22nd Annual Meeting
Florida Chapter American Fisheries Society
February 12-14, 2002

General Program Outline and Agenda

Tuesday, 12 February, 2002

Noon to 5pm • Registration

1:00 to 5:00pm • Contributed Papers

1:00 - B. L. Winner*, D. Blewett, and R. H. McMichael, Jr. Abundance and distribution of common snook, Centropomus undecimalis, along shoreline habitats of three Florida estuaries.
1:20 - K. J. Dockendorf* and M. S. Allen. Factors influencing black crappie Pomoxis nigromaculatus recruitment in three Florida lakes.
1:40 - T. D. Tuckey* and M. DeHaven. Comparison of fish assemblages in tidal creeks and seagrass habitats in the Suwannee River estuary.
2:00 - C. M. Reber* and W. A. Bennett. Thermal Acclimation Rates of Pinfish, Lagodon rhomboides, Exposed to Abrupt Temperature Decrease.
2:20 - B. N. Tiffany*, L. L. Martin, and W. A. Bennett. Effects of Acute Hypoxia on High Temperature Tolerance of Bluegill Sunfish, Lepomis macrochirus.
2:40 - J. M. Grim* and B. L. Winner. Relationship Between Weight and Growth of the Heart and Activity Level of Three Elasmobranch Fishes.
3:00 - Break, 20 min.
3:20 - N. A. Fangue,* B. N. Tiffany, and W. A. Bennett. Effects of Harmful Algal Blooms on Heat Tolerance of Atlantic Stingray in St. Josephs Bay, Florida.
3:40 - W. A. Bennett. The Toughest Aquatic Vertebrate in North America.
4:00 - J. J. Berg*, M. T. R.andall, M. Allen, and K. J. Sulak. Population Assessment of Gulf of Mexico Sturgeon in the Yellow River, Florida.
4:20 - N. M. Dunham* and B. L. Winner. Relative abundance and distribution of four species of batoids in Tampa Bay, Florida.
4:40 - J. E. Hill. Adverse Effects of Introduced Fishes in South Florida: What Do the Data Show?

5:00pm • Dinner

5:00 to 7:00pm • Poster Set Up

7:00pm • Poster Session (Drinks and snacks will be in the poster area, and the presenters will be available to answer questions) and BONFIRE Social

POSTERS

Robert J. Allman, Gary R. Fitzhugh and William A. Fable. Age Structure and Variation in Size at Age of Vermilion Snapper (Rhomboplites aurorubens), Reader Error or Differential Growth?
L. A. Collins* and W. T. Walling, Jr. The Value of Fishery-Independent and At-Sea Fishery-Dependent Sampling to Reproduction-Studies: Vermilion Snapper (Rhomboplites aurorubens), a Case Study.
K. J. Fitchett*, J. L. Rummer, N. A. Fangue, H. L. Wallman, B. N. Tiffany, C. M. Pomory, and W. A. Bennett. Utilization of Shallow Rockpools by Reef Fishes in the Dry Tortugas National Park.
R. F. Heagey*, T. Tsou, S. Kupschus. Size-specific salinity preferences of several ecologically and economically important species in Tampa Bay.
Kevin Grant and Christa Pierini*. Spatial-Temporal Distribution, Abundance, and Species Composition of Fishes and Selected Macroinvertebrates in Alligator Harbor, Florida.
A.K. Horntvedt, S.H. Denison & W.A. Szelistowski. Genetic differences in Western Atlantic and Eastern Pacific populations of the leatherjacket, Oligoplites saurus.
C. Idelberger. Fish assemblages in the tidal portions of the Myakka and Peace Rivers.
H. T. Porter*, M. D. Julian, A. B. Forstchen, and R. O. Reese. Parasite presence in cultured, stocked, and wild red drum Sciaenops ocellatus in the Alafia River, Florida.
C. Powell*, K. Guindon-Tisdel, and L. Barbieri. A preliminary assessment of the life history of the Florida pompano (Trachinotus carolinus) in the Tampa Bay area.
P. E. Thurman * and R. S. McBride. Age and growth of roughtongue bass (Serranidae: Holanthias martinicensis) in the Northeastern Gulf of Mexico.
B. N. Tiffany*, N. A. Fangue, and W. A. Bennett. Probable Extirpation of a Unique Endemic Octopus Species from St. Joseph's Bay, Florida.

