41st Annual Meeting of the Florida Chapter of the American Fisheries Society

April 20th – 22nd, 2021

Virtual

The Florida Chapter of the American Fisheries Society

Chapter Officers

President: Bob Heagey, FWC
President-Elect: Daniel Nelson, FWC
Past President: Nick Trippel, FWC
Secretary-Treasurer: Chris Anderson, FWC

Major Contributors for our Annual Meeting

Program: Lauren Kleiman, FAU
Webmaster: Chris Anderson, FWC
Newsletter Editor: Scott Bisping, FWC
Raffle Co-Chairs: Amanda Croteau, UWF & Chelsey Crandall, FWC
Student Travel Grants: Chuck Cichra, UF
Roger Rottmann Memorial Scholarships: Chuck Cichra, UF
Awards: Eric Nagid, FWC
Membership Database Manager: Larry Connor, FWC (retired)
Continuing Education: Allison Durland Donahou, Florida Southern
Marketing and Membership: Kerry Flaherty-Walia, FWC
Fisheries Policy: Ed Camp, UF

Special thanks to

Symposium participants & all presenters

All moderators & judges

41st Annual Meeting of the Florida Chapter American Fisheries Society

April 20-22, 2021

Virtual

Tuesday, April 20

8:50am – 9:00am	Welcome
9:00am – 11:40am	Contributed Papers
11:40am – 12:20pm	Lunch Break
12:20pm – 2:20pm	Contributed Papers
2:20pm – 3:00pm	Break
3:00pm – 4:00pm	Poster Session

Wednesday, April 21

8:50am – 9:00am	Opening Remarks
9:00am – 11:40am	Symposium Papers
11:40am – 12:20pm	Lunch Break
12:20pm – 2:20pm	Symposium Papers
2:20pm – 2:45pm	Break
2:45pm – 4:30pm	Business Meeting

Thursday, April 22

8:50am – 9:00am	Opening Remarks
9:00am – 11:40am	Contributed Papers
11:40am – 12:20pm	Lunch Break
12:20pm – 2:00pm	Contributed Papers
2:00pm – 2:10 pm	Closing Remarks

41st Annual Meeting of the Florida Chapter American Fisheries Society

Quick Reference Zoom Meeting Rooms

**Call-in Details Provided in Program following Abstracts*
***Call-in Details Provided on Poster PDFs*

Room Name and Zoom Link (Link Below Room)

Oral Presentations and Business Meeting*
https://ufl.zoom.us/j/94158484201

Below are links to meeting rooms with the following posters (1 poster per room):

Akins et al. – Trophic Transfer of Mercury in Coastal Pelagic Fishes of Southeast Florida**
https://ufl.zoom.us/j/92153902298

Farrell et al. – Environmental DNA Analysis of Forage Fish Diversity and Distribution in the Indian River Lagoon**
https://ufl.zoom.us/j/97533993755

Fitzgerald et al. – Passive Acoustic Monitoring of Artificial Reef Sites Reveals General Boat Traffic Patterns (but not Fishing Effort) in the Northwest Florida Gulf of Mexico**
https://ufl.zoom.us/j/92619339696

Murray et al. – Characterizing the digestive enzyme ontogeny and larval digestive tract morphology of Lachnolaimus maximus to inform nutritional protocols for aquaculture production**
https://ufl.zoom.us/j/94606241200

Trippel et al. – Estimating Boat Electrofishing Catch Rates for Native and Non–Native Freshwater Fish Species in South Florida**
https://ufl.zoom.us/j/98479461427

Savercool et al. – Preliminary trials to assess bycatch reduction potential for deep–set pelagic longline gear in the U.S. Atlantic fishery**
https://ufl.zoom.us/j/95981725789

Willse and Kerstetter – Diet of a dominant mesopredatory fish family (Alepisauridae) in the pelagic U.S. South Atlantic Bight**
https://ufl.zoom.us/j/98069899523

Day-By-Day Agenda – 41st Annual Meeting, 2021 - Florida Chapter American Fisheries Society

Tuesday, April 20th

8:50am – 9:00am **Welcome – Bob Heagey, Chapter President**

Contributed Papers

9:00am – Crandall, C., J. Hazell, M. Hoyer, S. Hervas Avila, N. Morales, and K. Lorenzen. Building a Habitat Management Plan for Lake Istokpoga

9:20am – Lorenzen, K., S. Hervas, C. Crandall, and J. Hazell. Using social science to uncover stories behind conflict: a case study

9:40am – O'Connor, J., C. Anderson, R. Stout, T. Tuten, N. Morales, and R. Paudyal. Who really cares about rare fish conservation? Awareness and attitudes about rare fish and their management in Florida

10:00am – Paudyal, R. COVID-19 effects on recreational fishing in Florida

10:20am – *Chong, L. and E.V. Camp. Review of the socioecological effects of artificial reefs in recreational fisheries

10:40am – Cleary, M. Integrating social science and fisheries management: opportunities for collaboration

11:00am – *Perry, D., C. Crandall, N. Morales, and E.V. Camp. Incorporating Diverse Stakeholder Attitudes and Preferences for Common Fisheries Management Actions

11:20am – Williams, B.J., K.E. Flaherty-Walia, B.L. Barabara, B.L. Winner, T.S. Switzer, S.F. Keenan, and T.C. MacDonald. Using hook and line gear to survey estuarine hard bottom fish communities

11:40pm – Break

Contributed Papers

12:20pm – *Loch, J., G.S. Cook, and L.J. Walters. Restored Coastal Habitat in the Indian River Lagoon Can Reel In Local Juvenile Sportfish Populations

12:40pm – Gorecki, R., M.N. Schrandt, and T.S. Switzer. Multispecies trends in juvenile fish recruitment to nearshore seagrass habitats of the eastern Gulf of Mexico

1:00pm – VanDoornik, T., E. Weather, and M. Schrandt. Spatial patterns of marine debris and relationship with nekton assemblages in Florida's estuarine waters

1:20pm – Gaither, M.R., G. Kumar, and E. Farrell. eDNA: The new frontier in biomonitoring

1:40pm – *Rose, K., L. Humphrey, R. Vollemans, C. Crowley, R. Gandy, and D. Behringer. The impact of trap confinement on the condition of the Florida stone crab *Menippe mercenaria*

2:00pm – Smith, G. Maturation and Fecundity of an Introduced Population of Pike Killifish

2:20pm – Break

3:00pm – 4:00pm **Formal Poster Session**

*Student Presentation, Presenter

Poster Session (3:00pm – 4:00pm)
(In alphabetical order by presenting author)
See quick reference table above or poster PDF for Zoom links

*Akins, E., D.H. Adams, and D.W. Kerstetter. Trophic Transfer of Mercury in Coastal Pelagic Fishes of Southeast Florida

*Farrell, E., G. Kumar, and M. Gaither. Environmental DNA Analysis of Forage Fish Diversity and Distribution in the Indian River Lagoon

Fitzgerald, S., K. Mille, and E. Maksimova. Passive Acoustic Monitoring of Artificial Reef Sites Reveals General Boat Traffic Patterns (but not Fishing Effort) in the Northwest Florida Gulf of Mexico

*Murray, C., S. Hutchins, F. Shopnitz, C. Ohs, J. Patterson, A. Collins, and M.A. DiMaggio. Characterizing the digestive enzyme ontogeny and larval gastrointestinal morphology of *Lachnolaimus maximus* to inform nutritional protocols for aquaculture production

*Savercool, B., S. Wilms, and D.W. Kerstetter. Preliminary trials to assess bycatch reduction potential for deep-set pelagic longline gear in the U.S. Atlantic fishery

Slone, D., P. Schofield, N. Trippel, M. Brown, K. Reaver, C. Anderson, L. Grove, and J. Kline. Estimating boat electrofishing catch rates for native and non-native freshwater fish species in south Florida

*Willse, E. and D.W. Kerstetter. Diet of a Dominant Mesopredatory Fish Family (Alepisauridae) in the Pelagic U.S. South Atlantic Bight

Day-By-Day Agenda - 41st Annual Meeting, 2021 - Florida Chapter American Fisheries Society

Wednesday, April 21st

8:50am – 9:00am **Opening Remarks – Dan Nelson, Chapter President- Elect**

Symposium: Schooling for Successful Science

9:00am – *Hutchins, S.W., L.E. Smith, and M.A. DiMaggio. Improvements to Culture Methods of the Cyclopoid Copepod *Oithona colcarva*

9:20am – *Boldt, N.C., F. Asche, and M.A. DiMaggio. A preliminary regulatory cost assessment of ornamental aquaculture farms in Florida

9:40am – *Murray, C.A., A.L. Wood, T.N. Lipscomb, Q. Tuckett, J. Patterson, and M.A. DiMaggio. Developing larval culture protocols for Blackbanded Sunfish (*Enneacanthus chaetodon*)

10:00am – *O'Neil, K., J. Lemus, and J. Patterson. Developing a robust index to describe ovarian condition in captive adult Red Drum (*Sciaenops ocellatus*)

10:20am – *Oxton, A. and D.C. Behringer. Sublethal Effects of *Microcystis aeruginosa* Toxin Exposure on Juvenile Blue Crabs (*Callinectes sapidus*)

10:40am – Croteau, A.C., H.N. Gancel, J.M. Caffrey, and M.J. Deitch. It takes a watershed to develop an estuary program - developing collaborative estuary programs in Northwest Florida

11:00am – *Gervasi, C.L., J.S. Rehage, R.O. Santos, R.J. Rezek, W.R. James, R.E. Boucek, C. Bradshaw, C. Kavanagh, and J. Osborne. Bottom-Up Conservation: Using Stakeholder Knowledge to Inform Conservation Priorities for an Unregulated and Recreationally Valued Fish Species

11:20am – Carlson, A. Joining the Florida fisheries community: A history and horizon scan

11:40am – Break

Symposium: Schooling for Successful Science

12:20pm – *Glomb, J., R. Lowe III, J. Shelton, and M. Hamel. Assessing Hydrilla Spread and Subsequent Impacts on Sportfish Communities in Lake Sinclair, Georgia

12:40pm – Bunting, M., D. Blewett, P. Stevens, and C. Saari. Navigating the gauntlet - juvenile tarpon emigration from coastal ponds in Southwest Florida

1:00pm – Heagey, B. Evolutionary Tools and Techniques in Fisheries: Balancing 30 years of change within a long-term dataset

1:20pm – *Alvarez, G., D. Gandy, B. Irwin, C. Jennings, and A. Fox. Using Video Surveys to Examine the Effect of Habitat on Gag Occurrence

1:40pm – Bonvechio, T. and K. Bonvechio. Proposed Standard Weight (W_s) Equation and Standard Length Categories for Lake Chubsucker *Erimyzon sucetta*

2:00pm – Nagid, E. and L. Ortiz. Habitat Suitability Indices for Freshwater Organisms in Support of Minimum Flows and Levels Rule Development

2:20pm – Break

2:45pm – 4:30pm **Chapter Business Meeting & Awards** – everyone please attend!
Student Awards (*Travel and Roger Rottmann Scholarships*)
Professional Awards (*Rich Cailteux and Outstanding Achievement)*
Chapter Elections

*Student Presentation, Presenter

Day-By-Day Agenda - 41st Annual Meeting, 2021 - Florida Chapter American Fisheries Society

Thursday, April 22st

8:50am – 9:00am **Opening Remarks – Dan Nelson, Chapter President**

Contributed Papers

9:00am – Hyle, R. and A. Bernhardt. Is There a Link Between Turbidity and Exotic Fish in the Upper St. Johns River Basin?

