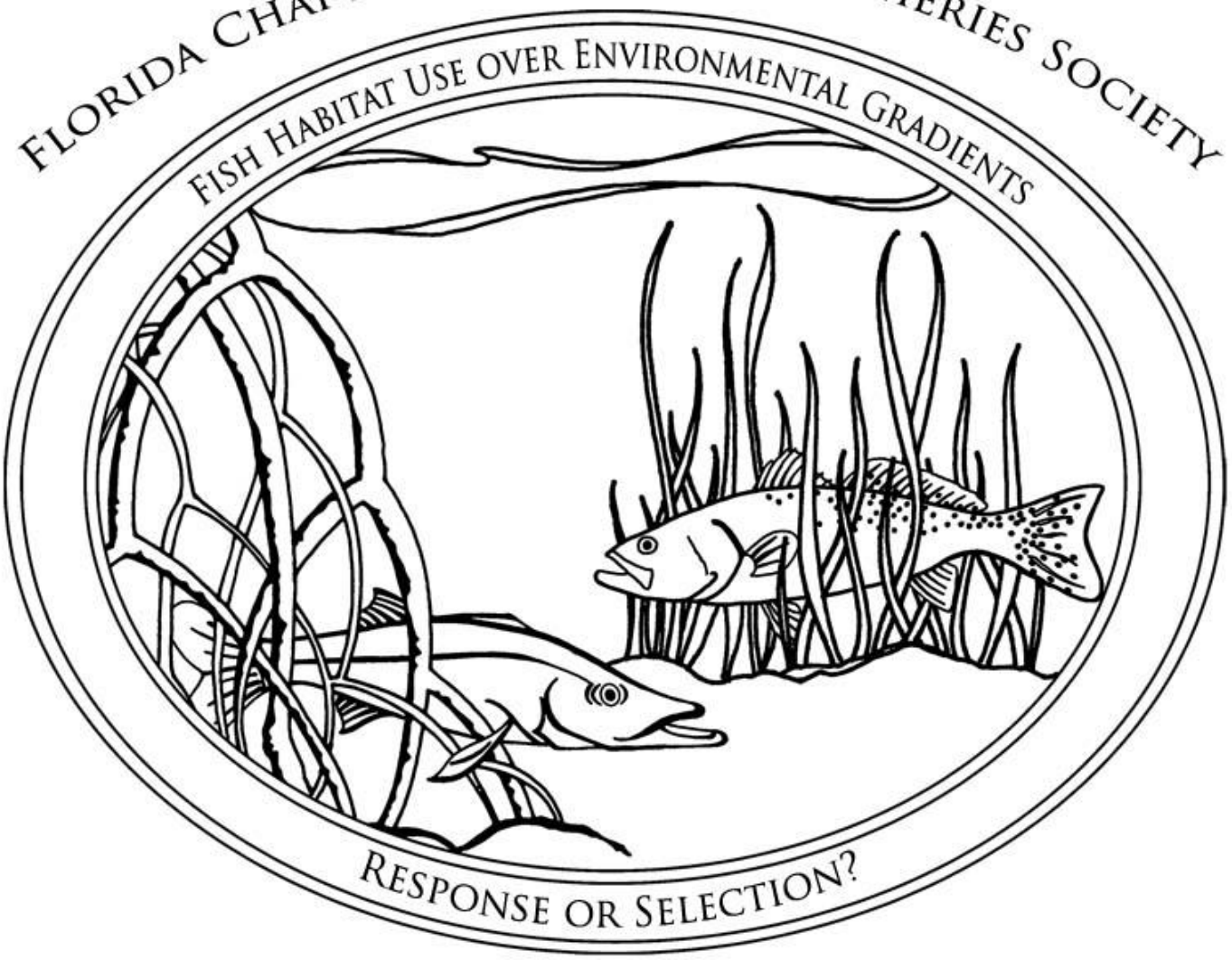
32nd Annual Meeting of the Florida Chapter of the American Fisheries Society



February 21-23, 2012

4-H Camp Ocala, Altoona, Florida

The Florida Chapter of the American Fisheries Society

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President-Elect: Kerry Flaherty, FWC

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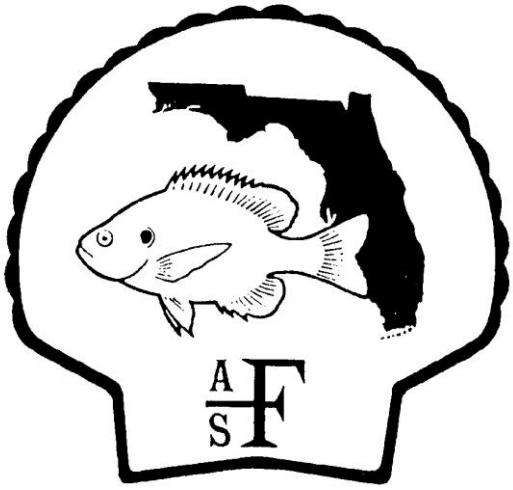

Thank you!

Thanks to the invited speakers!

Thanks to everyone for their symposium and contributed presentations!

Thanks to all the moderators and judges!

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32nd Annual Meeting of the Florida Chapter American Fisheries Society

February 21-23, 2012

4-H Camp Ocala, Altoona, Florida

General Program

Tuesday, February 21

11:00am – 6:00pm	Registration
12:00pm – 1:00pm	Lunch
1:00pm – 4:45pm	Contributed Papers
4:45pm – 5:15pm	***Tribute to Jack Dequine***
5:15pm – 7:00pm	Poster Setup
6:00pm – 7:00pm	Dinner
7:00pm – 8:00pm	Formal Poster Session Followed by the *bonfire social*

Wednesday, February 22

7:00am – 8:00am	Breakfast
7:30am – 6:00pm	Registration
8:00am – 12:05pm	**Symposium:** ***Fish habitat use over environmental gradients: response or selection?***
12:05pm – 1:00pm	Lunch
1:00pm – 5:05pm	**Symposium** (continued); Contributed Papers
5:05pm – 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 Professional Awards –Rich Cailteux Followed by **THE RAFFLE, AUCTION,** and the *bonfire social*

Thursday, February 23

7:00am – 8:00am	Breakfast
7:30am – 9:00am	Registration
8:00am – 11:45am	Contributed Papers
11:45am – 12:45pm	Lunch
12:45pm – 1:00pm	**Awards presentation**: Best Papers/Best Posters; Power Tie and Lampshade Awards

Day-By-Day Agenda – 32nd Annual Meeting - Florida Chapter American Fisheries Society

Tuesday, February 21

11:00am – 6:00pm **Registration**
12:00pm – 1:00pm **Lunch**
1:00pm – 1:10pm **Welcome – Dave Kerstetter, Chapter President**

Contributed Papers **Moderator:** Dave Kerstetter, NSU

1:10pm - Reyier, E., D. Abercrombie, E. Ault, G. Burgess, D. Chapman, J. Dutka-Gianelli, B. Franks, S. Gruber, J. Iafrate, J. Imhoff, Z. Jud, C. Kalinowsky, S. Kessel, C. Koenig, C. Layman, J. Ley, J. Provancha, D. Scheidt, R. Taylor, J. Whittington, and J. Young. An Introduction to the Florida Atlantic Coast Telemetry (FACT) Array

1:30pm - Scheidt, D.M., E.A. Reyier, C.M. Garreau, R.H. Lowers, and K.G. Holloway-Adkins. Multi-Year Movement Patterns of Adult Black Drum (*Pogonias cromis*) in Estuarine and Coastal Waters of East-Central Florida

1:50pm - Dutterer, A.C., M.S. Allen, and W.E. Pine III. Evaluation of spawning run American Shad spatial distribution and habitat use via acoustic telemetry gear at the St. Johns River, Florida

2:10pm - Young, J., E. Ault, A. Berry, J. Dutka-Gianelli, S. Marsh, G. Stoecklin, R. Taylor, A. Trotter, J. Whittington, and B. Yeiser. Individuality in a generalist species: a look into common snook spawning movements

2:30pm - *Hollensead, L., J. Carlson, D. Bethea, and R.D. Grubbs. Monitoring movement patterns of juvenile smalltooth sawfish (*Pristis pectinata*) using acoustic monitoring and tracking in a nursery habitat in southwest Florida

2:50pm – Break

Contributed Papers **Moderator:** Douglas Scheidt, NASA

3:05pm - *Lawson, L.L., J. E. Hill, S. Hardin, L. Vilizzi, and G.H. Copp. Adaptation and Evaluation of the Fish Invasiveness Scoring Kit (FISK) as a Risk Assessment Screening Tool for Non-native Fishes in Florida

3:25pm **-** *Gandy, D.A., J.S. Rehage, J. Kline, K.R.T. Whelan, and R. Urgelles. Nonnative Fishes in Freshwater Canals of the Florida Everglades: Implications for Management

3:45pm - *Haug, E.A., and J.E. Hill. Predator/prey Interactions between *Micropterus salmoides, Gambusia holbrooki*, and Non-native, Small-bodied Fish

4:05pm - Hill, J. E., K.B. Gestring, L.L. Lawson, M.S. Stanford, and E.A. Haug. Experimental Prey Selection by Non-Native Bullseye Snakehead *Channa marulius* from southern Florida

4:25pm – *Barbour, A., R. Boucek, and A. Adams. Effect of pulsed gastric lavage on apparent survival of a juvenile fish in a natural system

4:45pm – ***Tribute to Jack Dequine***

5:15pm – 7:00pm **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)
Followed by the *bonfire social*

*student presentation, person presenting

Poster Session (7:00pm – 8:00pm)
(In alphabetical order by presenting author)

Binder, B., A. Acosta, D. Morley, T. Kellison, C. Taylor, and A. Gleason. Estimating Fishing Intensity on Spawning Aggregation Sites by Means of Aerial Survey in the Florida Keys

*Campbell, C.A., D. Parkyn, and D. Murie. Otolith shape as a tool for examining stock structure in Gulf of Mexico greater amberjack

*Michael, C., J. Bennett, J. Carter III, K. Fitzpatrick, C. Flight, C. O'Brien, C. Petrilla, H. Ramirez, K. Mack, and W.A. Szelistowski. Genetic Structure of Chain Pipefish *Syngnathus louisianae* and Dusky Pipefish *Syngnathus floridae* populations in Florida

De Angelo, J., P. Stevens, D. Blewett, and T. Switzer. Differences in large-bodied fish assemblages between shoal and shoreline-associated seagrass beds in eastern Gulf of Mexico estuaries

DeVries, D., C. Gardner, J. Brusher, and P. Raley. Distribution and abundance patterns of several reef fish species among different hard bottom habitats in the NE Gulf of Mexico

*Edwards, M.A., T.K. Frazer, C.A. Jacoby, and M.S. Allen. Preliminary Estimates of Growth for the Indo-Pacific red lionfish (*Pterois volitans*) from Little Cayman Island, B.W.I.

Stafford, C., T.S. Switzer, K.E. Flaherty, R.E. Matheson, Jr., and R. Paperno. Geographic Variability in Seagrass-Associated Nekton Assemblages Determined by a Trawl Survey in the Eastern Gulf of Mexico

Gardner, C., D. DeVries, P. Raley, and J. Brusher. Relationships between reef characteristics and reef fish community structure and demographics in the NE Gulf of Mexico as revealed by video and side scan sonar data

*Gardner, P., T.K. Frazer, C.A. Jacoby, and R.P.E. Yanong. Reproductive Traits of Lionfish from Little Cayman: Insights into a Range-Expanding Invader

Hargrove, J., M.I.A. Guevara, and J.D. Austin. Genetic homogeneity but not panmixia of *Colossoma macropomum* at the Pacaya Samira National Reserve, Peru

*Hartman, C., M.E. Call, and A. Schworm. Ongoing Fish Community Evaluation in Four Anthropogenically Impacted Tributaries of the Peace River, Florida

*Khamesi, S, and D.W. Kerstetter. Probability-based Analysis of Pilot Whale-Pelagic Longline Interactions

McBride, R.S., S. Somarakis, G.R. Fitzhugh, A. Albert, N.A. Yaragina, M.J. Wuenschel, A. Alonso-Fernández, and G. Basilone. Effects of food availability on egg production in relation to fish reproductive strategies

Nelson, E. Black Creek Crayfish (*Procambarus pictus*) Baseline Survey at Camp Blanding Joint Training Center in Stark, Florida

Raley, P., C. Gardner, H. Trowbridge, and D. DeVries. Distribution and characterization of hard bottom habitat in cross-shelf side scan transects in Apalachee Bay, Florida

*Tzadik, O. Do fin rays and otoliths tell the same story? Comparing microchemistries of calcified structures

Poster Session (continued)

*Van Woudenberg, L., A. Alvarez, M. Tringali, and W. Szelistowski. Use of microsatellite DNA to assess genetic differences between bonnethead sharks, *Sphyrna tiburo*, from two areas in Florida

*Vecchio, J., and C. Stallings. Comparison of Reef Fish Assemblages Sampled Using Common Fishery-Independent Techniques

Keene, K., S. Cushner, and M. Walia. Length Frequency Distributions of Yellowfin Tuna Caught on Circle and 'J' Hooks

Day-By-Day Agenda – 32nd Annual Meeting - Florida Chapter American Fisheries Society

Wednesday, February 22
7:30am – 6:00pm **Registration**
7:00am – 8:00am **Breakfast**
8:00am – 8:10am **Welcome – Kerry Flaherty, Chapter President-Elect, Program Chair**

Symposium: *Fish habitat use over environmental gradients: response or selection?*

Symposium **Moderator:** Kerry Flaherty, FWC

8:10am – Peebles, E. Assembled habitat gradients, strong inference, and linking fitness to function in fish communities

8:30am – MacDonald, T. Habitat Linkages and Estuarine-Dependent Fish

8:50am – Dutka-Gianelli, J., R. Taylor, E. Nagid, J. Whittington, K. Johnson, W. Strong, T. Tuten, A. Trotter, S. Marsh, J. Young, A. Berry, B. Yeiser, and K. Nault. Habitat utilization and resource partitioning of apex predators in coastal rivers of southeast Florida

