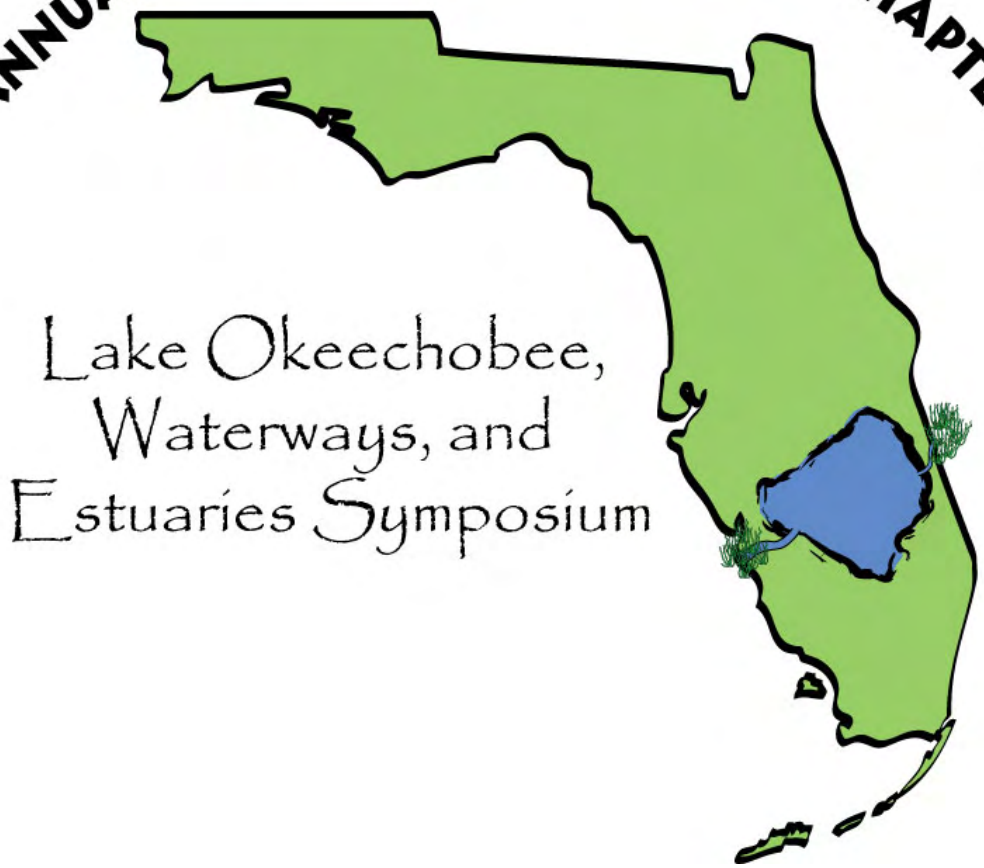
27TH ANNUAL MEETING OF THE FLORIDA CHAPTER AFS



Lake Okeechobee, Waterways, and Estuaries Symposium

February 20-22, 2007
4-H Camp Ocala, Altoona, Florida

The Florida Chapter of the American Fisheries Society

Chapter Officers

President: Chuck Cichra, UF

President-Elect: Eric Nagid, FWC

Past-President: Richard McBride, NOAA

Secretary-Treasurer: Linda Lombardi-Carlson, NOAA

Major Contributors for our Annual Meeting:

Webmaster: Bob Wattendorf, FWC

Newsletter Editor: Jaclyn Debicella

Raffle Co-Chairs: Bridget Tiffany, Gulf Islands National Seashore and Allan Collins, NOAA, retired

Student Travel Awards & Roger Rottmann Memorial Scholarships: Chuck Cichra, UF

Continuing Education: Richard McBride, NOAA

Membership Database Manager: Larry Conner, FWC

Program Cover and Shirt Design: Nate Weis, UF

Thanks to everyone for their symposium and contributed presentations!

Thanks to all the moderators and judges!

The 27th Annual Meeting of the Florida Chapter American Fisheries Society
February 20-22, 2007
4-H Camp Ocala, Altoona, Florida

General Program

Tuesday, February 20

12:00pm – 1:00pm / Lunch
11:00am – 6:00pm / Registration

1:00pm – 5:00pm / Contributed Papers

5:00pm – 7:00pm / Poster Setup

6:00pm – 7:00pm / Dinner

7:00pm – 8:00pm / Formal Poster Session
Followed by the *bonfire social*

Wednesday, February 21

7:00am – 8:00am / Breakfast
7:30am – 6:00pm / Registration

8:00am – 12:00pm / **Symposium:** ***Lake Okeechobee, waterways, and estuaries***

12:00pm – 1:00pm / Lunch

1:20pm – 4:30pm / Contributed Papers

5:00pm – 6:00pm / Student Subunit Meeting (All students)
Time to relax (All others)

6:00pm – 7:00pm / Dinner

7:00pm – 8:00pm / Chapter Business Meeting
Awards presentation: Student Awards – Travel and Roger Rottmann Scholarship
Followed by THE **RAFFLE, AUCTION,** and the *bonfire social*

Thursday, February 22

7:00am – 8:00am / Breakfast
7:30am – 9:00am / Registration

8:30am – 9:30am / Contributed Papers

10:00pm – Continuing Education series. *Patterns and Processes of Fish Reproduction: a primer*
Presented by Dr. Richard McBride

12:00pm – 1:00pm / Lunch

1:00pm – 1:10pm / **Awards presentation**:
Best Papers / Best Posters - Student and Non-student
Power Tie and Lampshade Awards

Day-By-Day Agenda - 27th Annual Meeting - Florida Chapter American Fisheries Society

Tuesday, February 20

11:00am — 6:00pm **/ Registration**
12:00pm — 1:00pm **/ Lunch**
1:00pm — 1:20pm **/ Welcome – Chuck Cichra, Chapter President**

Contributed Papers **Moderator:** Chuck Cichra, UF

1:20pm **—** ***** Tuten, M. T., M. S. Allen, and C. E. Cichra. Diet compositions and growth rates of black crappie *Pomoxis nigromaculatus* relative to benthic food availability at three Florida lakes.

1:40pm **—** ***** Tetzlaff, J. and B. M. Roth. Predation by *Lepomis* spp. on populations of invasive crayfish *Orconectes rusticus* in four northern Wisconsin lakes.

2:00pm **—** ***** Dance, M., W. F. Patterson, III, and D. Addis. Community development at unreported artificial reef sites off Northwest Florida.

2:20pm **—** ***** Addis, D., W. F. Patterson, III, and M. Dance. Site fidelity and movement of reef fishes tagged at unreported artificial reef sites off NW Florida.

2:40pm **—** Sauls, B. and B. Kalmeyer. A Pilot Survey of the Recreational Headboat Fishery in Florida.

3:00pm **—** Allen, M. S., M. W. Rogers, R. A. Myers, and M. W. Bivin. Simulated Impacts of Tournament-Associated Mortality on Largemouth Bass Fisheries.

3:20pm — BREAK **Moderator:** Bob Heagey, FWC

3:40pm **—** Bradshaw, C. D. and B. Mahmoudi. Estimating Natural Mortality of Juvenile Striped Mullet Using Fisheries Independent Catch Data.

4:00pm **—** Goetz, L. A. and R. J. Allman. Patterns in the age, growth and mortality of gray snapper, *Lutjanus griseus,* along the west Florida shelf.

4:20pm **—** *Marcinkiewicz, L. L. and W. E. Pine, III. Examining movement patterns and seasonal habitat use of adult common snook.

4:40pm **—** *Purtlebaugh, C. and M. S. Allen. Year-class strength, growth, and survival of five fish species in the Suwannee River estuary in relation to river discharge.

5:00pm — 6:00pm **/ Poster Setup**
6:00pm — 7:00pm **/ Dinner**
7:00pm — 8:00pm **/ Formal Poster Session** (Beverages and snacks will be in the poster area;
Presenters will be available to answer questions from 7-8 pm)
Followed by the ***bonfire social***

* An asterisk indicates a student presentation _____ Indicates person presenting

Poster Session (7:00pm – 8:00pm)

Beal, J. L., S. S. Hitt, L. W. Herren, G. Kaufmann, and R. Hauck. Biological response to hydrologic restoration of oligohaline floodplain communities and oxbows along North Fork St. Lucie River, St. Lucie County, FL.

*Clarke, C., J. Cobb, and W. Arnold. Grain Size Distribution VS Density and Size of Donax spp. on Pinellas County Beaches.

Denison, S. H., S. Seyoum, S. Swoch and M. D. Tringali. Investigation of genetic stock structure in pompano (*Trachinotus carolinus*) from the Gulf of Mexico, Southeastern United States and Puerto Rico

Flaherty, K. E. Effects of a red tide event on the relative abundance of juvenile and adult sport fish in Tampa Bay.

*Guajardo, M. and J. Gelsleichter. Thiamine concentrations in egg yolk of bonnethead sharks (Sphyrna tiburo) and their associations with infertility.

Hollensead, L. and D. M. Bethea. Distribution and abundance of early life stages of shark species in the panhandle of Florida, 2003-2006.

*Karouna-Renier, N. K., T. Lange, S. M. Gibson, R. A. Snyder, and K. Ranga Rao. Contamination Profiles in Largemouth Bass and Mullet Collected in Northwest Florida.

*McBride, R. S., J. M. Funk, and A. B. Collins. Classification schemes for monandric, protogynous fishes: a review and extension of Moe's (1969) model.

Miller, S. J., S. Connors, and L. Keenan. Historical Hydrology of the Upper St. Johns River in East-Central Florida.

Ockelmann-LoBello, L. and R. G. Taylor. A pilot tagging study to determine movement, stock affinity, and possible recruitment sources of common snook (Centropomus undecimalis) in Florida Bay and the Florida Keys.

Reyier, E., R. Lowers, D. Scheidt, and D. Adams. Daily and Seasonal Movements of Adult Red Drum (*Sciaenops ocellatus*) in a shallow Florida lagoon as Determined by Passive Acoustic Telemetry.

*Ribakoff, T. and M. C. Benfield. Scientific Applications of Industrial ROVs in the Deep Waters of the Gulf of Mexico.

*Richards, T., J. Krebs, W. Szelistowski, and C. McIvor. A new method for collecting mangrove rivulus (Kryptolebias marmoratus) and assessing microhabitat associations.