Wednesday, 13 February, 2002

7:00 to 8:00am - Breakfast

7:30am to 5:00pm - Registration

Ecosystem Based Approaches to Manage Fisheries Resources Symposium

Saltwater Focus Segment
8:20 - P. Hood. Marine Protected Areas (MPAs) in Florida: An Introduction
8:40 - J. Bohnsack. Marine conservation ethics and marine reserves: A test of fishery benefits at Cape Canaveral
9:00 - C. W. Osenberg, and C. M. St. Mary. Marine reserves: a tentative and cautionary evaluation of a powerful tool.
9:20 - J. Beets. Marine Protected Areas: Success and Precaution
9:40 - Break, 20 min.

10:00 B. M. Cufone, Esq. Marine Protected Areas: Beyond Economics.
10:20 - W. Ward. MPAs - A commercial fisherman=s view.
10:40 - D. Kelly. MPAs -- Is The Pain Worth The Gain?
11:00 - Discussion
11:20 - Andrew David* and Christopher Gledhill. Survey of Fish Assemblages and Habitat within Two Marine Protected Areas on the West Florida Shelf
11:40 - D. M. Tremain*, C. W. Harnden, and D. H. Adams. Fish movements in relation to an estuarine no-take zone and the concept of fisheries replenishment: through adult spillover - fact or fiction?
11:40 - K. Madley. Developing a Florida Estuarine and Marine Ecosystem and Habitat Classification System.
Noon - Lunch

Symposium:
Ecosystem Based Approaches to Manage Fisheries Resources--Continued
Freshwater Focus

1:00 - M. H. Hulon. Florida Fish and Wildlife Conservation Commission's Aquatic Resources Enhancement Section - What is it?
1:20 - D. R. Douglas, R. S. Hestand III, B. Z. Thompson, B. V. Jaggers, and L. L Trent, and C. T. Mallison. Cooperative Revegetation Projects in Central Florida Lakes - Getting Everybody Wet And Muddy.
1:40 - B. Furse. Fishery Response to Aquatic Habitat Enhancement on Lake Istokpoga.
2:00 - K. Runyon. Stormwater Treatment as a Resource Enhancement Technique in Montgomery Lake, FL.

3:00pm ? Contributed Papers

2:20 - C. Metcalf. Stream Restoration Using Natural Channel Design Techniques.
2:40 - S. A. Bortone. Optimally Creating Really Essential Fish Habitat: Studies from the Tarmac.
3:00 - Break, 20 min.
3:20 - P. Light* and F. Vose. Fish assemblage structure on artificial and natural reefs in Palm Beach County.
3:40 -
4:00 - R.S. McBride and M.D. Murphy*. Current and Potential Yield per Recruit for Hogfish, Lachnolaimus maximus, in Florida.
4:20 - C. Mesing* and R. Cailteux. Preliminary Evaluation of Stocking Advanced BFingerling Largemouth Bass to Supplement Non-drawdown Year Classes in Lake Talquin, Florida.
4:40 - K. R. Henry*, M. S. Allen, and E. Nagid. Evaluation of largemouth bass exploitation and potential harvest restrictions at Rodman Reservoir, Florida.

