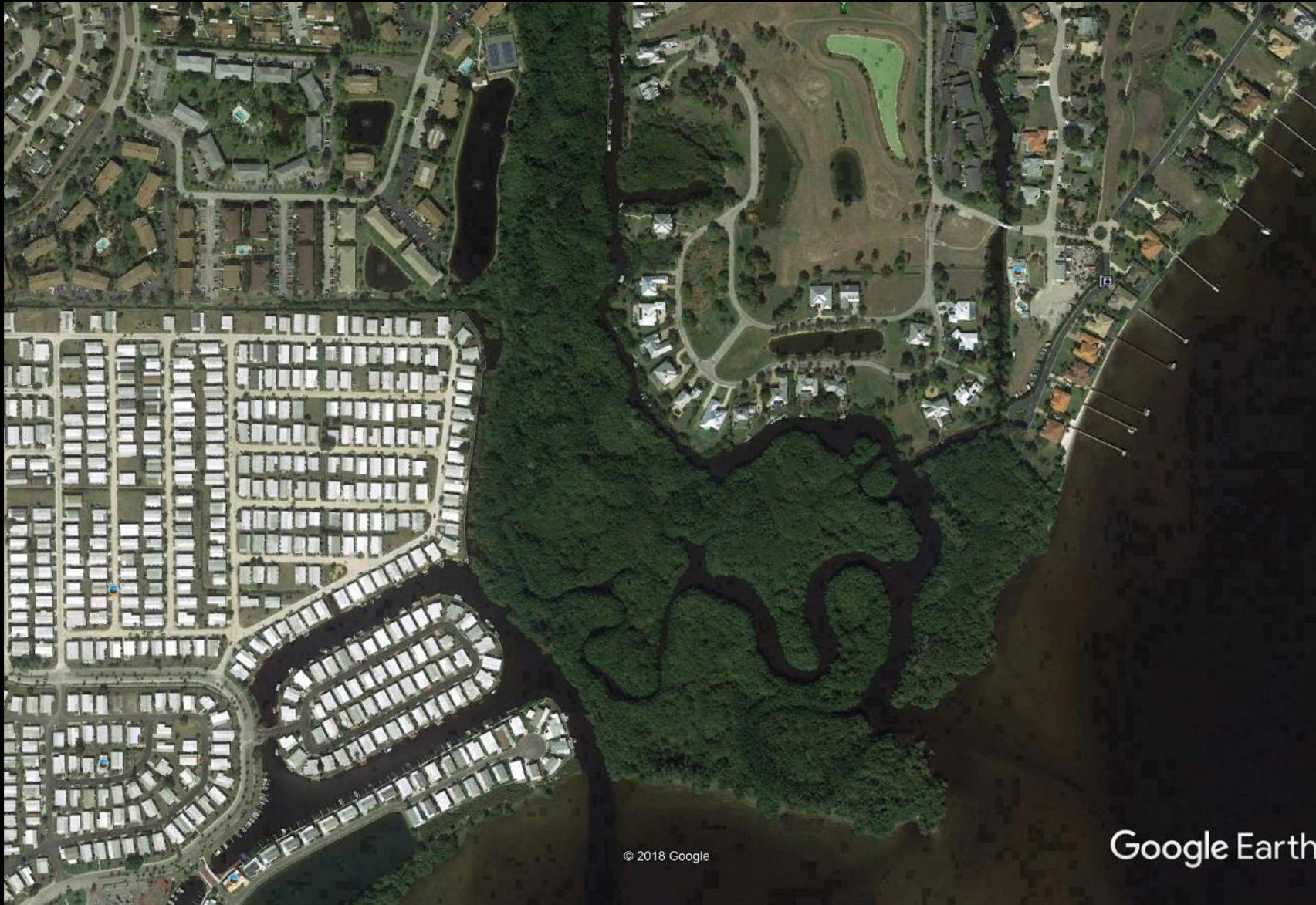
Examples: Tampa Bay



Examples: Charlotte Harbor

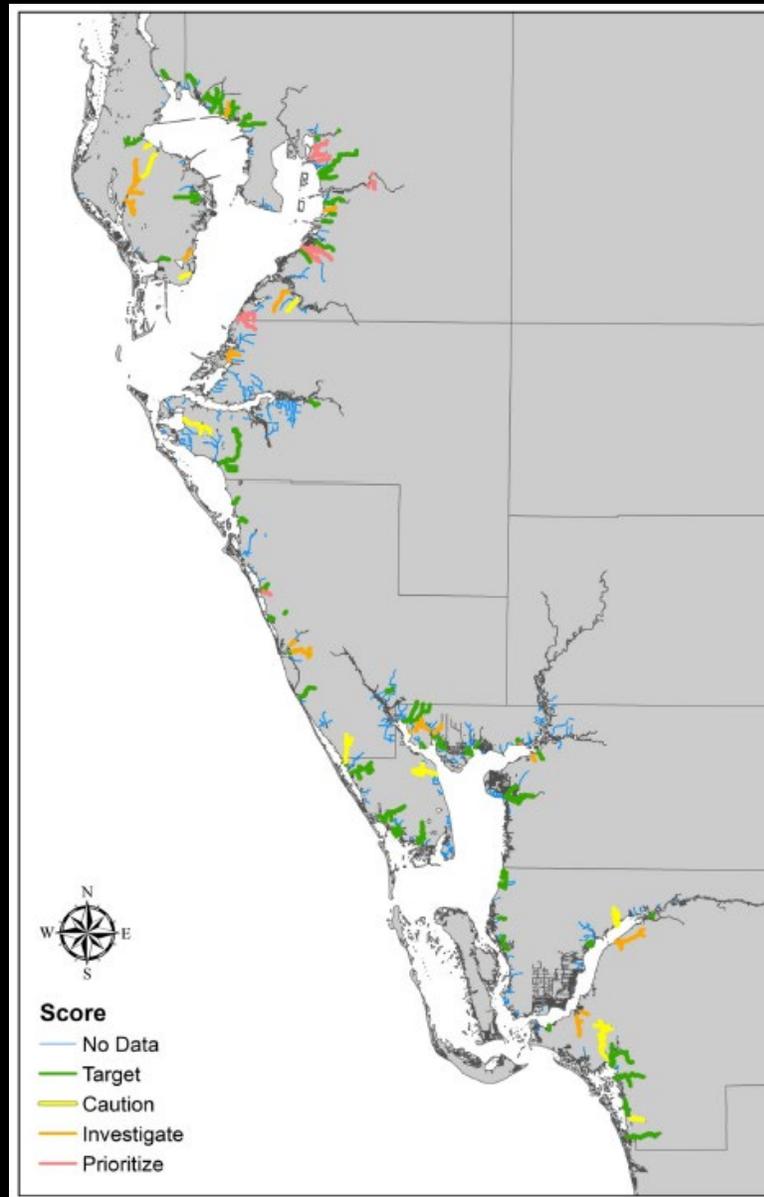
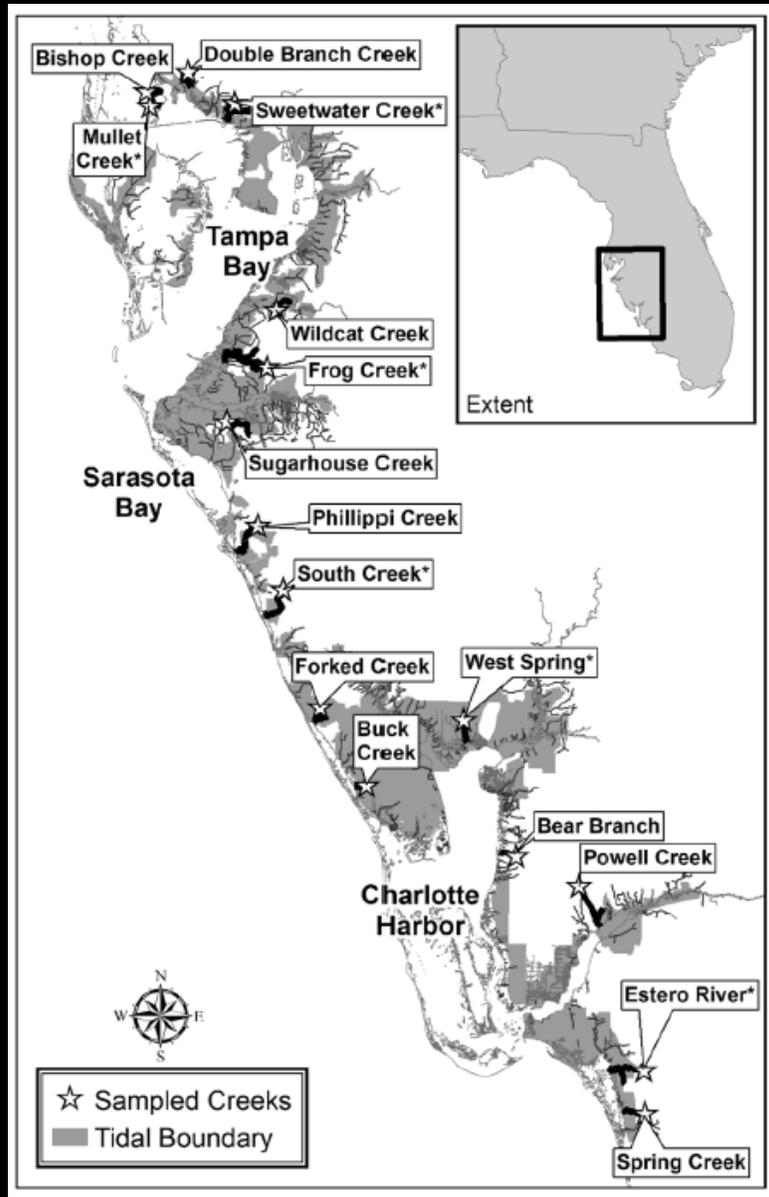


Vulnerable habitat: Tidal creeks and coastal wetlands



Eutrophication evident in tidal creeks - algal blooms

