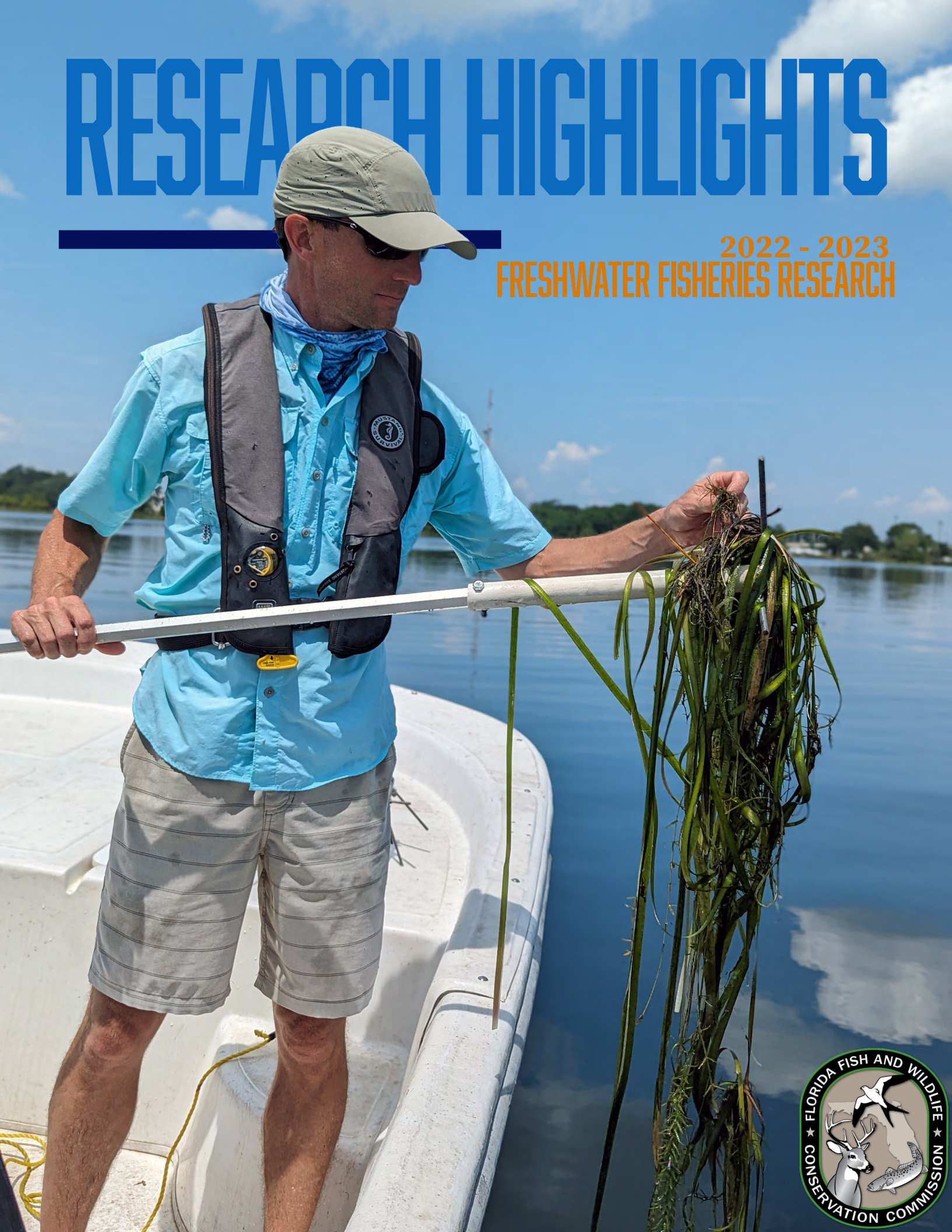
RESEARCH HIGHLIGHTS

2022 - 2023
FRESHWATER FISHERIES RESEARCH



A MESSAGE FROM THE SECTION LEADER

Welcome to the 11th edition of the Freshwater Fisheries Research Section Annual Research Highlights. The Integrated Research Management (IRMT) Team and the Annual Research Highlights document were two of my first moves as Section Leader with simple but critical objectives – to ensure that we were conducting the highest priority research projects for our management partners and the information is effectively communicated as broadly as possible to inform management actions. The IRMT and Research Highlights have both evolved over time, but the main objectives are the same and both have become core elements of our section. The annual Research Highlights document is intended to relay summary information in an easily digestible format (with photos) for the various research projects and programs conducted by scientists in Freshwater Fisheries Research. We are conducting about 50 different research projects/programs on a wide diversity of topics relevant to research and management partners from various sections, divisions, agencies, and institutions. You may be interested to learn more about our freshwater invertebrate program, trends in fisheries and habitat from long-term monitoring programs, conservation genetics, stock enhancement evaluations, threatened and imperiled species critical data gaps investigations, directed sport fish research, and more in this year's edition. While the Research Highlights document provides a snapshot of highlights from our research projects and programs, more detailed annual reports, and publications of select research projects are available. Every year I look forward to sending out this report to showcase the incredible quantity, quality, and diversity of research that we are conducting. I want to thank all the research scientists for their exceptional work at executing such high-quality research on high priority issues, as well as our management partners that are actively involved as collaborators on much of the work we do.

Jason Dotson
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FLORIDA'S STATEWIDE FRESHWATER MUSSEL CONSERVATION PROGRAM

Lauren Patterson, Amber Olson, Jacob Lanning, and Susan Geda

The program has conducted 1,216 discrete surveys and recorded 142,570 individual mussels. During this fiscal year, 112 surveys were performed in 11 basins where 9,043 individual mussels were collected representing 41 species. The total number of federally listed mussels collected was 375, representing 10 of the 16 listed species in the state. Two federally endangered Oval Pigtoe, Pleurobema pyriforme, were observed in the Suwannee River basin, making these individuals the 9th and 10th representatives of this species in this basin since 2012.

Mussel-host fish trials, supported through procurement of Section 6 funds, were completed. During this fiscal year, one host trial with the Chipola Slabshell, Elliptio chipolaensis, was conducted by exposing fish species to naturally released conglutinates. No juveniles were transformed on the exposed fish: Sailfin Shiner, Dollar Sunfish, Brown Darter, and Channel Catfish. Currently, the program is working towards publishing results gathered from the FY21-22 trail with the Choctaw Bean, Obovaria choctawensis, as well as organizing plans for the continuation of host fish research.

Program research and highlights were presented at multiple meetings and conferences, including at the Southeastern Fishes Council meeting in Georgia, Freshwater Mollusk Conservation Society symposium in Oregon, and Southern Division of the American Fisheries Society meeting in Virginia. Outreach efforts were also significantly bolstered by participation in several educational events for the public, including two social media videos.

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EVALUATION OF BLACK CREEK CRAYFISH (PROCAMBARUS PICTUS) POPULATION STATUS, 1976-2023

Kasey Fralick, Isabel Evelyn, and Gary Warren

The Black Creek Crayfish (BCC) is a state-listed crayfish that is only found in a small portion of the Lower St. Johns River watershed, mainly within the Black Creek basin. It is also found in other nearby watersheds outside of the Black Creek basin that feed into the St. Johns River (EX: Etoniah Creek, Clarkes Creek, Julington Creek).

In 2008, a crayfish native to parts of Florida, but not native to the Lower South Fork Black Creek basin – the White Tubercled Crayfish (WTC) – was first observed at two nearby sites in the Lower South Fork Black Creek.

Both BCC and WTC are specialists that require stream/river habitats that do not reach high temperatures in the summer. Other crayfish that overlap in range with BCC.

FWC conducted surveys from October 2018 – July 2023 to determine the current distributions of the BCC and the WTC within watersheds that contain records of BCC.

As of 2023, WTC have replaced BCC throughout most of the Black Creek basin. In general, WTC has completely replaced BCC in the higher order streams. The sites where both species currently co-occur are located in lower order streams. This period of co-occurrence is temporary, as WTC eventually replaces BCC in the sites it colonizes.

The only sites within the Black Creek basin where BCC are present without the WTC are located upstream of some kind of natural or artificial barrier that is preventing WTC from moving upstream.

No WTC were found in the sampled watersheds outside of the Black Creek basin, where only BCC or other native crayfish species were found.

FWC will continue monitorknown BCC populations within and outside the Black Creek basin, as well as conduct additional surveys to determine the range and status of BCC outside of the Black Creek basin.

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EVALUATION OF LAKE OKEECHOBEE LITTORAL AND SUBLITTORAL ZONE INVERTEBRATE COMMUNITY STRUCTURE

Kasey Fralick, Isabel Evelyn, and Gary Warren

The purpose of this project is to obtain information on the current status of the Lake Okeechobee macroinvertebrate community in both the sub-littoral and littoral zones of the lake. In fall 2021 and 2022, we conducted macroinvertebrate sampling in the sub-littoral zone of Lake Okeechobee within the three major substrate types– mud, sand, and peat – using the FWC site network utilized for previous macroinvertebrate surveys in the sub-littoral zone. Eighteen mud samples, 18 sand samples, and 18 peat samples were collected during each sampling event.

We plan to conduct further sampling in the Lake Okeechobee sub-littoral zone in February/March 2024, and conduct sampling in the Lake Okeechobee littoral zone in September 2023, February/March 2024, and August/September 2024.Invertebrate communities will be compared across spatial (habitat type, site) and temporal (season, year) scales.The results of our surveys will be compared to the findings of previous FWC Lake Okeechobee invertebrate community surveys (1987 – 1996; 2005 – 2008) to assess long-term trends.

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PHYLOGENY AND POPULATION STATUS OF IMPERILED SILTSNAILS ENDEMIC TO FLORIDA SPRING ECOSYSTEMS

Kasey Fralick, Isabel Evelyn, and Gary Warren

There are 13 species of siltsnails in the genus Floridobia in Florida. 12 are designated as critically imperiled (G1) or imperiled (G2) by NatureServe, and 11 are endemic to a single spring system.

There are 9 species of siltsnails in the genus Aphaostracon in Florida. 6 of these are endemic to a single spring system and designate as critically imperiled (G1) by NatureServe. Two of the three species with wider ranges are ranked by NatureServe as imperiled (G2), and one is ranked as vulnerable (G3).

FWC is currently conducting a project that seeks to: (1) Develop survey methods for Floridobia and Aphaostracon species; (2) Determine the current status and habitat preferences of single-spring endemic Floridobia and Aphaostracon species; and (3) Sequence Floridobia and Aphaostracon specimens to analyze phylogenetics and population genetics within the genera.

As of this report, seven of the narrow-range endemic Floridobia species – Floridobia mica (Coffee Spring), F. helicogyra (Hunter Springs), F. petrifons (Rock Springs), F. wekiwae (Rock Springs), F. parva (Volusia Blue Springs), F. alexander (Alexander Springs), and F. porterae (Green Cove Springs) – have been confirmed as present at their type locality. F. ponderosa (Sanlando Springs) and F. leptospira (Glen Branch) were not located. In addition, Four of the endemic Aphaostracon species – A. monas (Wekiwa Spring), A. pycnus (Alexander Spring), A. asthenes (Volusia Blue Spring), and A. theiocrenetus (Clifton Spring) – have been confirmed as present in their type locality. A. asthenes, however, was found at low densities.

Preliminary results from habitat association surveys at Hunter Springs, Alexander Springs, Volusia Blue Springs, and Rock Springs suggest that Floridobia and Aphaostracon are found at the highest densities vegetated habitats such as aquatic plants and macroalgae, and are a major component of the gastropod community in these habitats. They are not strongly associated with sand substrate, where other gastropod species tend to be more common.

The sequencing data for Floridobia and Aphaostracon is currently being analyzed.

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ANALYSIS OF SOCIAL MEDIA PERFORMANCE AND PRACTICES FOR FRESHWATER FISHERIES RESEARCH

Justin Hill

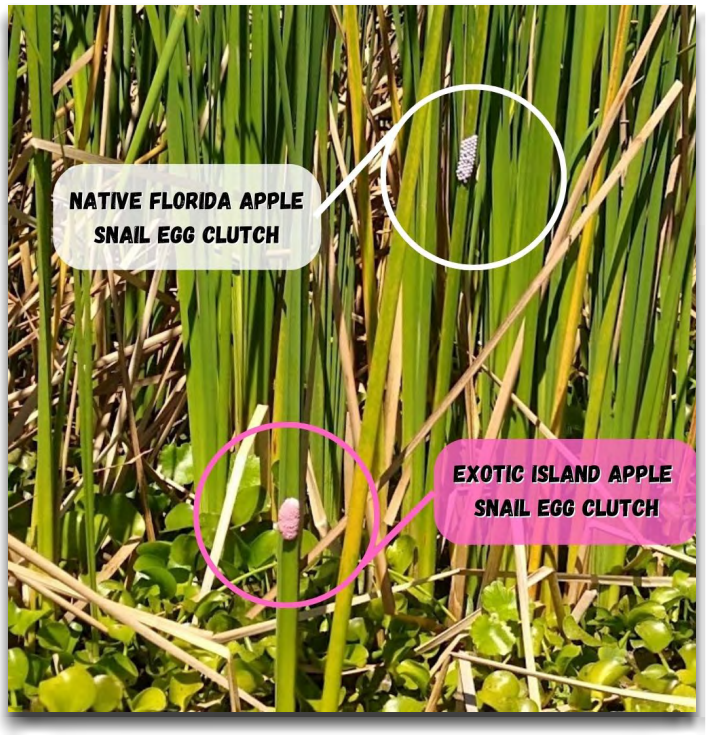
Outreach through social media is an integral part in taking the Florida Fish and Wildlife Conservation Commission's (FWC) collective information and data to the stakeholders. The Florida Fish and Wildlife Research Institute (FWRI) focuses on sharing quality scientific information through various social media platforms with Freshwater Fisheries Research (FFR) being a major contributor. Social media post totals were down slightly from previous years. Though not severe enough to warrant a call to action. This single year decline could be rectified going forward by increasing awareness in other facets of outreach thereby promoting growth in others by proxy. An example would be increased effort into the website leading to more social media posts highlighting the new web content. There are still asymptotic ends in our current practices.The nature of working for a government agency versus a private company often handcuffs certain aspects of social media work.

As percentages of FWRI content, Freshwater Fisheries is one of the most popular sections within the institute. Because of our self-reliance and quality content we have gained the trust of not just the outreach leadership within the FWRI, but also that of the Division of Freshwater Fisheries Management (DFFM) and have helped bridge a connection between the two allowing for content to be shared to mutual social media benefit.

In the coming fiscal year, I recommend we continue to probe to find alternative ways to communicate with stakeholders. Focusing on quality of interaction versus quantity can build meaningful connections with those who are more engaged.

There was a total of 110 outreach interactions in 2022/23.