Switzer, T. S., R. F. Heagey, and J. Burd. Fish movement and estuarine MPAs: does size matter?

Vecchio, J. L. and T. S. Switzer. A preliminary examination of abundance and distribution of sub-adult and adult fishes in Tampa Bay.

* An asterisk indicates a student presentation _____ Indicates person presenting

Wednesday, February 21

All day **/ Registration**
7:00am – 8:00am **/ Breakfast**
8:00am – 8:10am **/ Welcome – Eric Nagid, Chapter President-Elect and Program Chair**

Symposium: *Lake Okeechobee, waterways, and estuaries*

Symposium Papers **Moderator:** Eric Nagid, FWC

8:10am — Sharfstein, B. Lake Okeechobee, a historical perspective.

8:30am **—** Havens, K. E. Phosphorus dynamics in Lake Okeechobee: Influence of wind and water levels.

8:50am **—** Waller, J. E. The effects of sustained high water levels and declining bulrush (*Scirpus californicus* and *S. validus*) abundance on Lake Okeechobee's largemouth bass fishery.

9:10am **—** Kerns, J. A. Lake Okeechobee fish assemblage and population structure: a historical comparison.

9:30am **—** Egbert, M. E. Summary of roving creel survey results for Lake Okeechobee from 1977 to 2006.

9:50am — BREAK **Moderator:** Drew Dutterer, UF

10:10am **—** Fox, D. D. Status and trend of black crappie and largemouth bass populations of Lake Okeechobee, or "How am I suppose to fill my freezer from this pond?"

10:30am **— ***Rogers, M. W. and M. S. Allen. Lake Okeechobee's littoral fish community responses to hurricanes.

10:50am **—** Stevens, P. W., D. A. Blewett, and G. R. Poulakis. Use of tidal freshwater and oligohaline habitat by marine fishes in the Caloosahatchee River estuary, southwest Florida.

11:10am **—** Greenawalt-Boswell, J., C. Corbett, J. Guinn and E. Milbrandt. The use of submerged aquatic vegetation as an environmental indicator, so how is the Caloosahatchee Estuary doing?

11:30am **—** Pine, W. E., III and Lewis G. Coggins, Jr.. Using science and modeling to resolve uncertainty in river management: A case history from the Colorado River ecosystem below Glen Canyon dam.

12:00pm — LUNCH

Contributed Papers **Moderator:** Nick Trippel, FWC

1:30pm **—** Hanson, C. and B. Sauls. A Brief Report on the Status of Recreational Saltwater Fishing in Florida: Characterization of License Sales, Participation, and Fishing Effort.

1:50pm **—** *Binion, G., M. S. Allen, and W. E. Pine, III. Size Selectivity of an Otter Trawl for Black Crappie at Lake Jeffords, FL.

2:10pm — Collins, A. B. and R. S. McBride. The Hogfish Cooperative Research Project: Science with Spearfishers.

* An asterisk indicates a student presentation _____ Indicates person presenting

2:30pm — *Dotson, J., M. S. Allen, W. E. Pine, III, M. Hale, and B. Johnson. Effects of Commercial Gill Net Bycatch on Black Crappie Abundance and Angler Catch at Lake Dora, Florida.

2:50pm — BREAK **Moderator:** Phil Stevens, FWC

3:10pm — Jackson, J. B. and A. R. Knapp. The effects of variations in Suwannee River discharge on tidal creek fish communities.

3:30pm **—** *Flowers, H. J. and W. E. Pine, III. Movement of Apalachicola River Gulf Sturgeon in 2006.

3:50pm — *Barnett, B. K. and W. F. Patterson, III. Development of coring methods to extract nursery signatures from red snapper otoliths.

4:10pm **—** Patterson, W. F., III, R. A. Snyder, R. K. Rao, S. Gibson, S. Jeffers, and A. Ren. Bioaccumulation of PCBs and mercury in marine fishes off northwest Florida.

5:00pm — 6:00pm **/ Student Subunit Meeting (All students)**

6:00pm — 7:00pm **/ Dinner**

7:00pm — 8:00pm **/ Chapter Business Meeting – Please attend!**
Awards presentations: Student Awards – Travel and Roger Rottmann Scholarship
Followed by **THE** RAFFLE, AUCTION, and the *bonfire social*

Thursday, February 22

All day **/ Registration**
7:00am — 8:00am **/ Breakfast**
8:20am — 8:30am **/ Announcements**

Contributed Papers **Moderator:** Eric Reyier, Dynamac Corporation

8:30am **—** *Coggins, L. G., Jr., M. J. Catalano, M. S. Allen, W. E. Pine, III, C. J. Walters. Effects of Discard Mortality on Fishery Sustainability and Performance.

8:50am **—** Keenan, S. F. and T. S. Switzer. Geographic variability and habitat use by flounders in Florida.

9:10am **—** Miller, S. J. and B. Eisenhauer. Integrating Trophy Bass Management into a Modern Multipurpose Flood Control Project--The Farm 13 Experience.

9:30am — Break

10:00am **—** Continuing Education series. *Patterns and Processes of Fish Reproduction: a primer*. Presented by Dr. Richard McBride

12:00pm — 1:00pm **/ LUNCH**

1:00pm — 1:15pm **/ Awards presentation:**
Best Papers - Student and Non-student
Best Posters - Student and Non-student
Power Tie and Lampshade awards

* An asterisk indicates a student presentation _____ Indicates person presenting

Abstracts for the 27th Annual Meeting of the Florida Chapter American Fisheries Society
(in alphabetical order)

Addis, D., W. F. Patterson, III, and M. Dance
Student • Platform presentation
University of West Florida. 11000 University Parkway; Pensacola, FL, 32514.
dta2@students.uwf.edu; wpatterson@uwf.edu; mad@students.uwf.edu.

Site fidelity and movement of reef fishes tagged at unreported artificial reef sites off NW Florida

We have been conducting a tagging study at unreported artificial reef sites (n=9) located between 15 and 20 miles south of Santa Rosa Island, FL since December of 2004. In the first two years of the study, 2,309 were tagged with internal anchor tags. An additional 290 fish were caught at tagging sites but not tagged due to small size or being non-targeted species. The top five most frequently tagged species were red snapper (n=1,577), red porgy (n=272), grey triggerfish (n=203), gag grouper (n=95), and vermillion snapper (n=57). Of individuals tagged, 57 were recaptured on subsequent tagging trips and 120 were reported by fishers as being caught away from tagging sites. We will estimate species-specific site fidelity based on declines of recaptures at tagging sites over time.. Dispersion rate of fishes away from reef sites will be estimated by straightline distances from tagging sites to GPS coordinates reported by fishers. Tagging data from this study will provide information about reef residency, dispersion, and movement estimates. Tagging results will be one aspect of a larger study to produce an ecological model examining reef production.

Allen, M. S.[1], M. W. Rogers[1], R. A. Myers[2], and M. W. Bivin[3]
Platform presentation
[1]The University of Florida, 7922 NW 71st Street, Gainesville, FL, 32653. msal@ufl.edu; mrogers@ufl.edu.
[2]Texas Parks and Wildlife Department, 2122 Old Henderson Highway, Tyler, TX, 75702.
[3]Arkansas Game and Fish Commission, 220 S. Locust Avenue, Fayetteville, AR, 72701.

Simulated Impacts of Tournament-Associated Mortality on Largemouth Bass Fisheries

We used creel survey data combined with a simulation model to assess how tournament mortality could increase largemouth bass *Micropterus salmoides* exploitation and influence largemouth bass fisheries. We obtained estimates of total largemouth bass harvest (HARV) and total tournament catch (TC =fish brought to judging stations) at nine lakes from Arkansas, Florida, and Texas. The ratio of TC to HARV ranged from 0.35 to 5.18 across lakes and exceeded one in five of nine lakes. We simulated potential tournament mortality rates ranging from zero to 70% applied to TC fish. Because exploitation was not known, we modeled harvest estimates to represent four potential exploitation rates (5, 15, 25, and 35 %). The age-structured simulation model predicted that at three of nine lakes where TC/HARV ratios exceeded three, tournament mortality rates of 30-40% could cause 5-15% declines in the abundance of largemouth bass over 300 mm TL and could also influence population size structure. At lakes with TC/HARV ratios of less than one (N=4 lakes), the model predicted that tournament mortality would have a negligible impact (i.e., < 5%) on abundance of adult fish and population size structure regardless of the tournament mortality rate. Tournament mortality may not significantly influence most largemouth bass fisheries. However, in lakes where tournament catch was substantially higher than harvest, tournament mortality could encompass a large portion of fishing-associated mortality and would influence largemouth bass fisheries if harvest estimates corresponded to exploitation rates of 15% or more. Traditional exploitation measures may not reveal significant portions of fishing associated mortality for fisheries where tournament catch can exceed harvest (e.g., largemouth bass).

Barnett, B. K. and W. F. Patterson, III
Student ● Platform presentation
The University of West Florida. Department of Biology, 11000 University Parkway, Pensacola, FL, 32514.
bkb9@students.uwf.edu; wpatterson@uwf.edu.

Development of coring methods to extract nursery signatures from red snapper otoliths

The core of an otolith contains a chemical signature which is a permanent natural tag corresponding to the nursery period of the fish. Extracting and processing otolith cores may present risks of contamination, but bias also may be introduced in chemical signatures when an otolith is reduced from its three-dimensional structure to two-dimensions once it is sectioned and cored. We used a Merchantek Micromill to conduct experiments to examine the effect coring may have on chemical signatures of otoliths. The objectives were to test if stable isotope delta values or elemental concentrations of red snapper otoliths were significantly different between left and right otoliths, and whether coring affected chemical signatures. A series of experiments were conducted on age-0 red snapper otoliths; samples for each experiment were obtained from the sampling location. Pulverizing otoliths did not contaminate elemental signatures (MANOVA, $p = 0.958$; all ANOVAs of individual element:Ca ratios, $p > 0.464$). Coring also did not produce a significant difference on elemental signatures (MANOVA, $p = 0.095$). Mn:Ca did show a significant difference between whole right and cored left otoliths (ANOVA, $p = 0.033$), with the difference being driven by one outlying value. Coring significantly affected stable isotope signatures between pulverized whole right and pulverized cored left otoliths (MANOVA, $p = 0.03$). That result was drive by slightly higher $\delta^{13}C$ values in the cored otoliths (ANOVA, $p = 0.024$). Significant differences in $\delta^{13}C$ values between cored and whole otoliths likely resulted from ontogentic shifts in diet that were not fully captured with our initial coring technique. However, analysis of residuals resulted in no statistical difference in $\delta^{13}C$ values between cored and whole otoliths. Overall, results from the coring experiments support applying core chemical signatures as nursery tags as cores removed from the two-dimensional thin sections reflected chemical signatures recorded in three dimensions.