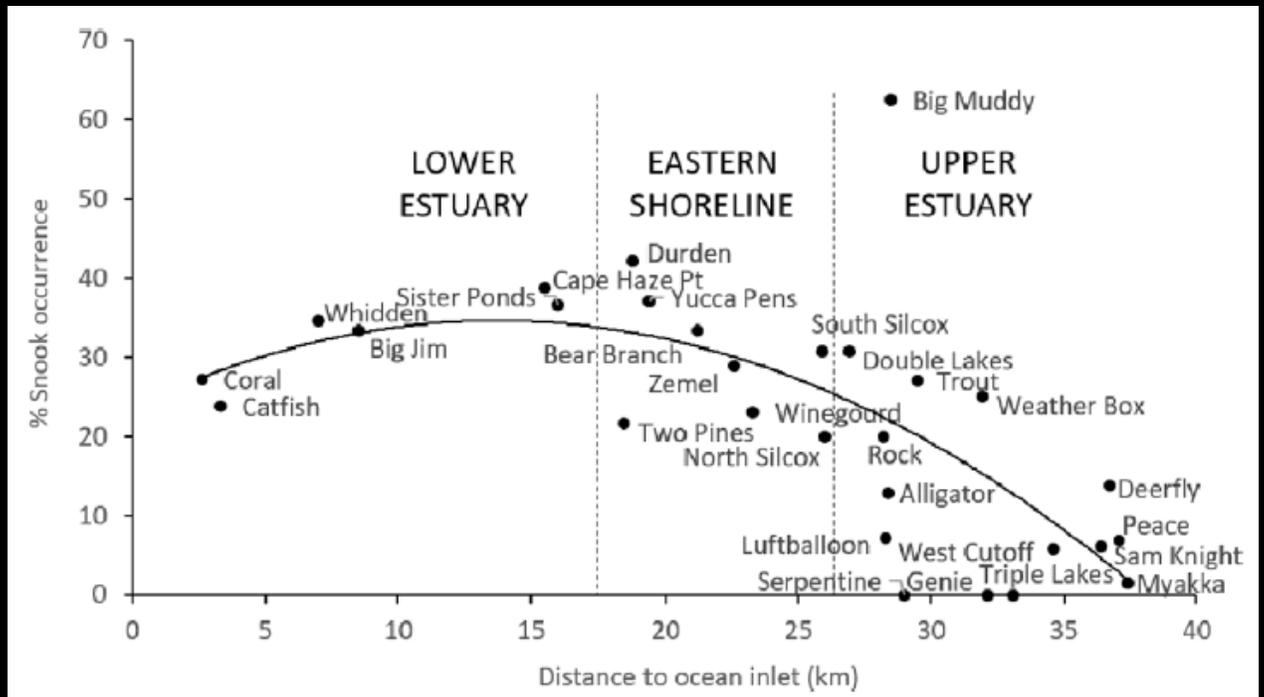




Wessel, M.R., J.R. Leverone, M.W. Beck, E.T. Sherwood, J. Hecker, S. West, A. Janicki. 2022. Developing a water quality assessment framework for Southwest Florida tidal creeks. *Estuaries and Coasts* 45:17-37.