- Facebook posts: 16
- YouTube uploads: 2
- Web content: 19
- Instagram posts: 17
- Other: 45
- Internet questions: 10



Notable posts: A post highlighting Red Drum in Lake George reached over 50,000 people on Facebook and a post identifying Apple Snail eggs reached nearly 20,000 accounts on Instagram.

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ANNUAL UPDATE OF FWC'S FRESHWATER CITIZEN-SCIENCE PROGRAM, TROPHYCATCH

Summer Lindelien, Kristen Eser, KP Clements, Drew Dutterer, John Cimbaro, Michelle Kerr, Jason Dotson, and Bill Pouder

TrophyCatch (TC) has 14,471 approved entries across 406 public waterbodies over 11 seasons as of June 30th, 2023. These citizen-science data collected for Largemouth Bass greater than eight pounds surpass data collected from standard electrofishing samples and the Trophy Bass Tagging Study (1,722 tagged fish from 165 public waterbodies).

Program awareness, as measured by the Trophy Bass Tagging Study, increased (31% to 72%) through seasons 1–4 but reached an asymptote (63%–73%) across seasons 4–9. Awareness then surged from 63% in Season 9 to 83% (all-time high) in Season 10. During Seasons 10 and 11 it has peaked between 79%–83% (see The Trophy Bass Tagging Study Report). TrophyCatch had 36,761 registrants as of June 30th, 2022.

On (06/19/2023), we surveyed TC participants about their current motivations for participation and their opinions for areas of improvement. There were 696 responses to the survey, in which, most anglers heard about TrophyCatch through word of mouth or from our website. The most important reason for registering was to support FWC and Florida Bass conservation, and when submitting, providing data for research and management. Fifty-three percent of respondents said the program was "good as is" or no change necessary.

We promoted the Battle of the Lakes competition for the Florida Trophy Bass Project (Orange vs. Fellsmere). Fellsmere leads in total weight (750 lbs. 7 oz.) versus Orange Lake (545 lbs. 12 oz.). As well as attended and presented at events such as, the Bassmaster Classic, ICAST, MarineQuest, News Channel 8, FL AFS, the FWC joint meeting, and the UF seminar series.

- Fellsmere Reservoir had the most approved catches for Season 11 (83; 9%;).
- Orange Lake had the second most approved catches for Season 11 (55; 6%;).
- Orange Lake had the most Trophy Club and Hall of Fame club catches (18 and 4).
- Mean recorded maximum total length was 24". Mean documented weight was 9.15 lbs.
- Nine percent of trophy bass were caught in tournaments. Most were reported from the Xtreme Bass Tournament Series.
- Seven percent of trophy bass were caught on guided trips. Most were caught with Shellen Guide Service.

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CREEL ESTIMATES REPORTED FROM TROPHYCATCH REGISTERED ANGLERS

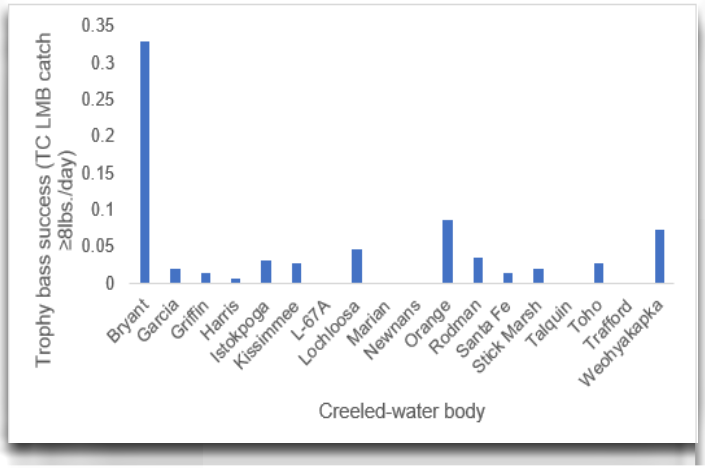
Summer Lindelien

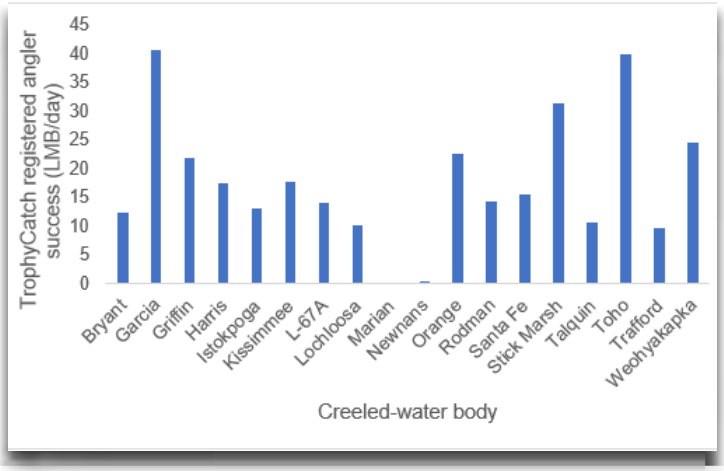
Starting in 2019, creel surveys around the state added a question to determine anglers who are registered for the TrophyCatch (TC) program. These data were collected to evaluate current TC registration rates, residency, targeted species, and TC registered angler effort, catch, and success. Tracking TC approved bass through the program is helpful, but we have no way to scale approved bass between water bodies. By capturing statewide-standardized TC registered angler effort we can better evaluate if TC approvals for a waterbody are higher because there is more TC registered angler effort or if the waterbody produces more TC bass.

To explore this further, we used TC catch date within water body creel periods and TC registered angler effort (LMB/day) to calculate catch per unit effort (LMB ≥8 lbs./day) of trophy bass. We can identify locations where additional TC promotion is needed and assess if TC registered angler effort is increasing to document growth of the program. These data could also help us evaluate changes in TC submissions and participation.

Creel survey data will expand information gained from TC collected data and allow for more scientific and management applications.
Out of the total number of FWC-creel surveyed anglers (9,446), 14% were registered for TC.

- Lake Kissimmee and Lake Tohopekaliga had the highest percentage of Florida residents that were registered for TC (36% and 34%).
- Lake Talquin and Lake Trafford had the lowest percentage of Florida residents that were registered anglers for TC (2%).
- Rodman Reservoir and Santa Fe Lake had the highest percentage of non-resident anglers that were registered for TC (25% and 22%).
- Karick Lake, Deer Point Lake, Lake Trafford, and the Suwannee River all had zero non-resident anglers registered for TC.
- Based on creel data from 18 waterbodies, TC registered angler effort was highest at Lake Harris and Lake Istokpoga (Table 1). Lake Harris also had the highest catch this year and last year.
- TrophyCatch registered angler success was highest at Lakes Garcia and Tohopekaliga (1.69 and 1.66 bass per hour; Table 1).
- TrophyCatch registered angler success was lowest at Lake Marian and Newnans Lake.
- Trophy bass success (bass ≥8 lbs. per day) was highest at Lake Bryant, Orange Lake, and Lake Weohyakapka.





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COMMUNITY BASED FISHING PROJECT

Nick Tripple, Eric Johnson, Josh Wilsey, Hayden Wennerdahl, Scott Coerver, Allen Martin, Courtney Stachowiak, Scott Bisping, Jennessy Toribio, Madison Fishman, and Ed Camp (UF)

No evaluations were completed during this fiscal year due to high staff turnover and sub-adult bass not being available from the hatchery. Camera creel analysis is still underway, angler counts in photos are still being processed in order to get up to date total angler effort estimates. Meetings were held to determine evaluation plans for 2023-2024. The South Region will evaluate stocking of catchable size bass and the Southwest, North Central, and Northeast regions will evaluate expanded marketing/ advertising efforts.

Plans are currently underway to evaluate stocking of catchable size largemouth bass in two of the South region lakes. The fish stocked for this evaluation will either be one year old hatchery fish or fish collected from DOT ponds that do not allow fishing and moved to the community based fisheries. Also, a marketing plan is currently be developed. Plans will be to increase marketing/advertising efforts on two lakes in the North Central region and also two lakes in the Southwest region. There will be two control lakes in the South region which do not get stocked and two control lakes each in the North Central and Southwest regions. Total Angler effort will be monitored in all lakes and staff will compare total effort in control lakes to those that were stocked or received increased marketing/ advertising to determine how much impact these management strategies impact total angler effort.

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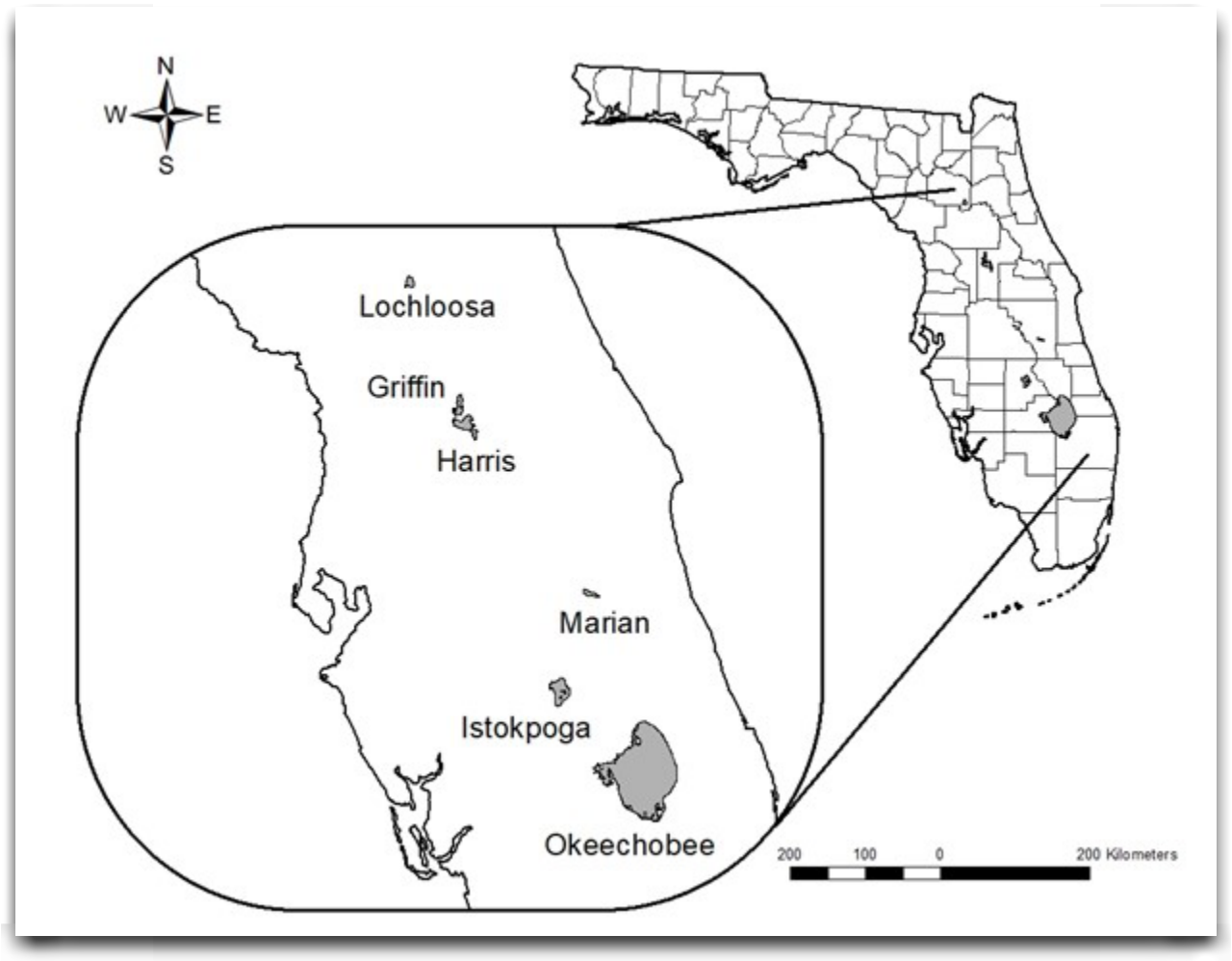
VIRTUAL POPULATION ANALYSIS OF BLACK CRAPPIE POPULATIONS IN FLORIDA

Andrew Marbury, Chris Anderson, Sara Menendez, Reid Hyle, and Matt Stevens

The VPA sampling was largely successful in the sixth year of collection with few problems in any of the sampled lakes this year. The key to collecting accurate, sufficient data for this ten-year, statewide, management/research partnership project is communication and collaboration between all biologists involved. The effort of management and research biologists continues to improve, even with high position turnover throughout many offices involved.

Gaps in creel data are a continuing problem and creel managers need more support and connection with other creel managers statewide. With some potential issues already apparent in data collection in past years, it is imperative to maintain the consistency and quality of the data in future years, which the new Black Crappie VPA data coordinator strives to do.

- The Lake Okeechobee creel methodology was changed to incorporate the entire lake.
- Data has been compiled in a single location that all parties can access.



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BLACK CRAPPIE STOCKING EVALUATION WITHIN TENOROC FMA'S PHOSPHATE MINE PIT LAKE

Ryan Howard, Paolo Pecora, Ted Lange, Brandon Thompson, and Eric Johnson

Tenoroc pits have undergone large declines in black crappie angling effort and managers are using stocking in attempts to enhance the fishery. Stockings will be evaluated in the future to determine management action success. To provide a basis of support for future black crappie stocking outcomes, we monitored water quality, productivity, and invertebrate forage, as they are linked to crappie growth, survival, and recruitment into the fishery.

Reclaimed lakes were found to have warmer water temperatures, more dissolved oxygen, less instances of hypoxia, and greater productivity on average than unreclaimed lakes. All unreclaimed lakes were nitrogen limited.

Lake Two was considered to have "good" water quality (TSI = 59.1), while Lakes Three and Shop were considered to have "fair" water quality based on their TSI values of 62.8 and 64.6, respectively. Cemetery and Picnic Lakes were also found to be nitrogen limited, while Pit C was found to be nutrient balanced.

Cemetery and Picnic Lakes were found to have "fair" water quality with TSI values of 61.6 and 68.3, respectively, while Pit C was found to have "poor" water quality (TSI = 74.9).

Cyclopoid specimens were the most common large invertebrate taxa enumerated comprising of 45.6% of all counts, followed by Calanoid taxa (28.9%), then Cladoceran taxa (23.8%), and lastly, Chaoborids and various insect larvae (any other large arthropods) (1.7%).

Neither total nitrogen, total phosphorus, nor chlorophyll-a were able to significantly predict crustacean zooplankton density: Density = 173.1 + 0.16*(total phosphate) - 0.04*(total nitrogen) - 0.04*(chlorophyll-a) ($R^2 = 0.15$, $F(3, 44) = 2.54$, $p = 0.07$).