9:10am – Stevens, P., and G. Poulakis. Juvenile fish use of specific locations within the environmental gradients of coastal rivers

9:30am – Rubec, P.J., R. Kiltie, L. McEachron, R. Flamm, and E. Leone. Development of Zero-Inflated Gamma and Beta Models To Support Habitat Suitability Modeling In Florida Estuaries

9:50am – Froeschke, J.T., and B.F. Froeschke. Spatio-temporal predictive model based on environmental factors for juvenile spotted seatrout in Texas estuaries using boosted regression trees

10:10am – Break

Symposium (continued) **Moderator:** Eric Nagid, FWC

10:25am – Flaherty, K.E., R.E. Matheson, Jr., and R. Paperno. Juvenile spotted seatrout (*Cynoscion nebulosus*) habitat use in Tampa Bay: the effects of seagrass bed architecture, seagrass species composition, and varying degrees of freshwater influence

10:45am – Smith, K., J.K. Carlson, C. Horn, and K. Shotts. Status and Population Viability of the Alabama shad (*Alosa alabamae*)

11:05am – *Wagner, C. W., and J.K. Craig. Effects of Hypoxia on the Spatial Distribution of Marine Megafauna in the Northwestern Gulf of Mexico

11:25am – Rindone, R.R., G.T. Kellison, and S.A. Bortone. The Search for Juvenile Red Snapper *Lutjanus campechanus* in Southeastern US Atlantic Waters

11:45am – *Fenton, J., A. Mariano, and D. Kerstetter. Post-Release Survival and Habitat Utilization of Juvenile Swordfish in the Florida Straits

12:05pm – Lunch

Symposium (continued) **Moderator:** Tim MacDonald, FWC

1:00pm – *Wilson, K.L., M.S. Allen, D. Gwinn, and M. Netherland. Quantifying fish detection probabilities with video cameras in dense submersed vegetation

1:20pm – Vecchio, J.L., T.S. Switzer, and S.F. Keenan. Integration of Stationary Underwater Video Camera Observations with Multibeam Acoustic Mapping to Evaluate Habitat Use by Reef Fishes in the Florida Middle Grounds

1:40pm – *Boucek, R., and J. Rehage. Resource Partitioning Among Three Mesoconsumers at a Marsh Mangrove Ecotone: A Response To a Seasonal Resource Pulse Subsidy

2:00pm – Bethea, D.M., K.L. Smith, and J.K. Carlson. Environmental Effects on the Recruitment of Smalltooth Sawfish, *Prisits pectinata*, in Southwest Florida, USA

2:20pm – Dutterer, A.C., C. Mesing, R. Cailteux, M.S. Allen, W.E. Pine III, and A. Strickland. Fish recruitment is influenced by river flows and floodplain inundation at the Apalachicola River, Florida

2:40pm – Symposium Concluding Remarks and Open Discussion

2:50pm – Break

Contributed papers **Moderator:** Gary Fitzhugh, NOAA

3:05pm – Bradshaw, C., and B. Sauls. Automated Video Assessment of Recreational Discards

3:25pm – Lang, E.T., and G. Fitzhugh. Can we expand at-sea sampling for fish reproductive potential using frozen ovaries?

3:45pm – Sauls, B., and O. Ayala. Circle Hook Requirements in the Gulf of Mexico: Are They Working?

4:05pm – *Matthias, B.G., C. Monk, M.S. Allen, and D. Gwinn. Impact of fish movement between areas vulnerable and invulnerable to angling on fisheries sustainability

4:25pm – Tyler-Jedlund, A., K.E. Flaherty, B.L. Winner, and J. Davis. Discard mortality rates for gray snapper and gag within a Florida gulf coast estuary and nearshore waters

4:45pm – *Vaughan, N.R., J.S. Ault, and T. Gedamke. Length-based Mortality Methods for Sustaining Florida's Fisheries

5:05pm – 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

Professional Awards – Rich Cailteux

Followed by **THE RAFFLE, AUCTION**, and the ***bonfire social***

*student presentation, person presenting

Day-By-Day Agenda – 32nd Annual Meeting - Florida Chapter American Fisheries Society

Thursday, February 23

7:30am – 9:00am **Registration**
7:00am – 8:00am **Breakfast**
8:00am – 8:10am **Announcements**

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

8:10am – *Shaw, S.L., S.M. Stephens, and M.S. Allen. Intra and interspecific density effects on largemouth bass *Micropterus salmoides floridanus* spawning behavior

8:30am – *Van Woudenberg, L., C. Daniels, S. Burghart, R. Kitzmiller, E. Peebles, and M. Breitbart. Genetic identification of single fish eggs for a community analysis of fish spawning in Terra Ceia Bay, Florida

8:50am – *Charpentier, C., and R.C. Chambers. Effects of temperature and salinity on the pre-feeding life stages of summer flounder, *Paralichthys dentatus*

9:10am – *Smith, G., D. Murie, and D. Parkyn. Implications of Skewed Sex Ratios on Population Dynamics of Greater Amberjack

9:30am – *Lombardi, L., and H. Lyon. Evidence for hermaphroditism in Golden Tilefish (*Lopholatilus chamaeleonticeps*)

9:50am – Break

Contributed Papers **Moderator:** Linda Lombardi, NOAA

10:05am – Parkyn, D. C., D.J. Murie, J.D. Austin, G. Smith, C.A. Campbell, and F. Carvalho. Influences on observed patterns of movement of greater amberjack *Seriola dumerili* in the Gulf of Mexico.

10:25am – *Weidner, T., C.F. Cotton, and D.W. Kerstetter. Habitat utilization and short-duration movements of the pelagic stingray *Pteroplatytrygon violacea* in the western North Atlantic and northern Gulf of Mexico

10:45am – *Moore, T. A., and D.W. Kerstetter. Trophic Dynamics and Ecosystem Changes within the SE Florida Coastal Pelagic Fish Community

11:05am – *Settevendemio Bradshaw, E., M. Rudd, M.S. Allen, and M. Netherland. Spatial and temporal dissolved oxygen dynamics and evaluation of fish habitat loss due to hypoxia in hydrilla

11:25am – *Barrientos C.A., and J.E. Hill. Seasonal fish association in littoral areas with submerged aquatic vegetation in Lake Petén Itza, Guatemala

11:45am – 12:45pm Lunch

12:45pm – 1:00pm Awards Presentation:
Best Oral Presentation- Student and Professional
Best Poster Presentation - Student and Professional
Power Tie and Lampshade awards

Abstracts for the 32nd Annual Meeting of the Florida Chapter American Fisheries Society
(In alphabetical order by presenting author, *student presentation, person presenting)

***Barbour, A.[1], R. Boucek[2], and A. Adams[3]**
Student ▪ Contributed presentation
[1]University of Florida, SFRC, Program of Fisheries and Aquatic Sciences, Gainesville, FL
[2]Florida International University, Department of Earth and Environmental Studies, Miami, FL
[3]Mote Marine Laboratory, Charlotte Harbor Field Station, FL
snook@ufl.edu

Effect of pulsed gastric lavage on apparent survival of a juvenile fish in a natural system
Dietary studies are essential for studying trophic dynamics, and are often based on analysis of stomach contents. A popular method to collect stomach contents is the use of pulsed gastric lavage (PGL), wherein a stream of pressurized water forces an individual to regurgitate food items. Most past experimental studies have shown no effect of PGL on survival, but these studies are limited to laboratory or cage experiments, thereby controlling for natural effects such as predation or emigration. Using a mark-recapture/resighting approach, we determined the effect of PGL on apparent survival (ϕ = 1 – mortality - emigration) in a natural system. In two study sites, we marked a total of 200 juvenile common snook, *Centropomus undecimalis* (Bloch 1792), with PIT tags, lavaged 89 of these individuals, and resighted 90% of marked fish at least once with a telemetry array. Using the Barker survival model, we determined a significant effect of PGL on apparent survival through $QAIC_c$ model selection, 95% confidence intervals of parameter estimates, and likelihood ratio testing (P = 0.017). The PGL effect reduced $QAIC_c$ model averaged maximum likelihood estimates of apparent survival by 12.0 – 17.4%. Since we estimated apparent as opposed to true survival, we could not partition lethal and sublethal (emigration) effects. Regardless of the mechanism, we found PGL affected individuals, which is contrary to most previous controlled studies finding no effect. Future researchers using PGL must consider the influence of potential lethal/sublethal effects in natural settings when designing studies.

***Barrientos C.A.[1], and J.E. Hill[2]**
Student ▪ Contributed presentation
[1]University of Florida, SFRC, Program in Fisheries and Aquatic Sciences, Gainesville, FL 32653
[2]University of Florida, SFRC, Program in Fisheries and Aquatic Sciences, Tropical Aquaculture Laboratory, Ruskin, Florida 33570.
cabc@ufl.edu

Seasonal fish association in littoral areas with submerged aquatic vegetation in Lake Petén Itza, Guatemala
Lake Petén Itza is a large (100 km^2) natural lake in the Yucatan region of northern Guatemala. Fish community composition was assessed using rotenone block nets (100 m^2) during five months of the year (2010-2011) in the most common vegetated, littoral habitats. *Vallisneria americana* was the dominant plant species present in the littoral zone with lesser amounts of other species (e.g., *Potamogeton* sp and *Chara* sp). We collected 20 fish species. The three most common (*Thorichthys meeki*, *Cichlasoma urophthalmum* and *Poecilia mexicana*) represented 75% of the fish biomass in the littoral zone. Total fish biomass was significantly different among months, with July having the lowest fish biomass. Fish density did not differ significantly among months sampled. Total fish species richness was similar (8-11 species) among months, but community composition changed with the rainy season. Some species showed significant differences in biomass and density, like *T. meeki*, which had the highest density and biomass in March (dry season) and the lowest in July (rainy season). *Petenia splendida*, which supports the most important subsistence fishery at the lake, was not significantly different among months. Two species of non-native fish were found in the rainy season (*Oreochromis niloticus* and *Pterygoplichthys* sp.); but only a few individuals were collected. The vegetated littoral zone should be a priority habitat for conservation due to the

richness and abundance of fish present and because of its importance to *P. splendida* juveniles.

Bethea, D.M., K.L. Smith, and J.K. Carlson
Symposium presentation
NOAA, National Marine Fisheries Service, Panama City, FL 32408
dana.bethea@noaa.gov

Environmental Effects on the Recruitment of Smalltooth Sawfish, *Prisits pectinata*, in Southwest Florida, USA

The completion of the Smalltooth Sawfish Recovery Plan initiated a new phase of conservation objectives for the US population of smalltooth sawfish, *Prisits pectinata*. Research and monitoring priorities identified in the Recovery Plan include monitoring recruitment and juvenile abundance in designated critical habitat and identifying affecting factors. Over the last 3 years, major environmental differences existed during peak times of hypothesized recruitment of neonates. Early 2010 posted unusually cold air temperatures for southwest Florida, resulting in the mortality of over 200 Florida manatee and several species of teleosts fish. Average backwater temperature in February 2010 was 17 ^{o}C; whereas, temperatures in other years were above 23 ^{o}C. Additionally, southwest Florida experienced unusually high rainfall during the "dry season" (December – May) and usually low rainfall during the "wet season" (June – November) in 2010, causing average backwater salinity to drop below 10 at certain times. In 2010, we experienced a significant decline in juvenile smalltooth sawfish recruitment over previous years with annual catch-per-effort dropping from 0.12 to 0.06 animals per net hour. In addition, juvenile smalltooth sawfish were not captured in 2010 until June when they are historically first encountered in late-March. We believe the unusually colder temperatures and lower salinity levels are the cause of the lower catch rates in 2010 and may be indicative of a recruitment failure.

Binder, B.[1], A. Acosta[1], D. Morley[1], T. Kellison[2], C. Taylor[3], and A. Gleason[4]
Poster presentation
[1]Florida Fish and Wildlife Conservation Commission, Fish and Wildlife Research Institute, Marathon, FL
[2]NOAA, National Marine Fisheries Service, SEFSC, Beaufort, NC
[3]NOAA, National Ocean Service, CCFHR, Beaufort, NC
[4]University of Miami, Physics Department, Coral Gables, FL
ben.binder@myfwc.com

Estimating Fishing Intensity on Spawning Aggregation Sites by Means of Aerial Survey in the Florida Keys

Reef fish spawning aggregations (FSAs) are a vital part of the life cycle of many reef fishes. Unfortunately, the act of aggregation leaves many species particularly vulnerable to overfishing. Several FSA's have been discovered throughout the Florida Keys, and in an attempt to protect, manage and prevent overexploitation, a variety of data gathering techniques have been employed by Florida Fish and Wildlife Conservation Commission in conjunction with NOAA and the Florida Keys National Marine Sanctuary. In 2010, Keys-wide aerial surveys were initiated during summer spawning moons, intending to identify FSAs experiencing elevated fishing pressure. Surveys were approximately two hours long and were conducted at low altitude during the new and full moons across the Florida Keys reef tract from Carysfort Lighthouse (Key Largo) to the west of Western Dry Rocks (Key West). A geographic information system was used to store flight data along with observed vessel type, destination, position, and vessel activity (fishing/diving/other). A total of 22 surveys were flown during the summer of 2011, between May 16th and July 16th. During the full moon in May, as many as 41 vessels were documented at a historical mutton snapper aggregation site west of Western Dry Rocks. Throughout the subsequent months, a diminishing concentration of vessels was documented at this site. One other location south of Marathon consistently experienced high fishing

pressure during morning surveys. The site was identified as a well known yellowtail snapper fishing site. Understanding the degree to which fishing impacts spawning aggregation sites in Florida Keys waters is an important consideration for the conservation of these fisheries and for future management efforts directed to the sustainability of these fish resources.