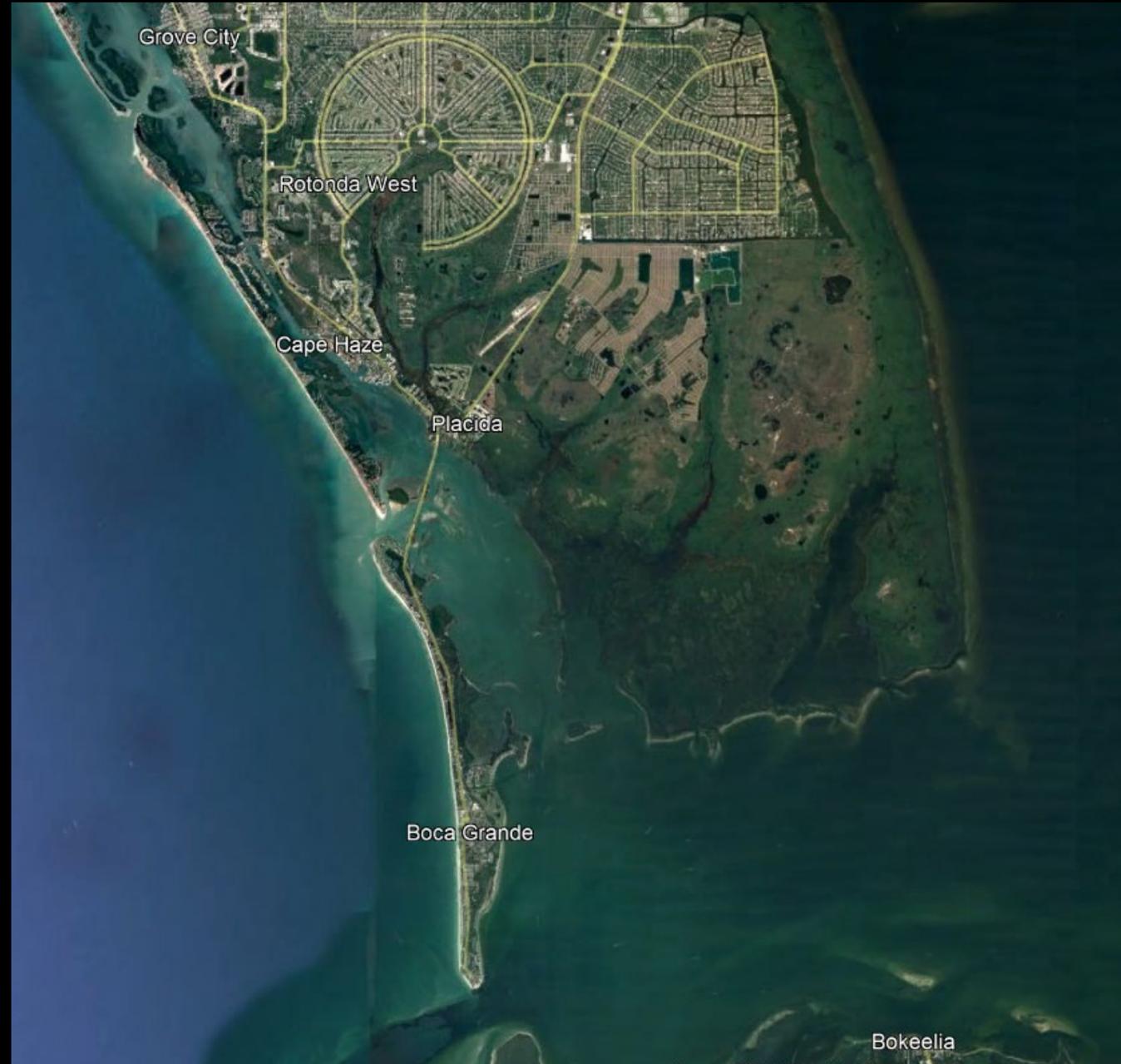
Species that use this habitat type as juveniles





J.K. Wilson, P.W. Stevens, D.A. Blewett, R. Boucek, A.J. Adams. 2022. A new approach to define an economically important fish as an umbrella flagship species to enhance collaborative stakeholder-management agency habitat conservation. *Environmental Biology of Fishes*. <https://doi.org/10.1007/s10641-022-01214-y>

Cape Haze, Charlotte Harbor



Coral Creek restoration dedicated

By STEVE REILLY
STAFF WRITER

ROTONDA—Charlotte County Commission Chairman Ken Doherty appreciates the Southwest Florida Water Management District's restoration of 250 acres along Coral Creek in western Charlotte County.

"The Coral Creek system — like many others in the state — was a victim of the development activities that were allowed prior to the implementation of Florida's environmental permitting rules and regulations in the 1980s," Doherty said at an official dedication of the water district — commonly known as Swiftmud — restoration project Wednesday.

As an engineer who has worked in Florida since the 1970s, Doherty recalled how developers didn't have to store and treat stormwater before it was discharged into natural drainage systems. Unfortunately, he said,

Charlotte Sun
Charlotte County
Daily 46,900
October 23, 2014



PHOTO PROVIDED BY SUE KILLJON

Coral Creek will get a bit more healthy and its water cleaner thanks to a \$1.1 million, 250-acre restoration project off of Rotonda Boulevard South in western Charlotte County. The Southwest Florida Water Management District plans a second-phase project to restore habitats surrounding Coral Creek.

some older developments still discharge heavily polluted water.

Besides removing exotic and other vegetation, the project included restoration of a filtering marsh, creation of wetlands and habitat restoration.

Swiftmud Executive Director Robert Beltran and Swiftmud governing board member Michael Moran described the project as a partnership with the Florida Department of Environmental Protection, Charlotte County, Bonefish

and Tarpon Trust, and others.

"We cannot do this alone," Moran said. "This project is a great example of where we can work together and preserve natural lands for generations to come."