- Three of the six study lakes were stocked with OTC- marked fingerlings.
- Lake Three was stocked with 20,000 crappie fingerlings (555 crappie/ha).
- Shop Lake was stocked with 8,500 crappie fingerlings (850 crappie/ha).
- Picnic Lake were stocked with 17,500 crappie fingerlings (700 crappie/ha).
- Post-stocking mortality was estimated to be 8.2% within Shop Lake, and 3% within Picnic Lake.

Thus far, no fluorescing OTC marks have been detected on crappie fingerling otoliths, but different detection methods are being explored. The stocking of OTC-marked crappie fingerlings is the first phase of a series of other stocking attempts that will take place for several years to come. Investigations are being made into substituting chemical marking techniques for genetic in order to identify hatchery produced crappie.

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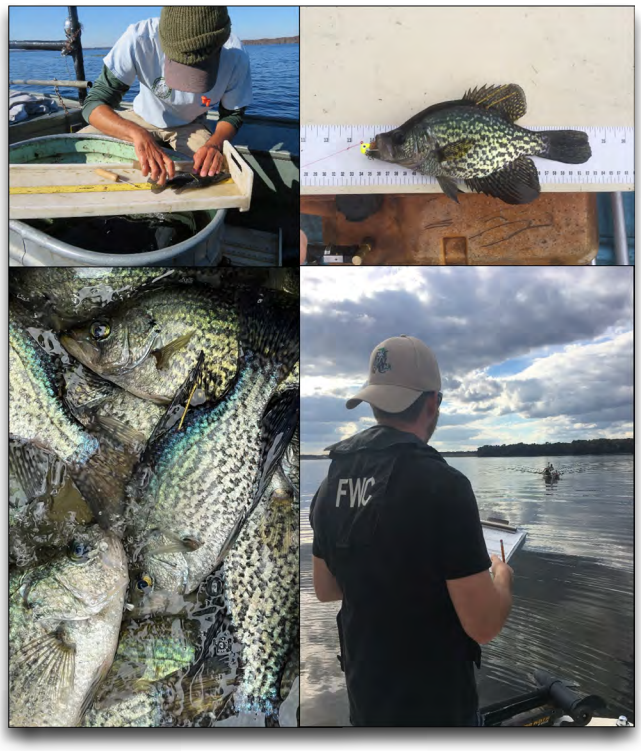
ANNUAL VARIABILITY IN ANGLER EXPLOITATION OF BLACK CRAPPIE AT NEWNANS AND LOCHLOOSA LAKES

Travis Tuten, Steve Beck, Chris Anderson, Jason O'Connor, Kyle Olivencia, and Allen Martin



FWC has observed significant relationships between Black Crappie abundance estimated from trawl sample CPUEs and angler effort, catch, and harvest estimated from creel surveys at multiple lakes. Our objectives are to determine how exploitation in Black Crappie fisheries varies annually and with fish abundance and angler response at lakes Lochloosa and Newnans.

We tagged 204 Black Crappie in Newnans Lake and 202 in Lochloosa Lake with high reward tags ($100) in November 2022. There were 33 tag returns from Lochloosa Lake, and 28 (84.8%) of those fish were harvested. This resulted in an exploitation estimate of 14.4%. There were only 9 tag returns from Newnans Lake, and 5 (55.6%) of those fish were harvested. This resulted in an exploitation estimate of 2.5%.

The 2022-2023 14.4% exploitation estimate at Lochloosa Lake was at the lower end of the range observed in eight years of the study (12.2-37.5%), and like a more typical year at Lochloosa Lake, where five of the eight exploitation estimates have ranged between 12.2 and 14.4%. The estimate for Newnans Lake (2.5%) is also the second lowest we've observed in eight years of the tagging study (Range: 1.0 – 22.9%).

- There is a strong, positive relationship between Black Crappie exploitation estimates and creel survey estimates of angler catch, harvest, and harvest success at both lakes.
- There is a positive relationship between Black Crappie exploitation and angler effort at Newnans Lake, but that relationship is weak at Lochloosa Lake.
- Relationships between exploitation and relative abundance of Black Crappie > 203 mm TL based on trawl CPUEs were positive, but weak at both lakes.
- Relationships between exploitation and relative abundance of Black Crappie > 229 mm TL based on trawl CPUEs were positive at both lakes, and stronger compared to smaller fish > 203 mm TL.

This was the eighth year of the study. As additional estimates of annual exploitation are available in future years, more detailed relationships between exploitation and fish abundance will be evaluated. Findings from this study played a key role in the Black Crappie regulation review process completed in 2021.

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EVALUATING BIOLOGICAL AND SOCIAL EFFECTS OF THE NEW STATEWIDE LARGEMOUTH BASS REGULATION

Daniel Nelson, Brandon Thompson, and Chelsey Crandall

July 1, 2016, the statewide Largemouth Bass regulation was changed to a five-fish bag, of which only one fish can be 16” or larger. Six years of the ten-year evaluation have been completed.

Creel surveys were conducted on a subset of lakes to assess changes in directed effort, catch, and harvest of Largemouth Bass, as well as social changes like regulation satisfaction and awareness. Electrofishing samples have shown no trends in catch rates, size structure, or condition of bass that can be related to the regulation change.

Regulation awareness has reached a new peak during the creels of 2022-23 (73%) and satisfaction remains high (4.61/5). Angler bass catch rates, harvest rates and overall effort have been relatively stable since the regulation. Age-at-length growth rates show no trends since the regulation change.

Five hundred seventy-nine (579) Largemouth Bass were tagged in fall 2022 to assess changes in size selective harvest post-regulation change. Exploitation rates remain low statewide, yet some interesting trends are appearing.

- In some regions the exploitation rates of small bass (<16”) are declining, while exploitation rates for larger bass (>16”) are increasing.
- Although no positive biological impacts are occurring, the new regulation has not had any negative impacts.

The new regulation is meeting the objectives of protecting mature female fish and allowing maximum harvest potential for a five-fish bag. Positive social impacts have been documented in continual high angler satisfaction. Continued evaluations at the variety of waterbodies through multiple sample types will allow biologists to detect any changes to bass populations and angler dynamics.

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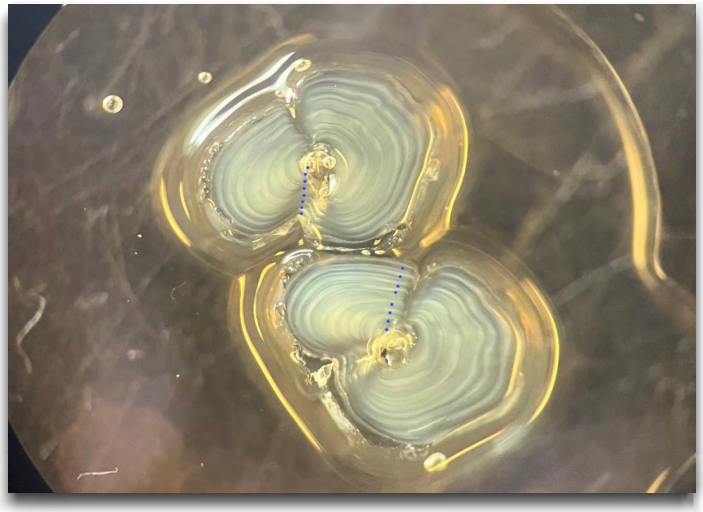
ADVANCING NONLETHAL AGE ESTIMATION METHODS AND APPLICATIONS FOR LARGEMOUTH BASS IN FLORIDA

Summer Lindelien and Drew Dutterer



Dorsal spines provide viable and uncommon age information about trophy-size LMB without sacrificing this socially and biologically important segment of the population. Incorporating a nonlethal ageing method in fishery-dependent activities (e.g., citizen-scientist data collection) expands age data sources and fosters increased angler interest and participation, generating a valuable new tool for bass research, management, conservation, and stakeholder engagement.

The best ageing method is a hybrid approach of using both otoliths and dorsal spines. This included using otoliths to age LMB <56 cm MTL and using dorsal spines to age LMB ≥56 cm MTL. Using this method, estimates of A fell within 1–2% of estimates of A using just otolith ages (current FWC method).

We received 33 total dorsal spine samples from eight anglers during the pilot program from January 2023 to June 30th, 2023.

- We received the most age samples from Kingsley Lake (20).
- The longest measured bass were documented from Kingsley Lake.
- Estimated ages from dorsal spines were oldest from Kingsley Lake and Porter Lake (13).
- Kingsley Lake bass displayed the highest weight gain per year (growth = 1.21 lbs./yr.).
- Anglers also collected sagitta otoliths from Southern Wildlife Taxidermy. One was a 15 lb. 12 oz., 10-year-old bass from Orange Lake in Alachua County.

We will conduct semi-structured interviews with the anglers who participated in the pilot program in the first year to see their views on the process and the results. There are plans to add another water body (Lake Placid) and train an angler to collect the third dorsal spine. We will continue collecting samples from the stated water bodies for 23-24 fiscal year.

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STATEWIDE EVALUATION OF ANGLER CATCH AND EXPLOITATION RATES OF TROPHY FLORIDA BASS

Drew Dutterer

The trophy bass tagging study was designed to evaluate components of Florida's statewide trophy-bass fishery during the operation of TrophyCatch, an angler-recognition, citizen-science, trophy-bass conservation program because it promotes catch and release for trophy-size bass (≥ 8 lbs).

Bass ≥ 8 lbs have been tagged with high-reward ($100) external dart tags during routine annual sampling across the state since 2011, and tagging efforts remain ongoing. Tag returns have been monitored to meet the objectives of measuring mean annual statewide catch, exploitation, and release rates of trophy-size bass and to measure awareness and participation rates of TrophyCatch.

Cumulatively through 12 years of operating the tagging study, FWC biologists have tagged 1,722 trophy-size bass (84–194 per year; this year: 84) from 165 public waterbodies (29–56 per year; this year: 29) within Florida. Throughout the study, estimates of mean annual catch of trophy-size bass have varied 12%–27% (this year: 22%), and annual exploitation varied 1%–6% (this year: 3%).

- Low annual exploitation rates were due to high release rates (77%–95%; this year: 88%), which were largely voluntary.
- Long-term trends of release rate showed a significant increase through time, and harvest for taxidermy has shown a statistically significant decrease.
- TrophyCatch awareness increased rapidly through its first four seasons (31% to 72%), and it remained steady between seasons 4–9, only varying between 63%–73%. During the last two seasons, awareness reached highest levels, varying between 79%–83%.
- TrophyCatch participation rate has varied through time (6%–42%), with peaks in participation rate during seasons 5 and 6 and again during the last two seasons (10 and 11).

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LARGEMOUTH BASS REGULATION EVALUATION IN THE ESCAMBIA RIVER MARSH

Matthew Wegener and Amanda Mattair

Largemouth Bass from the Escambia River Marsh rarely reach 406-mm TL, thus the entire population is susceptible to harvest because of the new statewide Largemouth Bass regulation. Excessive exploitation occurred on the Escambia River when the entire population was susceptible to harvest during the 1980's; however, there is uncertainty whether significant Largemouth Bass harvest still occurs on the Escambia River. Research is needed to re-evaluate the fishery from the Escambia River Marsh both from a biological perspective, and a human dimensions perspective.

- Catch rates from day-time electrofishing samples have not significantly decreased since implementation of the new regulation.
- Total annual mortality has increased since implementation of the new regulation. Largemouth Bass harvest rate has increased to > 30% after the statewide regulation was implemented.
- The lowest total fishing effort since surveys began in 1981 was reported in 2022. Exploitation estimates from two years of high-reward tagging were 0.00 (2022) and 0.01 (2023). Larger fish and bigger tags were used in 2023 to improve reporting, but there was no change in exploitation estimate, suggesting fish and tag size had little effect on reporting.
- Increased harvest rate, slightly higher total mortality rate and shift in age structure detected since regulation was implemented, but too few people fishing for it to have a negative effect on population abundance.

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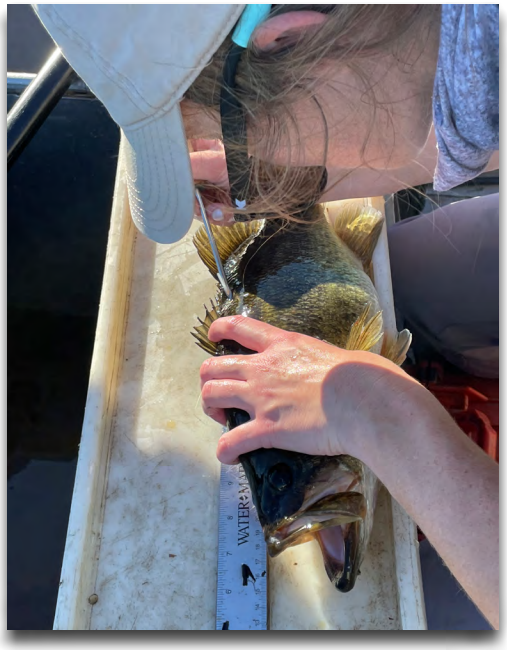
WHOLE-LAKE CREEL DESIGN COMBINING CATCH AND TAGGING TO ESTIMATE LARGEMOUTH BASS ABUNDANCE

Brandon Thompson, Daniel Nelson, Matt Stevens, and Josh Wilsey

Lake Okeechobee is considered Florida's most recognized and popular waterbody. The significance of this fishery, combined with large-scale changes over time, highlights the importance for comprehensive monitoring. Historical roving creel design only sampled approximately 10% of the lake area and there is a need to accurately represent lake-wide changes in the fishery.



Researchers and managers collaborated to design an innovative creel survey that assessed lake-wide effort and catch using trailer counts and access interviews at select public ramps while also correcting for lake-wide anglers with on-the-water surveys. With a new water level regulation schedule planned at Lake Okeechobee, there was also a need to assess changes in bass abundance over time. Therefore, a technique to estimate the population size was employed by taking the estimated bass catch from the creel (Jan–June) and dividing it by the proportion of bass caught (during the same time period) from the high-reward tagging study.

- Biologists dart tagged 436 bass over 16" in early January to assess angler capture rates for bass. Preliminary results from the creel estimated the total, lake-wide effort at just under one-million angler hours (995,703) over the 8.5-month survey (Oct 12, 2022 to June 20, 2023) and approximately 75% of the effort came from the north section of the lake.
- Roughly 56% of the total effort was targeted for Largemouth Bass and anglers caught nearly 500,000 bass.
- Although bass was the most targeted species, anglers targeted Black Crappie in nearly an equal proportion during peak fishing months (Dec-Mar) and represented 37% of the total effort.
High harvest rates resulted in an estimated 800,000 harvested crappie.
- From the tagging study, 92 of the 436 (21%) bass tagged, were reported as caught by anglers from early January through June 20th.
- During this same time (creel periods 4–9), the creel survey estimated that bass anglers caught a total of 336,603 bass.
- We explored methods for assigning capture vulnerability for all bass caught in the creel (generally over 12") and the method with the least bias resulted in an estimated 2.5 million bass (5.5bass/acre).