9:20am – Tuckett, Q.M., K.N. Ressel, J.L. Ritch, K.M. Lawson, and J.E. Hill. Domestication and feralization influence the distribution and phenotypes of escaped ornamental fish

9:40am – Garnett, M. and R. Stout. Ten Years in Review: Out of Season Spawning Technique of Florida Largemouth Bass

10:00am – Henry, R. and A. Strickland. Shoal Bass of the Chipola River and Impacts from Hurricane Michael

10:20am – *Yeager, J.W., T.F. Bonvechio, and M.J. Hamel. Suwannee Bass Movement and Life-History in the Withlacoochee River, Georgia

10:40am – Grey, R., R. Hyle, B. Fontaine, A. Bernhardt, and C. Hanlon. Kissimmee River Fish Study - Largemouth Bass Telemetry

11:00am – *Dluzniewski, T., M.S. Allen, E.R. Johnson, and A.P. Stanfill. Investigating Drivers of Seasonal Shifts in Fish Abundance in the Homosassa River System

11:20am – Zappulla, S., and A. Dutterer. Special Ops Fishing: Creating a High-demand, Limited-access Trophy Bass Fishery

11:40pm – Break

Contributed Papers

12:20pm – Vecchio, J., D. Lazarre, and B. Sauls. Increasing descender device usage may reduce recreational Red Snapper discard mortality

12:40pm – *Thurman, M.A., N.J. Haag, K.M. WIlson, and J.M. Shenker. Olfactory discrimination in juvenile bonefish (*Albula goreensis*) in response to food, predator, and habitat cues

1:00pm – Camp, E.V., T. MacDonald, Z. Siders, and K. Lorenzen. Density dependent survival in recruitment compensation - is it real?

1:20pm – *Kleiman, L., J. Young, and J. Baldwin. Environmental Influences on Directed Snook Movement During High Discharges

1:40pm – *Stang, S., A. Strickland, and M. Allen. Investigating the potential effects that climate change, fishing mortality, or a combination of both are having on a unique gulf strain of Striped Bass *Morone saxalitis*

2:00pm – 2:10pm **Closing Remarks – Dan Nelson**

*Student Presentation, Presenter

Abstracts for the 41st Annual Meeting of the

Florida Chapter of the American Fisheries Society

Alphabetical by Presenter

***Akins, E.[1], D.H. Adams[2], and D.W. Kerstetter[1]**
Poster Presentation
[1]Halmos College of Arts and Sciences, Nova Southeastern University
[2]Fish and Wildlife Research Institute, Florida Fish and Wildlife Conservation Commission
ea927@mynsu.nova.edu

Trophic Transfer of Mercury in Coastal Pelagic Fishes of Southeast Florida

Coastal pelagic fishes such as king mackerel and blackfin tuna are recreationally and commercially important, yet many of these species are known to contain elevated concentrations of mercury in their tissues. Understanding temporal changes or stability of mercury in marine fishes is increasingly relevant with concurrent shifts in anthropogenic releases of mercury in North America. It is particularly important to understand influences of trophic position on mercury concentrations as these coastal pelagic fishes play important roles in not only the marine environment but also the fishing industry. Muscle samples of 14 coastal pelagic fish species were collected from recreational and charter fishers in 2010. A 2004 study provided total mercury data on three tuna species included in this study, and the mean concentrations of tuna of similar sizes were either similar (e.g. little tunny), or reduced (e.g. yellowfin tuna), compared to our 2010 results. This comparison may show stability or reduction in mercury levels across a changing regulatory environment. By using muscle stable isotope ratios δ15N and δ13C, the trophic level and carbon sources can be determined for these 14 species and, when combined with mercury data, relationships can be analyzed between mercury and trophic level. Analyses of all species found a significant positive correlation between mercury concentration and δ15N and a significant positive correlation between fork length and δ15N, which both indicate that mercury is biomagnifying. Two distinct clusters were formed among 8 tested species, selected to preserve statistical integrity, based on a hierarchical cluster relationship analyses between δ15N, δ13C, and mercury. The groupings included 4 highly migratory, more pelagic species in the first category and 4 less migratory species in the second. This clustering may indicate that variation in diet, particularly away from coastal areas, may influence mercury concentrations.

***Alvarez, G.[1], D. Gandy[2], B. Irwin[3], C. Jennings[3], and A. Fox[1]**
Symposium Paper
[1] UGA Warnell School of Forestry and Natural Resources, GA
[2] Florida Fish and Wildlife Research Institute, FL
[3] United States Geological Survey, Georgia Cooperative Fish & Wildlife Research Unit, GA
Gina.Alexandra.Alvarez@gmail.com

Using Video Surveys to Examine the Effect of Habitat on Gag Occurrence

The economically important Gag (*Mycteroperca microlepis*) fishery was declared overfished in the Gulf of Mexico in 2009. Although Gag are no longer overfished in the Gulf of Mexico,

fisheries managers are concerned that stocks may not be recovering. Limited information on life history and habitat use contributes uncertainty about the long-term effectiveness of current management strategies in aiding recovery. Our objective was to identify habitat characteristics important to Gag, and their relationship to Gag occurrence throughout the West Florida Shelf (WFS). We obtained data on Gag presence and habitat from three separate fisheries-independent video surveys that occurred in the WFS from 2010-2017. Surveys were conducted by the National Atmospheric and Oceanic Administration (NOAA) Panama City, FL Office, the NOAA Southeast Area Monitoring and Assessment Program, and the Florida Fish and Wildlife Research Institute. For each survey, we created a suite of candidate mixed effects logistic regression models which included variables previously identified in the literature to be important for Gag, as well as a model that selected variables using backward stepwise selection. We then used Akaike's Information Criteria to determine the best fitting models for each survey. Our results indicate that an increase in rock, relief, latitude, depth, and seawhip had an overall positive relationship with Gag occurrence throughout the WFS. These findings provide new insight into the relationship between Gag and their habitat across the entire WFS. With this information, managers may be able to better identify and protect areas that contain favorable habitats for Gag.

***Boldt, N.C.[1], Asche, F.[2], and M.A. DiMaggio[1]**

Symposium Paper

[1]Tropical Aquaculture Laboratory, Program in Fisheries and Aquatic Sciences, School of Forest Resources and Conservation, Institute of Food and Agriculture Science, University of Florida, Ruskin, FL.

[2]Fisheries and Aquatic Sciences, School of Forest Resources and Conservation, Frazier-Rogers Hall, Institute of Sustainable Food Systems, University of Florida, Gainesville, FL.

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A preliminary regulatory cost assessment of ornamental aquaculture farms in Florida

The ornamental aquaculture trade is a diverse sector of aquaculture and faces unique challenges which other commodity groups do not have to contend with. The United States is the world leader in imported ornamental species with a total value of $65.3 million in 2018. Conversely, the U.S. ranked 9th in terms of exported ornamental fish at a value of $11.4 million in 2018. Florida led the country in production of ornamental fishes in 2018, with farm gates sales of $28.7 million and the state housed 42% of all ornamental farms operating in the United States. Regulatory assessment studies with the sportfish/baitfish and salmonid industries have been completed to quantify impacts associated with compliance and identify opportunities to streamline regulations. The goal of this research was to conduct a similar assessment for the ornamental aquaculture industry. Preliminary results from an industry-wide census have shown that there is a high regulatory burden on ornamental farmers for some regulatory categories. These include the control of fish-eating predators such as birds, turtles, and otters, which have been shown to cause substantial losses of marketable fish with little legal recourse available to farmers. Additionally, drugs and chemicals which would be beneficial to production, such as methyltestosterone, are banned for use in ornamental aquaculture in the United States. Many of these prohibited chemicals, however, are available to foreign competitors, improving production efficiency and their ability to compete in the global market. The inability of US ornamental farmers to raise species that have been restricted for culture at the national and

state level has also negatively impacted the growth of domestic ornamental aquaculture. Additional data analysis will help to better characterize the impact of regulatory compliance on an industry-wide scale.

Bonvechio, T.[1], and K.I. Bonvechio[2]
Contributed Paper
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[2]Florida Fish and Wildlife Conservation Commission, Eustis Fisheries Research Laboratory, 601 W. Woodward Ave., Eustis, FL 32726
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Proposed Standard Weight (W_s) Equation and Standard Length Categories for Lake Chubsucker *Erimyzon sucetta*

Standard weight equations have been proposed for a variety of fishes including many non-game species. Here, we developed standard weight (W_s) equations for Lake Chubsucker *Erimyzon succetta* using the traditional regression-line-percentile (RLP) technique and the newer empirical-percentile (EmP) method. Length and weight data for 19,727 Lake Chubsuckers from 129 populations were used in the final analysis. These fish were collected from 1977 to 2020 by various agency and university personnel from most of the known populations across the species' range in North America. This species is considered vulnerable, imperiled or extirpated in several Midwestern and northern states, but appears to be secure in the Southeast. The resulting W_s equations were $\log_{10}W = 3.1125 * \log_{10}L - 5.0962$ and $\log_{10}W = 3.8828 * \log_{10}L - 0.1701 * (\log_{10}L)2 – 5.9735$ for the RLP and quadratic EmP (EmP-Q) techniques, respectively, where W is weight (g) and L is total length (TL, mm). The RLP equation exhibited a greater length-related bias especially at the ends of the length spectrum, so we recommend the EmP-Q equation for this species. We also developed standard length categories for assessing the fish population size structure. We propose minimum lengths for five standard length length categories of 11, 18, 24, 28, and 35 cm TL for stock, quality, preferred, memorable, and trophy sizes, respectively. Development of a W_s equation and standard length categories will aid biologists in assessing the condition and size structure of wild Lake Chubsucker populations and those being propagated for supplemental stocking into trophy bass ponds for native forage or in areas with depressed populations.