Phase II is currently 30 percent complete in its design. Phase II will include the restoration of 300 acres of freshwater and estuarine wetland enhancement and exotic vegetation removal. A primary focus for Phase II is the creation of, and



SUN PHOTO BY STEVE REILLY

Southwest Florida Water Management District, known as Swiftmud, and other officials celebrate the restoration of 250 acres along Coral Creek. Charlotte County Commission Chairman Ken Doherty, Swiftmud governing board member Michael Moran, Florida Department of Environmental Protection District Director Jon Inglehart, Florida Fish and Wildlife Conservation Commission field laboratory manager Phil Stevens and Swiftmud executive director Robert Beltran plant a slash pine at a dedication of the restoration project Wednesday.

enhancement of, marine habitat for juvenile tarpon and snook.

"(Swiftmud) has allowed us to implement experimental design in the restoration project," said Phil Stevens, manager of the Florida Fish and Wildlife Commission field laboratory for Charlotte Harbor.

He described the project as improving the juvenile tarpon habitat on "relic creeks," half-dug canals. "As a nerdy scientist, this is a very unique opportunity," Stevens quipped. "We will learn a lot about snook and juvenile tarpon habitats."

Swiftmud senior

environmental scientist Stephanie Powers, who earned several kudos for her oversight of the Coral Creek restoration project, is already working with the Lemon Bay Conservancy to improve the juvenile tarpon habitat on Lemon Creek in its Wildlife Preserve.

