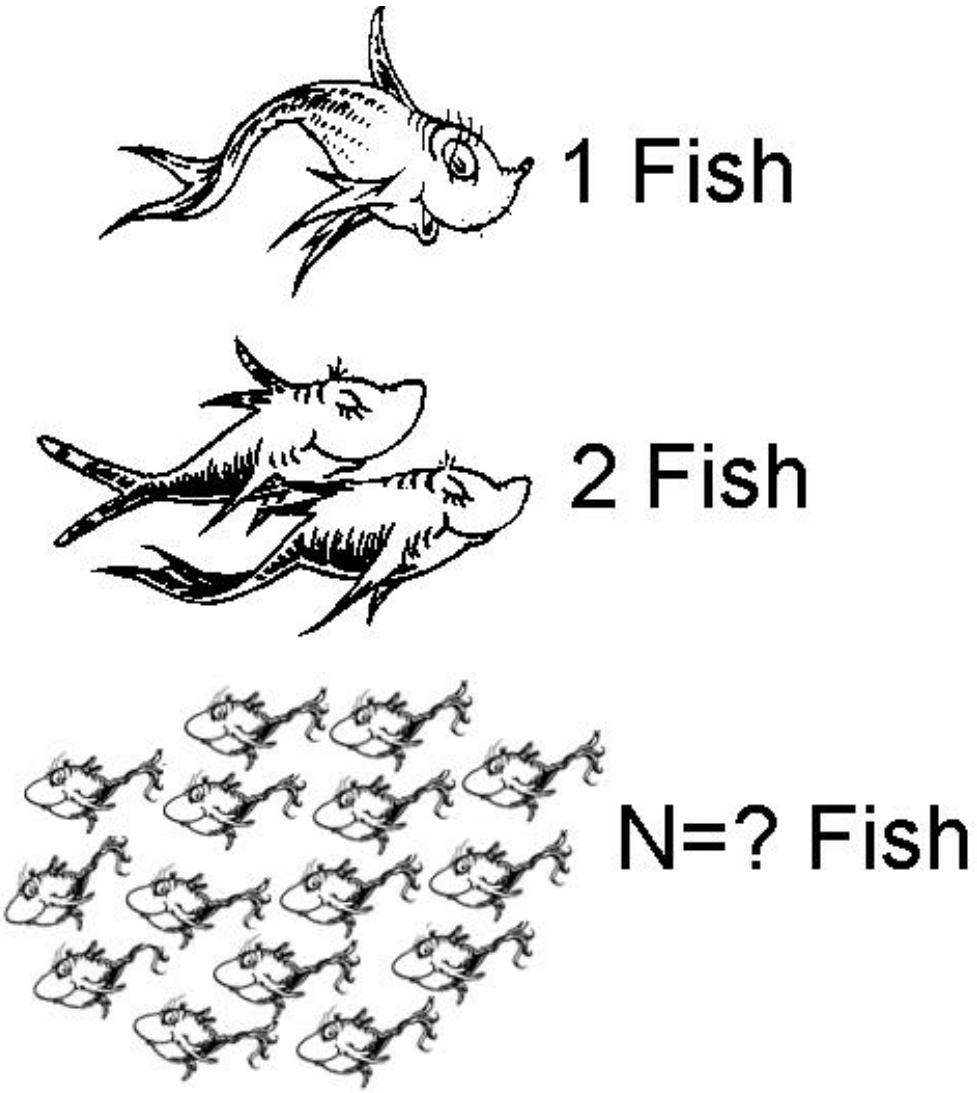
30th Annual Meeting of the Florida Chapter of the American Fisheries Society



Uncertainties in Fisheries Science

February 16-18, 2010
4-H Camp Ocala, Altoona, Florida

The Florida Chapter of the American Fisheries Society

Chapter Officers

President: Debra Murie, UF

President-Elect: Linda Lombardi, NOAA

Past-President: Will Patterson, UWF

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Major Contributors for our Annual Meeting:

Webmaster: Bob Wattendorf, FWC

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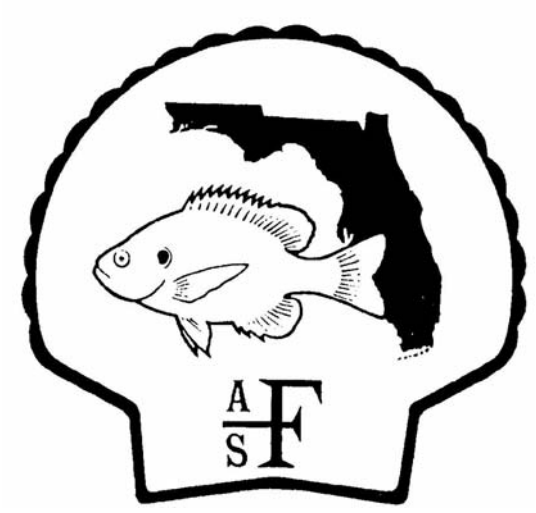
Raffle Co-Chairs: Andy Strickland, FWC, and Alan Collins, NOAA (retired)

Student Travel Awards: Chuck Cichra, UF

Roger Rottmann Memorial Scholarships: Chuck Cichra, UF

Rich Cailteux Award: Eric Nagid, FWC

Membership Database Manager: Larry Connor, FWC



Thanks to everyone for their symposium and contributed presentations!

Thanks to all the moderators and judges!

30th Annual Meeting of the Florida Chapter American Fisheries Society

February 16-18, 2010

4-H Camp Ocala, Altoona, Florida

General Program

Tuesday, February 16

11:00am – 6:00pm	Registration
12:00pm – 1:00pm	Lunch
1:00pm – 5:00pm	Contributed Papers
5:00pm – 7:00pm	Poster Setup
6:00pm – 7:00pm	Dinner
7:00pm – 8:00pm	Formal Poster Session Followed by the *bonfire social*

Wednesday, February 17

7:00am – 8:00am	Breakfast
7:30am – 6:00pm	Registration
8:00am – 12:00pm	**Symposium: *Uncertainties in Fisheries Science***
12:00pm – 1:00pm	Lunch
1:00pm – 5:00pm	**Symposium: *Uncertainties in Fisheries Science***
5:00pm – 6:00pm	Student Subunit Meeting (all students); Time to relax (all others)
6:00pm – 7:00pm	Dinner
7:00pm – 8:00pm	**Chapter Business Meeting** Awards presentation: Student Awards – Travel and Roger Rottmann Scholarship Professional Awards –Rich Cailteux Followed by **THE RAFFLE, AUCTION,** and the *bonfire social*

Thursday, February 18

7:00am – 8:00am	Breakfast
7:30am – 9:00am	Registration
8:00am – 11:20am	Contributed Papers
11:30am – 12:30pm	Lunch
12:30pm – 1:00pm	**Awards presentation**: Best Papers/Best Posters; Power Tie and Lampshade Awards

Day-By-Day Agenda – 30th Annual Meeting - Florida Chapter American Fisheries Society

Tuesday, February 16
11:00am – 6:00pm **Registration**
12:00pm – 1:00pm **Lunch**
1:00pm – 1:20pm **Welcome – Debra Murie, Chapter President**

Contributed Papers **Moderator:** Debra Murie, UF

1:20pm - Roberts, D.E., J. Taylor, K. Mesner, J.C. Young, and C. Young. Stock enhancement: User-friendly automation and data acquisition for intensive aquaculture applications using a real-time Programmable Automation Controller (PAC) and a Visual Programming Language (VPL).

1:40pm - *Skoumal, R.J., D.E. Roberts, K. Mesner, and W.A. Szelistowski. A method for estimating and modeling biomass and standing stock in recirculating aquaculture tanks using real-time automated data acquisition and a Visual Programming Language (VPL).

2:00pm - Trippel, N., W. Porak, J. Benton, B. Thompson, M. Matthews, R. Stout, and P. Stidham. Post-stocking survival of conditioned vs. naïve hatchery reared largemouth bass *Micropterus salmoides*.

2:20pm - Bonvechio, T. F., K.I. Bonvechio, and R.L. Cailteux. Proposed standard weight (Ws) equation and standard length categories for Suwannee Bass *Micropterus notius*.

2:40pm - *Carey, D., and D. Hering. ¡Olé! Bull Trout population restoration in Crater Lake National Park.

3:00pm – Break

Contributed Papers **Moderator:** Beverly Sauls, FWC

3:20pm - *Camp, E., W.E. Pine III, C.L. Staudhammer, and T.K. Frazer. Consequences of aquatic habitat shifts on specific size classes and taxa of a small fish and macroinvertebrate community.

3:40pm - Steward, C., M. Hale, and R. Laprairie. Recovery of black crappie in Lake Trafford after the massive 2004 fish kill.

4:00pm - Khatoon, Z., R. Paperno, and S. Makhdoom Hussain. Spatial and temporal changes in the fish communities from a mangrove-dominated creek system near Karachi, Pakistan.

4:20pm - *Floyd, T., and J.E. Hill. Predation refuge mediates multiple predator effects on a non-native fish.

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

*student presentation, person presenting oral presentation

Poster Session (7:00pm – 8:00pm)

(In alphabetical order by presenting author, *student presentation, person presenting)

Bayse, S.M., and D.W. Kerstetter. Characterization of swordfish buoy gear catches in the Florida Straits.

*Hutchinson, E., N. Brennan, and K. Leber. Size-structure, distribution, growth, and possible host interactions of two native Unionoid mussel species in a restored wetland pond of Southwest Florida.

DeVries, D., C. Gardner, J. Brusher, and G. Fitzhugh. Demographic and spatial patterns of reef fish on the N.E. Gulf of Mexico inner shelf as revealed in a fishery-independent trap and video survey.

*Downey-Wall, A.M., L.B. Van Woudenberg, W.A. Szelistowski and S.H. Denison. A Preliminary analysis of genetic structure in Florida populations of dusky pipefish *Sygnathus floridae* and chain pipefish *Syngnathus louisianae.*

*Fleming, K.M., D.A. Fox, and F.M. Parauka. Who pays the price of progress: Gulf sturgeon residency and habitat use in Choctawhatchee Bay, FL?

Gardner, C., and D. DeVries. Cross-shelf patterns in fish community structure and demographics on hard bottom habitat off northwest Florida.

Schaub, R., D. Scheidt, C. Garreau and C. Hall. Quantitative assessment of seagrass scarring in Southern Mosquito Lagoon and Northern Indian River, East Central, Florida.

*Gilkey, C.T., S.H. Denison and W.A. Szelistowski. Genetic analysis of the Atlantic and Pacific forms of the Amphi-American fish *Oligoplites saurus*.

Maxwell, K., W. Sharp, C. Bartels, J. Hunt, R. Bertelsen. Using e-mail surveys to evaluate the recreational spiny lobster (*Panulirus argus*) fishery in Florida.

*O'Donoghue, Z.G., A.J. Burnham, A.R. Gestl, M.H. Tan, A.R. Walsh, C.T. Gilkey, R.C. Harbeitner, N.W. Van Bibber, and W.A. Szelistowski. Haplotype changes in the Gulf pipefish *Syngnathus scovelli* along an Atlantic-Gulf genetic break in SE Florida.