Bunting, M.[1], D. Blewett[1], P. Stevens[2], and C. Saari[1]
Symposium Paper
[1]Florida Fish and Wildlife Conservation Commission, Fish and Wildlife Research Institute, Charlotte Harbor Field Lab, 585 Prineville St., Port Charlotte, Florida 33954
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Navigating the gauntlet – juvenile tarpon emigration from coastal ponds in Southwest Florida

Coastal wetlands worldwide are threatened by disrupted hydrology, urbanization, and sea level rise. In southwest Florida, coastal wetlands include tidal creeks, many of which terminate into a series of coastal ponds that are the primary habitat used by juvenile tarpon, an important sport fish. Such coastal ponds occur at the interface with uplands and are ephemerally connected to

the open estuary creating conditions of variable dissolved oxygen (0.5–7 mg/L) and salinity (0–40 psu). Tarpon are known to tolerate these conditions, but little is known about how they leave the remote nursery habitats, which often requires them to cross mangrove forests and salt pans to reach the open estuary. An acoustic telemetry study accompanied with the use of water level loggers was initiated in coastal ponds of varying elevations on the Cape Haze peninsula of Charlotte Harbor, Florida to characterize the climatic events and water levels that are needed to allow for juvenile tarpon emigration. To date, 34 tarpon (ca. 360–660 mm TL; 1.5–2 years old) have been surgically implanted with acoustic tags. The tag life expired for 11 tarpon before emigration occurred and for another three the fates were undetermined. The remaining 20 tarpon that carried tags were found to emigrate from ponds during summer king tides in some ponds, while tropical storm or hurricane conditions were needed to allow for emigration from ponds at higher elevations. After leaving coastal ponds, most of the tagged tarpon were detected in arrays located at the mouths of large rivers 30 km up-estuary. The characterizations of water levels and elevations needed for successful tarpon nurseries make it possible to create new habitat by incorporating coastal ponds in restoration designs and potentially through modification of stormwater ponds in urbanized settings.

Camp, E.V. [1], **T. MacDonald**[2], **Z. Siders**[1], **and K. Lorenzen**[1]
Contributed Paper
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[2]Florida Fish and Wildlife Conservation Commission Fish and Wildlife Research Institute, 100 8th Avenue Southeast, St. Petersburg, FL 33701
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Density dependent survival in recruitment compensation—is it real?

Density-dependent compensatory mortality during juvenile life-history stages is arguably the single most important ecological dynamic for exploited populations like fish. Though broadly supported by theory and applied to virtually every aspect of fisheries management and fish conservation, density-dependent compensatory mortality has been notoriously difficult to empirically demonstrate—especially in non-laboratory, marine fish populations. This has (1) encouraged research and management approaches that downplay the implications of density-dependent mortality and recruitment processes, and (2) stymied rigorous empirical assessment of the functional response of mortality to density. Here we use a long-term, multi-gear fisheries independent sampling dataset to evaluate the effect of density on the apparent mortality of fish during the recruitment process. We find surprisingly consistent evidence of strong mediation of mortality by density across seven of the eight taxa examined, despite existence of substantial process and observation error. These results have a series of implications spanning ecological theory, fisheries management actions, and monitoring approaches. Our results may constitute the strongest and broadest empirical evidence for density dependent compensatory mortality in marine systems, affirming the critical role of recruitment dynamics in driving these fish populations. Key management implications include how recruitment processes are accounted for in stock assessment and management strategy evaluations and the effects of management actions that may interact with density dependent mortality, such as stock enhancement or habitat restoration. The findings finally demonstrate the value of continuing long-term fisheries independent monitoring programs, especially those using multiple gear

types that combine to effectively sample a range of fish sizes, from pre- to post-recruit sizes classes.

Carlson, A.[1]
Symposium Paper
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Joining the Florida fisheries community: A history and horizon scan

My recent move to Florida has been a tremendous professional and personal opportunity. In joining the Florida Cooperative Fish and Wildlife Research Unit at the University of Florida, I have enjoyed meeting with state and federal partners to discuss wide-ranging topics in fisheries management and research. The 2021 FL AFS meeting provides an excellent venue to describe my previous research experiences, highlight topics and methodologies that are applicable to Florida fisheries, and "horizon scan" for the future. This talk will contribute to the fruitful exchange of fisheries information with Co-op Unit partners and lay a foundation for continued collaborations.

Chong, L.[1] **and E.V. Camp**[1]
Contributed Paper
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Review of the socioecological effects of artificial reefs in recreational fisheries

Artificial reefs are semi-permanent habitat alterations that provide structure mimicking natural reefs and have been increasingly implemented with the intent to enhance recreational fishing opportunities. While substantial work has been done to understand the ecological of artificial reefs, the efficacy of artificial reefs as a management tool hinges on socioecological feedbacks that are not well understood; the net effects artificial reefs may have on fisheries are difficult to intuit because they depend on multiple and complex interactions and feedbacks between fish, habitats, and fishers. To better understand the possible impacts of these structures in recreational fisheries, we conducted a literature review to catalog biological and social effects of artificial reefs on fish populations, anglers/fishers, and socioecological fishery systems. We extracted values of biological (natural mortality, recruitment, site fidelity, growth, and preferred habitat) and social (catch, catch rates, catchability, effort, and angler/fisher perception and behavior) parameters calculated on artificial reefs and compared them to values calculated on natural reefs or control sites from the years 1980-2021. Overall, artificial reefs have higher rates of catch, catch rate, catchability, and effort than natural reefs. However, artificial reefs also have fewer biological benefits (e.g. recruitment) than natural reefs on average. We also highlighted key, complex interactions between the biological and social parameters on artificial structures. This study emphasizes the need to evaluate fisheries with artificial reefs as socioecological systems and consider fisheries management in the siting and decision-making of the implementation of these structures. The results can also be integrated into future analyses of artificial reefs as they provide ranges of potential effects of artificial reefs on specific fish and fishery parameters and highlight research gaps and needs.

Cleary, M.[1]
Contributed Paper
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Integrating social science and fisheries management: opportunities for collaboration

Insights from social science research empower fisheries managers to make informed and adaptive decisions by providing critical information on key stakeholders. Social science and fisheries management practices have become more integrated in recent years, creating a stable foundation for future work on the seam of these two disciplines. Methods of social science data collection range from in-person interviews to broader surveys of the general population, and the applications of these data are equally diverse. In this presentation I will discuss a handful of social science methods that can inform fisheries management and will introduce the Florida Fish and Wildlife Conservation Commission's new Center for Conservation Social Science Research. Staff scientists are skilled in study design, a broad suite of qualitative and quantitative data collection methods, and accompanying statistical analyses including the integration of social data with GIS. The center consults agency personnel, and collaborates with internal and external partners to conduct original research.

Croteau, A.C.[1], **H.N. Gancel**[2], **J.M. Caffrey**[1], **and M.J. Deitch**[2]
Symposium Paper
[1]Center for Environmental Diagnostics and Bioremediation, University of West Florida, 11000 University Parkway Pensacola Florida 32514
[2]Soil and Water Sciences Department, University of Florida IFAS West Florida Research and Education Center, 5988 Highway 90 Milton Florida 32583
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It takes a watershed to develop an estuary program – developing collaborative estuary programs in Northwest Florida

Estuary programs (EP) have been successful in utilizing stakeholder and community engagement to restore and uphold ecological integrity of estuarine systems. Three new EPs along the Florida Panhandle (Perdido and Pensacola Bay EP, Choctawhatchee Bay EP, and St. Andrew and St. Joseph Bays EP) are in the incipient stages of their Comprehensive Conservation Management Plan (CCMP); a roadmap unique to each EP meant to guide and inform goals and priorities of each program. Our work involves collaboration with EP staff and stakeholders to build upon work previously done in these systems to assist with CCMP and program development. We are holding public and technical workshops to assess what stakeholders value in these systems and receive input on historical knowledge that stakeholders may have. Though evaluation of the participatory process we will assess stakeholder satisfaction and gauge their feelings of fairness, trust, and collaboration in the process of CCMP development. Evaluations will also be used to improve stakeholder engagement. Furthermore, to inform stakeholder decisions we are inventorying and analyzing historical and current literature and data with the intention of learning from what has already been done in these regions. Through this work we will be able to identify data gaps and provide EPs with lessons learned in the hopes that future decisions and projects implemented will move these programs forward,

building off efforts previously done in each region. Our results will have important implications for informing project priorities for each of these Northwest Florida EPs and will ultimately contribute to community and estuarine resiliency.

Crandall, C.[1], J. Hazell[2], M. Hoyer[2], S. Hervas Avila[2], N. Morales[3], and K. Lorenzen[2]
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Building a Habitat Management Plan for Lake Istokpoga

Lake Istokpoga is the 5th largest natural lake in Florida and is home to many different plant and animal species. In addition, people use the lake in numerous ways, including fishing, hunting, and wildlife viewing. Due to a variety of factors, including but not limited to lake water level regulation and the presence of non-native invasive plant species, habitats on the lake must be actively managed to ensure optimal conditions exist for lake wildlife and the people who use the lake. However, a great deal of conflict and tension surrounds the management of aquatic plants in Lake Istokpoga (and in Florida in general), in particular with regard to the use of aquatic herbicides. In 2017, a two-year process was initiated to engage community members in building a habitat management plan for Lake Istokpoga. The process included a qualitative situation assessment, public meetings, formation of an advisory committee, surveys, a citizen science project, meetings with the Florida Fish and Wildlife Conservation Commission Lake Istokpoga Working Group, and maintenance of a project website. In the end, the Lake Istokpoga Habitat Management Plan was created which outlines recommendations for habitat management on the lake. Following process completion, an evaluation was conducted to explore changes in attitudes as a result of the engagement process as well as overall appraisal of process successes, challenges, and improvements that could be made in future.