Ensl: reilly@sun-herald.com

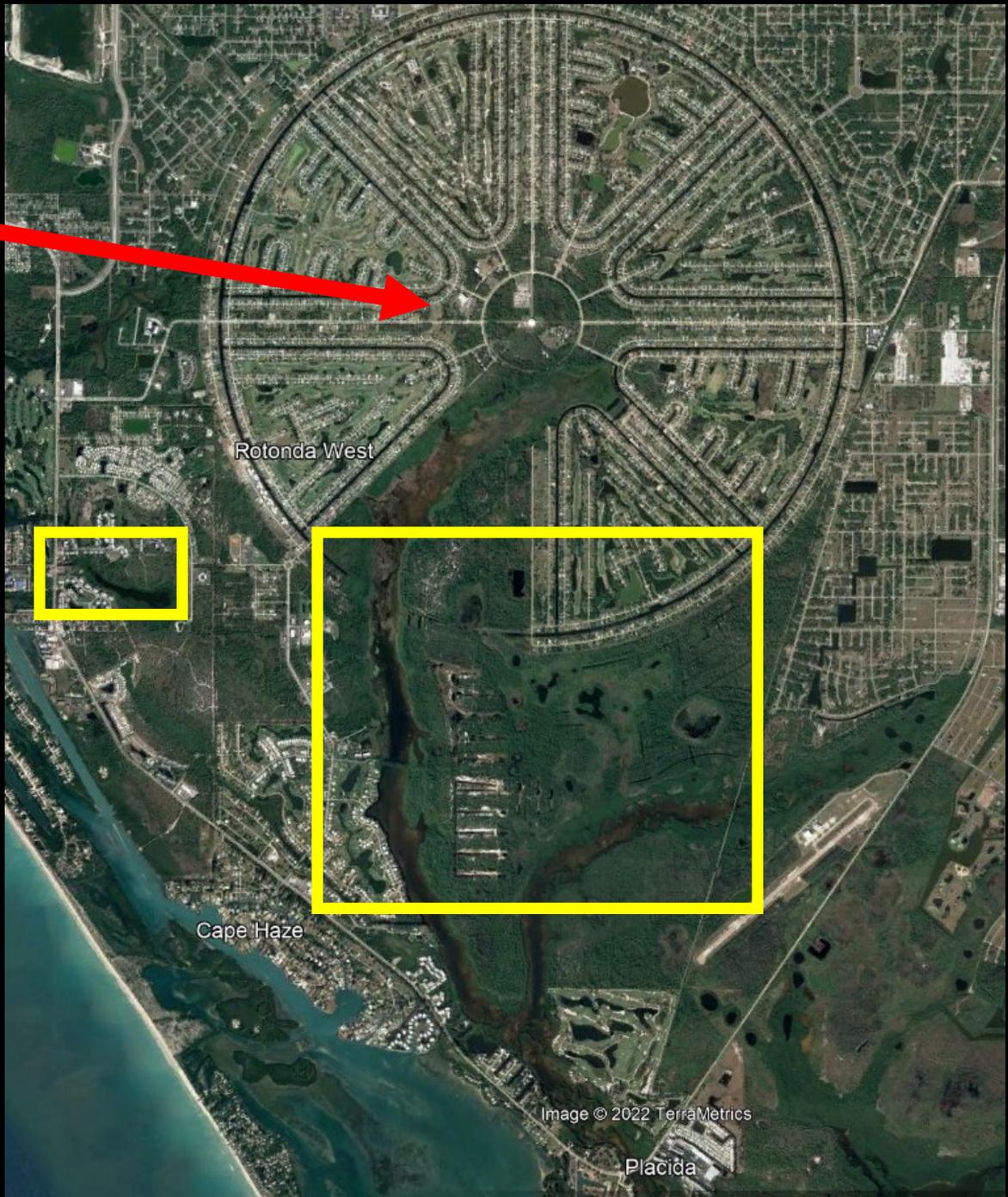
County Commissioner

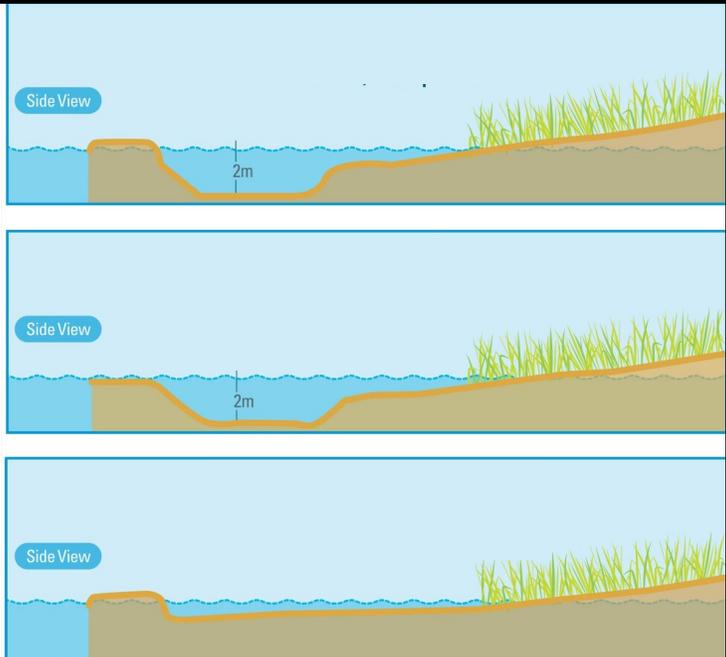
SWFWMD board member

DEP South District Director

SWFWMD executive director

FWC-FWRI





Habitat restoration designs for snook life history requirements

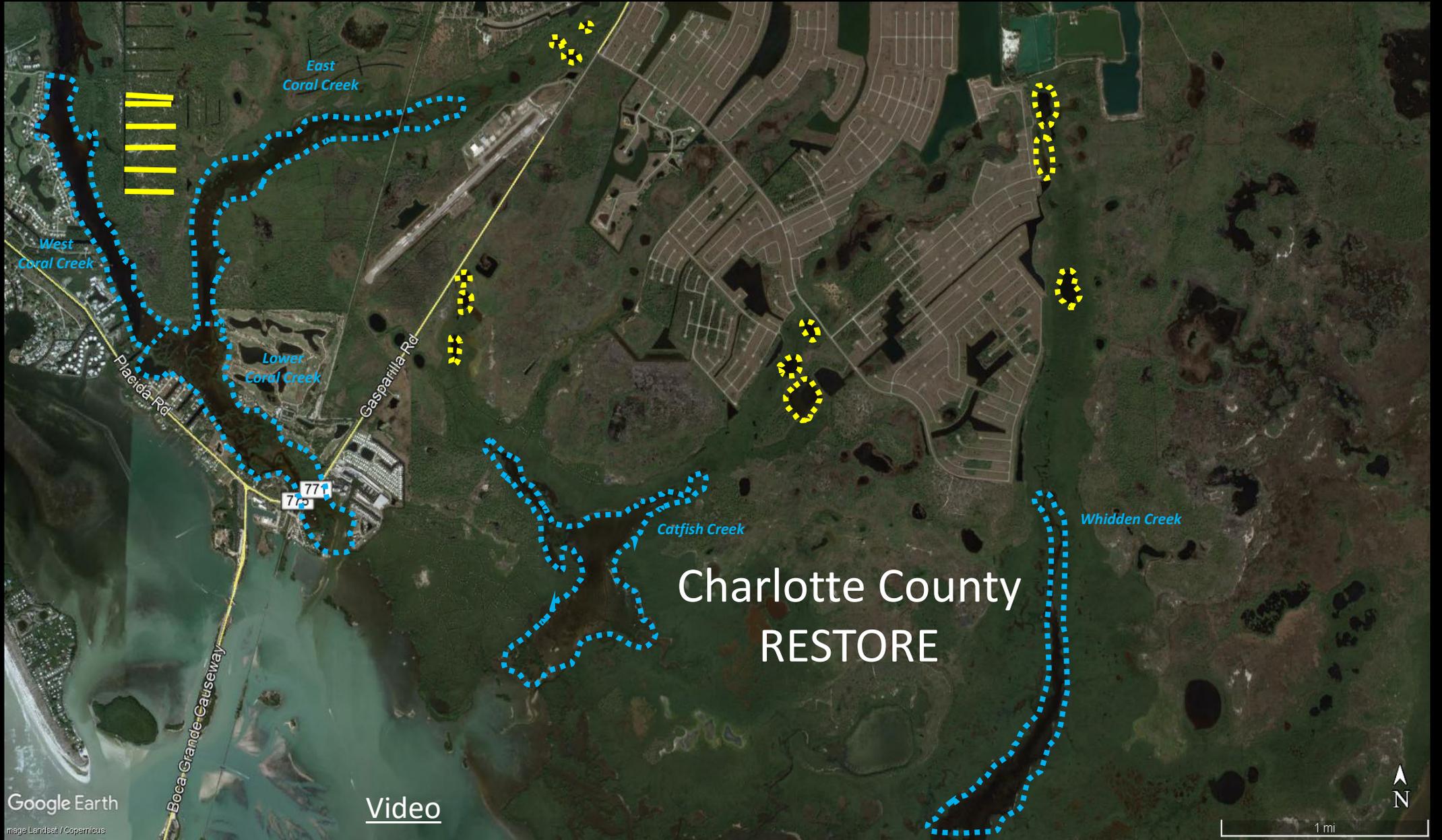


Lemon Creek
Wildflower Preserve

Follow up by Bonefish Tarpon Trust & FWC



Sampling universe - creeks and ponds

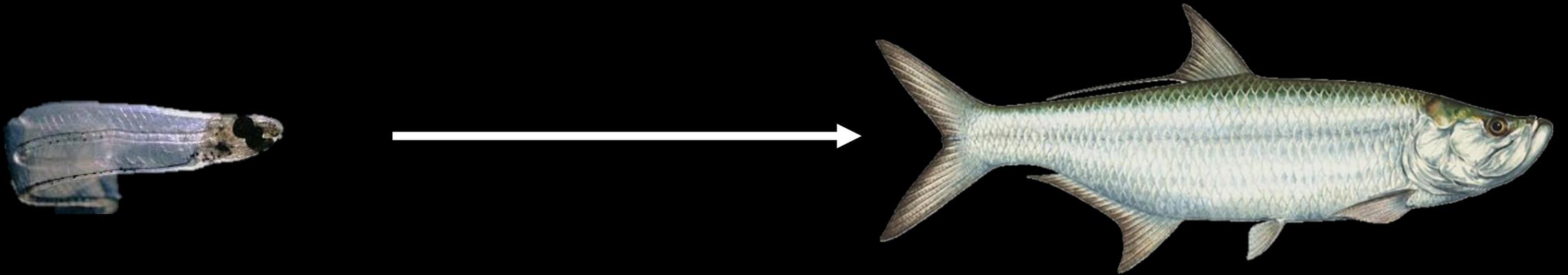


Sampling universe - creeks and ponds



Now that the fish are here.... How exactly do they get out?

Need precise data on elevation and water levels
to understand the connectivity of habitat and
characterize emigration patterns.



Acoustic Tagging

- Tarpon typically ranged 330-600 mm TL.
- Vemco v9 69 kHz acoustic tags.



