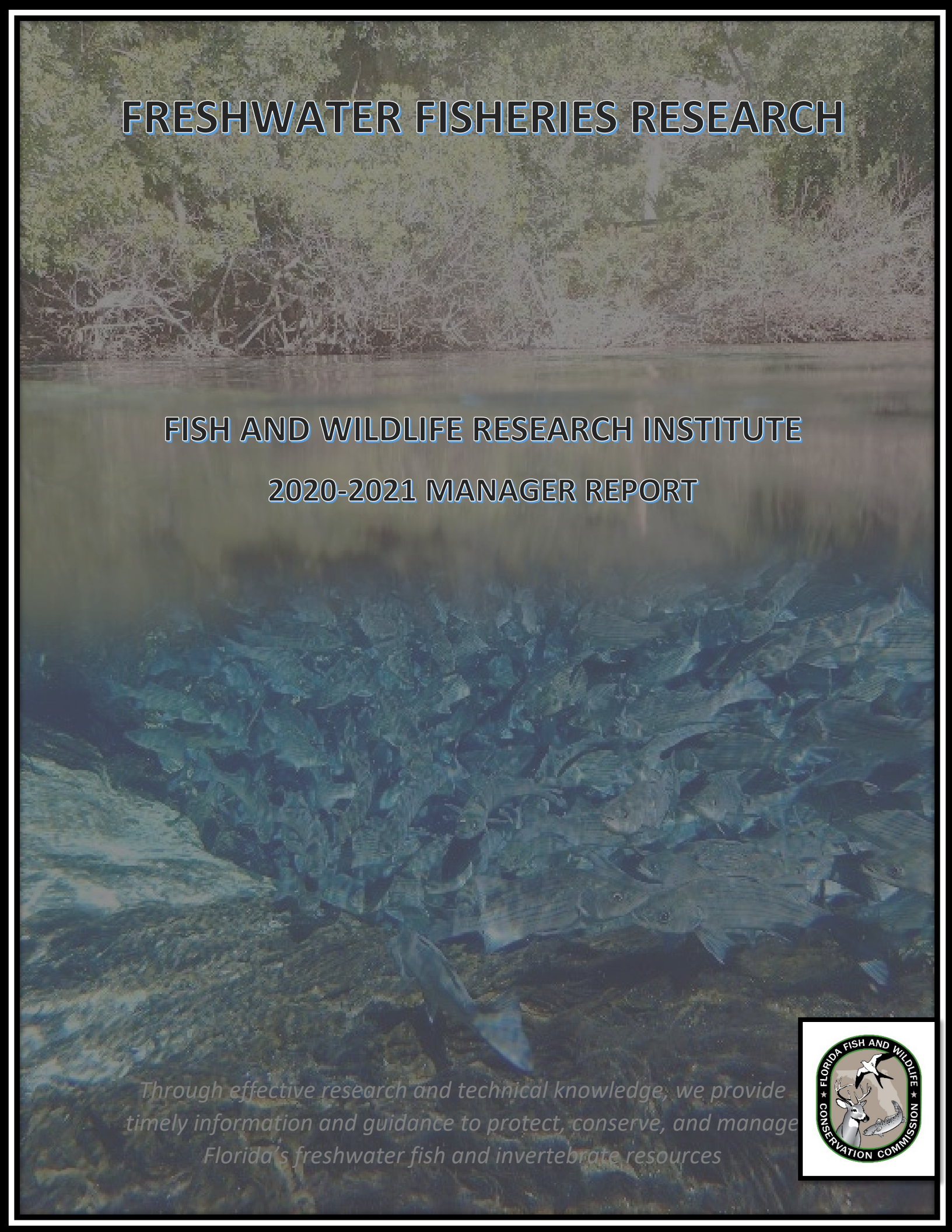
FRESHWATER FISHERIES RESEARCH

FISH AND WILDLIFE RESEARCH INSTITUTE

2020-2021 MANAGER REPORT



Through effective research and technical knowledge, we provide timely information and guidance to protect, conserve, and manage Florida's freshwater fish and invertebrate resources

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Aquatic Invertebrates

Evaluation of Black Creek Crayfish *(Procambarus pictus*) Population Status 1976-2021

Kasey Fralick, Gary Warren, Katherine Lawlor, Hannah VanBuren, Nicole Tripp, Cheyenne Stratton, Lindsey Reisinger, Paul Moler, Allen Hallman, Blair Hayman, and David Cook

- This project was initiated to document the range and Area of Occupancy (AOO) of a state listed species, the Black Creek Crayfish (BCC), which is confined to a small area and is threatened by a number of factors, most prominent of which is the basin-invasive White Tubercled Crayfish (WTC).

- Results from the past year are indicative of a decline in the BCC AOO throughout the Black Creek basin during a 43-year period and a corresponding increase in Extent of Occurrence (range) and AOO by the invasive White Tubercled Crayfish.

- Of the 56 historic BCC sites sampled both by FWC in 2018-2021 and previously by at least one other group (Franz and Franz 1979, Brody 1990, Franz et al. 2008, Nelson and Floyd 2011), only 8 sites (~14.3%) remained inhabited by BCC without the presence of WTC. WTC completely replaced BCC at 27 sites (~48.2%), and 14 sites (25%) were inhabited by both BCC and WTC. At 4 sites (~7.1%), *Procambarus fallax/paeninsulanus/seminolae* had replaced BCC.

The mechanism for the apparent replacement of Black Creek Crayfish by the White Tubercled Crayfish is unknown at this time

- The pathway for the White Tubercled Crayfish entry into the Black Creek basin is unknown, although release of crayfish captured in other basins (e.g., Suwannee River) for use as fish bait is one plausible explanation.

- A potential additional threat to the survival of BCC in the Black Creek basin, microsporidian infection, was identified by cooperating University of Florida biologists within the past year. The seriousness of this threat is under investigation.

- The Black Creek Crayfish appears to be completely absent from many Black Creek mainstem sites in the South Fork and North Fork and larger tributaries (e.g., Greene Creek) where it once occurred. Observations made by FWC and UF staff during the summer of 2019 and fall/winter 2020-2021 suggest that the White Tubercled Crayfish is currently abundant and well established in higher order streams such as the South Fork mainstem and is moving into headwater tributary areas.

- A cooperative project involving FWC, UF, and Camp Blanding is focusing upon refining the know distributions of the species and investigating the mechanism of replacement of BCC by WTC.

Phylogeny and Population Status of Imperiled Siltsnails (Hydrobiidae: *Floridobia* and Cochliopidae: *Aphaostracon*) Endemic to Florida Spring Ecosystems

Kasey Fralick, Gary Warren, Katherine Lawlor, Hannah VanBuren, Mike Tringali, Elizabeth Wallace, and Cecilia Puchulutegui

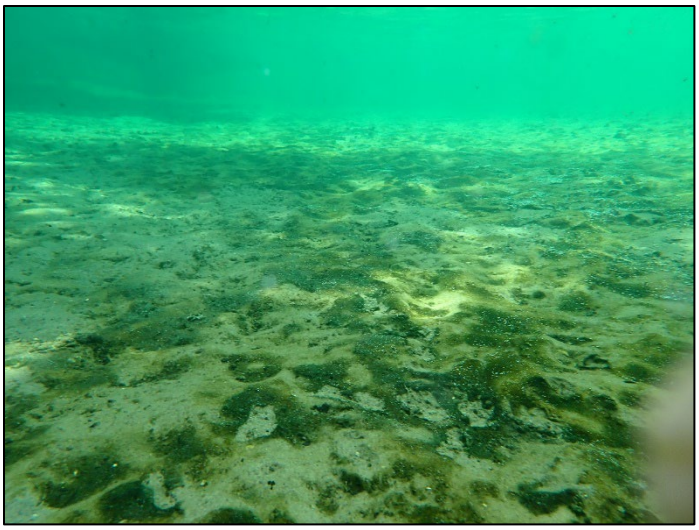
- This project was initiated to investigate the population status of critically imperiled species of the freshwater snail genus *Floridobia*. Of the 13 species of *Floridobia* known from Florida, 11 are endemic to only one spring system. Five of these 11 have been petitioned for federal listing.

- Our primary objectives were to sample each species to determine its long-term viability and to conduct genetic analyses to determine the phylogenetic relationships among the species - that is, to determine if, in fact, they are discrete species.

Of the 13 species of Floridobia known from Florida, 11 are endemic to only one spring system

- The initial year of the project (2020-2021) was devoted to obtaining specimens for genetic analyses to be conducted by the FWRI genetics lab in St. Petersburg. We visited 9 of the 11 sites inhabited by endemic *Floridobia*. We were unable to visit the remaining two sites because they are on private property. Of the 9 sites visited, we were able to collect the minimum number of specimens needed for genetic analysis (25) at 7 sites. We were unable to find any *Floridobia* at 2 of the 9 sites we visited – Sanlando Springs and Glen Branch.

- Field work to document population status, density (no./sq. m), and habitat association is scheduled to begin in November 2021.



Evaluation of Freshwater Invertebrate Community Response to Restoration of Ephemeral Ponds in Osceola National Forest

Kasey Fralick, Katherine Lawlor, Hannah VanBuren, and Gary Warren

- Ephemeral ponds are among the most exceptional and functionally dynamic of all freshwater ecosystem types. They differ from other freshwater ecosystem types in that they alternate from a flooded condition for a portion of the annual cycle to being completely dry for the remainder of the annual cycle. The unique faunal and floral communities that inhabit ephemeral ponds exhibit resilience to the wide ranges of environmental conditions associated with alternate periods of flooding and drying. A number of imperiled SGCN species are common inhabitants of ephemeral ponds in Florida.

The U.S. Forest Service and the AHRES subsection of FWC are cooperating to restore compromised ephemeral ponds in the Osceola National Forest

- Factors contributing to the decline of the affected ponds include invasion by undesirable hardwood tree species and shrubs and suppression of fire events that historically have controlled understory growth. Restoration activities include chain sawing and removal of undesirable trees and shrubs, girdling of undesirable hardwood tree species, and controlled burns to remove undesirable understory.

- Freshwater invertebrate communities were chosen as the tool to evaluate the success of FWC restoration efforts. Invertebrates are critical to normally functioning freshwater food webs and to the decomposition and nutrient cycling processes. Of equal importance, the structure of freshwater invertebrate communities is a proven indicator of ecological integrity in freshwater ecosystems.

- Two Osceola National Forest ephemeral ponds, OSC 2020-2 and OSC 2020-12, were sampled during the 2020-2021 study year. A total of 29 samples were obtained from these ponds, yielding 122 total invertebrate taxa to date. Processing of the 2020-2021 samples was incomplete as of the writing of the 2020-2021 annual report and is ongoing.

- Preliminary findings indicate that most of the species that composed the pond invertebrate community prior to restoration activities were opportunistic predators with terrestrial or semi-aquatic adult stages. The overall abundance of the pond fauna was dominated by microcrustacea and non-biting midge larvae that serve as the food resource for the many predator species. Shredder-detritivores, which are an important functional component of the invertebrate communities of most freshwater ecosystem types, were notably absent from the Osceola National Forest ponds sampled, with the exception of crayfish.

Florida's Statewide Freshwater Mussel Conservation Program

Susan Geda, Lauren Patterson, Kristen Lynch, Kallie Thornhill, and Ava Laszlo

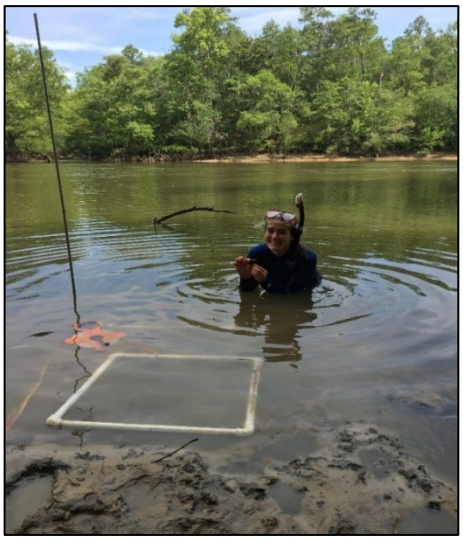
- In fiscal year 2020-2021 the FWC Freshwater Mussel Conservation Program (FMCP) sampled 51 discreet sites within 7 drainage basins. The sampling efforts documented 3,309 mussels from 41 species. 1,080 of the mussels collected are listed as Federally Endangered or Threatened and represented 11 of the 16 listed species.

- A recent publication by Patterson, LN, Geda, SR, and Johnson, NA (2021) reports the rediscovery and genetic confirmation of the Threeridge, *Amblema plicata*, in the Choctawhatchee River basin. *Amblema plicata* had not been reported in this basin in more than 61 years. This was a collaborative project with USGS.

- The FMCP finalized the *Florida's Freshwater Mussels and Clams* brochure update, which provides the current harvest regulations and conservation statuses of Florida's mussels.