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Investigating Drivers of Seasonal Shifts in Fish Abundance in the Homosassa River System

In the southeastern U.S., some subtropical marine fishes use thermal refugia during winter at the northern limits of their range. The Florida Fish and Wildlife Conservation Commission (FWC) recently completed the Springs Coast Fish Community Assessment Project which found marine species abundance (dominated by Common Snook and Grey Snapper) increased in several spring-fed rivers during winter, consistent with use of the warm springs as thermal refugia. The Homosassa River, located centrally among several spring-fed rivers in north-central Florida, was chosen to investigate: 1) seasonal water quality parameters (temperature, salinity) and their

influence on the timing of marine species immigration, 2) the timing of the winter influx and subsequent interactions between marine (Common Snook, Grey Snapper) and freshwater fishes (Largemouth Bass, Redear Sunfish), and 3) fish movement and habitat associations by marine and freshwater fish species in the mainstem and backwater habitats of the river system. The Homosassa project uses acoustic telemetry, electrofishing, mark-recapture, habitat assessment and abiotic measurements to investigate species interactions, distribution, and movement in the Homosassa River system. The Homosassa project used an ecosystem-based approach to better understand and protect the species that depend on this unique freshwater environment. Data provided in this study can assist resource managers with enhancing aquatic habitat for resident freshwater fish species, while providing important refugia for migratory marine species. Additional work, using the methods outlined in this study, can be adapted to benefit other coastal spring-fed rivers similar in ecological nature.

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Environmental DNA Analysis of Forage Fish Diversity and Distribution in the Indian River Lagoon

The Indian River Lagoon is one of the most species-rich estuaries in the United States, providing habitat to over 400 species of fish. Among these are critical forage fishes, such as menhaden, anchovy, and sardines, as well as many of their commercially important predators. The Florida Fish and Wildlife Conservation Commission (FWC) conducts monthly seine surveys in the IRL, which provide the basis for most fisheries resource management and conservation decisions in the region. However, many key species are systematically overlooked by these surveys due to gear bias, resulting in data deficiencies for many forage fish species and their dependent predators. This ongoing study aims to circumvent these issues by utilizing environmental DNA (eDNA) metabarcoding to conduct a survey of forage fish species in the IRL and create a rapid and cost-effective survey toolkit complimenting existing survey efforts. As part of this effort, we have collected water samples from 16 sites across the northern IRL alongside FWC's monthly surveys just before seine net deployment. Using protocols optimized in our lab at the University of Central Florida, we will extract DNA from these samples and prepare Illumina libraries using 16S primers. Species composition and individual occurrence records at each sample site and habitat will be evaluated based on the eDNA data. These results will be compared to those obtained from the FWC survey to evaluate the relative strengths and weaknesses of each method. Combining the data, we will create local and regional biodiversity hotspot maps for forage fishes that can be used to supplement FWC's species occurrence database.

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Passive Acoustic Monitoring of Artificial Reef Sites Reveals General Boat Traffic Patterns (but not Fishing Effort) in the Northwest Florida Gulf of Mexico

We used passive acoustic monitoring (PAM) to investigate boater behavior on thirteen sites in Northwest Florida where artificial reefs have been or will be constructed, with the goals of improving our ability to monitor and manage recreational use of artificial reefs. Hydrophones attached to underwater dataloggers recorded acoustic information at various sites from February 2017 to May 2019, and we developed automated algorithms to differentiate vessel noise from ambient oceanic noise and biological sounds in the acoustic data. Analyses showed that, unfortunately, our algorithms were unable to distinguish between boats that actually stopped to use an artificial reef from boats simply transiting past a site at high speeds. However, there are multiple indications that we are able to accurately identify general patterns of boating behavior in the Northwest Florida Gulf of Mexico. We detected more boats on weekends and holidays than on weekdays, more boats in summer months than in winter months, and more boats on calm days than on windy days. These results corroborate local knowledge of boater patterns in the region, suggesting that our algorithms can reliably detect high-speed vessels traveling within hundreds or thousands of feet of a hydrophone. While we could not identify boats making use of individual artificial reef sites, PAM remains a cost-effective form of data collection with great potential for improving monitoring and management of the marine environment, including artificial reefs. We are continuing to explore ways to develop this technology in order to eventually quantify recreational angler activity on artificial reefs.

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eDNA: The new frontier in biomonitoring

The use of environmental DNA (eDNA) in studies on aquatic systems has exploded over the past decade. Defined broadly, aquatic eDNA is any genetic material that has been extracted from a water sample and includes free floating DNA to microscopic organisms. Scientists and managers from state and federal offices and academic institutions are pushing the exploration of these new approaches in the hope that they will allow us to address important science and management questions by offering an efficient means to census marine life. Offering the ability to target single taxa or work across multiple trophic levels, eDNA is likely to revolution how we assess biodiversity and complement or in some cases replace traditional survey methods. Here I will evaluate the use of this exciting tool, talk about the work in our lab to optimize protocols in marine systems and discuss the future direction of eDNA in fisheries and biomonitoring.

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Ten Years in Review: Out of Season Spawning Technique of Florida Largemouth Bass

Florida Largemouth Bass (*Micropterus floridanus*) spawn naturally from late December to April throughout the state of Florida depending on longitude. The Florida Bass Conservation Center (FBCC) developed a technique in 2008 to spawn Florida Largemouth Bass out of sequence during the fall, or out of season. Florida Largemouth Bass hatchery broodstock spawn freely in 80-foot raceways with the addition of spawning substrate (Spawntex™ mats). Beginning in mid-June and running to mid-September photoperiod and temperature are controlled using chiller units and tank coverings to mimic the gradual light and temperature transition from summer to winter conditions and then to spring. Temperature manipulations range from 15℃ – 23℃ while ambient light is reduced from 16 h/d to 8 h/d. At the end of the cycle, spawning mats are added to raceways and out of season spawn begins. On average, out of season spawning produces 5,700 fry/spawn and following a 30 to 40-d grow out cycle, yields a 32-mm fingerling by early November. Extending grow out through the winter months yields a 100 mm phase II fingerling by spring. Out of season spawning allows the hatchery to annually double crop largemouth bass production and is a beneficial tool for successfully stocking locations in south Florida where the natural spawn occurs earlier in the year and forage is available prior to when spring spawned hatchery bass would be stocked. It also provides fisheries managers with a tool to stock a larger fish in the spring. This presentation intends to reflect on a decade of spawning data and review the goals and successes of the program.

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Bottom-Up Conservation: Using Stakeholder Knowledge to Inform Conservation Priorities for an Unregulated and Recreationally Valued Fish Species

Translational ecology defines a collaborative effort among scientists and stakeholders with the goal of rapidly translating environmental problems into action. This approach can be applied in a fisheries management context when information needed to inform regulations is unavailable, yet conservation concerns exist. Our research uses a translational ecology framework to assess the stock status and develop research priorities for the Crevalle Jack (*Caranx hippos*), an unregulated and data-poor fish species, by collaborating with recreational fishing guides in the Florida Keys, U.S.A. Interview data that compiled guide local-ecological knowledge were used to develop hypotheses that were then tested using existing fisheries-dependent datasets to check for agreement among sources and assess the consistency of observed patterns. From the guide interviews, six hypotheses were developed concerning the status and trends of the Crevalle Jack population in the Florida Keys, and four of these hypotheses received clear support, with agreement between guide observations and one or more of the fisheries-dependent datasets. Our results indicate that populations of Crevalle Jack in the Florida Keys are likely in decline,

particularly large, adult fish mainly captured offshore. Also, Crevalle Jack in South Florida appear to be migratory, so research into movement and migration patterns should be prioritized so that the spatial scale of management will match the spatial distribution of the species. The results of our study outline an effective translational ecology approach for recreational fisheries management designed to rapidly recognize potential management needs as identified by anglers, which allows for actionable science and proactive management.

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Assessing Hydrilla Spread and Subsequent Impacts on Sportfish Communities in Lake Sinclair, Georgia

Hydrilla is an invasive aquatic macrophyte that has negatively impacted freshwater ecosystems across the globe. It is a detriment to anthropogenic use of waterways for navigation, commercial fishing, irrigation, and hydroelectric power generation. Additionally, hydrilla has been shown to negatively impact aquatic food web dynamics when it surpasses a certain density. Understanding how fish communities in a system are affected by hydrilla is critical so that officials can make educated decisions when managing these species. Equally important is having clear and effective methods for assessing hydrilla abundance in a system. Therefore, the objectives of this study were to 1.) determine the efficacy of satellite imagery for identifying hydrilla spread across a large reservoir, and 2.) compare pre- and post-hydrilla assessments of Largemouth Bass relative abundance, age structure, size structure, and body condition. A normalized difference vegetation index combined with PLANET satellite imagery was effective at distinguishing hydrilla cover, providing an efficient and effective means at quantifying hydrilla colonization through time. Comparative assessments of Largemouth Bass pre- and post-hydrilla resulted in few differences in dynamic rate functions. However, body condition increased, with mean relative weight being highest the year after hydrilla became established in the lake. These results equip lake managers with a more efficient and cost-effective method for accurately identifying hydrilla and provide additional insight to further our understanding on the relationship between sportfish and hydrilla in large reservoirs.

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Multispecies trends in juvenile fish recruitment to nearshore seagrass habitats of the eastern Gulf of Mexico

Marine conservation and management often focus on habitat protection and adult populations, but the contribution of individuals from juvenile habitats to adult populations is often not fully

understood. Variation in recruitment abundances and its driving factors remain a source of uncertainty for fully understanding population dynamics, even for species with evidence of strong correlations between juvenile and adult abundances. Given the interest of progression from single-species to multispecies and ecosystem-based fisheries management, we examined potential temporal synchrony among time series of juvenile reef fish species' recruitment to seagrass habitats along the West Florida Shelf (WFS) in the eastern Gulf of Mexico. Dynamic factor analysis (DFA) was used to identify common trends in monthly catch-per-unit-effort from a nearshore seagrass trawl survey from 2008–2018. We found evidence of synchrony for 11 reef and non-reef fish species, whereby three common recruitment patterns were detected. Seasonal trends among most species generally mimicked seasonal variability of seagrass biomass, and long-term trends generally decreased from 2008 through 2014 or 2015 but increased thereafter. After testing multiple potential environmental drivers, a one-month lag in the prevailing wind direction along the WFS was found to be related to juvenile fish abundance, with southeast to westerly winds one month prior to sampling generally correlating with increased juvenile reef fish abundance. Identification of coincident recruitment patterns among multiple fish species can inform habitat protection and restoration efforts, multi-species survey design, stock assessments for data-rich and data-limited species (including forecasting adult population sizes), and other aspects of marine conservation and management.