Reyier, E., D. Scheidt, K. Holloway-Adkins, R. Lowers, C. Garreau, and S. Gann. Fishes inhabiting the trident submarine basin and adjacent waters of Port Canaveral, East-Central Florida.

Sauls, B., K. Brennan, and O. Ayala. Self-reported and observed recreational catches from headboats in Florida.

*Van Woudenberg, L.B., B.A. Belgrad, K.J. Mack, C.S. Phillips, D.A. Randazzo, R.C. Harbeitner, N.W. Van Bibber, M.C. Davis, C.G. Storer and W.A. Szelistowski. Use of microsatellite DNA to assess dispersal of juvenile Gulf pipefish, *Syngnathus scovelli*, from natal seagrass beds.

Day-By-Day Agenda – 30th Annual Meeting - Florida Chapter American Fisheries Society

Wednesday, February 17

All day **Registration**
7:00am – 8:00am **Breakfast**
8:00am – 8:10am **Welcome – Linda Lombardi, Chapter President-Elect, Program Chair**

Symposium: *Uncertainties in Fisheries Science*

Symposium **Moderator:** Linda Lombardi, NOAA

8:10am – Walters, C. Uncertainties in fisheries science.

8:40am - Patterson, W. and L. Barbieri. The Magnuson-Stevens Reauthorization Act: The alphabet soup of incorporating scientific and management uncertainty into U.S. Federal Fisheries Management.

9:00am – Murphy, M. Evaluating the uncertainty in the stock assessment for South Atlantic (SC-FL) red drum: input data, parameter estimates, and stock status.

9:20am - Sauls, B. and C. Bradshaw. An approach to resolving uncertainties regarding survival of fish released by recreational anglers.

9:40am - Bradshaw, C., and B. Sauls. Keeping track of what you toss: The fate of for-hire discards.

10:00am – Break

Symposium continued **Moderator:** Elizabeth Staugler, UF

10:20am - Baremore, I.E., and K.I. Andrews. The effects of propagating measurement error through the calculations of parameter estimates on stock assessment model results.

10:40am - McBride, R.S., S.J. Sutherland, L.A. Lombardi, and R.J. Allman. Measuring, minimizing, and mitigating ageing error for stock assessments.

11:00am - Miller, S. Evaluating the potential fisheries impacts of proposed surface water withdrawals from the St. Johns River, Florida.

11:20am - Trimm, D.L. and J. Shenker. A study of ichthyoplankton populations within the Florida Straits.

11:40am – Open Discussion

12:00pm – Lunch

Symposium continued **Moderator:** Nate Brennan, MOTE

1:00pm - Nagid, E., W. Strong, T. Tuten, and E. Leone. Inter-rater reliability of aquatic habitat measurements among multiple observers.

1:20pm - *Carvalho, F., D.J. Murie, F.H.V. Hazin, H.G. Hazin, and G.H. Burgess. Spatial predictions of blue shark catch per unit of effort (CPUE) and catch probability of juveniles in the southwestern Atlantic Ocean.

*student presentation, person presenting oral presentation

1:40pm - *Biesinger, Z., W. Lindberg, and B. Bolker. Fine-scale movement and habitat data for Gag Grouper.

2:00pm - *Nelson, J., D. DeVries, C. Gardner, and R.M. Wilson. Near-shore reefs are important transition habitats in the N.E. Gulf of Mexico.

2:20pm - Rubec, P., J. Lewis, D. Reed, and C. Westergren. An evaluation of the transferability of habitat suitability models between Tampa Bay and Charlotte Harbor, Florida.

2:40pm – Break

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

3:00pm - Fitzhugh, G., T. Kellison, K. Shertzer, and D. Wyanski. Uncertainty in reproductive potential of fish with indeterminate fecundity and consequences for stock assessments.

3:20pm - *Lauretta, M., W.E. Pine III, T.K. Frazer, and E. Nagid. Gear catchability estimation from mark-recapture and depletion sampling in coastal rivers.

3:40pm - *Hargrove, J.S., D.C. Parkyn, D.J. Murie, and J.D. Austin. Comparing trophic linkages inferred from visual and molecular analysis of stomach contents for a Caribbean reef fish.

4:00pm - Berens McCabe, E., D. Gannon, and R. Wells. An analysis of the ability to detect population trends in a long-term fish monitoring program.

4:20pm - Kerstetter, D.W., and G.M. Archer. Making lemonade from lemons: using pelagic longline gear behavior TDR data for insights into post-hooking behavior of fishes.

4:40pm – Symposium Concluding Remarks and Open Discussion

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

6:00pm – 7:00pm **Dinner**

7:00pm – 8:00pm **Chapter Business Meeting – Please Attend!**

Awards Presentations:

Student Awards – Travel and Roger Rottmann Scholarship

Professional Awards – Rich Cailteux

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

*student presentation, person presenting oral presentation

Day-By-Day Agenda – 30th Annual Meeting - Florida Chapter American Fisheries Society

Thursday, February 18

All day **Registration**
7:00am – 8:00am **Breakfast**
8:00am – 8:20am **Announcements**

Contributed Papers **Moderator:** Robert Allman, NMFS

8:20am - Staugler, E., N. Brennan, R. DeBruler, C. Neidig, C. Armstrong, K. Heym, and R. Yanong. Community-initiated "Kids Cup" tournament evaluates fate of red drum *Sciaenops ocellatus* in Charlotte Harbor, Florida.

8:40am - *Taylor, M., H. Laubach, and D.W. Kerstetter. Internal parasites of selected mesopelagic teleosts in the offshore tropical western North Atlantic Ocean.

9:00am - Allman, R., B. Black, and M. Schirripa. Relationships among otolith growth-increment chronologies, climate, and recruitment for red and gray snapper in the northern Gulf of Mexico.

9:20am - *Van Bibber, N.W., and T. Schultz. Population connectivity between *Callinectes sapidus* megalopae migrating into estuaries and ovigerous females migrating offshore to spawn.

9:40am – Break

Contributed Papers **Moderator:** David Kerstetter, NOVA

10:00am - *Smith, G., D. Murie, and D. Parkyn. Non-Lethal sexing and implications of sex ratio on population dynamics of Greater Amberjack, *Seriola dumerili*.

10:20am- *Addis, D., and W. Patterson. Site fidelity and movement of reef fishes tagged at unreported artificial reef sites off northwest Florida.

10:40am - *Machemer, E.G.P., D.W. Kerstetter, and J.F. Walter III. A predictive habitat model for the reef fish, rainbow parrotfish *Scarus guacamaia*.

11:00am - *Cournoyer, B., and R. Foy. Juvenile king crab (*Paralithodes camtschaticus*) preference for structural density and orientation of synthetic net habitat.

11:30am – 12:30pm Lunch

12:30pm – 1:00pm **Awards Presentation:**
Best Oral Presentation- Student and Professional
Best Poster Presentation - Student and Professional
Power Tie and Lampshade awards

*student presentation, person presenting oral presentation

Abstracts for the 30th Annual Meeting of the Florida Chapter American Fisheries Society
(In alphabetical order by presenting author, *student presentation, person presenting)

***Addis, D., and W. Patterson**
Student ▪ Contributed Presentation
University of West Florida, Department of Biology, Pensacola, FL 32515
addisdu@gmail.com; wpatterson@uwf.edu

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

A tagging study was conducted at unpublished artificial reefs (n=9) located 15-20 miles south of Pensacola, FL. Reef fish (n = 3,110) were tagged with anchor tags on quarterly tagging trips from March 2005 to December 2007 to estimate species-specific site fidelity and movement. The most frequently tagged species were red snapper (n = 2,114), red porgy (n = 422), gray triggerfish (n = 267), and gag (n = 96). Eighty-six tagged individuals were recaptured at tagging reefs on subsequent trips and fishers reported a total of 249 fish recaptured through December 2009 that were caught away from tagging reefs. Mark-recapture modeling results indicate that red snapper displayed low site fidelity (21% y^{-1}), while higher site fidelity was observed but not quantified as an annual rate for groupers and gray triggerfish. Mean (± sd) distance moved for red snapper, groupers, and grey triggerfish was 29.4 km (± 4.6), 19.5 (± 10.3), 7.9 (± 2.6), respectively. Site fidelity and dispersion will be discussed in the context of the efficacy of unreported artificial reef sites to positively affect reef fish spawning stock biomass.

Allman, R.[1], B. Black[2], and M. Schirripa[3]
Contributed Presentation
[1]NOAA Fisheries Service, SEFSC, Panama City, FL 32408
[2]Oregon State University, Hatfield Marine Science Center, Newport, OR 97365
[3]NOAA Fisheries Service, SEFSC, Miami, FL 3349
robert.allman@noaa.gov

Relationships among otolith growth-increment chronologies, climate, and recruitment for red and gray snapper in the northern Gulf of Mexico

We apply tree-ring (dendrochronology) techniques to develop indices of somatic growth for red snapper (*Lutjanus campechanus*) and gray snapper (*Lutjanus griseus*) using otolith growth-increment widths. The objectives of this study are to i) develop otolith growth chronologies, and ii) integrate chronologies with instrumental records of the environment and time series of year-1 red snapper abundance to evaluate the interrelationships among somatic growth, biomass, recruitment, and climate. From 1991 to 2007, red and gray snapper were sampled from recreational, commercial and fishery-independent landings from Louisiana and Florida. Visual cross-dating was used on sagittal otolith thin-sections, identifying conspicuously narrow increments in 1996, 1993, 1987, and 1978 and conspicuously wide increments in 1999, 1990, 1982, and 1979, which aided in ensuring that all growth increments had been assigned the correct calendar year. Otolith growth increment widths were measured, and crossdating was statistically verified. Master chronologies were then developed by averaging all otolith measurement time series after age-related growth declines had been removed via the process of detrending. Red and gray snapper master chronologies spanned 30 years (1975-2005) and significantly correlated ($r = 0.68$; $p < 0.001$) with one another. The red and gray snapper master chronologies both significantly correlated with March and April sea surface temperatures, Multivariate ENSO Index (MEI) during the prior year, and weakly positive relationships with Mississippi River discharge in February and March. Red snapper recruitment patterns also related to environmental variability and in much the same manner as the red and gray snapper growth chronologies. Considering the overlap in climate-growth relationships, the gray snapper chronology positively and significantly related to red snapper recruitment. The relationship

with the red snapper chronology was also positive, but not significant ($p > 0.1$). Overall, growth was remarkably similar across these snapper species, and was positively related to recruitment through shared sensitivities to environmental variability.

Baremore, I.E., and K.I. Andrews
Symposium Presentation
NOAA Fisheries Service, SEFSC, Panama City, FL 32408
Ivy.Baremore@noaa.gov; Kate.Andrews@noaa.gov

The effects of propagating measurement error through the calculations of parameter estimates on stock assessment model results

Fishery biologists often take several morphometric measurements of fishes to assess growth and other life history characteristics of a stock or population. Measurement error is higher for some measurement techniques, and that error can affect the outcome of growth models, such as the von Bertalanffy growth equation, and ultimately the stock assessment model. Length-at-age data from six species of sharks were used to determine which length measurements (precaudal, fork, natural total, and stretched total) produced variable parameter estimates, specifically the k value, for the von Bertalanffy growth equation. Then the effects of propagating the measurement errors on the outcome of stock assessments were determined for two species of sharks with varying life histories: Atlantic sharpnose shark, *Rhizoprionodon terraenovae*, and blacknose shark, *Carcharhinus acronotus*.