The Freshwater Mussel Conservation Program is working collaboratively with DFFM in restoring mussel communities in Lake Trafford to improve water quality

- The FMCP is also part of a collaborative initiative with the US Army Corps of Engineers, Apalachicola Riverkeeper, Auburn University, and malacologist Michael M. Gangloff involving a slough restoration project that includes pre- and post-dredging community-wide assessments of Douglas Slough and Spider's Cut.



- Colleagues at USFWS requested assistance to help a local production company obtain footage of a super-conglutinate as part of a documentary highlighting the biodiversity of the Florida panhandle. The goal is to get footage in the wild of a host fish mistaking the super-conglutinate for a prey item and becoming naturally infested with glochidia.

- The FMCP is working closely with USFWS, USGS, and GADNR on conservation efforts for the Federally endangered Ochlockonee Moccasinshell, *Medionidus simpsonianus*. Enhanced surveying efforts and eDNA techniques will be employed to identify cryptic populations and/or reaches of this imperiled species, especially after Hurricane Michael. The data collected will aid future reintroduction efforts.

- Procurement of USFWS Section 6 funds allowed program biologists to re-open, maintain, and expand the Malacological Applied Research Laboratory at FWC Blackwater Hatchery. Research is ongoing to identify the host fishes for eight Federally petitioned freshwater mussel species, as well as one Federally Endangered and one Federally Threatened mussel species. A preliminary host trial was completed with a common mussel species with known host fish, the Southern Fatmucket *Lampsilis straminea*, to verify that baseline system conditions were restored.

Surveys, Citizen Science, and Outreach

Analysis of Social Media Performance and Practices for Freshwater Fisheries Research During Fiscal Year 2020 / 2021

Justin Hill

- There was a total of 118 outreach interactions in fiscal year 2020/21.
  - Facebook posts totaled 24
  - YouTube uploads totaled 4
  - Web content totaled 24
  - Instagram posts totaled 18
  - Other: Public events/Hard Print totaled 25
  - Internet questions answered 23

Instagram remains more angler friendly and less toxic in interactions along with a higher reach from a smaller audience.

- The number of social media posts were similar to previous years with the exception of agency website posts which has shown an increase since fiscal year 18-19.

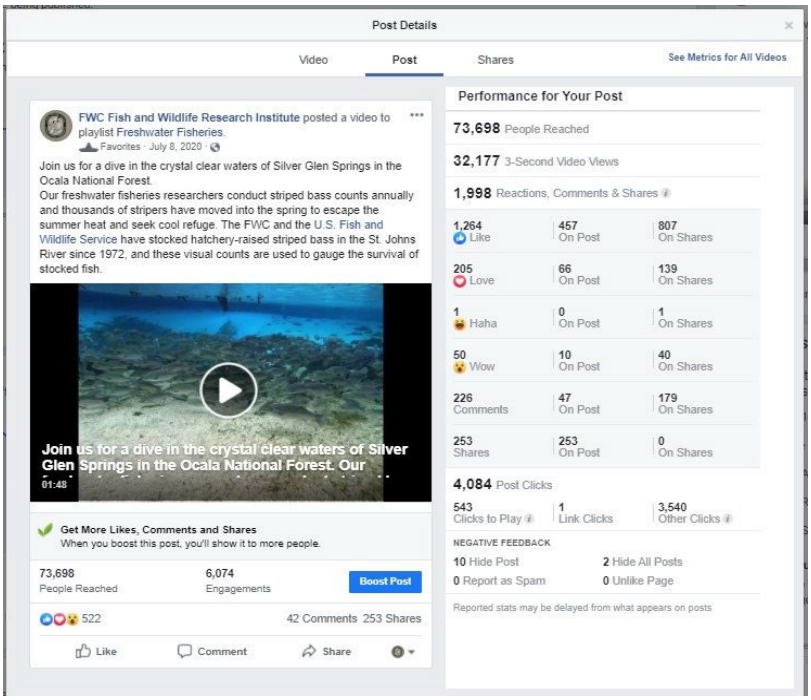
Outlets	18-19	19-20	20-21
Facebook	32	18	24
Instagram	20	16	18
Flickr	2	--	--
YouTube	1	2	4
Website	8	11	24
Internet questions	--	36	23
Other: Outreach	41	32	25
Total	104	115	118

- Notable posts: A post revisiting Silver Glen Springs research reached nearly 70,000 people on Facebook.

- A post on Gulf Pipefish was the most popular Instagram post reaching 20,000 users.

- Continuing this fiscal year, recording of monthly seminars has become a useful tool to share and save presentations. Videos are posted on YouTube as unlisted videos and are only viewable by those who have the link allowing those that miss the meeting or want to review and option to view the meeting.

- Between AFS recordings and the seminars, 18 videos were added for internal use and often have more views than our public YouTube content.



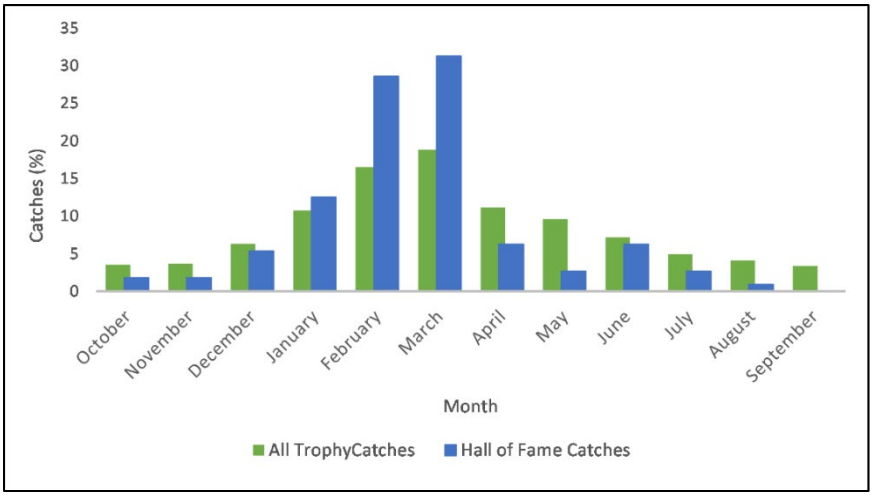
Annual Update of FWC's Freshwater Citizen-Science Program, TrophyCatch

Summer Lindelien, Kristen Eser, KP Clements, John Cimbaro, Drew Dutterer, Laura Walthall, and Jason Dotson

- The TrophyCatch citizen-science data collected for Largemouth Bass ≥8 lbs., surpass data collected from standard electrofishing samples since 2006 (1,648 bass from 105 waterbodies) and the Trophy Bass Tagging Study since 2011 (1,531 tagged fish from 158 public waterbodies).

Approved Catches	Lunker Club (8–9.99 lbs)	Trophy Club (10–12.99 lbs)	Hall of Fame Club (≥13 lbs)	Total
Season 1 (start October 2012)	131	53	1	185
Season 2	760	228	6	994
Season 3	1,362	365	17	1,744
Season 4	1,914	347	7	2,268
Season 5	1,396	264	16	1,676
Season 6	938	255	8	1,201
Season 7	863	263	12	1,138
Season 8	1,166	311	22	1,499
Season 9 (through June 2021)	860	244	25	1,129
Total	9,390	2,330	114	11,834

- Program participation measured by TrophyCatch approvals increased from Season 7 to Season 8 across all club levels. Season 9 approvals are comparable to Season 7 for the Lunker and Trophy clubs.



TrophyCatch surpassed 100 total approved Hall of Fame (≥ 13 lbs.) catches, including 25 alone in Season 9

- TrophyCatch has 32,554 registrants as of June 30th, 2021.

- The TrophyCatch Eyeball Challenge engaged anglers to guess weights of bass in photographs. The challenge was implemented through three online surveys during the summer of 2020, and collectively, anglers tallied nearly 5,000 complete survey responses. Average guessing error exceeded ±2 pounds per fish. Subjective determinations of bass weights from photos should be made and received cautiously.

- To celebrate 100 approved HOF submission, a survey was administered to all anglers who had approved HOF catches. The survey included questions about their catch, time of day, conditions etc. and results were posted on the TC website.

Creel Estimates Reported from TrophyCatch Registered Participants

Summer Lindelien, Bill Pouder, and Adrian Stanfill

- Starting in 2019, creel surveys around the state added a question to document anglers who are registered for TrophyCatch (TC). These data are used to evaluate current TC registration rates, residency, targeted species, and TC registered angler effort, catch, and success.

Waterbody	Total Anglers	# Registered Resident (% of total)	# Registered Non-resident (% of total)	Registered Unknown (% of total)	Targeted Species/Registrant			
					LMB	BLCR	Bream	All
Julington Creek	83	13 (18%)	2 (22%)		14	0	1	0
Santa Fe	536	92 (19%)	17 (40%)		108	0	1	0
Trafford	242	15 (8%)	0		15	0	0	0
Kissimmee	1,182	189 (28%)	34 (7%)		220	3	0	0
Toho	516	215 (47%)	7 (12%)		221	0	1	0
George	280	34 (15%)	2 (4%)		33	3	0	0
St. Johns River	509	166 (33%)	0		68	58	6	1
Weir	167	16 (14%)	0	8 (20%)	24	0	0	0
Marian	102	7 (26%)	5 (7%)		8	4	0	0
Dora	978	146 (27%)	20 (8%)	27 (14%)	178	15	0	0
Newnans	1,362	57 (4%)	2 (3%)		7	48	4	0
Lochloosa	1,781	74 (6%)	5 (1%)		34	38	7	0
Orange	772	159 (24%)	21 (19%)		91	29	42	18
Deer Point	327	31 (10%)	0		30	0	1	0
Talquin	516	10 (3%)	0		5	4	0	1
Rodman	939	306 (40%)	62 (34%)		350	5	7	5
Tsala Apopka	553	199 (40%)	6 (10%)		170	10	0	25
Okeechobee	392	181 (59%)	21 (25%)		168	33	1	0
Escambia River	191	0	0		0	0	0	0
Istokpoga	1,766	301 (26%)	72 (12%)		373	0	0	0

Waterbody	TC Effort	% TC of total LMB Effort	TC Catch	TC Success
Dora/Beauclair	10,046	35%	5,313	0.65
Istokpoga	32,202	48%	20,868	0.66
Kissimmee	14,496	40%	8,067	0.56
Orange	4,623	41%	3,816	0.59
Talquin	728	15%	450	0.94
Toho	15,018	24%	15,286	1.05
Weir	1,228	30%	976	1.03
Santa Fe	3,242	28%	2,252	0.76
Rodman	18,801	53%	10,702	0.63
Lochloosa	1,431	40%	476	0.28
Weohyakapka	1,957	72%	2,933	1.02
Julington Creek	302	19%	205	0.65
Inverness Pool	3,426	44%	2,257	0.64
Marian	109	15%	0	0

- Using these data, we can calculate effort and percent participation for individual waterbodies/resources, compare proportional TC catch rates and effort between waterbodies/resources and calculate the percent of registered separately from non-register anglers.

- We could use these data collected from creel surveys to identify locations where additional TC promotion is needed and assess if TC effort is increasing to document growth of the program. They could also help us evaluate changes in TC submissions and participation.

Evaluating the Economic Impacts of Largemouth Bass Tournaments on Lake Okeechobee

Robert Botta, Lee Grove, Christa Court, and Ed Camp

- We developed an innovative approach to evaluate economic expenditures and angler value using the unique tournament exemption permitting system (Permit Me).

- Previous studies have found that tournament anglers spend disproportionately more money compared to non-tournament anglers. These findings emphasize the importance of carefully considering potential impacts on tournament angling when making management decisions, as losing a few tournaments may have larger than anticipated impacts.

Florida hosted roughly 3,500 tournaments in the 2016 – 2017 fiscal year alone

- The Permit Me system provides us with tournament information prior to the tournament so we contacted tournament directors in advance of their scheduled tournament during FY 2019/20 and request they distribute an online economic survey to the tournament anglers.

- Economic impacts of bass tournaments on Okeechobee during FY 2019/20 were calculated using data on the economic structure of the Okeechobee region (defined 5-counties: Hendry, Glades, Martin, Palm Beach, and Okeechobee) along with angler expenditures for 3 tournament types (Invitational, Member Only, and Open).

- A total of 151 tournament angler responses were received, of which 75% were non-local responses (defined as any participant whose home zip code was not within the Okeechobee region).

- Because economic impact analysis measures how new economic activity affects the regional economy, only non-local expenditures were used within the calculations.

- The proportion of non-local, FWC survey responses per aggregated tournament type was multiplied by the Permit-Me's average number of angler participants per tournament type to estimate the total number of non-local anglers for the entire 2019/2020 bass tournament season (invitational: n = 92; members only: n = 3,083; open: n = 1,371 anglers). This was used to calculate the average expenditure per person per tournament type to obtain the total expenditures (invitational: $8,569; members only: $562; open: $727).

- Each expenditure was then assigned to the most representative IMPLAN® sector and analyzed within the IMPLAN® software to calculate the total economic impacts associated with Lake Okeechobee's FY 2019/20 tournament season.