This study has revealed that we were able to effectively assess the lake-wide fishery at Lake Okeechobee and that it receives by far the most sportfish effort in Florida. Further, it also demonstrates that high reward tagging can be used in combination with the annual creel surveys to obtain reasonable abundance estimates and this technique could be incorporated into the monitoring of this high priority resource.

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NEWNANS LAKE LARGEMOUTH BASS STOCK ENHANCEMENT EVALUATION

Kyle Olivencia, Steve Beck, Chris Anderson, Summer Lindelien, and Steve Hooley

Newnans Lake is one of three major lakes in the Orange Creek Basin (OCB) in north central Florida. Its bass fishery is characterized by low catch rates in electrofishing surveys, and low angler effort and catch success rates in creel surveys, especially when compared to the other major OCB lakes (i.e., Orange and Lochloosa) over the last decade. Three high density stocking events occurred at Newnans Lake during spring 19–21 when nearly 1 million pellet-reared, fingerling bass were released across all three years combined (112/ha).

Electrofishing mean catch-per-unit-effort (CPUE) from bass targeted sampling in the spring increased from 0.03 ± 0.01 bass/min in 2022 to 0.13 ± 0.02 bass/min in 2023; however, the water level in Newnans was 1.86 feet NGVD88 higher in 2022 than 2021, which likely had a substantial, negative impact on our catch rates in 2022.

- Creel estimates for bass angler effort decreased from 3932 ± 526 angler hours in 2021-22 to 1198 ± 270 angler hours in 22-23.
- Angler catch success rates of bass decreased from 0.09 ± 0.02 bass/hr in 2021-22 to 0.06 ± 0.04 bass/hr in 22-23.
- The proportion of trips where anglers targeting bass successfully caught at least 1 bass decreased from 0.15 ± 0.03 trips in 21-22 to 0.06 ± 0.03 trips in 22-23.
- The percentage of bass anglers surveyed that were aware of the high density stocking events that took place from 19–21 increased from 6% in 2020-21 to 28% in 2021-22 and then decreased to 7% in the 22-23 season.
- Top 3 ways anglers heard about the stocking were by word of mouth, creel surveys, and signs.
- Hatchery contributions of bass from the 19-21 stocking events made up 4% in 2020, 0% in 2021, and 8% in 2022 of the bass sampled during bass-targeted electrofishing in the spring.
- Genetic analysis of bass sampled during spring 2023 bass-targeted electrofishing are still being analyzed. These metrics will continue to be monitored and an in-depth data analysis will be conducted upon completion of data collection in FY 23-24.

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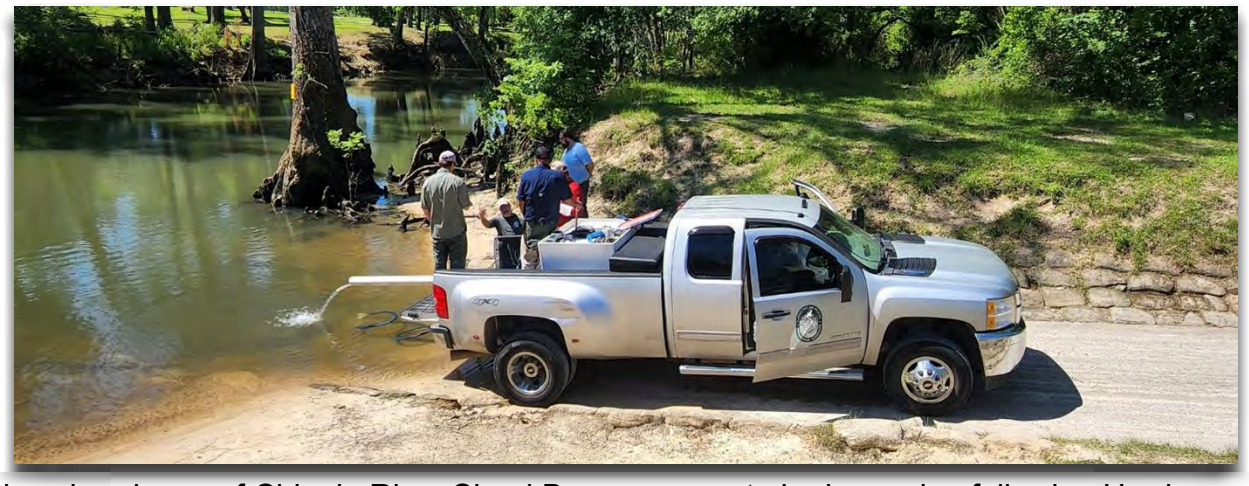
SHOAL BASS MONITORING AND PRELIMINARY STOCKING EVALUATION

Ryan Henry, Andy Strickland, Stephen Stang, Chris Paxton, Brandon Barthel, and Bryan Winston



• Relative abundance of Chipola River Shoal Bass appears to be improving following Hurricane Michael; likely due to a combination of natural reproduction and the 2022 stocking.

• 63 age-0 Shoal Bass were collected during the stocking evaluation.

• 65% (41 of 63) of age-0 Shoal Bass collected were hatchery fish.

• Hatchery fingerlings were found as far as 10-km downstream from the stocking location No fish were found in Reach C or upstream from the stocking location in Reach A.

• Hatchery fish were larger (TL 136 mm) on average than the wild produced age-0 Shoal Bass (TL 116 mm.

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DEVELOPMENT OF A COMPREHENSIVE FLORIDA FRESHWATER FISHERIES STRATEGIC STOCKING PLAN

Ed Camp (UF) and Diana Perry (UF)

The FWC contracted University of Florida (UF) to develop a comprehensive freshwater fisheries strategic stocking plan over a four-year period. The fourth and final year of the project included holding a workshop to discuss the stocking simulation tool and strategic stocking plan, finalizing a stocking simulation tool, and developing a strategic stocking plan.

The stocking simulation tool allows managers to test different scenarios of stocking largemouth bass in terms of numbers and sizes, and landscape strategies for stocking to support specific objectives such as overall catch rate or trophy catch rate.

The stocking simulation tool was finalized considering stocking strategies discussed at a workshop that included attendees from FWC administrators and staff from the Division of Freshwater Fisheries Management (DFFM) and FWRI's Freshwater Fisheries Research Section (FFR).

Close to two hundred stocking scenarios were run with the stocking simulation tool to give expected outcomes of stocking largemouth bass for improving overall catch rates and trophy catch rates.

The stocking simulation tool allows managers to explore potential outcomes of stocking scenarios without having to wait months or years for results.

The strategic stocking plan was developed to support managers making optimal stocking decisions by integrating scientific information while considering fish populations, economic contributions, and stakeholders desires and participation.

The strategic stocking plan was meant to help:

- Sustain or increase fish populations.
- Maintain or increase satisfaction of freshwater anglers.
- Maintain or increase economic contribution from fisheries along with participation of freshwater fisheries.
- Learn from the stocking system and support the use of adaptive management.

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ST. JOHNS RIVER MORONE SPP. STOCKING PROGRAM ASSESSMENT

Susanna Harrison, Jay Holder, and Earl Lundy

Directed electrofishing efforts and snorkeling surveys throughout the SJR system have indicated that Silver Glen Springs (SGS), a first magnitude spring discharging into Lake George via a one-kilometer run, holds one of the largest summer aggregations of Morone spp.

From early July 2022 through June 2023, we made visual snorkel/video observations on at least a monthly basis of Striped Bass Morone saxatilis and Sunshine Bass (Morone chrysops x M. saxatilis) at SGS. Count numbers were lower overall than in previous years, but Morone spp. were found in all surveys with numbers peaking (~800) in late summer 2022.

In previous years, we have always observed large aggregations of Morone spp. in the main boil area during spring and summer. However, during this fiscal year's surveys (July 1, 2022 – June 30, 2023), we did not see any fish in the main boil at any point during the year. The fish we did see were confined to the user-restricted chimney area. Further research is needed to determine why observed Morone spp. have numbers declined at SGS and what the implications might be for future stocking efforts.

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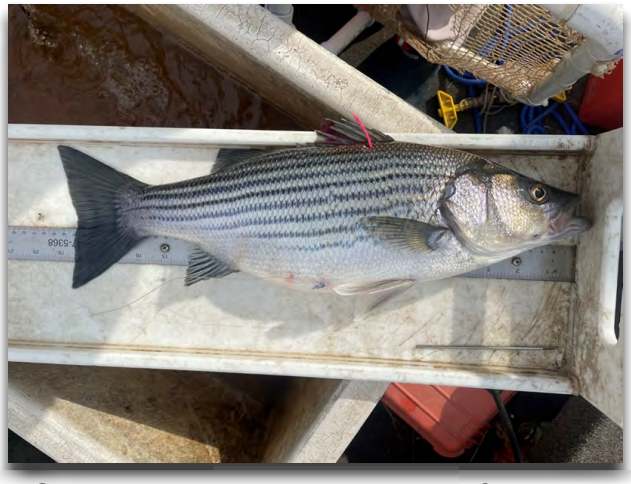
USING TELEMETRY TO IDENTIFY HABITAT FOR STRIPED BASS IN LAKE TALQUIN AND THE OCHLOCKONEE RIVER

Stephen Stang, Andy Strickland, Ryan Henry, Chris Paxton, Jacob Cunningham, and Sam Burke



Forty-three Striped Bass were surgically implanted with radio-tags and external dart-tags from February 15, 2023, to March 1, 2023 before being released into Lake Talquin. These tagged fish ranged in size from 457 to 879 mm. Four passive radio-receivers were placed around Lake Talquin and lower Ochlockonee River to detect emigration and supplement active tracking. This took place on Lake Talquin on a weekly basis beginning in May and the lower Ochlockonee River was actively tracked in July. Plans are to continue to actively track through the fall of 2023.

- Survival 30 days post-surgery of 40 detected fish was 90%.
- Fifteen fish (35% of sample size) emigrated through the Jackson Bluff Dam from February through June.
- There have been four mortalities detected.
- Four fish have been recaptured by anglers, three of which were harvested.
- Ocklawaha Creek and the Little River have been identified as thermal refuge areas in Lake Talquin.
- Lake Talquin's tailrace, Hubbard's Branch, and Telogia Creek have been identified as thermal refuge areas in the lower Ochlockonee River.
- No fish have been detected in creek's that were part of HSC shredding projects aimed at improving thermal refuge habitat during the winter/spring of 2022.

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ALLIGATOR GAR RESEARCH IN PENSACOLA BAY

Amanda Mattair, Matthew Wegener, and Bradford Warland

The population status of Alligator Gar in Florida is currently unknown but is thought to be declining throughout its historical range.

Large-mesh gill nets were used to sample Alligator Gar and captured individuals were surgically implanted with ultrasonic-telemetry tags and externally implanted with PIT tags. Active and passive tracking were used to estimate movement and habitat use of these fish.

- All Alligator Gar captured in FY 22-23 were captured in the Escambia River
- Majority of detections occurred in bay habitats, followed by Escambia River.
- Most of the river detections occurred during the warmer months (May-September).
- Alligator Gar were petitioned for state threated listing.
- Long-range movement coincided with rising river levels and could have been related to a spawning event.
- Telemetry results suggest Alligator Gar in Pensacola Bay are panmictic, likely traveling to a single tributary of Pensacola Bay to spawn.
- Telemetry and genetic analysis combined suggest a mark/recapture estimate in the Escambia River during the spring could be representative of the entire Pensacola Bay population.

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AGE AND GROWTH OF AMERICAN EEL IN THE LOWER ST. JOHNS RIVER, FLORIDA

Kimberly Bonvechio, Trevor Philips, Susanna Harrison,
Marcus Zokan, Brittany Bottom, and Michelle Taliercio

The American Eel Anguilla rostrata stock is considered to be in a state of decline by the Atlantic States Marine Fisheries Commission. Little is known about populations in much of its range, including Florida. This study focuses on American Eel life history and population dynamics in the lower St. Johns River.

- Two years of sampling included 42 sampling events over a 12-week period from August to November 2021 and September to December 2022.
- A total of 297 eels were collected ranging from 150 to 705 mm total length, but a modal peak was observed for the 32-33.99 cm size group.
- Eel catches were low but varied by section of river and through time; however, no differences were observed in the length-weight relationship or size structure among river sections.
- We observed adult Anguillicoloides crassus in 36% of swimbladders, while 57% exhibited some level of swimbladder damage. No patterns were observed in incidence of infection or severity of swimbladder damage among size groups, sex, or river section. However, relative swimbladder size was significantly less for fish with severe swimbladder damage.
- Otoliths for fish collected in 2022 are still being processed for age determination, but 2021 samples revealed continental ages ranging from 0 to 8 years with a modal age of 3 years.
- Histological data were only summarized for 2022, and they revealed a male:female ratio of 0.9:1 with nearly all fish being sexually immature.

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SHAD AND RIVER HERRING MONITORING. ST. JOHNS RIVER

Reid Hyle, Susanna Harrison, Earl Lundy, and Jay Holder

Freshwater Fisheries Research continued to collect spawning stock, creel, and juvenile data for Alosa species in the St. Johns River as part of the ASMFC Shad and River Herring Management Plans for Florida

The spawning stock abundance index was the 4th lowest in the 21-year time series and the 7th consecutive year below the action threshold set forth in the management plan.

Anglers expended an estimated 7,279 hours targeting shad in the primary fishing areas which was the 2nd highest value in the 13 years of the creel but well below historic effort levels. Harvest was estimated to be only 21 total fish out of a total catch of 3,672 fish.

The juvenile abundance index was 2.48 which ranked 10th in the 16-year time series. Juvenile abundance has high inter-annual variability likely tied to spawning season river flow but has an overall increasing trend.

No action was recommended in the annual management plan compliance report to ASMFC. The rational was that the low effort and minimal harvest in the recreational fishery are not factors in the low spawning stock abundance observed over the last seven seasons.
Adult Hickory Shad and Blueback Herring were also collected in the spawning stock survey at typical low abundance.

Extremely warm temperatures led to water temperatures reaching 27 C on the 54th day of the year; this is the earliest date yet recorded since monitoring began. This is the upper threshold for American Shad spawning. There is an ongoing trend toward earlier warming which may impact recruitment in the future by truncating the spawning season. Sampling was terminated a full month earlier than historic norms.

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POPULATION DYNAMICS AND HABITAT USE JUVENILE GULF STURGEON – PENSACOLA BAY FL

John R. Knight, Jonah Cruz, Kirsten Humphries, and Bradford Warland

The Garcon Point Aquatic Research Laboratory recently completed the seventh year of juvenile Gulf Sturgeon monitoring from the Pensacola Bay watershed (Escambia and Yellow Rivers).