Bayse, S.M.,[1, 2] and D.W. Kerstetter[1]
Poster Presentation
[1] Nova Southeastern University Oceanographic Center, Dania Beach, FL 33004
[2] Present address: FL Fish and Wildlife Conservation Commission, Tallahassee, FL 32301
kerstett@nova.edu

Characterization of swordfish buoy gear catches in the Florida Straits

Swordfish buoy gear (SBG) is a relatively new commercial fishery located off the eastern and southern coasts of Florida that began in 2002. The area targeted by this fishery has been closed to pelagic longline gear (PLL) since 2001. Swordfish buoy gear has largely taken the place of PLL as a commercial fishery for swordfish (*Xiphias gladius*) within the FEC. Conceptually, SBG is similar to a vertical longline, with free-floating individual buoys connected to approximately 100 meters of monofilament with one or two hooks constituting one "buoy." Most vessels currently using this gear are fishing approximately 10 "buoys" simultaneously. Due to the way each individual "buoy" drifts independently with the current, SBG is considered to fish more like PLL than the former NMFS classification of the "handgear" gear type. This study compared swordfish catch and bycatch rates between 56 sets of contemporary SBG field data and historical PLL observer data from the FEC. Catch was dominated by swordfish (91.4%), followed by sharks (6.9%). Analyses show higher swordfish catch-per-unit-effort (CPUE) for SBG vs. PLL (202.4 to 31.8 per 1000 hooks) and much lower bycatch rates for SBG, including no istiophorid billfish, marine mammal, or sea turtle bycatch during the 56 experimental sets. These data indicate that SBG is a cleaner and more efficient commercial fishery for swordfish in this area when compared to PLL. Additional work using small temperature-depth recorders (TDRs) indicate that the actual fishing depths (57.3 m ± 19.2 m) were much shallower than the predicted depths (71.7 m ± 23.7 m). On-going depth modeling work with TDR data is described.

Berens McCabe, E.[1], D. Gannon[2], and R. Wells[1]
Symposium Presentation
[1]Chicago Zoological Society, c/o Mote Marine Laboratory, Sarasota, FL 34236
[2]Bowdoin College, Bowdoin Scientific Station, Brunswick, ME 04011
eberens@mote.org

An analysis of the ability to detect population trends in a long-term fish monitoring program

Ecosystem monitoring programs provide a wealth of basic ecological information and give necessary guidance when setting conservation priorities. However, their utility depends on their ability to detect trends, such as population declines or recovery. Using power analysis, we assessed the current sampling regime of a long-term fish monitoring program in Sarasota Bay, Florida. This seasonal fish sampling program was initiated in 2004 and has been used to investigate the effects of *Karenia brevis* red tides on nearshore fish communities. Effect sizes were calculated based on mean log-transformed catch-per-unit-effort (CPUE) and standard deviations in seagrass habitat, both within and across years. Including clupeids in the analysis increased variability; therefore the tests were completed both with clupeids and without clupeids. With the current sample sizes and α=0.05, the power to detect changes in summer fish abundance between years and between non-red tide and red tide periods ranged from 0.34-0.99. When clupeids were dropped from the analysis, power increased ≥0.97. Within summer seasons the power to detect changes in abundance between non-red tide and red tide periods with and without clupeids was 0.20 and 0.87, respectively. Mean summer CPUEs were more variable than winter CPUEs (X=1.53-2.90 vs. 1.80-2.20 and CV=0.12-0.61 vs. 0.19-0.30, respectively). Within and across years in the winter months we have a 5-73% probability of rejecting the null hypothesis when it is indeed false and the alternative is correct, with and without clupeids in the analysis. Large effect sizes ($d \geq 0.81$) were detected with the current sample sizes. Current levels of sampling would likely detect large changes in winter CPUE however mean winter CPUEs have remained relatively steady over the last 5 seasons. Due to this lack of variation, it is not logistically possible to increase annual winter sample sizes to the point where a minimum power of 0.80 can be achieved.

***Biesinger, Z.[1], W. Lindberg[1], and B. Bolker[2]**
Student ▪ Symposium Presentation
[1]University of Florida, SFRC, Program in Fisheries and Aquatic Sciences, Gainesville, FL 32653
[2]University of Florida, Department of Biology, Gainesville, FL 32611

Fine-scale movement and habitat data for Gag Grouper

Fisheries models often treat demographic parameters as constant across large spatial scales. However, spatial variation in habitat-dependent processes may be important to population dynamics, especially in species with spatially structured life histories. One reason for assuming process spatial homogeneity has been the logistic and technological challenges of gathering movement and landscape data at appropriate scales. Using acoustic transmitters and a fully submergible autonomous hydrophone array, we record 2- and 3-dimensional position estimates to sub-meter performance every several seconds for weeks at a time for grouper ranging >200m. During June through December of 2009 we acoustically tagged a total of 56 gag grouper living on 3 experimental artificial reefs placed in sand-bottom landscapes and 3 reefs in live-bottom landscapes. Gag center their activity at the reef and forage about the surrounding landscape. With transmitters sounding every 2s we recorded individuals' positions for 14 days. In conjunction with detailed water flow measurements (obtained from an Acoustic Doppler Current Profiler) and habitat maps (obtained from our side-scan sonar imagery), the gag positional data can be used to relate movement metrics to landscape and environmental characteristics. We compare space-use metrics (like utilization distributions or average distance to reef) of individuals in both sand- and live-bottom landscapes, including temporal changes over daily and tidal cycles. Finally, measures of gag size and growth will

allow us to link landscape type, gag behavior, and expected gag fitness. Understanding how individual movement relative to landscape features at such fine-scales affects gag size and growth will improve fisheries models which incorporate spatial variation in demographic parameters.

Bonvechio, T.F.[1], K.I. Bonvechio[2], and R.L. Cailteux[3]
Contributed Presentation
[1]Georgia Department of Natural Resources, Waycross, GA 31502
[2]FL Fish and Wildlife Conservation Commission, Eustis, FL 32726
[3]FL Fish and Wildlife Conservation Commission, Quincy, FL 32351 (deceased)
kim.bonvechio@myfwc.com

Proposed standard weight (Ws) equation and standard length categories for Suwannee Bass *Micropterus notius*

We developed standard weight (Ws) equations for Suwannee bass *Micropterus notius* using the traditional RLP technique and newer EmP method. Length and weight data for 2,137 Suwannee bass > 110 mm total length (TL) collected from all ten populations within its narrow geographic range were used to develop the equations. The RLP-derived Ws equation exhibited a slight length-related bias, overestimating condition for smaller (< 150 mm TL) and larger (> 400 mm TL) individuals. As a result, the EmP method was used but only the quadratic form of this Ws equation was successful in eliminating the bias. The resulting Ws equation was determined as Log10WT=-1.014 -0.583*log10TL +0.828*(Log10TL)2 (WT, weight in grams; TL, in millimeters). To assess fish population size structure, five standard length categories (stock, quality, preferred, memorable, trophy) are also suggested based on the longest fish measured in the dataset (425 mm TL) which was larger than the reported world record (400 mm TL) for this species. Urban development and the recent introduction of non-native species into some of these systems pose threats to the conservation of this rare black bass. Thus, the development of a Ws equation and standard length categories will aid biologists in evaluating and monitoring Suwannee bass populations as part of continuing conservation efforts.

Bradshaw, C., and B. Sauls
Symposium Presentation
FL Fish and Wildlife Conservation Commission, FWRI, St. Petersburg, FL 33701
chris.bradshaw@myfwc.com

Keeping track of what you toss: The fate of for-hire discards

FWRI is currently conducting a tagging study to examine the survival of discarded fish captured in the for-hire industry along Florida's Gulf coast. Over 6,000 reef fish were tagged during the 7 month period from June 2009 to December of 2009 aboard charter and headboat vessels. Tagged species include: red grouper (n=2,614), red snapper (n=950), gag grouper (n=490), gray triggerfish (n=184), and vermilion snapper (n=114). Individual fish were tagged if they were to be released by the angler. Of all red grouper captured, 91% were released with tags. In contrast, 59% of red snapper captured were tagged. This is due to the difference in average size for both species; on average, red grouper were 162 mm below the minimum legal size while red snapper averaged just 24 mm below legal size. Both red snapper and red grouper were lip-hooked most often (87% and 92%, respectively) with gut-hooking being second most common (7% and 3%, respectively). A total of 310 individual fish have been recaptured to date, 75 on trips with observers present and 235 by recreational anglers on unobserved vessels. Our recaptures are primarily from recreational anglers due to the consistent utilization of regular fishing locations by the for-hire industry. However, a few fish have been recaptured by commercial fisherman and scientific research vessels. Most recaptured individuals moved less than 15 km from their original tagging location. Individual fish have been at large for as little

as 5 minutes and as long as 190 days. Our continued collection of discard data will help FWRI to develop a matrix for predicting discard mortality in the for-hire fishery.

***Hutchinson, E.[1], N. Brennan[2], and K. Leber[2]**
Student ▪ Poster Presentation
[1]Florida State University, Department of Biological Science, Tallahassee, FL 32306
[2]Mote Marine Laboratory, Sarasota, FL 34326
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Size-structure, distribution, growth, and possible host interactions of two native Unionoid mussel species in a restored wetland pond of Southwest Florida

Freshwater mussels are highly diverse in North America, but of 297 taxa, 213 are either endangered, threatened, or of special concern. These mussels are important to their environment due to their filter feeding and sediment stabilizing capabilities. The study of these organisms and their life history facts are becoming increasingly important as their status becomes more imperiled. This study focuses on two species of Unionoid mussels discovered in a restored wetland pond at the Mote Aquaculture Park (MAP) in Sarasota, FL: *Elliptio jayensis* and *Villosa amygdale* confirmed through molecular genetics. Mussel size structure, density, and growth rates among sub-habitats of the pond were measured from June to August, 2009. In addition, host fish species for glouchidia, a larval stage of the mussels, were identified. Quadrant sampling across sub-habitats showed the majority of mussels were located at non-cattail littoral sites. Size structures indicated that mussels at cattail littoral sites were smaller than those for the other three sub-habitat types in June and August. *Villosa amygdala* was most abundant at cattail littoral sub-habitats while *Elliptio jayensis* was most abundant in non-cattail littoral sub-habitats. Comparative size structures suggested that mussels grew through the summer as confirmed by individual growth patterns from tagged mussels in and outside of enclosures. Using a multi-way ANOVA we found that growth rates were significantly influenced by sub-habitat but species and caging effects were insignificant. Mean growth rates in open sand deep sub-habitats were significantly lower than those in shallow sub-habitats. Of seven species of fish examined for glouchidia, two native species (bluegill and redear, Lepomidae) and two exotic species (mosquitoe fish [*Gambusia affinis*] and African jewelfish [Cichlidae, *Hemichromis letourneuxi*]) were hosts.