Beal, J. L.[1], S. S. Hitt[1], L. W. Herren[2], G. Kaufmann[2], and R. Hauck[2]
Poster presentation
[1]Florida Fish and Wildlife Conservation Commission, 3300 Lewis St. Ft. Pierce, FL 34981.
jeff.beal@myfwc.com; steve.hitt@myfwc.com
[2]Florida Department of Environmental Protection, 3300 Lewis St. Ft. Pierce, FL 34981.
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Biological response to hydrologic restoration of oligohaline floodplain communities and oxbows along North Fork St. Lucie River, St. Lucie County, FL.

Alteration (straightening) of the North Fork St. Lucie River during the 1920s to facilitate drainage of the adjacent watershed adversely affected the floodplain communities, historical oxbows, water quality, and associated flora and fauna. The North Fork drains into the St. Lucie Estuary, a severely impaired waterway in east-central Florida targeted for restoration through the Indian River Lagoon South Feasibility Study of the Comprehensive Everglades Restoration Plan (CERP). The primary objective is the rehabilitation of floodplain wetlands and historical oxbows. During the straightening of the river, the dredge spoil was placed along the newly created riverbank as high as 25', partially or completely disconnecting historical oxbows and precluding river flood into the adjacent floodplain communities (blackwater stream, slough, floodplain swamp and forest). Two pilot studies were conducted to measure feasibility, cost, and environmental benefit of hydrologic restoration along the North Fork St. Lucie River. The first pilot involved breaching of the spoil berm to create tidal creeks and to utilize a culvert to move water across the floodplain surface. Biological responses included changes in fish and decapod community structure, movement of transient species into the wetlands, occasional movement of wetland residents toward open water, improved DO levels within the wetlands, and subtle changes in vegetative community structure. Organisms captured include commercially and recreationally important species

(e.g., *Callinectes* spp., *Farfantepenaeus* spp., *Centropomus* spp.). The second pilot consisted of reconnecting the disconnected end of an historical oxbow to restore flow to the historical rivercourse. Numerous riverine and estuarine species immediately utilized the newly available rivercourse and DO improved in the oxbow. These projects demonstrate the efficacy of specific restoration techniques for oligohaline riverine habitats and the rapid biological responses associated. Further feasibility planning (identification of numerous sites along the North Fork) has identified additional restoration projects along this historically important river. Additional improvements will have significant effects upon the water quality and organisms associated with downstream receiving waterbodies (St. Lucie Estuary, Indian River Lagoon, Atlantic Ocean).

Binion, G., M. S. Allen, and W. E. Pine, III
Student • Platform presentation
The University of Florida, Department of Fisheries and Aquatic Sciences, 7922 NW 71st Street, Gainesville, FL 32653. bingreg@ufl.edu; msal@ufl.edu.

Size Selectivity of an Otter Trawl for Black Crappie at Lake Jeffords, FL

Estimates of the selectivity of fishing gears are a critical aspect for sound fishery assessments. All fishing gears exhibit selective properties, and understanding the magnitude and direction of these biases are required to make competent management recommendations. Black crappie *Pomoxis nigromaculatus* support some of the largest recreational fisheries in North America, but highly variable or cyclic recruitment patterns cause inconsistent angler catch among years. We evaluated the size selectivity of a bottom trawl, which is commonly used when assessing black crappie fisheries. Mark-recapture methods were used to create a tagged population via three gears (bottom trawls, electrofishing, and hoopnets) at Lake Jeffords, a 65-ha eutrophic lake in North Central Florida. Mortality of tagged fish was estimated with holding pens as replicates for 24 h. Recapture sampling with otter trawls took place two weeks after marking events ended. We estimated how catchability (*q,* the fraction of the fish stock captured with a given level of sampling effort) varied with fish size for the bottom trawl, and explored how the selectivity patterns could influence black crappie assessments.

Bradshaw, C. D. and B. Mahmoudi
Platform presentation
Florida Fish & Wildlife Conservation Commission, Fish & Wildlife Research Institute. 100 Eighth Avenue, SE, St. Petersburg, FL 33701. Chris.Bradshaw@myfwc.com ; Behzad.Mahmoudi@myfwc.com

Estimating Natural Mortality of Juvenile Striped Mullet Using Fisheries Independent Catch Data

Striped mullet, *Mugil cephalus* (Linnaeus, 1758), is an important fishery species in the state of Florida. The gulf coast contributes the majority of landings (71%) for the state. Although striped mullet are sought by both recreational and commercial fishermen, the recreational fishery contributes only 16% of landings. Here we investigate the feasibility of calculating a mortality estimate for juvenile striped mullet (17 to 280 mm Fork Length [FL]) through abundances and lengths of juveniles randomly sampled from the Tampa Bay estuary system. Data were compiled from the Florida Fish and Wildlife Conservation Commission's (FWC) Fisheries Independent Monitoring program (FIM) database from 1989 to 2005. Data were formatted, imported into FiSAT II, a FAO stock assessment program, and then growth parameters and a catch curve were fitted to the data. Annual mortality for juvenile striped mullet was found to be 0.958 (95% CI 0.948 to 0.967) when the entire data set (1989-2005) was analyzed. This mortality estimate is within the expected range of juvenile mortalities for a fast-growing, short-lived estuarine species and is supported by an r^2 value of 0.70. Total mortality estimates provide the best approximation for natural mortality of juvenile striped mullet because of the lack of fishing pressure on individuals under

280 mm FL (these fish are illegal to harvest). This natural mortality estimate can be used for future stock assessments and may be used as a metric to assess year class strength. The applicability of this method for estimating the natural mortality of other commercially- and recreationally-important species collected during routine FIM sampling will also be explored.

Clarke, C.[1], J. Cobb[2], and W. Arnold[2]
Student ● Poster presentation
[1]Eckerd College, 4200 54th Ave North, Box 293, St. Petersburg, FL 33714. Clarkece@eckerd.edu
[2]Florida Fish & Wildlife Conservation Commission, Fish and Wildlife Research Institute, 100 Eighth Avenue SE, St. Petersburg, FL 33701. Janessa.Cobb@MYFWC.com; Bill.Arnold@MYFWC.com.

Grain Size Distribution VS Density and Size of Donax spp. on Pinellas County Beaches
FWRI has teamed up with research agencies across Florida to assess the biological and ecological effects beach renouishment is having on our beach habitats. To understand how the renouishment process is affecting a habitat one must first understand the indicator species and the environment in which it lives. The purpose of this investigation was to determine the effects of grain size distributions on the common Coquina Clams (Donax spp.). Samples of sediment and Donax spp. were collected from six sites along the western Florida coast. Back in the lab the Donax spp. were counted and measured and the sediment dried, sieved, and weighed. There was no correlation found between grain size and Coquina clam abundance or size. This suggests that the finer sand that will be placed on the beach during the renourishment should not directly effect the animal and if and decrease in abundance is found it will most likely be to do the amount of deposit not the grain size.

Coggins, L. G., Jr.[1], M. J. Catalano[2], M. S. Allen[2], W. E. Pine[2], III, C. J. Walters[3]
Student ● Platform presentation
[1]U.S.G.S., Grand Canyon Monitoring and Research Center, Flagstaff, AZ, lcoggins@usgs.gov.
[2]Department of Fisheries and Aquatic Sciences, University of Florida, Gainesville, FL, 32653. catalm@ufl.edu; msal@ufl.edu; billpine@ufl.edu
[3]Fisheries Centre, University of British Columbia, Vancouver, BC. c.walters@fisheries.ubc.ca

Effects of Discard Mortality on Fishery Sustainability and Performance
Fishery collapses cause substantial economic and ecological harm, but common management actions often fail to prevent overfishing. Minimum length limits are perhaps the most common fishing regulation used in both commercial and recreational fisheries, but their conservation benefits can be influenced by discard mortality of fish caught and released below the legal length. We constructed a computer model to evaluate how discard mortality could influence the conservation intent of minimum length regulations. We evaluated policy performance across two disparate fish life history types: short-lived high-productivity (SLHP) and long-lived low-productivity (LLLP) species. Length limits failed to prevent recruitment overfishing when discard mortality rate exceeded about 0.2 for SLHP species and 0.05 for LLLP species, and reductions in overall fishing mortality (e.g., lower fishing effort) were required to prevent recruitment overfishing if discard mortality exceeded these values. Similarly, relatively low discard mortality rates (gt 0.05) rendered maximum yield unobtainable and caused a substantial shift in the shape of the yield response surfaces. Analysis of fishery efficiency showed that length limits caused the simulated fisheries to be much less efficient, potentially exposing the target species and ecosystem to increased negative effects of the fishing process. Our findings suggest that for overexploited fisheries with moderate to high discard mortality rates, reductions in fishing mortality will be required to meet management goals. Resource managers should carefully consider impacts of discard mortality on fishery sustainability.

Collins, A. B.[1] and R. S. McBride[2]
Platform presentation
[1]Florida Fish and Wildlife Conservation Commission. Fish and Wildlife Research Institute. 100 8th Ave SE, St. Petersburg, FL 33701. angela.collins@myfwc.com
[2]NOAA's National Marine Fisheries Service. Woods Hole, MA 02543. richard.mcbride@noaa.gov.

The Hogfish Cooperative Research Project: Science with Spearfishers

Hogfish (*Lachnolaimus maximus*) are an important fishery in the southeastern United States and are highly sought after by both commercial and recreational divers. Collaboration between scientists and the dominant user group of a resource can allow for an efficient and successful method of data collection. A cooperative team of scientific, recreational and commercial divers was developed to compile information regarding hogfish biology and ecology in the eastern Gulf of Mexico. Dive sites were distributed over depth strata (0-60 meters) and habitat type. Size estimates and abundance of hogfish at all dive locations were recorded via visual transects. Gonads and otoliths were removed from hogfish samples collected by spearfishing and are being analyzed for life history information. During the first 15 months of the study, 480 hogfish have been collected and over 1,250 have been observed during 356 dives. Fish size increases with depth and distance from shore. Males in shallow water (<20 m) are significantly smaller than those (either males or females) found in deeper water (>20 m). Although larger fish are found offshore, groups are smaller in number and less concentrated. Females are usually not solitary, with at least one other female present within 3 meters. Males were less abundant than females over all depths and habitat and showed increased courtship behaviors and aggression toward divers during spawning months. Habitat associations and distribution by depth do not appear to change with season.