- Final results are pending, analysis and will be reported within the upcoming fiscal year.

Community-Based Fishing Project

Nick Trippel, Ed Camp, Lee Grove, Barron Moody, Matt Stevens, Trevor Phillips, Allen Martin, and Max Inchausti

- FWC South, Southwest, and North Central Regions participated in year-two of this study. The objectives were to compare how stocking sub-adult catchable-size Largemouth Bass impacted angler effort in South Region FMA's and to see how advertising /marketing impacted angler effort in Southwest Region FMA's.

- A unique opportunity became available in the North Central Region to look at how stocking catchable-size Black Crappie in FMA's impacts angler effort.

- Camera creel analysis is still underway, most camera data has not been entered, and total effort estimates are not yet available.

- Sub-adult bass were only stocked into Okeeheelee FMA but did not reach requested rates. Tropical Park FMA, the other sub-adult bass stocking lake, did not get any fish this year.

- In November, trophy-sized, retired brooder Channel Catfish were stocked into Okeeheelee and Tropical Park FMA's along with age-three Channel Catfish.

Based on year-one surveys, Black Crappie and Largemouth Bass were the most requested species to be stocked by anglers

ATTENTION ANGLERS!

Black Crappie have been stocked in this pond to provide a new target species for anglers. Fish were stocked during two separate events, one week apart on May 4th and May 11th, 2021.

Please note: Some of the larger black crappie have been previously tagged. These fish were used in a previous study looking at long-term tag retention rates in black crappie. **These ARE NOT reward tags.** However, each tag has a unique identification number. If you catch a tagged crappie and would like to report the date caught, tag number, and fish length, please contact:

Trevor Phillips
FWC; Freshwater Fisheries Management
Lake City, FL
Phone: 386-754-6254 (O) or 386-623-3954 (C; call or text)
Email: trevor.phillips@myfwc.com

Big Catch

- In May, a Black Crappie tag retention study was completed, and 109 mature-size Black Crappie from this study were stocked into Bethesda FMA in the North Central Region.

Sportfish Research and Monitoring

Virtual Population Analysis of Black Crappie Populations in Florida

Cheree Steward, Travis Tuten, Stephen Jones, Sara Menendez, Adrian Stanfill, Alyssa Jordan, Mason Smith, Andrew Marbury, and Reid Hyle

- The VPA sampling was largely successful in the fourth year of collection.
- Data has been compiled in a single location that all parties can access.
- Andrew Marbury and Stephen Jones will coordinate, maintain, and manage sampling and data, including data analysis as this study moves forward.
- To date, a total of 1,870 Black Crappie have been collected and 497 sacrificed for age and growth on four VPA lakes. Remaining lakes are currently being processed.

The collaborative effort of management and research biologists was very good, and will get smoother with experienced staff

Fishery dependent data collected in 2020-21 for the statewide crappie VPA

Waterbody	Sample Collection Dates	Creel Analysis Complete	Angler Harvested BLCR otolith status	Fish measured / otoliths collected
Okeechobee	October 2020 to June 2021	In process	Complete	322 / 105
Istokpoga	October 2020 to June 2021	Yes	In process	
Marian	January to April 2020	Yes	Complete	489 / 148
Griffin	November 2020 to May 2021	Yes	Complete	568 / 111
Harris	November 2020 to May 2021	Yes	Complete	491 / 133
Lochloosa	November 2020 to May 2021	In process	In process	

Black Crappie trawl survey samples collected in the 2020-21 season.

Waterbody	Sample Collection Dates	Number of trawl samples	Otoliths Processed
Okeechobee	January 2021	15	Yes
Istokpoga	December 2020	30	Yes
Marian	December 2020	30	Yes
Griffin	November 2020	31	Yes
Harris	November 2020	30	Yes
Lochloosa	November 2020	18	Pending

Assessing Annual Variability in Angler Exploitation of Black Crappie at Newnans and Lochloosa Lakes

Travis Tuten, Chris Anderson, Jason O'Connor, Steve Beck, 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.

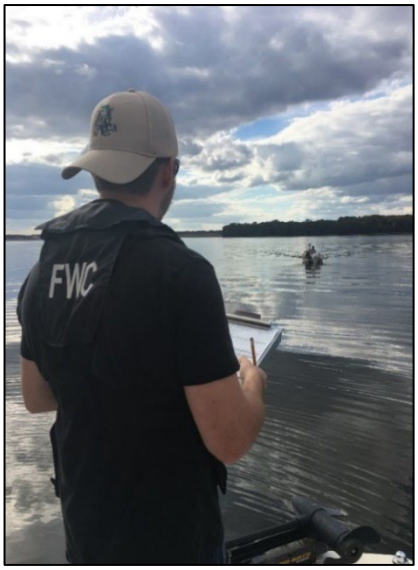
- Our objectives are to determine how exploitation in Black Crappie fisheries varies annually with fish abundance and angler response at lakes Lochloosa and Newnans.

- We tagged 203 Black Crappie in Newnans Lake and 210 in Lochloosa Lake with high reward tags ($100) in November 2020.
- There were 29 tag returns from Lochloosa Lake, and 27 (93.1%) of those fish were harvested. This resulted in an exploitation estimate of 13.8%.

- There were only 31 tag returns from Newnans Lake, and 26 (83.9%) of those fish were harvested. This resulted in an exploitation estimate of 12.9%.

- The 2020-2021 exploitation estimate for Newnans Lake (12.9%) was an intermediate value similar to what we found in two other years (13.6 and 13.9%), and much higher than what we estimated in 2018-2019 (1.0%) and lower that what we estimated in 2015-2016 (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



- The 2020-2021 exploitation estimate for Lochloosa Lake (13.8%) was one of the lower estimates made during six years of the tagging study (Range: 12.2 – 37.5%), but very similar to lower estimates made in three other years (12.2, 13.6, and 13.9%).

- 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 $\geq$ 203 mm TL based on trawl CPUEs were positive, but weak at both lakes.

- Relationships between exploitation and relative abundance of Black Crappie $\geq$ 229 mm TL based on trawl CPUEs were positive at both lakes, and stronger than when including smaller fish $\geq$ 203 mm TL.

- This was the sixth 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.

Largemouth Bass Regulation Evaluation in the Escambia River Marsh

Matthew G. Wegener and Amanda E. Mattair

- Largemouth Bass from the Escambia River Marsh rarely attain a size greater than 406-mm TL, thus the entire population is susceptible to harvest because of the statewide Largemouth Bass regulation implemented in 2016.

- 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 not only from a biological perspective, but also a human dimensions perspective.

• Catch rates from day-time electrofishing samples have not significantly decreased before-and-after implementation of the regulation.

• Otolith analysis indicated an increase in total mortality after implementation of the regulation.

- Largemouth Bass harvest has increased to ≥ 30% in 2 of the past 4 years after the statewide regulation change.

Total fishing effort has increased slightly since 2017, but is still significantly lower than when surveys began in 1981

• Continued monitoring is needed to determine whether angler attitudes have shifted away from catch-and-release to harvest.

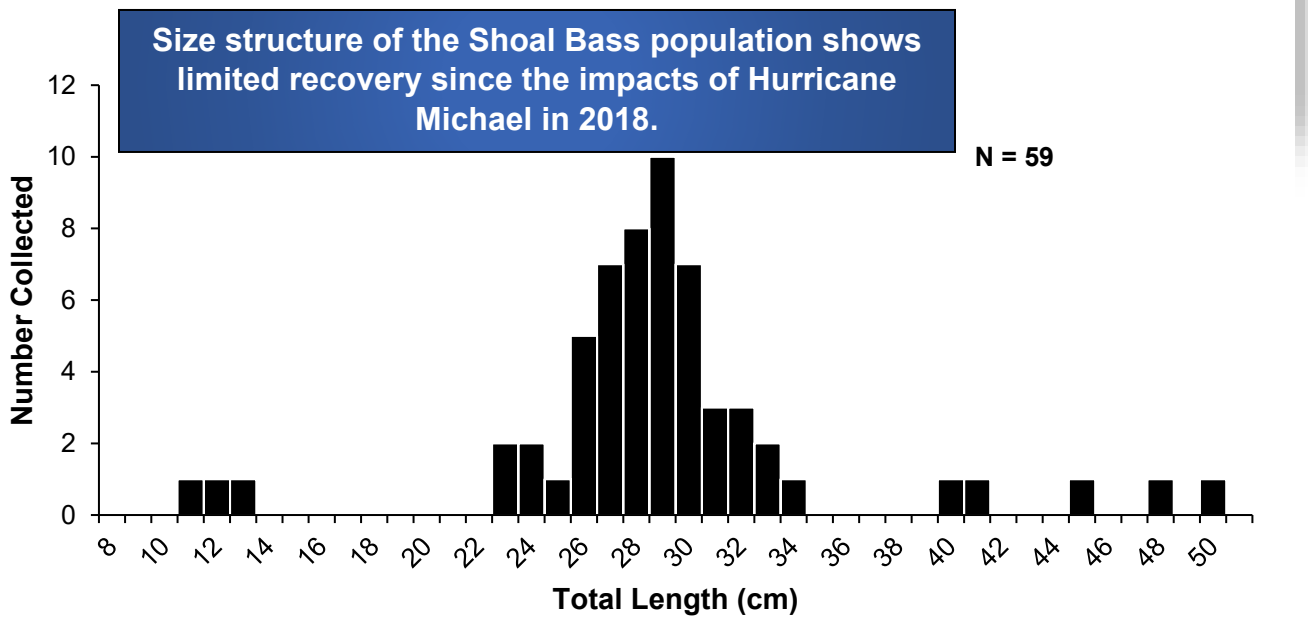
• A future exploitation study will be conducted using high reward tags.

• A supplemental roving creel will collect a subset of information on which ramps anglers are using and may be applied as a corrective factor to future angler effort estimates.

Shoal Bass Population Monitoring in the Chipola River, FL

Ryan Henry, Stephen Stang, and Andy Strickland

- 59 Shoal Bass were captured in November 2020 (86% were from the 2019 cohort).
- 23 Shoal Bass were collected and were sent to the Blackwater Research and Development Center to serve as brood stock.



- Genetic purity for the Shoal Bass population is estimated to be 84% (95% in 2019).
- A re-assessment of the Shoal Bass population on the Chipola River will continue annually.
- A mark-recapture population estimate for the Shoal Bass population is anticipated in 2021.

St. Johns River *Morone spp.* Stocking Program Assessment

Andrew Marbury, Jay Holder and Earl Lundy

- Directed electrofishing efforts and snorkeling surveys throughout the St. Johns River (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 2020 through June 2021, 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. *Morone spp.* were found in all surveys with numbers peaking (~3,000) in the summer, but with small numbers remaining throughout the winter.

- Sunshine Bass stockings far surpass Striped Bass stockings in recent years and continue to dominate observations (~90%) in SGS.

- We acoustically-tagged a total of 25 Sunshine Bass in Lake George in April 2019 in an effort to identify other seasonally important habitats in the middle St. Johns River as well as document seasonal movement.

Morone spp. were found in all snorkel surveys with numbers peaking (~2,400) in the summer, but with small numbers remaining throughout the winter

- Results highlight the relative importance of SGS as thermal refuge, but also identify other refugia in the area. Movement rates decline while water temperatures are high (>25°C), although fish are still documented moving for short periods of time into the mainstem river and to alternate refugia.

- Rates of tag “loss” while within the array suggest high (> 40%) summer mortality in this population of Sunshine Bass.

Thermal Refuge and Fishing Mortality of Striped Bass *Morone saxatilis* in Lake Talquin and the Ochlockonee River

Stephen Stang, Andy Strickland, Mike Allen, and Ryan Henry

- Lake Talquin currently offers marginal summer habitat for adult (> age-2) Striped Bass.
- Best summer refuge habitat for adults is found in Hammock Creek, Ocklawaha Creek, and Little River.
- 79 of 201 (39%) tagged Striped Bass have been recaptured to date (August 13, 2021).
- Of the 79 recaptures, 8 of the original 23 tagged in Lake Talquin were recaptured and 71 recaptures were below Jackson Bluff Dam.
- Recapture information suggests evidence of dam escapement from Lake Talquin to the Ochlocknee River likely from the new flow regime.
- Tag-loss rate was estimated at 5%. Plastic-tipped dart tags have shown good tag retention so far with 21 out of 22 recaptured double tagged fish having both tags intact.
- 7-month estimate of angler exploitation is 24% and harvest rate was estimated to be 58%.

Angler harvest consisted of 56% of Stiped Bass less than and 65% greater than 24 inches TL

- 81% of anglers with a recapture were specifically targeting Striped Bass.

- The most common reasons anglers gave for releasing a tagged fish was that they were primarily a catch and release angler and that they prefer to harvest larger fish.
- Of the 12 recaptures from mid-May through July (period of thermal stress),1 fish was recaptured in Lake Talquin (Little River thermal refuge area) and 11 were recaptured below the Jackson Bluff Dam.
- The tailrace offers suitable summer habitat for adult Striped Bass.