Matt Bunting UF Thesis



Distal pond

Mesial pond

Proximal pond

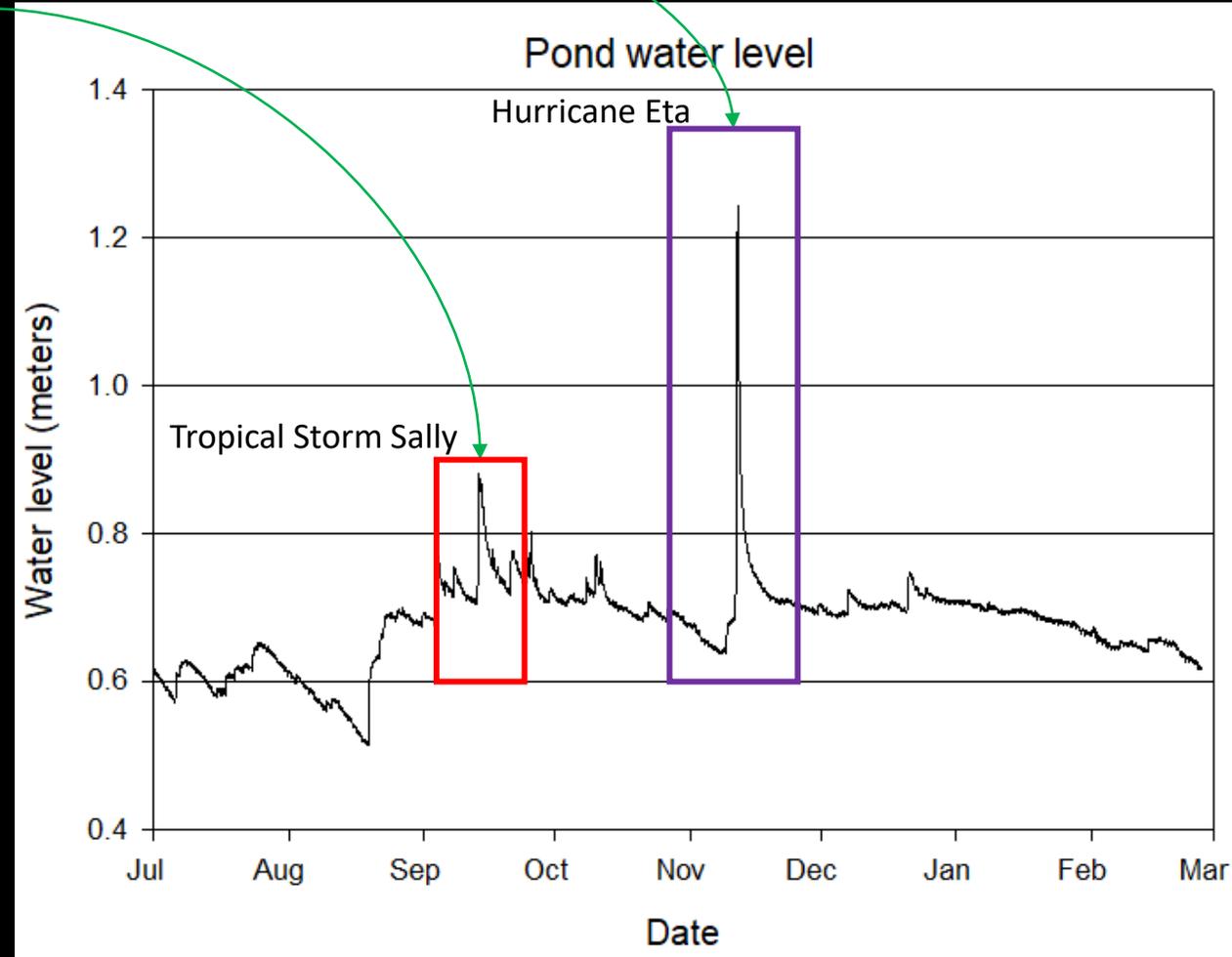
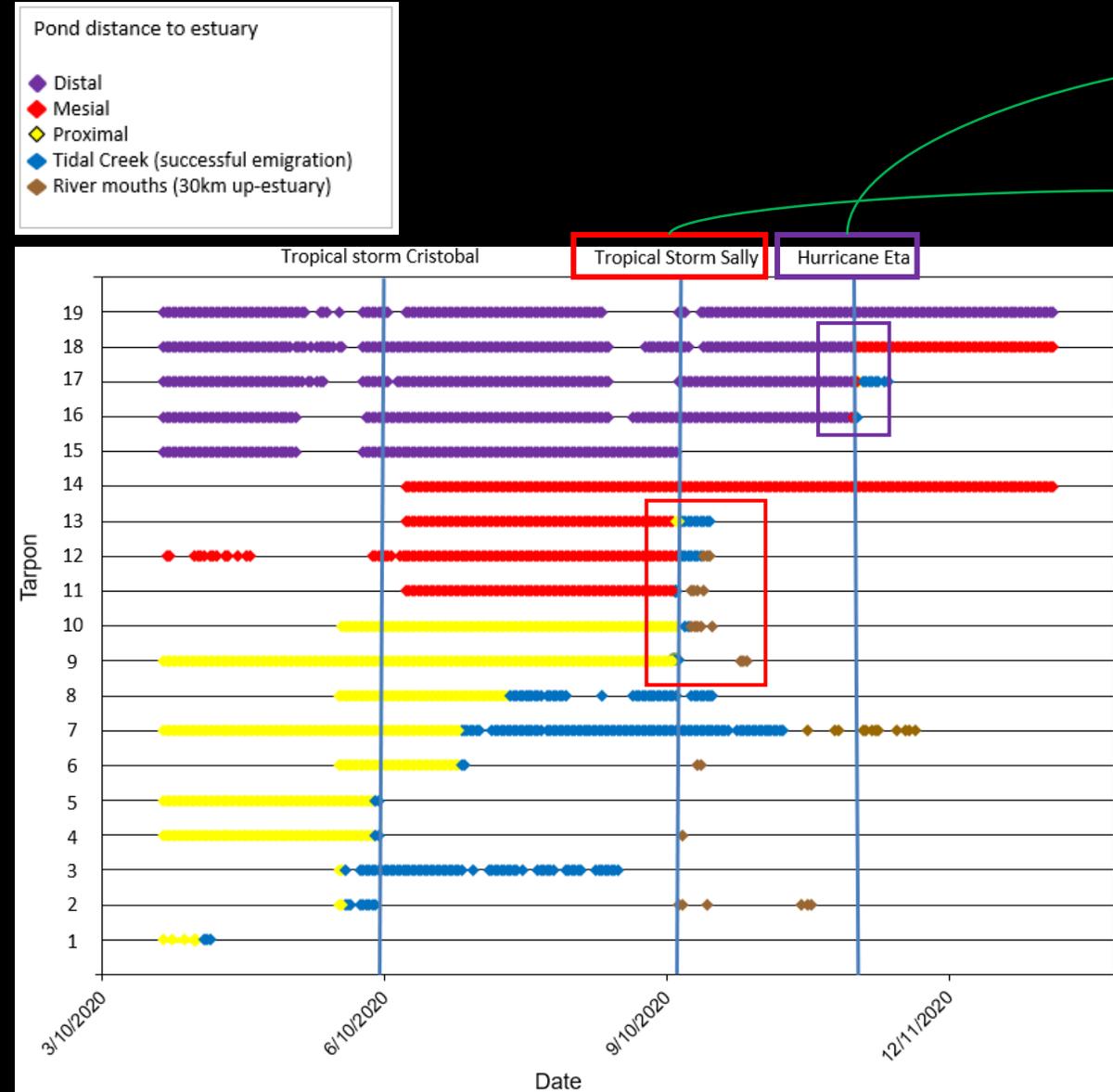
Tidal creek