5:00pm &#65533; Dinner

6:30 to 7:30pm &#65533; Chapter Business Meeting

7:30pm UNTIL? - RAFFLE and Bonfire SOCIAL

Thursday, 14 February, 2002

7:00 to 8:00am - Breakfast

7:30 to 9:00am - Registration

8:00am to Noon - Contributed Papers

8:00 - R. P. Cody* and S. T. Brown. Trends in Commercial and Recreational Shark Fisheries in Florida (1991-2001).
8:20 - L. Lombardi-Carlson. Latitudinal variation in life history traits of the bonnethead shark, Sphyrna tiburo, from three areas in the Gulf of Mexico.
8:40 - Dr. J. K. Carlson and I. Baremore *. Preliminary age and growth analysis of the spinner shark, Carcharhinus brevipinna.
9:00 - J. Mikulas*, G. Fitzhugh, D. DeVries, C. Palmer, N. Evou, L. Lombardi-Carlson, R. Allman, K.J. Starzinger, N. Amesbury, C. Gardner, C. Mangum, and W. Fable. Developing a Production Aging Program for Reef Fish and Mackerel Supporting Gulf of Mexico Stock Assessments.
9:20 - Clare M. Mangum* and G. Walter Ingram, Jr. A Preliminary Investigation of the Age Structures of Gray Triggerfish (Balistes capriscus) in the Gulf of Mexico.
9:40 - P. W. Stevens*, C. K. Bennett , and J. J. Berg. A flyingfish spawning aggregation (Parexocoetus brachypterus) observed in the northeastern Gulf of Mexico.
10:00 - Break, 20 min.
10:20 - J. Frouzova*, W. F. Porak and W. E. Johnson. Feeding behavior of two size groups of na&#65533;ve (pellet-reared) and wild largemouth bass (Micropterus salmoides) in a laboratory experiment.
10:40 - Beck*, J.L, Turingan, R.G. Predator-prey interactions in the marine plankton: the effect of prey swimming behavior on the feeding performance of Sciaenops ocellatus larvae.
11:00 - S. Lowerre-Barbieri*, F. E. Vose and J. A. Whittington. Sex, lines, and videotape: does catch-and-release of the common snook, Centropomus undecimalis, affect reproductive output?
11:20 - R. G. Taylor. Laboratory calibration of postovulatory follicles from natural spawning common snook.
11:40 - R. S. McBride*, F. J. Stengard, and B. Mahmoudi. Maturation and diel reproductive periodicity of round scad (Carangidae: Decapterus punctatus).
Noon - lunch
1:00 - Awards presentation. Best Papers & Posters
Rottman Scholarships

Florida Chapter, American Fisheries Society

19th Annual Meeting

12-14 February 2002, Brooksville Florida

ABSTRACTS

Abstracts for Contributed Papers, Invited Symposium Speakers and Poster presenters are provided in alphabetical order by the senior author's surname.

Authors are not required to produce a final manuscript. However, many authors have detailed speaker's notes or have prepared some of their data and analysis for publication elsewhere. Information is provided for you to directly contact the author should you require additional information. Tips for speaker and poster presenters are available.

We hope that this facilitates communications between you and other Chapter members, as well as with invited speakers, who may not yet be members.

Unfortunately, the Florida Chapter cannot waive costs for registration, room and meals for speakers.

Robert J. Allman, Gary R. Fitzhugh and William A. Fable

Age Structure and Variation in Size at Age of Vermilion Snapper (*Rhomboplites aurorubens*), Reader Error or Differential Growth?

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In 2000, over 1500 vermilion snapper otoliths were collected along with corresponding biological data from Texas to the West Florida shelf. Six-hundred sagittal otoliths were sub-sampled for age determination in an effort to be as representative as possible by gear and location. Biological samples were collected from private boats, charter boats, head boats, commercial boats and scientific surveys.

Sectioned otoliths were assigned an age based on the count of annuli and the degree of marginal edge completion. Three readers made independent age determinations of otolith sections. The average percent error (APE) for all vermilion snapper aged was 8.38% as compared to 5.24% for red snapper. Much of the disagreement between readers was due to difficulty establishing the first or core ring. Size at age data indicated large variation in size at age. This led stock assessment biologists to use a surplus production model instead of an age based VPA model in the 2001 assessment. These data agree with some controversial earlier work on vermilion

snapper in the Gulf of Mexico and the South Atlantic Bight, which indicated large variation in size at age.