Statewide Evaluation of Angler Catch and Exploitation Rates of Trophy Florida Bass (The Trophy Bass Tagging Study)

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.

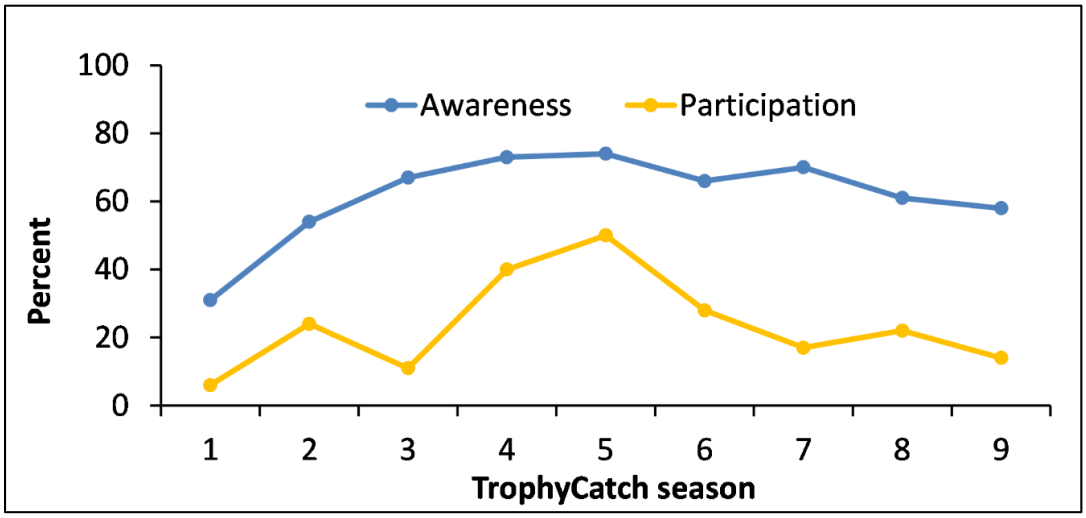
TrophyCatch participation rate showed an increasing trend through the first five seasons (6%→50%), but during seasons 6–9 participation rate has decreased, varying between 14%–28%

- Cumulatively through ten years of operating the tagging study, FWC biologists have tagged 1,531 trophy-size bass (104–195 per year; this year: 122) from 158 public waterbodies (32–56 per year; this year: 45) within Florida.

- Throughout the study, estimates of mean annual catch of trophy-size bass have varied 12%–27% (this year: 15%), and annual exploitation varied 1%–5% (this year: 1%).

- Low annual exploitation rates were due to high release rates (77%–95%; this year: 94%), which were largely voluntary.

- TrophyCatch awareness showed increase through its first five seasons (31%→74%). However, in seasons 3–5, increases in awareness slowed (67%→74%). Over the last seven seasons (3–9) awareness has only varied within 61%–74%, suggesting it has reached an asymptote.



Evaluating Biological and Social Effects of the New Statewide Largemouth Bass Regulation

Daniel Nelson, Brandon Thompson, and Matty Cleary

- The statewide Largemouth Bass regulation was changed in July 2016.
- A set of waterbodies was selected to assess biological changes as an effect of the Largemouth Bass regulation change and three (of ten) years of post-regulation data have been collected.
- Creel surveys were conducted on 19 lakes to assess changes in directed effort, catch, and harvest of Largemouth Bass.
- Fifty-eight percent of anglers were aware of the new regulation and average satisfaction was 4.42 in 2020-21.

Overall regulation awareness and satisfaction have remained static through four years

Year	Overall Awareness (%)	Overall Satisfaction (1-5)	LMB Awareness (%)	LMB Satisfaction (1-5)	Resident Awareness (%)	Non-Resident Awareness (%)
2017-18	52	4.30	70	4.30	59	51
2018-19	56	4.31	71	4.36	65	54
2019-20	52	4.48	67	4.48	52	50
2020-21	58	4.42	75	4.41	60	47

- Electrofishing was conducted on 40 lakes to assess Largemouth Bass population level changes in response to the regulation change.
- A modified age sample (age-at-length) was collected from 20 lakes to assess growth changes in Largemouth Bass in response to the regulation change.
- 576 Largemouth Bass were tagged in fall 2018 to assess changes in size selective harvest post-regulation change.
- With results of two years of tagging (2017 and 2018), harvest rates and exploitation rates remain low statewide.
- All of these assessments will continue through the 10-year evaluation and trend analysis will aim to detect changes (or lack thereof) to the Largemouth Bass population, size structure, growth, and angler harvest.

Exploitation rates for Largemouth Bass tagged across 79 waterbodies in Florida. Results presented from tag returns are recaptures within one year of tagging date. Waterbodies are presented in three separate strata. Largemouth Bass tags are presented in two categories.

		2017-18 Exploitation			2018-19 Exploitation		
Strata	**Waterbodies**	**< 16"**	**> 16"**	**Overall**	**< 16"**	**> 16"**	**Overall**
Panhandle	19	6.0	7.0	6.2	3.5	16.7	6.1
Peninsula Large	29	1.0	0.0	0.5	2.9	1.9	2.4
Peninsula Small	29	4.0	4.5	4.2	3.9	2.2	3.2
Peninsula Overall	58	2.5	2.1	2.3	2.5	1.6	2.0
Total	**79**	**4.1**	**3.0**	**3.6**	**3.5**	**4.7**	**4.0**

Developing a Nonlethal Ageing Method Using Largemouth Bass Dorsal Spines Collected in Florida

Summer Lindelien, Drew Dutterer, Paul Schueller, Chris Anderson, and Jason O'Connor

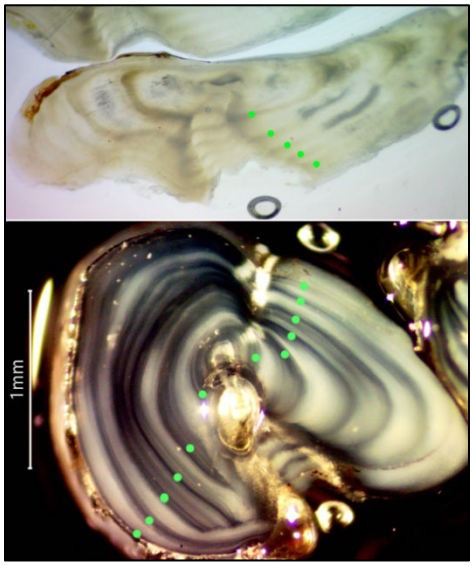
- Seven Largemouth Bass (LMB) fin structures (anal rays and spines, dorsal rays and spines, pelvic rays and spine, and pectoral rays) were useful for estimating age.
- Dorsal spines were the simplest to clip and they provided the most promising ageing accuracy.

Ages derived from dorsal spines were relatively comparable to otolith ages (mean PA = 42%) and were more comparable within one year (mean $PA_{\pm 1yr}$ = 80%)

- All LMB survived with dorsal spines III–V removed in a 35-d tank study, and experiment-wide survival was 0.94 (0.87–1.00; 95% confidence interval).

- The removal sites healed with no infection or inflammation at the conclusion of the experiment.
- Dorsal spine removal is a nonlethal option for collecting ageing structures of adult LMB in Florida, including large individuals and could likely extend to other black bass species as well.
- Genotypes can be collected from the skin and distal section of dorsal spines using several storage methods.
- Dorsal spines can 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., tournaments, TrophyCatch) would expand age data sources and possibly foster increased angler interest and participation, generating a valuable new tool for bass research, management, conservation, and stakeholder engagement.
- Dorsal spine ageing is used in select water bodies with ongoing tagging studies and restoration efforts to better understand population dynamics of LMB.
- We are studying the effects of errors associated with dorsal spine age estimates and how errors affect population-level estimates of growth, mortality, and recruitment, relative to using otoliths which are the generally the most accurate LMB body part for estimating age but are lethal to collect.



Evaluation of the Fishery at Fellsmere Reservoir

Brad Fontaine, Reid Hyle, Arthur Bernhardt, Trevor Knight, and Brandon Thompson

- Fellsmere Reservoir (10,000 acres) was flooded in May of 2016.
- Prior to flooding, FWC contracted heavy equipment to manipulate and sculpt over 2,000 acres to provide beneficial fish habitat.
- Once flooded, FWC also stocked over 1 million Florida Largemouth Bass to enhance the potential of the new reservoir.
- The much-anticipated boat ramp was opened to the public on August 10, 2020.

- It was expected that the reservoir had potential to become one of the best bass fisheries in Florida and managers committed to a year-round access creel survey.
- To inform management at the reservoir, a human dimension survey was conducted at the ramp to gather angler opinions and economic expenditures.

Anglers caught 220,000 bass with a catch rate of 1.3 bass/hr. and release rate of 99.7%

- The creel survey estimated 170,000 angler hours with 95% being directed towards bass fishing during the first ten months of the reservoir being fully open (August 2020 through June 2021).

- The creel survey estimated a catch of 778 bass over 8 lbs. but only 58 were submitted to and approved by TrophyCatch during this period (an additional 8 were known to have come from Fellsmere).
- The human dimension survey showed that anglers generally supported a regulation that protected larger bass from harvest with 68% most preferring catch-and-release, 16% most preferring a 16” max with no over-length fish, and 15% preferring the current statewide regulation.
- The majority of surveys responses (78%) did not support weigh-in style tournaments and 85% of respondents opposed length limit exemptions for tournaments.
- Preliminary analysis of expenditures indicates that anglers may have spent nearly 7 million dollars in association with fishing Fellsmere.

Development of a Comprehensive Florida Freshwater Fisheries Strategic Stocking Plan

Ed Camp (UF), Jason Dotson, Bob DeMauro, Rick Stout, Stasey Whichel, and Ryan Hamm

- The FWC contracted University of Florida (UF) researchers to develop a comprehensive freshwater fisheries strategic stocking plan over a four-year period.

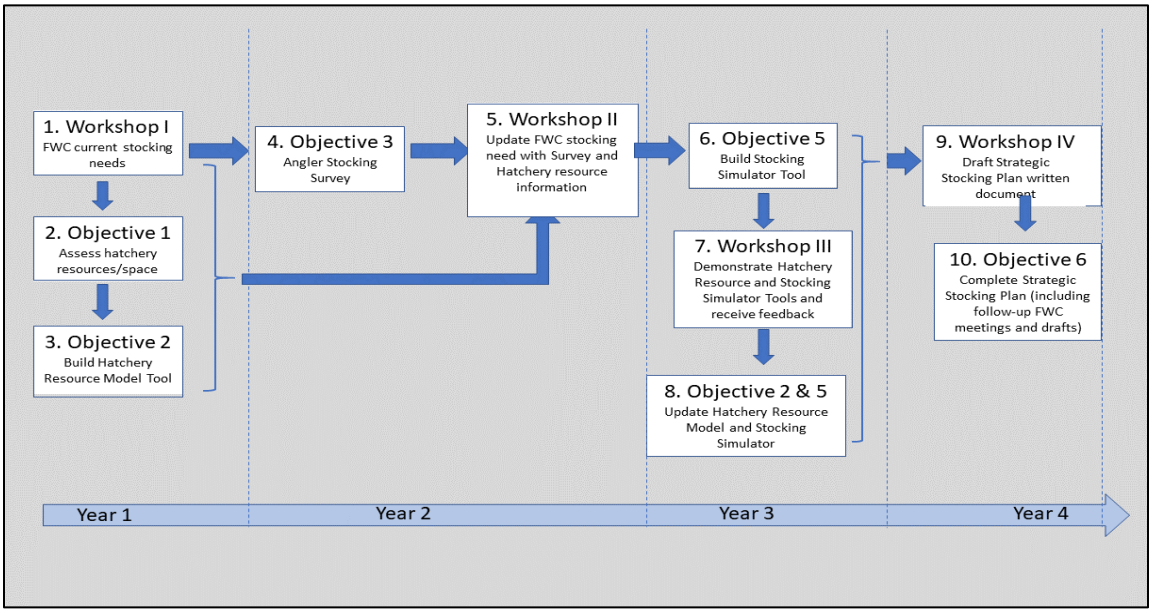
- In year two, the team finalized the assessment of hatchery production potential, the development of the hatchery resource model tool, and the distribution of an angler stocking survey including an analysis of the results.

Survey results suggest that stocking Catfish had limited impact on an angler's decision on how often they fish compared to fish habitat and facility improvements

- In the second year of the study the focus shifted to addressing space limitations in ponds and raceways, with the time required for species production, especially > phase I, and survival of fish in the hatchery each season.

- Using these data, a Hatchery Resource Tool was developed to provide a visual model including comparisons and graphs to better understand how species requests utilize hatchery space.