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Kissimmee River Fish Study – Largemouth Bass Telemetry

The Kissimmee River meandered 166 km from Lake Kissimmee to Lake Okeechobee with a thriving floodplain ecosystem dependent on an annual cycle of flooding and drying. The 90 km long C-38 canal, designed to maximize flood control, was completed in 1971 and divided the river into five regulated pools. The severe negative impacts on the floodplain ecosystem resulted in an immediate call for restoration and the middle segments of the canal have been back-filled to reconnect the historical river channel. The fish community and sportfish populations were expected to respond favorably to restoration but wet-season hypoxia is a recurrent problem that has caused numerous fish kills. Water managers want to know if Largemouth Bass in the river following the fish kills have emigrated from upstream or are survivors from within the restored areas. We surgically implanted Largemouth Bass with radio transmitters in winter 2020 and 2021 and have been using passive and active telemetry to track them. We placed 30 radio-tagged Largemouth Bass in the restored river, 10 in the C-38 canal, and 10 in Lake Kissimmee in each year. Stationary receivers were strategically placed as gates to detect emigration to the restored area from upstream or out of the restored area in either direction. Four of the 30 fish tagged in the restoration area in 2020 are confirmed alive and present in 2021. Both emigration and immigration occurred in 2020, with 5 fish leaving the restored area (2 have since returned) and 2 fish entering from upstream. Fourteen of the fish are presumed dead, and the remaining nine fish have an unknown fate. There were twelve

angler recaptures reported in 2020, all occurring in either Lake Kissimmee or the C38 canal/Pool A. All fish tagged in 2021 are alive and active tracking will continue through fall of 2021.

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Evolutionary Tools and Techniques in Fisheries: Balancing 30 years of change within a long-term dataset

Recent technological advances have been a game changer in nearly everything we do. Our daily life is now entangled with new technology from dawn to dusk and even while we sleep. Advances in fisheries are no exception. While tools for collecting fisheries data are evolving very fast, advances in harvest technology likely surpass our ability to track targeted populations. We now use many more electronic, digital, and computerized instruments, though nets, hooks, and vessels are also vastly improved. This presentation is a ride down memory lane from the old days of pushing the boat against the tide both to and from the sampling area to todays' voice commands, touch screens, and even passive detection.

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Shoal Bass of the Chipola River and Impacts from Hurricane Michael

The Chipola River is home to the only known population of naturally reproducing Shoal Bass (*Micropterus cataractae*) in Florida. They are listed as a species of greatest conservation need by the Florida Fish and Wildlife Conservation Commission (FWC). The Shoal Bass population was significantly impacted by Hurricane Michael, which made landfall in the Florida Panhandle in October 2018 with sustained winds of 257 kph (160 mph). The east side of the eyewall swept up through the Chipola River drainage resulting in severe fish kills in the days following Hurricane Michael. A post-hurricane assessment of the Shoal Bass population was completed in May of 2019. During four sampling events throughout historical shoal bass habitat, only 33 adult shoal bass were collected. This represents a 91% decrease in catch compared to the most recent sample before the hurricane. Subsequently, an executive order suspending the harvest of shoal bass on the Chipola River was issued by FWC in June of 2019 and was passed into rule at the end of the year. In addition, 24 adult shoal bass are currently being held at the Blackwater Fisheries Research and Development Center. These individuals will serve as brood stock for a supplemental stocking project slated to begin in spring of 2021.

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Using social science to uncover stories behind conflict: a case study.
Conflict can result from different users utilizing the same natural resource for different purposes. The word conflict at its core represents an underlying disagreement in beliefs, perceptions or interpretations. One of the aims of natural resource management is to manage the people that utilize the resources, which means sometimes managing conflict. So, what tools exist to do this? Quantitative research can shed light into partly understanding a context. However, it requires trust and a sincere conversation to get to the roots of conflict. This is where social science comes in; by focusing on studying stakeholder relations, worldviews, history and procedural aspects in a qualitative manner. An example of this is the case study of the conservation of the Southeast Florida Coral Ecosystem Conservation Area (ECA). During 2013-2016 there was a community planning process aimed to engage reef stakeholders to create recommended management actions (RMAs) for the conservation of the ECA. A broad range of stakeholders were engaged in this process including fishing stakeholders. The latter's participation proved difficult to sustain and several fisheries-related RMAs were subsequently opposed by fishing interests at the state and federal levels. A situation assessment paved the path to understand stakeholder perspectives, experiences and influence. Through empathic interviews and qualitative data analysis, results showed, among other findings, the perceived existence of distinct "angler" and "diver/environmental" networks who have conflicting narratives on the relative importance of fishing as a threat. The lead agency was also viewed by fishing stakeholders as part of the "diver/environment" network, therefore, fishing stakeholders felt marginalized and disempowered from the start. Uncovering the picture of this complex conflict through a situation assessment allowed to take further steps into creating a new tailored process for engagement. Therefore, this toold based on meaningful conversations, suspending one's biases and a qualitative analysis can be valuable towards conflict management in natural resources.

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Improvements to Culture Methods of the Cyclopoid Copepod *Oithona colcarva*
Copepod nauplii are vital to the survival of altricial larvae of marine fishes. Copepods are a natural prey item for many ornamental and food fish species and have high nutritional value. The cyclopoid copepod *Oithona colcarva* is an ideal live feed for aquaculture due to its small size and durability in suboptimal culture conditions. A series of experiments were conducted to refine standard culture protocols used at the Tropical Aquaculture Lab for production of *O. colcarva*. Factors such as diet, stocking density, and photoperiod were evaluated to quantify impacts on naupliar production. The first set of diet experiments compared live microalgae blends using the species *Tisochrysis lutea*, *Chaetoceros muelleri*, and *Tetraselmis chuii* fed at 400,000 cells/mL. Naupliar production was the highest when adult copepods were fed a 1:1 carbon equivalence ratio of *T. lutea* and *T. chuii*. This diet became the control in a subsequent experiment examining the effects of algal concentrates on naupliar production. The live

microalgae control diet performed the best in this investigation but further studies are needed before ruling out the use of algae concentrates as a feed for *O. colcarva*. Stocking density experiments showed no significant differences in nauplii production among cultures stocked at 8, 12, 16, and 24 adults/mL. Photoperiod experiments yielded similar nauplii production between 6-hour light : 18-hour dark and 12-hour light : 12-hour dark photoperiods. However, both treatments had significantly higher nauplii production than 18-hour light : 6-hour dark, so natural diurnal cycles should suffice for culture conditions. Results from these experiments were translated to commercial scale production in a greenhouse. Production tanks (200L) were able to produce an average of 2.56 million nauplii/day for 10 consecutive days. Results from these experiments will contribute to commercial production protocols for this promising new live feed for aquaculture.

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Is There a Link Between Turbidity and Exotic Fish in the Upper St. Johns River Basin?

The Upper St. Johns River is a low gradient sub-tropical river that flows through a broad herbaceous marsh. The river itself and associated lakes had abundant submerged vegetation, especially during dry periods. The once abundant submerged aquatic vegetation has become rare to completely absent in most locations from the canals in the headwater marsh downstream to Lake Harney and the formerly clear water has become very turbid during low flow. We have investigated multiple datasets to attempt make some inferences about the timing and causes of this change. Data from FWC's Freshwater Fish LTM dataset go back only to 2007 so we dredged through records from old annual and completion reports to patch together a timeline of exotic fish expansion. We also drew on water quality, hydrological, and meteorological datasets from the St. Johns River Water Management District, United States Geological Survey, and the National Weather Service to quantify changes in water quality over time and to explore environmental factors that coincided with the expansion of tropical exotic fish in the basin. During the 1980s and 1990s the river and lakes were characterized by low turbidity at all flows, high color during high flows, and low color during low flow. This provided good light penetration and abundant submerged plants during low flow. A regime shift occurred in the late 1990s such that there was a 10-fold increase in average turbidity and a 60-70 percent reduction in transparency at sites throughout the basin. This effect is most pronounced during low flow. Since 1998 there is an inverse relationship between water level and turbidity at all site types; canal, river, and lake. This coincided with a rapid expansion of *Pterigoplichthys disjunctivus* and *Oreochromis aureus* throughout the basin which coincided with a significant decline in the frequency cold lethal to tropical exotic fish.

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Environmental Influences on Directed Snook Movement During High Discharges

Movement, behavior, growth, and diet of fish can all be affected by freshwater discharges. In southern Florida, thousands of miles of canals control direction and volume of discharge from Lake Okeechobee to the St. Lucie and Caloosahatchee estuaries. While effects of these discharges on sessile organisms, like seagrass and oysters, have been quantified, the effects on more mobile organisms have been difficult to recognize. Since large population responses aren't obvious, responses to high discharges and the environment are not evident. This study utilizes the common snook (*Centropomus undecimalis*) as a model for a highly mobile, large, predatory, estuarine fish. Passive acoustic telemetry was used to track common snook (n=280) movement from 2008-2014 during four high discharge events in St. Lucie estuary. Common snook did not show widespread movement response to discharges, but some individuals exhibited movements that seemed to correspond with discharges. In an effort to determine if the individuals that are moving are responding to the same cue, focus turned to relating environmental parameters to directed movements of individual snook during the high discharges. Paired samples t-tests were conducted to compare environmental measurements at the starting and ending locations of the snook. This should provide an indication if snook that are mobile during discharges are responding to environmental changes during high discharges.

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Restored Coastal Habitat in the Indian River Lagoon Can Reel In Local Juvenile Sportfish Populations

Declining coastal habitats in the Indian River Lagoon have impacted economically important fisheries, resulting in dedicated oyster reef and shoreline restoration projects. These restored habitats can theoretically enhance predator populations, but this is understudied. To assess the impact of habitat restoration on juvenile sportfish populations and communities, we measured sportfish abundance, diversity and composition using seine nets in a Before-After-Control-Impact experiment. Juvenile sportfish populations were variable over time but were collectively higher on restored oyster reefs compared to controls and were similar between control and restored shorelines, which was influenced by biotic features of the restoration, prey abundance and decreasing distance to Ponce Inlet. Sportfish diversity demonstrated similar trends, with differing community composition between oyster reefs and living shorelines. These data suggest that restored habitat encourages sportfish populations and site selection may influence its success in fisheries enhancement, which will help us better utilize habitat restoration to manage fish populations.