Dance, M., W. F. Patterson, III, and D. Addis
Student • Platform presentation
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Community development at unreported artificial reef sites off Northwest Florida

We estimated reef fish abundance and community structure at 27 unreported artificial reef sites located between 15 and 20 miles south of Santa Rosa Island, Florida. Three reef types were sampled, with reefs (n = 3) of each type located in each of three depth strata. Type A reefs are solitary pyramidal modules with a height of 3m and a base of 3m. Type B reefs are paired pyramid modules with smaller pyramid inserts inside. Those modules are 1.8m tall and have a base of 3m. Type C reefs are paired reef ball structures with a height of 1.5m and a base of 1.8m. Quarterly video sampling was conducted at all sites from November 2004 through September 2006 using a novel remotely operated vehicle-based methodology. Species were identified and enumerated from video in the laboratory. Estimated fish abundance was significantly different among reef types (ANOSIM, p=0.015), depth strata (ANOSIM, p=0.022, and sampling quarters (ANOSIM, p=0.010). The most abundant fish observed was red snapper, which steadily increased from fall 2004 through summer 2006. Other snapper species (namely vermillion and lane) followed similar patterns of increasing abundance. Groupers (gag, red, and scamp) showed an opposite trend with steady decreases over the same time period. With respect to species diversity measures, the shallowest sites had the lowest richness while the deep sites had the lowest evenness. Among all quarters there has been a general increase in all measures of diversity. Reef balls and fish havens had the highest richness and evenness respectively among reef types. Results will be discussed in the context of a larger study examining the ecological function of unreported artificial reefs.

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Investigation of Genetic Stock Structure in pompano (*Trachinotus carolinus*) from the Gulf of Mexico, Southeastern United States and Puerto Rico

The Florida pompano, *Trachinotus carolinus*, is an economically important gamefish found from Massachusetts to Brazil and in the Gulf of Mexico. It is not known if the fish in these locations represent a single genetic stock or multiple stocks. To help define genetic stock structure, we have conducted a genetic analysis on samples from Brownsville, TX (and nearby Mexico), Apalachicola, Tampa Bay and Stuart, FL, North Carolina and Puerto Rico. For genetic analysis, the genotypes for 13 polymorphic nuclear microsatellite loci were determined for samples from each location. Population differentiation testing (Fisher exact test) for allelic distributions across samples indicated no significant differences in allele frequencies between samples in the Gulf of Mexico and Southeastern United States (Stuart, FL and North Carolina), suggesting that fish in these locations represent a single panmictic stock. However, highly significant differences were observed between each of these samples and the Puerto Rico sample, suggesting that pompano from Puerto Rico comprise a separate stock. F_{ST} estimates similarly indicated no significant population differentiation among Gulf of Mexico and Southeastern United States samples but highly significant differences were observed between these samples and the Puerto Rico sample.

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Effects of Commercial Gill Net Bycatch on Black Crappie Abundance and Angler Catch at Lake Dora, Florida

Bycatch, the incidental catch of non-target species with fishing gear, occurs in almost all commercial fisheries. A commercial gill net fishery was initiated at Lake Dora, Florida in March, 2005 to reduce the abundance of omnivorous gizzard shad *Dorosoma cepedianum*. Black crappie *Pomoxis nigromaculatus* are the primary bycatch of this fishery, as well as the primary sport fish targeted by recreational anglers. Thus, black crappie bycatch associated with the gizzard shad fishery is of concern to anglers and agency personnel. We assessed total black crappie bycatch and bycatch mortality, and measured recreational harvest and effort to measure the population-level effects of bycatch on the black crappie fishery. Commercial fishing occurred in the spring of 2005 and 2006. Total black crappie bycatch was determined from onboard observations of commercial fishers, and bycatch mortality rates were assessed via cage experiments. A recreational creel survey was conducted during 2005 and 2006 to assess recreational fishing effort, catch, and harvest of black crappie. Trawl surveys were conducted annually for a fishery-independent assessment of age/size composition, and carcasses from the recreational catch were collected annually for age/size composition data from the recreational fishery. A tagging study was conducted in 2006, which provided estimates of exploitation for the recreational and commercial (i.e., bycatch) fisheries. Results indicated approximately 17,000 and 30,000 crappie were captured in the commercial fishery and mortality rates of crappie captured was 31% and 47% in 2005 and 2006, respectively. Creel survey analysis indicated that 31,000 and 38,000 crappie were harvested in the recreational fishery in 2005 and 2006, respectively. We use an age-structured population model to evaluate the population-level effects of black crappie bycatch.

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Summary of Roving Creel Survey Results for Lake Okeechobee from 1977 to 2006

Lake Okeechobee, Florida is a large subtropical lake that supports an estimated $100 million dollar a year recreational fishery. Anglers visiting Lake Okeechobee primarily pursue largemouth bass (*Micropterus salmoides*), black crappie (*Pomoxis nigromaculatus*), bluegill (*Lepomis macrochirus*), or redear sunfish (*Lepomis microlophus*). From 1977 to 2006, a roving creel survey was conducted annually in two densely fished areas of the lake to estimate the effort and success rates of largemouth bass and black crappie anglers. In 1996, the creel survey was expanded to include bluegill and redear sunfish anglers, and then in 1999 the creel was amended to include measuring largemouth bass that were being harvested by anglers. Angler effort and success rates fluctuate annually. However, there are appreciable changes in these rates that coincide with changes to the Lake Okeechobee water schedule and natural events such as hurricanes and droughts. Due to Lake Okeechobee's wildlife and economic value it is important that we continue metrics such as roving creel surveys to assess the condition of the lake's fisheries.

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Effects of a red tide event on the relative abundance of juvenile and adult sport fish in Tampa Bay

A massive red tide event occurred in the Gulf of Mexico in 2005. High concentrations of the red tide organism (*Karenia brevis*) were found in the lower regions of Tampa Bay beginning in May and extending into December. The fish kills associated with this event led to concern regarding sport fish populations and their recruitment. Annual indices of relative abundance (1996-2006 data obtained from Florida's Fisheries-Independent Monitoring program) were calculated for five major sport fish in the bay: red drum (*Sciaenops ocellatus*), spotted seatrout (*Cynoscion nebulosus*), sand seatrout (*Cynoscion arenarius*), common snook (*Centropomus undecimalis*), and sheepshead (*Archosargus probatocephalus*). Significant declines in young-of-the-year (YOY) abundance were evident in 2005 for all species except snook. Low abundances were evident again in 2006 for YOY *C. nebulosus*, *C. arenarius*, and *A. probatocephalus*. These declines may have been due to mortality of YOY as they recruited to the bay, the failure of the adults to spawn, or perhaps the relocation of spawning to other areas not affected by the red tide. In addition to the lower abundance of YOY sport fish during 2005, there was also a decrease in the total number of all YOY fishes collected in the lower bay compared to previous years. Adult abundances within the bay during 2005 and 2006 were consistent with previous years; however, a shift in abundance from the lower bay to the upper bay was apparent possibly corresponding to a movement away from areas affected by the red tide.

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Movement of Apalachicola River Gulf Sturgeon in 2006

During the spring 2006, we documented movement and spawning site selection for Gulf sturgeon (Acipenser oxyrinchus "desotoi") in the Apalachicola River system, Florida. We used a combination of radio and sonic telemetry techniques to relocate 31 of a possible 45 (69%) sturgeon within the system. Based on relocations of telemetered animals and Gulf sturgeon egg collections, we were able to identify two active spawning sites in the Apalachicola River during spring 2006. Following the spring spawning period, we relocated fish moving and aggregating in previously identified summer holding areas in the Brothers River and monitored these fish emigrating from the river to the Apalachicola estuary in late fall. Our findings demonstrate extensive movement patterns of Gulf sturgeon throughout the Apalachicola River basin and also demonstrate the importance of the lower Apalachiocola and Brothers Rivers as habitat for Gulf sturgeon from other river systems.

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Status and trend of black crappie and largemouth bass populations of Lake Okeechobee, or "How am I suppose to fill my freezer from this pond?".

Reduced relative abundance of black crappie (*Pomoxis nigromaculatus*) and largemouth bass (*Micropterus salmoides*) during the late 1990's and early 2000 period is attributed to poor recruitment as a result of habitat loss associated with excessive high lake stages during the late 1990's. A managed water level recession in 2000 followed by a subsequent drought in 2001 resulted in historically low lake levels which stimulated expansion of submerged and emergent aquatic plant communities. In response to increased and enhanced habitat, black crappie and largemouth bass populations exhibited enhanced recruitment in 2002. Extremely high lake stages commencing in 2003 began to impact habitat, resulting in continued low recruitment. Hurricanes Frances and Jeanne in 2004 further reduced the areal coverage and quality of aquatic plant communities, resulting in continued reduced recruitment in 2005.

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Patterns in the age, growth and mortality of gray snapper, *Lutjanus griseus,* along the west Florida shelf

Gray snapper, *Lutjanus griseus,* were sampled from the recreational, commercial hook and line, and long-line fisheries along the west Florida shelf from 1991 to 2005. Total lengths (TL) ranged from 182 to 724 mm (mean = 443 mm TL). Gray snapper were aged using sectioned sagittal otoliths, viewed at 75 X, with a high degree of precision (average percent error = 3.8%). Ages ranged from 1 to 27 yr with a mean of 8.53 yr for commercial hook and line, 11.03 yr for commercial long-line, and 7.04 yr for recreational landings, fish were on average older than other common lutjanids taken in the U.S. Gulf of Mexico fisheries. Gray snapper entered the commercial hook and line and recreational fisheries by age 6 and in the commercial long-line fishery by age 11 with no one age class dominating any sector. The von Bertalanffy growth model derived from TL at age for all fishing modes combined was [$L_t = 563.72(1-e^{-0.18(t+2.08)})$]. In both the commercial hook and line and recreational fisheries the oldest individuals on average were from the north and the youngest were from the south. Size-at-age differed significantly regionally for ages 4 through 10, with fastest growth in the north and slowest growth in the south. The total instantaneous total mortality rate (z) of gray snapper for the commercial hook and line fishery for all years combined was 0.25 and increased from north to south (0.16 north, 0.20 central and 0.36 south).

