35th Annual Meeting of the

Florida Chapter of the

American Fisheries Society

February 17th – 19th, 2015

4-H Camp Ocala

Altoona, Florida

The Florida Chapter of the American Fisheries Society

Chapter Officers

President: Chris Bradshaw, FWC
President-Elect: Jennifer Rehage, FIU
Past-President: Travis Tuten, FWC
Secretary-Treasurer: Cheree Steward, FWC

Major Contributors for our Annual Meeting

Webmaster: Eric Sawyers, FWC
Newsletter Editor: Chris Wiley, FWC
Raffle Co-Chairs: Andy Strickland, FWC & Alan Collins, NOAA
Student Travel Awards: Chuck Cichra, UF
Roger Rottmann Memorial Scholarships: Chuck Cichra, UF
Rich Cailteux Award: Eric Nagid, FWC
Membership Database Manager: Larry Connor, FWC

Special thanks to

Symposium participants & all presenters

All moderators & judges

Derek DeYoung for donating his snook print for our shirts
http://www.derekdeyoung.com/

Program overview

Annual Meeting of the Florida Chapter American Fisheries Society

February 17-19, 2015

4-H Camp Ocala, Altoona, Florida

Tuesday, February 17th

11:00am – 6:00pm	Registration
12:00pm – 1:30pm	Lunch
1:30pm – 5:00pm	Contributed Papers 1 & 2
5:00pm – 7:00pm	Poster Setup
6:00pm – 7:00pm	Dinner
7:00pm – 8:00pm	**Formal Poster Session**
	Followed by BONFIRE SOCIAL

Wednesday, February 18th

7:30am – 8:30am	Breakfast
7:30am – 6:00pm	Registration
8:30am – 11:50pm	**Symposium: Fisheries-dependent vs. fisheries-independent approaches**
11:50pm – 12:00pm	Group picture
12:00pm – 1:00pm	Lunch
1:00pm – 2:25pm	**Symposium: Fisheries-dependent vs. fisheries-independent approaches**
2:40pm – 5:00pm	Contributed Papers 3
5:00pm – 6:00pm	Student Subunit Meeting (all students please attend)
6:00pm – 7:00pm	Dinner
7:00pm – 8:00pm	**Chapter Business Meeting & Award Presentations** (all please attend)
	Student Awards: *Travel and Roger Rottmann Scholarship*
	Professional Awards: *Rich Cailteux Award*
	Followed by the RAFFLE, AUCTION & BONFIRE SOCIAL

Thursday, February 19th

7:30am – 8:30am	Breakfast
7:30am – 9:00am	Registration
8:30am – 8:40am	Announcements
8:40am – 12:00pm	Contributed Papers 4 & 5
12:00pm – 1:00pm	**Lunch & Awards presentation:**
	Best Papers/Best Posters
	Power Tie
	Lampshade Awards

Day-By-Day Agenda – 35th Annual Meeting, 2015 - Florida Chapter American Fisheries Society

Tuesday, February 17th

11:00am – 6:00pm **Registration**
12:00pm – 1:30pm **Lunch**
1:30pm – 1:40pm **Welcome – Chris Bradshaw, Chapter President**

Contributed Papers 1 **Moderator:** Chris Bradshaw, FWC

1:40pm – *Lawson, K, QM Tuckett, JL Ritch & JE Hill. Distributions of select non-native fishes in west-central Florida: What's their status?

2:00pm – Yang, H. Application of germplasm preservation for aquaculture and restoration of molluscan shellfish resources restoration.

2:20pm – O'Connor, J, N Branson & J Knight. Implementing the State Species Action Plan for the imperiled cyprinid, *Notropis melanostomus*

2:40pm – Tuten, T, J Austin, J Hargrove, H Jelks, E Nagid, K Johnson & M Barrett. Phylogenetic status and divergence of Florida's Southern Tessellated Darter.

3:00pm - Break

Contributed Papers 2 **Moderator:** John Benton, FWC

3:20pm – Hill, JE, JL Ritch, LL Lawson & QM Tuckett. Biotic resistance to survival and recruitment of non-native fish in experimental ponds.

3:40pm – Gandy, D, R Hyle & J Holder. Density-dependence and recruitment of American Shad *Alosa sapidissima* in Florida's St. Johns River: Does spawning stock demographics explain young-of-year production?

4:00pm – *Boucek, RE & JS Rehage. Go without the flow: Preliminary evidence that snook increase movement with decreasing freshwater flow.

4:20pm – Schaefer, A, B Thompson, & M Allen. Discard mortality of Black Crappie *Pomoxis nigromaculatus* in Florida.

4:40pm – Freedman, JA, MJ Diana & DH Wahl. Macroinvertebrate assemblages differ in lakes with and without gizzard shad.

5:00pm – 7:00pm **Poster Setup**
6:00pm – 7:00pm **Dinner**
7:00pm – 8:00pm **Formal Poster Session** (Beverages and snacks in the poster area)
Followed by BONFIRE SOCIAL

*Student presentation, Presenter

Poster Session (7:00pm – 8:00pm)

(In alphabetical order by presenting author)

Casselberry GA, DM Bethea, JK Carlson, ER Hoffmayer, JM Hendon, JL Imhoff, RD Grubbs, CT Peterson & GH Burgess. Distribution and community structure of coastal batoids in the northeastern Gulf of Mexico**.**

*Crandall, C, K Lorenzen, M Monroe & J Dutka-Gianelli. Why participate? Understanding citizen science volunteer motivations.

*Flight, C, L Van Woudenberg, A Alvarez, M Tringali, W Szelistowski & P O'Donnell. Genetic structure of bonnethead sharks, *Sphyrna tiburo*, along Florida's Gulf Coast.

*Kroloff K, JS Rehage, J Heinen, RC Santos & RE Boucek. Where are all the bonefish? Integrating angler perspectives and ecological changes influencing bonefish declines in the Florida Bay.

*Lee, JA & JS Rehage. Drying times: survival of Florida Largemouth Bass in a coastal refuge habitat during seasonal drying.

*Pappas, M, K Riley, & J Morris. Comparison of fish otolith marking techniques to aid in age validation.

*Partridge, L & JE Hill. Preliminary results from a parasite survey of the non-native fish, *Belonesox belizanus* (Poeciliidae) in Tampa Bay.

*Rubio, V & K Work. The effects of nutrient cycling by the exotic catfish, *Pterygoplichthys disjunctivus*, on algal growth in a central Florida spring.

Strickland, A, C Middaugh, T Alfermann & P Nguyen. Estimating largemouth bass exploitation rate across northwest Florida lakes and rivers using high reward tags.

Vecchio, J. Researchers' trash is an educator's treasure: Field specimens as educational tools

*Workman, S, K Work, M Gibbs & J Freedman. Variation in the Blue Spring food web as determined by stable isotope analysis.

*Student presentation, Presenter

Day-By-Day Agenda - 35th Annual Meeting - Florida Chapter American Fisheries Society

Wednesday, February 18th, 2015
7:30am – 8:30am **Breakfast**
7:30am – 6:00pm **Registration**

8:30am – 8:35am **Welcome – J.S. Rehage, Chapter President-Elect, Program Chair**

Symposium: ***Fisheries-dependent vs. fisheries-independent: common ground, dissimilarities and insights gained***

Moderator: JS Rehage, FIU

8:35am – Allen, MS & E Camp. The need for empirical estimates of fishing effort dynamics in recreational fisheries.

8:55am – Dutterer, D. Understanding trophy-bass fisheries across the Florida landscape.

9:15am – Lombardi, L. Federal assessments: the use of the best, available data.

9:35am – *Skaggs, J, MS Allen, R Ahrens & T Tuten. Assessing inland recreational fisheries using catch-at-age methods.

9:55am – Break

Symposium: Fisheries-dependent vs. fisheries-independent (continued)

Moderator: JS Rehage, FIU

10:10am – Stallings, C, T Switzer, B Winner, C Purtlebaugh, R McMichael Jr & K Wall. Combining fishery-independent and fishery-dependent methods: a pilot study on a hybrid approach to sampling reef fishes.

10:30am – Hyle, R. Evaluating a fishery dependent restoration target for American shad in Florida's St. John River: Can angler catch per unit effort really be used as a proxy for abundance?

10:50am – *Ducharme-Barth, N. Classifying VMS data in Gulf of Mexico reef fisheries: model selection and evaluation.

11:10am – Thompson, B & S Bisping. Utilizing independent and dependent data to evaluate fish attractors in Lake Griffin, Florida.

11:30pm – *Olson, E. Evaluating the accuracy of data-poor stock assessment methods in the southeast United States.

11:50pm – Group picture (please wear shirts!)
12:00pm – 1:00 Lunch

*Student presentation, Presenter

Symposium: Fisheries-dependent vs. fisheries-independent (continued)

Moderator: Drew Dutterer, FWC

1:00pm – Heagey, B, & C Bradshaw. Calling names: When in Rome do you speak Latin?

1:30pm – Wilson, KL, *BG Matthias, AB Barbour, RNM Ahrens, T Tuten & MS Allen. Combining samples from multiple gears helps avoid fishy growth curves.

1:50pm – Struve, J, K Lorenzen, J Dutka-Gianelli & C Crandall. Spatial patterns of snook catch rates derived from fisheries dependent surveys, fisheries independent monitoring, and voluntary catch records from the iAngler data base.

2:10pm – Symposium wrap up (additional questions, discussion)

2:25 – Break

Contributed Papers 3 **Moderator:** L Lombardi, NOAA

2:40pm – Crawford, S. Reflections of an old fish head.

3:00pm – *Crandall, C, K Lorenzen, J Struve & J Dutka-Gianelli. Helplessness, hope and reasonable people: understanding angler feelings toward management.

3:20pm – *Hansen, NR & DW Kerstetter. Habitat utilization and vertical distribution of the great barracuda *Sphyraena barracuda* (Edwards 1771) in the western North Atlantic Ocean.

3:40pm – Thompson, BC & MS Allen. Simulating population level impacts of fishing spawning largemouth bass using empirical data from Lake Eustis, Florida

4:00pm – Trippel, N, J Hargrove, W Porak & E Leone. Impacts of angling for nesting Florida bass, *Micropterus floridanus*, on nest success and recruitment

4:20pm – Wegener, MG & B Barthel. Genetic composition of largemouth bass in coastal rivers of northwest Florida.

4:40pm – Tuckett, QM, JL Ritch, KM Lawson & JE Hill. Best management practices and escapement of non-native fish from aquaculture facilities in Florida.