- Finally, an online stocking survey was distributed to freshwater licensed anglers. Results provide baseline information on stakeholder perceptions of stocking, which may help future work, provides information to help managers make immediate decisions regarding the selection of species or size, and provides information for parameterizing the stocking model which will be developed in year three of this study.



Stock Enhancement at Lake Wauberg

Brandon Thompson, Andrew Dutterer, Dan Nelson, Stephen Jones, and Allen Martin

- Lake Wauberg has provided a unique opportunity to assess and compare multiple stocking strategies and how stocked Largemouth Bass impact the natural population.

- Two stocking events (2012 and 2015) resulted in near or higher than 30% contribution of stocked Largemouth Bass to the entire adult bass population each year from 2013–2018.
- Contribution dropped to 16% in 2019, which was four years from the last marked stocking.
- We recommend a stocking rotation of 2-3 years to maintain high contribution of stocked fish.
- By 2017, we found that a disproportionate number of the larger bass at Lake Wauberg were hatchery bass. This included over half of all trophies in 2018 and 2019.
- In 2019, we documented the first stocked fish at Lake Wauberg larger than 10 pounds.
- We used PIT tags to track growth in wild and hatchery fish after one year and found that hatchery fish did not have faster growth.

Surveys in 2020 and 2021 resulted in the lowest hatchery contribution (8% and 5%, respectively) since assessments began in 2013

- By 2020, we did not collect any hatchery fish from the 2012 stocking (eight years post-stocking).

- Intensive mark-recapture population estimates from the two stocking studies showed that the total adult population doubled from 2013 to 2018. However, in 2019 both stocking contribution and abundance declined.

- In 2019, we initiated another stocking study to compare survival and growth between larger grade-out bass from the hatchery raceways and standard advanced-fingerlings.
- It is unclear why the 2019 stocking had seemingly low survival and thus, we are unable to detect any differences in growth or survival between stocking treatments. We will continue to monitor all stocked cohorts as they move through the fishery.

Evaluating an Out-of-Season Stocking of Fingerling Florida Bass *Micropterus floridanus* at Lake Apopka

Daniel Nelson, Brandon Thompson, and Scott Bisping

- Stocking out-of-season fingerling Florida Bass in the fall at Lake Apopka for two consecutive years was determined to have the best opportunity to augment natural recruitment and increase angler effort.

- In fall 2016 and 2017, almost 1.5 million fingerling Florida Bass 30–50 mm TL were stocked across 34 sites and no stocking mortality was observed.

- Fin clips were taken during the spring bass sample in 2018 (N = 104), 2019 (N = 300) and 2020 (N = 148) and 2021 (N = 221) to determine hatchery contribution to each respective year-class.

- No hatchery fish were collected in 2018, which primarily assessed the 2016 stocking, due to low catchability of 2017 stocked fish in 2018.

- In spring of 2020, 3 bass were identified as hatchery-stocked fish. One from 2016, one from 2017, and one that was inconclusive to stocking year—resulting in 2% contribution to the adult population.

- High mortality in the first few months of stocking is likely the reason we did not see higher contribution, although the cause of the mortality is unknown.

- Game cameras have tracked peak season angler effort since 2012 and have not shown an increasing trend.

- Although stocking did not meet our intended goals, managers should continue to try to utilize other forms of promotion, such as kiosks or other positive promotion techniques, to promote the existing bass fishery.

This stocking highlights the ability of the Florida Bass Conservation Center to produce large numbers of out-of-season fingerling bass, which may be a useful technique for increasing annual hatchery production

Evaluation of Largemouth Bass Immigration, Emigration, and Mortality in Response to Seasonal Oxygen Depression in Restored Areas of the Kissimmee River

Reid Hyle, Rachel Grey, Chuck Hanlon, Steve Bosquin, Brad Fontaine, Arthur Bernhardt, and Tanner Beagell

- FWRI has partnered with the South Florida Water Management District in a two year study to investigate the fish population dynamics of Largemouth Bass in response to wet season oxygen depression in the Phase-I and Phase-IV restoration areas of the Kissimmee River.
- In year 2 of this study, fifty additional Largemouth Bass (0.95 - 3.2 kg) were implanted with radio transmitters in January in three areas within the Kissimmee River and basin (30 – river restoration area; 10 – Lake Kissimmee; 10 – Unrestored Pool – A).
- Stationary receivers were places at strategic locations to detect immigration and/or emigration between the lake, unrestored and restored river.
- Fish have been tracked weekly since early February with mobile telemetry in the restoration area and stationary receivers are downloaded monthly.
- Four of 30 fish tagged in the Kissimmee River in 2020 survived 2020 and three of those still being tracked as of September 2021 with one having again exited the study area to the south as it did in 2020.
- Nineteen of 30 fish tagged in the Kissimmee River in 2021 are still being tracked between Istokpoga Canal and S65-A.

Three fish are confirmed to have moved from Pool A up into Lake Kissimmee. Two were transported by anglers during a tournament weigh-in and released in the lake. The other is presumed to have moved on its own due to having its reward tag intact

- There was excessive fish movement during the period of rising water levels in July 2021 coinciding with a gradual decline in dissolved oxygen in the river. Thirteen moved upstream to the transition from the canal to Phase-IV, 6 remained in Phase-I, 8 were confirmed dead and 2 immigrated south.

- Anglers have recaptured six fish in 2021: two in Lake Kissimmee, three in Pool-A, and one in Phase IV.
- One of the fish captured in Lake Kissimmee in 2021 was originally tagged in Pool-A in 2020 and one fish captured in Pool-A in 2021 was tagged in Lake Kissimmee in 2021.
- The summer mortality event observed in 2020 (26 out of 30 fish died) did not occur in 2021 (8 out of 30 died). It is presumed that the high flow events that occurred in 2020 resulted in anoxic conditions. Gradual increases in flow during 2021 allowed most fish time to find refuge during low dissolved oxygen periods.
- Tracking will continue through the 2nd week of November. We will evaluate then whether or not to continue tracking or attempt to collect the remaining live fish via electrofishing.

Non-game Research Projects

Population Trend Assessment of Saltmarsh Topminnow (Fundulus jenkinsi)

Chelsea Myles-McBurney, John Knight, Cynthia Lupton, Brandon Barthel

- Saltmarsh Topminnows (SMTM) are small-bodied fish that rely on low salinity saltwater marsh habitat and occupy a small range along the Gulf Coast.
- SMTM are listed as Threatened in Florida (FNAI RANK= G3, S2) and are a candidate for Federal listing pending a final decision from USFWS.

Genetically differentiated subpopulations of Saltmarsh Topminnow were identified within the Perdido River, Bayou Grande, Escambia Marsh, Escambia Bay, and the Yellow River Marsh

- A population trend assessment of SMTM was conducted between 2016 and 2020 and was completed during this fiscal year (FY 20-21).
- Thirty-nine sites were sampled within the Pensacola Bay complex between 2016 and 2020 using a standard trapping array. Each trap array included six Gee minnow traps and six Breder traps in a 12 m x 16 m grid.
- Between February 2016 and July 2020, 28,565 total fish were collected including 1,203 SMTM.
- Trap type was the best predictor of detection probably and the null model was the best model for colonization and extirpation probability.
- Results from this study estimated the proportion of occupied sites within the study area to be 29% in the summer of 2016 to a maximum of 50% in the spring of 2020.

- Sixty-nine sites were sampled across Apalachicola Bay between September 2017 and June 2020 using the same standardized method. A total of 1,898 fish from 29 species were collected. No SMTM were detected.
- Eighty sites were sampled within the Choctawhatchee Bay between October 2015 and August 2020 collecting a total of 8,104 fish from 41 species. No SMTM were detected.
- 266 SMTM were successfully genotyped from 7 different locations from the Pensacola Bay complex.
- Over the course of this study, little variability was observed in the proportion of salt marsh habitat occupied by SMTM.

Alligator Gar Research in Pensacola Bay

Matthew G. Wegener and Amanda E. Mattair

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

Telemetry results suggest Alligator Gar in Pensacola Bay are panmictic, likely traveling to a single tributary of the bay to spawn

- Large-mesh gill nets were used to sample for Alligator Gar whereas small-mesh gill nets and low-pulse electrofishing were used to collect Longnose & Spotted Gar.

- Captured Alligator Gar were surgically implanted with an ultrasonic-telemetry tag.

- Active and passive tracking were used to estimate movement and habitat use of Alligator Gar.
- Two fish were captured in Blackwater Bay after manually tracking an aggregation of tagged fish.
- Majority of detections occurred in Bay habitats, followed by Escambia River.

- No detections occurred in the upper reaches of the Yellow River.
- Most of the river detections occurred during the warmer months (March-June).
- 8 of the 11 fish tagged in this study were detected in the Escambia River during late spring and early summer of 2020.
- This long range movement coincided with rising river levels and could have been related to a spawning event.
- 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.

Population Trend Assessment of Blackmouth Shiners (*Notropis melanostomus*)

Chelsea Myles-McBurney, John R. Knight, Jason O'Connor, and Brandon Barthel

- The Blackmouth Shiner *Notropis melanostomus,* is a small cyprinid that inhabits tannin-stained backwater pools, sloughs, or oxbow lakes within Mississippi, Florida, and Alabama.

- Blackmouth Shiners are listed as Threatened in Florida due to their restricted range within the state, severe population fragmentation, and general decline in extent and quality in habitat.

- A genetic monitoring protocol for Blackmouth Shiners was conducted between 2016 and 2020 and was completed this fiscal year (FY 20-21).

- Visual surveys within forested wetland habitats were used to locate and collect Blackmouth Shiners.

- 203 Blackmouth Shiners were successfully genotyped from 10 sampling sites within the lower, middle, and upper areas of the Blackwater River.

Genetically differentiated groups of Blackmouth Shiners were identified from the lower versus upstream areas of the Blackwater River

- Limited dispersal of Blackmouth Shiners between Pond Creek and the Blackwater River proper were observed over the course of the study.

- Results from this study have aided in the development of a genetic monitoring protocol that can be used to track trends in Blackmouth Shiner populations.

Saint Johns River Shad and River Herring Long-Term Monitoring

Reid Hyle, Andrew Marbury, Earl Lundy, and Jay Holder

- American Shad and Blueback Herring are anadromous herring that range along the Atlantic Coast of North America from Florida to Canada. Each river has a unique spawning stock. Most stocks are at historically low abundance. Florida's populations are low, and the commercial fishery is closed but American Shad can be popular among recreational anglers when abundance is higher.

- Our primary objectives were to monitor the spawning stock abundance, size structure, sex ratio, and age composition of the spawning stock of American Shad in the St. Johns River, monitor annual juvenile production of American Shad in the St. Johns River, and monitor effort, catch rate, total catch, and total harvest of American Shad from the recreational fishery on the St. Johns River.

- Data were collected about the Blueback Herring spawning stock and juvenile relative abundance from the American Shad surveys to satisfy federal FMP requirements.

- We conducted standardized electrofishing (80 samples) for the spawning stock survey, standardized pushnetting (a modified trawl pushed ahead of the boat just below the surface) for the juvenile survey (144 samples), and an access point creel (42 samples and 373 interviews) for the fishery monitoring.

- The 2021 index of the American Shad spawning run was the second lowest since sampling began in 2003. Three consecutive years of a low spawning stock index triggers a management review under the SFMP. The Juvenile Abundance Index (JAI) has increasing trend over the most recent 10-years while fishing effort has declined so no management action is recommended.

Recreational fishing effort 3,108 hours was the 3rd lowest since the current access point creel survey began in 2011 and CPUE (0.84 fish/hr.) was equal to the median for the time series

- The American Shad JAI for 2020 ranked 2nd out of the 14-year time series.

- The Blueback Herring spawning stock CPUE in 2021 was the 2nd lowest in the time series with 16 total individuals captured in 80 samples.

- The JAI of Blueback Herring in the 2020 pushnet survey was the second highest in that time series continuing a trend of above average indices for the last several years.

- Florida submitted an updated *American Shad Sustainable Fishing Plan for the St. Johns River System, Florida* to the Atlantic States Marine Fisheries Commission. The plan was updated to include the Econlockhatchee River, Wekiva River, Ocklawaha River, and Black Creek.

- Florida submitted the *ASMFC Alternative Management Plan for Shad and River Herring in Florida* to the Atlantic States Marine Fisheries Commission. This plan stipulates that for Blueback Herring statewide and for American Shad outside of the St. Johns River system that Florida will either implement a monitoring and management program or harvest moratorium if harvest is documented to be occurring. The plan was approved in 2021.