***Boucek, R., and J. Rehage**
Student ▪ Symposium presentation
Florida International University, Department of Environmental Studies, Miami, FL 33199
rbouc003@fiu.edu

Resource Partitioning Among Three Mesoconsumers At a Marsh Mangrove Ecotone: A Response To a Seasonal Resource Pulse Subsidy

Pulse subsidies account for a substantial proportion of resource availability in many systems, having persistent and cascading effects on consumer population dynamics, and the routing of energy within and across ecosystem boundaries. Although the importance of resource pulses is well-established, consumer responses and the extent of resource partitioning is not well understood. In the southwest Everglades, annual variation in rainfall drives patterns of marsh inundation, and thus habitat availability for fishes. In response to seasonal drydown, marsh fishes move into deep water habitats such as ecotonal mangrove creeks, resulting in a significant prey subsidy into estuarine habitats. In this study, I continuously sampled the abundance of prey and predators at a marsh-mangrove ecotone, as well as the diets of three dominant consumers (largemouth bass, bowfin, and snook). I identified a pulse of marsh cyprinodontoid, invertebrate, and sunfish prey, which was met by an influx of both marsh and estuarine predators. In response to the pulse, consumers showed heavy segregation among their diets. Bass consumed significantly more cyprinodontoids, bowfin consumed significantly more invertebrates, and snook almost exclusively targeted sunfishes. Though all consumers exploited the subsidy, only bass and bowfin showed measurable fitness gains. The diversity of the resource pulse subsidizes multiple consumers, routing pulsed production through various trophic pathways and across ecosystem boundaries. Preserving these complex trophic linkages can be important to maintaining ecosystem function and the provisioning of services (e.g., recreational fisheries).

Bradshaw, C., and B. Sauls
Contributed presentation
Florida Fish and Wildlife Conservation Commission, Fish and Wildlife Research Institute, St. Petersburg, FL 33701.
chris.bradshaw@myfwc.com

Automated Video Assessment of Recreational Discards

Recent efforts to control harvest in recreational fisheries have had the unintended consequence of increasing the numbers of released fish that are vulnerable to post-release mortality. In tightly regulated fisheries, the number of released fish can far outnumber the harvested portion of catch and mortality of released fish has the potential to exceed harvest. For fisheries-dependent surveys of recreational fishing, the increasing number of released fish has translated into a growing portion of catch that is unavailable for direct observation. Numbers of discarded fish are more difficult to quantify with precision than harvested catch, due largely to the fact that current methods rely on angler recall sometime after the trip has occurred. A small portable camera system was developed to record the species and lengths of discarded fish in an effort to gain a better understanding of discarded fish than angler recall can provide. The camera system was developed to withstand the rigors of being at sea. One high resolution camera focuses on a length board and 3 wide angle cameras observed the action onboard the vessel. The camera on the length board was used for fish identification and to get a length measurement and the other cameras ensured that all caught fish are measured. The wide angle cameras were also used to determine the feasibility of the camera system to provide a gross visual assessment of release condition. Fish that would have been discarded were

retained and then compared to the video record, to assess the effectiveness of the camera system and the accuracy of the measurements generated by the video readers.

***Campbell, C.A., D. Parkyn, and D. Murie**
Student ▪ Poster presentation
University of Florida, SFRC, Fisheries and Aquatic Sciences Program, Gainesville FL 32653
kicksea@ufl.edu

Otolith shape as a tool for examining stock structure in Gulf of Mexico greater amberjack
Greater amberjack *Seriola dumerili* (GAJ) in the eastern United States are currently managed as two distinct stocks, with one stock residing in the Gulf of Mexico and a second along the Atlantic Coast (including the Florida Keys). Support for independent management of the two stocks is based largely on both tagging and genetic data that demonstrate that a small degree of exchange is occurring between the stocks. To address a need to better understand mixing of GAJ in the Gulf and the southeast overall, the present study examines sagital otolith morphology to determine if it differs among subregions in the Gulf of Mexico. Studies have found otolith shape useful in differentiating between fish stocks of many species, including cod, goatfish and king mackerel. A combination of shape indices calculated from otolith measurements and harmonics calculated using elliptical Fourier analysis were used to describe otolith shape. No significant differences were detected between left and right otoliths within the same individual. Similarly, no significant differences between male and female otoliths were observed, which is consistent with the lack of no significant differences in growth rate observed in Gulf GAJ. The analysis is proving useful for detecting misidentification of fishes in the dataset including closely related almaco jack. Preliminary exploration of the data using PCA and cluster analysis indicates no clear regional separation, supporting the idea that mixing may be even more prevalent than indicated by tag returns and genetics. However, larger sample sizes and more in-depth statistical analyses with an increased sample size may yield further insights into fine scale regional stock structure.

***Michael, C., J. Bennett, J. Carter III, K. Fitzpatrick, C. Flight, C. O'Brien, C. Petrilla, H. Ramirez, K. Mack, and W.A. Szelistowski**
Student ▪ Poster presentation
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Genetic Structure of Chain Pipefish *Syngnathus louisianae* and Dusky Pipefish *Syngnathus floridae* populations in Florida
The pipefish and seahorse family (Syngnathidae) is interesting from a population genetics standpoint because the sedentary nature of adults and lack of planktonic egg and larval stages may restrict dispersal. For the last several years our lab has investigated the genetics of three pipefish species in Florida: Gulf pipefish *Syngnathus scovelli*, chain pipefish *S. louisianae*, and dusky pipefish *Syngnathus floridae*. Although there are some differences in microhabitat use, salinity tolerance/preference, and geographical range, all three species live sympatrically in submerged aquatic vegetation along the Gulf and Atlantic coasts and might be expected to exhibit similar patterns of population structure. Our previous work using mtDNA control region sequences showed that *S. scovelli* populations are highly structured, with modest genetic differences occurring over relatively small spatial scales within the Gulf and Atlantic, and strong genetic differences between Gulf and Atlantic populations. In contrast, preliminary results suggested much more homogeneous population structure in *S. louisianae* and *S. floridae*. The DNA sequences for these latter species, however, were somewhat ambiguous and we have revised our laboratory protocol to obtain more reliable sequences. This work is currently in progress. If results remain consistent with the preliminary data, then interspecific variation in population structure is likely due to differing roles of adult and/or juvenile rafting among species.

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Effects of temperature and salinity on the pre-feeding life stages of summer flounder, *Paralichthys dentatus*

Water temperature and salinity are key natural environmental factors which affect marine resource species and are expected to fluctuate with climate changes, especially in near-shore habitats where many resource species in the Mid-Atlantic spawn and spend their early lives. Although the developmental rates of eggs and larvae of marine fish are expected to increase directly with temperature, we lack quantitative descriptions of environmental effects on the early life-stages of important resource species. We subjected embryos of summer flounder, *Paralichthys dentatus*, to a wide yet relevant range of constant temperatures and salinities and monitored effects on survival, size, and condition of eggs and pre-feeding larvae. Adult summer flounder collected from New Jersey inshore waters were strip-spawned, and 40 100-mL beakers with 100 fertilized eggs each were incrementally transferred to 10 target constant temperatures (12.5 to 25.5 ˚C) and 4 salinities (20, 25, 30, and 35 ppt). We assessed survival to hatching, embryonic developmental rate, larval size, and larval persistence in a food-free environment. Survival to hatching was maximal between 12.5 and 22 ˚C and decreased at temperatures > 25 ˚C. Days to hatching decreased with increasing temperature (6 d to 36 hrs at 12.5 to 25.5 ˚C, respectively), and developmental rate increased nearly linearly with temperature. Hatchlings from the warmest temperatures were smaller and those that experienced the warmest temperatures and lowest salinities had less yolk reserves. Survival duration after hatching was independent of the embryonic environment's temperature and salinity. These results support more accurate and realistic parameterization of population process models. They also suggest that changes in the thermal environment due to climate change could significantly affect the timing of critical events in the early-life stages of summer flounder, survival to hatching, and the size of young larvae, which in turn could affect their likelihood of recruitment.

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Differences in large-bodied fish assemblages between shoal and shoreline-associated seagrass beds in eastern Gulf of Mexico estuaries

Location of seagrass beds within an estuary, proximity of seagrass beds to adjacent habitats, and various other habitat characteristics (i.e., depth, seagrass coverage) influence assemblage structure of seagrass-associated fishes. Although these relationships have been documented for small-bodied fishes, few studies have examined seagrass habitat use by large fishes (>100 mm). To examine effects of habitat characteristics on large-bodied fish assemblages, two seagrass habitat types were sampled in three eastern Gulf of Mexico estuaries (2008-2010) with a 183-m haul seine: (1) seagrasses adjacent to shorelines, and (2) seagrasses associated with shoals. Fish densities were generally greater (up to 2X) in shoal seagrass beds than in those along shorelines. Multivariate analyses identified significant differences in overall assemblage structure between the two habitat types. Species that distinguished the seagrass shoreline (e.g., *Leiostomus xanthurus, Archosargus probatocephalus*) had affinities for habitats that were relatively shallow, gently sloped, less saline, and muddy with lower seagrass coverage. Species that distinguished seagrass shoals (e.g., *Orthopristis chrysoptera, Bairdiella chrysoura*) had affinities for habitats that were deeper, steeply sloped, sandy and more saline with higher seagrass coverage. Habitat differences between seagrass beds adjacent to

shorelines and those associated with shoals are sufficient to support different large-bodied fish assemblages.

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Distribution and abundance patterns of several reef fish species among different hard bottom habitats in the NE Gulf of Mexico

The NMFS Panama City lab has surveyed reef fishes since 2005 on the northern West Florida shelf (WFS) between 6 and 40 m using fish traps and stationary video cameras. Besides indices of abundance, the survey yields data on habitat, community structure, bathymetric and geographic distributions, and habitat associations of reef fishes. Although WFS reef habitat types form a continuum, we classified each reef sampled into one of four general classes – gorgonian/sponge, scattered, solid, and ledge - based on a mostly qualitative assessment of relief, continuity of the exposed rock, and the density of attached biota. Video analysis consisted of noting the maximum number of a given species viewed in any one frame during 20 minutes of a 30 minute recording. Both red and gray snapper were rarely observed over sponge/gorgonian habitat but were very common over more rocky, higher relief reefs in the same region; mean video counts were ~10 fold higher and CV's were ~70-75% smaller in the latter vs the former habitats. Only 7% of sites sampled in Apalachee Bay in 2009 were classified as ledges, but 33% of all gray snapper sightings were on that habitat. Gray triggerfish showed obvious differences in their affinities for ledge vs. gorgonian/sponge reefs, occurring on 85% of the former but only 24% of the latter. In depths <24 m, frequency of occurrence of scamp, red snapper, gray snapper, and gray triggerfish was roughly twice as high on ledges as on the other three habitats; while black sea bass showed the opposite pattern, with frequency of occurrence 4-6 times higher on gorgonian/sponge, scattered, and solid reefs than on ledges. Although habitat effects on fish distribution, abundance, and demographics are often confounded with effects of depth, fishing effort, and ontogenetic movements - knowledge of these effects is critical for more cost efficient surveys and more accurate stock assessments.

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Evaluation of spawning run American Shad spatial distribution and habitat use via acoustic telemetry gear at the St. Johns River, Florida

The St. Johns River, Florida supports the southernmost spawning population of anadromous American shad *Alosa sapidissma*. Previous research has suggested that spawning habitats of migrating shad could be influenced by variation in water levels. Thus, a greater understanding of the linkage between American shad spawning habitat and water levels in the St. Johns River is needed as demand for freshwater sources in Florida may lead to greater reliance on the this system for water supply. We used acoustic telemetry tags in conjunction with active and passive detection methods to follow American shad during spawning migrations in 2009 - 2011. Near continuous monitoring of telemetry tagged American shad allowed us to infer areas of high and low-use for between-year comparisons of spatial distribution and habitat use under contrasting water-level conditions observed during our study (low water level: 2009 and 2011; high water level: 2010). Overall, spatial distribution patterns of telemetered shad during each year were largely similar; however, we observed some key differences related to seasonal water

level conditions. Most notably, the upstream range for telemetered shad within the St. Johns basin was lower during low water years compared to high water years. During the 2011 spawning season, we compared basic microhabitat parameters between used and available habitats. We found that when habitat selection occurred, telemetered shad selected for greater depth and higher flow velocities relative to available habitat conditions. Results from this study showed linkages between American shad spawning and river flow and levels in the St. Johns River. Large-scale reductions in discharge and water level could restrict access to spawning reaches or reduce the availability of habitat with sufficient flow velocities necessary for American shad spawning. Therefore, water use and regulation in the St. Johns River should take into consideration effects on American shad spawning habitat.

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Fish recruitment is influenced by river flows and floodplain inundation at the Apalachicola River, Florida

High human demand for limited water resources often results in water allocation tradeoffs between human needs and natural flow regimes. Therefore, knowledge of ecosystem function in response to varying streamflow conditions is necessary for informing water allocation decisions. Our objective was to evaluate relationships between river flow and fish recruitment and growth patterns at the Apalachicola River, Florida, a regulated river, during 2005-2010. To test relationships of fish recruitment and growth as responses to river discharge, we used linear regression of: 1) empirical catch in fall, 2) back-calculated catch, via cohort-specific catch-curves, and 3) mean total length (TL) in fall of age-0 largemouth bass *Micropterus salmoides*, redear sunfish *Lepomis microlophus*, and spotted sucker *Minytrema melanops* against spring-summer discharge measures in Apalachicola River. Empirical catch rates in fall for all three species showed positive and significant relationships to river discharge that sustained floodplain inundation during spring-summer. Back-calculated catch at age-0 for the same species showed positive relationships to discharge measures, but possibly because of low sample sizes (n = 4-6), these linear regressions were not statistically significant. Mean TL for age-0 largemouth bass in fall showed a positive and significant relationship to spring-summer discharge; however, size in fall for age-0 redear sunfish and spotted sucker showed no relation to spring-summer discharge. Our results showed clear linkages among river discharge, floodplain inundation, and fish recruitment, and they have implications for water management and allocation in the Apalachicola River basin. Managed flow regimes that reduce the frequency and duration of floodplain inundation during spring-summer will likely reduce stream fish recruitment.