5:00pm – 6:00pm **Student Subunit Meeting** (all students please attend)
6:00pm – 7:00pm **Dinner**
7:00pm – 8:00pm **Chapter Business Meeting & Awards** – everyone please attend!
Student Awards (*Travel and Roger Rottmann Scholarship*)
Professional Awards (*Rich Cailteux)*
Followed by RAFFLE, AUCTION & bonfire social

*Student presentation, Presenter

Day-By-Day Agenda – 35th Annual Meeting, 2015 - Florida Chapter American Fisheries Society

Thursday, February 19th

7:30am – 8:30am **Breakfast**
7:30am – 9:00am **Registration**
8:30am – 8:40am **Announcements**

Contributed Papers 4 **Moderator:** Jonathan Freedman, UF/INHS

8:40am – Deacy, BM, A Mathers, DM Bethea & JK Carlson. A reanalysis of the age and growth of lemon shark, *Negaprion brevirostris,* in the western North Atlantic with implications for population growth.

9:00am – Benton, J. Lake Eustis Pupfish - current status and plans for monitoring the species in the future.

9:20am – Alfermann, T & A Strickland. Comparison of backpack electrofishers and an electric seine for sampling shoal habitat in the Chipola River, FL.

9:40am – *G Hill, JS Rehage. Passive antenna systems: Tracking fish movement at the top and bottom of America.

10:00am – Break

Contributed Papers 5 **Moderator:** Chris Stallings, USF

10:20am – Harriger, K, J Knight & M Wegener. Population status of Harlequin Darters *Etheostoma histrio* in the Escambia River watershed, Florida.

10:40am – *Barker, BD, AZ Horodysky, & DW Kerstetter. Thermal preferences and critical temperatures of invasive lionfish complex (*Pterois volitans/P. miles*).

11:00am – Branson, N & J O'Connor. Exploratory sampling of the saltmarsh topminnow *Fundulus jenkinsi* in northwest Florida.

11:20pm – Anderson, C, T Lange & G DelPizzo. Effects of dissolved oxygen regimes on fish community composition in littoral zone habitats of Florida lakes.

11:40am – JL Ritch, QM Tuckett, L Partridge & JE Hill. Pike killifish facilitate local persistence of non-native green swordtails.

12:00pm – 1:00pm **Lunch & Awards Presentation**
Jack Dequine Best Student Paper
Best Professional Oral Presentation
Best Poster Presentation – Student & Professional
Power Tie & Lampshade awards

*Student presentation, Presenter

Abstracts for the 35th Annual Meeting of the Florida Chapter of the American Fisheries Society

Allen, MS & EV Camp
Symposium presentation
Fisheries and Aquatic Sciences, University of Florida, Gainesville, FL 32653
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Need for Empirical Estimates of Fishing Effort Dynamics in Recreational Fisheries

Substantial evidence now shows that recruitment overfishing can occur via recreational fisheries. However, the risk of overfishing is strongly influenced by recreational angler effort dynamics. Fisheries where fishing effort remains high regardless of stock abundance create a high risk of overfishing, whereas systems where anglers respond to reductions in fish abundance by directing effort to other systems allows self-regulation. Surprisingly, there are very few evaluations of how angler effort responds to changes in fishing quality and fish abundance, despite substantial effort on fisheries dependent creel surveys. Here, we outline critical research needs and identify experimental designs that could be used to improve our understanding of fishing effort dynamics in recreational fisheries. Results of this study could be used to improve future management of recreational fisheries, and may substantially contribute to predicting where and when overfishing is likely to occur.

Anderson, C, T Lange & G DelPizzo
Contributed oral presentation
Florida Fish and Wildlife Conservation Commission, Fish and Wildlife Research Institute, Eustis Fisheries Research Laboratory, Eustis, Florida 32726
christopher.anderson@myfwc.com

Effects of dissolved oxygen regimes on fish community composition in littoral zone habitats of Florida lakes

Dissolved oxygen (DO) logging probes were deployed with mini-fyke nets (MFN) as part of long term fish monitoring during the summer months of 2013 and 2014. Paired probe-MFN sets (n=164) were randomly placed throughout littoral zone habitats (depth <0.6m) in 24 Florida lakes. The goal was to determine if variations in diel DO regimes affect fish community composition/similarity. Variation in diel DO regimes was quantified using the number of probe readings (15-minute intervals) with DO under 2 mg/L to calculate the duration of time (in hours) each probe-MFN set experienced hypoxic conditions (i.e., DO < 2 mg/L). Each probe-MFN set was placed into one of five groups (D1-D5) based on the duration of DO under 2 mg/L. The ranges of hypoxia duration for each group are as follows: D1=0 hours, D2=0.25-3.75 hours, D3=4-12 hours, D4=12.5-19 hours, D5=19.75-23.25 hours. Percent similarity index (PSI) and Jaccard's similarity index (JSI) were used to determine fish community similarity between MFN sets with no hypoxia (D1) and sets that experienced any duration of hypoxia (D2-5) as well as among duration groups D2-D5. Community composition was considered similar if values for both PSI and JSI were at least 80. D1 versus D2-5 had PSI=29% and JSI=65%. For groups D2 through D5, PSI ranged from 61% to 79% and JSI ranged from 59% to 73%. In terms of relative abundance and species richness, the

values for PSI and JSI indicate that different diel DO regimes can affect littoral zone fish community composition. However, results are preliminary and additional probe-MFN samples will be collected. Findings suggest the importance of maintaining a diverse array of littoral zone habitat types, regardless of perceived quality, if fish community diversity in these habitats is sought to be managed for in Florida lakes.

Alfermann, T & A Strickland
Contributed oral presentation
Florida Fish and Wildlife Conservation Commission, Fish and Wildlife Research Institute, Quincy, FL 32351, USA
Ted.Alfermann@myFWC.com

Comparison of backpack electrofishers and an electric seine for sampling shoal habitat in the Chipola River, FL

Long-term monitoring of lakes and rivers is important for understanding changes that occur to aquatic populations over time. Detecting and explaining trends is only possible if data are collected in a consistent and statistically sound manner. Prior to full implementation of a long-term monitoring program on the Chipola River, a pilot study was needed to determine how to best sample unique shoal habitat within the river. Shoal habitat is relatively shallow (< 1m), with rock substrate and rock outcroppings making boat electrofishing impossible. Thus, we compared the fish catching capabilities and sampling efficiency of two alternate gears: backpack electrofishers and an electric seine. We compared the gears by collecting 25 random samples with each gear over four shoal habitats from Aug. 28 to Oct. 3, 2014. Samples were 4 meters (m) wide by 5 m long and enclosed on the sides and downstream portion with a blocknet. The number of samples per shoal per gear was kept as even as possible given crew availability, time, and sampling area constraints. Environmental variables such as depth, surface current velocity, aquatic vegetation percent coverage, and substrate percent coverage were recorded for each sample. Five crew members were required for electric seine samples and four were required for backpack samples. Backpack electrofishers collected 1,155 fish representing 21 species, while the electric seine collected 1,036 fish representing 22 species. Fish assemblage descriptors such as Shannon's diversity, Pielou's evenness, and Simpson's dominance were similar between gears. Statistical comparison between the gears will guide future methods and protocol for sampling shoal habitats of this unique Florida river.

***Barker, BD[1], AZ Horodysky[2], & DW Kerstetter[1]**
Contributed oral presentation
[1]Nova Southeastern University Oceanographic Center, Dania Beach, FL 33004
[2]Department of Marine and Environmental Science, Hampton University, Hampton, VA 23668
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Thermal preferences and critical temperatures of invasive lionfish complex (*Pterois volitans/P. miles*)

Acute temperature preference and thermal limits were determined for locally captured, juvenile lionfish at four different acclimation temperatures (13°C, 20°C, 25 °C and 32°C). Temperature preferences were evaluated using an automated shuttlebox system that presents temperature stimuli in a subject-driven fashion. Subjects control the temperature with their movement throughout the tank. Acute preference was calculated as the mean temperature that the fish occupied during the first two hours of dynamic experimentation. Critical thermal methodology was used to determine the CTmin and CTmax of the lionfish with loss of equilibrium (LOE) as the endpoint. It is assumed that beyond this temperature, the fish would be unable to survive. Temperature was increased or decreased by 0.33°C per minute until the end point was reached. Thermal tolerance polygons provide a visual representation to the lower and upper thermal avoidance temperatures of the invasive lionfish, delineating the thermal range of the species. Their CTmin and CTmax (acclimated to 25°C) were compared experimentally to two other Florida reef fish (*Cephalopholis cruentata* and *Lutjanus apodus*). Acute preference data can be used to estimate final preferendum. This analysis has shown a final preferendum around 27-28°C, but no significant difference of acute preferences between acclimation temperatures. Final preferendum is shown to correlate well with optimal temperatures for growth, metabolic rate, digestions, etc. Thermal tolerance describes the range of temperature in which lionfish can survive. The thermal tolerance polygon shows a strong correlation between CTM and acclimation temperature, with the highest CTmax at 39.5°C and the lowest CTmin at 9.5°C. Additionally, at 25°C, lionfish have a smaller tolerance range compared to schoolmaster and graysby.

Benton, J
Contributed oral presentation
Florida Fish and Wildlife Conservation Commission, Eustis Research Lab, Eustis, FL 32726
john.benton@myfwc.com

Lake Eustis Pupfish - current status and plans for monitoring the species in the future

The Lake Eustis Pupfish (*Cyprinodon variegatus hubbsi*) is classified as a Species of Special Concern by the FWC, as it exists in only eight lakes in central Florida (Beauclair, Carlton, Dora, Harris, Eustis, Griffin, Yale, and Weir). The subspecies was recommended for delisting by a Biological Review Committee, as it did not meet International Union for the Conservation of Nature criteria for a Threatened or Endangered species. A Species Action Plan (SAP) for the Lake Eustis Pupfish is included in the FWC's Imperiled Species Management Plan currently under review. The goal of the SAP is preventing the decline of Lake Eustis Pupfish populations to levels requiring listing. This calls for a monitoring plan and establishing population benchmarks for occupied water bodies. The Lake Eustis Pupfish is known to inhabit sandy beach areas with gentle slope and relatively devoid of aquatic vegetation. There has been no comprehensive survey to investigate other habitats the species may occupy. We mapped the shoreline in all known occupied lakes and classified sediment types in a GIS system, then used that map to allocate and collect 196 random electrofishing samples within these occupied water bodies. We verified the continued existence of the species in all historically occupied lakes and evaluated several methods of capture (seine, Breder trap, mini-fyke net, and electrofishing). We also investigated potential presence of Lake Eustis pupfish in water bodies associated with or in proximity to occupied water bodies using both seines and barge mounted electrofishing, but found none. Lake

Eustis Pupfish were captured exclusively in areas virtually clear of vegetation, having sandy substrates, and never collected in areas of flocculent sediment or heavily vegetated sandy habitats. Barge mounted electrofishing was selected as the most practical method for monitoring.