Fish Health and Genetic Monitoring

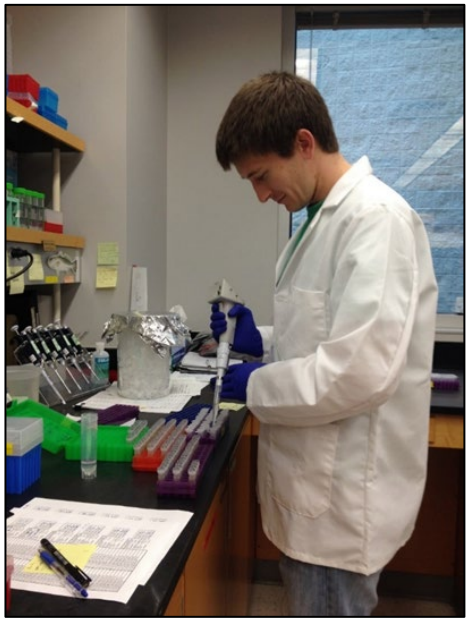
Population Genetics of Freshwater Fish for Management and Stock Enhancement - Wild Population Studies

Brandon Barthel, Mike Tringali, Nathan Van Bibber, and Bryan Winston

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

Dorsal spine clips collected from adult Florida Largemouth Bass can be successfully used as a source of DNA for microsatellite genotyping. This provides researchers and managers with a new option for collecting tissue samples in the field, especially if the spines have already been collected for age determination

- Larval fish specimens collected from the Dead Lakes section of the Chipola River were genetically determined to be Yellow Perch. This should provide managers with information on where and when Yellow Perch reproduce within the system.



- A potential state record Spotted Bass caught in the Choctawhatchee River was genetically determined to be an intergrade Largemouth Bass x Florida Bass.

- The FWRI Freshwater genetics program is working with Yale University to reexamine relationships of Northern Largemouth Bass and Florida Largemouth Bass by conducting genetic and morphological evaluations of samples collected from their natural ranges.

- This study will hopefully provide the needed genetic and morphological information necessary to define Florida Largemouth Bass as unique species rather than a subspecies.

Population Genetics of Freshwater Fish for Management and Stock Enhancement – Hatchery Related Projects

Brandon Barthel, Bryan Winston, Nathan Van Bibber, and Mike Tringali

- The FWRI freshwater genetics program completed a number of projects that involved identifying the ancestry of new hatchery brood fish and post-release assessments of hatchery reared Florida Bass.

- Genetic screening analyses were conducted on a set of fish to confirm they were Florida Bass before they were added to the brood stock and allowed to spawn at the Florida Bass Conservation Center at Richloam Hatchery.

- Genetic screening of the putative Shoal Bass collected from the Chipola River identified 54 fish that could be used in future spawning activities and five hybrids between Shoal Bass and Choctaw Bass. One of the hybrids had a genomic assignment that suggested it might be a first-generation backcross between a Shoal Bass and a Choctaw Bass x Shoal Bass hybrid.

A test of a buccal swab procedure for collecting DNA samples suggested that this could be a useful procedure if samples were allowed to dry sufficiently before storage

- The genetic screening procedure was used to determine that the Florida Fish Farms private hatchery had produced pure Florida Bass in 2020.

- Eighteen of the 379 fish collected from Lake Pierce in 2020 were hatchery fish.

- Three of the 148 fish collected from Lake Apopka in 2020 were determined to be hatchery fish.

- Two of the 24 fish collected from Newnans Lake in April 2017 were hatchery releases.

- Twelve of the 71 fish collected from Newnans Lake in March 2020 were hatchery releases.

- Ten of the 31 fish collected from Newnans Lake in November 2020 were hatchery releases.

- Four of the 56 fish collected from Newnans Lake in March 2021 were hatchery releases.

Statewide Mercury (Hg) Investigations – Field Operations

Ted Lange, Doug Richard, Andy Reich (FL DOH), and David Tyler (FL DEP)

- There are 446 locations with fish advisories in Florida fresh and marine waters. In freshwaters, mercury (Hg) is most common. Advisories are recommendations only, and don't restrict any individual from consuming fish.
- Staff collected 1,202 fish during FY20/21 with most analyzed for Hg.
- Top level predators have the highest levels of Hg and have been sampled most often. Species lower in Hg are also being tested to provide safe eating alternatives.
- Department of Health (DOH) provides 4 levels of consumption for the sensitive population (children and women of childbearing age) and the general population.

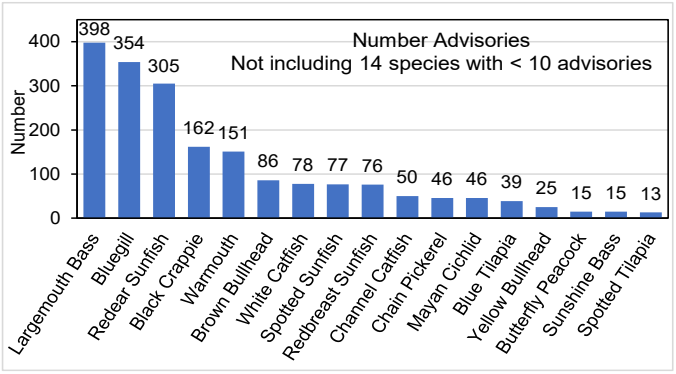
Non-native species, mostly found in the southern peninsula, are generally low in Hg

SPECIES	Meal Frequency	General Pop Advisories
Brown Hoplo	Two per week	2
Bullseye Snakehead	Two per week	8
Butterfly Peacock	One per week	3
	Two per week	12
Mayan Cichlid	One per month	2
	One per week	5
	Two per week	39
Oscar	One per week	4
Spotted Tilapia	Two per week	13
Blue/Nile Tilapia	One per week	2
	Two per week	38

General Population Number of Advisories	
Meal Frequency	LMB
DO NOT EAT	11
One per month	126
One per week	140
Two per week	121

Sensitive Population Number of Advisories	
Meal Frequency	LMB
DO NOT EAT	73
One per month	254
One per week	50
Two per week	21

- Bass have the highest percentage of more restrictive consumption advisories.
- Sensitive population advisories are most restrictive.
- Other freshwater fish have less restrictive advice.
- Sunfish and catfish from throughout the state are generally a good choice and low in Hg.
- Highest Hg in fish occurs in parts of the Everglades and panhandle blackwater rivers.



- WEB: DOH and FWC "What's Happening on My Lake" (WHOML) provide site specific advice by species.
- PRINTED: FWC's FW Fish Regulations provide generalized guidance for anglers to select fish to eat.

General Population Number of Advisories				
Meal Frequency	Redear Sunfish	Bluegill	Black Crappie	Catfish
DO NOT EAT	0	0	1	0
One per month	0	5	14	1
One per week	28	36	37	11
Two per week	277	313	110	152

Contaminant	Advisories
Arsenic	2
Dioxin	1
Mercury	435
Lead	1
PCBs	2
Pesticides	4
Saxitoxin	1

Implementing a Statewide Protocol for Monitoring Abnormalities in Freshwater Fish

Daniel Nelson, Jason O'Connor, Shalyn Zappulla, Taylor Dluzniewski, Marcus Zokan, Josh Wilsey, John Saxton, Jennifer Moran, and Ted Lange

- The health of freshwater fish has not been extensively evaluated by FWC fisheries managers.
- Disease and parasitic infestations are natural and expected and presence of abnormalities alone does not indicate an unhealthy ecosystem.
- Stakeholder concern for Florida's freshwater ecosystems, aided in the decision for FWC biologists to gain more knowledge of fish health.
- The Fish Health Coding (FHC) team utilized conclusions from the 2020 Joint Meeting with DFFM and FFR to formulate sampling protocols to identify, document, and monitor fish health conditions and trends in freshwater ecosystems.
- Initial results will be temporal and spatial data on abnormalities in freshwater fish to support a basic understanding on the prevalence of fish health conditions, directed research where appropriate, and outreach and education.
- The FHC team developed a standardized field-based data collection protocol for LTM sampling that is broad-based with low resolution to document the presence of abnormalities in freshwater fish. Standardization is sought through a training module.
- Coding follows the "FLOPS" model where F = Fin rot/erosion, L = Lesion (including inflammation, ulcers, tumors, and sores), O = Other (angler/predator wounds, spawning stress), P = parasitic infections, and S = Skeletal malformations.

Largemouth Bass were field coded with 8.5% and 4.7% of all bass having FLOPS abnormalities in spring 2020 and spring 2021 LTM samples, respectively

- All codes are assigned during field observation and only include fish that exceed minimum size and coverage criteria for various conditions for each of the "FLOPS".
- Code P was most prevalent in 2020 (4.3% of all bass) but declined in 2021 (0.5%) due to refinement of criteria for coding parasitic infections.
- Code L was also common, 3.4% in 2020 and 2.3% in 2021, due to the wide range of conditions that are categorized in the field as a lesion.
- During the fall 2021 LTM community sampling, coding will include fish of all species that are field measured.
- The training and calibration module includes examples of abnormalities and whether to code them or not.

Fisheries and Habitat Monitoring

Long-Term Monitoring of Lakes – Statewide Summary

Kim Bonvechio

- Standardized fish community electrofishing samples were collected from 29 waterbodies in late summer and fall (September 2020 to January 2021).
- Inverse Simpson diversity index varied from 1.75 to 7.32 and averaged 4.08 for all systems combined.
- A total of 71 identified species of freshwater and marine taxa were collected during community sampling.

- Bluegill 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 2021 on 29 waterbodies.
- Largemouth Bass electrofishing catch rates were variable and averaged (± 1 SE) between 0.15 ± 0.02 fish/min at Newnans Lake to 1.97 ± 0.10 fish/min at Tarpon Lake.
- Largemouth Bass age and growth information was collected on lakes Okeechobee, Orange, and Rodman.
- Black Crappie were collected with a standard otter trawl at seven lakes from September to December 2020. Mean catch rate (± 1 SE) ranged from 1.03 ± 0.24 fish/min at Lake Harris to 8.36 ± 1.49 fish/min at Lake Trafford.

Bluegill, Largemouth Bass, and Redear Sunfish were the most ubiquitous species; being collected in every lake sampled

- A subsample of Black Crappie was collected for age and growth (N=817). Overall age ranged from 0 to 11 yrs.
- Roving creel surveys were conducted on 18 waterbodies during 2020-21. 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 (2.93 ± 0.95 and 2.76 ± 0.54, respectively), followed by sunfishes *Lepomis* spp. (0.58 ± 0.17) and Ictalurid catfishes (0.14 ± 0.07).
- Mean catch and catch rate ± 1 SE for Largemouth Bass were estimated as 1.57 ± 0.39 fish/ha/100 d and 0.57 ± 0.06 fish/h, but harvest and harvest rate for Largemouth Bass were approximately 1/10th of those values.

Long-Term Monitoring of Rivers – Statewide Summary

Eric Nagid

- Fish community samples were collected by standard electrofishing protocols from eight rivers between the fall of 2020 and spring of 2021 to assess and track trends in lotic fish communities.

- No samples were collected on the Chipola and Apalachicola rivers due to flood conditions.

A total of 112 species of freshwater and marine fish taxa were collected and of these species, 21 were sportfish and 8 were non-native

- Diversity as represented by the modified Simpson's diversity index [1/sum(pi2), where p is the proportion of species i in the catch], ranged from 1.7 in the upper St. Johns River to 14.6 in the Escambia River.

- Species richness ranged from 31 in the Middle St. Johns River to 62 in the Escambia River.

- 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.

Streams included in FWC's freshwater fisheries monitoring program during 2019-20. An "X" denotes rivers where age data or creel surveys were collected for the corresponding sportfish species of monitoring interest: LMB=Largemouth Bass.

Streams	County*	Florida Length (km)	Sampled Length (km)	Species Richness	Species Diversity	Sportfish	Age Sample	Creel Survey
Big Escambia	Escambia	9	3.0	42	7.8			
Escambia	Escambia	87	2.8	62	14.6	LMB	X	X
Ocklawaha	Putnam	121	3.9	41	7.2			
Santa Fe	Gilchrist	113	3.2	38	5.0			
St. Johns (Upper)	Brevard	512	4.0	35	1.7			
St. Johns (Middle)	Duval	512	3.2	31	5.1			
Suwannee	Dixie	333	4.1	46	4.6			
Yellow	Santa Rosa	98	3.3	48	7.4			

* Indicates the county where the mouth of the river is located, not necessarily the county where samples were collected.

Long-Term Aquatic Habitat Monitoring of Florida Lakes

Kevin Johnson

- Submersed vegetation and point-intercept mapping began at the end of last fiscal year (mid-May 2020) and continued into this fiscal year (early-December 2020) on freshwater fisheries long-term monitoring (LTM) program core lakes.

- Mapping efforts primarily focused on LTM program lakes that contained established submersed vegetation communities, with the objective of mapping primarily during the summer to early fall months to provide a snapshot of percent area covered (PAC) estimates, percent volume infested (PVI) estimates, and point-intercept vegetation speciation data collected during the vegetation growing season. During this time frame we mapped submersed vegetation in 16 of the 29 core LTM lakes.

- We teamed with IPM, AHRES and DFFM to map submersed vegetation in an additional 20 lakes that were considered important for management and research needs.

- BioBase (https://www.biobasemaps.com) generated vegetation maps for the 16 LTM core lakes, along with the corresponding point-intercept species data, were transformed into ArcGIS maps and then put into PDF format that could be easily be found here.