Estuary



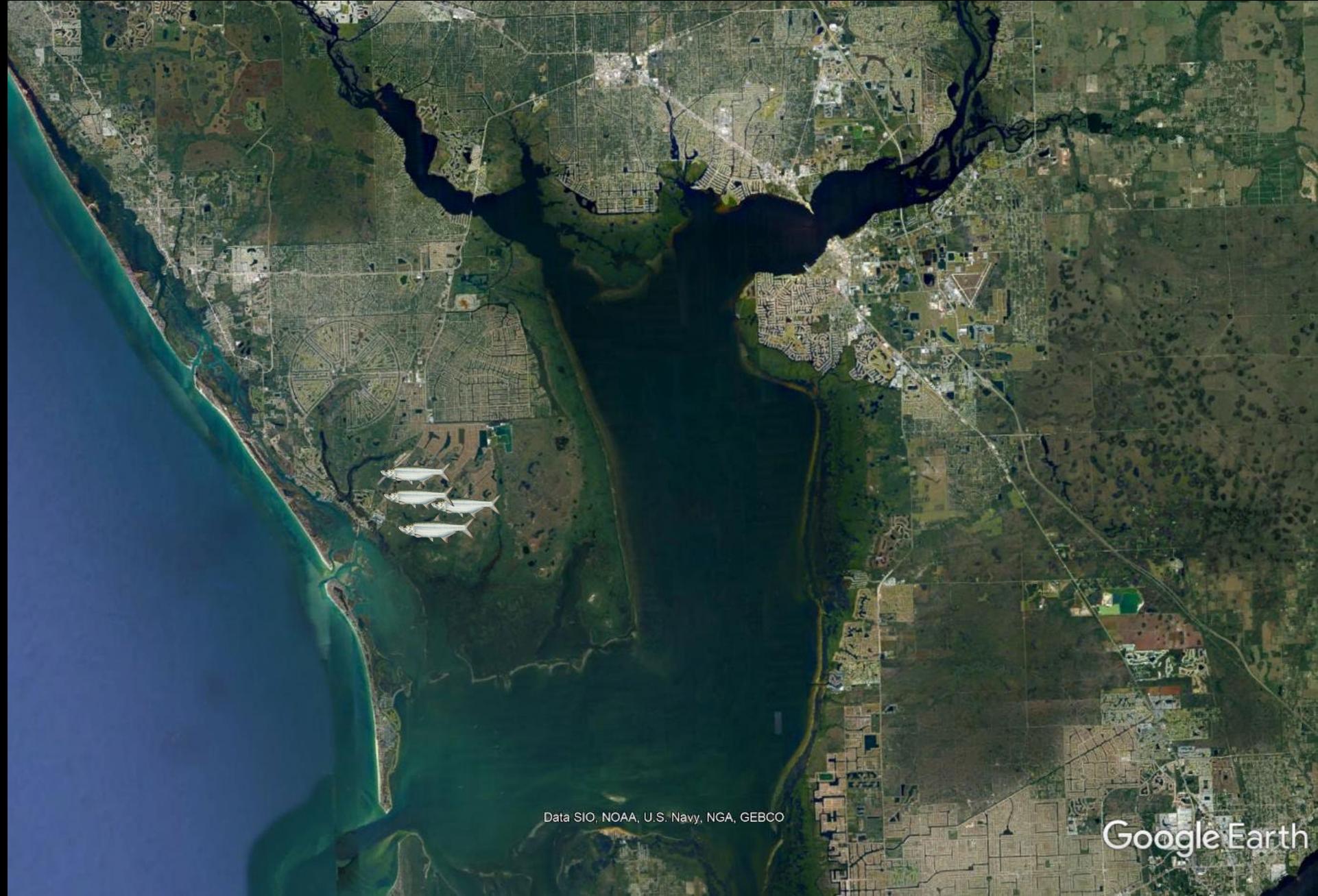
When did the fish emigrate?

2020 water levels that led to emigration of tarpon from mesial and distal pond.



Secondary Nursery?

Following 2019-2020 tagging, about half (9 of 19) of the juvenile tarpon that emigrated were detected in upper estuary; some for up to 3 months