Results of this study suggest that gray snapper are exploited at a higher rate off southern Florida compared to central and northern Florida.

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The use of submerged aquatic vegetation as an environmental indicator, so how is the Caloosahatchee Estuary doing?

Hydrologic alterations in the Kissimmee River Basin, Lake Okeechobee and throughout South Florida have drastically altered the flow regime of the Caloosahatchee River. The Caloosahatchee estuary now artificially receives large quantities of water released from Lake Okeechobee, causing concern about the effects on the health of the estuary. Submerged aquatic vegetation is commonly used to assess the health of the estuary on several scales. The SFWMD currently uses aerial photography to map seagrasses on a biennial basis, providing a large scale (hectares) estimate of seagrass coverage. Between 1982 and 2004, although seagrass coverage was highly variable, there were no significant trends. However, seagrass data on a transect scale (tens-hundreds of meters) collected annually from 1999-2004 shows significant changes that correlate with salinity variability. The species composition of seagrasses also appears to be driven by the low salinity regime during the wet season. *Halodule wrightii* has the broadest salinity tolerance and therefore we predict that under low (or highly variable) salinity conditions species composition will shift to *H. wrightii*. Two sites are monitored bi-monthly in San Carlos Bay (meter scale) to assess species composition, shoot density and biomass of *Thalassia testudinum* and *H. wrightii*. Over the past two years, a shift in dominant species composition has occurred. For well over a year the *T. testudinum* shoot densities have remained less than 50/m^2, where just prior to this collapse shoot densities were over 275/m^2. Density of *H. wrightii* reached the highest monthly average in September 2006. Finally, growth measurements of *T. testudinum* demonstrate significantly slower growth near the mouth of the river during the summer growing season. Although large scale measurements do not show declining trends, small scale measures are an indication of declining estuarine health, and can be used to encourage changes in water management strategies before large scale habitat losses occur.

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Thiamine Concentrations in Egg Yolk of Bonnethead Sharks (Sphyrna tiburo) and Their Associations With Infertility

Thiamine (Vitamin B1) is essential for development and survival of progeny of egg bearing vertebrates. Reductions in thiamine concentrations of egg yolk have been linked to diseases that cause low offspring survival rates in both fish and reptile populations. In this study, thiamine status of bonnethead shark (Sphyrna tiburo) egg yolk was examined to determine if thiamine deficiency is associated with the high infertility rate observed in certain Florida populations of this species. Thiamine concentrations of egg yolk were measured using a new, rapid solid phase extraction procedure. There were no significant differences in yolk thiamine concentrations in female sharks sampled during different stages of

reproduction. Significant differences were observed in yolk of sharks from the Tampa Bay and Florida Bay estuaries, but thiamine concentrations were greater in the population with a higher rate of reproductive failure (Tampa Bay). No significant difference was observed between the infertile and fertile ova from Tampa Bay sharks. These results suggest that thiamine deficiency is unlikely to be associated with infertility in S. tiburo.

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A Brief Report on the Status of Recreational Saltwater Fishing in Florida: Characterization of License Sales, Participation, and Fishing Effort.

Florida's recreational saltwater fishery is among the largest in the country, accounting for nearly 40% of all recreational trips taken in the Atlantic and Gulf of Mexico (excluding Texas). Saltwater fishing generates an estimated $6 billion annually in economic revenue to the state. Monitoring and managing the increasing recreational pressure on Florida's saltwater fishery resources is becoming a vital and significant challenge as population and tourism in the state continue to grow. Indices of recreational fishing indicate that pressure on Florida's fishery resources have been increasing, particularly in the past several years. For instance, the average number of recreational saltwater fishing licenses sold to both residents and nonresidents has increased by 32% since the late 1990s. Likewise, the estimated average number of saltwater anglers in 2001 increased 19% over 1991 estimates in one national survey, and another survey estimated a 47% increase in the number of saltwater anglers in Florida since 2000. The average number of recreational saltwater fishing trips has also increased by 19% since 2000 compared to the late 1990s, particularly on the west coast where trips have increased three times faster than on the east coast. Fishing effort for important saltwater finfish species managed by the state have shown similar trends of increasing pressure. For example, the average number of fishing trips targeting or catching snook increased 34% between 1995-1999 and 2000-2004. Trips targeting red drum also increased substantially (41%) in Florida between 1995-1999 and 2000-2003, and red drum trips increased four times faster on the east coast. Directed trips for spotted seatrout increased 41% between 1995-1999 and 2000-2005. The underlying theme emerging in the management of these and other important saltwater fisheries is this increasing recreational fishing pressure. This paper highlights some of the important trends in Florida's recreational fishery emphasizing indices measuring fishing pressure.

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Phosphorus Dynamics in Lake Okeechobee: Influence of Wind and Water Levels

Phosphorus (P) dynamics in Lake Okeechobee are greatly influenced by physical processes such as wind-driven sediment resuspension, at times scales from hours to years. Results from long-term (30 year) research on this shallow lake (area 1,730 km^2, mean depth 2.7 m) illustrate key features of these P dynamics. Variations in wind velocity result in changes in water column transparency, suspended solids, and total P (TP). In summer there are diurnal changes in TP associated with afternoon winds, and in winter, when strong winds occur for multiple days, monthly average TP remains high compared to summer. The magnitude of daily and seasonal TP changes can exceed 100 ppb. Hurricanes and tropical

storms also cause extreme changes in TP that are superimposed on seasonal dynamics. When a Category I hurricane passed 80 km south of the lake in October 1999, mean pelagic TP increased from 88 to 222 ppb. Major hurricanes passing over the lake in 2004 and 2005 had even greater impacts. During large resuspension events, which often coincide with high water level due to heavy rainfall, turbidity and light attenuation are increased, and this influences the biomass and spatial extent of submerged plants, as well as water column TP. In Lake Okeechobee, TP concentrations in shoreline areas typically are near 20 ppb when submerged plants are dense, vs. greater than 50 ppb when plants are absent due to prolonged deep water, and phytoplankton biomass and algal bloom frequency both are increased. These changes can affect the entire food web, including zooplankton, macro-invertebrates and fish. In Lake Okeechobee and other large shallow lakes, complex models that explicitly consider wind-wave energy, hydrodynamics, and sediment resuspension, transport are needed to accurately predict how lake water TP will respond to different management options.

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Distribution and abundance of early life stages of shark species in the panhandle of Florida, 2003-2006

Identification and conservation of essential fish habitat are important components of providing adequate management and conservation for shark populations. This is of particular importance when attempting to understand the dynamics of young sharks in coastal nursery areas. Gillnets were fished in four areas in the panhandle of Florida (~29°40'N, 85°13'W) April through October 2003-2006: St. Andrew Bay, Crooked Island Sound, St. Joe Bay, and the gulf-side of St. Vincent Island. A total of 563 sets were made. Captured sharks species were measured (fork length, cm FL), sexed, and assessed for life history stage (young-of-the-year, juvenile, and adult), and, when in good condition, tagged and released. Information on adult sharks is not presented. Differences in size distribution were observed between areas. In St. Andrew Bay, Crooked Island Sound, and St. Joe Bay (three protected areas), the most abundant species-life stage combinations were Atlantic sharpnose shark juveniles (37-74 cm TL) and young-of-the-year (25-52 cm FL) and bonnethead young-of-the-year (43-52 cm FL). However, on the gulf-side of St. Vincent Island, the most abundant were blacktip juveniles (50-107 cm FL, mean=78.1 cm FL, n=195), finetooth juveniles (50-105 cm FL, mean=84.9 cm FL, n=146), and spinner juveniles (56-104 cm FL, mean=79.0, n=83). For each set, mid-water temperature (°C), salinity (ppt), dissolved oxygen (mg l^{-1}), average depth (m), and water clarity (depth of the photic zone, cm) were measured. Habitat profiles were relatively similar among areas and species. In general, young-of-the-year were more often collected in shallower water with higher temperature, lower salinity, and more turbid conditions compared to juveniles. Over one-thousand immature sharks were tagged from 2003 to 2006. Tag recapture data was collected for 43 sharks for that time period, the majority being Atlantic sharpnose.

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The effects of variations in Suwannee River discharge on tidal creek fish communities

We investigated nekton community assemblages and individual species abundances in 23 tidal creeks within the Suwannee River estuary. All analyses were performed within each of four seasons and used

data collected over nine years by the FWRI fisheries-independent monitoring program. Using PRIMER software, we analyzed how nekton assemblages changed based upon the proximity of tidal creeks to the Suwannee River and based upon year-to-year variability in river discharge. Within each season, we also used two-way ANOVA to analyze how individual species abundances changed based upon the same two parameters. Tidal creek nekton assemblages differed based upon proximity to the river and level of discharge during both spring and summer. In both seasons, species that were more abundant in tidal creeks near the river during years with low discharge would often become more abundant farther from the river during years with high discharge, although interaction was rarely significant. During autumn, assemblages differed based only upon level of river discharge, and during winter, assemblages differed based only upon proximity to the river. During spring and autumn, species evenness was greater during years with high river discharge, but during spring and summer, there were a greater number of individuals during years with low river discharge. Individual species analyses within seasons also revealed that most species that did experience a significant difference in abundance were more abundant during years with low river discharge. Provided that high levels of discharge promoted greater species evenness and low levels of discharge promoted opportunistic peaks in abundances of some species, we concluded that there is not an ideal discharge level that would benefit the entire tidal creek nekton community. Rather, inter-annual cycles of low discharge, high discharge, and average discharge provided alternating optimal conditions for various members of this community.