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Characterizing the digestive enzyme ontogeny and larval gastrointestinal morphology of *Lachnolaimus maximus* to inform nutritional protocols for aquaculture production

Hogfish (*Lachnolaimus maximus)* are popular recreational and commercial fishing targets in Florida and fishing pressure has led to increased management and concern regarding population status over the past several decades. Developing aquaculture protocols for this species would allow for the commercial production of hogfish to meet market demands while simultaneously creating opportunities for stock enhancement. To develop commercial aquaculture protocols for *L. maximus*, larval development and nutritional requirements must be discerned for optimization of larval survival. Characterizing the digestive enzyme ontogeny and changes in gastrointestinal morphology throughout larval development will give insight into digestive capacity and potential nutritional protocols. Fertilized *L. maximus* embryos were collected, hatched, and raised on live feeds including copepods, rotifers, and *Artemia* for 45 days. Larvae were sampled throughout the experiment to analyze growth, digestive enzyme activity, and gastrointestinal development. The activities of lipase, trypsin, and pepsin were analyzed using microplate spectrophotometric assays. Digestive tract development was analyzed using histochemistry to visualize neutral and acidic mucopolysaccharides, commonly associated with the presence of a functional stomach. Both lipase and trypsin activities were detectable from 1-day post-hatch (dph). A dramatic increase in lipase and trypsin activities occurred at 18 dph and continued throughout the larval period. Pepsin activity was undetectable throughout the larval period. The digestive tract remained agastric and was characterized by an oesogaster located after the esophagus and before the intestine. The data collected from this trial was used to design nutritional and weaning protocols for *L. maximus* larvae. Currently, a trial is underway to determine the earliest point at which *L. maximus* larvae can be transitioned from copepod nauplii to rotifers without sacrificing survival or growth.

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Developing larval culture protocols for Blackbanded Sunfish (*Enneacanthus chaetodon*)

The Blackbanded Sunfish (*Enneacanthus chaetodon*) is a small freshwater centrarchid endemic to slow moving waters and lakes from New Jersey to Central Florida. The distribution of this species has been increasingly fragmented due to habitat destruction, competition with non-native species, and in some cases, collection for the aquarium trade. The development of larval culture protocols is essential for the production of this species for the aquarium trade and for potential reintroduction to areas of extirpation. The objectives of this study were to characterize digestive system ontogeny, identify the appropriate timing for weaning larvae from live feeds to an inert microparticulate diet, and determine commercial microparticulate diet that yields the highest larval survival and length. Blackbanded Sunfish larvae were sampled 11 times from 1-day post-hatch (dph) to 50 dph for subsequent analysis of digestive enzyme activity via microplate spectrophotometric assays and digestive system morphology via histology. Blackbanded Sunfish

larvae transition from agastric to gastric digestion at approximately 40 dph, which was determined by the presence of gastric glands and acid protease activity. Results of this experiment informed a weaning experiment where microdiets were introduced to larvae at various timepoints surrounding the development of a functional stomach. The highest survival was found when larvae were fed exclusively *Artemia* or when microdiets were introduced at 48 dph. Lastly, a dietetics trial was conducted to test the efficacy of three commercial microparticulate diets against a control diet of *Artemia* nauplii. Certain microparticulate diets yielded higher survival than others, however all diets performed equally when considering total length of *E. chaetodon* larvae. Overall, larval *E. chaetodon* begin to transition to an adult mode of digestion at 40 dph and can be successfully transitioned to a microparticulate diet after 48 dph without significantly affecting survival or total length.

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Who really cares about rare fish conservation? Awareness and attitudes about rare fish and their management in Florida

Stakeholder support is critical to the success and persistence of effective conservation programs. More than 40 fish species in Florida are of conservation concern, most of which are non-game. However, public awareness and attitudes regarding rare fish conservation are poorly understood. We sought to evaluate whether differences in rare fish awareness exist among the general public and potential stakeholder groups. We also wanted to know whether stakeholder groups differ in their attitudes regarding potential conservation actions that could be taken to benefit rare fish. To achieve these goals, we distributed an online survey to a representative sample of Florida residents, conservation organization members, outdoor-recreationists, citizen-scientists, and native fish enthusiasts between March and May 2020. Knowledge and awareness of rare fish was lowest among the general public and citizen science groups and highest among fish enthusiasts. Regardless of group, most respondents believed that proper management could prevent the loss of rare fish species but didn't know enough to judge current conservation efforts. Given alternative management options, most respondents expressed a preference for improving existing habitat and regulating harvest over creating new habitat and stocking. Fish enthusiasts and conservation groups expressed the greatest support for regulating water use and quality for the benefit of rare fish, while recreation groups expressed lower support than the general public. Only fish enthusiasts and citizen scientists expressed greater support than the general public for stocking rare fish. These results highlight areas where outreach efforts may benefit rare fish conservation support and encourage management decisions that are congruent with stakeholder attitudes.

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Developing a robust index to describe ovarian condition in captive adult Red Drum (*Sciaenops ocellatus*)

Research in developing new and innovative approaches to stock enhancement is essential to managing, conserving, and restoring marine sport fisheries. Red Drum (*Sciaenops ocellatus*) is an iconic inshore sportfish species that supports a major fishery in Florida and much of the southeastern US. Substantial stock enhancement of such sportfish relies on the ability to optimize spawning of broodstock in captivity, among other processes. Improving identification of spawning conditions and optimizing spawning quality for both stock enhancement research and production requires accurate and succinct description of oocyte maturation in captive Red Drum as a reference. Oocyte biopsies during regression, regeneration, and spawning were collected with a cannula (1.2-1.5 mm inner diameter polyethylene tubing) and preserved in Trump's fixative for staining and histological analysis. Stereology, the science of quantifying structural features of an object (number, length, surface area, and volume) using a series of two-dimensional images, is being explored as a method to quantify ovarian maturation through these developmental phases in Red Drum. Densities and/or ratios of these counts and measurements may be used to classify the reproductive condition of the ovary and describe oogenesis during the captive maturation and spawning schedule, which is compressed with respect to the natural cycle. Ideally, this will create a tractable tool with direct application in Red Drum hatchery management as well as broader relevance for finfish aquaculture, especially when evaluating novel species for stock enhancement. This presentation outlines stereology method development in captive Red Drum broodstock for the purposes of ovarian condition description.

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Habitat Suitability Indices for Freshwater Organisms in support of Minimum Flows and Levels Rule Development

Aquatic ecosystems in Florida depend on responsible water resource stewardship while experiencing landscape development and increasing water use by a growing human population. The Florida Water Management Districts (WMDs) are charged with developing minimum flows and levels (MFLs) for waterbodies throughout the state to prevent significant harm to the water resources or ecology of the area. Current State Water Policy provides additional guidance and states that consideration shall be given to fish and wildlife habitats, including the passage of fish. Consequently, the relationship between stream flow and habitat is often used to evaluate

the effects of flow reduction to specific fish and wildlife species, and software such as the Physical Habitat Simulation Model and System for Environmental Flow Analysis has been developed as assessment frameworks to model riverine habitat. These frameworks integrate hydrological and biological models to estimate the amount of usable area for a particular organism, which can then be used to predict the change in habitat that may occur from reduced water flows and levels. Habitat suitability indices (HSIs) are the biological inputs to these frameworks, but WMDs often use HSIs for fish and wildlife species that were developed outside of Florida due to the time and money constraints associated with developing in-situ HSIs at every watercourse in the state. The goals of this study are to (1) compile and review all existing HSIs being used by Florida WMDs, (2) make revisions as needed to existing HSIs through expert opinion using the Delphi Technique, and (3) develop new HSIs for Redeye Chub and Pirate Perch from the Rainbow and Withlacoochee rivers, respectively. This presentation will provide an overview of the project goals and current progress towards meeting these goals.

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Sublethal Effects of *Microcystis aeruginosa* Toxin Exposure on Juvenile Blue Crabs (*Callinectes sapidus*)

The Atlantic blue crab *Callinectes sapidus* has a complex estuarine lifecycle. In certain Florida estuaries, this lifecycle overlaps with cyanobacteria blooms. *Microcystis aeruginosa* is a toxic cyanobacteria that forms blooms in freshwater lakes and can be transferred to estuaries through the rivers connecting them. In South Florida, freshwater is released from Lake Okeechobee into the Caloosahatchee and St. Lucie Rivers as a flood control measure, often containing blooms. When the cyanobacteria meets saltwater, the algal cells lyse, releasing the hepatotoxin, microcystin. We examined the potentially lethal and sublethal effects of exposure to Microcystin-LR (MC-LR) on juvenile *C. sapidus*. A 28d exposure trial was conducted using a control [0µg/L], low [5 µg/L], medium [15µg/L], and high treatments [50µg/L] of MC-LR. Mortality, food consumption, and molts were recorded daily. Weekly, crabs were put through righting time assays to assess overall muscular functioning. On day 28, a subset of crabs was euthanized for histology to examine tissues for pathology. Chemosensory trials were conducted to identify if *C. sapidus* use chemoreception to detect and avoid water containing MC-LR. *Callinectes sapidus* showed high survival in the presence of 5 µg/L, 15µg/L, and 50µg/L of MC-LR. Using food consumption and molting as proxies for sublethal impacts, we found that a concentration of 50µg/L of MC-LR significantly decreased the amount of food consumed and the number of molts completed. Additionally, at medium and high treatment levels, histological analysis revealed tissue pathology including loss of tubular/lumen structure and delamination of epithelium in the hepatopancreas. Behavioral assays did not demonstrate a significant impact on muscular functioning of *C. sapidus* exposed to MC-LR at any treatment concentration nor did crabs show a significant avoidance of water containing MC-LR. At concentrations tested, juvenile *C. sapidus* experienced only sublethal effects from MC-LR exposure. Long-term consequences for their growth and survival are unknown.