Currently the monitoring program is working on a multi-state agreement with Louisiana State University, University of Southern Mississippi, University of Georgia, University of Florida, the U.S. Fish and Wildlife Service, and the U.S. Geological Survey to assess population dynamics of juvenile sturgeon range wide.

During FY 22-23, a total of 88 sampling days was conducted on this project. Fifty-two were allocated to the Yellow River system, while 34 were dedicated to sampling the Escambia system.

Sampling was initiated in late winter and continued through fall of the previous FY. Late winter and spring sampling primarily targeted estuarine habitats where juvenile appear to aggregate prior to migrating into the rivers.

A total of 60 juvenile sturgeon (<1000 mm) were collected for a parentage (genetic) analysis. Thirty-four fish (<750mm) were internally implanted with acoustic telemetry tags to monitor juvenile habitat use and movement from both the rivers and estuary habitats.

Results from previous year's research indicate that juvenile Gulf Sturgeon vary both spatially and temporally on multiple scales. In-migration holding areas were not similar from one year to the other, with juvenile fish even occurring in non-natal systems (the Blackwater Bay/River) in the spring. Summer holding areas also vary substantial even at the daily scale. Results from this research will aid in guiding future management and conservation of this federally Threatened species in order to recover decimated Gulf Sturgeon populations.

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HABITAT SUITABILITY INDEX FOR BLUENOSE SHINER POPULATIONS IN PENINSULAR AND PANHANDLE RIVERS

Earl Lundy, Chelsea Myles-McBurney, Kyle Miller, Kallie Thornhill, and John Knight

Bluenose Shiners (Pteronotropis welaka) are small minnows native to the Southeastern US and are listed in Florida as a Threatened/ Imperiled species due to concerns over water quality degradation and possible habitat loss. Water quality decline due to nutrient pollution, heightened turbidity, and water withdrawals are all possible threats which may lead to habitat loss.

Peninsular sampling was performed in Alexander Springs Run, Rock Springs Run, and the Wekiva River beginning in July of 2022. Panhandle sites were identified from 29 springs and their associated spring runs within the Choctawhatchee, Escambia, and Yellow River drainages beginning in August 2022.

- Currently there are 98 sites completed in peninsular rivers, with 108 total encounters and 251 Bluenose Shiners collected.
- A total of 38 sites have been completed in panhandle rivers, with 31 encounters and 124 Bluenose Shiners collected.

Bluenose Shiners have been detected farther downstream in Alexander Springs Run than previously documented. Additionally, Bluenose Shiners have been observed in larger areas along Rock Springs Run than previously seen. In the Wekiva River, researchers have observed a contraction of the range away from the SR 46 bridge, possibly due to perturbation from construction.

Sampling has resulted in the identification of new populations of Bluenose Shiners on the Escambia River. Populations in the Escambia River appear to be more common on the lower stretches than previously believed. Bluenose Shiners occurrences have been more extensive at historical locations than previously recorded on Holmes Creek and Escambia River. Low detections have been observed for both Choctawhatchee and Yellow Rivers, although we believe this could be a result of sub-optimal sampling conditions and low sample sizes.

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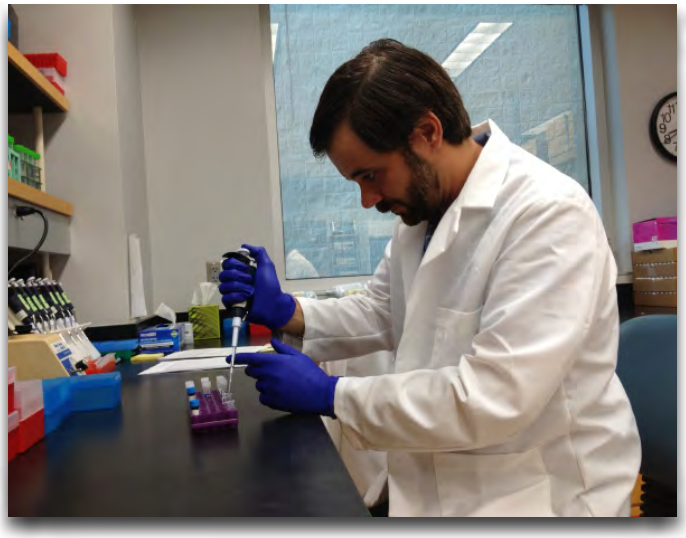
POPULATION GENETICS FOR MANAGEMENT AND STOCK ENHANCEMENT – HATCHERY RELATED PROJECTS

Brandon Barthel and Bryan Winston



The FWRI freshwater genetics program completed a number of projects that involved post-release assessments of hatchery reared Florida Bass.

- One of the 18 bass collected from Lake Trafford in 2022 was a hatchery release.
- Eighteen of the 152 bass collected from Newnans Lake in fall 2022 were identified as hatchery releases.
- Nineteen of the 281 bass collected from Lake Pierce in spring 2021 were identified as hatchery releases.
- Sixteen of the 297 bass collected from Lake Pierce in 2022 had been released from the hatchery.
- Fourteen of the 152 fish collected from Lake Talquin in December 2022 were hatchery releases.

Genetic co-parentage was used to determine that 10 Shoal Bass brood fish formed 8 spawning pairs that produced the 124 offspring that had been collected from the Blackwater hatchery pond when it was drained.

Genetic tracking was used to determine that 41 of the 63 age-0 Shoal Bass collected from the Chipola River had been released from the hatchery. This wild caught sample was used to estimate the effective sizes of the hatchery and wild spawned fish that had been collected from the river. Wild fish had an effective size five times larger than the fish from the hatchery.

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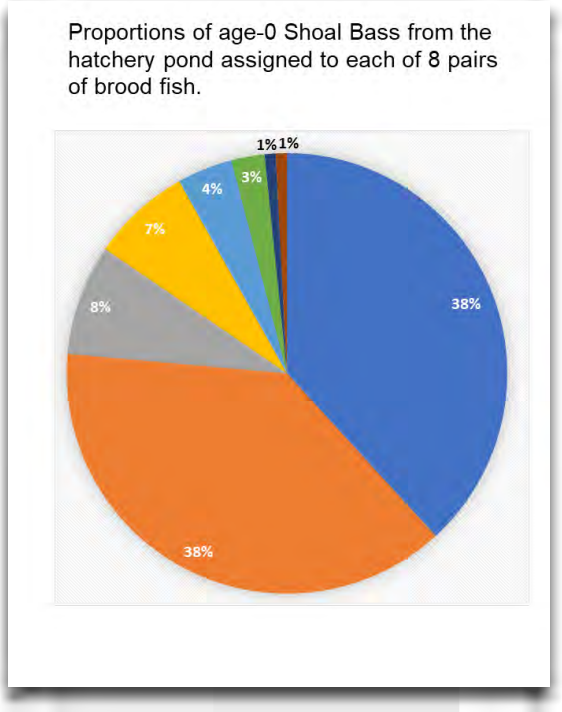
POPULATION GENETICS FOR MANAGEMENT AND STOCK ENHANCEMENT – WILD POPULATION STUDIES

Brandon Barthel and Bryan Winston



The FWRI freshwater genetics program completed several projects related to the conservation and management of wild fish populations in Florida.

- A sample of nearly 200 putative Shoal Bass was collected from the Chipola River in 2022 and genotyped with microsatellite markers.
- Three of 198 fish in the Chipola River collection were hybrids. All three were later generation backcrosses with >90% Shoal Bass ancestry.

The effective size estimates for the 2022 sample collected from the Chipola River was similarly low to other estimates for the population following Hurricane Michael. There appears to have been a rapid decrease in effective size that mirrors the decrease in the census size of the Chipola River Shoal Bass population. Future work will be required to monitor the population now that it is impacted both by hybridization and negative effects of Hurricane Michael.

Six microsatellite markers were identified for work on Spotted Bullhead and Snail Bullhead. This study identified two genetic groups of Spotted Bullhead where one group was found in north Florida drainages from the Chipola River to St. Marks River and the other included all the collections from the Suwannee River drainage and the southern Withlacoochee River in peninsular Florida. There was evidence of genetic differentiation between Spotted Bullhead populations from isolated streams within the two major genetic groups.

Overall, the genetic evidence suggests that it is likely that the southern Withlacoochee River population is the product of Spotted Bullhead from the Suwannee River drainage being introduced into the Withlacoochee River. The fish from the Withlacoochee River had fewer alleles than the other population samples and the allelic distribution patterns were consistent with rare alleles having been lost via a population bottleneck or founder effects.

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ASSESSING DELAYED MORTALITY FOR SMALLER CLUB LARGEMOUTH BASS TOURNAMENTS IN FLORIDA

Ryan Howard, Brandon Thompson, Ted Lange, and Scott Bisping

Delayed mortality is a difficult parameter to estimate due to introduced biases such as additional confinement stress. Previous work by the FWC developed custom designed enclosures to account for such biases and validated them to produce unbiased estimates of delayed mortality of tournament-caught bass through a 9-day period using telemetry. Using similarly designed enclosures, this study estimated the delayed mortality of bass caught during sixteen summer and nine winter bass fishing tournaments.

- Tournament-caught bass were placed into enclosures alongside reference bass (bass collected via electrofishing) and the enclosures were monitored daily to check for mortalities of both groups.
- Average total mortality of tournament caught largemouth bass was greatest in the summer months at 43% (N = 16) tournaments, range 26% to 85%) compared to 7% (N = 9 tournaments, range 0% to 25%) during the winter months.
- Reference bass experienced lower mortality than tournament caught bass with 8% dying on average during the summer, and 1% during the winter.
- On average, delayed mortality contributed 90% of total mortality (Table 1).
- The majority of the delayed mortality (81%) occurred in the first 5 days after an event.
- Larger bass (≥508mm) did not die at greater proportions than smaller bass (< 508mm)during the 9-day holding period (p-value = 0.98); their delayed mortalities were 29% and 39% respectively.

We will proceed with developing educational materials to perform outreach with tournament organization and other interested groups.

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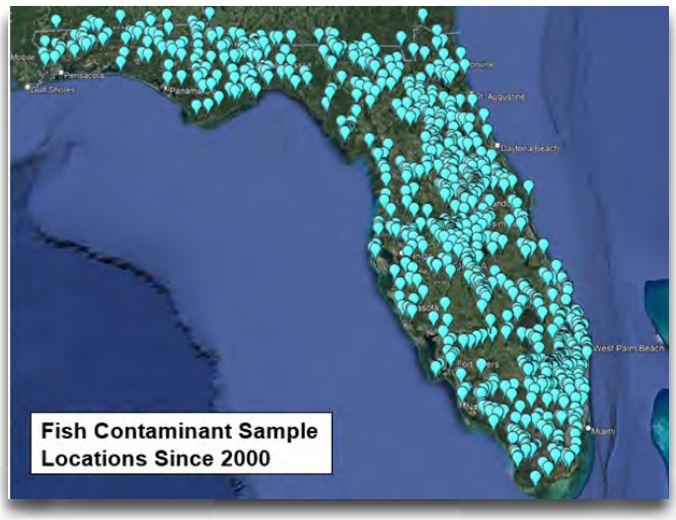
STATEWIDE MERCURY (HG) INVESTIGATIONS

Ted Lange, Doug Richard, Ryan Howard, Mike Mitchell (FL DOH), and David Tyler (FL DEP)



Management partners use contaminant specific criteria for the protection of human health to issue fish consumption advisories (FLDOH) and to identify waters as impaired for designated use under the federal Clean Water Act (FLDEP) where fish consumption; recreation, propagation and maintenance of a healthy, well-balanced population of fish and wildlife are maintained. FWC maintains data to support human health risk assessments and monitor spatial and temporal trends in fish mercury (Hg) bioaccumulation.

Most fish advisories in freshwater fish are due to Hg contamination but advisories also exist for organochlorine pesticides (e.g. DDT, Dieldrin), Dioxins and PCBs. Advisories are recommendations only and come under the authority of the State Health Officer; Advisories are primarily due to Mercury (435), but also for Arsenic (2), Dioxin (1), Lead (1), PCBs (2), Pesticides (4), and Saxitoxins (1).

In FW, 41 and 15 species of native and non-native fish, respectively have been tested for contaminants for a variety of research and monitoring projects since 2000. Bass have the most advisories (398) while non-native species have the fewest but are important in localized areas (fig).

Since 2000, Hg concentrations in fish have remained steady. Largemouth bass are the most extensively sampled due to their importance as a sport fish and as a top-level predator, sentinel species which bioaccumulates high levels of Hg. Other important sport fish have about 50% the level of Hg than bass. The USEPA action level for Hg in fish is 0.3 mg/kg; however, FLDOH advisories start much lower for recommendations of limiting consumption to 2 meals/week (Fig)

Non native species are generally low in Hg, at least partially due to their high abundance in lower east coast urban canals which have low rates of Hg bioaccumulation (Fig).

During this past year approximately 1500 fish were collected for contaminants testing including trends assessment in the Everglades and other Florida locations, assessing new fisheries for human health risk assessments, and a re-assessment of Dioxin like compounds in Wagner Cree a tributary of the Miami River which has undergone restoration. Staff also assisted FWC HSC staff to evaluate bounty caught pythons for potential human consumption.

Per- and polyfluorinated alkyl substances are entirely anthropogenic compounds, originally created for industrial purposes in the 1950s, and are widely used in textile, upholstery, nonstick product manufacturing, aqueous film forming foams, and hydraulic fluids. Commonly referred to as PFAS or PFOS compounds, they are an emerging class of contaminants that have been detected in biota from around the world, including Florida. They appear to have a ubiquitous distribution in water and sediment in Florida (Griffin et al. 2023), have been detected in fish tissue from Florida (NRSA), are the focus of monitoring by FLDEP (DEP), and monitoring for their presence in Florida fisheries should commence in 2024.

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LONG-TERM MONITORING OF LAKES – STATEWIDE SUMMARY

Kim Bonvechio

Standardized fish community electrofishing samples were collected from 25 waterbodies in late summer and fall (August 2022 to January 2023) and from L67A canal in spring (April 2023).