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Consequences of aquatic habitat shifts on specific size classes and taxa of a small fish and macroinvertebrate community

Alterations of aquatic habitats can have profound consequences for the abundances and distributional patterns of associated faunal organisms. Accordingly, management of key habitats is the objective of multiple state and federal agency initiatives. In Florida, submersed aquatic vegetation (SAV) occurring in spring-fed coastal rivers, such as the Chassahowitzka and Homosassa rivers, is considered a habitat of special concern. A decade of research indicates a shift in the SAV communities within each of these rivers, with decreases in rooted macrophytes (e.g. *Vallisneria americana* and *Sagittaria kurziana*) and concomitant increases in the relative abundance of filamentous macroalgae. To understand potential consequences of this shift in habitat, we assessed linkages between five specific SAV habitat types and the epibenthic small bodied fish and macroinvertebrate (SFI) community. Our results suggest both SFI density and species composition were significantly related to SAV habitat type. Densities of the overall SFI community were generally highest in filamentous macroalgae. However, Shannon's diversity index values for SFI were lowest in filamentous macroalgae and higher in

native rooted macrophytes. Specifically, smaller sized SFI (e.g., *Lucania parva* and *Palaemonetes* spp.) densities were greater in filamentous macroalgae, whereas larger SFI (e.g., *Lepomis punctatus*) densities were greater in rooted macrophytes. Our results suggest that the SAV shift observed in these systems may impact the SFI community; some smaller taxa may flourish, while other larger taxa decline. Combining these findings with other studies provides insight into how shifts in SAV may affect the structure and function of Florida's spring fed rivers and other aquatic ecosystems. This information is valuable for investigating the ecology of habitat-animal relationships and as a decision support tool for managers.

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¡Olé! Bull Trout population restoration in Crater Lake National Park

Eighteen years ago bull trout of Sun Creek, inside Crater Lake National Park, OR, were threatened with a high risk of extinction from hybridization and competition with introduced brook trout. Since then, two fish immigration barriers were constructed and brook trout were removed with a combination of techniques including electrofishing, snorkeler spear fishing, trap-netting, and the use of the piscicide Antimycin-A. The treatments used were effective in removing and excluding brook trout, with no brook trout observed above the immigration barriers since 2005. The bull trout population response has been slower than expected, however their abundance and distribution has increased from approximately 150 fish occupying 2 km of stream in 1989 to approximately 1,750 fish occupying 11 km of stream in 2009. Snorkel surveys and most recently mark-recapture and PIT tagging observation methods have been used to monitor the bull trout. In order to recover this bull trout population under the Endangered Species Act their abundance and distribution must be increased and extended downstream (through private cattle lands with water rights for irrigation) to provide connectivity with other Klamath Basin bull trout populations and reduce the risk of extinction from a catastrophic event or genetic isolation. Such reconnection of historical migratory routes through private lands is being supported scientifically by the recent PIT tag research on the individual movement of fish in Sun Creek.

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Spatial predictions of blue shark catch per unit of effort (CPUE) and catch probability of juveniles in the southwestern Atlantic Ocean

Accurate population assessments, especially for highly migratory species, such as sharks, require the ability to differentiate changes in abundance from altered catch vulnerability resulting from the natural variability in oceanographic conditions. In the present study, a General Regression Analysis and Spatial Prediction (GRASP) was applied to CPUE data of blue sharks to examine their distribution and abundance in relation to environmental factors in the Southwestern Atlantic Ocean. CPUE was generated by blue sharks caught by the Brazilian pelagic longline fleet between 1997 and 2008. In addition, size distribution of blue sharks

caught in the pelagic longline fleet of Brazil was used to model the proportion of juvenile blue sharks in the catches between 2006 and 2008. Sea surface temperature was the most important environmental factor to influence the blue shark CPUE in the southwest Atlantic Ocean. CPUE spatial predictions indicated two separate areas of higher catch probabilities. The first one was located close to the southern coast of Brazil, Uruguay and Argentina, while the second area was located in a more oceanic region, in the vicinity of the Rio Grande Rise, between 25°S and 35°S. Sea surface temperature was also the most important factor influencing juvenile blue shark spatial distribution. The spatial prediction map showed that juveniles were more frequent to the south of 35oS and that the proportion of juveniles also was high in the area close to the mouth of the Plata River (Rio da Plata). However, for the majority of the Brazilian coast, between 5oN to 30oS, the proportion of juvenile blue sharks in the catch was very low compared with the catch from >35oS. Using GRASP demonstrated that the spatial regression models could predict blue shark distribution relatively well, and may be used in future management strategies for shark conservation in the southwest Atlantic Ocean.

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Juvenile king crab (*Paralithodes camtschaticus*) preference for structural density and orientation of synthetic net habitat

To better understand the importance of habitat structural density and substrate orientation, two experiments were conducted with two cohorts of juvenile red king crab (*Paralithodes camtschaticus*). In both experiments, young of the year (YOY) and one-year-old lab raised crabs were released into separate tanks containing multiple habitat structures and monitored every twelve hours to assess differences in preference between individuals of different ages and sizes. In the first experiment, crabs were randomly placed on one of three types of synthetic netting representing habitats of different density experienced by crabs in the wild and potential marine debris sources for nursery material in an aquaculture nursery setting: 1) large nylon mesh, 2) bundles of free strands of line (chaffing gear), and 3) small monofilament mesh. YOY abundance was not significantly higher on any one habitat after six days time to redistribute. One-year-olds, on the other hand, preferred different netting based on size, with significantly more large individuals found on netting with larger mesh. In the second experiment, crabs were randomly placed on vertical and horizontal mesh panels at the beginning of testing to represent habitats of different orientation experienced by wild crabs. There was no significant difference between YOY crab abundance on horizontal vs vertical structure. However, one-year-olds exhibited size specific habitat preference with significantly more small crabs found on vertical habitats and larger individuals not preferring either structure. Results suggest that juvenile crabs may seek specific structural density and orientation to potentially avoid predation. Assessment of habitat requirements and size-based spatial needs of juvenile crabs will lead to improved understanding of essential habitat for wild crabs and improved methods for aquaculture.

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Demographic and spatial patterns of reef fish on the N.E. Gulf of Mexico inner shelf as revealed in a fishery-independent trap and video survey

A fishery-independent survey of inner shelf, hard bottom habitat (6-41 m depths) in the NE Gulf of Mexico using fish traps was begun in 2004, with stationary video cameras added in 2005. Besides age-specific recruitment indices, the survey yields valuable data on spatial and temporal patterns in demographics and community structure of reef fishes. Gag, scamp, red porgy and gray snapper were far more detectable with video than with traps, with the opposite true for red grouper. Gray triggerfish, red snapper and white grunt were detected equally well by both gears. Trap data revealed three dominant cohorts (99, 02, 06) of red grouper during 2004-2008. No strong year classes were apparent in red snapper, 2005-07, and modal age was 2 yr each year. With gag, no distinct spatial patterns or dominant year classes were seen, and virtually all were 1-3 yr old. There were distinct faunal and demographic differences either side of Cape San Blas. Trap and video data indicated that west of the Cape red snapper was the most common exploited reef fish, but to the east it was white grunt. Red porgy was very common west, but absent east of the Cape, while black seabass and hogfish showed the opposite distribution.

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A preliminary analysis of genetic structure in Florida populations of Dusky Pipefish *Sygnathus floridae* and Chain Pipefish *Syngnathus louisianae*

Population structure in marine organisms is believed to be largely dependent on dispersal ability. This concept is especially applicable to fishes which range widely in dispersal ability due to differences in the form of early life history stages and adult mobility. In the Gulf pipefish, *Syngnathus scovelli*, restricted dispersal is believed to be responsible for a distinct Gulf-Atlantic lineage break with no shared haplotypes from either coast. The congeners *S. louisianae* and *S. floridae* exhibit similar body forms and life history characteristics, and occupy much of the same habitat as *S. scovelli*. In this study we are characterizing the population structures of *S. floridae* and *S. louisianae* using a portion of the mtDNA control region and comparing them to that of *S. scovelli*. Fish were collected during 2009 from Fort Pierce on the Atlantic coast, from Pensacola, Apalachicola/St. Josephs Bays, Tampa Bay, and Charlotte Harbor on the Gulf coast, and from Long Key in the Florida Keys. A high degree of genetic diversity was found for *S. floridae*, however due to low sample size no further conclusions have been made to date. In *S. lousianae* over two dozen haplotypes have been found and the most prevalent haplotypes were found on both coasts. A pair-wise comparison of all sites revealed little genetic differences between sites. These data suggest gene flow around the Florida peninsula. A maximum parsimony tree showed no discernable evolutionary relationships associated with geographic location. The weak population structure and lack of genetic separation between Gulf and Atlantic stocks suggest that *S. louisianae* has substantially greater dispersal ability than *S. scovelli*, and has a population structure more comparable to larger fish with high dispersal potential.

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Uncertainty in reproductive potential of fish with indeterminate fecundity and consequences for stock assessments

Assessments need some measure of population reproductive potential; the default often being spawning stock biomass (SSB). While relatively easy to obtain, the use of SSB is increasingly being questioned in the literature as equivalent levels of SSB don't yield equivalent levels of reproductive potential under annually differing levels of system productivity and age structure. Uncertainty increases approaching the tropics as species are batch spawners with indeterminate fecundity and protracted spawning, thus requiring estimates of batch fecundity (BF), spawning frequency (SF), and duration of spawning season to provide meaningful annual estimates of reproductive output. While BF is commonly measured by size or age, the other variables are not. And none are measured routinely (i.e., annually). We found assessment benchmarks can be very sensitive to shifts in SF affecting the fecundity-at-age matrix. The same is expected for duration. However, these variables have always been assumed to be constant by size/age in southeastern assessments (SEDAR) due to lack of data. This is not a good assumption as a review of the literature reveals that both duration and SF generally increase with age. That there are relatively few studies returning contrasts by age points to the difficulty of meeting spatial-temporal sampling requirements. We discuss possible approaches to address this issue, and welcome any suggestions.

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Who pays the price of progress: Gulf sturgeon residency and habitat use in Choctawhatchee Bay, FL?

Choctawhatchee Bay serves as important foraging habitat for Gulf sturgeon (*Acipenser oxyrinchus desotoi*) during periods of estuarine residence. Such habitats are critical to Gulf sturgeon, as they depend exclusively upon them for growth. In recent years, the Choctawhatchee watershed has undergone significant anthropogenic landscape-level changes concurrent with dramatic rises in human population. Associated habitat transitions from rural/forested to urban/suburban, coupled with apprehension over climate change, has lead to management concerns regarding modifications in water quality and degradation of benthic communities. Forty adult and juvenile Gulf sturgeon were captured in Choctawhatchee River and outfitted with acoustic transmitters in 2009. Monitoring is being conducted using both active and passive telemetry to examine size-specific patterns of residency and habitat use. Through January, 2010 we have relocated the vast majority (38/40) of telemetered sturgeon. An additional 16 sturgeon tagged in Choctawhatchee River in 2008 and two sturgeon from Escambia River have also been recorded. The majority of adults tagged were documented entering the Gulf of Mexico and Santa Rosa Sound in November and December, while almost all juveniles appear to have remained in the Bay. Findings will be compared with existing data to assess alterations in estuarine habitat use resulting from landscape-level changes. This study provides managers with quantitative estimates of habitat change and resulting impacts on Gulf sturgeon behavioral ecology.