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COVID-19 effects on recreational fishing in Florida

This study examined how COVID-19 affected recreational fishing in Florida. A random sample of residents and non-resident anglers were drawn from the recreational license database and an email survey was conducted. Respondents were asked series of questions related to their fishing habits, specialization, attitudes about recreating outdoors and changes in fishing experience during the pandemic, and more than 1300 responses were collected. In general, respondents expressed strongly positive attitudes about recreating outdoors and its benefits during the pandemic. About 60% of the respondents reported their fishing participation (frequency, day/time, destination, species sought, etc.) did not change due the COVID-19. Of those who were affected, majority of respondents indicated changes in frequency of their fishing trips (80%), number of people they go fishing with (37%), location they fish from (30%), and participation in recreational activities other than fishing (25%). About 75% of non-resident anglers and about 55% of residents anglers indicated of doing less or much less frequent trips compared to a typical year, whereas about 50% of the resident anglers and about 20% of the non-residents anglers reported doing of more or much more frequent fishing trips during the pandemic compared to a typical year. Results suggest that number of people travelling together for a trip significantly decreased during the pandemic. For instance, more than 25% of the respondents travelled alone and more than 60% travelled with a party size of 2-3 persons during the pandemic compared to 10% and 46%, respectively for a typical year.

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Incorporating Diverse Stakeholder Attitudes and Preferences for Common Fisheries Management Actions

Better understanding of the diversity of stakeholder preferences can help to develop diversified management strategies that offer greater satisfaction to a broader range of stakeholders. Stakeholder diversity is described by many metrics, including demographics, motivations, behaviors, and specialization. One measure of specialization that has been shown to transcend other common diversity metrics is centrality to lifestyle. Centrality to lifestyle measures how important an activity, like recreational fishing, is to an individual, and has been shown to mediate stakeholder preferences for management actions. Here, we examine how centrality to lifestyle may mediate attitudes towards and preferences for a management action largely considered to be homogenously popular with stakeholders—stock enhancement of recreational fisheries. We hypothesize that anglers generally support stocking regardless of centrality to

lifestyle, but (i) the specific type of stocking, (ii) how supportive anglers are of stocking relative to other management actions, and (iii) the effect of stocking on planned participation in angling will be mediated by centrality to lifestyle. To test this, we developed a likert-style internet-based survey to examine how centrality of fishing to an angler's lifestyle affects their attitudes towards and preferences for stocking specific species, stocking as a management action, and stocking compared to other management actions. Understanding angler attitudes towards and preferences for a commonly used management action, such as stocking, can lead to improved management strategies and, eventually, increased angler satisfaction. The results of this study have implications for other stock enhanced fisheries as well as other natural resource management decisions with diverse stakeholder populations. Incorporating the results of this study into recreational fisheries management could lead to greater angler retention and possible recruitment of new anglers.

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The impact of trap confinement on the condition of the Florida stone crab *Menippe mercenaria*

Stone crab fishery landings in Florida are typically valued at > $30 M annually. The commercial fishery in Florida is claw only, meaning that live animals are returned to the water once one or both claws have been removed. Because animals can be fished more than once in their lifetime, the fishery is often thought of as sustainable. Recent stock assessments and fishing mortality studies suggest that many animals do not often survive claw removal and that the fishery is in danger of being overfished. Having fished-out many inshore habitats, fishermen have begun moving their traps farther offshore and checking them less frequently to compensate for the extra time and fuel required to harvest. To investigate how increased soak times affect the health and condition of stone crabs before claw removal, we conducted field and corresponding laboratory simulation studies. Trap studies were conducted in both fall and spring at the northern (Cedar Key) and southern (Marathon) regions of the fishery to account for geographic and temperature variation. Lab-based simulations have been conducted under winter conditions and will be conducted under summer conditions during summer 2021. Initial results suggest that with increasing soak times crabs become nutritionally depleted but not neurologically impacted. Claw removal has been documented as a traumatic event for stone crabs, with less than half of crabs that have both claws removed surviving. Understanding how time spent in traps affects the condition of a crab before claw-removal will allow for a more accurate mortality assessment and potentially be used to manage the Florida stone crab fishery more sustainably.

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Preliminary trials to assess bycatch reduction potential for deep-set pelagic longline gear in the U.S. Atlantic fishery

The U.S. Atlantic pelagic longline fishery uses a shallow-set gear configuration to target swordfish and yellowfin tuna at depths of around 75-100 m. However, the fishery has been the subject of several bycatch reduction regulations due to incidental catch and mortality of sea turtles, istiophorid billfishes, and marine mammals. Used in the U.S. pelagic longline fishery based in Hawaii, the deep-set longline gear deployment method differs from the shallow-set longline gear by deploying a greater length of mainline per unit distance through the use of a line shooter, resulting in a deeper catenary curve and gear that fishes much deeper in the water column at depths around 250 m. Along with the additional length of mainline, deep-set gear also typically includes additional hooks per basket. Catch composition differs greatly between the two gear types, as each gear type is fishing in different vertical water strata. From June 2020 to February 2021, deep-set gear was formally trialed in the U.S. South Atlantic Bight pelagic longline fishery to assess catch rates and assess its potential for bycatch reduction compared to shallow set gear. Over 50 sets of each gear deployment technique, effective fishing depths were recorded with micro-TDRs and catches were monitored with at-sea fisheries observers. During the trials, deep-set pelagic longline gear did not have any marine mammal or sea turtle bycatch, while the shallow-set gear encountered both bycatch taxa. Additionally, 47% of the fish caught from the shallow-set gear was classified as bycatch and released or discarded. To further gauge bycatch reduction potential and economic feasibility, further trials of this gear type are recommended for additional seasons and geographic regions of the U.S. Atlantic pelagic longline fishery.

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Maturation and Fecundity of an Introduced Population of Pike Killifish

Pike Killifish is an established non-native fish species in Florida that was first documented in south Florida in 1957 and secondarily in Tampa Bay tributaries in 1994. Altered size structure and decreased abundances of several small-bodied fish have been linked to the introduction of Pike Killifish in both of these regions. Life history characteristics, such as size at maturation and fecundity, of introduced species can aid in determining the potential extent of spread and impacts to native communities, as well as whether potential control measures could be successfully utilized to limit or eliminate populations. Reproductive information has been investigated for some of the south Florida populations of Pike Killifish, mainly from freshwater locations. However, no such information has been reported for the Tampa Bay population, which is primarily estuarine. Pike Killifish collected during a study investigating their diet and potential impacts on juvenile snook were also examined for reproductive information. The maturation status of individuals was recorded and the brood size of pregnant females, those containing fertilized eggs or embryos, was calculated.

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Investigating the potential effects that climate change, fishing mortality, or a combination of both are having on a unique gulf strain of Striped Bass *Morone saxatilis*

Striped Bass *Morone saxatilis* are a popular sport fish with a native range that spans along the Atlantic Coast from Florida to Maine and historically from Florida's panhandle to Texas in the Gulf of Mexico. It is now known that Striped Bass in the Gulf of Mexico are genetically unique from the fish living in the Atlantic, and Florida's Panhandle contains one of the few remaining stocks of this unique gulf strain of Striped Bass. Since these fish are very sensitive to warm water temperatures, they rely heavily on thermal refuges provided by the creeks and springs that flow into mainstem rivers and reservoirs during the warm summer months. Currently, many of the remaining gulf strain stocks are propped up by stocking efforts, and the Ochlockonee River and Lake Talquin currently serve as a major source for broodstock collections each year. In recent years it has been less common to observe fish larger than 20 pounds in this system. These larger, older fish are popular with the angling public and serve as an important source of eggs for the hatchery system, but they are more susceptible to warmer water temperatures and are also heavily targeted by anglers during certain times of the year. Now there is a question of whether this lack of older, larger fish is due to high fishing mortality, increasing water temperatures in thermal refuges, or a combination of both. In this talk I will discuss temperature and dissolved oxygen readings that we collected during the summer months in thermal refuges as well as preliminary results of an ongoing angler exploitation tagging study.

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Olfactory discrimination in juvenile bonefish (*Albula goreensis*) in response to food, predator, and habitat cues

Taxis and orientation within the environment via sensory signals is essential for survival throughout ontogeny. Bonefish *Albula* spp., fishes that are important to coastal recreational fishing throughout the Caribbean, are at their most vulnerable to predation as juveniles, and are physically limited in their ability to emigrate from sub-optimal environmental conditions at scales beyond their realized habitat. Therefore, the early onset ability to orient and move within suitable nursery habitat is critical to survival. Little is known about how juvenile bonefish use sensory systems like olfaction to find food, avoid predation, and locate suitable habitat. Understanding the role of olfactory discrimination, an organism's ability to differentiate scents and make decisions based upon those scents, is imperative to assessing how coastal anthropogenic activities could result in a population bottleneck and reduced recruitment, as

current bonefish stocks in South Florida are experiencing. We used a Y-maze decision experiment to determine if juvenile bonefish, *Albula goreensis*, use olfaction for locating food (commercial feed), avoiding predation (predator discharge), and finding suitable habitat (near-shore reef water). Olfactory cues of food and near-shore reef water significantly influenced juvenile bonefish movement, while the predator scent elicited a random response. These results suggest that olfactory cues and chemotaxis play an important role in juvenile bonefish movement and behavior, a process that may be susceptible to disruption through anthropogenic activities. (Funding provided by the Florida Institute of Technology).

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Estimating boat electrofishing catch rates for native and non-native freshwater fish species in south Florida

This project used a repeated measures analysis to estimate electrofishing catchability rates for native and non-native freshwater fish species in canals from two south Florida locations. At the Merritt canal in the Picayune Strand State Forest, southwest Florida, electrofishing catchability rates were estimated for two native and five non-native species, with rates ranging from 0.6 – 20.3%. At the L31-W canal along the border of Everglades National Park, southeast Florida, electrofishing catchability rates were estimated for two native and seven non-native species and ranged from 4.3 – 34.8%. Electrofishing catch per unit effort (CPUE) data is often used to make management decisions, and a better understanding of catchability rates will allow managers to make informed decisions with more accurate population density information. Species specific catchability/detectability rates will also help determine where electrofishing might be used as a tool for early detection and rapid response to new occurrences of non-native species.