• Inverse Simpson diversity index varied from 1.62 to 6.68 and averaged 3.98 for all systems combined.
• A total of 72 identified species of freshwater and marine taxa were collected during community sampling.
• Bluegill, Eastern Mosquitofish, and Threadfin Shad were the most abundant numerically, whereas Florida Gar, Bowfin, and Largemouth Bass dominated the catch by weight.
• Targeted sampling for Largemouth Bass were collected during spring 2023 on 29 waterbodies.
• Largemouth Bass electrofishing catch rates were variable and averaged (± 1 SE) between 0.02 ± 0.03 fish/min at Lake Trafford to 1.55 ± 0.61 fish/min at Lake Tarpon.
• Black Crappie were collected with a standard otter trawl at six lakes from October to December 2022. Mean catch rate (+ 1 SE) ranged from 1.53 ± 0.73 fish/min at Lake Istokoga to 6.64 ± 2.73 fish/min at Lake Trafford.
• A subsample of Black Crappie was collected for age and growth (N=650). Overall age ranged from 0 to 10 yrs.
• Roving creel surveys were conducted on 15 waterbodies during 2022-23. All surveys were conducted during the “peak” sportfishing season(s) for each system.
• Mean species directed effort (number of angler-hours/hectare/100 days) ± 1 SE was greatest for Largemouth Bass and Black Crappie (2.62 ± 0.49 and 2.10 ± 0.72, respectively), followed by sunfishes Lepomis spp. (0.87 ± 0.31) and Ictalurid catfishes (0.13 ± 0.05).
• Mean catch and catch rate ± 1 SE for Largemouth Bass were estimated as 1.73 ± 0.35 fish/ha/100 d and 0.63 ± 0.08 fish/h.

Bluegill, Florida Gar, Largemouth Bass, Redear Sunfish, and Brook Silverside were the most ubiquitous species; being collected in every lake sampled.

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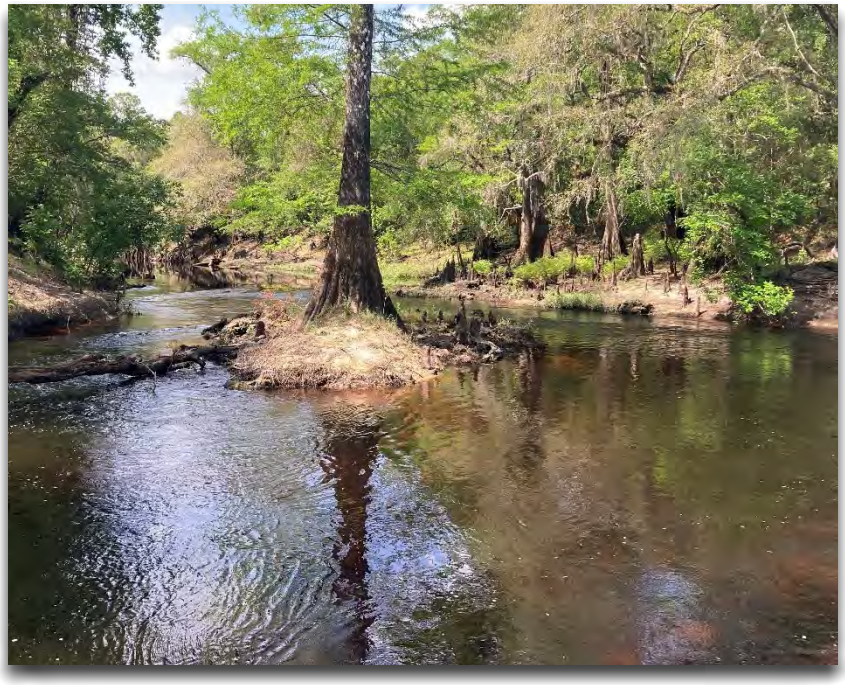
LONG-TERM MONITORING OF RIVERS - STATEWIDE SUMMARY

Eric Nagid



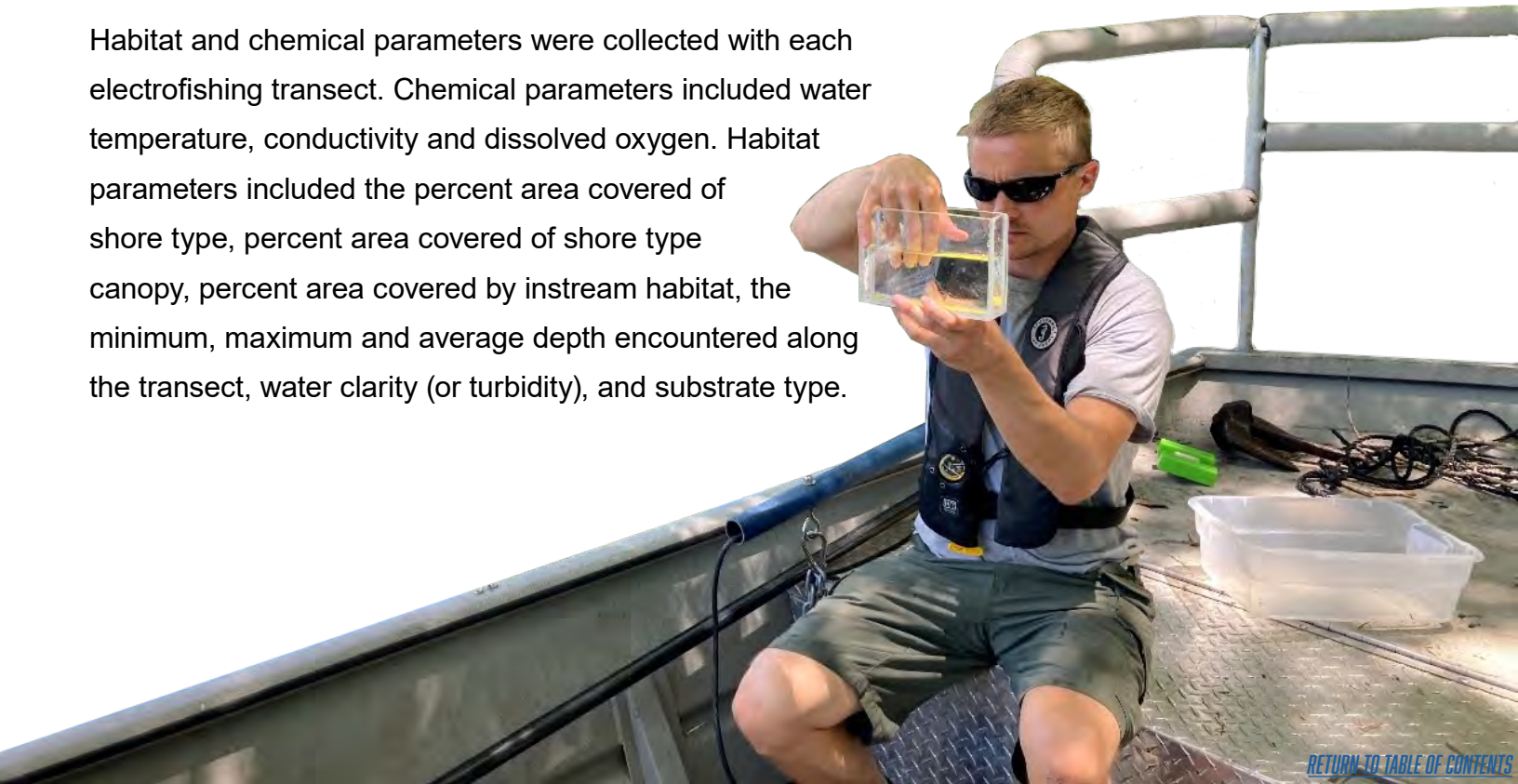
Fish community samples were collected by standard electrofishing protocols from 10 rivers between the fall of 2022 and spring of 2023 to assess and track trends in lotic fish communities.

Species richness ranged from 32 in the Apalachicola River to 53 in the Escambia and Yellow Rivers.

Diversity as represented by the modified Simpson's diversity ranged from 1.4 in the Myakka River to 11.0 in the Blackwater River.

Visual fish health inspections were made on individual fish species for abnormalities with fin erosion, lesions, parasitic infections, and skeletal malformations. Abnormalities were only present in 0.27% of all fish examined across all rivers.

Habitat and chemical parameters were collected with each electrofishing transect. Chemical parameters included water temperature, conductivity and dissolved oxygen. Habitat parameters included the percent area covered of shore type, percent area covered of shore type canopy, percent area covered by instream habitat, the minimum, maximum and average depth encountered along the transect, water clarity (or turbidity), and substrate type.



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LONG-TERM AQUATIC HABITAT MONITORING OF FLORIDA LAKE

Kevin Johnson, Jennifer Moran, Kirk Dunn, Jamie Casteel, Rachel Liebman, Destiny Beltran, Brady Dickerson, Kyle Miller, and Chelsea Buescher

We teamed with the Florida Fish and Wildlife Conservation Commission's (FWC) Invasive Plant Management Section, Aquatic Habitat Restoration and Enhancement Subsection, Division of Freshwater Fisheries Management, Freshwater Fisheries Research Section, and several external partnering universities and agencies to map vegetation at 28 out of the 43 lakes that were considered important for management and research needs in 2022.

Submersed vegetation and point-intercept mapping was completed May 2022 through November 2022 at the 43 Florida lakes, 15 of which were LTM core lakes.

Mapping provided estimates of submersed vegetation percent area covered (PAC) and percent volume infested (PVI), and point-intercept vegetation speciation data including submersed vegetation species distribution, density, and a PAC (i.e., frequency of occurrence estimates); point-intercept data generated maps of individual vegetation species distribution and density with frequency of occurrence estimates; and species richness.

Vegetation maps and point-intercept data for the 15 LTM core lakes mapped in 2022 were stored on FWC's internal freshwater fisheries LTM program SharePoint website.

We have begun to reassess the list of lakes that we map for a given mapping season. This reassessment process has and will include for future years, rotating the mapping of certain lakes, selection of lakes for mapping in particular mapping season that are most important for management and research needs, and the inclusion of some lakes within a mapping season that have never been mapped before to create a baseline of habitat conditions. This process will include creating the upcoming season's mapping lake list further in advance to allow for a more rigorous assessment and prioritization of the lake list, starting at the section leader level.

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HARRIS CHAIN OF LAKES MANAGEMENT REPORT

Andrew Marbury, Brandon Thompson, KristieRae Saenger, and Logan Masterson

Extensive monitoring occurs at the Harris Chain of Lakes (HCOL) as it is one of the premier freshwater fisheries in Florida and numerous research studies and evaluations utilize this data. In general, most lakes have shown a trend of improved water quality, water clarity, and expansion of SAV; resulting in an improved bass fishery but a declining crappie fishery.

Bass effort and angler catch rates have increased on nearly all lakes and the number of exempted tournaments has shown an increasing trend over the past 7 years (410 tournament days this year).

The most recent plant maps from summer of 2022 showed PAC increased or stayed the same at all lakes except Lake Harris (declined from 10 to 5%). The SAV on lakes Dora, Beauclair, Carlton and Griffin are primarily natives whereas hydrilla is the primary SAV at Apopka, and Yale. As the population of bass has increased with expanding vegetation, there has been a noticeable decrease in bass relative weights at all lakes, however it has seemingly leveled out on most.

Lake Apopka has had considerable levels of SAV (i.e., hydrilla) the last three years. Over the same timeframe, angling effort at Apopka increased by 44% (from camera effort data) and bass catch rates (electrofishing) have been historically high.

Angler effort and catch rates for bass the last two seasons were the highest recorded in 30 years at Lake Harris. Black Crappie effort also was the highest recorded since 2008.

Bass remains the primary target of anglers on Lake Griffin, although effort has dropped the last two years. The crappie fishery continues to have a lower level of effort but is highly variable.

Lakes Dora and Beauclair have the highest electrofishing catch rates of quality sized bass on the chain for the past several years and expanding SAV has corresponded with five consecutive years of high age-1 catch rates. Recent creel surveys show that Lakes Dora/Beauclair have a similar pattern to Griffin and Harris where bass has replaced crappie as the primary targeted species.

TrophyCatch submissions for season 10 (Oct 2021-Sept 2022- last full season) fell notably, with much fewer submissions coming from lakes Harris and Griffin than did in past years. Lakes Beauclair and Apopka, however, have shown increasing trends in TrophyCatch submissions.

While additional exotic species have been encountered in recent years on the HCOL, numbers have not substantially increased after initially falling off in the 2010 cold kill.

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LOWER ST. JOHNS RIVER LONG-TERM LAKE MONITORING

Earl Lundy, Jay Holder, and Susanna Harrison

We conducted both community and single-species (Largemouth Bass) electrofishing surveys in LTM study lakes in FY 2022-2023. A Largemouth Bass survey was also conducted on Lake Beresford. Community data were collected from November – December 2022, and Largemouth Bass data from February – March 2022. A creel was performed on Lake George to determine angler preference, utilization, and harvest. No community sampling was performed on Lake Monroe, as record high waters rendered the lake unsampleable.

Community abundance indices and species composition for Crescent Lake and Lake George were within historical ranges but were on the lower end of historical data. Crescent Lake biomass catch showed a significant decrease using Kendall's Tau analysis.

Both community samples were dominated numerically by Bluegill. Crescent Lake biomass was dominated by Florida Gar and Lake George biomass was dominated by Striped Mullet.

Abundance for Largemouth Bass populations in lakes Crescent, Monroe, and George were among the lowest recorded since monitoring began, likely due to continuing Hurricane Irma-induced vegetation loss. Kendall's Tau analysis indicates a strong decrease in catch rates for lakes George and Monroe.

The Lake George creel survey indicated total effort was greatly reduced over the previous year. Anglers still primarily target Largemouth Bass on Lake George, although there was a 19% drop in effort over the previous year. Black Crappie effort on Lake George showed a 24% increase over the previous year.

Submersed vegetation was largely absent on all lakes, and emergent vegetation could at best be described as "sparse." This continues a trend first seen after Hurricane Irma impacted the state in 2017 and seems to be driving low catch rates on all lakes.

The percentage of standardized Largemouth Bass transects on Lake George with zero catch has continued to rise since 2018, and currently accounts for 68% of all sampled sites.

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LOWER ST. JOHNS RIVER LONG-TERM MONITORING

Earl Lundy, Jay Holder, and Susanna Harrison

The fish community in the St. Johns River between Lakes Monroe and Beresford is typically sampled via electrofishing during late fall and early winter each year as part of a long-term monitoring plan. On September 29, 2022, Hurricane Ian made landfall near Fort Myers and passed over central Florida on September 29 and 30. The storm brought heavy rains with rainfall totals of up to 22 inches in some east central Florida locations. In November, Hurricane Nicole brought additional heavy rainfall to the area. The combined effects of these storms lead to prolonged flooding on the middle St. Johns River. Water levels rose to over 5.5 ft. above historical median levels and remained over historical levels until February 2023. As a result, we were unable to sample the fish community in 2022, breaking a streak of nine consecutive years of monitoring fish communities in this stretch of the St. Johns River.

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UPPER ST. JOHNS RIVER LONG-TERM LAKE MONITORING

Sam McPherson, Arthur Bernhardt, Reid Hyle, and Kirsten Humpries

Electrofishing surveys of fish communities were conducted in fall and winter of 2022/2023 on Blue Cypress Lake, Lake Poinsett, Lake Washington, and the Upper St. Johns River. Largemouth bass were sampled on the LTM lakes in spring of 2023.