Thompson, B & S Bisping
Symposium presentation
Florida Fish and Wildlife Conservation Commission, Eustis Research Lab, Eustis, FL 32726
Scott.Bisping@myfwc.com

Utilizing independent and dependent data to evaluate fish attractors in Lake Griffin, Florida

Installing brush fish attractors in freshwater lakes is a common management strategy used by fish and wildlife agencies to concentrate fish and increase angler catch rates. In Florida, warm productive water quickly breaks down even hardwood tree species and frequent refurbishing or replacement of woody structure is necessary to maintain high angler catch rates. Mossback® plastic fish attractors that have recently become commercially available appear to have similar habitat complexity as brush with the added benefit of longevity. In this study, our objective was to determine which treatment of fish attractor (density and material type) concentrates the highest abundance of sport fish. We deployed three treatments of ¼-acre fish attractors in Lake Griffin, which included brush attractors with 50 or 100 units and plastic attractors with 100 units. Six of each treatment was deployed in a randomized block design in six different areas of the lake. Our evaluation included independent (electrofishing and hook-and-line) and dependent (creel survey and angler diary) data to compare how material type and density concentrate fish and influence angler catch rates. Throughout the roving creel survey, limited angler interviews on the attractors prohibited comparison between treatments. Our angler diary was completed by a former professional bass angler and showed higher catch rates for largemouth bass on plastic attractors compared to brush. A similar trend was observed in our project's weekly, independent hook-and-line sampling where biologists caught more bass while fishing plastic attractors during 17 of the 24 trips. However, electrofishing surveys showed similar relative abundance of bass between brush attractors with 100 units and plastic. The first year of data indicates that plastic and brush concentrates similar numbers, but bass may be more vulnerable to angling on plastic attractors. This evaluation will continue on all fish attractors for two more years to determine if abundance and angler catch rates decline as brush decomposes. We will provide a discussion of the advantages and disadvantages of using fishery dependent and independent data for evaluating fish attractors in a freshwater lake.

***Boucek, RE & JS Rehage**
Contributed oral presentation
Florida International University, Miami, FL, 33199
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Go without the flow: Preliminary evidence that snook increase movement with decreasing freshwater flow

Natural variation in freshwater flowing from rivers has been consistently linked to estuarine fisheries production, yet underlying mechanisms between these relationships remain poorly understood. One such way the delivery of freshwater flows to estuarine systems may influence the productivity of a fishery is by altering fish behaviors (i.e. foraging tactics, distribution, etc.), which in turn changes the catchability of the exploited stock. In the coastal rivers of the Florida Everglades, common snook (*Centropomus undecimalis*) are an important recreationally sought after fish, yet relationships between snook behaviors and freshwater flows are unknown. The purpose of this study was to test whether snook change their short term movement behaviors with changes in flow. From December 2012 to December 2013, we tracked the movements of 20 snook inhabiting the oligohaline reaches of the Shark River using the Florida Coastal Everglades LTER acoustic telemetry array. We calculated the average daily upstream downstream distance individual snook moved and correlated those average movements to river stage with linear regressions. Our results showed that the daily distance snook moved tracked river stage well (r2 = 0.66), such that as river flow decreased, snook moved more. At high river stage, snook daily movement distances could not be detected with the array (<.5 KM moved per day), however at low stage, average snook upstream downstream daily movements increased to 4 KM per day. Though the underlying mechanism behind this relationship is unclear, we speculate that it may be related to snook foraging behaviors. Such that at high flows, snook adopt a sit and wait foraging strategy, and at low flows become more of a cruising forager. With forecasted decreases in rainfall and sea-level rise, it is likely that freshwater flow rates will decrease, potentially altering snook behaviors thus their catchability, which may affect the value of the fishery.

Branson, N & J O'Connor
Contributed oral presentation
Florida Fish and Wildlife Conservation Commission, Holt, FL
Neil.Branson@MyFWC.com

Exploratory sampling of the saltmarsh topminnow *Fundulus jenkinsi in* northwest Florida

The Saltmarsh Topminnow *Fundulus jenkinsi* is a small bodied fish that occurs in vegetated saltmarsh habitats throughout the northern Gulf of Mexico. Accounts extend from Texas to the Pensacola/Escambia Bay of Florida, however surprisingly little is known about their abundance and habitat requirements. The designation of this minnow as Threatened on the State level has prompted the development of a Species Action Plan (SAP) to better aide with conservation efforts. In accordance with the objectives of this SAP, we conducted preliminary, qualitative sampling within the Perdido, Escambia, and Blackwater bay systems from 8/20/2014 to 1/12/2015. Historic locations were acquired from the FWC database and potential sites were identified in the field. Thirty-two unique locations were sampled for Saltmarsh Topminnows using multiple gear types, and physical habitat characteristics were recorded at each location. Breder traps, Gee minnow traps, fyke nets, seine pulls, and active dipnetting were all employed in an attempt to determine presence/absence and an effective method of collection. During this time, 402 Saltmarsh Topminnows were collected at 15 sample locations (4 historic and 11 new). A standardized, quantitative approach is currently being developed to better understand population sizes and our efforts will be extended east to the Choctawhatchee and Apalachicola systems.

Casselberry GA[1], DM Bethea[2], JK Carlson[2], ER Hoffmayer[3], JM Hendon[4], JL Imhoff[5], RD Grubbs[5], CT Peterson[5] & GH Burgess[6]
Poster presentation
[1]Riverside Technology, Inc., Southeast Fisheries Science Center, Panama City Laboratory, Panama City, FL 32408
[2]NOAA National Marine Fisheries Service, Southeast Fisheries Science Center, Panama City Laboratory, Panama City, FL 32408
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[4]The University of Southern Mississippi, Gulf Coast Research Laboratory, Ocean Springs, MS 39564
[5]Florida State University, Coastal Marine Laboratory, St. Teresa, FL 32358
[6]The University of Florida, Florida Museum of Natural History, Gainesville, FL, 32611
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Distribution and community structure of coastal batoids in the northeastern Gulf of Mexico

The distribution and community structure of coastal batoids in the northeastern Gulf of Mexico were examined across seven geographic regions using data from fishery independent gillnet surveys from 2003-2011. A total of 762 batoids were captured from 13 different species and seven different families. Adults comprised 53.7% of the animals caught, whereas juveniles and young-of-the-year comprised 25.7% and 20.6%, respectively. Of the 13 species, cownose rays (*Rhinoptera bonasus*), smooth butterfly rays (*Gymnura micrura*), and southern stingrays (*Dasyatis americana*) were the three most abundant species. Cownose rays and southern stingrays were captured in six of the seven sampling regions, whereas smooth butterfly rays were caught in five of the seven sampling regions. Many species (e.g., spotted eagle rays, *Aetobatus narinari*, giant manta rays, *Manta birostris*, devil rays *Mobula hypostoma*, clearnose skates, *Raja eglanteria*, roundel skates, *R. texana*, Atlantic guitarfish, Rhinobatos lentiginosus, and Brazilian cownose rays, *R. brasiliensis*) were caught in only one or two sampling regions. Size of the animals varied significantly by both region and species. Species diversity and evenness varied by geographic area but both indices were highest in the easternmost sampling region, between Cedar Key and Anclote Key, Florida. Globally, batoid community assemblages are studied infrequently, and this study provides the first examination of coastal batoid community structure over such a broad geographic area in the northeastern Gulf of Mexico.

***Crandall, C[1,2], K Lorenzen[1], M Monroe[1] & J Dutka-Gianelli[1]**
Poster presentation
[1]School of Forest Resources and Conservation, University of Florida, Gainesville, FL 32653
[2]School of Natural Resources and Conservation, University of Florida, Gainesville, FL 32611
kicksea@ufl.edu

Why participate? Understanding citizen science volunteer motivations

Volunteer angler data programs constitute a citizen science effort in which anglers voluntarily record and submit data on their individual fishing experiences. There are many benefits to utilizing volunteer data, such as a relatively lower cost, reduction in angler recall error, and the potential to increase feelings of resource stewardship through stakeholder engagement.

However, the literature identifies small and declining participant pools as one difficulty associated with volunteer angler data programs. Such issues are not unique to fisheries data collection, and recruiting and maintaining participants is a frequently cited difficulty across citizen science projects. Understanding what motivates people to participate is an important first step in addressing concerns about declining participation. For this reason, authors have looked to several behavior models to capture what motivates people to participate in citizen science. This study reviews and synthesizes the current literature on citizen science participants' motivations, with the addition of literature examining motivations for similar volunteer efforts, such as Wikipedia. Results are then synthesized into a general understanding of volunteer motivations and a framework for understanding participant typologies. These results are currently being used to create a survey for use with volunteer angler data participants to understand which motivations are most important in this context and to explore how fisheries volunteer motivations may differ from other citizen science projects.

***Crandall, C[1,2], K Lorenzen[1], J Struve[1] & J Dutka-Gianelli[1]**
Contributed oral presentation
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[2]School of Natural Resources and Conservation, University of Florida, Gainesville, FL 32611
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Helplessness, hope and reasonable people: understanding angler feelings toward management
The Reasonable Person Model posits that people behave in a "reasonable" manner when their environment enables them to build understanding, act effectively on that understanding, and participate in a meaningful way. This includes both feeling hopeful that one's actions will have an impact and not feeling helpless to affect change. Pilot interviews suggest that some Florida fisheries stakeholders feel powerless to influence management decisions, indicating that they do not currently perceive avenues for meaningful action in the decision-making process and may feel helpless and hopeless with regards to the management process, resulting in feelings of frustration. This study is part of a larger project exploring ways to facilitate cooperative place-based governance of Florida's marine recreational fisheries through the creation of local fisheries forums. These forums provide novel ways for stakeholders to engage with the fisheries management process. It is hypothesized that fisheries forums will decrease feelings of helplessness and hopelessness, which will be linked to an increase in satisfaction with the management process and declines in frustration. To test this hypothesis, a pre-survey was distributed via email to randomly selected anglers in two study areas (Charlotte Harbor and Sarasota Bay) and two control areas (Pinellas and Collier Counties) during summer 2014. A total of 826 individuals completed the survey. The majority of respondents were white (96%) males (84%) who typically fish from a boat (83%) in inshore/coastal marine habitat (92%), with a mean age of 49. Mean satisfaction with management was 2.96 (on a scale of 5). Helplessness and hopelessness were each significantly negatively correlated with satisfaction with management ($r = -0.5$ and -0.549 respectively). The survey will be repeated in 2016 in each area to test whether the fisheries forum interventions will be associated with changes in helplessness, hopelessness, and satisfaction.