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Preliminary Estimates of Growth for the Indo-Pacific red lionfish (*Pterois volitans*) from Little Cayman Island, B.W.I.

Two species of lionfish (*Pterois volitans* and *Pterois miles*) were introduced to the waters off the coast of southeastern Florida in the 1980s. They have spread up the east coast of the United States and throughout the Caribbean and Gulf of Mexico. Managers are concerned about the effects of these invasive predators on coral reef ecosystems that already are stressed as a consequence of nutrient pollution, coral bleaching, coral disease, and overfishing. Knowledge of key demographic parameters for this species in its new range is necessary for managers to develop and implement effective responses. This study assessed the utility of using whole reads of sagittal otoliths to determine size at age for lionfish off Little Cayman. Specimens (N = 729) were collected weekly to monthly from January to December 2011. A Von Bertalanffy growth equation was employed within a maximum likelihood framework to estimate growth parameters. This analysis yielded K = 1.11 for the population, K = 0.96 for males, and K = 1.40 for females, which suggests a difference in allocation of energy between sexes. These initial estimates are based on relatively young fish because lionfish arrived at Little Cayman in 2008. In addition, data were generated by a single reader, and annuli have yet to be validated. When completed, this study will provide valuable information that will guide the design of culling, harvesting or other strategies to control this invasive species.

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Post-Release Survival and Habitat Utilization of Juvenile Swordfish in the Florida Straits

The use of pop-up satellite archival tags (PSATs) allows a researcher to overcome limitations associated with acoustic, conventional, or archival type tags. With PSATs, both data collection and retrieval are fishery-independent. Previous research techniques have provided information on longer-term movements, migrations, and behavior patterns, but there is still a need for additional tagging studies with "second generation" tags with depth and light data and increased memory that will further define the short-duration activity patterns and habitat utilization of juvenile swordfish in the North Atlantic. PSATs have been successfully used on other large pelagic fishes, but have yet to be used on juvenile swordfish. This project investigates two topics: the post-release survival rates of twenty juvenile swordfish after being released from the recreational rod-and-reel fishery or buoy fishery in the Florida Straits, and habitat utilization of juvenile swordfish following release. High-resolution PSAT technology is being used to estimate post-release survival, analysis will be done using the "Release Mortality" program. A deterministic, periodic model is being developed to fit to the data and describe the fishes' habitat utilization. This model has four amplitude parameters, two each for the daily and lunar cycle, and a mean depth value. Data gathered by the PSATs will also be used to analyze behavioral interactions with the fishing gear and compared with other descriptions of swordfish behavior. This study is a collaborative effort with the local recreational and buoy swordfish fishery, utilizing local fishermen to conduct the field work. Data from this study will aid in determining better management practices in terms of the efficacy of mandatory release of undersized fish. The data from the tags will also provide experimentally-generated estimates of recreational fishing mortality that can be used in stock assessments conducted by the international management body for swordfish, the International Commission for the Conservation of Atlantic Tunas (ICCAT).

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Juvenile spotted seatrout (*Cynoscion nebulosus*) habitat use in Tampa Bay: the effects of seagrass bed architecture, seagrass species composition, and varying degrees of freshwater influence

Spotted seatrout (*Cynoscion nebulosus*) are estuarine residents that are extensively studied primarily due to their economic importance. Although spotted seatrout have a documented affinity for seagrass beds, there is little information on how seagrass bed architecture, seagrass species composition, and freshwater influence affect this affinity. The objective of this study was to document patterns of spatiotemporal distribution and abundance of juvenile spotted seatrout (≤ 100 mm SL) in Tampa Bay seagrass beds. We analyzed long-term fisheries-independent monitoring data (1996 – 2009) and conducted a short-term synoptic study targeting seagrass beds with varying vegetative characteristics and degrees of freshwater influence. Juvenile spotted seatrout were most abundant in seagrass beds which were influenced by freshwater and dominated by shoal grass, *Halodule wrightii*. Annual abundance varied over the sampling period, with some peaks in juvenile abundance corresponding with high levels of freshwater inflow. Although analysis of the long-term data indicated that juvenile spotted seatrout abundance was positively related to percent seagrass cover, the canopy cover of seagrass beds sampled during the synoptic study was lower in areas influenced by freshwater. The value of seagrass as spotted seatrout habitat transcends the mere fact that it is present or absent, and management decisions regarding this species and particular seagrass beds need to be made with full consideration of these complex relationships.

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Geographic Variability in Seagrass-Associated Nekton Assemblages Determined by a Trawl Survey in the Eastern Gulf of Mexico

Seagrass beds provide refuge and feeding areas for various species and life stages of nekton, and are a major component of estuarine systems along the eastern Gulf of Mexico. Most faunal studies targeting seagrass beds have been conducted in shallow, easily accessible areas. Historically under-sampled deep seagrass beds (>1 m in depth), especially those in the Big Bend region, are vast and continuous, and may provide preferred habitat for certain species. From 2008 through 2010, nekton sampling in deep polyhaline seagrass beds was conducted using a 6.1 m otter trawl synoptically in five estuarine systems: Apalachicola Bay, the Big Bend Region, Charlotte Harbor, St. Andrew Bay, and Tampa Bay. Differences in community structure were driven principally by estuarine geomorphology rather than geographic location. Species composition in traditional closed estuaries differed significantly from those collected in the Big Bend Region, which lacks protective barrier islands. Differences between systems were reflected in the abundance of both managed and non-managed species, including higher abundances of *Argopecten* spp. and *Centropristis striata* in open systems, and higher abundances of *Callinectes sapidus*, *Mycteroperca microlepis*, and *Lutjanus griseus* in closed systems. Community structure differences between these geomorphologically distinct systems may provide valuable insight into future monitoring effort.

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Spatio-temporal predictive model based on environmental factors for juvenile spotted seatrout in Texas estuaries using boosted regression trees

Long-term, fisheries-independent bag seine surveys conducted in Texas, USA estuaries from 1977-2009 were used to develop a spatio-temporal species-environment model for juvenile spotted seatrout, *Cynoscion nebulous*. Relationships between environmental predictors and juvenile spotted seatrout distribution were investigated using boosted regression trees (BRT). Results showed good model performance and suggested that, in relation to environmental factors, juvenile spotted seatrout distribution is most closely linked to salinity, temperature, and distance from tidal inlets. There was also a strong seasonal pattern where abundance increased from May to October and declined precipitously after November. Juveniles were rarely captured between January and April. By interpolating the environmental predictors, monthly maps of the probability of capture were produced using ordinary kriging. Spatial patterns were also evident. Probability of occurrence began increasing first in Upper Laguna Madre peaking in Baffin Bay. Probability of occurrence was consistently higher in this region than other regions within the study area. Predicted occurrence was also high in portions of Corpus Christi, Aransas, San Antonio Bays, and the southern portion of Galveston Bay. Overall, probability of occurrence increased with increasing distance from tidal inlets. The development of spatially explicit models allows for prioritization and conservation of areas in a region that has great potential for human disturbance and climate change impacts.

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Nonnative Fishes in Freshwater Canals of the Florida Everglades: Implications for Management

Nonnative species pose a serious threat to the ecological integrity and biodiversity of natural ecosystems, including those within protected areas. Presently in Everglades National Park (ENP), fourteen nonnative fishes are established, yet we know little about how they interact with native biota, their response to hydrological disturbance including restoration efforts, and their overall impact. A subset of these nonnative fishes are new invasions since 2000, several of them accompanying restoration projects. Additional invasions of nonnative fishes may be expected as the number of nonnative fishes established outside of the protected natural areas continues to increase. Ongoing research examines the impact of nonnative fishes on lower trophic levels and ecosystem processes, how their impact is mediated by hydrology, the potential for new invasion threats from bordering canals, and the alternatives for their containment. This study examines the spatiotemporal dynamics of fish communities, both native and nonnative, in canals bordering ENP. Our questions include the following: (1) What factors drive community structure in canals? (2) How do canals function as conduits for nonnative fishes? (3) How does the inclusion of nonnative fish species alter fish community structure? Fishes are sampled via boat-mounted electrofishing. Fish communities appeared distinct among canals, with nonnative fishes composing between 8-70%. Habitat complexity and other abiotic factors seem to be influencing natives and nonnatives differently. Because restoration efforts in this region will impact water management, there is a strong need to better understand how these canals function as habitat. In addition, canals are being used by restoration projects to deliver water to Everglades marshes often with little consideration of

their role in the spread of nonnative taxa. Our findings suggest a need for more effective management of nonnative fishes while they are confined to the canal systems and should serve as a useful tool for restoring Everglades marshes.

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Relationships between reef characteristics and reef fish community structure and demographics in the NE Gulf of Mexico as revealed by video and side scan sonar data

From 2005-2010, the NMFS Panama City Lab has been conducting a stationary video and trap survey of reef fish on hard bottom habitats in the NE Gulf of Mexico. Fish communities, densities, and demographics vary among those habitats, sometimes considerably. Many sampling sites have been mapped with side scan sonar, providing information on reef type, area, relief, proximity to neighboring reefs, and rugosity. These variables were quantified and combined into a relative, standardized score for each reef to provide a repeatable, quantifiable measure to use in a weighting scheme when randomly selecting sites for sampling. Larger reefs with characteristics such as high vertical relief, high rugosity, and close proximity to neighboring reefs received higher rankings. Data were compared with video, and in some cases trap samples, from each site. Higher ranking reefs showed greater numbers of species (mean: 10.5 vs. 8.2; $p<.01$) and higher diversity (mean Shannon Weaver value: 2.5 vs. 1.8; $p<.01$) than low ranking ones. Diversity also differed significantly between solid rocky reefs and both scattered and epifauna dominated reefs ($p<.01$). Commercially important species such as gag, red grouper, and red snapper also showed increasing numbers on higher scoring reefs. Black sea bass relative abundance showed a negative relationship with reef score, while white grunt showed no clear patterns. In general, large rugose reefs with high relief appeared to be higher value reef fish habitat (higher densities and greater diversity), but in some cases, such as black sea bass, the opposite was true. Such information on habitat associations will be invaluable for increasing precision and accuracy of survey abundance estimates by revealing important strata for both survey design and data analysis.

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Reproductive Traits of Lionfish from Little Cayman: Insights into a Range-Expanding Invader

Indo-Pacific Lionfish (*Pterois volitans* and *Pterois miles*) were first observed in the western Atlantic off Dania Beach, Florida in 1985, and they have since spread north to Rhode Island, east to Bermuda, and south to Venezuela. Reef resource managers are concerned that these species may exacerbate deleterious impacts from other stressors because their densities that are often significantly higher (5X) than in their native range. Moreover, field experiments in the Bahamas have shown that lionfish reduce recruitment of native reef fish by an average of 79%. Despite its range and abundance, quantitative information on key life history characteristics for these species is lacking. Key characteristics, such as early maturation and high reproductive rate, play important roles in determining the invasiveness of these and other species. For lionfish, little information exists, for example, on timing and duration of reproduction. As part of this study, histological analysis of lionfish gonads, visual staging and calculation of Gonadosomatic Indices (GSIs) are being used to assess periodicity in gonad development, spawning season, spawning frequency and batch fecundity. Preliminary GSI data indicate no clear temporal pattern in gonad development, which suggests that lionfish spawn throughout the year. In combination, the results of all analyses should provide guidance for managers considering targeted removals as a response to the invasion of Indo-Pacific lionfish.

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Genetic homogeneity but not panmixia of *Colossoma macropomum* at the Pacaya Samira National Reserve, Peru

Colossoma macropomum is an economically and ecologically important fish species distributed throughout tropical South America in the major tributaries of the Amazon River. Large potential size and good flavor make *C. macropomum* the preferred fish species for human consumption in the region. Extensive commercial exploitation has resulted in a significant reduction in population size, age structure, and maximum length throughout its range and reports indicate regional populations are being fished at unsustainable levels. To provide resource managers with accurate characterization of population structure, an important metric for establishing relevant management regulations, we used 13 microsatellite markers to characterize the population structure of 131 individuals collected from 7 distinct floodplain lakes in the Pacaya Samira National Reserve, Peru. Bayesian cluster analysis of individual genotypes indicated *C. macropomum* forms one population on the scale of the Pacaya Samira Reserve, however; a stepping stone model, as opposed to a panmictic scenario, was ranked as the most likely form of migration throughout the river basin. These results suggest sustainable exploitation of *C. macropomum* should focus on preserving critical habitat on the scale of the entire preserve.

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Ongoing Fish Community Evaluation in Four Anthropogenically Impacted Tributaries of the Peace River, Florida

The Peace River drainage basin is the largest in southwest Florida. This river and its major tributaries have been subjected to many anthropogenic changes, including consumptive and non-consumptive water withdrawals which are expected to increase. Florida law requires the development of minimum flows and levels (MFLs) that protect critical habitat. Setting effective MFLs entails evaluating fish community structure and associated habitat use. Fish are excellent indicators of ecological condition and are used to evaluate aquatic degradation. Four major tributaries (Charlie, Horse, Prairie and Shell creeks) were intensively sampled quarterly from summer 2010 through winter 2012 and will continue until the cessation of sampling in fall 2012. The specific objectives of this study are to 1) compare fish assemblages to habitat metrics within four tributaries of the Peace River and 2) compare fish assemblages in these four tributaries to those historically collected in the main stem of the Peace River. A novel electrofishing approach was developed to capture microhabitat data to achieve objective 1. The novel method uses three-pass depletions in discrete, four by two meter microtransects. This method facilitates the estimation of fish community metrics (e.g., species richness, diversity) as well as the collection of physical (e.g., woody debris count, water velocity) and chemical parameters (e.g., conductivity) within each microtransect. Habitat complexity indices (HCI) will be developed from woody debris and macrophyte coverage, and will be compared to fish community metrics. Baseline data from this study will help to define fish community structure and habitat requirements under varying hydrological conditions. These data will aid water managers when establishing MFLs that ensure preservation of healthy fish communities and protection of their habitat.