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Predation refuge mediates multiple predator effects on a non-native fish

Most prey are eaten by more than one predator, yet most experimental studies focus on single predator-single prey systems. Multiple predators may have non-additive effects, facilitating or interfering with one another, with profound consequences for prey, including for non-native prey during the process of invasion and establishment. Although not well-studied for aquatic systems, resident predators may prevent establishment or limit abundance of invaders. Predation refuges in the environment are necessary for the persistence of prey and should influence the ability of species to successfully invade new areas. We conducted tank experiments to test for multiple predator effects of two common native predatory fish, largemouth bass Micropterus salmoides and eastern mosquitofish *Gambusia holbrooki*, on a non-native, ornamental fish released into Florida's environment, the swordtail *Xiphophorus hellerii*. This two predator system with intraguild predation (largemouth bass eat mosquitofish) would hypothetically yield predator interference, resulting in higher survival of swordtails due to largemouth bass reducing the effect of mosquitofish. Predators were tested alone and in combination with either a weak (artificial vegetation) or strong (vegetation plus barrier) refuge from largemouth bass predation. Mosquitofish alone had little effect on swordtail survival because swordtails avoided vegetated areas with mosquitofish. With a weak refuge, swordtail survival was two times higher with both predators than largemouth bass alone because largemouth bass ate mosquitofish and mosquitofish attacked swordtails less (interference). With a strong refuge, swordtail survival was one third lower in the combination treatment relative to the largemouth bass treatment. In this case, swordtails seeking refuge were excluded from the vegetation by mosquitofish attacks and were consumed by largemouth bass in open water outside the refuge (facilitation). Swordtails were caught "between a rock and a hard place," with no refuge from predatory fishes. Under these conditions, persistence of swordtails in the environment is unlikely.

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Cross-shelf patterns in fish community structure and demographics on hard bottom habitat off northwest Florida

In 2006 we began studying fish community structure, trophic dynamics, demographics, and habitat associations on hard bottom habitats from nearshore to the shelf break in the northeastern Gulf of Mexico, as well as delineating and quantifying those habitats using multibeam sonar. Three sites were sampled seasonally in each of three depths: 23, 37, and 49 m. Video data on species composition, relative abundance, and size structure were collected using an ROV. Specimens for age, food habits, and stable isotope analyses were collected using hook-and-line, traps, and spears. Diversity was much higher midshelf and offshore, primarily because of the occurrence of more tropical unexploited species. Gray snapper abundance was >30 fold higher nearshore (491/ha) than at midshelf (16/ha), with none observed offshore. Except for gray snapper nearshore and vermilion snapper offshore, red snapper was the most abundant exploited reeffish in all strata, averaging 66/ha nearshore, 112/ha midshelf, and 96/ha offshore. Of exploited species, scamp was the most abundant serranid in all strata, and among the top five reef fishes, averaging 52/ha inshore, 63/ha

midshelf, and 23/ha offshore. Among red grouper, three cohorts were dominant (1999, 2002, 2006), and individuals were notably smaller and younger inshore than in the two deeper strata.

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Quantitative assessment of seagrass scarring in Southern Mosquito Lagoon and Northern Indian River, East Central, Florida

The Indian River Lagoon complex located on the east-central coast of Florida, is a long, shallow estuary made up of three sub-basins; Indian River proper, Banana River, and Mosquito Lagoon. There are over 29,784 ha of seagrass in the Indian River Lagoon complex with 8,389 ha within the study area. Shoal grass (*Halodule wrightii*) is the dominant seagrass species in the study area with widgeon grass (*Ruppia maritima*) and manatee grass (*Syringodium filiforme*) both commonly occurring. Previous assessments of seagrass prop scarring follow the Sargent et al (1995) technique of drawing polygons around scarred regions to define three broad categories of scar density. The technique applied during this assessment includes the digitizing of individual scars and fusing the scars with one acre virtual sampling plots where scar density is calculated as the percentage of scarred seagrass within each virtual plot. Color aerial photography at a scale of 1:6,000 was scanned to a resolution of 10 cm and orthorectified. Individual scars were digitized on-screen at a scale of 1:500 and categorized into two severity classes by assessing the degree of substrate exposure. A bathymetric map was used to assess the relation of scar occurrence to water depth. Approximately a third of all virtual plots contained scarring and a total of 476,945 m of scar were identified. Most scars (84%) were categorized as low severity with little substrate exposure. This investigation found less scarring than reported by Sargent et al (1995), with a maximum scar density of 7.9% and only a few patches of scar density in the 5-7.9% range. Scar occurrence is influenced by water depth and boat draft. This technique provides a high fidelity scar map and eliminates the subjectivity of determining the polygonal bounds of different scar severity classes, thereby providing a more reproducible means of quantifying scars.

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Genetic analysis of the Atlantic and Pacific forms of the Amphi-American fish *Oligoplites saurus*

The rise of the Isthmus of Panama approximately 3 MYA separated marine fish populations formerly distributed in both the Atlantic and Pacific Oceans, giving rise to numerous examples of closely-related species pairs found on either side of Central America. Many of these pairs were originally described as single species, however later taxonomic work based on slight morphological differences indicated that most consist of separate species. The yellowtail leatherjacket *Oligoplites saurus* is one of the few coastal fish still considered to occur in both the Atlantic and Pacific, ranging from Maine to Uruguay in the Atlantic and from Baja California to Ecuador in the Pacific. The purpose of this study is to determine if there is genetic evidence suggesting that Atlantic and Pacific specimens are separate species by analyzing the mitochondrial 16s and CO1 regions. Using a 750 bp section of the 16s region, four haplotypes were discovered including two from the Atlantic and two from the Pacific. Haplotypes within each ocean differed by a single transition. There were nine base pair differences between the most common Atlantic and Pacific haplotypes, including six transitions and three transversions. The divergence time for the two groups was estimated to be 3.73 MYA. These

differences are consistent with those of other species pairs separated near the time of the isthmian rise including the blackblotch pompano *Trachinotus kennedyi* (Pacific) and Atlantic permit *Trachinotus falcatus*, which we found to differ by six transitions and two transversions. Methodological problems have prevented analysis using the CO1 gene, and we are working to resolve these. The preliminary genetic data suggest that the Atlantic and Pacific forms of *O. saurus* may be separate species.

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Comparing trophic linkages inferred from visual and molecular analysis of stomach contents for a Caribbean reef fish

Fish stomachs are routinely examined as part of diet studies designed to establish trophic links with habitat. Despite the utility of such studies, intrinsic limitations can confound reliable identification of consumed prey. Examples include differential rates of digestion, whereby prey with no hard parts (e.x. exoskeleton) is digested more rapidly, and physical structures such as pharyngeal teeth which can macerate prey items beyond recognition. As a result, certain prey items can be rendered unidentifiable and subsequently underrepresented or not represented at all in diet summaries. The present study, analyzed the stomach contents of French grunt (*Haemulon flavolineatum*), a reef fish which possesses pharyngeal teeth and forage on soft-bodied prey items including polychaete and sipunculid worms. We collected 99 grunt from St John, US Virgin Islands over two sampling events (June 2008 and May 2009): 51 of which contained stomach contents that have been visually analyzed. Sampled fish ranged in size from 57-188 mm ($\bar{X}$ =119.4 mm, SD=4.02) and were collected from multiple habitat types including seagrass beds and coral reefs. Numerically, sipunculid worms, decapods, polychaete worms, and unidentifiable prey were most abundant. As a supplemental approach to visual analysis, we used the polymerase chain reaction (PCR) to amplify fragments of the cytochrome c oxidase 1 (CO1) gene or "barcoding" region of mitochondrial DNA from prey tissue recovered from stomachs. Sequences generated from PCR products were then compared to established databases (GenBank & BOLD) of known individuals to establish taxonomic identification potentially to the species level. Thus far, DNA extracted from 99 distinct prey items produced 26 DNA "barcode" sequences of which two specimens have sequence similarity of 99% to known species, with the remainder of specimens ranging from 75-92% similarity ($\bar{X}$=81.9%,SD=5.66%). The utility of a barcoding approach to diet items to increase taxonomic resolution of diet studies will be discussed.

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Making lemonade from lemons: using pelagic longline gear behavior TDR data for insights into post-hooking behavior of fishes

Determining the actual fishing depths of pelagic longline gear has long been a goal of fisheries science, largely for the standardization of fishing effort through the use of habitat-oriented modeling. Early efforts to record these depths used large temperature-depth recorders (TDRs) along the mainline, but more recent work with improved (smaller) technology has resulted in the deployment of hundreds of microTDRs on the gangions themselves to determine actual hook depths. The use of baited hooks on these gangions resulted in the occasional catch of a fish on a gangion equipped with a microTDR. These records are therefore useless from a gear

behavior modeling perspective and have been previously disregarded. The collection of several hundred new and old microTDR records of caught pelagic fishes now allows some insight into actual post-hooking fish behavior. A total of 490 records were examined from microTDR research by the senior author between 2003 and 2009, spanning 17 teleost and 13 elasmobranch species. Extracted data included time, temperature, and depth at hooking and death, and these were then matched with individual fish data, such as length. Analyses show a broad range of survival time on the hook, even within species. Hook location (internal versus external) and individual fish size were variable effects to the length of post-hooking survival. Post-hooking behavior patterns were consistent for some species (e.g., manta ray Manta sp.), but not others (e.g., swordfish *Xiphias gladius*). Not surprisingly, the two most commonly used estimators of hook depths consistently overestimated the hooking depths for most species, suggesting that subsequent population analyses based on these estimated depths are suspect. These data indicate that the present hook depth predictor equations do not provide sufficient information to extrapolate individual species' habitat utilization and, by extension, any rationale for their use in pelagic longline fishing gear standardization efforts.

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Spatial and temporal changes in the fish communities from a mangrove-dominated creek system near Karachi, Pakistan

During February 1999 to December 2001, a survey to monitor the distribution and abundance of fishes in the Korangi-Phitti Creek system (24°45′ N, 67°20′ E) near Karachi, Pakistan was undertaken. Fish were collected from 123 stations where a combination of monofilament gill nets of 8.9 cm, 5.7 cm, and 3.8 cm stretch mesh sizes were used. The objectives of the study were 1) to compare the fish communities between creeks of varying structure (width) and 2) to examine how the fish communities changed in these creeks temporally (season). The physical condition of the study area was found to have significant seasonal (monsoon) patterns related more to temperature than rainfall and salinity. A total of 17,023 fish representing 86 species were collected during the study period. *Sardinella gibbosa* and *Nematalosa nasus* were the most abundant taxa collected accounting for over 50% of the total catch during the study. The community sampled in large creeks (shipping channels) was very different in composition than the community in small creeks in this system. The deeper wide creeks were characterized by schooling pelagic species (e.g., *S. gibbosa*, and *N. nasus*), while the smaller creeks were characterized by the additional presence of mullets (*Valamugil cunnesius*, *Mugil cephalus* and *Liza carinata*), and scats (*Scatophagus argus*).