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Domestication and feralization influence the distribution and phenotypes of escaped ornamental fish

Domestication has a dominant and increasing influence on the evolutionary trajectory of species, the extent of which may be influenced by advertent selection used to meet consumer demands of the ornamental trade. Ornamental species can have multiple varieties in trade, including those produced without advertent selection for color (i.e., inadvertent selection). Consumer demand for colorful varieties can have invasion consequences because demand is related to propagule pressure and color can exhibit fitness costs. However, domesticated varieties can also adapt to wild conditions through feralization, changing the phenotypes of feral populations. Our objective was to examine how domestication and feralization together influence the feral distribution and phenotypes of two highly domesticated, ornamental poeciliids. We first determined that colorful varieties exhibited higher trade availability and local production than the wild-type variety. Using a multi-year landscape-scale survey, we then determined that colorful varieties are common near sources of production but attenuated at increasing distance, replaced by the wild-type form. Wild-type varieties exhibited trait differences from ornamental varieties, which may affect fitness and result from feralization. Domestication to meet consumer demand influences feral distributions and phenotypes of escaped fish, but only in proximity to sources of production. Feralization influences relative capture rate of ornamental versus wild-type varieties, as well as the traits of captured fish. Thus, there may be a balance between propagule pressure, thought to increase with trade volume, and the pattern of domestication and feralization selection, which affects feral distribution and phenotypes.

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Spatial patterns of marine debris and relationship with nekton assemblages in Florida's estuarine waters

Marine debris in our waterways and oceans poses a threat to many organisms and ecosystems. Identifying areas of high concentration for marine litter and understanding their impacts on natural resources is key to informing future management and policy decisions.

We analyzed 25 years of fisheries-independent monitoring bycatch data to identify patterns of marine debris collection in several of Florida's major bays, estuaries, and rivers. Marine debris bycatch was greatest near urban areas, with the Hillsborough River (Tampa, FL) having the highest average man-made bycatch (0.89 L/100 m^2). Overall, marine debris concentrations were significantly greater in river systems than bays throughout Florida. To examine the potential impacts of marine debris on fish communities, a subset of fisheries-independent seine and trawl catch data were analyzed from selected rivers around Tampa Bay. Seine samples with man-made bycatch had a greater number of taxa, species richness, taxonomic diversity, and number of individuals than samples without man-made bycatch. Most taxa contributing to differences in the seine communities were more abundant in samples with marine debris, including economically important species like Common Snook. However, some economically important species like Red Drum and Spot were more abundant in samples without marine debris. Trawl samples with man-made bycatch also had a greater number of taxa, species

richness, and number of individuals than samples without man-made bycatch, although less pronounced. Sand Seatrout, Blue Crabs, and Pink Shrimp were more abundant in trawl samples containing man-made bycatch than in samples without. Benthic feeders such as Hogchoker, Southern Kingfish, and Lined Sole were more abundant in trawls without man-made bycatch. Our results suggest that both marine debris and diverse fish communities tend to co-occur in similar areas. These results demonstrate the benefits of long-term fisheries-independent monitoring data to provide insight into a variety of ancillary topics, such as marine debris.

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Increasing descender device usage may reduce recreational Red Snapper discard mortality

The proportion of regulatory discards in the recreational American Red Snapper (*Lutjanus campechanus*) fishery in the southeastern US has increased tremendously over the past several decades, sparking concern over the fate of these discarded fish. Recent biological studies suggest that descender devices provide a survival benefit for released Red Snapper. However, these devices are not yet widely used. Here we used discard mortality estimates derived from the literature combined with varying levels of hypothetical angler engagement to create estimates of depth-dependent Red Snapper discard mortality under several potential levels of descender use. We applied these estimates to discarded fish observed in the recreational hook-and-line fishery off the east coast of Florida. Observed Red Snapper discards were assigned to one of five release conditions (no impairment, descended, vented, impaired & descended, impaired & vented). We used these categories to calculate the proportional mortality of recreationally released Red Snapper at 10 m depth intervals. We estimated that total discard mortality was approximately 26.3 - 27.9% with no descender use, and approximately 20.7 - 21.8% with descenders being used in place of venting. Given these calculated differences in mortality, and the high magnitude of fish released every year, the South Atlantic Red Snapper fishery could see a substantial decrease in total release mortality if the practice of descending fish is widely adopted in the recreational fishery.

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Using hook and line gear to survey estuarine hard bottom fish communities

Hardbottom habitats (e.g., corals, sponges, limestone ledges, artificial reefs) are known to support diverse fish communities in offshore areas of the Gulf of Mexico, but less is known about these habitats that occur within estuaries. In this study, we tested the feasibility of using repetitive-timed-drop hook and line methods to survey fish communities associated with

estuarine hardbottom in Tampa Bay (2017-2019). Sixteen stations were randomly selected and sampled each season from three hardbottom habitats (8 natural, 5 artificial, 3 bridge). A total of 1,225 fish (6.4 individuals/station) from 44 taxa were caught. The most numerous species collected were Sand Perch (*Diplectrum formosum*, n = 293, 1.5 individuals/station), followed by White Grunt (*Haemulon plumierii*, n = 263, 1.4 individuals/station). Fish community structure varied by habitat (5.6% of variation explained), season (2.5%), and year (1.4%). Habitat differences were driven by high abundances of Sand Perch over natural hardbottom and high abundances of White Grunt over artificial hardbottom. Seasonal differences were driven by high abundances of White Grunt and Hardhead Catfish (*Ariopsis felis*) in summer and fall and by low abundances of Sand Perch in summer. Notable decreases in catch-per-unit-effort and species richness occurred in winter and spring 2019, following a red tide event that occurred in the sampling area. Community structure differences in 2019 were driven by lower abundances of Sand Perch and White Grunt and higher abundances of Hardhead Catfish and Black Seabass (*Centropristis striata*) than in other years. The hook and line sampling methods employed in this study were complementary to visual surveys using baited remote underwater video and provided a practical methodology for assessing hardbottom fish assemblages over time.

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Diet of a Dominant Mesopredatory Fish Family (Alepisauridae) in the Pelagic U.S. South Atlantic Bight

Lancetfishes (*Alepisaurus* spp.) are mesopelagic predators and common bycatch in commercial pelagic longline fisheries for tuna and swordfish. Despite being such common bycatch species, little is known about the biology, behavior, or trophic ecology of Lancetfishes. They may play important roles in nutrient cycling from the epipelagic to the mesopelagic and likely share many prey populations with commercially important epipelagic predators. Using stomach content analysis of fishes caught opportunistically as pelagic longline fishery bycatch in the U.S. South Atlantic Bight, this study describes and compares diet composition between species and size classes of Lancetfish. To date, 120 Longnose Lancetfish (*Alepisaurus ferox*) and Shortnose Lancetfish (*A. brevirostris*) stomachs have been examined. Only 8% of examined stomachs were completely empty, and most prey items were in a nearly undigested state. Common prey items have been fishes, including *Sternoptyx diaphana,* smaller Lancetfishes, *Omosudis lowii,* and representatives from the families Gempylidae, Paralepididae, and Trichiuridae; planktonic invertebrates like heteropods and salps, crustaceans such as *Phronima* sp., and *Platyscelus* sp. amphipods, and a variety of cephalopod species. Prey items also include juveniles of inshore tropical species such as acanthurids and pomacanthids, as well as an occurrence of a juvenile lionfish (*Pterois* sp.). Plastic and other anthropogenic debris have been found in many stomachs, and parasites have occurred in nearly every Lancetfish, with the most common taxa being nematodes and digeneans.

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Suwannee Bass Movement and Life-History in the Withlacoochee River, Georgia

The Suwannee bass is an obligate riverine species that is endemic to the SE United States and occupies one of the most limited ranges of all black basses, including three river systems in Georgia and six rivers in Florida. Most information regarding Suwannee bass is described from clear, spring-fed, calcareous streams in Florida, with scarce research available on Suwannee bass populations in Georgia. Prior research has indicated that presence of submerged aquatic vegetation could play a key role in nesting site selection, but Suwannee bass also occur in tannic, 'blackwater' streams with little-to-no aquatic vegetation. Basic information on life history of this fish - including movement and habitat selection - throughout the range is lacking and is essential for conservation measures. The objective of this study is to: (1) quantify sex-specific movement patterns, (2) identify home range, and (3) determine habitat associations. Telemetered Suwannee Bass (n=28) were tracked from February to September 2020. Distance, frequency, and trajectory of movement was highly variable among individuals. Male and female Suwannee bass were similar in mean total distance moved (7.28 vs. 6.71 km); however, the maximum distance moved was higher for males (28.5 vs. 18.9 km). Spawning occurred in late March in areas of flow refugia provided by limestone rock. Most Suwannee Bass locations were associated with large-diameter woody debris, deep pools downstream of shoals, and along steep limestone banks. These data are important for filling in critical knowledge gaps in Suwannee bass life history, providing fisheries managers necessary data for species conservation and management.

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Special Ops Fishing: Creating a High-demand, Limited-access Trophy Bass Fishery

During the joint DFFM/FWRI fisheries meeting that took place in Haines City, FL on January 21-24, 2018, a brainstorming session took place to develop ideas for future projects. One project idea was to create a high-demand, limited-access trophy bass fishery fulfilling New Opportunities Action Item No. 7 of the Black Bass Management Plan: "Develop a network of special-opportunity trophy bass fishing areas, on water bodies not currently open to the public." Blue Pond, located on Camp Blanding in Clay county, was identified as a resource of interest. Blue Pond has a similar bathymetry to Kingsley Lake, and supportive evidence that deep lakes can contribute to trophy bass production came from a recent study on Kingsley Lake. Being a small, deep lake with no current public access in a secluded, controlled setting on a military base rendered Blue Pond a unique and choice location for this fishery. The project

moved forward as a collaboration between DFFM and FWRI staff. Fishery data was lacking, and data collection commenced in June 2018 with the creation of bathymetric, SAV, and bottom hardness maps. Water quality data was collected from June 2018 through August 2019. Fall and spring electrofishing occurred from 2018 to 2020. Hook-and-line sampling targeting trophy bass (8+ lbs) supplemented electrofishing data in spring of 2020. Research and management staff discussed data collected, future data collection, and management options. A meeting with Camp Blanding staff took place on June 30, 2020 to propose the project and procure support. Ultimately, Camp Blanding was not open to the idea of granting public access to Blue Pond because of the pond's partial location within an impact zone and was in the process of reducing privately accessible areas of the pond. Nearby Magnolia Lake at Camp Blanding has become the new site for a revised project.

Zoom Meeting Room Full Details

Oral Presentations and Business Meeting

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