Vermilion snapper collected during 2000 were estimated to be from 2 to 21 years old. The commercial fishery collected the greatest number of older individuals with 30% 10 years or older. The commercial fishery was bimodal with a mode at 4 years when vermilion snapper were recruiting to the fishery and another at 10 years. The 10 year old fish could be indicative of a large 1990 year class. Both the head boat and scientific survey indicated that 4 and 5 year olds were most common with fish recruiting to the fishery by age 4. Full recruitment to the charter boat fishery was not until age 5. The age structure of the commercial fishery was fairly similar between the eastern and western gulf with the east consisting of a larger percentage of 3 and 4 year olds while the west had a slightly higher percentage of older fish.

Jessica. L. Beck and Ralph G. Turingan,

Predator-prey interactions in the marine plankton: the effect of prey swimming behavior on the feeding performance of *Sciaenops ocellatus* larvae

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It is hypothesized that the strength of a recruiting class of marine teleosts is determined by the magnitude of mortality during the larval stage of ontogeny. This study investigates the possible influence of zooplankton swimming behavior on the feeding performance of marine fishes during this 'critical period' in their life history. Several zooplankton prey types (Brachionus rotundiformis, *Artemia franciscana* and two copepod species) were cultured in the laboratory and their swimming behaviors filmed using high-speed videography at 250 frames per second. Results from ANOVA and multiple pair-wise comparisons revealed significant differences in normal swimming and escape velocities between the various prey types. *Sciaenops ocellatus* larvae showed variable feeding kinematics and capture success when fed prey of different swimming behaviors. These suggest that the behavior of planktonic prey plays an important role in the feeding of marine fish larvae. Understanding the causal mechanisms that underlie feeding success in marine fish larvae is important in understanding the factors that regulate population size of marine fishes.

Jim Beets

Marine Protected Areas: Success and Precaution

Jacksonville University, Department of Biology and Marine Science, 2800 Univ. Blvd. N, Jacksonville, FL 32211.Phone: 904/745-7300; E-mail: jbeets@ju.edu

Marine protected areas have been established for numerous uses. As fisheries management strategies, MPAs can be very effective in protecting essential fish habitat and increasing local fish biomass, among other benefits. In the Virgin Islands, a seasonal closure of a known spawning area resulted in improved conditions of an important grouper species. Later the area

was provided full protection status. Another MPA, Virgin Islands National Park, was designated for resource protection, but not specifically as a fisheries management strategy. Although protected by legislation, local fisheries have had a large negative effect on resources. Large declines in several species have been documented within the protected area, and resource conditions are not significantly different between the protected area and surrounding unprotected areas. Protected areas can provide valuable benefits, but goals and assessment must be carefully considered and evaluated.

Wayne A. Bennett

The Toughest Aquatic Vertebrate in North America

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Biological extremes define the range of physiological adaptation, elucidate physiological mechanisms less obvious in the norm, and help us recognize patterns and determine the "general laws" by which species are governed. Among fishes, sheepshead minnow possess physiological adaptations that allow them to survive the most extreme abiotic conditions known. The physiological adaptations of sheepshead minnow to the abiotic environment have lead some investigators to hail the fish as the toughest aquatic vertebrate in North America. The fish's thermal tolerance limits of -1.9 to 45.1�C set the biokinetic limits for vertebrate life and their thermal tolerance polygon area of 1470�C2 is the highest ever measured in a fish. Thermal pre-acclimation allows these fish to survive unpredictable, rapid and severe changes in water temperature. In nature, the pupfish occupy tidal pools with salinities of 152‰ and have been maintained in the laboratory at 167‰. Critical oxygen minimum for sheepshead is 0.2 ± 0.11mg/L. Physiological insights derived from studies of sheepshead minnow expand our understanding fish biology and provide tools and insights that are applicable to other areas of fisheries biology.