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Gear catchability estimation from mark-recapture and depletion sampling in coastal rivers

The estimation of gear catchability and associated variance is critical to accurately assess trends in species abundance over time from catch data. In fisheries monitoring, catchability estimates are often used to relate relative abundance indices to absolute abundance estimates (e.g., catch-per-unit-effort trends may be used to estimate population status and predict total

allowable catch). This requires that two sources of error are incorporated into catchability estimation, sampling error associated with relative abundance indices and the error associated with absolute abundance estimates. To appropriately deal with multiple error structures in catchability estimation, we propose a Monte Carlo linear regression method. We assessed the utility of this method by examining relative and absolute abundance data for several fish species from multiple-pass, mark-recapture electrofishing surveys and block-netted, seine depletions in two spring-fed, coastal rivers. These regressions produced less biased estimates compared to point estimates of catchability. The results provided a useful tool for monitoring fish populations in coastal rivers by allowing for absolute abundance estimation from relative abundance data that is comparatively easier and less expensive to collect. In addition, these results give insight into the spatial and temporal variance associated with monitoring fish populations in these systems.

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A predictive habitat model for the reef fish, rainbow parrotfish *Scarus guacamaia*
The rainbow parrotfish, *Scarus guacamaia* is a prominent teleost herbivore in the coastal waters of southeastern Florida whose life history is strongly linked to a dependence on both mangrove and coral reef habitats. Ecologically, the species serves a role in maintaining the health of coral reefs by controlling algal growth. Using NOAA Fisheries data from the Biscayne Bay and the Upper Florida Bay Mangrove Visual Census (1999-2007) and the Reef Visual Census (1979-2006) programs in combination, this study examined the different factors that affect the presence and absence of adult rainbow parrotfish and the ontogenetic shifts present in this species between juvenile and adult stages. Logistic regression was used to predict abundance and occurrence using environmental variables gathered contemporaneously during the studies of temperature, dissolved oxygen, salinity, average depth. A variable for the distance of each site from the nearest channel openings was later calculated using ArcGIS. Presence and absence were also measured against mangrove cover, bottom substrate type, and shoreline development based on available maps and literature. Salinity, average depth, and distance from channel openings were significant in predicting the occurrence of this species, while temperature and dissolved oxygen were not, showing the importance of specific habitat sites. Future research should examine larval dispersal patterns and utilize site fidelity research methods to provide a more accurate picture of occupancy. The health of this and other parrotfish species may be useful in determining the management breadth and priorities of coral reef communities across the greater Caribbean Sea region. Conservation efforts for this and similar parrotfish species, listed as vulnerable by the IUCN, need to be given greater consideration, along with including the ecologically important mangrove coverage within coral reef community conservation plans.

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Using e-mail surveys to evaluate the recreational spiny lobster (*Panulirus argus*) fishery in Florida
Since 1991, the Florida Fish and Wildlife Conservation Commission has been estimating fishing effort and landings of the recreational spiny lobster fishery in Florida using annual mail

surveys of persons holding a valid Florida recreational lobster fishing permit. However, for the 2007-08 lobster fishing season, we began evaluating the efficacy of replacing this survey method with e-mail surveys as a means to reduce cost and increase data management efficiency. To evaluate the potential differences between mail and e-mail surveys, we conducted both types of surveys during the 2007/08 lobster fishing season. Among some other differences, the e-mail survey had a lower response rate, but those that responded were more likely to have fished. This suggested that the lower response rate was a result of non-fishers being less likely to participate in the e-mail survey than recipients that did fish for lobster. This non-respondent bias resulted in differing estimates of lobster landings derived from the two surveys. We adjusted our e-mail survey for the 08/09 fishing season to improve response rates and harvest estimates. In the introductory e-mail letter to the recipient, we emphasized the importance of completing the survey even if people did not fish, and attached a copy of the survey so that they would feel confident they were participating in a legitimate state-sponsored survey and that it was not time consuming to complete. The difference in response rate between the e-mail and mail surveys declined from the 2007/08 fishing season survey to the 08/09 fishing season survey, as did the difference in landings estimates. The 2009-10 recreational lobster fisher survey was conducted exclusively by e-mail, and we continue to evaluate methods to maximize response rates to ensure they provide the most accurate estimates of recreational lobster fishing effort and landings possible.

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Measuring, minimizing, and mitigating ageing error for stock assessments

Ageing fish is a human endeavor, and despite many technological and statistical advances to the process, ages are measured with error. Our focus here is on ageing efforts in support of data-rich stock assessments. Such assessments require production (program) ageing practices, in contrast to one-time (project) age and growth studies. Error within production ageing can be viewed as having three important aspects:

1) Quality assurance, which begins with age validation, but includes training and procedures to maintain consistent age interpretation over time;
2) Quality control procedures to measure and minimize age error in individual samples; and
3) Practices to evaluate or even mitigate the remaining error in ages used in stock assessments.

Ageing, as a science, requires both acceptance that the calcified structure contains reliable annual increments (no process error) and institution of practices to maximize repeatability of age estimates (minimizing observation error). Standards of terminology, processing methods, age assignment, and threshold tests for age readers must all be considered. Inter-laboratory exchanges, ageing workshops, and cooperative efforts to build reference collections are cost-effective tools that significantly enhance the QA/QC procedures of individual laboratories. Other considerations to the development and maintenance of a successful production ageing program include adopting a statistically-sound sampling design, evaluating appropriate sample sizes, and seeking opportunities for innovation. Within stock assessments, several studies have shown that modest ageing error does not confound results, particularly if the error is unbiased. Moreover, methods currently exist to incorporate measured levels of age error into a stock assessment, either to mitigate the error or to test for sensitivity of the error in the outcome of the assessment. In sum, ageing error will exist in the foreseeable future. However, it does not derail efforts to use age-based assessments and can be managed effectively at various steps of the process from the initial field sampling effort to the subsequent stock assessment workshop.

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Evaluating the potential fisheries impacts of proposed surface water withdrawals from the St. Johns River, Florida

The St. Johns River is a potential surface water supply source for meeting the growing water demands of central Florida. Preliminary assessments have indicated that up to 586 million l/d (155 million gallons per day (mgd)) may be available upstream of the confluence with the Ocklawaha River. Another 405 million l/d (107 mgd) may be available from the Ocklawaha River, the major tributary to the St. Johns River. A wide range of issues has been raised concerning the potential impacts of surface water withdrawals on the ecology and natural resources of the river. Included among these diverse issues is the effect of water withdrawals on fish populations. In response, the St. Johns River Water Management District is currently conducting a large interdisciplinary study of the potential ecological effects of the proposed withdrawals. These studies, which have been developed through an intensive review process with a panel of experts from the National Academy of Sciences, are scheduled to conclude in 2011. Potential impacts to fisheries resources that are being evaluated and will be discussed in greater detail include: 1) direct population impacts due to egg/ larval entrainment, 2) loss or reduction of reproductive and foraging habitat for floodplain dependant species, 3) shifting salinity gradient impacts to estuarine dependant species, and 4) impacts to anadromous fish.

Murphy, M.
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Evaluating the uncertainty in the stock assessment for South Atlantic (SC-FL) red drum: input data, parameter estimates, and stock status

Interstate fisheries management of red drum by the Atlantic States Marine Fisheries Commission has used estimates of static spawning potential ratio to determine stock status since 1989. An age-structured analysis was developed to estimate the age-specific fishing mortality rates required to calculate this ratio. The analysis incorporated the variability around eight estimated indices of abundance, estimates of the annual number of angler-landed red drum, and age-composition data. Though age-specific natural mortality and release mortality were specified in the model without error, sensitivity analysis were used to examine the effects of the likely range of these rates. A retrospective analysis indicated a problematic pattern of upward revision in past fishing mortalities when new data were added to the analysis. Even without incorporating the sensitivity and retrospective analyses, the 95% confidence interval for the most recent, three-year-average static spawning potential ratio ranged from 19-82%. Despite this high level of uncertainty and after considering all demonstrated sources of error, managers concluded that fishing mortality for southern-stock, Atlantic red drum was probably low enough to allow the population to exceed the 30% static spawning potential overfishing threshold.

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Inter-rater reliability of aquatic habitat measurements among multiple observers
Habitat use by fishes is an information need becoming increasingly important to aquatic resource managers for the purpose of developing occupancy models, gap analysis studies, setting lake and instream flow standards, and producing predictive assessments. However, quantitative aquatic habitat measurements in Florida are often difficult to obtain due to tannin-stained, muddy and/or non-wadeable lakes and rivers that are typical of Florida systems. In addition, subjective habitat measurements such as percent area covered of vegetation make qualitative assessments of questionable value when the accuracy and precision of such measurements are unknown. Consequently, we tested the precision of habitat measurements made by multiple observers using an inter-rater reliability statistical procedure. We capitalized on cooperative research being conducted by three FWRI field labs that are investigating the resource partitioning of largemouth bass and common snook in three southeast Florida rivers. This analysis is intended to provide the level of consistency between observers on individual habitat metrics, and may ultimately provide some perspective on the overall habitat data quality.

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Near-shore reefs are important transition habitats in the N.E. Gulf of Mexico
High resolution mapping of the N.E. Gulf of Mexico shows extensive hard bottom habitat particularly between the 20m-40m water depth. This habitat varies in relief, rugosity, and biological complexity. Although quite extensive, very little is known about the ecology of the communities that occur on these shallow water reefs. We collected biological data from three fixed sites across three depth stratum inshore (23m), mid-shelf (37m), and offshore (45m). We used video data, collected from drop cameras and remotely operated vehicles (ROV), to assess species composition and relative abundance. Samples of muscle tissue were collected for stable isotope analysis from species that co-occur at each depth stratum. Both seasonal video data and stable isotope analysis show that the inshore reefs are important habitats for species that undergo seasonal migrations or ontogenetic habitat shifts from coastal habitats into the offshore environment. Stable isotope data reveals that these inshore reefs receive a significant food web subsidy via these annual migrations. To our knowledge this is the first study to elucidate this aspect in the ecology of these poorly studied habitats.

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Haplotype changes in the Gulf pipefish *Syngnathus scovelli* along an Atlantic-Gulf genetic break in SE Florida
Population structure in marine fishes is expected to be strongly related to dispersal ability, however studies of the population genetics of marine fishes has focused mostly on large,

economically important species with good adult swimming abilities and planktonic eggs and larvae. Members of the family Syngnathidae (pipefishes and seashorses) are good models for examining population structure in fish that are poor dispersers because adults are relatively small and sedentary and give birth to free-swimming juveniles. Our previous work on Gulf pipefish *Syngnathus scovelli* has found a strong genetic difference between Gulf fish (sampled down to the Middle Florida Keys) and Atlantic fish (sampled down to Ft. Pierce in the Indian River Lagoon). In this study we are examining the nature of this genetic break by sequencing the mitochondrial control region for specimens collected along the SE Florida coast from Long Key, Barnes Sound, Miami, Lake Worth, Jupiter Inlet, and Fort Pierce. Preliminary data suggest that Gulf haplotypes extend north to Miami and that Atlantic haplotypes extend south to Lake Worth, and that significant genetic differences occur among the three locations with Gulf haplotypes. The coastline between Miami and Lake Worth consists primarily of high-energy sandy beaches which have apparently served as a long-term barrier to gene flow between Gulf and Atlantic fish. Genetic differences among the Gulf locations are unusual in light of their proximity and apparent lack of dispersal barriers.