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Reflections of an old fish head

As my 39-year career as a state fisheries biologist comes to a close, I have evaluated what I have learned and what I can pass along to young biologists. Contemporary academia has greatly improved the biological and statistical aptitude of graduates. So instead, I want to offer practical advice that is seldom taught in a classroom. There are key attitudes that fish biologists need to be successful. There are important activities that can grow a career and improve the science. There are several approaches that may need to be adjusted to keep balanced. My hope is that the profession continues to learn from the past as it grows to fit the ever changing needs of the future.

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A reanalysis of the age and growth of lemon shark, *Negaprion brevirostris*, in the western North Atlantic with implications for population growth

Age and growth information is often used for determination of natural mortality, longevity and, ultimately, calculation of other vital rates used in demographic models. The only age and growth study for lemon shark indicates slow growth and late maturation which when input into a demographic model suggests lemon shark possess low productivity that ultimately would increase their risk for overexploitation. Current and accurate information on life history is essential to predict the productivity of the population and ensure that they are harvested at sustainable levels. A revised age and growth model of lemon shark (n=87; 51–251 cm fork length) were estimated from ring counts on vertebral sections collected from fishery-dependent and -independent surveys. The von Bertalanffy growth model (VBGM) was fit to observed and back-calculated size at age data. The VBGM predicted a theoretical maximum size (L_∞) of 229.2 cm FL, a growth coefficient (k) of 0.16 year-1 and a theoretical age at zero length (to) of –1.98 years. The back-calculated model was similar to the observed model. When comparing our model estimates to previously published information, our VBGM predicted a significantly lower theoretical maximum size and a higher growth coefficient than those produced using data collected during the 1980s. Implications of these revised age and growth estimates for demography of the population, management and, conservation of lemon shark will be discussed.

***Ducharme-Barth, N**
Symposium presentation

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Classifying VMS Data in Gulf of Mexico Reef Fisheries: Model Selection and Evaluation

Spatial information can be used to understand and correct potential biases in fisheries dependent data. Vessel Monitoring Systems (VMS) are an important source of information for spatial fishing effort. Growth of VMS data comes with increasing need for analysis and classification. Work has been done within the European Union to develop methods for categorizing VMS data as fishing or non-fishing, especially for trawl fisheries. Knowledge gaps exist in the literature for classifying VMS data for vertical line fisheries. This project fills the existing knowledge gap by evaluating the best way to classify VMS data for a vertical line fishery. Vessels holding a Gulf of Mexico Reef Fish Permit have been required to have active VMS since 2007. Coinciding with this dataset is the Reef Fish Observer Program covering roughly 5-10% of total trips. Most of the literature detail simple cut off rules such as vessel speed and heading for classifying VMS data, this project assesses the performance of models fit to data points for which there exists observer coverage and then projected to the remaining unobserved data. Two models are compared: a Random Forest and Generalized Additive Model (GAM). These models were selected for their ability to handle non-linear relationships between the variables assigned to each VMS point (speed, depth, latitude, longitude, heading, distance from shore, etc.). These models are evaluated on their ability to correctly identify fishing points and avoid assigning fishing status to non-fishing points based on the observer data. Given the volume of VMS data (2 million entries a year in the Gulf of Mexico) processing this data becomes a significant computational challenge. It is critical to identify a model capable of accurately handling non-linear relationships in the data in a computationally efficient manner, where the best model is a tradeoff between accuracy and resource use.

Dutterer, D
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Understanding trophy-bass fisheries across the Florida landscape

Florida bass fisheries have high recreational, economical, and social value, and trophy-size bass contribute a large part of the identity and draw of these fisheries. In adopting the state's comprehensive Black Bass Management Plan in 2011, the Florida Fish and Wildlife Conservation Commission (FWC) emphasized a commitment to research and management practices that enhance opportunities for angler catch of these rare and valuable fish. The resulting resurgence in trophy-bass research has been based on a unique blend of fisheries-dependant and -independent data sources. FWC's primary mechanism for monitoring largemouth bass populations is the freshwater fisheries Long-Term Monitoring (LTM) program, which relies heavily on seasonal standardized electrofishing surveys at key waterbodies across the state, but the LTM program samples only 100–200 trophy bass annually. To overcome data limitations incurred with these rare individuals, the FWC has leveraged the strength in numbers of Florida's bass anglers through a citizen-science program—*TrophyCatch*. Among several functions, it

documents catches of trophy bass (≥8 lbs), building a database of where and when these catches occur to aid in long-term and landscape-level analyses. In tandem with TrophyCatch, the FWC has used LTM sampling to tag trophy bass. Besides measuring important fishery parameters such as catch, exploitation, and release rates, the tagging study provides a mechanism to ground-truth the fisheries-dependant data of *TrophyCatch*. In particular, the tagging study allows us to measure the fraction of trophy bass that get caught and documented with *TrophyCatch*, which in turn allows us to make predictions about state-wide catch and abundance. In likewise fashion, *TrophyCatch* data can provide valuable insight into design and spatial coverage of the tagging study and LTM program. In this coupling of data sources, not only does each program firmly stand on its own, but in combination they generate results that neither could produce on its own.

***Flight, C[1], L Van Woudenberg[2], A Alvarez[3], M Tringali[3], W Szelistowski[1] & P O'Donnell[4]**
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Genetic structure of bonnethead sharks, *Sphyrna tiburo*, along Florida's Gulf Coast

Highly mobile shark species are often characterized by a relatively homogenous population structure while more sedentary species or those exhibiting philopatry can be exceptions to this pattern. The bonnethead shark, *Sphyrna tiburo*, is a coastal member of the hammerhead shark family that has been shown to exhibit life history differences at various locations along the Gulf coast of Florida (Florida panhandle, Tampa Bay, and Florida Bay) such as growth rate, age, size at maturity, and fecundity. These differences may be due to evolved adaptations to different conditions at each site made possible by site-fidelity and a lack of migration that could result in contact with sharks from other locations. If true, then it should be possible to detect genetic variations along the Gulf coast. The aim of this study is to compare population structure of bonnethead sharks within this region of Florida. We are examining genotypic and allelic differences in 11 microsatellite DNA loci, and in control region sequences of sharks from the Apalachicola region, Tampa Bay, and Rookery Bay. To date, no significant population structure has been detected between the Apalachicola and Tampa Bay regions based on microsatellite DNA. Additional microsatellite samples from Rookery Bay will be incorporated into future analyses along with control region sequences from all sample sites. A lack of genetic population structure would suggest that life history differences along the Gulf coast may be a phenotypically plastic response to varied environmental conditions rather than evolved adaptations.

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Macroinvertebrate assemblages differ in lakes with and without gizzard shad

Gizzard shad *Dorosoma cepedianum* are a common omnivorous species that comprise significant biomass in lakes and reservoirs throughout the U.S. By feeding on detritus, they can alter environmental conditions by increasing sedimentation and nutrient cycling in the water column, and their effects on zooplankton have been well-documented. To examine the effects of gizzard shad on benthic macroinvertebrates, we sampled 28 lakes in Illinois over a 13 year period (204 lake-years): 13 lakes with and 13 without gizzard shad, and two lakes in which gizzard shad became established during the study period. Secchi depths were lower whereas chlorophyll a concentrations were higher in lakes with gizzard shad. Macroinvertebrate taxa differed in their response to gizzard shad: some taxa (including Hirudinea, Hydracarina, Megaloptera, and Tabanidae) were present in lower densities in lakes with gizzard shad whereas others (such as Chironomidae, Trichoptera, and Ephemeroptera) were not different. No taxa were more abundant in lakes with gizzard shad, and there were no differences in overall macroinvertebrate density. Whereas adult gizzard shad may consume macroinvertebrates incidentally while feeding on detritus, lower macroinvertebrate densities are likely associated with environmental changes mediated by gizzard shad.

Gandy, D[1], R Hyle[2] & J Holder[1]

Contributed oral presentation

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Density-dependence and recruitment of American Shad *Alosa sapidissima* in Florida's St. Johns River: Does spawning stock demographics explain young-of-year production?

Title: Density dependence and recruitment of American Shad *Alosa sapidissi*ma in Florida's St. Johns River: Does spawning stock demographics explain young-of-year production?

Abstract: A key aspect concerning fisheries management and conservation is understanding the mechanisms influencing the reproductive potential of fish populations. Although stock-recruit relationships have been applied extensively to fisheries management decision aimed at minimizing the risk of overfishing, their relationships are invariably messy and generally lack the ability to accurately forecast year-class strength with precision. Parental stock demographics may be an important density-dependent factor regulating recruitment variability. In this study, we focused on American Shad Alosa sapidissima in Florida's St. Johns River to understand the relative importance of how temporal variability in the age and gender structure of the parental stock influences young-of -year production. Our specific objectives are as follows: 1) Examine temporal patterns in the age and gender structure of adult American Shad in the St. Johns River, Florida, and 2) Determine how young-of-year production may be affected in relation to the spawning stock age and gender structure. Pearson's Chi-square goodness of fit test indicated statistically significant differences in American Shad estimated catch-at-age distributions among gender,

year, and gender within year. Using an Aikaike's information criterion model selection approach, we found that models that included only age-4 spawners for both males and females greatly improved our predictive power at explaining the year-class strength of age-0 cohorts. Our results have improved our understanding of some of the potential density-dependent mechanisms that may be influencing juvenile production in the St. Johns River. However, future work to elucidate the relationship between spawners and recruits, and the precision of stock forecasts should address other density-independent processes (environmental stochasticity) that may be contributing to inter-annual variability in recruitment.

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Habitat utilization and vertical distribution of the great barracuda *Sphyraena barracuda* (Edwards 1771) in the western North Atlantic Ocean

The great barracuda, *Sphyraena barracuda*, is a large predatory teleost commonly seen in the tropics of the Western North Atlantic. There has recently been some stakeholder concern over the population numbers of this species. Using pop-up satellite archival tags (PSATs), six large S. barracuda (85-118 cm) were tagged off the coast of South Florida and Bimini, Bahamas. Two of the six tags remained attached to the S. barracuda for the duration of the deployment period. S. barracuda 88094 traveled 471 km MSLD over the 15-day tag duration, while S. barracuda 88095 traveled 1231 km MSLD over its 15-day deployment period. S. barracuda 88094 dove to a maximum depth of 145.2 m, while 88095 dove to a maximum depth of 186.9 meters. The data obtained indicate significant differences in diel behavior, with both S. barracuda utilizing deeper depths during nighttime periods. The results of this study show that S. barracuda are capable of travelling great distances over short periods of time, and can inhabit depths greater than 175 meters. These data will allow fisheries managers to better understand S. barracuda behavior and how they interact with more economically valuable species, with the ultimate goal of more effective species management.