James J. Berg[1,2,3], Micheal T. Randall[1,3], Mike Allen[2], and Ken J. Sulak[1]

Population Assessment of Gulf of Mexico Sturgeon in the Yellow River, Florida

[1]Florida Caribbean Science Center, US Geological Survey

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[3]AScI Corporation, 2880 Capital Medical Blvd, Tallahassee, FL 32308.

A mark- recapture study was done to assess population size and structure of Gulf sturgeon in the Yellow River, Fl. Three marking efforts and one recapture effort were made between June 8, 2001 and October 28, 2001. Thirteen field days of marking effort resulted in the tagging of 101

unique fish, and 27 field days of recapture effort resulted in the recapture of 16 marked individuals and the tagging of 81 more unique fish. The unbiased Peterson estimator gave a population of 588 fish, with 95% confidence intervals of 404 to 1122 fish. Relative to the Suwannee River, the population structure was shifted towards larger fish. One captured fish had been tagged in the Leaf River, MS. We equipped two fish with pop-off satellite tags set to deploy in February 2002. Spine samples were taken from 70 fish and will be used to determine age structure of the population.

James A. Bohnsack

Marine conservation ethics and marine reserves: A test of fishery benefits at Cape Canaveral

Southeast Fisheries Science Center, NOAA Fisheries, 75 Virginia Beach Dr.

Miami, Florida, 33149, USA.

Actions to establish no-take aquatic reserves as an ecosystem-based management tool remain controversial partly because conservation ethics vary so widely and few empirical studies have shown evidence of enhanced finfish production compared to allowing all areas to be exploited. I examine conservation ethics and the impacts of reserves at Cape Canaveral, the oldest and until 1999 the largest reserve system in North America. I tested hypotheses predicting a higher concentration of International Gamefish Association world records near reserves than elsewhere in Florida and proportional increases after reserves were established. Results support both predictions for year-round resident estuarine gamefishes: black drum (*Pogonias cromis*), red drum (*Sciaenops ocellatus*), and potted seatrout (*Cynoscion nebulosus*). Result show multispecies benefits of no-take reserves for recreational fishing and as an ecosystem-based tool to protect marine ecosystems. Successful use will require a reevaluation of conservation ethics. Leopold's scientifically derived, biotic ethic provides an ideal model because it incorporates self-interest into conservation.

Stephen A. Bortone

Optimally Creating Really Essential Fish Habitat: Studies from the Tarmac

The Conservancy of Southwest Florida, 1450 Merrihue Drive, Naples, Florida 34102 USA. Phone: 941/403-4232; Email: sbortone@conservancy.org.

The optimal design of artificial reef habitats should be done using the establish principles (and lessons) from empirically-based and modeled ecological studies. The overriding principle of foraging theory provides one of the most important guides to this process. Thus optimal designs for artificial reefs should aim to minimize forage overlap as well as 'underlap' (is that a word?) to make the most efficient use of expensive artificial reef construction materials and deployments. Optimal designs should allow daily foraging to occur, to and from an artificial reef, while provided maximum space utilization of the forage area that uses the least amount of reef material. While reef construction could be based on mathematical concept, there are practical

problems that reef designers face when handed the dilemma of allowing optimal forage opportunity, with a minimal amount of reef materials. Fortunately, this problem may have already been solved by the designers of airport terminals. The objectives are the same: provide the most contact points while offering free access to the exterior. This translates to allowing air-traffic controllers to park as many airplanes as they can at sites (gates) with the least amount of terminal while offering unobstructed departure from the gates. Examples are provided from airport-based 'artificial reef' architectural designs, both locally and from around the world.