Data SIO, NOAA, U.S. Navy, NGA, GEBCO

Google Earth



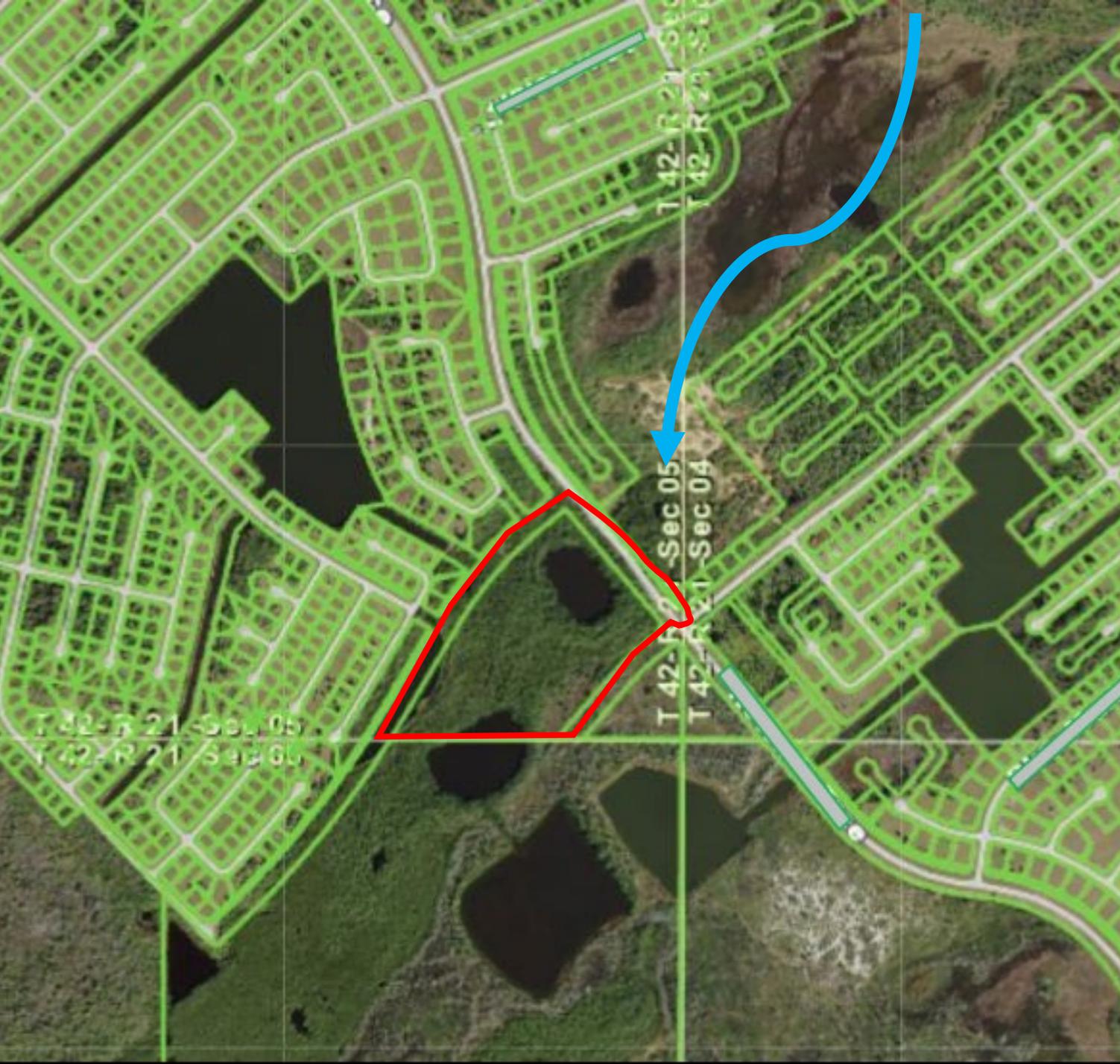
Southwest Florida
Water Management District



NOAA Actionable Science Grant

Co-Production for place-based recreational fishery conservation

Lead PI: Corey Anderson, FWC HSC

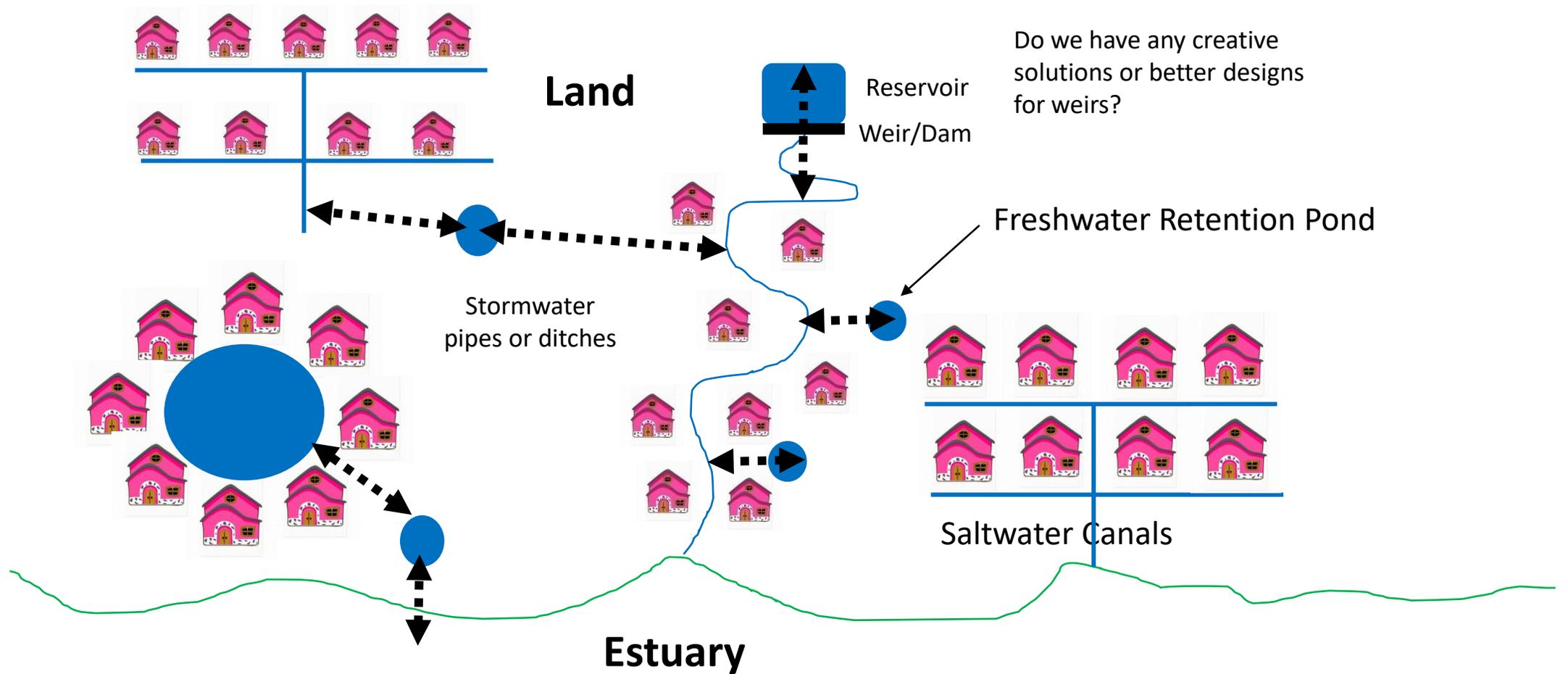


Habitat Conservation

- Nurseries *in* developments
- Land use affects fish habitat - policies set by local governments
 - land zoning
 - future development
 - acquisition
 - stormwater infrastructure
 - natural resource management
- Habitat threats addressed locally (County, Estuary Program, etc.)

Planning for the future...

Nurseries in an urban landscape?



Thank you!