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The Magnuson-Stevens Reauthorization Act: The alphabet soup of incorporating scientific and management uncertainty into U.S. Federal Fisheries Management

It is clear from provisions in the Magnuson-Stevens Reauthorization Act (MSRA) that Congress intended for fisheries management in U.S. federal waters to account for both scientific and management uncertainty when setting annual catch targets (ACTs). Subsequent Technical Guidelines issued by the National Marine Fisheries Service (NMFS) provide guidance as to how uncertainty may be incorporated when setting ACTs. Proceedings from national meetings held in fall 2008 and 2009 of representatives from regional SSCs, NMFS scientists, council representatives, and others provide examples of how different councils and SSCs are addressing uncertainty. In general, guidance has centered on a framework that a stock's annual catch limit (ACL) should be less than or equal to its allowable biological catch (ABC), which in turn should be less than or equal to its estimated overfishing level (OFL). The NMFS Technical Guidelines provide guidance as to how SSCs should discount ABC relative to estimated OFL, but little guidance is given as to the relationship between ABC and ACL. As a term, ACT does not exist in the MSRA, thus only exists in the Technical Guidelines as a recommended, though not required, part of the framework to establish annual fishery quotas. Confused yet? If yes, then you are not alone. This talk will focus on the clear intent of the MSRA for addressing some of the shortcomings of the preceding legislation, as well as offer some ideas as to how the provisions of the MSRA might be instituted in a more straightforward manner than has been proposed to date. Lastly, we will provide examples of how the SSCs of the South Atlantic and Gulf of Mexico Fishery Management Councils have proposed incorporating different sources of scientific uncertainty in addressing ABC control rules, as well as regional interpretations of the relationship between ACL and ABC and whether ACT is a useful parameter to include in management.

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Fishes inhabiting the trident submarine basin and adjacent waters of Port Canaveral, East-Central Florida

Coastal deep-water ports are often considered poor fish habitat due to high rates of anthropogenic disturbance but this view is rarely substantiated by empirical evidence. While entirely manmade and highly industrialized, Port Canaveral, east-central Florida offers expansive subtidal rock revetments and other hard-bottom substrates with the potential to support a diverse assemblage of reef-associated marine fishes. The Port also serves as the only connection to the adjacent Indian River Lagoon system (via the Canaveral Lock) over a 140 km span of Florida coastline and thus may function as an important migratory corridor for estuarine-dependant fish taxa. We are currently conducting a two year multi-gear survey of military and adjacent public waters within Port Canaveral to assess local ichthyofaunal richness and document seasonal abundance trends for ecologically and economically valuable fish species. Sampling consists of monthly otter trawls, bottom longlines, and fish traps as well as quarterly underwater visual censuses, gill net, and rotenone collections. During Year 1 (April 2008- March 2009), 11,694 fishes were collected with nearly 200 distinct taxa now recorded. The most speciose families documented include the Sciaenidae (drums and croakers, 14 taxa), Carangidae (jacks, 10 taxa), Serranidae (groupers and seabasses, nine taxa), and Gobiidae (gobies, eight taxa). No non-native fish species have been documented to date. While catches are dominated by juvenile size classes, results also suggest that Port Canaveral supports high adult densities of certain fish species including common snook (*Centropomus undecimalis*) and goliath grouper (*Epinephelus itajara*) both of which are intensively managed. When complete, this study will serve as one of the more rigorous faunal surveys of any deep-water port in the S.E. United States and will provide insights as to how to manage, or in some instances, enhance fish habitat (and the economic benefit derived from it) in industrialized port facilities.

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Stock enhancement: User-friendly automation and data acquisition for intensive aquaculture applications using a real-time Programmable Automation Controller (PAC) and a Visual Programming Language (VPL)

Supervisory Control and Data Acquisition Systems (SCADA) are becoming more important in fishery propagation as recirculating aquaculture systems (RAS) evolve to meet production needs. RAS production of fishery species is an important strategy for stock enhancement as coastal aquaculture facilities and pond discharges encounter cost and environmental prohibition. Monitoring, control, and alarming are critical to life support in these high density systems. Available real-time data is paramount for prevention of catastrophic failure and it offers unique monitoring opportunities for fish culture. An automated embedded life support system requires programmatic elements with different priorities. Timing, execution of life support tasks, and other deterministic needs have highest priority, with data logging, analysis, communication, distribution and other non-deterministic tasks having a lower priority. This report describes development of such a system without on site application engineering using real-time embedded controllers and LabVIEW® as a graphical data flow VPL.

An embedded SCADA was implemented on a marine RAS with three rearing tanks (total system capacity=60 m3 of seawater) at the Florida Fish and Wildlife Conservation Commission (FWC), Stock Enhancement Research Facility (SERF) in Palmetto, Florida. The system uses embedded real-time virtual instruments (vi's) recompiled to run on the real-time operating system (RTOS), VxWorks®. It conducts and accomplishes tasks grouped in the following categories: 1). Control (opening and closing valves for backup emergency oxygenation; operation of proportional, integral, derivative control loops (PID) and pulse wave modulation (PWM) for primary oxygenation, automation of feeders, switching for alarming systems), 2). Monitoring (water quality parameters, water depth in rearing tanks, water depth in storage tanks, water flow in tanks and filtration systems, electromechanical systems runtime), 3). Data Storage (high resolution structured query language (SQL) logging and storage of all machine data, customized task-oriented logging and storage for staff using text, MS Excel® and Access®, real-time and historical trend analysis), 4). Alarming (alarm logging and execution using text messaging, email, telephone, audible and visual signaling), 5). Automated Data Analysis (variable development using LabVIEW shared variables, tags, functions, and vi's), 6). Publication (data, trends, control panels, and reports are automatically generated and published over networks), and 7). Remote Access (total control of the system afforded over the internet or local area network using a virtual private network (VPN) and/or Windows® remote desktop). Examples of these and other tasks, including samples of data and machinery are presented and summarized.

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An evaluation of the transferability of habitat suitability models between Tampa Bay and Charlotte Harbor, Florida

Spatial models and methods were developed by the Florida Fish and Wildlife Research Institute (FWRI) to conduct habitat suitability modeling in Tampa Bay and Charlotte Harbor. These models predict spatial distributions of estuarine species from data collected by fisheries independent monitoring (FIM) and other sources. Respective FIM catch rates (CPUEs) for 11 species of estuarine fish and shrimp were standardized across gear types. Splines were fitted to mean CPUEs across environmental gradients and input as suitability indices (Sis) to Habitat Suitability Models (HSM). The HSM analyses included computation of the geometric mean of Sis associated with grid-based habitat layers within the ArcMap GIS Spatial Analyst to produce predicted seasonal habitat suitability maps. The models were verified by overlaying gear-corrected CPUEs onto the predicted maps to determine whether observed mean CPUEs increased across predicted suitability zones. Maps created from abundance indices within each estuary and reciprocally transferred from the other estuary were used to test transferability of the models. The HSM models run with five factors did not work as well as models built by varying the number of factors in the model. The seasonal within and transferred HSM maps for each estuary created with varying Sis exhibited increasing verification scores 97-98% of the time. Seasonal HSM map pairs (within and transfer) were similar 78% of the time in Charlotte Harbor and 91% of the time in Tampa Bay. The modeling approach provides information concerning the habitat requirements of estuarine species of fish and shrimp. The HSM modeling approach can be used to support determination of critical habitat for threatened and endangered species, habitat areas of particular concern (HAPCs) for fisheries management, to support natural resource damage assessment (NRDA) for oil spill response, and to support coastal zone planning and management.

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An approach to resolving uncertainties regarding survival of fish released by recreational anglers

Reducing the uncertainty surrounding the estimated numbers of fish and mortality of fish released by recreational anglers has become increasingly important for regional stock assessments. This is particularly true in the Gulf of Mexico where recreational fisheries are large and dispersed and regulatory restrictions on red snapper and other reef fish species require that high portions of fish caught by recreational anglers be released. In 2009, FWC's Fish and Wildlife Research Institute began a three-year directed study of recreational fisheries directed at red snapper and related reef fish species in western Florida. Our directed study has three components: 1) a mark-recapture study focused on identifying significant factors that influence survival of released fish; 2) a voluntary catch-card for private recreational anglers to characterize the sizes and conditions of fish caught and released by the private recreational sector; 3) a random mail survey of licensed recreational anglers to characterize the size and extent of red snapper fishing in different regions throughout the state. The three components of this study will be combined to assess the overall impacts of catch-and-release fishing as it is practiced in the recreational fisheries in western Florida.

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Self-Reported and observed recreational catches from headboats in Florida

Fisheries landings are often reliant on data that are self-reported by harvesters, and evaluating the accuracy of self-reported information is important. We used self-reported logbook data submitted by operators of recreational headboat vessels throughout the state of Florida and compared it to data collected by at-sea observers on a sample of headboat trips between the years 2005-2007. For trips where a logbook report was filled out by the vessel operator and an at-sea observer was present, we conducted a direct comparison of numbers of fish self-reported versus numbers of fish observed. Results suggest that self-reported harvest does not significantly differ from what was directly observed. However, for fish that were released from headboat trips, self-reported numbers of fish were significantly less than observed numbers. Our results indicate that headboat vessel operators are able to accurately report harvested fish on logbook trip reports and are doing so in earnest; however, they may be less able to keep track of and accurately report numbers of fish that are released at sea. Therefore, estimates for numbers of fish discarded in this fishery should not rely solely on data that are self-reported.

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A method for estimating and modeling biomass and standing stock in recirculating aquaculture tanks using real-time automated data acquisition and a Visual Programming Language (VPL)

Intensive recirculating aquaculture production of fishery species is an important strategy for stock enhancement. Monitoring, control and alarming are critical to life support in these systems, and available real-time data offers unique monitoring opportunities for fish culture. An automated control system was implemented on three recirculating aquaculture tanks using a programmable automation controller (PAC) and LabVIEW 2009® at the Florida Fish and Wildlife Conservation Commission (FWC), Stock Enhancement Research Facility (SERF) in Palmetto, Florida. Hardware and software elements of the system were used to monitor and estimate biomass, standing stock, grow out tank water volume and stock density for red drum, Sciaenops ocellatus, during fingerling growout trials. LabVIEW® virtual instruments (vi's) were written to provide functionality, conduct tasks, monitor physical and chemical data, make biomass calculations and predict future values of biodensity in each of the three culture tanks. Real-time monitoring results were published to a front panel over the computer network. Biological morphometric data were collected bi-weekly using standard fishery science methods to empirically truth programmatic calculated estimates of biodensity, and standing stock and to refine the model. Predicted and observed results are compared.

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Non-lethal sexing and implications of sex ratio on population dynamics of Greater Amberjack, *Seriola dumerili*

Greater amberjack, *Seriola dumerili*, is a pelagic reef fish that is managed in the US as two separate stocks, the Gulf and the Atlantic. 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. Some of these questions can be addressed through tagging studies, but most tag returns are lack information on the sex of the fish caught. It would therefore be useful to determine the sex of a fish prior to its release in a tagging study allowing sex-specific data to be used in assessing sex ratios, sex-specific migration patterns, and sex-specific mortality rates. To explore the affect of sex ratio on the exploitation of greater amberjack, we first developed a non-lethal method of sex determination and tested it for accuracy in the field based on the sexing of greater amberjack in a catch-and-release tagging study. Preliminary results have shown this method to be accurate in non-lethally sexing greater amberjack. An accuracy of 99.4% was obtained in the sexing of 154 individuals. Accuracy for males was 100% (n=84) and for females was 98.6% (n=70). Length at 50% maturity for amberjack from the Gulf of Mexico is approximately 900 mm fork length. Sexing of fish below and above this size resulted in accuracies of 97.1% (n=35) and 100% (n=119), respectively. This method is now being applied to determine regional sex ratios. This will then be incorporated into size- and age- structured models to investigate the effects of skewed sex ratios on the population dynamics of greater amberjack.