Catch rate of all species across sites on Blue Cypress Lake was the highest in the past 10 years at 7.07 (SE = 0.67) fish/min, a noticeable increase compared to the previous year (5.26 fish/min, SE = 0.76). Community composition has been relatively stable since 2020, although golden topminnow (Fundulus chrysotus) and yellow bullhead (Ameiurus natalis) were detected on Blue Cypress for the first time in 2022 (Fig. 1).

Mean catch rate of largemouth bass (LMB) on Blue Cypress was 0.188 (SD = 0.143) fish/min, on par with the 10-year average of 0.191 (SD = 0.074) fish/min. LMB relative weight for this lake has been decreasing slightly over the past 10 years ($R^2 = 0.388$, $F_{1,8} = 5.071$, $p = 0.0544$; Fig. 2), concurrent with similar trends for several reservoirs in the Upper St. John's River basin.

On Lake Poinsett, mean catch rate of all species was 3.84 (SE = 0.71) fish/min, a slight increase from the previous year (2.34 fish/min, SE = 0.38), but still down from the 10-year average (5.06 fish/min, SE = 1.09). Catch composition was numerically dominated by forage fish, such as Eastern mosquitofish, while the species comprising the greatest biomass were mostly exotic (i.e., Pterygoplichthys and Oreochromis) in the wake of fish kills following an intense hurricane season in 2022.

Mean catch rate of LMB on Lake Poinsett was 0.116 (SD = 0.132) fish/min, down from the 10-year average of 0.379 (SD = 0.189) fish/min, and one of two lowest values recorded for the lake in 10 years. Only 46 individuals were collected, reflecting population reduction after the lake experienced fish kills.

Catch rate of all species on Lake Washington was 3.86 (SE = 0.53) fish/min, consistent with the 10-year average (3.93 fish/min, SE = 0.44). Community composition was skewed toward higher-than-usual representation of forage fish, potentially due to bankfull conditions at time of sampling.

Mayan cichlids were detected for the second year in community samples of Lake Washington (Fig. 3).

Mean catch rate of LMB on Lake Washington was the lowest recorded in 10 years at 0.244 (SD = 0.182) fish/min, a decrease from the previous year and the 10-year average of 0.595 (SD = 0.221) fish/min. Few fish collected were below 200 mm TL indicating poor recruitment in 2022.

In community samples of the Upper St. John's River, mean catch rate across sites was 11.17 (SE = 1.82) fish/min, drastically lower than the previous year (81.84 fish/min, SE = 34.6) and lower than the 10-year average (30.01 fish/min, SE = 6.80).

Community composition at river sites was heavily dominated by Eastern mosquitofish (Gambusia holbrooki; 37.86%) and juvenile bluegill (Lepomis macrochirus; 37.04%) following fish kills and persistent high water in the fall.

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FISHERY RESOURCE ASSESSMENT OF WATER MANAGEMENT IMPOUNDMENTS OF THE UPPER ST. JOHNS

Arthur Bernhardt and Reid Hyle

The impoundments (Farm 13/Stick Marsh, Lake Garcia, Kenansville Lake, Fellsmere Reservoir) of the Upper St. Johns River Project are unique water bodies and widely considered among the best fisheries in the area.

We collected 1,552 Largemouth Bass in 95 transects using boat-mounted electrofishing.

Peak season access creels were executed on Garcia and Stick Marsh while an annual access creel continues on Fellsmere.

Largemouth Bass electrofishing CPUE in 2023 is consistent across years (2007-2023) on Garcia, Stickmarsh, and Kenansville around 1 fish/min. Fellsmere CPUE for LMB was 1.29 fish/min, slightly higher than the other impoundments.

Juvenile (< 21cm) Bass were abundant in all lakes (except Stick Marsh), indicating successful recruitment into the fishery. Loss of SAV and a drawdown during the spawn are likely the reason for the lower abundance of juvenile LMB at the Stick Marsh.

Lake Garcia was very clear with abundant SAV. This is a continuation of the last two year's vegetation coverage and clarity. Kenansville Lake SAV (mostly Hydrilla) is abundant and covers most of the lake. Farm 13/ Stick Marsh remains turbid and SAV has disappeared from the south end of the reservoir. Farm 13/ Stick Marsh was drawn down 4 ft starting early spring through the summer to facilitate bullrush and spatterdock plantings in the southern part of the lake. Fellsmere WMA is a heavily vegetated marsh and will require maintenance vegetation control. Continued treatment of cattail and para grass creates open-water habitat and has been replaced by SAV.

Relative weights have declined in all upper basin reservoirs and Blue Cypress Lake in recent years. Three of these are heavily infested with SAV and two are almost devoid of SAV. Sample timing has not changed but warming winters could be a common factor to all five waterbodies.

Largemouth Bass Angling Success was high Lake Garcia (1.21 fish/min) and Farm 13/Stick Marsh (1.25 fish/min)

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FELLSMERE RESERVOIR LONG-TERM MONITORING FOR FISH COMMUNITIES, LARGEMOUTH BASS, AND CREEL

Arthur Bernhardt and Reid Hyle

Electrofishing surveys of fish communities were conducted in Fall/Winter 2022. LMB surveys were conducted in spring 2023.

Fellsmere Reservoir is unique to other LTM lakes in that there is quality fish habitat that extends beyond the shoreline. Therefore, offshore sampling sites were selected in addition to shoreline sites.

The fish community composition has been stable over the past few years, Sunfish and Forage are generally the most common guilds collected at Fellsmere Reservoir.

The overall catch rate of the fish community was 12.21 ± 1.06 fish per minute, CPUE was lower in 2022 than the previous year (15.95 ± 2.75 fish/min) and the increasing trend in CPUE since reservoir flooding in 2016 may be starting to plateau.

On-going large scale vegetation treatments have converted thousands of acres of dense cattail and tussock into areas of open water that have been colonized by SAV including hydrilla and coontail. Each year, more open water habitat was available to sampling, potentially influencing the rise in CPUE.

Catch rates for Largemouth Bass were 1.3 ± 0.13 fish/min, continuing the upward trend, though it may be slowing.

Largemouth bass relative weight which had shown a decline over the previous 2 years, increased slightly.

There is an abundance of nursery habitat and a high catch of age-1 fish (40% of LMB collected in 2023).

The creel survey continues running year-round with August 20 to August 20 setting the creel year since the boat ramp opened in August of 2020.

Angler CPUE remains above 1 fish per angler-hour and the reservoir produced one fish over 24” per nine trips.

Total effort was ~143,000 angler-hours

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LONG-TERM MONITORING OF SELECTED RIVERS AND STREAMS IN NORTHWEST FLORIDA

Chelsea Myles-McBurney

Monitoring efforts are important in freshwater ecosystems due to their sensitivity to anthropogenic change, invasive species, climate change, sedimentation, and other environmental factors (Reid et al. 2019).

Escambia River, Yellow River, Blackwater River, and Big Coldwater Creek were sampled to assess their sport fish populations and species compositions during FY 22-23.

Sampling of large rivers were conducted in the fall for the Escambia and Yellow River and in the spring for the Blackwater River and Big Coldwater Creek.

This is the first time that Big Coldwater Creek has been sampled using standardized methods for LTM.

All sport fish collected were sorted by species, individually measured (mm, TL), and weighed (g). Non-sport fish were sorted by species and individually measured (mm, TL) and weighed (g), or sorted by species, counted, and batch weighed (usually by cm size).

Twenty-Nine sites were sampled on the Escambia River between 20 October 2022 and 1 November 2022.

Sampling resulted in the collection of 52 species of fish, and 2,237 individuals. Percent composition was numerically dominated by Cyprinid fishes (>39% of total catch) and sport fish accounted for 53% of total fish collected.

Thirty-three sites were sampled on the Yellow River between 21 October 2022 and 16 November 2022.

Sampling collected 49 species of fish and 2,381 individuals. Percent composition was numerically dominated by Cyprinid fishes (>43% of total catch) and sport fish accounted for 43% of total fish collected.

Twenty-six sites were sampled on Blackwater River between 22 March 2023 and 28 April 2023.

Percent composition was numerically dominated by Cyprinid fishes (>38% of total catch) and Sport fish accounted for >29% of total fish collected.

Twenty-nine sites were sampled on Big Coldwater Creek between 5 May 2023 and 13 June 2023.

Percent composition was numerically dominated by Cyprinid fishes (>49% of total catch) and sport fish accounted for >30% of total fish collected.

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ALTERNATIVE MANAGEMENT STRATEGIES FOR COMMISSION MANAGED IMPOUNDMENTS

Matthew Wegener, Kimberly Bonvechio, and Summer Lindelien

Commission Managed Impoundments (CMI's) are naturally low in productivity but receive immense fishing effort. Previous fertilization programs are no longer feasible due to environmental concerns. Managers are looking for alternative management strategies on the CMI's. Habitat enhancement, forage stocking and complete renovation were selected as strategies to implement.

Habitat enhancement investigated three different types (gravel only, gravel & MossBacks, MossBack only) of structure located both onshore and offshore.

For all sportfish species combined, significantly more fish collected at offshore sites than onshore sites.

For Largemouth Bass, significantly more fish collected on gravel/MossBack than reference sites for onshore locations and more fish collected on gravel than reference sites for offshore sites.

Spawning beds of Largemouth Bass, Bluegill and Redear Sunfish observed on gravel sites and gravel/MossBack sites.

Stocking forage species could maintain growth rates of sport fish without fertilizing. Three species were identified to research production techniques: Threadfin Shad, Golden Silversides, and Lake Chubsuckers.

5,700 Threadfin Shad were stocked in hatchery ponds, six months later 378,750 were harvested from those ponds. 16,440 Golden Silversides were stocked in hatchery ponds, 3-8 months later 115,890 Golden Silversides were harvested from those ponds. No Lake Chubsuckers were received from the hatchery, primarily due to avian predation.

No Threadfin Shad or Golden Silversides were captured with electrofishing or found in the diets of Largemouth Bass.

Although production of Threadfin Shad and Golden Silversides were successful, it is unlikely the necessary numbers can be produced in a hatchery if survival is limited after stocking.

Renovation was completed on Karick Lake in 2019 and fish were stocked that summer.

More large fish were collected after the renovation relative to before, but aging dorsal spines indicated those large fish were holdovers from the pre-renovation.

Back-calculated growth rates were compared before and after renovation to determine the effect of renovation on the Largemouth Bass population.

Growth was slower after renovation, suggesting the use of a drawdown to improve sportfish populations in northwest Florida is not a viable strategy.

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ASSESSING EAST LAKE TOHOPEKALIGA HABITAT RESTORATION ON THE SHALLOW WATER FISH COMMUNITY

Chris Anderson, Ted Lange, Doug Richard, Travis Tuten, Jason O'Connor, Jen Moran, Arthur Bernhardt, Steve Beck, Brad Fontaine, John Saxton, Kirk Dunn, Kyle Miller, Chelsea Buescher, Kyle Olivencia, Sam Burke, Rachel Liebman, Jamie Casteel, Steve Hooley, Ryan Howard, Tim Coughlin, and Marty Mann

Water level stabilization and excessive growth of invasive aquatic plants have all contributed to the accelerated rate of lake succession in East Lake Tohopekaliga (ELT). A lake drawdown began on October 1, 2019 when water levels were lowered from 56.41 ft (NGVD) to 52.31 ft (NGVD) on May 24, 2020 (> 1,133 ha of lakebed exposed).

Littoral habitat restoration was conducted by AHRES in spring/summer 2020 by controlling/removing monocultures of invasive emergent vegetation via herbicide treatment and prescribed burning as well as the mechanical removal of woody vegetation, tussocks, and associated organic material from the littoral zone

Our study will evaluate impacts to shallow water fish communities, site-specific water quality (e.g., diel dissolved oxygen regimes) and habitat structure/composition (e.g., aquatic vegetation density and depth of organic sediment) across a range of habitat restoration and enhancement actions (i.e., pre- vs post-treatment).

Mini-fyke nets and dissolved oxygen sondes were used to sample the fish community and DO regimes, respectively in September 2016, 2018, 2019 (i.e., pre-treatment), and 2020, 2021, and 2022 (i.e., post-treatment). Qualitative habitat assesments of aquatic vegetation and sediment cores were also completed at each site.

- A total of 33,661 fish were captured using MFNs in 2022 (n = 88 of 90 MFNs fished successfully).
- Compared to 2021, the total number of fish caught increased by 57% (21,438 fish in 2021).
- Significantly more fish were captured post-treatment (26,303 fish/year; 78,908 total) than pre- treatment (7,548 fish/year; 22,644 total).

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EMERALDA MARSH CONSERVATION AREA DISSOLVED OXYGEN STUDIES

Ted Lange, Brandon Thompson, Scott Bisping, and Dan Kolterman

We monitored dissolved oxygen (DO) concentrations in a restored wetland where submerged aquatic vegetation (SAV) is dominated by aggressive growth of Hydrilla, Hydrilla verticillata. EMCA consists of historic wetlands, farmed for 50 years, and restored starting in 1994. Farms remained flooded until hydrologic connections between EMCA 2, 3, and 4 were re-established between 2005 and 2016. EMCA7 was not re-connected and remains isolated. Connected marshes contribute to the Lake Griffin fishery during much of the year by providing habitat for feeding and spawning. Tagging studies have documented Griffin fish utilizing the marsh. Marshes support excellent duck hunting and bird watching opportunities.

Our main study area, EMCA3 is divided by interior levees with breaches into 3 cells with EMCA3-Q having the most connectivity to Lake Griffin, EMCA3-T less, and EMCA3-Z has no connections to the lake except through the other cells.

Hydrilla, and to a lesser degree Coontail, continue to dominate the SAV and maintain near 100% coverage over the entire year within EMCA marshes. Topped out conditions persisted year-round in EMCA7 (no hydrologic connections) and between June through July in EMCA3 (with hydrologic connections).

During summer, the frequency of hypoxic conditions ranged from 80-100% of all readings in EMCA3 and were associated with topped out conditions when water temperature was highest. EMCA7 was always hypoxic and Lake Griffin was never hypoxic.

Topped out SAV and frequency of hypoxic conditions increased in EMCA3 cells in relation to decreased hydrologic connections from Cell Q < Cell T < Cell Z.

Increased water flow through levee breaches reduced summertime topped out conditions, increased open water areas and resulted in slightly reduced frequency and duration of hypoxic conditions.

Findings to date resulted in funding for an FWC Habitat and Species Conservation project to increase hydrologic connections within EMCA3 by creating 2 breaches connecting to Lake Griffin and 1 to Haines Creek. Work will commence in spring of 2024.