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Contamination Profiles in Largemouth Bass and Mullet Collected in Northwest Florida
We conducted a survey of contaminant levels in largemouth bass (*Micropterus salmoides*) and striped mullet *(Mugil cephalus*) collected from rivers, bayous, and estuaries in the Pensacola Bay area. These samples were analyzed for 17 dioxin/furan congeners, 209 Polychlorinated Biphenyl (PCB) congeners, 48 Polybrominated Diphenyl Ether (PBDE) congeners, 23 organochlorine pesticides, mercury and arsenic. To our knowledge, a systematic survey of multiple contaminants in largemouth bass and mullet had not been previously conducted in this region. Mercury levels in tissues were assessed using screening values (SV) set by the State of Florida (FL). All other contaminants were evaluated using SV calculated using U.S. EPA recommendations for establishing consumption advisories. Mercury levels in largemouth bass at 8 of 10 sampling locations exceeded the FL SV, which results in an advisory for the general population to limit consumption to one meal per week. In contrast, mullet exhibited low levels of mercury. Organochlorine pesticides were generally higher in mullet than in bass although none of the concentrations exceeded the EPA SV. DDT and its metabolites were detected in nearly all mullet samples but total DDT isomers never exceeded the SV. Mullet from one location (Bayou Chico) exceeded the EPA SV for dieldrin. The PCB/dioxin WHO TEQs for largemouth bass and mullet exceed the EPA SV (0.26 ng/kg) at nearly all sampling locations. One bass sample and four mullet samples exceeded the EPA SV (20 ng/g) for total PCBs. The highest levels of total PCBs were found in samples from locations downstream of a historical point source of PCBs on the Escambia River (Supported by EPA Cooperative Agreement X-97455002).

Keenan, S. F. and T. S. Switzer
Platform presentation

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Geographic variability and habitat use by flounders in Florida

The Fisheries-Independent Monitoring (FIM) program of the Florida Fish and Wildlife Conservation Commission's Fish and Wildlife Research Institute currently monitors finfish populations in six estuaries throughout the state. The FIM program relies upon a multi-gear approach to effectively target a variety of habitats and fish life-history stages. For this presentation we have summarized catch data from 21.3-m center bag seines that primarily target juveniles (< 100 mm SL) as well as 183-m haul seines that primarily target larger sub-adults and adults (> 100 mm SL). These gear have been used consistently in all estuaries sampled from 2001 to 2005. Five species of paralichthyid flounder were collected within estuarine habitats of Florida: gulf flounder (*Paralichthys albigutta*), southern flounder (*P. lethostigma*), broad flounder (*P. squamilentus*), summer flounder (*P. dentatus*) and ocellated flounder (*Ancylopsetta quadrocellata*). Statewide distributional patterns showed variability along latitudinal and longitudinal gradients with only *P. albigutta* found in all estuaries sampled. On the gulf coast, *P. albigutta* was only outnumbered in the northernmost estuary by *A. quadrocellata*, although *P. lethostigma* and *P. squamilentus* also occurred. Only *P. albigutta* and *A. quadrocellata* were found in southern gulf coast estuaries. On the Atlantic coast, *P. albigutta* were numerically dominant in southern catches, but were outnumbered by *P. lethostigma* in the northern estuary, where all species co-occurred. This northern estuary contained the only incidence of *P. dentatus*. An example in habitat variability is observed in northeast Florida with *P. lethostigma* recorded in lower salinity, fine sediment areas and *P. squamilentus* found in higher salinity, coarse sediment areas. Further differences in habitat selection among species and life-history stages will be discussed.

Kerns, J. A.

Symposium Platform presentation

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Lake Okeechobee fish assemblage and population structure: A historical comparison

From 1988 through 1991 a lakewide trawling program was undertaken to determine composition and distribution patterns of important fish species within the entire limnetic area of Lake Okeechobee. This program was resumed in December 2005 to determine if and how the fish assemblage and population structure had changed over the years. Samples taken in December 2005 and 2006 yielded 3,922 fish (total) with a cumulative biomass of 338.5kg. A total of 22 species were represented in these later samples with four species comprising 84% of the catch by number. Those species, in order of abundance were: black crappie (*Pomoxis nigromaculatus*), white catfish (*Ictalurus natalis*), threadfin shad (*Dorosoma petenense*), and bluegill (*Lepomis macrochirus*). In terms of biomass, white catfish and Florida gar (*Lepisosteus platyrhincus*) accounted for 65% of the catch by weight in the 2005-06 samples. With respect to the 1988-91 averages there were notable declines. Catch rates fell from 11.21 fish per minute in the earlier samples to 3.72 fish per minute in 2005-06. Furthermore, the average number of adult (> 200mm) black crappie collected from 1988-91 was 548 compared to only 19 in 2005-06, and coincidently threadfin shad averages decreased from 2,992 in 1988-91 to 424 in 2005-06.

Marcinkiewicz, L. L. and W. E. Pine, III

Student • Platform presentation

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Examining movement patterns and seasonal habitat use of adult common snook
Common snook, *Centropomus undecimalis*, are an ecologically and economically important estuarine dependent predatory fish species found throughout south Florida. Despite increasingly restrictive management actions over the past 50 years, common snook populations are thought to have declined. Possible reasons for this decline are high harvest rates, increasing natural mortality due to red tides, and loss of essential habitat related to coastal development. Using telemetry methods, we have previously documented that snook are heavily exploited and that recent red tide events can cause locally high mortality events. Currently, we are evaluating seasonal habitat occupancy and movement patterns for adult snook in Sarasota Bay, Florida. Results from this study show that individual snook move varying distances throughout the bay system, demonstrate strong seasonal fidelity to specific tidal creeks, and appear to seasonally select distinct habitat types. Additionally, anomalous movement and habitat use patterns have been observed concurrently with red tide events in Sarasota Bay. This telemetry study has provided important new information related to the ecology of common snook. Simultaneously, it provides essential information that can be used to improve conservation management plans by identifying key habitats, and may help to better understand the direct and indirect effects of threats associated with anthropogenic and environmental disturbances on snook populations.

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Patterns and processes of fish reproduction: a primer
Reproduction is a key concept for the study of population dynamics, but it is complex enough that it requires specialized methods and terminology. There is probably no better time to learn about reproduction by fishes, because the successes of recent experimental studies offer cogent evidence about the processes of oogenesis, an accumulation of comparative studies reveals the diversity of reproductive patterns, and a modern literature offers a fairly lucid framework of terminology. This presentation will present a literature review of the patterns and processes of fish oogenesis and fish reproduction.

This 'primer' will introduce the germ cell, oogonial proliferation (mitosis), and oocyte development (meiosis). The focus will be on microscopic approaches, such as with histology and examination of whole oocytes, although reference to macroscopic methods will also be included. Workable definitions will be given to distinguish semelparity from iteroparity and total spawners from batch spawners. Various definitions of fecundity and oocyte synchrony will be reviewed, along with the implications for each. Finally, the diversity of these patters will be examined for fishes of the North Atlantic. Following the presentation (approximately 45 minutes), an informal, open discussion is encouraged.

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Classification schemes for monandric, protogynous fishes: a review and extension of Moe's (1969) model
Progress in science requires formulation of clearly-stated models and supporting terminology for the development of such models. In this sense, Martin Moe's (1969) investigation of the biology of red grouper (Serranidae: *Epinephelus morio*) stands as a seminal paper for diagnosing and classifying the

reproductive processes of a monandric, post-maturational and protogynous hermaphrodite. He correctly used the terms “stage” and “class”, which were in the literature to characterize the development of germ cells vs. the gonad (= individual), respectively. According to the “Web of Science,” 129 peer-reviewed papers have cited Moe (1969), with many citing his reproductive model specifically. Nearly all of these studies accepted Moe’s scheme of 10 classes without modification. In a recent, unpublished investigation of hogfish (Labridae: *Lachnolaimus maximus*) reproductive biology (McBride, unpublished data), it was useful to break up and reorder some of the transitional and male classes. Classes were added that allow tracking of the rate of sex change, which in *L. maximus* occurs over several months spanning the post-spawning season. The main criteria for these new classes rest on the pace of oocyte degradation in ovo-testes. It is postulated that while Moe’s (1969) model for monandric, protogynous fishes is fundamentally sound, closer scrutiny and further tests with histological data will probably find variation on the basic theme; these variations themselves will add insight into the reproductive biology of hermaphroditic fishes.

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Historical Hydrology of the Upper St. Johns River in East-Central Florida

In this study we evaluate historical St. Johns River flows and stages in the river’s upper reaches to identify long-term spatial and temporal trends and to relate them to either natural or anthropogenic effects. Long-term mean daily stage and flow data from four USGS monitoring sites at were analyzed using Indicators of Hydrologic Alteration software developed by the Nature Conservancy. Results indicate the most significant hydrologic changes occurred upstream of Lake Washington following removal of the “vegetation jams “ in 1953. After construction of a permanent weir in 1977, water levels increased. Short-duration, high flows also that may have important ecological flushing effects also declined upstream of the lake, likely in response to construction of levees associated with the Upper Basin Flood Control Project. Significant temporal trends at other sites downstream of Lake Washington were not found with the exception of an increase in low water annual levels at Hwy 46. This increase is associated with increased base flow from the Econlockhatchee River that occurred because of increased urban wastewater treatment system discharges. Rainfall was the most important factor influencing stage and flow downstream of Lake Washington. Multi-decadal patterns in precipitation must be considered when attempting to relate anthropogenic impacts to hydrologic change in this system.

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Integrating Trophy Bass Management into a Modern Multipurpose Flood Control Project: The Farm 13 Experience

Farm 13 is a 2,600 ha wet detention reservoir that was constructed as part of the Upper St. Johns River Basin Project. Primary design objectives of Farm 13 were flood control storage, water quality improvement and agricultural water supply. Since it was flooded in 1990, Farm 13 has also developed into one of the premier trophy largemouth bass fishing lakes in the state. Managing Farm 13 to protect and enhance sport fishery resources while continuing to meet primary objectives of the overall flood control project has created a unique series of challenges. In this presentation we discuss how sport

fishing has been integrated into water management strategies for the reservoir, we discuss potential risks associated with competing water uses, and we grade project area success at meeting multiple goals. Hopefully information obtained from 15 years of management of Farm 13 will provide basis for other agencies or private entities to integrate sport- fishing into the management objectives of other multi-purpose reservoirs.