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Population status of Harlequin Darters *Etheostoma histrio* in the Escambia River watershed, Florida

Harlequin Darters *Etheostoma histrio* are small, cryptic darters found throughout the lower Mississippi and Gulf Coast drainages, but they are only found in the Escambia River watershed in Florida. Harlequin Darters have been listed as either threatened or species of special concern in Florida since 1977 due to their restricted range. The Florida Fish and Wildlife Conservation Commission released a Species Action Plan for Harlequin Darters in 2013 with the main objective

of determining their population status. This information is needed to understand whether or not the Harlequin Darters need continued protection. In summer and fall 2014, we conducted a mark-recapture study on Harlequin Darters in Big Escambia Creek (tributary to Escambia River) to begin a population estimate for the species. The mark-recapture study was accomplished using visual snorkel surveys in 25-m reaches (sites) during stream conditions at or near baseflow. The study was conducted in Big Escambia Creek because it is clear and wadeable at baseflow, unlike the Escambia River. Two snorkelers surveyed each site and used small, hand-held nets to capture darters. All captured darters were tagged with Visible Implant Elastomer (VIE) tags and were returned to the site where they were captured. Each site was revisited, and any untagged Harlequin Darters that were captured were tagged. Twenty-four sites were surveyed between 3 July and 29 October 2014. In total, 374 Harlequin Darters were captured and 53 were recaptured (14%). A preliminary Schnabel population estimate (pooled sites) predicted 945 darters (95% CI = 744-1293) from the 24 sites. Mark-recapture surveys will continue in Escambia River tributaries in 2015 and 2016, and a final population assessment will be made by 2017.

Heagey, B & C Bradshaw
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Calling Names: When in Rome do you speak Latin?

Fisheries monitoring often involves communicating with fishers. This is viewed as an essential skill for fishery dependent samplers but is often overlooked by those sampling with fishery independent methods. Due to various emerging issues, especially regarding federally managed fisheries, the distinction between fisheries dependent and fisheries independent methods is becoming blurred, and so interactions between scientists and fishers are increasing. Scientists and fishers typically cross paths for data collection, dissemination, and other common areas of life on the water, around boats, and fishing gears. Further, fishers are becoming much more directly involved in the assessment process. An ability to effectively communicate with anglers allows for better data collection for both fisheries independent and dependent monitoring groups. Scientists rightly insist on binomial nomenclature to deliver unambiguous information to their peers, though this is seldom the correct choice for communicating with fishers as they have their own language. Often using the "correct" common name can lead to problems where the lack of knowledge of local names indicates inexperience to anglers. Through to case studies this talk highlights potential pitfalls and implications of name confusion and emphasizes the importance of clarity in communication with fishers.

***Hill, G & JS Rehage**
Contributed oral presentation
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Passive antenna systems: tracking fish movement at the top and bottom of America

The use of PIT tags and passive antenna systems (PAS) can be an effective and cost efficient way of monitoring movement and survival rates of many organisms in a variety of habitats. The ability of these systems to track movement of individual animals over small and large spatiotemporal scales has provided valuable information to research and management agencies throughout the world. The applicable flexibility of this technology is what makes it so versatile. However, a range of factors must be considered for the proper application PAS in different situations and environments. The arctic rivers of the Alaskan tundra and the freshwater marsh of the Florida Everglades are two very different environments where fish movement and distribution patterns play key roles in ecosystem dynamics. Each of these environments also provides its own unique set of challenges when trying to study fish movement. We assessed the application of PAS to both environments and its usefulness in collecting data on large and small scale movement patterns. A series of PAS's were set up along the length of two Alaskan North Slope Rivers to monitor the seasonal migratory patterns of arctic grayling in arctic river systems. Results from this 20 year ongoing study suggest that changing seasonality of arctic river hydrology could alter key biotic linkages these migratory patterns are a part of. In South Florida, PAS were set up in in-situ field enclosures to track the fine-scale habitat shifts of Everglades sunfish in relation to changing hydrological conditions across seasons. Results suggest a degree of temporal partitioning in habitat usage that may differentially influence the susceptibility of warmouth to avian predation. Our comparison of PAS use in these two extreme opposite environments shows the versatility of PAS in collecting movement data in very different situations and conditions.

Hill, JE, JL Ritch, LL Lawson & QM Tuckett

Contributed oral presentation

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Biotic resistance to survival and recruitment of non-native fish in experimental ponds

Understanding factors that contribute to or impede establishment by non-natives is fundamental to development of management strategies for invasive species. A growing body of experimental and field evidence suggests that native fish communities can limit the establishment of non-native fishes. Biotic resistance may be particularly important in regions where small-bodied ornamental fish enter the environment from aquaculture escape or hobbyist release and where abiotic factors allow establishment such as peninsular Florida. Past research suggests that native fish predators and aggressive competitors such as eastern mosquitofish *Gambusia holbrooki* and largemouth bass *Micropterus salmoides* limit the survival and recruitment of ornamental fish in simplified mesocosm environments. We evaluated whether non-native, ornamental green swordtails *Xiphophorus hellerii* can establish and recruit across a gradient of native fish communities in 0.05-ha ponds. Four predator communities were created to assess their impact on swordtail establishment, including 1) NO PREDATORS, 2) LOW PREDATOR (mosquitofish only), 3) MEDIUM PREDATOR (Lepomis spp. and mosquitofish) and 4) HIGH PREDATOR (largemouth bass, *Lepomis* spp. and mosquitofish). Each of the 4 treatments was replicated 4 times and 16 total ponds were used. After predator communities were established, 20 swordtails were stocked

each week into all 16 ponds, consistent with escapement rates observed for fish farms in Florida. Swordtails were then harvested after 14 weeks. Overall, survival and recruitment were greatest in the no predator treatment and nearly nonexistent in high predator communities. Low and medium predator communities were similar, but survival was lower in the medium predator community. Body size of swordtails was greater in the medium predator treatments, suggesting adult survival may be influenced by the gape of Lepomis spp. These results indicate survival and recruitment vary as a function of the predator community, suggesting biotic resistance may also vary across the landscape.

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Application of germplasm preservation for aquaculture and restoration of molluscan shellfish resources restoration

Molluscan resources in Florida include the eastern oysters, clams, scallops, conches, squids and octopuses. However, their fishery landings have been decreasing in the past 30 years. Therefore, restoration of these resources is needed, and attention has been put on these issues, such as oyster restoration programs. Germplasm preservation is a technology to cryopreserve germplasm materials in perpetuity, and has been applied for preservation of natural resources and conservation of endangered species. For molluscan aquaculture and restoration, the potential applications of germplasm cryopreservation can be: 1) *Preservation of wild populations*. The germplasm from wild populations will serve as comprehensive repositories for addressing genetic biodiversity, conservation, and resource management in the restoration programs; 2) *Preservation of specific lines*. Intensive aquaculture can yield specific strains and lines; germplasm cryopreservation can be used to preserve these valuable strains and provide materials for breeding programs; 3) *Creation of specific lines for breeding and genome research*. Most bivalves are protandrous, beginning life as males and changing into females. Therefore, self-fertilized lines can be created by using cryopreserved sperm and eggs from the same individuals. In addition, cryopreservation is an required tool for mutant line creation by use of a new approach called targeting induced local lesions in genomes, and 4) *Assistance of aquaculture hatchery practices for seed production*. The preserved germplasm materials can function as a reservoir to meet the need for continuous seed production for aquaculture and restoration.

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Evaluating a fishery dependent restoration target for american shad in Florida's St. Johns River: Can angler catch per unit effort really be used as a proxy for abundance?

The Atlantic States Marine Fisheries Commission Fishery Management Plan (FMP) for Shad and River Herring requires that states with open fisheries for American Shad have sustainable fishing plans that include monitoring of spawning stock abundance and restoration targets. Florida currently has a small recreational fishery for American Shad in the St. Johns River. A stock assessment completed in 2007 found concordance between angler catch per unit effort (CPUE) and simultaneous electrofishing CPUE in the St. Johns River during the period 2003 through 2005. Therefore, the FMP recommended a restoration target of an angler CPUE of 1 fish/ hour based on the length of the time series of creel data. However, the fishery has since changed in both location and tactics. Updated data were compared to re-evaluate the utility of the use of angler CPUE as a restoration target. The Florida Fish and Wildlife Conservation Commission runs two concurrent surveys to monitor of the spawning stock of American Shad in the St. Johns River. One survey is a fishery-independent randomized electrofishing survey and the other is a fishery-dependent creel survey. The electrofishing survey gathers biological data; age, sex, size and a CPUE based abundance index. The creel survey monitors total effort, CPUE, total catch, and harvest. CPUEs of the surveys were correlated, but only when the surveys overlapped in time and space. The recreational fishery targets a small section of the spawning grounds and local fluctuations in abundance and non-random application of fishing effort influenced CPUE. The comparison of the two surveys indicated that if either survey is to function as an index of abundance it must be broad in time and space relative to the distribution of the spawning stock so that small scale changes in fish distribution do not bias the index relative to actual spawner abundance.

***Kroloff, E, JS Rehage, J Heinen, RC Santos & RE Boucek**

Poster presentation

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Where are all the bonefish? Integrating angler perspectives and ecological changes influencing bonefish declines in the Florida Bay

In south Florida and throughout the west-central Atlantic Basin, bonefish *Albula vulpes* are the backbone of recreational fisheries and are favored by anglers because of their challenging capture. Bonefish fisheries in Florida contribute almost $1.5 billion yearly to the economy), supporting livelihoods for professional fishing guides year-around. Recreational fishing and evidence of bonefish decline have both increased with human population growth. In the last century, Florida bay has changed from a natural to a highly managed system due to the construction of large networks of canals that have diverted freshwater away from the Bay, as well as other notable changes. This project aims to account for the change in distribution and abundance of bonefish throughout Florida bay. We ask what has caused bonefish decline, how has bonefish decline changed over space and time, and how has the decline in bonefish changed overall angler perceptions and behaviors? We aim to answer these questions by analyzing trends in previously and on-going collected data on prey abundance, sea-grass distribution, and hydrological changes in Florida bay. A mix of semi-structured surveys and key informant

interviews will also be conducted to complement and strengthen the patterns and changes we find in the biological data sets. By establishing data through these methods we should be able to derive a baseline not currently known due to a lack of data on bonefish catches. The importance of understanding bonefish dynamics and why they have experienced declines benefits both the conservation and maintenance of the species, and the maintenance of livelihoods that recreational bonefish fisheries provide. By involving anglers and guides in the main data collection process we can increase both outreach and education on the importance of sustainable fishing practices and increase overall support for conservation.