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Predator/prey Interactions between *Micropterus salmoides*, *Gambusia holbrooki*, and Non-native, Small-bodied Fish

One of the most influential factors on the life history of aquatic animals, such as teleost fish, is the risk presented by predators. Despite the large number of exotic fish introductions in peninsular Florida, the freshwater systems have proven highly resistant to small-bodied, (< 150 mm in length) non-native, ornamental species, with a single exception in the African jewelfish *Hemichromis letourneuxi*. Small-bodied fishes generally cannot employ one of the most successful methods for avoiding predation, large body size, because they do not grow enough to be immune to gape-limited predators. Because of this, they are more dependent than larger fish on alternative predator avoidance adaptations, such as antipredator behavior. To test the hypothesis that predation could explain this absence of small non-native fish, we evaluated several representative non-native, freshwater, ornamental fishes' vulnerability to two species of common, native predatory fish in tank experiments. The non-native ornamental species, which functioned as prey in our system, were the African jewelfish, the kenyi cichlid *Maylandia lombardoi*, and the fancy guppy *Poeciliia reticulata*. The native predators were largemouth bass *Micropterus salmoides,* a large-bodied predator, and eastern mosquitofish *Gambusia holbrooki*, a small-bodied but aggressive competitor and predator. Mosquitofish attack small fish by biting their caudal fin, causing mortality and changes in habitat use. We exposed sets of ten prey fish to three predator treatments (n = 4) including each predator alone (either 1 bass or 75 mosquitofish) and both predators together. We found that different predator treatments showed significantly different effects on prey fish mortality and caudal fin damage. The predators interacted with each other as well as the prey fish in the combination treatment. These data support the hypothesis that native predators can reduce the probability of establishment by ornamental fish in Florida.

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Experimental Prey Selection by Non-Native Bullseye Snakehead *Channa marulius* from southern Florida

Bullseye snakehead *Channa marulius* is a predatory fish native to Southeast Asia. A non-native population was discovered in canals of Broward County, Florida, in 2000. Currently, bullseye snakehead is one of the most abundant large, predatory fish in some canals. This species is a generalized predator, consuming a variety of vertebrate and invertebrate prey, with fish making up the bulk of the diet in Florida. Otherwise, little is known about the trophic ecology of this species. We determined the length-specific gape size of bullseye snakehead and experimentally tested maximum prey size using blue tilapia *Oreochromis aureus*. Previous literature suggested that snakeheads consume fish prey larger than gape size. In contrast, no snakehead (n = 5; 622-717 mm total length) consumed prey with body depths larger than 80% of predator gape; mean maximum prey size was 78.4%. Snakeheads offered a choice of three blue tilapia size classes (large = 75-80% of gape; medium = 50-60%; and small = 20-30%) selected medium tilapia at a significantly greater rate than large blue tilapia. Snakeheads were offered blue tilapia, golden shiner *Notemigonus crysoleucas*, eastern mosquitofish *Gambusia holbrooki*, and crayfish *Procambarus* spp. to determine prey selection. Crayfish were consumed twice as often

as expected relative to random selection whereas blue tilapia was consumed only one-sixth as often. Consumption of golden shiner and mosquitofish did not differ from random selection. Future work includes testing more snakeheads, comparing size of prey in stomachs of snakeheads collected in the field with predator gape size, and estimating prey vulnerability for snakeheads in a south Florida canal using data on snakehead and prey fish size structure. These data, coupled with diet information, will advance understanding of potential impacts of bullseye snakehead on south Florida fish communities.

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Monitoring movement patterns of juvenile smalltooth sawfish (*Pristis pectinata*) using acoustic monitoring and tracking in a nursery habitat in southwest Florida
Historically, the U.S. range of smalltooth sawfish stretched from North Carolina to Texas including the Gulf of Mexico. Due to fisheries bycatch, habitat loss, and a low productivity, the US population has declined leading to their inclusion on the U.S. Endangered Species Act in 2003. Necessary to their recovery is a description of critical habitat, mandated in the Smalltooth Sawfish Recovery Plan. Using passive acoustic telemetry and active tracking, precise delineation of smalltooth sawfish activity space and patterns of habitat use can be determined. Juvenile smalltooth sawfish less than 1 meter total length are fitted with dual-coded transmitters and tracked for given time periods while an array of acoustic receivers is anchored in and around Turner River, Mud Bay, and the Lopez River system within Everglades National Park as well as Faka Union Bay for continuous monitoring,. In 2010, 6 juvenile sawfish were fitted with acoustic tags. One animal was tagged with in the Everglades National Park array, and was detected only a few number of times in the array by five receivers. Five juvenile sawfish were tagged in the Faka Union Bay system. One of these tagged animals was recaptured two months later, on the same location of a spoil island. For better coverage, the array in Everglades National Park has been doubled and three acoustic listening stations have been installed in Faka Union Bay. From this telemetry data, we will construct resource selection function models in an effort to delineate areas of essential fish habitat for juvenile sawfish.

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Probability-based Analysis of Pilot Whale-Pelagic Longline Interactions
We apply joint-probability analysis to evaluate the probabilities of interactions between pelagic longline gear (PLL) and pilot whales. The objectives of this study were to: (1) Investigate how pilot whales and Risso's dolphins are interacting with pelagic longline gear during fishing and haulback; and (2) Characterize pilot whales' and/or Risso's dolphins' social structure/behavior and/or habitat utilization in the Mid-Atlantic Bight region and how it may influence interactions with pelagic longline gear. Interaction probabilities were created using varying temporal and spatial parameters along with detailed gear information. From 2010 to 2012, temperature-depth recorders (TDRs) were deployed on commercial PLL gear (n=23, average soak duration 6 hours) and digital acoustic tags (DTags) were deployed on pilot whales (n=8, average tag duration 8 hours). TDR records were used to generate probabilities of gear depths at varying times and DTag records were used to create both habitat utilization envelopes and feeding probabilities varying across depths and times. The combination of these fine-scale pilot whale data (DTag and echolocation) and PLL gear depth distribution were used to evaluate the

probabilities of interactions between PLL gear and pilot whales at varying temporal and horizontal-vertical spatial scales, as well as different feeding motivations. By creating a standard exportable methodology for assessing interaction probability bycatch reduction methodologies can be applied to specifically identified and thus targeted areas of high interaction probabilities.

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Can we expand at-sea sampling for fish reproductive potential using frozen ovaries?
In order to estimate reproductive potential in a stock exhibiting indeterminate fecundity, best practices may include sampling from multiple sources over an extended spawning period and across the stock range. Thus more sampling may be desired from on-board observers who can freeze samples when constrained from using preservatives. Our objective was to compare reproductive measures from red snapper (*Lutjanus campechanus*) ovaries that were either frozen and later preserved (10% neutral buffered formalin), or immediately preserved in formalin. Weight regressions were made for conversion purposes. Histological comparisons were made, largely to gauge the ability to estimate spawning fraction and determine gamete stage. A comparison/conversion was also conducted for batch fecundity. We found that red snapper ovary weight relationships were essentially 1:1 for fresh, frozen, or thawed weights across a 250 g range. Histological quality factors were significantly different ($p<0.0001$) based upon a paired Wilcoxon test confirming the value of initial formalin preservation over freezing. However, there was 82% agreement on leading gamete stage and 84% agreement on presence/absence of postovulatory follicles (POF) between the two approaches suggesting that adequate information may be gained from frozen tissue. Batch fecundity varied by treatment and regression indicated a correction was necessary to account for greater hydrated oocyte counts per unit weight when ovaries were sub-sampled and tissue frozen.

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Adaptation and Evaluation of the Fish Invasiveness Scoring Kit (FISK) as a Risk Assessment Screening Tool for Non-native Fishes in Florida
In peninsular Florida, there are at least 98 non-native freshwater fish species that have been introduced into the wild or have escaped captivity, 34 species are established (i.e. permanent populations unlikely to be extirpated), and multiple pathways provide the potential for future introductions. Use of a full risk analysis of potential invasiveness is a lengthy, often expensive process. Whereas, the Fish Invasiveness Scoring Kit (FISK) is a semi-quantitative risk screening tool that permits a rapid assessment. Comprised of 49 questions within four subject themes (biogeography, biology, ecology, "undesirable" traits), FISK produces a total score (ranging from -11 to 49) with which to categorize the potential risk of a fish species being invasive as low, medium, or high. Developed and tested initially in the United Kingdom, FISK has been applied in temperate region countries only (Belgium, Belarus and Japan). To suit better the sub-tropical/warm temperate conditions in Florida and the southern U.S., we modified 23 of the 49 questions and assessed the 98 non-native fish species observed in peninsular Florida; each species was scored by at least two assessors. Using the maximum, mean, minimum and range

in scores for each species, we evaluated the accuracy of the modified FISK in identifying species specific risk, based on comparison to a priori risk categorizations given by FishBase and from a consensus classification of risk based on a survey of 25 fisheries professionals. Preliminary results indicate the modified FISK is >80% accurate at identifying invasive fishes as high risk while simultaneously maintaining 90% accuracy at identifying noninvasive fishes as low risk. Additionally, we are calibrating the FISK scoring thresholds to reflect risks to Florida more accurately. Our goal was to develop a tool capable of quickly assessing the potential risks of non-native fishes not yet introduced into Florida.

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Evidence for hermaphroditism in Golden Tilefish (*Lopholatilus chamaeleonticeps*)
Golden tilefish (*Lopholatilus chamaeleonticeps*) (n = 1859, 280-1040 mm FL) were collected from both fishery dependent and fishery independent sources along the east coast of Florida and the northern Gulf of Mexico. Gonads were classified through histology and a majority of fish collected were functional, mature males (n = 1052, 56%) with very few immature fish (n = 26). Male golden tilefish were determined to reach maturity at a younger age (male, <1 yr; female, 2.5 yr) and smaller size (male, 150 mm FL; female, 331 mm FL) than females. An analysis of gonadal somatic index revealed both males and females spawned from January through June and peaked in April. Golden tilefish gonads are described as being intersexual with both functional males and functional females identified as having non-functional (opposite) sex tissue. Of the functional males, 71% had numerous stages of atretic oocytes (88% primary growth, 29% vitellogenic, 28% cortical alveolar, 10% hydrated). Twenty-six percent of the functional females also had self-contained male tubules containing all stages of spermatogenesis within its own germinal epithelium. Male gonads contained a cavity that qualified as originating from ovarian lumen and sperm sinuses were present within the gonad wall. Therefore, not only do golden tilefish exhibit intersexual tendencies, evidence supports a protogynous hermaphroditic reproductive strategy. Golden tilefish also exhibited sexual dimorphic growth with males more prevalent in the larger and older age classes, although the sex ratio was only slightly different from 1:1.

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Habitat Linkages and Estuarine-Dependent Fish
The over-whelming majority of economically important species in the Gulf of Mexico are estuarine dependent during one or more stages in their life history. Different estuarine-dependent species have different reproductive strategies, occupy the estuary during different life history stages, and have varying lengths of stay, timing of recruitment, and essential habitats. Many species (e.g., spotted seatrout, *Cynoscion nebulosus*; common snook, *Centropomus undecimalis*) typically complete their entire life history within the estuarine environment. Other species reproduce in the Gulf of Mexico but use estuarine environments for the first 12 – 18 months (e.g., gag, *Mycteroperca microlepis*; gray snapper, *Lutjanus griseus*), first several years (e.g., red drum, *Sciaenops ocellatus*; goliath grouper, *Epinephelus itajara*), or majority of their life history (e.g., striped mullet, *Mugil cephalus*). These estuarine-dependent species use the many, varied habitats available within an estuary. Common snook, for instance, are typically most abundant in backwater areas during their first year but move into and in-between many other habitats (e.g., rivers, seagrasses, fringing mangroves, open

beaches, passes, manmade structures) during various life history stages and ecological seasons. Recruitment to, and movement between these various estuarine habitats can be restricted by barriers. The most obvious barriers within estuaries are physical structures (e.g., dams, weirs, causeways) but less obvious, non-structural barriers also exist (e.g., freshwater inflow, dissolved oxygen). Habitat degradation within an estuary (e.g., dredge and fill, mangrove trimming, hardened shorelines) and within the estuary's watershed (e.g., impervious surfaces, stormwater runoff) can also limit movement and recruitment. The life history strategies of several estuarine-dependent species, their habitat linkages, impediments to their successful recruitment and the data available to assess recruitment success during various life history stages will be discussed.

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Impact of fish movement between areas vulnerable and invulnerable to angling on fisheries sustainability

Conventional fisheries management typically ignores spatial and behavioral patterns in vulnerability to fishing. However, a portion of a fish stock may be invulnerable to fishing due to protected areas (regulatory invulnerability), spatial patterns in angler distribution relative to fish distribution (spatial invulnerability), or some individual fish not being reactive to fishing gears (behavioral invulnerability). Few studies have examined how the rate of movement between vulnerable and invulnerable states impacts the effectiveness of size limits as conservation tools in cases where some fish aren't vulnerable to fishing. A multistate age-structured model was constructed to examine the impacts of movement into and out of vulnerable states on spawning potential ratio (SPR) and yield for a black crappie fishery with low, medium, and high fishing mortality rates and minimum length limits. A fully open fishery was compared to situations where three-quarters, one-half, and one-quarter of a fish population was invulnerable to fishing. For the limited vulnerability models, we considered monthly movement rates (e.g. percent of the population that switches vulnerability states each month) ranging from 0.01 to 0.99. In all situations SPR was higher when a greater portion of the population was invulnerable to angling. On the other hand, yield was higher when a greater portion of the population was vulnerable to angling, except when SPR values dropped below 0.2. These low SPR values occurred under the lowest length limits at medium and high exploitation rates and at the medium length limit at high exploitation rates. By ignoring the assumption of limited vulnerability, stock predictions are conservative, which can result in reduced yield and greater sustainability. More studies are needed to quantify spatial and behavioral refuges that may occur in fish populations, and movement rates that could influence predictions from traditional models that assume all fish are equally vulnerable at all times.