Ockelmann-LoBello, L. and R. G. Taylor
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A pilot tagging study to determine movement, stock affinity, and possible recruitment sources of common snook (Centropomus undecimalis) in Florida Bay and the Florida Keys

The fishery for common snook in Florida is of paramount importance because of its popularity among recreational anglers and contribution to the state's economy. Strict fishery regulations are updated often to prevent over harvest and ensure robust stocks for the future. Tringali et al. (1996) demonstrated that the Florida population was comprised of two separate stocks, the Atlantic stock and the Gulf stock which is managed with the strictest regulation. Frequent stock assessments are conducted to determine the efficacy of regulations and the condition of the stocks. Three previous stock assessments have identified the lack of, and need for, understanding large-scale annual movement and genetic drift between coastal stocks, and short-term seasonal exchange between local populations, particularly in the critical region of south Florida where stock attributes overlap. The origin of snook in Florida Bay remains unclear particularly since an earlier attempt at defining stock affinity of snook in Florida Bay using otolith microchemistry met with equivocal results (Patterson et al. 2005). Necessary research should be conducted that describes movement and genetic exchange between snook from Florida Bay and snook from the Florida Keys. An external tagging program will provide direct observations of short term, local, regional, and seasonal movement of snook along and between Florida Bay and the Keys. Past research has indicated that snook do not reproduce successfully either in Florida Bay or along the Keys; hence the source of adult recruitment in this region remains to be defined. Tag returns that consistently suggest a 'one way' movement may be construed as a partial recruitment vector and provide some indication for the source of adult recruitment.

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Bioaccumulation of PCBs and mercury in marine fishes off northwest Florida

We examined total PCB and mercury concentration in fishes (n = 375 in 91 composites representing 29 species) collected from nearshore and offshore marine waters off Pensacola, Florida. Muscle tissue with skin removed was dissected from individuals, along with stomachs for gut content analysis and otoliths to estimate fish age. When single fish did not produce ≥150 g of muscle tissue, composites (n = 24) of muscle tissue dissected from more than one similar-sized fish were homogenized. A sub-sample of homogenized muscle tissue from each sample was analyzed for [PCB] with high resolution gas chromatography coupled with high resolution mass spectrometry using USEPA Method 1668A. Sub-samples of muscle tissue also were analyzed with inductively coupled plasma-mass spectrometry to estimate [Hg], and with isotope ratio-mass spectrometry to measure ^{15}N, ^{13}C, and ^{34}S values. Eight samples (all single fish) had [PCB] above the EPA's PCB criterion of 0.2 g kg^{-1}, with the highest

being a king mackerel with [PCB] = 0.92. Fourteen composites exceeded the EPA's mercury criterion of 0.3 mg kg^{-1}, with the highest samples (all single fish) being two red snapper and one greater barracuda with [Hg] = 0.48 mg kg^{-1}. Both [PCB] and [Hg] were significantly correlated ($p < 0.05$) with fish mass, age, length and trophic position (^{15}N) for all samples. Pearson's correlation coefficients generally were higher between those factors and [Hg] (mean r = 0.50) than [PCB] (mean r = 0.27), and increased when individual taxa were analyzed separately (e.g., Serranids, Lutjanids). Results of this study, which is the first comprehensive examination of PCB bioaccumulation in Gulf of Mexico marine fishes, indicate PCBs, as well as Hg, are accumulating in fishes to levels that may affect ecosystem and human health.

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Using science and modeling to resolve uncertainty in river management: A case history from the Colorado River ecosystem below Glen Canyon dam

An adaptive management program is underway in the Colorado River ecosystem below Glen Canyon Dam in Grand Canyon, AZ. The focus of this effort is to identify dam operations and other treatments that can be used to protect natural and cultural resources in Grand Canyon while also meeting the operational needs of Glen Canyon Dam. The adaptive management process assumes that ecosystem responses to management policies are inherently complex and often unpredictable. Because of this complexity, the direction of resource response cannot always be predicted for proposed management actions even when extensive pre-action monitoring programs are able to provide data for predictive model development to evaluate propose action. To respond to the challenge of protecting the natural resources of Grand Canyon, the Glen Canyon Dam Adaptive Management Program has embraced long-term monitoring of key resources (sand and fish), interpretive and predictive modeling exercises to evaluate monitoring data and management actions, and large-scale experimentation (planned and unplanned) to examine restoration options for key abiotic and biotic assets in Grand Canyon. As Florida continues to develop management plans for river resources, it is important to look to other regions of the US and globally to learn from others what approaches have worked, what has not worked, and why.

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Year-class strength, growth, and survival of five fish species in the Suwannee River estuary in relation to river discharge

Understanding effects of river flow on year-class strength of estuarine fishes is important, because anthropogenic withdrawals and lower river flows are an increasing concern in Florida. Freshwater input provides nutrients for primary and secondary production in estuaries, thereby promoting the success of larval and juvenile fishes in estuarine nursery areas. The Suwannee River system is one of the few remaining large river systems in the United States that has no major impoundments. We assessed the relationship between river discharge and year-class strength of spotted seatrout (*Cynoscion nebulosus*), sand seatrout (*Cynoscion arenarius*), red drum (*Sciaenops ocellatus*), pinfish (*Lagodon rhomboids*), and

spot (*Leiostomus xanthurus*) in the Suwannee River estuary. Analyses included nine years of data (1997-2005) collected by the FWRI fisheries-independent monitoring program. Objectives of this study were to determine if relative abundance of selected fish species varied with seasonal river discharge and to assess potential mechanisms by evaluating growth and survival of each species, relative to river discharge. Using multiple regression models, we found a positive correlation between abundance and seasonal river discharge for spotted seatrout, sand seatrout, and red drum. Conversely, pinfish relative abundance was negatively related to river discharge. Spot displayed no significant relationships. Preliminary results suggest a positive correlation between instantaneous daily growth and river discharge for all species except for red drum, for which no significant correlation was found. Instantaneous daily mortality was positively correlated with river discharge for all species except late-recruiting sand seatrout. Our results suggest that altered hydrology due to anthropogenic water withdrawals has the potential to negatively influence estuarine fishes in this system.

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Daily and Seasonal Movements of Adult Red Drum (*Sciaenops ocellatus*) in a shallow Florida lagoon as Determined by Passive Acoustic Telemetry

The red drum, *Sciaenops ocellatus*, is one of the most popular coastal sportfishes in the southeastern United States and supports a large recreational and guide fishery throughout the northern Indian River Lagoon (IRL) system, Florida. Evidence is mounting that many adult IRL red drum forego offshore migrations and instead spawn within estuarine waters where they are targeted year round by anglers, often at known locations. Given the continued expansion of the fishery, concern as to the sustainability of this estuarine population is well warranted, especially if these schools are long term estuarine residents. In this ongoing study, we use an array of twenty-seven acoustic receivers to autonomously monitor both daily and seasonal movement patterns of adult red drum in Mosquito Lagoon, a 159 km^2 sub-basin of the IRL system. Since May 2006, twenty-two adult red drum (98 cm mean FL) have been tracked for up eight months (and counting) resulting in over 75,000 position detections. While individuals typically exhibited site residency for several weeks duration, often displaying predictable diel activity patterns, intra-estuarine movement increased markedly during spawning months (August – October) with most fish eventually utilizing a large portion of southern Mosquito Lagoon. To date, however, only a single individual has emigrated to Atlantic Ocean waters through nearby Ponce Inlet with many fish temporarily moving into lower salinity of the IRL proper via Haulover Canal. Continued tagging and monitoring efforts in the coming year will provide further insights as to red drum spawning behavior, site fidelity, and mortality rates.

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Scientific Applications of Industrial ROVs in the Deep Waters of the Gulf of Mexico

On most of the 3,500 petroleum platforms in the Gulf of Mexico, remotely operated vehicles (ROVs) are used to work in deep water to inspect and troubleshoot the petroleum drilling process. The SERPENT project is a global academic-industrial partnership that uses ROVs to explore areas of the ocean that scientists rarely get the chance to study. In July and August 2006, through a SERPENT project operated by Louisiana State University and funded by NOAA, we visited ROV teams aboard Gulf of Mexico oil platforms/ships contracted by British Petroleum. With the help of ROV operators, we conducted water column surveys and analyzed a variety of planktonic organisms in the deep waters of the Gulf of Mexico. Video obtained from the ROVs was reviewed in the laboratory to classify the array of species by site and depth around petroleum platforms.

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A new method for collecting mangrove rivulus (Kryptolebias marmoratus) and assessing microhabitat associations

The mangrove rivulus is a self-fertilizing hermaphroditic fish that inhabits crab burrows and leaf litter in the mangrove intertidal zone of south Florida. Due to the structurally complex nature of these microhabitats, collection of this species is often difficult. In this study we present a new method for directed collection of *K. marmoratus* using a shallow trench trap sunk into the mangrove forest floor. This design was inspired by routine collection of rivulus in perimeter trenches of 6m^2 bottomless lift nets used for sampling mangrove- associated fish in the Everglades. Trench traps used in the current study consisted of 3.05 meter pieces of "U"- shaped aluminum trenching (7.6cm high x 10.2cm wide) installed flush with the sediment surface within the intertidal zone of mangrove forests. Each trench contained a folded panel of 3 mm delta mesh netting into which rivulus were expected to accumulate. To test this method, we selected three locations for trap installation in mangrove forests adjacent to mosquito-control ditches at Weedon Island Preserve, St. Petersburg, Florida. Three traps were placed at each location at varying distances from the bank of the ditch, opened on the low rising tide for one tidal cycle, and then checked for the presence of fish. In addition to collecting catch-per-unit-effort data, we measured crab burrow density, leaf litter biomass, and percent soil moisture data at each of the 9 trench locations. Relative abundance data will be correlated with site-specific physical parameters to characterize the pattern of microhabitat use by rivulus in this altered mangrove wetland in the Tampa Bay estuary.

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Lake Okeechobee's littoral fish community responses to hurricanes

Habitat diversity and complexity largely influence fish community structure and population dynamics. Aquatic macrophyte abundance affects community interactions (e.g., food web dynamics) and therefore has been related to species diversity and population production rates. Thus, large scale changes to macrophyte abundance and distributions may result in lake-wide changes in fish community structure. Lake Okeechobee, Florida, was impacted by 3 hurricanes during 2004-2005 that resulted in lake-wide changes to littoral habitats (i.e., > 75% lake-wide loss of aquatic vegetation). We sampled the littoral

fish community during the summer of 2003 and 2004 (i.e., pre-hurricane) and again in summer 2006 (i.e., post-hurricane). We found decreased species diversity, species richness, total biomass, and centrarchid biomass following hurricanes. Loss of complex vegetated littoral habitats also resulted in increased biomass of open water species (i.e., shad, *Dorosoma* spp.; and silversides *Labidesthes sicculus*). Our results illustrated rapid responses of the littoral fish community to large scale natural disturbances and we concluded that the impacts of those disturbances were likely magnified by modifications to the lake's hydrology.