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Distributions of select non-native fishes in west-central Florida: What's their status?

There are approximately 32 non-native fishes that have successfully established in peninsular Florida. Many factors such as temperature, biotic resistance, and human intervention can limit establishment in some regions, leading to frequent distributional shifts. Some fishes may appear to be widespread in certain areas although their status is difficult to determine (e.g., Green Swordtail, *Xiphophorus hellerii*) while others are undoubtedly established in a large area (e.g., Blue Tilapia, *Oreochromis aureus*). The USGS maintains a Nonindigenous Aquatic Species (NAS) Database for the United States which reports species distributions, however it is up to the field biologists to report their records to help keep this up to date. Further, maintaining current species distributions allows managers to identify population expansions or contractions which could assist management decisions and actions. The purpose of this work is to provide an update regarding the distributional changes of some established non-native fishes in Florida with a special focus on the Tampa Bay area. Invasion patterns and spread for select species will be addressed as historic distributions will be presented along with contemporary distributions. Many of these new distributional records are a result of extensive sampling in rivers, streams, and ditches around the Tampa Bay area by the Hill Lab, University of Florida. In general, three trends were found 1) non-native poeciliids were more widespread than previously recorded, 2) small, potentially ephemeral populations of Jack Dempsey *Rocio octofasciata* were found throughout the area, and 3) expanded distributions of Oriental Weather Loach *Misgurnus anguillicaudatus* were found in Hillsborough and Polk counties. Ultimately, data reflecting current distributions assist managers with making important decisions and field biologists are encouraged to recognize and share new distribution records.

***Lee, JA & JS Rehage**
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Drying times: survival of Florida Largemouth Bass in a coastal refuge habitat during seasonal drying

Persistence in the face of disturbance can be largely influenced by the availability and quality of refuge habitat. Refuges for aquatic species become increasingly important under reduced water flows and, as the scarcity of the world's freshwater resources grows, so will our need to understand the ability of refuge habitat to buffer populations under altered flow regimes. In the seasonally-pulsing Everglades, hydrological modifications have increased the magnitude and frequency of marsh drying events. This overall reduction in flow has likely increased the importance of deep water refuge habitats in maintaining fish populations, but at the same time these same alterations have also negatively influenced the available refuges. Coastal mangrove creeks of the Everglades are vulnerable to changes in freshwater inflows and hydrological reductions have altered the characteristic salinity gradients of this oligohaline region. Understanding these changes is crucial, as ecotonal estuarine habitats function as important refuge for large-bodied mesoconsumers, such as the Florida Largemouth Bass, *Micropterus salmoides floridanus*, (LMB). We employed a unique combination of mark-recapture techniques and citizen science to investigate the ability of mangrove creeks to buffer LMB populations from seasonally occurring periods of marsh drying, i.e., serve as refuge. We hypothesized that survival would decrease in times when marshes are drying down and in periods when marshes functionally dry. We found survival consistently decreased once marshes dried, but remained high while marshes were drying. We also expected survival to vary across years as a result of annual variation in marsh inundation patterns. Instead, the year varying model ranked lower, indicating that there is a consistency in the monthly rates of survival within each period, despite yearly variation in drying patterns. Understanding survival during disturbance events will further our knowledge of how populations may respond from future changes in flow regimes driven by Everglades restoration and climate change.

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Federal assessments: the use of the best, available data

Species managed by the National Marine Fisheries Service within the Southeast Fisheries Science Center use data from multiple sources to help inform stock assessments. These data sources include both fishery dependent (FD) and independent (FI) data streams. Since 2002, stock assessments in the southeast have been governed by the SEDAR process. During a benchmark SEDAR assessment, the first step is to review the available data that are recommended to inform the stock assessment. This data includes life history parameters (e.g., age, growth, maturity, mortality), indices of abundance (FD and FI), commercial and recreational landings and discards, and more recently ecosystem and environmental parameters. In this presentation, I will focus on the use of FD and FI data involved in describing red grouper life history. Data streams for red grouper life history information began in the late 1970s, with most of the effort involving annual federally funded FD programs that collected both landings and biological samples. FD data cost effectively returns information on adult stock composition (age, length). In the last 5 years, there

has been a shift with more effort in fishery FI surveys (long-term) and special projects (short-term) to fill-in life history gaps. For instance, with the increase in biological sampling from FI surveys and special projects, we gain better understanding of juvenile life stage, which is not typically covered by FD sources due to size-selective nature of fisheries. These FI data not only provide information on the age, growth, and reproduction of red grouper, but also adds to our understanding of the mortality, habitat preferences, and movements of red grouper. Therefore, the use of both FD and FI data is beneficial to properly manage species in the Gulf of Mexico.

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Contributed oral presentation
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Implementing the State Species Action Plan for the imperiled cyprinid, *Notropis melanostomus*
Blackmouth Shiners *Notropis melanostomus* are one of Florida's smallest native cyprinids. They were first described from the Blackwater River drainage in 1989 and are patchily distributed from Mississippi to Florida. They are listed as state threatened in Florida, and are known only from the Blackwater and Yellow River drainages. Survey conducted since 2000 have only collected Blackmouth Shiners in the Blackwater River, suggesting possible extirpation in parts of the historic range. We initiated a watershed-scale survey targeting Blackmouth Shiners in August 2014 to achieve priority conservation actions in the Blackmouth Shiner Species Action Plan. Using visual surveys, we sampled 58 sites, including 11 known historical sites. Between 24 August and 18 December 2014, we collected 74 Blackmouth Shiners among 5 total sites, including 3 historical and 2 new locations. Despite detecting blackmouth shiners at only a few locations, we collected shiners at a rate of 0.44 per sampling minute at those sites. Water temperature, conductivity, pH, and dissolved oxygen did not differ between sites with and without blackmouth shiners. Future effort will be aimed at developing site occupancy models using repeated site visits, which will account for imperfect detection and can be used to identify new sampling locations. Future sampling will also involve developing quantitative methods to sample this species to determine patterns of abundance.

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Evaluating the accuracy of data-poor stock assessment methods in the southeast United States
Many fish stocks in the Southeast do not have sufficient data to allow for traditional stock assessments. These 'data-poor' stocks lack or have unreliable information concerning catch time-series, stock size, or life history parameters. Such data are the primary information sources for traditional stock assessments. Without this information it is difficult to conduct stock

assessments and determine annual catch limits (ACLs) and other reference points legally required for every fished stock by the Magnuson-Stevens Act. While data-poor stocks are present around the United States, 75% of stocks and stock complexes assessed for ACLs in the Southeast are stocks that have only catch history data based on both fishery dependent and fishery independent sources. Alternative data-poor methods to calculate catch limits in such cases exist, but their effectiveness is still subject to question. Two of the more common data-poor methods, DCAC and DB-SRA, have been applied to data-rich stocks on the West Coast and found to be relatively accurate at estimating Maximum Sustainable Yield in comparison to the more traditional stock synthesis assessment method. Accuracy ranged from 70% to 85% for DCAC and 80% to 155% for DB-SRA for the west coast studies, but no similar work has been done on stocks in the Southeast. This study compares catch limits in terms of overfishing limits (OFLs) and biological reference point outputs from the Southeast Data, Assessment, and Review (SEDAR) stock assessments to those of data-poor methods for the same stocks in order to determine the accuracy of the data-poor estimates. Data-poor methods estimate OFLs of SEDAR assessed stocks to varying degrees of accuracy on a stock-by-stock basis. Some methods, especially DB-SRA, are not applicable to many SEDAR-assessed stocks. Further analysis will reveal which, if any, data-poor methods are best suited to certain life history types, with the intent to identify the best methods for creation of ACLs for actual data-poor fish stocks.

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Comparison of fish otolith marking techniques to aid in age validation

The quality of a fisheries stock assessment is predicated upon accurate measures of ages of fish. To determine accuracy, a validation process must show that the interpretation or reading of ages is correct. By developing a standard procedure for marking calcified structures (otoliths, vertebrae, fin rays) in juvenile marine fish at a known time, daily and annual rings of the otolith can be determined outward from the mark. In this study, pinfish, *Lagodon rhomboides*, (4.7 ± 0.7 cm TL; 1.6 ± 0.7 g) were collected from the wild and held in recirculating aquaculture systems until used in experiments to test mark strength of chemical dyes on otoliths. Fish were immersed in oxytetracycline (OTC) or calcein, buffered with a solution of sodium hydroxide to a pH of 8.2. Treatments consisted of 3, 6, and 9 h immersions of OTC of 250 and 500 mg/L. Fish were immersed in calcein at 125 mg/L and 250 mg/L for 1.5 and 2.5 h treatments. Mortality was recorded using either natural seawater or a NaCl solution. Fish were euthanized, and sagittal otoliths were sampled five weeks post treatment to distinguish mark strength. No mortality occurred in natural seawater, while mortality in the NaCl solution was high (>50%). For OTC, marks were stronger at higher concentrations and longer immersion times, however, calcein was a better marking agent overall. This work provides procedures for age validation of other fish species managed in the Southeast U.S. and Gulf of Mexico.

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Preliminary results from a parasite survey of the non-native fish, *Belonesox belizanus* (Poeciliidae) in Tampa Bay

Transmission of novel diseases is a potentially strong impact of non-native fishes, but is little studied in Florida. The Pike Killifish, *Belonesox belizanus*, has been a non-native inhabitant of southern Florida waterways since the 1950s. In the early 1990s, this species was introduced into Tampa Bay, where it established in brackish and fresh waters along the eastern shore including the Alafia and Little Manatee Rivers. Pike Killifish commonly occurs in preferred habitat for juvenile Common Snook, *Centropomus undecimalis*, an ecologically and economically important predator in Tampa Bay. Predation and competition impacts of Pike Killifish in invaded systems have been investigated, but health impacts, specifically introduction and transmission of non-native parasites to native fishes are unknown. Therefore, our overall goal is to determine the risk that parasites from Pike Killifish pose to native hosts, specifically juvenile Common Snook. In order to evaluate the risk, a parasite survey, transmission experiment and risk assessment will be completed. To date, 176 *B. belizanus* specimens have been collected, dissected and examined for parasites as part of the parasite survey. So far, only ectoparasites have been identified and examined for prevalence among sampling sites. Gills were heat-fixed upon collection using 70°C water and 5% neutral buffered formalin (NBF) before parasites were isolated. Parasites were mounted and stained on slides, then identified using taxonomic keys and polymerase chain reaction (PCR). Parasites in Class Arthropoda, Digenea, and Monogenea have been found externally in the gill filaments. Of these, one species of Monogenea is thought to be of non-native origin. Information collected from the survey will ultimately determine what species are used for the parasite transmission experiment involving juvenile Common Snook and the overall risk assessment to determine whether parasites from Pike Killifish pose a risk of parasitic infection emerging in juvenile Common Snook.