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Effects of food availability on egg production in relation to fish reproductive strategies
Fish oogenesis follows a basic, universal plan among fishes, yet it is flexible enough that a variety of reproductive strategies emerge. For example, by varying the rate and synchrony that developing eggs are produced, the spawning frequency of fishes varies from every day to once in a lifetime. By storing energy and drawing on it later, spawning can take place away from the feeding ground or in the absence of feeding altogether; however, fish that participate in prolonged spawning seasons supply energy for reproduction from concurrent feeding. We are interested in how this processes of oogenesis, as the basis of reproductive strategies, intersects with the source of energy used for reproduction. In a review of over 30 species, we match a suite of reproductive traits with evidence that food amount or food type affect egg production in fishes, and whether there is evidence of storing energy for gonadal growth (capital breeding) or if the energy for gonad growth is obtained during the spawning season (income breeding). Capital-income breeding is generally but not always matched with a specific type synchrony of oogenesis. Extreme capital breeding is associated with long-lived, boreal species; extreme income breeding is associated with short-lived, tropical fish. Nonetheless, few species use capital or income sources exclusively, such that capital-income breeding is generally a conditional strategy, whereby an individual's genotype is capable of moving along this continuum in response to its own physiological condition and the environment. There were even a few examples of intraspecific variation along the capital-income continuum. We suspect these types of variation will become more common as researchers look for it. This awareness of capital and income spawning patterns is likely to expand our understanding of the resiliency of fishes to environmental change, to design better studies that investigate these processes, and to inform recruitment predictions of economically valuable fisheries.

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Trophic Dynamics and Ecosystem Changes within the SE Florida Coastal Pelagic Fish Community
The waters off the southeast coast of Florida are home to a unique pelagic and coastal pelagic ecosystem. The objective of this research project is to investigate and achieve a greater understanding of coastal pelagic fishes, with an emphasis on the higher order species that inhabit the mid-range coastal pelagic to true pelagic waters, and the ecological role they play within the community ecology of the pelagic ecosystem. The selected fish species includes King Mackerel (*Scomberomorus cavalla*), Blackfin Tuna (*Thunnus atlanticus*), Skipjack Tuna (*Katsuwonus pelamis*), Atlantic Bonito (*Sarda sarda*), Little Tunny (*Euthynnus alletteratus*), Wahoo (*Acanthocybium solandri*), Greater Amberjack (*Seroila dumerili*), and Dolphinfish (*Coryphaena hippurus).* These species were selected based on their position as upper trophic

level predators in the marine ecosystem food web and their general habitat distribution in the coastal pelagic zone. In the two year period between March 2010 and March 2012, approximately 420 fish from the 11 species have been sampled. The samples were collected opportunistically from recreational tournament anglers in the south Florida area between West Palm Beach and the Florida Keys. From each fish specimen sampled the stomach, gonads, blood, muscle tissue, and liver tissue was collected for further analysis. Morphometric data for each specimen was also recorded. A stable isotope analysis was performed with the muscle tissue and blood samples using carbon $\delta^{13}C$ and nitrogen $\delta^{15}N$ for trophic analysis. A gut content analysis was performed with the frequency of occurrence and percent composition by weight approaches used for quantitative description of the analysis. The gut content analysis is performed and compared to the stable isotope analysis to further understand the trophic interactions and trophic position among the coastal pelagic community. The preliminary results of the stomach content and stable isotope analysis from year 1 and year 2 of sampling is being presented.

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Habitat utilization and resource partitioning of apex predators in coastal rivers of southeast Florida

We investigated how largemouth bass and common snook used and partitioned shared resources in four southeast coastal rivers in Florida: the Loxahatchee, the St. Lucie South Fork, the St. Lucie North Fork, and the St. Sebastian River. Research focused on four broad topics: 1) habitat use, 2) trophic dynamics, 3) seasonal movement, and 4) population exchange. This presentation focuses on the habitat use results and includes descriptions of the distributions of largemouth bass and common snook, microhabitat use, and habitat overlap. We used multiple correspondence analysis (MCA) and habitat suitability criteria (HSC) functions to illustrate habitat associations of largemouth bass and common snook. Our results indicated that common snook and largemouth bass were found in a range of water velocities and depths with varying structure coverages and compositions, indicating that both species display habitat-generalist tendencies. However, locations lacking cover were generally avoided by both species indicating that some form of cover is sought by these species. Largemouth bass distribution was limited by salinity, and individuals were most suited to the freshwater and oligohaline portions of the rivers studied. Common snook were more evenly distributed throughout the freshwater to mesohaline portions of the rivers studied. Small differences in habitat use were encountered between adult largemouth bass and common snook that provided a minor indication of habitat partitioning and high degree of habitat overlap. Juvenile common snook were associated with slower and shallower locations relative to adults, comprised of woody debris, aquatic vegetation, or terrestrial vegetation. Man-made structures were generally avoided by juvenile snook, which may indicate a dependence to natural habitats for suitable nursery areas.

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Black Creek Crayfish (*Procambarus pictus*) Baseline Survey at Camp Blanding Joint Training Center in Stark, Florida

The Florida Fish and Wildlife Conservation Commission performed a baseline survey for Black Creek crayfish (BCC) within the Camp Blanding Joint Training Center boundaries. Sampling was performed within the North and South Forks of Black Creek and its tributaries, and Bull Creek. At each location quantitative and qualitative habitat and water quality characteristics were measured and recorded on a data sheet. Qualitative D-frame dipnet and minnow trap sampling targeted known BCC habitats. BCC and Peninsula (*Procambarus paeninsulanus*)/Slough (*Procambarus fallax*) crayfish (PEC/SLC) were found on north post, east post, and south post. White Tubercled crayfish (*Procambarus spiculifer*) (WTC) were only found on north post in the Bull Creek drainage. BCC were found at 128 sites, PEC/SLC were found at 36 sites, and WTC were found at 6 sites. No crayfish were observed at all for 16 sites, while 73 sites were observed to be dry with no water. Both dipnet and trap sampling methods were effective at capturing female and male sexes, and adult and juvenile life stages of the crayfish species, but the trap caught larger sized crayfish compared to the dipnets. Relative abundance estimates based on average catch per unit effort by dipnet and trap were very similar for both BCC and PEC/SLC. Relative abundance estimates for WTC were higher compared to both BCC and PEC/SLC. Generally, BCC were observed at sites with lower turbidity and siltation, higher dissolved oxygen and water flow, and clearer water color compared to sites with PEC/SLC. BCC were observed at sites with lower water depth and flow, higher turbidity, siltation, and dissolved oxygen, and clearer water color compared to sites with WTC. BCC occurrence in Alligator Creek on the south post documents a range extension for the species outside of the Black Creek drainage, and into the Half Moon Lake Outlet drainage.

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Influences on observed patterns of movement of greater amberjack *Seriola dumerili* in the Gulf of Mexico.

Greater amberjack (GAJ) movements were assessed through an ongoing tag and recapture study in the Gulf of Mexico. In total, 172 tags (11.5%) have been returned, including 159 fish with recapture location information. Returns of double tagged fish suggest shedding is infrequent. Differential returns were observed in various areas of the Gulf with highest relative rates of return for fishes in the Florida Keys. In addition, hook type and location had some influence on subsequent recapture. Differences in hooking location, as well as other factors such as depth, water temperature, fight time, hooking location, and ascent rate are included in the assessment of factors contributing to GAJ recapture rates. Popup Satellite tags corroborated the observation that most amberjack move less than a few km following tagging. In addition, vertical movement data showed surprisingly limited variability in depth movements. Mixing rates between different regions of the Gulf and the Atlantic region were examined and found to be low, these are compared to results of an ongoing genetics study.

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Assembled habitat gradients, strong inference, and linking fitness to function in fish communities

Useful inference can be obtained by examining habitat gradients within one study location or gradients that have been purpose-built from multiple locations (i.e., gradients specific to ponds, streams, estuaries, tide pools, continental shelf waters, or other ecosystem types). Whether gradients exist at a single location or are assembled, the units for measuring species-level habitat performance should relate to fitness. Vital parameters representing differential growth, survival and reproductive output along habitat gradients are defendable fitness measures, whereas measures of differential density (individuals per unit habitat), while often useful, have become somewhat less defendable due to arguments based on "effective habitat" and density-dependence. Because vital rates are often interrelated and synergistic, easy-to-measure proxies such as individual condition may have extended fitness implications. At the community level, multiple hypotheses can be tested using one or more assembled gradients, allowing strong inference (testing multiple hypotheses instead of one). This approach offers a promising tool for understanding ecosystem function, particularly in regard to holistic trophic characterizations (e.g., basal resource variations) and human interactions with natural resources at all trophic levels. Examples of this approach are presented along with process-based theories that address habitat functionality.

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Distribution and characterization of hard bottom habitat in cross-shelf side scan transects in Apalachee Bay, Florida

Little is known about the quantity, distribution, and types of inner- and mid-shelf hard bottom habitats – essential to reef fish populations – in the NE Gulf of Mexico. High resolution habitat maps are essential for maximizing efficiency, accuracy, and precision in fishery-independent reef fish surveys. Such maps are also invaluable for marine spatial planning and for predicting, assessing, and modeling impacts of many natural and anthropogenic events and actions. The objective of this study was to map, quantify, and classify hard bottom habitat in 10 cross-shelf transects (8-42 m depth, 20-40 nm x 150 m area) surveyed with a Marine Sonic dual frequency (600/1200 kHz) side scan sonar in Apalachee Bay off Florida's Big Bend. Marine Sonic's Sea Scan software was used to obtain location, reef type, area, and vertical relief of all patches of hard bottom habitat. A reef classification scheme was developed by comparing ground truthed still and video images with acoustic backscatter. A total of 1378 patches of hard bottom habitat were located, composing 4% (3.12 km^2) of the 79.4 km^2 surveyed. Hard bottom habitat occurred across all depths, but was not uniformly distributed. Densities dropped considerably beyond 30m, composing 4.5% from 8 to 30 m, but less than 1% between 30 and 43 m. Four reef types were identified: scattered rock, pavement, gorgonian/sponge, and ledge. Scattered rock was by far the most common type observed (~80%), while ledges were the least common (2.25%); gorgonian/sponge and pavement reefs made up 12.5 and 5.25% respectively. No ledges or solid rock reefs were observed in depths > 30 m, and both types were more concentrated in the northern transects. Individual reefs ranged in area from 10 to ~60,000 m^2, and averaged larger in shallow depths (2300 m^2 in 8-30 m vs. 1500 m^2 in > 30 m).

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An Introduction to the Florida Atlantic Coast Telemetry (FACT) Array

Understanding how and why animals move through their environment is central to resolving their role within a given ecosystem and a necessary step for crafting sound management strategies for exploited and imperiled species. The development of low cost, scalable autonomous acoustic telemetry systems now allows the movements of aquatic animals to be resolved over ever-larger geographic areas and extended time periods. The Florida Atlantic Coast Telemetry (FACT) Array, a collaboration of the Bimini Biological Field Station, Florida Fish & Wildlife Conservation Commission, Florida International University, Florida Program for Shark Research, Florida State University, Georgia Department of Natural Resources, Kennedy Space Center Ecological Program, Naval Undersea Warfare Center, and Stony Brook University, has evolved into one of the largest acoustic arrays in the world. Now spanning 300 km of the Florida east coast from Daytona Beach to West Palm Beach, the FACT Array consists of ~200 VEMCO VR2 and VR2W autonomous receivers deployed along a continuum of habitats from freshwater rivers to offshore reefs. The array has proven itself well-suited for evaluating site fidelity, habitat preferences, seasonal migration patterns, and reproductive strategies of over twenty of Florida's most valuable estuarine sportfish, sharks, and marine turtles, insights which have already helped shape management decisions. Moreover, FACT has enhanced communication among partner groups, spurring several additional collaborative fish life history studies which otherwise would have been logistically and financially prohibitive.

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The Search for Juvenile Red Snapper *Lutjanus campechanus* in Southeastern US Atlantic Waters

The marine environment offers multiple pathways for the movement of individuals from one area of suitable habitat to another. Understanding these pathways and movement patterns is of critical importance to fisheries management. In Gulf of Mexico and the western Atlantic Ocean off the southeastern U.S., red snapper (*Lutjanus campechanus*) are perhaps among the most intensively fished, managed, and, in the Gulf of Mexico, researched reef fish, with rebuilding plans in place for the species in both regions. Significant research has been conducted on red snapper juveniles in the northern Gulf of Mexico and off the coast of Texas; however, many scientists recognize a dearth of knowledge about juveniles along the southeastern U.S. continental shelf. The apparent absence of documentation of juveniles in this region leads scientists to question the ability of the southeastern U.S. Atlantic population

to sustain itself, opening the possibility of the Gulf of Mexico population acting as a source for the southeastern U.S. Atlantic. There are several possibilities that may explain this observation, among them are: the Gulf of Mexico is contributing a significant number of larvae via the Straits of Florida; migration of adult fish contributes to the southeastern U.S. Atlantic as evidenced by the genetic homogeneity between the populations. Both these explanations are problematic. The contribution of juveniles from the Gulf of Mexico, however, is uncertain and remains untested. Research and monitoring efforts need to be conducted to identify juvenile habitats in the southeastern U.S. Atlantic, to investigate potential sources of recruitment, and to properly manage the respective fisheries.