John K. Carlson and Ivy Baremore

Preliminary age and growth analysis of the spinner shark, *Carcharhinus brevipinna*

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Preliminary age and growth dynamics of the spinner shark, *Carcharhinus brevipinna* were estimated from specimens collected in the Gulf of Mexico from August 1995 to September 2001. Von Bertalanffy growth models (VBG) and a model proposed by Fabens (1965) were fitted to observed and back-calculated size-at-age data from 206 individuals (126 female, 80 male). An additional length-frequency method (Shepherd 1987) was also used. Depending on method, growth parameters varied for females from a theoretical maximum size (Linf) of 335 cm total length (TL) using the VBG model to 243 cm TL from Fabens' method. Growth coefficients (k) ranged from 0.05 to 0.21, respectively. For males, theoretical maximum size ranged from 258 cm TL derived from length-frequency data to 211 cm TL using the VBG. Growth coefficients varied from 0.21 using Fabens' method to 0.09 from the VBG. The oldest aged sharks were 18+ and 9+ years for females and males, respectively.

Richard P. Cody and Steven T. Brown.

Trends in Commercial and Recreational Shark Fisheries in Florida (1991-2001).

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In recent years, recreational and commercial shark fisheries in Florida have converged in terms of harvest. Whereas reported commercial landings show a decreasing trend, estimates of recreational harvest have increased steadily (1995-2001). The latter trend is particularly evident from estimates of landings of requiem sharks (Carcharinidae). The decline in commercial harvest is largely associated with changes in Federal quota regulations in 1993 and 1997. Suggestive of a decrease in the level of participation and/or an increase in fishing success, the amount of effort as represented by the number of trips has also decreased for the commercial fishery. A change in the dynamics of the recreational fishery is suggested when the recreational fishery is examined with respect to mode fished (shore, charter-boat, private\rental boat). Although the majority of recreational landings (1991-2001) are attributable to private/rental boat mode angling, an increase in the significance of recreational angling for sharks among the for-hire industry is evident from a steep increase in charter-boat mode landings of requiem sharks in 2000-2001.

L. Alan Collins and William T. Walling, Jr.

The Value of Fishery-Independent and At-Sea Fishery-Dependent Sampling to Reproduction-Studies: Vermilion Snapper (*Rhomboplites aurorubens*), a Case Study

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Ten years of sampling gonads from grouper and snapper (most notably from vermilion snapper, Lutjanidae: *Rhomboplites aurorubens*) indicated the relative importance of three types of field sampling (dockside fishery-dependent, at-sea fishery-dependent, and fishery-independent) for spawning and fecundity studies. Our overall objective in these studies was to provide accurate length-specific estimates of fecundity (batch fecundity, frequency of spawning, and annual fecundity) for all sizes of mature fishes in order to enhance stock assessment of these species. Fisheries-dependent samples were taken from recreational (headboat and charterboat) and commercial (rod and reel, bandit and longline) boats.

Intensive dockside fisheries-dependent sampling and a few at-sea fisheries-dependent sampling trips began off Panama City in the northeastern Gulf of Mexico in 1991 and have continued with expanded mainly dockside sampling-coverage from south FL to south Texas. Our main fisheries-independent sampling began in 2000 from our 25' boat off Panama City and continues from February through October with day/night hook and line fishing from our laboratory's 25', 36' and 65' boats. Although periodic cruises on NMFS large research vessels and other vessels occurred over the last several years, these cruises usually occurred too infrequently to provide many useful gonad samples during each spawning year.

At-sea fisheries-dependent and fisheries-independent sampling provided the best quantity and quality of gonad samples to determine length at first spawning, time of oocyte-hydration, spawning time, location/depth of spawning, batch fecundity, and spawning frequency. Fisheries-independent sampling found the smallest females with hydrated oocytes, indicating length at first spawning (159 mm total length), as well as time of oocyte hydration (1300-2230 hours) and spawning (2230 hours). Eight of 10 probable-spawning sites for vermilion snapper caught at depths of 30-114 m from Panama City to Key West were found by at-sea fisheries-dependent and fisheries-independent sampling. By sampling intensively from our own boat just before spawning occurred off Panama City, we obtained more batch-fecundity samples in one year of fisheries-independent sampling (59, during 2000) than in three years of dockside fisheries-dependent sampling (44, during 1992-1994) and also found a more-accurate frequency of spawning (93, for 2000). At-sea sampling on a week-long commercial trip and 24-hour headboat trips during 2001 provided large vermilion snapper that were not available by other means.