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Pike killifish facilitate local persistence of non-native green swordtails

Few small-bodied ornamental fish have successfully established in Florida, this is thought to be due in part to biotic resistance in native habitats. Through agonistic behaviors such as fin nipping, eastern mosquitofish (*Gambusia holbrooki*) are thought to limit the recruitment and survival of

small-bodied, non-native ornamental fish. Yet, in some locations, the green swordtail (*Xiphophorus hellerii*), a non-native poeciliid popular in the aquarium trade, does exhibit persistent reproducing populations and our initial observations suggested they can be found in sympatry with a novel non-native poeciliid predator, the pike killifish (*Belonesox belizanus*). Our primary question was whether pike killifish could limit mosquitofish biotic resistance and lead to the persistence of these swordtail populations. We used a combination of field surveys (locations with/without pike killifish), feeding trials (pike killifish gape and preference) and mesocosm experiments with mosquitofish, swordtails and pike killifish to address this question. Our field experiments suggest mosquitofish are nearly absent when pike killifish are present. The preference trials support this finding; pike killifish prefer mosquitofish over equal-sized swordtails, possibly because of greater swordtail body depth. Reproducing populations of large-bodied swordtails were found in sympatry with pike killifish, suggesting swordtails can reduce their vulnerability to predation. Using mesocosm experiments, we found that swordtails do not recruit in the presence of mosquitofish. These result suggest the distribution of mosquitofish and their ability to limit reproduction of ornamental fish may vary over the landscape, dictated by the presence of pike killifish. Thus, the range expansion of pike killifish in Hillsborough County, a region with a large density of ornamental fish farms, could allow greater persistence of ornamental fish, not limited by other environmental factors.

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The effects of nutrient cycling by the exotic catfish, *Pterygoplichthys disjunctivus*, on algal growth in a central Florida spring

Nutrient recycling by fish plays a large role in the availability of nutrients, such as nitrogen and phosphorous, in freshwater aquatic systems. The invasive exotic catfish *Pterygoplichthys disjunctivus* has infiltrated central Florida springs and may have contributed to algal overgrowth in these springs due to its digestive by-products. In this research, we focused on whether algae would grow on microscope slides as a direct result of the presence of *P. disjunctivus* feces in situ by implanting an array in Volusia Blue Spring to measure algal growth. The algal accumulation in control and experimental treatments was compared using dry mass as well as spectrometry for chlorophyll a. Algae also were grown over the course of four weeks in a growth medium to calculate the variability of growth from viable algal cells within the excrement. There was significantly more growth of algae in the presence of *P. disjunctivus* feces than in controls. In addition to promoting algal growth, *P. disjunctivus* feces were found to contain viable algal cells that were thriving after being excreted. The addition of nutrients and viable cells due to the presence of feces could be a contributing factor to eutrophication and ecological shifts in Volusia Blue Spring.

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Discard mortality of black crappie *Pomoxis nigromaculatus* in Florida

Discard mortality is an important parameter used in population modeling. If released fish experience high mortality then there is little or no benefit to enforcing a minimum length limit. Few studies have investigated crappie discard mortality, and these studies focused on white crappie *Pomoxis annularis*, which are not present on the Florida peninsula. We stocked 300 black crappie into each of four 0.24-ha ponds and allowed them to acclimate for five weeks. After the acclimation period, we angled 100 crappie from each pond and released them into adjacent 0.08-ha ponds and observed them for a period of two weeks. At the end of the observation period, we drained the ponds and counted the surviving fish for an estimate of discard mortality. This project is ongoing and we plan to replicate it next year. We plan to discuss the preliminary results and insights that we've gained as the project has progressed. The results of this study will provide an estimate of discard mortality that can be applied in population models to more accurately predict the response of black crappie populations to length limits.

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Assessing inland recreational fisheries using catch-at-age methods

Data collection methods vary significantly between marine and inland fisheries. Marine fisheries rely heavily upon fishery dependent data for stock assessments. These data are often used in catch-at-age models such as virtual population analysis that allow estimates of mortality and recruitment. Inland fisheries rarely use catch-at-age models, despite their potential to improve management. In the southeastern United States, Black Crappie *Pomoxis nigromaculatus* support important harvest-oriented fisheries. Black Crappie stock assessments are typically done only through fishery independent sampling (trap nets or trawls) or fishery dependent methods (creel surveys), with occasional tagging studies to estimate fishing mortality. We assessed the effectiveness of catch-at-age models when applied to a Florida Black Crappie fishery. We hypothesize that use of catch-at-age models could provide estimates of fishing mortality, recruitment, and factors related to recruitment in a cost-effective manner. The use of catch-at-age models commonly employed in marine fisheries can potentially improve the ability to assess and manage inland recreational fisheries.

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Combining fishery-independent and fishery-dependent methods: a pilot study on a hybrid approach to sampling reef fishes

Abstract: The assessment and management of marine fishes requires data on their abundance, size and age structure, and reproductive status. Traditionally, these data have largely been provided by fishery-dependent (FD) sources which are confounded by non-random sampling, varying management regulations and socioeconomic factors. Increasingly, data are being provided by broad-scale, fishery-independent (FI) surveys that are based on a statistically-valid sampling design, incorporate standardized sampling methodologies, and characterize the entire population. However, FI surveys are expensive and differences in trends in abundance between FD and FI data are often difficult to reconcile. We therefore tested various FD and FI hooked gear methods and also developed and tested a hybrid approach to sampling reef fishes by integrating aspects of both FD and FI methods. This hybrid approach involved an active sampling technique used by commercial fishermen in the eastern Gulf of Mexico, combined with standardized protocols that controlled for gear, bait, and soak time. We found that the catch and size structure of focal reef fishes were similar between the hybrid method and passive FI methods currently used. Additionally, the hybrid approach typically performed as well or better than purely FD methods. We also characterized fishing methods used by our commercial industry partners to determine whether and how FD and FI data can be integrated into a single index of relative abundance. Even with a highly-standardized statistical survey and the use of only a few vessels, we observed high variability in fishing methods. Attempts to integrate FD data would require assumptions as to the similarity of various fishing approaches, many of which probably are not warranted. Because the hybrid method was as effective or better than other FI or FD methods for sampling reef fishes, this method warrants further consideration as a research and monitoring tool.

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Estimating Largemouth Bass Exploitation Rate Across Northwest Florida Lakes and Rivers Using High Reward Tags

Largemouth Bass *Micropterus salmoides* are a popular freshwater sport fish in Florida and are actively managed at both the local and regional scale. The northwest region of Florida, west of the Suwannee River, has separate Largemouth Bass length and bag limits from other regions of the state. In addition, little is known about actual fishing pressure and harvest rate in this region. To better understand region-wide exploitation of Largemouth Bass, we used high-reward ($100) plastic tipped dart tags. The number of tagged fish in each lake or river was proportional to lake size or river length, and size distribution of tagged fish was based on past sampling data (where

available). One hundred fifty-nine legal-sized Largemouth Bass (≥ 305 mm) were tagged throughout 16 lakes in November and December 2012. The region-wide exploitation rate in northwest Florida lakes was 10%. One hundred sixty legal-sized Largemouth Bass (≥ 305 mm) were tagged throughout 10 rivers from October to December 2013. The region-wide exploitation rate in northwest Florida rivers was 8%. These rates are similar to those reported in a similar study in peninsular Florida and suggest that overharvest of Largemouth Bass in northwest Florida is not a concern.

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Spatial patterns of snook catch rates derived from fisheries dependent surveys, fisheries independent monitoring, and voluntary catch records from the iAngler data base.

Fisheries dependent and independent data are not collected within the same sampling frame, and may display various degrees of bias due to data being collected at different times, with different gear selectivity, and by different sections of the angler or fisher population. We examine fisheries independent monitoring data, data from the Marine Recreational Information System and Angler Action records for evidence of a relationship between mangrove density and catch-per-trip. Both fisheries independent monitoring data and MRIP data are collected using standardized sampling protocols, but the spatial resolution of MRIP data is higher. Voluntary catch records from the iAngler data base have a low coverage in space and time, and a higher mean than MRIP data, which may reflect different targeting, a different level of angling experience, or selective reporting. We interpret the data as different indices of relative abundance and assume that they are influenced by habitat factors in a similar way. The data sets display a common geographical trend, which is likely due to the influence of several variables changing with latitude, including temperature and mangrove density. We compare basic statistics, trends and spatial patterns of the data sets to see if they are complementing each other, and if factors that drive the relative abundance of snook in Florida can be identified from them.

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Simulating population level impacts of fishing spawning largemouth bass using empirical data from Lake Eustis, Florida

Florida anglers continue to express concern about fishing for spawning Florida Bass *Micropterus salmoides.* No special regulations exist in Florida during the bass spawning season. Fishery managers assume that catching nesting bass can result in higher nest failure, but they also assume that nest fishing should have little impact on the overall population. Quantifying population-level impacts caused by fishing nesting bass is difficult in natural systems because of high recruitment variability resulting from environmental fluctuations (e.g., water levels, vegetation, weather). We designed a study that would use empirical data collected from a moderately pressured Florida lake (Lake Eustis, FL) to simulate impacts that nest fishing may have on recruitment if all bass caught by anglers during the spawning season were nesting fish and all caught bass had 100% nest failure (i.e., worst case scenario). An equilibrium population model was built to evaluate the effects of various regulations; including closing the fishery for bass during the spawning season. Simulations for a spawning season closure resulted in increases in the adult population (9%), recruitment (6%), catch rate (29%), and spawning potential ratio (62%; increased from 0.54 to 0.84). Although under this "worst case scenario", most metrics tested increase slightly with a spawning closure, these results indicate that the bass population is not heavily impacted by fishing nesting bass. There are substantial tradeoffs for implementing a spawning season closure in Florida as this is the peak season for bass angling and the spawning season can occur over three months or more. We conclude that much more significant impacts would have to be observed on the bass population before managers should consider a spawning season closure.