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Development of Zero-Inflated Gamma and Beta Models To Support Habitat Suitability Modeling In Florida Estuaries

The FWC Fisheries-Independent Monitoring (FIM) program utilizes various gears over different benthic habitats in Florida estuaries. We sought to develop models to deal with zero-inflation of the catch-per-unit-effort (CPUE) and to standardize CPUEs across gear types within the models in a timely manner. A program written in R was developed to run zero-inflated gamma (ZAGA) and zero-inflated beta (BEINFO) models to relate CPUEs to associated environmental variables (temperature, salinity, dissolved oxygen, depth, and bottom type). Running the full model with all five factors, the program automatically chooses either the BEINFO or the ZAGA model based on the lowest Akaike Information Criterion (AIC). The program internally computes gear-correction (GC) factors to adjust all the CPUEs to one gear type prior to fitting splines across environmental gradients. It then fits splines to positive CPUEs and frequency of occurrence data. Three spline-fitting procedures (B-spline, cubic smoothing spline, and restricted cubic spline) are evaluated. The user can then choose which spline-fitting method to use based on the lowest AIC. The user can choose to run either the full model with five factors or a reduced model with fewer environmental factors. The best model is chosen by the program based on evaluation of AICs. The models use CPUEs and associated environmental data from the FIM dataset and environmental data from the Habitat dataset to predict GC CPUEs across the estuary. Using GIS, the predicted GC CPUE grid is then divided into four habitat suitability zones using quartiles. Several different spatial tests are being evaluated to validate the models based on the agreement of point CPUEs (by latitude and longitude) with predicted GC CPUE grids. Analyses are presently being conducted to model and map 11 fish and invertebrate species representing 22 life stages for four seasons within Tampa Bay (total of 88 species life-stage maps).

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Circle Hook Requirements in the Gulf of Mexico: Are They Working?

A primary target group for recreational anglers in the Gulf of Mexico is the reef fish complex, which includes an assemblage of snappers (Family Lutjanidae), groupers (Serranidae), triggerfishes (Balistidae), and amberjacks (*Seriola* spp.). In 2008, recreational anglers in the Gulf of Mexico were required to use circle hooks when catching federally managed reef fish species (50 CFR 622.41). The State of Florida also requires the use of circle hooks when

catching reef fishes in state waters of the Gulf of Mexico (Florida Administrative Code 68B-14.005). This study evaluates the benefits of circle hooks in the recreational fishery for reducing potentially lethal hooking injuries for eight regulated reef fish species and two unregulated species commonly targeted by recreational anglers. From June 2009 through November 2010, we observed hook-and-line fishing during for-hire recreational fishing trips off the west coast of Florida. Anglers were observed using circle hooks and other hook types in a wide range of sizes from a variety of manufacturers. For eight out of ten species evaluated, there were significant reductions in potentially lethal injuries for fish caught with circle hooks compared to all other hook types. Reductions were most notable for some managed species with high discard rates in the recreational fishery. For red snapper (*Lutjanus campechanus)*, potentially lethal injuries were reduced from 17.1% with other hook types to 6.3% with circle hooks (a 63.5% reduction). For red grouper (*Epinephelus morio*), injuries were reduced from 9.3% to 5.4% (41.4% reduction). For gag (*Mycteroperca microlepis*) and scamp (*Mycteroperca phenax*), potentially lethal injuries were <5.5% for all hook types and reductions were not significant. Further study is needed to evaluate internal injuries during circle hook removal and before circle hooks are embedded.

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Multi-Year Movement Patterns of Adult Black Drum (*Pogonias cromis*) in Estuarine and Coastal Waters of East-Central Florida

An acoustic telemetry study was conducted from January 2009 to October 2011 in an effort to document the movement and habitat use patterns of sportfish such as black drum, within the waters surrounding Kennedy Space Center (KSC), Florida. The primary study area includes waters within and near the boundaries of KSC including a large portion of the northern Indian River Lagoon (IRL) System and coastal waters of the Atlantic Ocean. The KSC Array consists of 87 autonomous acoustic receivers and is part of the larger Florida Atlantic Coast Telemetry (FACT) Array. During this study, a total of 29 black drum were surgically implanted with Vemco VR16 acoustic tags. Individuals ranged in size from 485 to 881 mm SL (mean 668 mm SL). Time at liberty for individual fish ranged from 55 to 1042 days with a mean of 450 days, with most fish still active within the array. The exception is for three individuals that have been confirmed as being harvested by anglers. To date a total of 1.05 million tag detections have been recorded. On a seasonal basis, fish exhibited greater activity in fall and winter as measured by the mean number of different receivers a fish was detected upon per month. This movement may be related to spawning. Nonetheless, most individuals remained within the KSC area year round and mostly within the waters of the IRL system in which they were captured and released. Several individuals did travel greater distances and outside of KSC. One such journey involved travel to south Florida via the entire length of the IRL before returning to KSC. Another, more remarkable journey involved a roundtrip from KSC to coastal South Carolina and Georgia via nearshore Atlantic waters.

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Spatial and temporal dissolved oxygen dynamics and evaluation of fish habitat loss due to hypoxia in hydrilla

The fast growth and dense structure of some macrophyte species can alter water chemistry and impact fish habitat utilization. *Hydrilla verticillata* is an invasive aquatic weed which exhibits rapid, dense growth and may contribute to low dissolved oxygen (hypoxia, DO <2.0 mgL^{-1}) levels during warm summer months. The management of hydrilla is difficult and costly, and current block-treatment methods result in unfavorable fish habitat, such as large areas devoid of vegetation. An alternate method recently proposed is to remove hydrilla in channels through dense beds, increasing 'edge' habitat to promote higher water circulation and thus increasing dissolved oxygen levels. We evaluated the spatial and temporal dynamics of dissolved oxygen in three habitats: open-water, edge, and dense hydrilla beds, and assessed the percentage of habitat loss due to hypoxia. Our results showed there are significant interactions influencing DO between habitat and time of day, and habitat and month. Both, dense and edge habitats saw 100% habitat loss at the peak of hydrilla growth and water temperature in September, suggesting that increasing edge habitat may not greatly influence DO concentrations during summer.

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Intra and interspecific density effects on largemouth bass *Micropterus salmoides floridanus* spawning behavior

The objective of this study was to determine if intra and interspecific density has an effect on the natural fluctuations observed in annual largemouth bass spawning behavior in a series of study lakes with high density largemouth bass and bluegill populations. We tested the hypotheses that: a) largemouth bass nests per spawner were negatively related to bluegill density (number of bluegill/littoral area); b) bass nests per spawner were positively related to adult largemouth bass density. We used snorkel surveys to monitor largemouth bass spawning in four study lakes in north central Florida in 2010 and 2011. The study lakes, located southeast of Hawthorne, Florida, ranged in size from 2.7 – 16.6 ha. Mark-recapture population estimates were used to estimate largemouth bass and bluegill abundance at each lake. Snorkel surveys were conducted twice weekly to estimate the total number of nests over the duration of the spawning season. The estimated total number of nests varied among lakes and years. Spawning behavior was relatively consistent in only one lake with similar numbers of total nests in both years. Some degree of skip spawning was noted in three of four lakes in both years, with only 2 to 50% of adult largemouth bass spawning on a given lake/year. Linear regression showed a negative relationship between nests per spawner and bluegill density (R^2 = 0.25). Where bluegill density exceeded 1,000 fish per ha, largemouth bass spawning was almost completely inhibited. There was no apparent relationship between nests per spawner and adult bass density (R^2 = 0.006). Our findings indicate both intra and interspecific interactions influence spawning inhibition in largemouth bass. Adult bass reproductive behavior and the potential for density-dependent effects on spawning should be considered when managing largemouth populations with high intra- and interspecific densities of fishes.

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Implications of Skewed Sex Ratios on Population Dynamics of Greater Amberjack

Greater amberjack, *Seriola dumerili*, is a pelagic reef fish that is managed in the US as two separate stocks, the Gulf of Mexico and the South Atlantic stocks. The most recent stock assessment for the Gulf stock found it to be overfished and undergoing overfishing. Sex-specific spatial distribution and exploitation may contribute to our understanding of the stock's overexploitation. This may be important for greater amberjack since schools in some regions may predominantly be one sex or the other and, based on the fisheries, amberjack may be subject to sex-specific mortality. These factors may lead to sex ratios that are highly skewed from an assumed ratio of 1:1. Altered sex ratios have been found to influence population dynamics in sex changing fish, and it may be that in a gonochoristic fish that exhibits sexually dimorphic growth, such as greater amberjack, there may also be an influence. Age, size, and sex structured models incorporating a range of potential sex ratios were used to evaluate the potential effects of skewed sex ratios in this species. The sex ratios examined were based on data from field-based non-lethal sexing, port sampling data, and data from previous age, growth, and reproduction studies. Outputs from the models, including male and female spawning stock biomass, and egg, sperm, and fertilized egg production, have demonstrated that female skewed sex ratios may impart some resilience, while even moderately male skewed sex ratios may be considerably more susceptible to overfishing.

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Status and Population Viability of the Alabama shad (*Alosa alabamae*)

Historically, Alabama shad have been recorded as far north as the Ohio River in West Virginia and were commonly found in other Mississippi River tributaries including the Red, Arkansas, Missouri, and Tennessee Rivers. Over the last several decades, habitat fragmentation as a result of locks and dams blocking access to spawning areas and altering hydrology and river substrates has resulted in declines in the range of Alabama shad. The habitat fragmentation and reduction in range caused the National Marine Fisheries Service to list this species as Species of Concern in 2004. We evaluated new sources of data to provide an update as to whether Alabama shad should be retained or removed from the Species of Concern list. Surveys from scientists at Universities, state and federal facilities, and non-profit organizations suggest that the population has undergone severe fragmentation, but spawning populations persist in the Suwannee, Choctawhatchee, Escambia, and Pascagoula Rivers, with the largest spawning population of Alabama shad in the Apalachicola River in Florida. Population Viability Analysis indicates populations could increase if favorable environmental conditions are restored throughout its range. Scenarios exploring increases in habitat availability and survivorship all resulted in increases in the number of spawners. Positive results such as these provide incentives to advance research and develop management plans to enable the species to increase in abundance and re-occupy historic systems.

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Juvenile fish use of specific locations within the environmental gradients of coastal rivers

During periods of extreme freshwater inflow variation to coastal rivers, it has been theorized that juvenile fishes can be faced with a trade-off between remaining in favorable static habitat (e.g., preferred vegetation type) or moving substantial distances to occupy favorable dynamic habitat (e.g., specific salinity range). Examples of movement patterns illustrating different responses to changing salinity are given using two large-bodied juvenile fishes that were tracked in a coastal-river nursery using acoustic telemetry. Juvenile bull sharks *Carcharhinus leucas* immediately responded to changes in salinity by moving up or down the river to occupy a specific salinity range, presumably to minimize stresses associated with osmoregulation and to maximize energy allocated to growth. Juvenile smalltooth sawfish *Pristis pectinata* showed affinities for specific sites within the river referred to as hot-spots and exhibited 90-day lagged responses to changing salinity; for example, sawfish moved upriver after salinity had been increasing for over three months. The lags apparent in the sawfish responses could occur for at least three reasons: juvenile sawfish (1) may be more tolerant of changes in salinity than other elasmobranchs; (2) may have strong affinities for specific sites within the river and remain there until conditions change enough for them to respond by relocating; (3) respond to indirect effects of salinity, such as the redistribution of prey populations that are known to exhibit similar distribution responses to lagged environmental changes. Regardless of the causal factors, the two contrasting response patterns illustrated here may be indicative of juvenile fish ecology at a greater scale. Still unknown is whether movements needed to occupy favored conditions, or stresses related to tolerating widely fluctuating conditions, come at an energetic cost that affects growth rates and nursery residency.

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Discard mortality rates for gray snapper and gag within a Florida gulf coast estuary and nearshore waters

Due to the extensive fishing pressure on gray snapper, *Lutjanus griseus*, and gag, *Mycteroperca microlepis*, minimum size and bag limits have been employed to prevent overexploitation. The management strategy underlying minimum size limits depends on the assumption that a large number of undersized fish that are discarded will survive, return to the population, and later recruit to the fishery. This project characterized recreational discard mortality rates for gray snapper and gag captured by fisheries scientists, with help from volunteer recreational anglers and local fishing guides in the lower Tampa Bay estuary and neighboring Gulf of Mexico waters. A total of 247 gray snapper were caught over four inshore and five nearshore experiments; 17 of these fish died within 48 hours, for an overall mortality rate of 6.9%. Results from discard mortality experiments indicated that mortality rates for gray snapper were relatively low for both inshore (1.4%) and nearshore (14.4%) habitats. The higher mortality rate found in nearshore waters was probably related to depth of capture, which along with hook position significantly influenced the probability of gray snapper mortality. For gag, a total of 111 fish were caught over four inshore experiments, and eight of these fish died within 48 hours, for an overall inshore mortality rate of 7.2%. Hook position and decreasing size of the individual significantly influenced the probability of gag mortality. For both species, individuals hooked in the lip were most likely to survive the catch-and-release event, while gray snapper

hooked in the esophagus or gag hooked in the gills were the least likely to survive. Overall, catch-and-release fishing, though an effective management tool for reducing take,can contribute to cryptic mortality, especially in deeper waters.

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Do fin rays and otoliths tell the same story? Comparing microchemistries of calcified structures

Calcified structures of bony fishes have proven to be effective tools for studies concerning their life histories. For example, aging studies have found external structures such as fin rays and spines, which may be taken without sacrificing the fish, can be used as effectively as otoliths in age determination. Preliminary studies have suggested that a direct correlation between otolith and fin ray microchemistries also exists. In an effort to eventually quantify life histories and preferred habitats of reef fishes, this project will first verify the similarities in microchemistries of the two distinct calcified structures from red grouper, *Epinephelus morio* and gray snapper, *Lutjanus griseus*. Otoliths and fin rays from the same individual fish are being compared using inductively coupled plasma mass spectrometry to detect trace element concentrations along an age continuum for each structure. The resulting concentrations are being analyzed for variances using a distance based redundancy analysis. If, as expected, the microchemistries provide statistically similar results, then the technique will be applied as a non-lethal alternative to investigate life history characteristics of three reef fishes in southern Florida. Non-lethal life history determinations may prove particularly useful for species of conservation interest such as the federally protected goliath grouper, *Epinephelus itajara*.