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Community-initiated "Kids Cup" tournament evaluates fate of red drum *Sciaenops ocellatus* in Charlotte Harbor, Florida

Red drum (*Sciaenops ocellatus*) from three annual catch-and-release tournaments in northern Charlotte Harbor, Florida were evaluated to determine post-event dispersal and related mortality. These research-based tournaments ("Kids Cup") were designed to allow community and youth stakeholders to participate in research and encourage resource accountability and awareness. During each event, slot size tournament-caught red drum were weighed, measured, fitted with dart tags (Hallprint, Victor Harbor, Australia), and released. Subsets of red drum (n=20, 20, and 22 in 2007, 2008, and 2009) were also surgically implanted with individually-coded acoustic transmitters (Vemco, Nova Scotia, Canada) and released. We used an array of stationary underwater receivers and mobile hydrophones to track post-tournament activity. For each tournament, we also conducted a 48 h post-event mortality study on subsets of the tournament fish (n=15, each year) held in five 1000-l tanks supplied with flow-through ambient water. Here, experimental treatments included red drum implanted with placebo transmitters, dart tags, and no tags. After this, all surviving red drum were fitted with dart tags (if not already tagged) and released. Trained volunteers assisted scientists during field procedures and project findings were relayed to community stakeholders via print media and an interactive website. Annual dart tag reporting rates were 20% (of 64 released), 10% (of 68) and 14% (of 44). In 2007, 90% of the acoustic-tagged red drum were heard post-release, but in 2008 and 2009, 100% of the acoustic-tagged red drum were heard after incorporating more detectable transmitters. Mean 48h mortality rates were 13% for fish implanted with placebo acoustic tags, 7% for dart-tagged drum and 0% for untagged drum, although means were not significantly different. Recaptures from receivers and anglers are providing information on release site fidelity and dispersal with respect to capture origins, and habitat-specific preferences such as their use of man-made canal habitats.

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Recovery of black crappie in Lake Trafford after the massive 2004 fish kill

Lake Trafford, a small (600 ha) hypereutrophic lake in southwest Florida, is home to the southernmost black crappie fishery in the United States. It has also historically supported largemouth bass and panfish fisheries. There is anecdotal evidence that the lake bottom was once sandy, but by the 1990's, it had become covered with several feet of flocculent organic

muck composed largely of decomposing plant matter. In the mid 1990's, the lake began to show visible signs of water quality degradation and to experience spring algal blooms and fish kills. The largest fill kill occurred in April 2004. For the 3 years immediately preceding the kill, the average catch rate for largemouth bass in spring electrofishing samples was 0.3 fish/min. However, immediately following the fish kill, no bass were caught during spring electrofishing efforts, and the catch rate remains at essentially 0 today. For black crappie, which were sampled in the fall using a bottom trawl, catch rates from 2000 to 2003 ranged from 8.4 fish/min to 22.7 fish/min. Although no crappie were collected in fall 2004 trawl samples, catch rates have increased steadily since 2005 to a high of 35.6 fish/min in 2008. Roving creel surveys, conducted in 2006/2007 and 2008/2009, also showed black crappie success rates rebounding; with values approaching half of pre-2004 levels within two years and continuing to increase.

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Internal parasites of selected mesopelagic teleosts in the offshore tropical western North Atlantic Ocean

Internal parasites have the potential to both inhibit nutrient uptake and stimulate an inflammatory response in the host. Of the many potential sources of cryptic mortality and morbidity in fishes, the effects of internal parasites are perhaps the least studied. The internal parasite fauna of the mesopelagic teleost species snake mackerel (*Gempylus serpens*), oilfish (*Ruvettus pretiosus*), lancetfish (*Alepisaurus ferox* and *A. brevirostris*), and escolar (*Lepidocybium flavobrunneum*) are described from the South Atlantic Bight in the western North Atlantic. Host specimens were obtained as incidental bycatch aboard commercial pelagic longline vessels. All specimen fishes were preserved on ice or frozen whole, and parasites recovered at laboratory dissections were preserved in 70% ETOH. To date, 122 mesopelagic teleost fishes have been sampled, yielding well over 200 individual parasite specimens. Parasite phyla found to date include nematodes (roundworms), trematodes (flukes), acanthocephalan (thorny-headed worms), and cestodes (tapeworms). Total internal parasite loads were compared against the size (length and weight) of the host; however, results show no relationship between these factors. Each of these co-occurring mesopelagic species shows a different parasite complex. *G. serpens* appears to show the lowest incidence of parasitism yielding predominantly nematodes with a small amount of trematodes. *A. ferox* has shown nearly one hundred percent parasitism yielding trematodes. *L. flavobrunneum* have been shown to host nematodes, cestodes, and acanthocephalans. *R. pretiosus* have been shown to host mostly nematodes. These results establish methodologies and baseline values for expected internal parasite load and species compositions for mesopelagic teleost hosts. As preliminary data has shown that the parasites in these hosts are not species specific, other pelagic and mesopelagic fishes may be susceptible to similar infestation. Future research is suggested to ascertain if commercially valuable, co-occurring pelagic fishes may not also be at risk for similar infestation patterns.

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A study of ichthyoplankton populations within the Florida Straits

Oil and gas development, along with alternative energy technologies proposed within the Florida Straits (Gulf Stream) have the potential to impact fishery populations through loss or reduction of eggs and larvae that rely on currents for transport and dispersal. A basic understanding of seasonal ichthyoplankton assemblages and densities that could be at risk from water intakes at these type facilities is critical for assessing operational impacts. Presently, no public information for this area is available for predicting impacts to these populations. From December 2006 through November 2007, a survey was conducted to establish baseline populations, and seasonal, depth-related and diurnal trends for selected ichthyoplankton species off of Ft. Lauderdale. Based on survey results, a modified empirical transport model was used to predict incremental losses from egg and larval entrainment considering conditional mortality, variability and uncertainty related to 'patchiness'.

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Post-stocking survival of conditioned vs. naïve hatchery reared largemouth bass *Micropterus salmoides*

We compared the growth and survival of conditioned and naïve hatchery-reared largemouth bass *Micropterus salmoides* in research ponds. Four 1-acre research ponds at the Florida Bass Conservation Center were stocked with predator and prey species to simulate typical fish populations in eutrophic Florida lakes. We stocked equal numbers (n = 125) of two groups of hatchery-reared bass into each research pond at densities similar to what would typically be released into in the wild. One group of the study fish (naïve) were grown out in concrete raceways using normal hatchery protocol. The other group (conditioned) were reared in concrete raceways and then moved to a ½ acre earthen outdoor pond the last ten days prior to stocking. The conditioning pond had been stocked with prey (≈ 3,750 Eastern Mosquitofish *Gambusia holobrooki*) and predators (seven largemouth bass and five bowfin *Amia calva*). We also placed brush piles around the conditioning pond to provide structural habitat. This was done to acclimate hatchery reared fish to predators, structure, and having to seek forage. Ponds were drained and all fish left in each pond were counted after one month. Survival between the four ponds averaged 32% for naïve fish and 59% for conditioned fish. At time of stocking there was no significant difference in size of fish (P=0.49). Naïve fish averaged 87 mm in total length and conditioned fish averaged 88 mm. After 30 days in research ponds, there was a significant difference in size between the two groups (P=1.2E-24). Naïve fish averaged 96 mm in total length while conditioned fish averaged 106 mm. Predator avoidance and prey capture efficiency studies were conducted on conditioned and naïve hatchery largemouth bass in tanks to evaluate mechanistic relationships that might have contributed to differences in survival in the research ponds. Results from these studies will be discussed.

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Population connectivity between *Callinectes sapidus* megalopae migrating into estuaries and ovigerous females migrating offshore to spawn

Ovigerous female blue crabs (*Callinectes sapidus*) migrate to the mouth of estuaries to spawn. The released larvae move to high salinity waters offshore to develop through seven zoeal stages before they return to estuarine waters to mature. Maximum megalopal immigration peaks about every two weeks corresponding with the strongest flood tides. It is typically thought that once offshore larvae will distribute and mix with larvae from surrounding estuaries; however, ours is the first study to examine this from a genetic standpoint. Megalopae were collected from the Newport River estuary (Beaufort, NC) every day for a three month period (August 28-November 21, 2008) and ovigerous females were collected within the estuary while on their spawning migration 30-60 days prior. Crabs were sequenced for the mitochondrial ND2 region and population structure was assessed between each of the three peaks of maximum megalopal immigration and between each peak and the group of ovigerous females. We observed 118 haplotypes with high haplotype (h = 0.9256 ± 0.014) and nucleotide diversity (π = 0.01430 ± 0.00042). Pairwise comparison between all peaks revealed no significant structure but significant structure was observed between peaks 1 and 2 and the ovigerous females (FST = 0.04108 and 0.07353; P= 0.01855 and 0.00098, respectfully). This evidence supports the theory of offshore larval mixing.

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Use of microsatellite DNA to assess dispersal of juvenile Gulf pipefish, *Syngnathus scovelli*, from natal seagrass beds

Dispersal is a nearly universal phenomenon in both aquatic and terrestrial organisms. Many marine fish have dispersive egg and/or larval stages followed by residence in a nursery ground apart from the adult habitat. In Gulf pipefish, *Syngnathus scovelli*, males give birth to free-swimming juveniles following incubation of embryos in a brood pouch, and both juveniles and adults live among submerged vegetation. It is unknown whether juveniles disperse from natal areas as do species with planktonic eggs or larvae, and if so, at what stage dispersal occurs and whether it is sex-biased. It is also unknown if small juveniles have different habitat requirements than adults in this species. We are using field collections and microsatellite DNA to try to answer these questions. We sampled all adults and a large portion of the juveniles from three small seagrass patches in Tampa Bay. Fish of all life history stages were common, ranging from newborns to large adults, suggesting that juveniles may not have a separate nursery area. To assess whether juveniles disperse to other seagrass beds following birth, we are using four microsatellite markers to determine whether juveniles reside in the same seagrass beds as their parents by comparing genotypes of a wide size range of juveniles to those of the adults collected from the same seagrass patches. Implications of our preliminary results will be discussed.

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Uncertainties in fisheries management

Virtually all important fisheries policy decisions are made in a cloud of uncertainty, and things are not getting better. Modern stock assessment and risk management models have promised to provide better tools for management planning, but instead have simply made matters worse by pretending estimation and prediction capabilities that we still do not have. Of the big three processes in population dynamics (growth, natural mortality, recruitment), we really only understand and can predict growth, because it is easy to study. Recruitment variation and response to management treatments (conservation, habitat) remain largely a mystery. We are not going to gain much further understanding about the recruitment mystery until we focus on it as the central cause of uncertainty in fisheries, and adopt much better experimental (adaptive) management policies aimed at teasing apart the effects of the various factors that drive recruitment variation.

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