A new “gator proof” sample float was developed resulting in no loss of sonde floats to alligators during the reporting year.

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ANTHROPOGENIC IMPACTS ON SUBMERGED AQUATIC VEGETATION IN CENTRAL FLORIDA SPRINGS

Susanna Harrison, Jay Holder, Earl Lundy, and Kimberly Bonvechio

In recent years, submerged aquatic vegetation (SAV) has substantially declined in many of the spring headwaters and runs of the middle St. Johns River Basin.

SAV is a critical component in the SJR basin ecosystem, functioning as habitat, nursery grounds, and cover for sportfish and other aquatic taxa.

Because Alexander and Juniper Springs are home to the last large expanses of American eelgrass remaining in the middle SJR, the protection of these SAV beds may be crucial to any future aquatic habitat restoration efforts in the area.

In January 2022, we installed game cameras around the swim areas at Alexander and Juniper Springs to monitor recreational use.

Beginning in February 2022, we conducted monthly visual/ photographic SAV surveys in the headsprings using underwater cameras.

Our goal was to produce a quantitative estimate of spring usage while simultaneously quantifying changes in the health and coverage of SAV in springs, allowing us to identify any potential correlations between human use and SAV degradation.

Our results suggest that the summer season is associated with both high recreational use and low SAV scores at Alexander and Juniper Springs.

Increased human use had a negative impact on SAV score and condition at Juniper Springs.

There was no apparent effect of human use on SAV score, coverage, or condition at Alexander Springs, but it is possible that our methods were not as effective at detecting changes in SAV over such a large area.

Even if SAV at Alexander Springs is currently resilient to the effects of human use, our results at Juniper Springs suggest that this could change in the future, particularly if use continues to increase with Florida's growing population.

By examining the impacts of human springs use on SAV health, we can provide the USFS and other management partners with valuable data to inform and support recreational management decisions.

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INVESTIGATING THE BEHAVIOR AND SURVIVAL OF GRASS CARP IN LARGE FLORIDA LAKES

Logan Masterson and Brandon Thompson

Grass Carp are an effective biological tool used to control Hydrilla in Florida, but managers are concerned with their impact on native vegetation along with emigration from open waterbodies. We designed a radio telemetry study to investigate their survival, dispersal, habitat preference and emigration survival after stocking. Over the span of two years, we radio tagged both juvenile (Lake Yale, Apopka and Parker) and adult (Lake Apopka and Parker) Grass Carp. This report provides preliminary findings from the two-year study and tracking will continue through the next fiscal year.

Within two weeks of stocking all study lakes, juvenile and adult Grass Carp dispersed quickly throughout the areas of hydrilla from a single stocking point–some moving up to seven miles from the stocked area within just several days.

Dispersal patterns can inform stocking strategies for large lakes and reveals that stocked Grass Carp will distribute throughout different areas of dense hydrilla to provide more lake wide control (rather than all fish moving to a single infested area).

Many tagged fish developed smaller home ranges in areas of dense hydrilla and other fish were more mobile, moving between different areas of hydrilla.

For all study lakes, over 80% of locations were found in hydrilla and this suggests that Grass Carp will have very little impact on native vegetation when substantial hydrilla is present.

From the two open study lakes (Apopka and Parker), we observed low rates of emigration (<15%) for adult Grass Carp.

In both systems emigration is limited by water control structures when water levels are not high and we observed fish moving out of the system (although not at a high rate) during a high flow event during the first summer.

Annual survival for juvenile Grass Carp for all lakes in both years was near zero based on active tags but it is likely that tag loss greatly influenced inactive tags as fish seemed to be able to shed tags while moving through dense hydrilla compared to those held in tanks or cages.

Adult Grass Carp had higher survival but there is also some evidence of tag loss.

Further investigation could focus on assessing survival using small transmitters without a trailing antenna.

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IDENTIFYING PROBLEMATIC HERBIVORES OF *VALLISNERIA AMERICANA* IN THE ST. JOHNS RIVER BASIN

Susanna Harrison, Earl Lundy, Jay Holder, and Chelsea Buescher

Submersed aquatic vegetation (SAV) plays a vital role in aquatic ecosystems, providing critical ecosystem services, acting as an important food resource for many organisms, and offering vital habitat for numerous aquatic taxa, including economically important sport fishes. Globally, SAV abundance and diversity are declining in both marine and freshwater systems. Herbivory, especially by non-native and/or nuisance species, may play a role in inhibiting SAV expansion and establishment.

In recent years, American eelgrass Vallisneria americana and most other non-algal SAV has disappeared from the SJR basin. This initially resulted from wave action and an extended period of flooding due to the impacts of Hurricane Irma in 2017.

Results from ongoing efforts to restore eelgrass in the SJR basin suggest that plantings succeed when they are protected by an exclusionary fence or cage. When that protection is removed, damaged, or breached, the plantings disappear within days of exposure. These results offer strong evidence that herbivores may be limiting SAV recovery in the SJR.

Our objectives are to identify which herbivores are impacting the re-establishment of eelgrass in the SJR basin and use that data to inform targeted management strategies to mitigate the effects of herbivory on current and future restoration efforts. We will use camera surveys at locations with established eelgrass plantings throughout the SJR basin to identify species that are consuming, uprooting, or otherwise damaging unprotected plants.

In situ and ex situ grazing intensity studies will be used to determine which of the species identified in the camera surveys have the highest potential to negatively impact eelgrass restoration in the SJR.

Camera surveys will begin in summer or fall of 2023 at Lake George and Silver Glen Springs, with future surveys planned for lakes Poinsett, Washington, Harney, and Monroe, as well as locations in the lower river near San Mateo and Green Cove Springs. This project is expected to continue through 2026.

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USE OF A COMMERCIAL HAUL SEINE FISHERY AS A MANAGEMENT TOOL FOR TILAPIA IN UPPER SJR LAKES

Arthur Bernhardt, Reid Hyle, Steve Miller (SJRWMD), and Randy Fink (SJRWMD)

Commercial Tilapia Haul Seine fishing took place on Lakes Florence and Poinsett in April and May 2023.

FWC and SJRWMD observed fishing events and subsampled catch to identify catch composition.

Haul-Seine nets were 1000 ft long and 19 ft deep, with a 3-inch stretched mesh.

Area Swept by nets ranged between 30-60 acres.

Fisherman kept and sold tilapia and brown hoplo and were required to keep and dispose of vermiculated sailfin catfish. Non-target species were released alive.

45,577 lbs of tilapia were caught, representing a value of $30,820 to the fishermen.

5,200 lbs of vermiculated sailfin catfish were caught, and cost the fisherman $71 to dispose.

Tilapia made up 80% of the catch from Lake Poinsett, just 11% of the catch were gamefish.

An experimental 2-inch stretch mesh net was used in Lake Florence, but not fished in the most effective manner resulting in a failed attempt.

On one occasion, a sunken canoe snagged the haul-seine and the effort resulted in a failed attempt, another attempt captured a dozen alligators in the net and their release rendered the fishing effort less successful.

SJRWMD estimates 60 lbs of phosphorous removed directly from system.

Preliminary Tagging Effort deployed 81 tags in Tilapia in Lake Cone, water levels dropped too low for netting recap attempt for several weeks following tagging.

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MOVEMENT AND DIET OVERLAP OF BULLSEYE SNAKEHEAD, LARGEMOUTH AND PEACOCK BASS IN LAKE IDA

Courtney Stachowiak, Brian Hutchinson, Kelly Gestring, Josh Wilsey, Dan Nelson, Kristin Rogers, and Nick Trippel

Twenty-five Largemouth Bass, Bullseye Snakeheads, and Butterfly Peacock Bass were tagged had radio transmitters inserted in them in spring of 2021 in Lake Ida. An additional 7 Butterfly Peacock Bass were tagged in December of 2022. Fish were tracked manually and passively monthly and fish were also dart tagged to monitor angler catch and harvest rates. Tracking concluded in spring of 2023 when all tags had died. Typically 15 to 20 fish were located during each manual tracking event.

One snakehead was caught by an angler over 15 miles north of where it was tagged.

Detailed movement analysis not complete yet.

15 fish have died.

Bullseye Snakehead seem to preferred shallower areas than Butterfly Peacock Bass or Largemouth Bass.

Bullseye Snakehead preferred natural shoreline areas while Butterfly Peacock Bass preferred artificial shorelines. Largemouth Bass seemed to utilize both natura and artificial shorelines regularly.

Bullseye Snakehead were located most frequently in the North Canal area while Butterfly Peacock Bass were found most frequently in Lake Ida. Largemouth Bass were located frequently in both the North Canal area and Lake Ida.

The most common type of vegetation all three species were located in was Eelgrass followed by Hydrilla for Bullseye Snakehead and Largemouth Bass. Areas of no vegetation were the second most common type of habitat Butterfly Peacock Bass were located in.

Out of the 25 Bullseye Snakehead and Largemouth Bass and 32 Butterfly Peacock Bass tagged, anglers caught 14 Largemouth Bass, 14 Butterfly Peacock Bass, and 2 Bullseye Snakeheads. All have been released.

Diets were also looked at monthly for these three species in this same area for a period of one year.

A total of 29 electrofishing trips were made to collect diet samples. 477 Largemouth Bass, 529 Butterfly Peacock Bass, and 288 were collected and lavaged.By weight, fish was the most abundant prey item for all three species though at much different percentages: 87% for Largemouth Bass, 99% for Butterfly Peacock Bass, and 32% for Bullseye Snakeheads.

Largemouth Bass commonly preyed on juvenile Largemouth Bass, Brook Silversides, African Jewelfish, grass shrimp, and crayfish.

Butterfly Peacock Bass commonly preyed on juvenile Largemouth Bass, juvenile Butterfly Peacock Bass, and grass shrimp.

Bullseye Snakeheads commonly preyed on Cane Toad tadpoles, amphiuma, crayfish, grass shrimp, swamp darters, and mosquito fish.

More detailed diet analysis will be completed soon.

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THERMAL HABITAT SUITABILITY FOR NONNATIVE FISHES IN FLORIDA'S LOTIC ECOSYSTEM

Chris Anderson, Andrew Carlson and Alexandra Scott

Climate change is a major phenomenon altering the distribution of nonnative fishes and their ecological and socioeconomic impacts.

The influence of climate change on water temperature has substantial implications for the distribution of nonnative fish because water temperature influences individual fish survival, growth, reproduction, and dispersal as well as population and community structure.

Understanding water temperature variability and the effects of climate change on aquatic thermal regimes is critical for managing non-native fishes in Florida now and in the future.

Thermal habitat research in Florida's lotic systems has not been conducted at sufficient spatiotemporal and ontogenetic resolution to predict when and where nonnative fishes are likely to occur throughout their life histories in the context of climate change.

We will address these knowledge gaps by supplementing Florida's network of 200 water temperature loggers by deploying additional loggers in high-priority rivers and canals that are not currently well-monitored (e.g., Upper Santa Fe, Ocklawaha, Kissimmee, L67A).

We deployed 21 HOBO Tidbit MX Temp 400' temperature loggers to measure water and air temperatures for the Ocklawaha and Santa Fe rivers in FY2022-23.

In the Ocklawaha River, we deployed 16 total loggers at sites from the headwaters above Lake Griffin to 0.2-km above the St. Johns River confluence with 9 measuring water temperature and 7 measuring air temperature.

Consecutive nights with below freezing air temperatures in late December 2022 pushed water temperatures as low as 11 oC in the Ocklawaha River near Gore's Landing.

Capturing cold snaps such as these will be critical for our ability to model how these events impact survival and dispersal of non-native fishes from both spatial and temporal perspectives.

In the Santa Fe River, we deployed 5 total loggers at sites distributed from above the Alachua Sink to 0.1-km downstream of the Olustee Creek confluence with 3 measuring water temperature and 2 measuring air temperature.

We will use these water and air temperature data to create water temperature models that predict nonnative fish survival, reproduction, recruitment, and dispersal under different climate change scenarios from 2022–2070.

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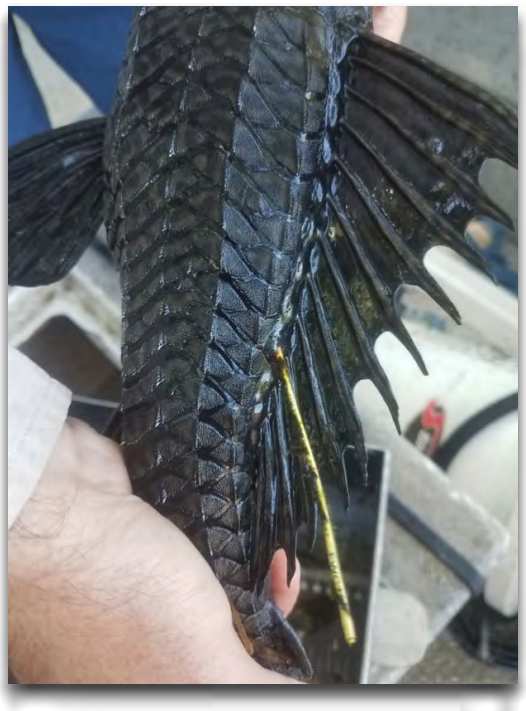
SEASONAL MOVEMENTS AND RESIDENCE OF SAILFIN CATFISH AND TILAPIA IN SILVER GLEN AND SALT SPRINGS

Nick Trippel, Andrew Marbury, Jay Holder, Earl Lundy,
Trevor Knight (DFFM), Clay Coates (USFS), John Galvez (USFWS)



In February 2021 acoustic tags were placed in 15 Blue Tilapia and 15 Sailfin Catfish each at Salt Springs and Silver Glen Springs for a total of 60 tagged fish.

Fish were collected using boat electrofishing, using large mesh gill nets as seines, and by snorkelers hand-grabbing Sailfin Catfish.

All tagged fish appeared uninjured and were able to successfully swim away following tag-attachement.

Sailfin Catfish had a low rate of tag retention (~20%) regardless of tagging technique.

Bowfisherman harvested five (14%) tilapia and ten (33%) Sailfin Catfish.

Two shed acoustic tags were recovered by snorkelers and five acoustic tags were turned in by bowfisherman. Those tags were placed back out again in seven more tilapia in Silver Glen in April 2021 as Sailfin Catfish could not be tagged effectively.

Movement data for Sailfin Catfish were deemed unreliable due to the high rate of tag loss. The small sample size of active fish however, suggested that Sailfin Catfish do not migrate between springs and seem to remain in spring runs and nearby Lake George habitats.

Movement data for tilapia suggest high rates of movement between springs for some individuals, although few were found leaving the Lake George system entirely.

Tag detections by receivers in Juniper run and the Silver Glen headspring indicate almost exclusive nocturnal use, with 92% of total detections in both locations occurring between sunset and sunrise.

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