Sauls, B. and B. Kalmeyer
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A Pilot Survey of the Recreational Headboat Fishery in Florida

Headboats are large passenger vessels that charge a per-person fee to take anglers on recreational fishing trips. There are approximately 100 such vessels currently operating throughout Florida. In 2005, the Fish and Wildlife Research Institute began a pilot survey of recreational headboats around the state. We will present preliminary results from the first two years of the pilot headboat survey in Florida.

The objectives of the pilot survey are to:

- Estimate recreational fishing effort from headboats.
- Estimate harvest and released catch from headboats.
- Obtain species composition and size distribution information from both harvested and released fish.
- Observe and record release conditions for discarded fish.

Headboat captains have reported their fishing activities to the National Marine Fisheries Service Southeast Logbook Program since the 1970's. This pilot survey uses survey methods similar to those used for estimating catch and effort from other types of for-hire fisheries in Florida, including fishing from smaller charter and guide vessels. The pilot survey methodology includes procedures for field validating self-reported trip data, and biologists observe recreational fishing to gather catch information directly. Recreational catch and effort estimates from the pilot survey will be compared with unvalidated logbook data to evaluate methods for monitoring the headboat fishery.

As recreational fisheries are increasingly managed through a suite of restrictions on the size and number of fish that may be retained for harvest, information on discarded catch is becoming increasingly important for assessing stocks of recreational fisheries. Stock assessment analysts are forced to make assumptions about the species composition, size distribution, and release condition of discarded fish in recreational fisheries in the absence of quantitative data. This pilot survey is the first large-scale fishery dependent data source in the region that provides this detail on discarded recreational catch.

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Early explorers and settlers described Lake Okeechobee as having clear water and a hard sand, muck and shell bottom. Pre-settlement, the lake was surrounded by cypress and pond apple hammocks, which, on its southern margin, merged into the sawgrass marshes of the Greater Everglades. Water flowed south

from the lake, hydrating the marshes and possibly periodically purging the lake of accumulated sediment during storms and flooding events. Settlement brought with it the deepening and straightening of natural waterways, channelization and drainage of surrounding lands, and the eventual encirclement of the lake by The Herbert Hoover Dike; which in turn resulted in significant environmental damage and habitat loss, largely as a result of increasing nutrient and sediment loads and the maintenance of unnaturally high lake levels.

Current federal and state restoration efforts aim to reduce nutrient inputs to the lake and provide water storage through the construction of reservoirs, aquifer storage and recovery wells and other technologies to enable the lake to be operated under a more environmentally sound hydroperiod regime without compromising the flood control and water supply needs of South Florida, but problems and challenges still remain.

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Use of tidal freshwater and oligohaline habitat by marine fishes in the Caloosahatchee River estuary, southwest Florida

Euryhaline fishes able to survive the harsh conditions associated with low salinities of the upper estuary are thought to benefit from reduced competition, lower predator pressure, and an abundant food supply. Consequently, tidal rivers are important to the life histories of many estuarine and marine fishes. In the Caloosahatchee River estuary, high-quality information on juvenile fish communities is being developed that may be useful when gauging the effects of natural and anthropogenic disturbances, and changes in water delivery associated with water management. Tidal freshwater and oligohaline portions of major rivers also serve as habitat for larger fishes such as juvenile smalltooth sawfish (*Pristis pectinata*) and adult common snook (*Centropomus undecimalis*). Sawfish are born in the lower reaches of major southwest Florida rivers and results of ongoing multigear sampling indicate that juvenile sawfish use riverine shorelines for up to two years before egressing from the river systems. Adult snook spend much of the year along open estuarine shorelines and ocean passes, but are thought to move into major rivers during winter to find thermal refuge; a paradigm that has never been formally tested. Electrofishing surveys were conducted in three major rivers to determine the seasonal abundance of snook. Relative abundance of snook collected in rivers doubled during fall and winter coinciding with a similar decrease in snook abundance in fisheries-independent seining in the lower estuary. These results provide evidence of overwintering; however, a relatively high abundance of snook still remaining in rivers during summer suggests that a portion of the population may be resident. An acoustic receiver array established in the Caloosahatchee River is providing data that are useful for understanding factors that influence the movement patterns of these two large marine species.

Switzer, T. S., R. F. Heagey and J. Burd
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Fish movement and estuarine MPAs: does size matter?

Marine protected areas (MPAs) are becoming an increasingly common management alternative based on the perception of increased abundance and expanded size structure of exploited species within protected boundaries. The importance of reserve size and mobility of target species in determining the efficacy of MPA establishment has been well-documented in marine systems, although few studies have been conducted on estuarine-dependent fishes. The Florida Fish and Wildlife Conservation Commission's Fish and Wildlife Research Institute conducted a mark-recapture study to examine movements of red drum (*Sciaenops ocellatus*) and common snook (*Centropomus undecimalis*) tagged within a small (8 km^2), de facto MPA surrounding the MacDill Air Force base and a nearby, fishable area adjacent to Weedon Island in Tampa Bay. In total, 2,589 red drum and 2,731 common snook were tagged and released from June 2004 through May 2006, of which 182 red drum and 192 common snook were subsequently recaptured. The majority of individuals of both species were recaptured within 2 km of their original tagging location, and most common snook (89%) and red drum (75%) were recaptured within the study area in which they were originally released. Differences between the two species were evident with respect to the average distance between tag and recapture locations, and were primarily related to large (> 25 km), ontogenetic movements of larger red drum into the lower estuary and nearshore Gulf of Mexico. These results indicate that small, estuarine MPAs may offer some protection to estuarine-dependent fishes, although it is likely that potential benefits are heavily dependant on species-specific life history characteristics.

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Predation by *Lepomis* spp. on populations of invasive crayfish *Orconectes rusticus* in four northern Wisconsin lakes.

The introduction and spread of non-native species around the globe is a prominent issue for ecologists and natural resource managers alike. Nevertheless, the role of native predators in species invasions is rarely quantified. One such example is the invasion of rusty crayfish in northern Wisconsin lakes. Abundant rusty crayfish often have negative impacts on littoral zone communities, including macrophytes, invertebrates, and some fish. However, rusty crayfish do not become abundant in all lakes, and the role of native fish predators as a determinant of rusty crayfish impacts is subject to some debate. Herein, we describe our effort to quantify the effect of predation by native sunfish (*Lepomis* spp.) on populations of the invasive rusty crayfish (*Orconectus rusticus*) in four northern Wisconsin lakes. We conducted a case study of *Lepomis* predation on rusty crayfish in four lakes in northern Wisconsin to determine if *Lepomis* predation on crayfish was capable of controlling rusty crayfish abundance in some lakes. We determined the effect of predation by comparing consumption estimated with fish bioenergetics models to surveys of crayfish abundance in each lake. Our results indicate that *Lepomis* spp. are important crayfish predators and, where *Lepomis* are extremely abundant, have the ability to constrain rusty crayfish populations. Therefore, *Lepomis* spp. could be an important component of ecosystem resilience to impacts of rusty crayfish invasions.

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Diet compositions and growth rates of black crappie *Pomoxis nigromaculatus* relative to benthic food availability at three Florida lakes.

Factors influencing black crappie *Pomoxis nigromaculatus* growth are an important research need for management of black crappie fisheries. We evaluated the diets and growth of black crappie in relation to their population structures (e.g., abundance) and benthic food availability among three Florida systems: Lakes Lochloosa, Marian, and Monroe. The simplified Morisita index was used to measure similarity of diet contents (i.e., mean numbers) relative to benthic macroinvertebrate densities throughout sampling periods. Black crappie at Lake Monroe obtained the largest size at age, whereas Lake Marian had the smallest size at age. Lake Marian had the highest abundances of black crappie based on otter trawl mean catch per unit effort data and Lochloosa Lake had the lowest abundance. Differences in prey availability were related to diet composition across lakes. Results were variable for different taxa, but indicated that benthic prey availability can influence consumption rates of prey items by black crappie, particularly for more utilized taxa. Manly's *α* index of selectivity resulted in two major trends. First, black crappie at Lakes Lochloosa and Marian were consistently selective of Diptera pupae. Secondly, black crappie at Lake Monroe were consistently selective of Mysidacea *Americamysis almyra*. The diet, prey availability, and population structure differences among lakes likely contributed to the variation in black crappie growth rates.

Vecchio, J. L. and T. S. Switzer

Poster presentation

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A preliminary examination of abundance and distribution of sub-adult and adult fishes in Tampa Bay

The estuaries of west central Florida provide important habitat for many commercially and recreationally important finfish species. Since 1996 the Florida Fish and Wildlife Conservation Commission's Fisheries Independent Monitoring (FIM) program has conducted stratified-random sampling of shoreline habitats using a 183-m haul seine to characterize the near-shore assemblages of large (≥100 mm SL) sub-adult and adult fishes in the Tampa Bay estuary. These data were summarized to identify dominant species as well as detect patterns of diversity through space and time. Throughout Tampa Bay, catches were dominated numerically by pinfish (*Lagodon rhomboides*); although recreationally important species such as common snook (*Centropomus undecimalis*) and red drum (*Sciaenops ocellatus*) were also quite abundant. Species richness and H' diversity of catches were generally highest in central regions of the bay and lowest near the mouth of the bay. These parameters also fluctuated on both a monthly and inter-annual basis. Across years, lowest species richness and H' diversity values were observed during January and February, corresponding with the coolest water temperatures. Species richness and H' diversity were also significantly higher when either overhanging vegetation ($t=5.32$, $p<0.001$) or submerged aquatic vegetation ($t=2.81$, $p<0.001$) were present as compared to unvegetated shorelines and unvegetated sediments respectively. Both overhanging vegetation and benthic vegetation provide increased cover and complexity, traits which have been shown to be exploited by many fish species. These results highlight the importance of highly structured habitats for a variety of finfish species within the Tampa Bay estuary.

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Symposium Platform presentation

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The Effects of Sustained High Water Levels and Declining Bulrush (*Scirpus californicus* and *S. validus*) Abundance on Lake Okeechobee's Largemouth Bass Fishery

Sustained high water levels in Lake Okeechobee, Florida resulted in an appreciable decline of adult giant bulrush (*Scirpus* sp.) stems at three transects over a six year period. The loss of bulrush in conjunction with high water significantly ($P < 0.05$) influenced the catch rates of largemouth bass (*Micropterus salmoides*) during fall electrofishing at two of the transects over the same time period. As lake level increased and bulrush stems declined, the number of largemouth bass collected in these areas was reduced.