- The PDF maps provide FWC researchers and managers with lake maps and estimates of submersed vegetation PAC and PVI, point-intercept data, and species richness and frequency of occurrence estimates collected from the point-intercept data.

- We contracted with BioBase and Eomap (https://www.eomap.com) companies again this year to use semi-automated algorithm methods in GIS software to map emergent vegetation using high resolution (2-meter pixel size) multispectral satellite imagery.

Overall accuracy of emergent vegetation imagery for Lake Okeechobee north-west marsh, Lake Istokpoga, and East Lake Tohopekaliga were 67, 73, and 76%, respectively, all at the100 m^2 MMU

- Emergent vegetation maps using 2-meter resolution imagery was collected in from Lake Okeechobee north-west marsh (May 2020), Lake Istokpoga and East Lake Toho (September 2020). Minimum mapping unit (MMU) of 100, 500, and 1,000 m^2, were used with the goal of achieving an 80% or greater overall vegetation classification accuracy for each lake for at least one MMU.

- Low numbers of points were used for some of the vegetation classes to assess the accuracy, therefore the results of the accuracy assessments should be used with caution and may not be very robust.

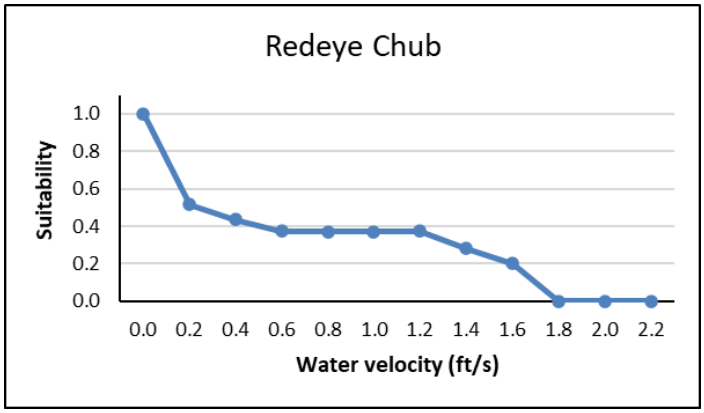
- Mapping emergent vegetation is planned to occur again in 2021 for the Lake Okeechobee north-west marsh.

Habitat Suitability Curve Analysis

Eric Nagid and Kym Rouse Holzwart

- The purpose of this study is to evaluate the comprehensive list of habitat suitability indices (HSIs) presently being used by the FL water management districts (WMDs) to determine if they are representative of the functional and structural characteristics of streams within Florida, and reflective of the habitat affinities of Florida fish populations.

- Refinements to HSIs will be made through best professional judgement or empirical data collection.



The HSI library currently consists of 57 sets of indices representing 24 species and life stages of fish, which have been used for MFL evaluations at 17 river drainages to date

- HSIs are being developed using empirical data for Redeye Chub and Pirate Perch from the Rainbow River and Withlacoochee River (south), respectively.

- HSIs will also be developed for 3-5 species (TBD) using the Delphi technique, which involves HSI development through blind surveys of subject matter experts.

- The final product will be a living document of HSIs approved by FWC that the WMDs will use to protect the habitat and life history requirements of lotic fish species throughout Florida.

Lower Withlacoochee River Fish Community Assessment

Eric Nagid and Kym Rouse Holzwart

- The Southwest Florida Water Management District is committed to establishing Minimum Flows and Levels (MFLs) using the best available information, which includes fishery resource assessments that evaluate the status of existing fish species, their composition, and abundances.

- The Lower Withlacoochee River was surveyed in the summer 2020 and in the winter 2021 using the FWC standardized river sampling protocol to obtain a contemporary list of the fish species inhabiting the Lower Withlacoochee River and to characterize the fish community composition.

Four species (Spotted Sunfish, Striped Mullet, Bluegill, and Largemouth Bass) were collected from the majority of transects and comprised approximately 50% of the species composition in both sampling events

- Redbreast Sunfish and Coastal Shiner were also numerically abundant in the winter sample and made up an additional 17% of the species composition.

- There were no obvious seasonal shifts in composition due to marine species, but the species compositions differed significantly between the summer and winter samples, primarily because the catch rates of eight freshwater species (excluding striped mullet) were greater from the winter 2021 sampling event than the summer 2020 sampling event.

- The most notable observation from this assessment was the collection of Spotted Bullhead. The Suwannee River drainage was thought to be the southernmost drainage where Spotted Bullhead occurred prior to our collection event. Spotted Bullhead is a Species of Greatest Conservation Need in Florida and their occurrence in the Lower Withlacoochee River represents an important range extension to their distribution.

Evaluation of Water Quality Response to a Large-Scale Habitat Enhancements in Newly Inundated Fellsmere Reservoir

Ted Lange, Brad Fontaine, Doug Richard, Arthur Bernhardt, Paul Schueller, and Reid Hyle

- Prior to flooding 10,000 acres of agricultural land, DFFM and SJRWMD created 1,300 acres of habitat enhancements called contours which consisted of deep holes, sunken islands, underwater shelves, and shallow ridges.

- Dissolved oxygen (DO) and water temperature were monitored hourly for up to 48 consecutive days during 15 seasonal deployments between August 2016 and July 2020.
- Visually estimated aquatic plant percent area coverage (PAC) and species composition were recorded at the start and end of each deployment at sites in un-contoured and contoured vegetated and unvegetated (open water) habitats and an existing borrow pit.
- PAC at open water and vegetated sites ranged from 0-45% and 61-76%, respectively.
- DO concentrations measured in surface water (0.5 to 1 m) ranged from 0 to 32 mg/l and all habitats experienced hypoxic conditions (< 2mg/l).
- For all dates, un-contoured open water had the highest median DO (6.55 mg/l) and the fewest hypoxic readings (7%) while at un-contoured vegetated, contoured open and contoured vegetated sites hypoxic readings occurred 48, 43, 41% of the time with lower mean DO.
- A Kruskal-Wallis test followed by a Dunn's Test showed significant differences in DO among all habitat combinations (K-W chi-squared = 7386.406, df = 4, p-value = 0).

Open water habitats had higher daily minimum DO than vegetated habitats

- Linear regression was used to determine factors that influenced minimum daily DO concentrations among contoured and un-contoured vegetated and unvegetated sites.
- Contoured open water and vegetated sites saw the most improvement in minimum daily DO over the study period.
- Plant management activities across the study period influenced DO concentrations.
    - Early in the study period plant management focused on emergent Cattail and floating tussocks.
    - During early 2020 plant management activities focused on emergent Cattail and Para Grass (*Urochloa mutica*) in the enhancement area.
    - Active plant management in the enhanced (contoured) areas resulted in the highest modelled DO concentrations in both contoured open and vegetated sites.
    - Predicted minimum DO concentrations in the unenhanced vegetated site where plant management was limited did not experience increases in minimum DO concentrations during the study period.

Upper St. Johns River Fishery Resource Assessment

Arthur Bernhardt, Brad Fontaine, and Reid Hyle

- Electrofishing surveys of fish communities were conducted on the Upper St. Johns River, River Lakes, and Blue Cypress Lake as part of the long-term monitoring program in Fall/Winter 2020.

- Largemouth Bass populations were also sampled on Lake Washington, Lake Poinsett, and Blue Cypress Lake.

More fish (12,950) were collected during SJR river surveys this year compared to the previous 10 years, although most (70%) were from a single species, Eastern Mosquitofish

- Eastern Mosquito fish are typically the numerically dominant species collected in the river, though this year was the highest number collected.

- Prolonged periods of elevated water levels on the flood plain prior to sampling may result in increased abundance of forage for Largemouth Bass. The observed forage availability may be an influential factor associated with the higher Largemouth Bass relative weights observed this year, particularly in Lake Poinsett.

- Community summary statistics and diversity indices are consistent with long-term average values.

- Fish communities appear stable. Most shifts in abundance among common species were likely attributable to interannual differences in water level during sampling.

- The Largemouth Bass catch rates and population assessment metrics were consistent with long-term trends.

Fishery Resource Assessment of Water Management Impoundments of the Upper St. Johns River Basin

Brad Fontaine, Arthur Bernhardt, and Reid Hyle

- The impoundments (Farm 13/Stick Marsh, Lake Garcia, Kenansville Lake, Fellsmere Water Management Area) of the Upper St. Johns River Project are unique water bodies and widely considered among the best fisheries in the area.
- We collected 1,643 Largemouth Bass in 86 transects using boat-mounted electrofishing and conducted 3,244 individual angler surveys. Significant findings are highlighted below:
- Electrofishing CPUE for Largemouth Bass in 2022 is above the long-term average for Farm 13/ Stick Marsh and Kenansville Lake, and Lake Garcia. Fellsmere CPUE for LMB 1.53 fish/min, similar to other impoundments.
- Juvenile (< 21cm) Bass were abundant in all lakes, indicating successful recruitment into the fishery.
- Lake Garcia was very clear with abundant SAV. This is a continuation of last year's vegetation coverage and clarity which occurred for the first time in recent history. Kenansville Lake SAV (mostly Hydrilla) has recovered from Hurricane Irma and covers most of the lake. Farm 13/ Stick Marsh remains turbid and SAV growth stagnant. Farm 13/ Stick Marsh could benefit greatly from wind breaks. Re-visiting bulrush planting on the internal berms is recommended. Fellsmere WMA is a heavily vegetated marsh and will require maintenance vegetation control. SJRWMD has plans to keep floating vegetation under control.
- Relative weights were high for most impoundments at 92, 84, 89, and 90 for Farm 13/Stick Marsh, Kenansville Lake, Lake Garcia, and Fellsmere, respectively. Kenansville Lake went from 90 in 2020 to 84 in 2021. The rest of the impoundments were similar to 2020.

Fellsmere Water Management Area was open to the public in August 2020. Creel survey data shows excellent catch rates. Prior FWC management actions on FWMA have led to an incredible fishery.

- Largemouth Bass Angling Success remains high on Lake Garcia and Farm 13/Stick Marsh (1.74 fish/hr. and 1.48 fish/hr., respectively).
- Despite Fellsmere Reservoir boat ramp opening, Largemouth Bass effort remained nearly the same at Farm 13/Stick Marsh (20,928 angler hours in 2021).
- Since the opening of the Fellsmere boat ramp, there have been 170,357 hours of angling effort and a Bass catch rate of 1.32 fish/angler-hr. 96.2% of the effort was directed towards Largemouth Bass.
- Habitat management projects have been discussed in the past (Bulrush Planting) to help increase available habitat and promote growth of SAV in Farm 13/Stick Marsh. These ideas should be re-visited by our AHRE section now that Fellsmere is operating as part of the Upper Basin Project.

Lower St. Johns River Long-term Lake Monitoring

Earl Lundy, Andrew Marbury, and Jay Holder

- We conducted both community and single-species (Largemouth Bass) electrofishing surveys in all three LTM study lakes in FY 2020-2021. Largemouth Bass surveys were also conducted on Lake Dexter and Lake Woodruff. Community data were collected from October – December 2020, and Largemouth Bass data from February – March 2021. Creels were performed on Lake George and Crescent Lake to determine angler preference, utilization, and harvest.

- Community abundance indices and species composition for our LTM lakes were within historical ranges. Crescent Lake data indicated a large drop in fish numbers and biomass. Lake George metrics were on the high end of historical catch rates. Lake Monroe community metrics were the lowest recorded in terms of numbers and biomass, and biomass catch showed a significant decrease using Kendall's Tau analysis. Lake Monroe catches were numerically dominated by Eastern Mosquitofish, with other small-bodied fishes (Silversides and Sailfin Mollies) also much more prevalent than in the past.

Largemouth Bass populations in lakes Crescent, Monroe, and George were among the lowest recorded since monitoring began, likely due to continuing post-Irma hurricane-induced vegetation loss

- Largemouth Bass catch rates for Lake Monroe have shown a strong, significant decrease according to Kendall's Tau. Indices for lakes Dexter and Woodruff showed considerable improvement since we sampled three years ago but are still below average.

- The Lake George creel survey indicated total effort was greatly reduced over the previous year. The creel survey further indicated that anglers still primarily target Largemouth Bass on Lake George (86% of non-tournament effort). The BassMaster Elite tournament in Palatka, FL had a 53% drop in effort on Lake George compared to effort expended the previous year. Crescent Lake creel data indicated Black Crappie as the dominant sportfish.

- 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, and seems to be driving low catch rates on all lakes.

- Tournament effort on Lake George for 2021 was only 707 hours, which represents a 43% decrease from 2020's creel and is a 27% decrease from 2019 creel data. This decrease is largely due to the lack of habitat on Lake George, which severely limits available areas for angelrs to use.

Lower St. Johns River Long-term Monitoring

Earl Lundy, Jay Holder, and Andrew Marbury

- The St. Johns River Water Management District (SJRWMD) has concluded that up to 155 million gallons of water per day could be withdrawn from the St. Johns River at the Yankee Lake facility for future water demands. While this action, according to the SJRWMD, is believed to not cause any significant ecological harm to the system (Robison 2004), baseline data on the fish communities throughout this reach of river is currently lacking.