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Use of microsatellite DNA to assess genetic differences between bonnethead sharks, *Sphyrna tiburo*, from two areas in Florida

Shark species are often characterized by relatively homogeneous population structure across modest geographical distances, with the exception of those species that are moderately sedentary or exhibit philopatric behavior. One such species, *Sphyrna tiburo*, the bonnethead shark, is a coastal member of the hammerhead shark family which grows to about 1m in length. Previous studies have shown that bonnetheads from several sites in Florida (Florida panhandle, Tampa Bay, Florida Bay) exhibit life history differences in traits such as growth rate, age and size at maturity, and fecundity. Because bonnetheads are relatively site-specific and do not appear to exhibit the long migrations observed in many other shark species, these differences may reflect evolved adaptations at each site. If so, it may be possible to detect genetic population structure in sharks from this region. The aim of our study is to examine whether bonnethead sharks from Tampa Bay and the Apalachicola region of the Florida panhandle are separated into two genetically distinct populations. By examining the genotypic and allelic differences among microsatellite DNA from ninety-four sharks, we hope to determine the extent of the relationship between bonnetheads from these two areas. Results may provide insight regarding whether the life history variation in this species is due to evolved differences or phenotypically plastic responses.

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Genetic identification of single fish eggs for a community analysis of fish spawning in Terra Ceia Bay, Florida.

Determining fish spawning grounds based on identification of fish eggs is vital to management and conservation of fisheries habitats. Percomorpha is a bony fish group comprised of about 15,000 species of spiny-rayed fishes, many of which are commercially important. Identifiable species characteristics are apparent in adults; however, visual classification of percomorph eggs to species level is extremely difficult due to their high diversity and morphological similarity. Recent advances in molecular barcoding of the cytochrome oxidase subunit I (COI) gene, a gold standard for taxonomic classification of metazoa, have allowed for genetic identification of fish eggs. The purpose of this project was to conduct a community analysis of fish species spawning in Terra Ceia Bay, Florida. Fish eggs were collected in plankton tows from fourteen sites around the bay and sorted individually into 96 well plates. DNA was extracted from each fish egg separately, followed by amplification of the COI barcode region by PCR and sequencing. A total of thirteen fish species was detected, with the most abundant being *Centropomus undecimalis,* the common snook*; Eugerres plumieri*, the striped mojarra*; Cynoscion nebulosus,* the spotted seatrout*;* and *Prionotus scitulus*, the leopard searobin. Snook (*Centropomus undecimalis*) have traditionally been thought to swim offshore and spawn in the Gulf of Mexico, yet little is known about whether they also spawn in inshore areas. These results are the first molecular evidence to confirm that snook spawn within Terra Ceia Bay, which supports prior circumstantial observations. Future work should optimize for high-throughput genetic identification of eggs to accommodate large-scale and shipboard collections, which can provide key information for fisheries management to protect and conserve spawning areas.

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Length-based Mortality Methods for Sustaining Florida's Fisheries

South Florida's reef fisheries present stock assessment scientist with unique challenges. Large and diverse recreational fleets limit the utility of CPUE and gear standardization techniques, providing length frequency data as the principal observation for fisheries monitoring. The development of reliable length-based stock assessment methodologies has therefore been of great interest for a long time. The Beverton-Holt (BH) total instantaneous mortality estimator based on average size of fish in the exploited phase, despite its potential for strong biases, has been a popular tool due to its simplicity, computational efficiency, and modest data requirements. Recently two major concerns of BH method have been addressed through the works of *Ehrhardt & Ault* (EA) and *Gedamke & Hoenig* (GH). The 1992 EA formulation corrected potential positive bias in the BH equation by truncating the range of integration to the exploitable lifespan of a species, resulting in a zero-bias estimate at equilibrium. GH in 2006 transformed the original BH model to a non-equilibrium formulation to accommodate potential changing mortality rates over time. In addressing these issues both EA and GH provide obvious technical advances, yet their differing goals provide a challenge in optimal model choice which is often unclear. This study set out to develop a hybrid model formulation that incorporates the advances of each approach and provides optimal mortality estimates in all situations. In pursuit of this a stochastic simulation framework was developed to

objectively evaluate model accuracy and precision. Here we report on the results of a new decision protocol to identify the situations under which certain formulations provided superior estimates. Application to Florida Keys coral reef fisheries demonstrates this model provides a unified tool for future fisheries management.

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Comparison of Reef Fish Assemblages Sampled Using Common Fishery-Independent Techniques

The assessment of reef fishes in the southeastern U.S. has historically depended heavily on fishery-dependent data sources. Stock assessments based solely on fishery-dependent data have been suspected of being inaccurate due to management measures that restrict landings and a lack of randomization in sampling techniques. Fishery-independent monitoring can provide a more accurate reflection of true population size and fish assemblage structure; however, sampling schemes, gear types, and even bait types may influence the results of fishery-independent surveys. Chevron traps have been used throughout the southeastern U.S. as a fishery-independent reef-fish sampling gear type for several years. As the technology has become more affordable, fishery-independent monitoring programs from North Carolina to the northern Gulf of Mexico have added video cameras to the chevron traps already being deployed. This combination of camera and trap data will allow us to observe that portion of the fish assemblage which is not captured in traps. This project will compare the trap and video data from three regions: the south Atlantic Bight, the west Florida shelf, and the Florida panhandle. Similarities and differences between trap and video catches will be compared within each region. Data will be compared among regions to determine whether region influences the correlation between trap and video data. Results of these analyses will further our understanding of reef-fish assemblages throughout the southeastern U.S., and reveal gear selectivity that may exist for commonly used fishery-independent gears.

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Integration of Stationary Underwater Video Camera Observations with Multibeam Acoustic Mapping to Evaluate Habitat Use by Reef Fishes in the Florida Middle Grounds

The emphasis on ecosystem-based fisheries management has been increasing due to improvements in fish–habitat linkages. In order to collect ecosystem-based fisheries data, a variety of gear types have been developed, including capture, acoustic, and visual imaging gears. This study utilized multibeam mapping data of the Florida Middle Grounds (FMG) to pre-select sampling stations based on depth and bottom hardness criteria. The stratification scheme divided the FMG into 0.1 nm x 0.3 nm stations, each assigned one of eight distinct habitat strata. A total of 162 Stationary underwater camera arrays (SUCAs) were deployed within the FMG during two sampling events in 2009 to visually ground-truth habitat characteristics and identify fish assemblages at deployment locations. Comparisons of assemblage structure among pre-defined habitat strata suggested that bottom hardness was the most important station-level criterion for determining fish assemblage. The assemblages found in hard-bottom stations were distinct from and more diverse than those found in soft-bottom stations. Assemblages found in stations with “mixed” bottom types were not easily discernible from either soft-bottom or hard-bottom stations, highlighting the difficulties of

accurately classifying heterogeneous habitats on broad spatial scales. Fish assemblages analyzed by individual SUCA location suggest that more accurate strata can be assigned based on smaller spatial scales. These results underscore the importance of accounting for fish – habitat relationships in the design of fisheries-independent reef-fish surveys on the west Florida shelf.

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Effects of Hypoxia on the Spatial Distribution of Marine Megafauna in the Northwestern Gulf of Mexico

A large area of hypoxia (dissolved oxygen, DO, ≤ 2.0 mgl^{-1}) forms on the northwestern Gulf of Mexico shelf in the summer as a result of riverine nutrient inputs and strong salinity stratification associated with the Mississippi-Atchafalaya River system. Low DO can lead to direct mortality of sessile organisms and sensitive mobile organisms that are unable to escape to waters with higher DO. Hypoxia can also enhance metabolic costs, lead to habitat loss, and alter species interactions by modifying the spatial distributions and overlap of interacting species. However, few studies have investigated the effects of hypoxia on species interactions at the upper end of marine food webs. To address this gap, synoptic aerial and hydrographic surveys were completed in August 2003 and 2004 at two study sites within the larger Gulf hypoxic zone. These surveys were repeated at the shelf-wide scale in July 2011 and will be replicated in July 2012. Analyses to date indicate that forage species, such as juvenile finfishes and penaeid shrimp, avoid low DO and aggregate at high densities within 3 km of the edge of the hypoxic zone. In this study, we expect to find that apex marine predators and other megafauna are influenced by hypoxia primarily via shifts in the spatial distribution of their primary food resources. Specifically, we hypothesize that bottlenose dolphins, several species of sea turtles, and coastal sharks aggregate near the edges of the hypoxic zone where demersal prey densities are high. Alternatively, these species may aggregate within the geographic bounds of the hypoxic layer where pelagic prey are compressed in surface waters above the bottom hypoxic layer. This work will help elucidate the indirect effects of hypoxia on interactions between top predators and the forage fish community in marine ecosystems.

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Length Frequency Distributions of Yellowfin Tuna Caught on Circle and 'J' Hooks

The effectiveness of hooks has always been an issue of concern within commercial fisheries, mainly by fishermen and more recently managers. In 2004, the National Marine Fisheries Service (NMFS) implemented the mandatory use of circle hooks to aid in the reduction of protected species bycatch within the commercial pelagic longline fishery. We seek to compare length frequency of a single economically important species, yellowfin tuna (*Thunnus albacares),* between different size 'J' and circle hooks, by fishing region. Common historically used hooks, by the U.S. pelagic commercial fishing fleet, were used in our analysis of length frequency. Predominant hook types used have been 8/0, 9/0 'J' hooks and 16/0 circle hooks (Watson et al, 2005; Carruthers et al, 2009). Data used spanned the years 1992-2011. Cumulative frequency graphs were plotted comparing circle and 'J' hooks of different sizes with variations in lengths of yellowfin tuna for the various geographical areas. Evidence showed that there was a usage correlation between hooks of different types (circle and 'J'). We determined it was most pertinent to compare 7/0 'J' hook data with 15/0 circle hook data, 8/0 'J' hook data with 16/0 circle hook data, and 9/0 'J' hook data with 18/0 circle hook data. Size selectivity

may be present, by hook type. Further statistical methods will be applied to the refined data to attempt to discover a correlation between hook type and selectivity by animal size. While the use of circle hooks alone is not responsible for the reduction in incidental take interaction and/or mortality, it cannot be ignored that their use is an integral management tool for keeping this fishery sustainable while still retaining marketable catch.

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Habitat utilization and short-duration movements of the pelagic stingray *Pteroplatytrygon violacea* in the western North Atlantic and northern Gulf of Mexico

The pelagic stingray *Pteroplatytrygon violacea* is the only true pelagic dasyatid stingray, and the species is commonly encountered as bycatch in the pelagic longline fishery targeting swordfish and tunas. However, very little is known about its habitat utilization and whether depth or temperature differences between the pelagic stingray and the pelagic longline gear type could be used to develop fisheries bycatch mitigation techniques. Four pop-up satellite archival tags (PSATs) with 13-day deployment durations were deployed on pelagic stingrays in 2010 and 2011 in both the South Atlantic Bight (n=2) and the northern Gulf of Mexico (n=2). Data from these tags indicate clear diel difference in behavior, with all four animals displaying deeper depth utilizations during daylight periods. All four stingrays appear to be following a temperature regime above all other variables. Differences in depth were examined to determine the speed and the range of the vertical movement between sequential 90 second point data. All four animals also displayed frequent short-duration (*ca.* 5-minute lengths) movements of more than 50 m from the "baseline" depth of the diel period and a thermal range of approximately 8°C over 24-hour periods.

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Quantifying fish detection probabilities with video cameras in dense submersed vegetation

In freshwater ecosystems, dense submersed vegetation provides important habitat for many fish populations but can pose significant sampling problems for fish population assessments due to habitat complexity. We validated a new sampling technique using underwater video cameras (UVC) to measure fish abundance, by evaluating the relationship between fish detection probabilities and habitat. We utilized UVC to obtain point counts on known densities of replica-fish below the canopy layer in dense hydrilla *Hydrilla verticillata* habitat on three 0.45 ha ponds. Our approach avoided uncertainty in animal behavior and point count abundance focusing solely on the relationship between habitat covariates and detection probability. Stem density, turbidity, available light and distance to fish were measure at each point count. We analyzed video recordings to quantify the detection probability in each pond obtaining average detection probabilities of 44% of fish at each point count that sampled ~0.90m^2. Analysis found that distance to fish and plant stem density significantly influenced detection probability at each point count. We simulated habitat data and UVC point counts drawn from two fish populations to estimate detection probability and ultimately estimate fish abundance. Our results indicated that UVC can be utilized to estimate fish abundance in dense submersed vegetation. Current limitations with UVC are the total sampling area is often <1.0m^2 increasing the number of samples needed to make valid abundance estimates. We provide an innovative method for estimating heterogeneous detection probabilities for fish in

dense submersed macrophytes, showing that underwater video cameras can be a reliable method of estimating fish abundance in such habitats.

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Individuality in a generalist species: a look into common snook spawning movements
Common snook have been the subject of reproductive studies since the 1980s, and much has been learned about reproduction at the population level. Mark and recapture studies coupled with histological sampling of gonads from ecological surveys confirm that common snook migrate to inlets to spawn in the summer months on the east coast of Florida. As management has increased in scope and complexity, the need for more detailed data regarding spawning frequency and duration has emerged. As part of a multi-year study, 271 adult common snook were internally tagged with ultrasonic V-16 Vemco acoustic transmitters for monitoring in the rivers, estuaries, inlets and nearshore waters of SE Florida. Fish locations were recorded by a large receiver array (n>250) maintained by the Florida Atlantic Coast Telemetry (FACT) group. Common snook were tracked over a three year period. Preliminary results indicate that snook are generalists: they exploit and rapidly adapt to varying salinity and environments. Snook can travel over 30 km in a single day, particularly during the spawning season. They showed high site fidelity to spawning sites, visiting the same inlets every year. Over 90% of snook used one or two inlets, but a small number of snook (2%) used four inlets in a single spawning season. Snook tagged inshore made 8±6.5 (median± interquartile range) trips to inlets during one spawning season, and spent 4.72±2.17 (mean±SE) days in the inlet on each trip. Snook did not spawn over the entire spawning season (April to October). Individual spawning seasons lasted 82.17±3.51 days with peak numbers of animals spawning between June and September. Understanding the frequency and duration of spawning runs is vital to calcultaing potential reproductive output. This information should improve the stock assessment for common snook and provide insight on reproduction of other high-frequency spawning species.

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