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Impacts of angling for nesting florida bass, *Micropterus floridanus*, on nest success and recruitment

Nesting black bass *Micropterus* spp exhibit parental care during the spring spawning season. Anglers often intentionally target black bass that are guarding nests. Little work has been done to evaluate whether this indirect fishing-associated mortality could influence population level recruitment and no work has been done to look at impacts bed fishing has on Florida bass M. floridanus. During this study, nine replicate ponds were used to simulate a natural system during two consecutive years. Ponds were snorkeled every other day throughout the spawning season to track nest success and abandonment. During each year in five of the ponds, every nest located was angled. Angled fish were held in a cage within the pond for one hour before being released back into the pond. No angling was conducted on the other four control ponds each year. Nests were considered successful if swim up fry were observed. Nest success rates were 52% for fished ponds and 45% for unfished ponds during year one and 36% and 57% in year two respectively . Off the fish caught off of nests, 50% in year one, and 45% in year two returned to that nest and ended up with swim up fry. During both years combined, fish in unfished ponds produced significantly higher numbers of nests. Nest sizes were no different between fished and

unfished ponds. During year one the average number of adults contributing to the year class produced was similar between fished and unfished ponds. Ponds were drained nine months after stocking in order to compare young-of-the-year recruitment between fished and unfished ponds. During both years there was no significant difference in the number of recruits produced between fished and unfished ponds. Results from this study indicate that in Florida bed fishing likely does not negatively impact year class production.

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Best management practices and escapement of non-native fish from aquaculture facilities in Florida

Tropical ornamental aquaculture is an important industry in the state of Florida and includes production of up to 800 current and historic non-native fish varieties. While the industry is an important economic sector in the state of Florida, escapement of non-native organisms has resulted in criticism that the ornamental aquaculture industry is essentially unregulated. This is not the case, aquaculture in Florida is regulated by multiple agencies with main authority residing within the Florida Department of Agriculture and Consumer Services (FDACS). The goal of the present study was to evaluate FDACS Best Management Practices (BMP) regarding non-native species. Our specific objectives were to 1) evaluate the inspection process, 2) examine BMP compliance, 3) identify the critical control points for fish escapement, 4) analyze the stages of invasion and 5) determine the effectiveness of current aquaculture BMPs following evaluation of the above objectives. We conducted site visits with FDACS compliance inspectors and bird surveys on farms, sampled fish immediately adjacent to farms and sampled fish across the broader environment in west-central Florida. Our findings suggest a coherent inspection process, strong compliance by producers and rapid correction of non-compliance issues. Escape in effluents is the dominant pathway of introduction; all other possible pathways were unimportant. Presence of a detention pond or absence of effluents is the most important factor increasing compliance. Native fish dominated the catch across the sampled landscape from adjacent to farms out into the larger, more natural aquatic systems. Despite the occurrence of some non-natives adjacent to facilities, the number and diversity of fish declined rapidly with distance from the farm such that non-native ornamentals were rare to non-existent in the broader landscape. Our results suggest the mandatory BMP inspection process is fundamentally sound with a coherent regulatory structure that facilitates cooperation between FDACS and farm operators.

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Phylogenetic status and divergence of Florida's Southern Tessellated Darter

The Florida population of Southern Tessellated Darter (*Etheostoma olmstedi maculaticeps*) is only known to occur in the Ocklawaha River Basin and is isolated from the next closest known population in the Altamaha River Basin, Georgia, by more than 200 km. The state of Florida has considered it a Species of Special Concern since 1979. Recently, a recommendation was made to elevate the status to Threatened on the criteria of small population size, limited geographic range within Florida, and fragmented occurrence. We collected darter tissues from seven basins throughout its distribution, and analyzed the samples to determine the phylogenic status of the subspecies throughout its range, determine whether the Florida population is monophyletic, and characterize the level of genetic diversity within the Florida population relative to more northern drainages. Results inferred from cyt b sequences indicated that the Florida population was nested within a larger clade that included immediate geographic neighbors in the Altamaha, Ogeechee, and Savannah Basins, but was monophyletic within the clade. Based on molecular genetic dating, the Ocklawaha River basin population has been isolated from its closest drainage for an estimated 150,000 years. The genetic diversity of fifteen darters collected from the Florida population was considerably lower compared to the other six basins, providing additional support for a long-term isolation in Florida and suggesting that the population size has been small for a long period of time. These results are important for managers responsible for protecting habitat in areas where this species is known to occur within Florida and who may consider translocation of individuals from other states to supplement the Florida population.

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Researchers' trash is an educator's treasure: Field specimens as educational tools

During many regular monthly sampling efforts, biologists collect representatives from a variety of species identified in the field for laboratory verification. Once laboratory ID is complete, the samples are discarded. This process is repeated hundreds of times a year in many different contexts. I have created a novel classroom lesson plan for middle and high school students in which the participants re-use samples that would otherwise be discarded. During this classroom investigation, small groups of students identify a selection of small fish samples using dichotomous keys and field guides. They then measure each fish in their sample, record species names, lengths, and numbers of individuals, mimicking the work of fisheries staff. Using these data, students may also analyze species diversity parameters and research individual species. During this lesson, students learn to identify a variety of local fish species using meristics and other easily observable physical characteristics. They learn to combine picture-based field guides

with dichotomous keys for successful fish identification. They learn the importance of using a consistent, meticulous process to identify and quantify their local fish species. Finally, they are able to grasp the diversity of fishes encountered in their local waterways. In this way, a resource which would otherwise be discarded is given another life, and students learn valuable lessons about fish diversity, fisheries studies, and scientific observation

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Genetic composition of largemouth bass in coastal rivers of northwest Florida

Coastal rivers provide exceptional fishing opportunities for a variety of freshwater species. Largemouth Bass are a major component in these fisheries and are highly valued by anglers, especially in northwest Florida where few impoundments and natural lakes exist. Typical of most northern Gulf Coast rivers, salinity levels in the upper Escambia River are low but may exceed 13 ppt in the lower, estuarine section of the river. Recent sampling on the Escambia River indicated there may be large differences in age and size structure in Largemouth Bass populations inhabiting the main river compared to estuarine habitats. Previous research on coastal rivers have documented life-history differences between individuals in river and estuarine habitats, however it is unknown if this variation can be attributed to phenotypic plasticity or limited gene flow between the two groups. Genetic samples were collected in both river and estuarine habitats in the Escambia River to determine if individuals existed as a single randomly mating (panmictic) population or if some environmental barrier or behavior was preventing individuals from mating randomly. Microsatellite DNA analysis indicated no genetic differences between samples collected from the upper and middle sections of the river, suggesting that individuals in the river habitat exist as a panmictic population. Allele frequencies were significantly different between fish in river and estuary habitats at a number of microsatellite loci; however the magnitude of the differences indicated there was a relatively small amount of genetic structure between these groups. Overall, this indicates that samples from the river and estuary were not taken from a randomly mating population, but that there is some of gene flow between fish in estuary and river subpopulations. It is possible that environmental differences between river and estuarine habitats have led to divergent selection and limited mating between subpopulations within the same river system.

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Combining samples from multiple gears helps avoid fishy growth curves

Size-at-age information is critical in estimating growth parameters (e.g., the von Bertalanffy growth function [VBGF]) that are used to assess fish populations. Due to gear selectivity, single sampling methods rarely sample all ages/sizes equally well. Most growth estimates rely on samples from a single gear and therefore provide biased and imprecise growth parameter estimates. We evaluated the efficacy of combining samples from two gears with different size selectiveness to estimate VBGF and then applied that approach to a case study on the Black Crappie *Pomoxis nigromaculatus* population in Lochloosa Lake, Florida. Simulations of age- and size-structured populations were randomly sampled with two gears with different size-selectivity curves (a 'small-size' selective gear and a 'large-size' selective gear). Maximum likelihood VBGF estimates were obtained for each gear separately and compared to estimates obtained via a combined VBGF fitted to data from both gears. In every scenario simulated, a combined gear approach reduced bias and increased precision for estimating the VBGF, but the specific combined proportions that improved VBGF estimates depended on size-selectivity. Estimates of the VBGF in Black Crappie populations showed the combined gear method had intermediate parameter values compared to single-gear approaches from fisheries-independent trawl sampling and fisheries-dependent angler-discards. Furthermore, combined approaches had increased precision in individual parameter estimates and much less variance when estimating the VBGF compared to single-gear approaches. Combining data from two gears can increase sample representativeness leading to improvements in the estimation of VBGF. Such approaches can reduce uncertainty in VBGF estimation and provide insight into key demographic processes occurring in fish populations where ontogeny and gear-selectivity lead to inefficient sampling.

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Variation in the Blue Spring food web as determined by stable isotope analysis

Springs in Florida have experienced a variety of disturbances, such as changes in flow rates, changes in nutrient quantities and ratios, and introductions of exotic species. To adequately evaluate the effects of these disturbances, a good picture of spring food webs is vital. Stable isotope analysis (SIA) of carbon and nitrogen is a good tool for constructing an ecosystem food web by examining shifts in isotopic ratios among different species. We used SIA to determine nutrient sources and trophic levels of organisms in Volusia Blue Spring, and to construct a provisional food web. We collected seasonal samples of leaves, algae, amphipods, sailfin mollies

(*Poecilia latipinna*), and mosquitofish (*Gambusia holbrooki*) at three different locations: the spring boil (to capture primarily aquifer inputs), approximately midrun (to capture potential allochthonous inputs), and the St. Johns River just outside the run. We also collected fecal samples of Florida manatee (*Trichechus manatus*) and fecal and muscle samples of sailfin suckermouth catfish (*Pterygoplichthys disjunctivus*) to determine how migratory and exotic species fit within the food web. The data are preliminary and the study is ongoing. Early results reveal seasonal and spatial differences in nitrogen signatures in algae, possibly due to fertilizer inputs to the spring, and further up the food web in mosquitofish. For many organisms, the isotopic signatures differed between the spring run and the river and between the fall and spring/summer. The isotopic signature of the exotic armored catfish was similar to both the sailfin mollies and mosquitofish, whereas the signature for the Florida manatee indicated a lower trophic level than the other vertebrates sampled in the spring run, and carbon signatures consistent with its presumed reliance on aquatic plants in the river rather than organic matter from the spring. This ongoing study is helping to illuminate complex trophic interactions in a Florida spring.

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