- To determine the effect of future water withdrawals and associated water treatment practices at this site, our objective was to initiate a long-term monitoring project to collect baseline data (2013-pres) on the status and trends of fish communities below the proposed withdrawal site (between lakes Monroe and Beresford).

- We conducted community electrofishing surveys from December 2020 – January 2021.
- Catch rates were typical for most segments.
- Species richness and Simpson's Diversity Index (Simpson's D) were well-within historical ranges for this stretch of river.

Chanchita (Dimerus Cichlid) a non-native aquarium species has been documented more frequently in the Lower SJR

- After 8 years of data collection, a strong positive correlation was noted between Secchi depth and two indices—total biomass and average biomass (g/Km).

Long-Term Monitoring of the Ocklawaha Chain of Lakes

Andrew Marbury, Stephen Jones, Cheree Steward, Scott Bisping, and Brandon Thompson

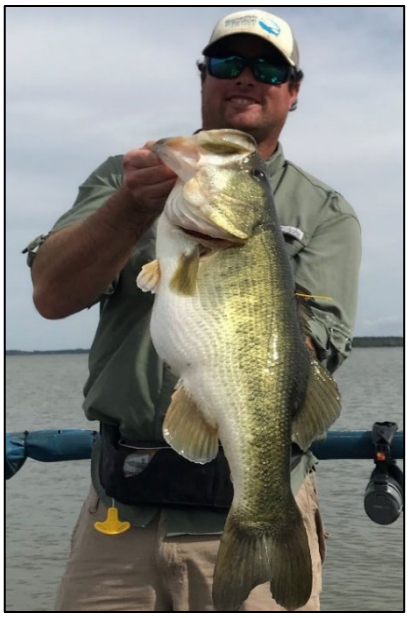
- Extensive monitoring occurs at the Harris Chain of Lakes (HCOL) as it is one of the premier freshwater fisheries in Florida and numerous research studies and evaluations utilize this data.

Angling effort at Apopka doubled this year (from camera effort data); likely from the fishing challenge that incentivized angling

- 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 5 years (353 tournament days this year).

- Vegetation surveys revealed that SAV increased at all lakes besides Eustis (remained 5%) and Lake Griffin (remained 36-38%). The SAV at lakes Dora, Beauclair, and Griffin are primarily natives whereas Hydrilla is the primary SAV at Apopka and Harris.



- As the population of bass has increased with expanding vegetation, there has been a noticeable decrease in bass relative weights at all lakes.

- After having very little Hydrilla at Lake Harris in 2019, it quickly expanded during the summer of 2020 to 1,500 acres; but was then treated in the winter of 2020/21. The catch rates of age-1 bass have been lower with the lack of rearing habitat and the angler catch rates were lower this year (0.42) at Lake Harris.

- At Lake Griffin, several submersed plants, such as Eelgrass, Hydrilla, and Southern Naiad are contributing to a thriving bass fishery which has resulted in high targeted effort and catch rates that are consistently between 0.8–0.9 bass per hour. The crappie fishery continues to have a lower level of effort, but the harvest rate is relatively high (1.14 fish/hr.) with a 10” minimum size limit.

- 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 likely resulted in three consecutive years of high age-1 catch rates. After two recent years of creel surveys, lakes Dora/Beauclair have shown a similar pattern to Griffin where bass fishing effort has replaced crappie as the primary targeted species.

- During spring Largemouth Bass electrofishing, we continue to sample fewer trophy-sized bass (likely due to larger fish using deeper areas where they are less vulnerable) but the TrophyCatch submissions at the HCOL were the highest in season 8 (N = 80).

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

Assessing Temporal and Spatial Trends in Fish Assemblages within Spring Runs of the St. Johns River Basin

Jay Holder, Phillip Parsley, Earl Lundy, Andrew Marbury, Nick Trippel and Ted Lange

- The primary goal for this study was to establish electrofishing sampling protocols and collect baseline data for long-term monitoring of fish populations within eight spring runs in the St. Johns Basin.

- The spring runs included Alexander, DeLeon, Gemini, Juniper, Rock, Salt, Silver Glen, and Wekiva springs.

Two sampling events occurred in each spring run (one in winter and one in late spring/early summer) to see if fish populations differed seasonally, particularly with regards to non-native fishes

- We built partnerships with the various governmental entities that oversee these springs, determined permitting needs, and established the most efficient access points to deploy sampling strategies.

- Methodologies were standardized to the extent possible with existing procedures for assessing trends in freshwater fisheries. Species catch curves were developed to determine sample sizes.

- We did not detect seasonal differences but did conclude that water levels, manatee usage, and recreational activities best determined sample season selection.

- Of particular interest, we found a few Bluenose Shiners, a state imperiled species, in Rock Springs Run and one at the Wekiva River/Rock Springs confluence in our electrofisher samples.

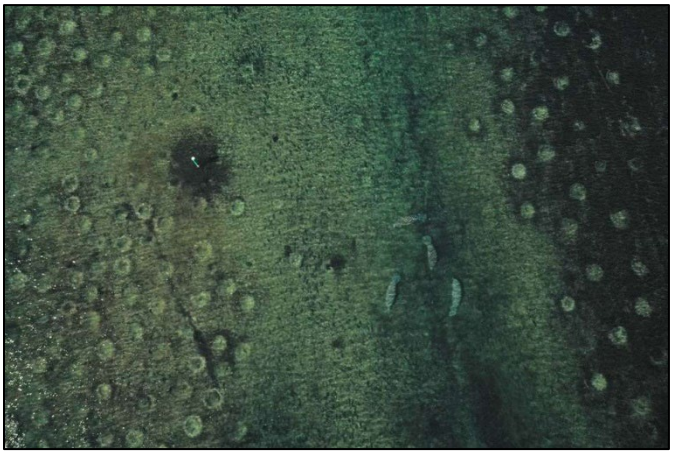
- We deployed mini-fyke nets at Wekiva, Rock and Alexander Springs runs to see if this gear was more effective for Bluenose Shiners. Our results showed increased catches in both Rock and Alexander Spring runs but not in the Wekiva River. Further research into habitat preferences for this species is warranted.

- We had planned on testing different techniques for collecting and removing non-native fishes such as Blue Tilapia and Sailfin Catfish (Plecos) during the winter season in this study. Unfortunately, increased usage of the targeted spring runs (Silver Glen and Salt Springs) by the Florida Manatee delayed our testing. By the time the manatees had departed, the COVID-19 pandemic had begun, and we were in lockdown and restricted from sampling. We did manage to locate side channels after lockdown and found we could remove tilapia that were confined to side channels in a small number of locations.

Seasonal Movements and Residence Time of Sailfin Catfish and Blue Tilapia in Silver Glen Springs and Salt Springs, FL

Nick Trippel, Andrew Marbury, Jay Holder, Earl Lundy, Trevor Knight, Clay Coates, and John Galvez

- In February, acoustic and reward 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 hand-grabbing Sailfin Catfish during snorkeling.
- All tagged fish appeared uninjured and were able to successfully swim away.



Bow-fisherman harvested three Blue Tilapia and nine Sailfin Catfish

- Sailfin Catfish have a low rate of acoustic tag retention.
- Shed acoustic tags were recovered by snorkeling and multiple tags were turned in by bow-fisherman.
- Recovered acoustic tags were reused on Blue Tilapia as Sailfin Catfish could not be tagged effectively.

- Because tags were deployed in spring of 2021, movement data is still being collected and will be analyzed once the study is completed.
- Acoustic tag battery life is estimated at approximately 476 days and we anticipated a study end date of summer 2022.
- Data will help determine if future removal projects may be feasible and best timing for these projects.

Bullseye Snakehead Movements and Habitat Preference Compared to Largemouth Bass and Peacock Bass in Lake Ida

Brad Fontaine, Max Inchausti, Courtney Stachowiak, Kristen Rogers, Dan Nelson, and Nick Trippel

- 75 fish were successfully radio tagged and released in March 2021 (25 Largemouth Bass, 25 Peacock Bass, 25 Bullseye Snakehead).

•Three passive tracking stations were set up with solar batter chargers. These stations were installed at the three outlet canals in Lake Ida to track movement in and out of the system.

•Active tracking occurred every 2 weeks, while the three passive stations were downloaded every 2 weeks as well.

•There is a $100 reward tag in each fish to help encourage tag returns.

11 Largemouth Bass, 10 Peacock Bass, and 2 Bullseye Snakeheads have been caught and reported

- After the first full month with no mortality, 8 fish have died (3 Largemouth Bass and 5 Peacock Bass).

- Attempts to recover radio tags from dead fish were made, 3 Peacock Bass have been re-tagged with radio transmitters. Water temperature was too high to re-tag anything other than Peacock Bass.

- During active tracking trips, an average of 26.2 fish are heard on the radio receiver. An average of 14.9 fish are recorded with pinpoint locations.

- The high mortality of Peacock Bass has led to discussion on determining what the natural mortality and fishing mortality is on the species. An age sample and exploitation study could be done to help answer these questions.

Assessing the Effects of the East Lake Tohopekaliga Habitat Restoration on the Shallow Water Fish Community

Chris Anderson, Ted Lange, Doug Richard, Brad Fontaine, Arthur Bernhardt, Jason O'Connor, Travis Tuten, Jen Moran, 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, and 2019 (i.e., pre-treatment).

- Qualitative habitat assesments of aquatic vegetation and sediment cores were also completed at each site.

- A total of 7,830 fish, comprising 28 species were captured using MFNs in 2019 (*n* = 89 of 90 MFNs).

- Total fish decreased, but species richness increased relative to 2018 (9,972 fish, 27 species).

- We detected a similar number of significant differences for pairwise comparisons of environmental parameters between treatment areas in 2019 as we did in 2018; however, the parameters that were significantly different between treatment areas changed between years.

Although significant differences in fish community composition were detected between years and treatment areas, most test statisitics were close to 0, indicating that these differences are not ecologically significant

- Inter-year comparisons (i.e., 2016 vs 2018 vs 2019) yielded significant differences in water quality (e.g., temperature and pH) and habitat parameters (e.g., total habitat areal coverage and floating plant areal coverage) amongst pre-treatment sampling years.

- These environmental changes may have resulted from impacts of Hurricane Irma in 2017 and/or natural variation in littoral environmental conditions over time.

Comparison of Natural Brush and Plastic Fish Attractors in Lake Griffin, FL

Brandon Thompson, Andrew Marbury, Stephen Jones, Dan Nelson, and Scott Bisping

- Fish attractors are a valuable tool used to concentrate fish and increase angler catch rates.

- Managers are interested in the effectiveness and longevity of plastic and brush materials to inform future fish attractor construction in Florida.

- Eighteen fish attractors were deployed in Lake Griffin from December 2013 to February 2014 to study bass abundance and angler catch rates for bass on fish attractors constructed of 100 plastic trees, 100 brush trees, and 50 brush trees in each of six blocks around the lake.

- Effectiveness of each treatment was evaluated by relative abundance of Largemouth Bass using monthly electrofishing surveys and angler catch rate by weekly hook-and-line surveys.

- Results of this study indicate that brush attractors with 100 units of brush concentrate more bass and anglers likely catch more bass on them compared to brush attractors with 50 units.

If managers' goal is to maximize the productivity of attractors in the short term (i.e., five years), then brush could be more effective and cost efficient

- Plastic attractors often held similar numbers of bass to brush attractors with 100 units but were more variable with lower catch rates in year two of the study.

- Trend analysis shows decreasing electrofishing catch rates on both brush attractor types over the course of the study, while plastic attractors have remained relatively consistent.

- Hook-and-line surveys catch rates were higher for plastic attractors compared to brush in year one but in year three, anglers had higher catch rates on brush 100 attractors compared to plastic (marginally significant) and brush 50 treatments (significant).

- Visual inspection of fish attractor height from down imaging suggests that brush attractors are breaking down after five years and data shows declining catch rates since then.

- If a manager's priority is longevity because of limited ability to refurbish a site, then plastic provides an additional option with comparable long-term cost.

- This is likely the last year of data collection, as declines in brush attractor catches indicate a need for refurbishment.

Alternative Management Strategy: Gravel Bed Research

Matthew G. Wegener and Amanda E. Mattair

- 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.

Catch was significantly higher on onshore gravel sites than offshore sites

- Managers are looking for alternative management strategies on the CMI's.
- Addition of firm substrate is a strategy for improving productivity without fertilizing.
- Firm substrate increases habitat for spawning and macroinvertebrates.
- More research on firm substrate in the form of gravel beds needs to be done.
- No research has been done on where to place gravel beds in a lake.
- Catch was significantly higher on gravel sites than reference sites.
- Redear Sunfish are the only species to be caught in greater frequency on offshore gravel sites relative to onshore gravel sites.
- Spawning beds of 3 sport fish species observed on gravel sites.