Marianne Cufone, Esq.

Marine Protected Areas: Beyond Economics

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How much is a fish worth if it is not a fillet? What would you pay to meet a sea turtle face to face while swimming through towers of rainbow coral in clear blue waters? What price would leaving a legacy of near-pristine seagrass meadows, white sands and abundant marine wildlife for your children's children to learn from and enjoy obtain at a market? These questions are not easily answered, but are very important when considering the value of a healthy ocean ecosystem. There are intrinsic, "existence" values to healthy functioning ecosystems and all within them that require protection. Unfortunately, existence values are often ignored since they cannot be adequately expressed in terms of monetary gain. In a society often lost in numbers of dollars, how do we move people to see beyond economics and protect some of our unique and valuable ocean resources?

One way to help protect valuable ocean ecosystems is through supporting the establishment of an ecologically interrelated system of "no-take" marine protected areas or marine reserves, areas of the marine environment where consumptive use is completely prohibited. Such areas have been used successfully as fish and habitat management and protection tools around the world for many years. There is strong and growing support by scientists, including The National Research Council and The National Center for Ecological Analysis and Synthesis, for their efficiency in protecting and conserving marine fish, essential fish habitat, biodiversity, and healthy ocean ecosystems.

Despite overwhelming support for use of marine protected areas and especially "no-take" marine reserves, at present very little of U.S. waters are protected in "no-take" marine reserves. Conventional management measures alone (gear restrictions and fish size limits, for example) have not been as successful as once hoped in rebuilding declining fish populations and maintaining healthy ocean ecosystems. Use of marine protected areas, particularly "no-take" marine reserves, in conjunction with other management approaches, is key to conserving marine fish, essential fish habitat, biodiversity, and healthy ocean ecosystems.

Andrew David[1] and Christopher Gledhill[2]

Survey of Fish Assemblages and Habitat within Two Marine Protected Areas on the West Florida Shelf

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[2]National Marine Fisheries Service, Pascagoula Laboratory, 3209 Frederic Street, Pascagoula, MS 39567

The primary goals of this project were to: 1) establish a baseline estimate of fish abundance, especially for species of groupers and snappers; 2) describe significant habitat features in the Madison-Swanson and Steamboat Lumps MPAs; and, 3) estimate the age structure and reproductive status for groupers and snappers. The secondary objective was to locate spawning aggregations of gag, scamp, and snappers. Side scan mosaics were used to stratify each MPA based upon benthic topography and geographic association and between 4 and 15 sites were randomly selected within each of 8 Madison-Swanson and 5 Steamboat Lumps strata.. The

Madison-Swanson MPA and adjacent control areas were sampled at 91 sites during 5 research cruises conducted between February and April, 2001. An additional 47 sites were sampled in the Steamboat Lumps MPA during 2 cruises in June and July, 2001. Gear employed during the surveys included panoramic video camera arrays, (Hi-8 cameras at 57 sites, digital cameras at 45 sites), chevron traps (12 sites), and an ROV (20 sites). Spawning aggregations of gag and/or scamp were confirmed at 11 sites and suspected at 5 others through video surveillance from 20 ROV dives within the Madison-Swanson MPA. Histological and otolith samples were taken from 59 fish for reproductive and ageing studies. Species collected included gag (*Mycteroperca microlepis*), scamp (*Mycteroperca phenax*), red grouper (*Epinephelus morio*), snowy grouper (*Epinephelus niveatus*), speckled hind (*Epinephelus drummondhayi*), red snapper (*Lutjanus campechanus*), silk snapper (*Lutjanus vivanus*), red porgy (*Pagrus pagrus*), knobbed porgy (*Calamus nodosus*), gray triggerfish (*Balistes capriscus*), and greater amberjack (*Seriola dumerili*). At Steamboat Lumps, sites sampled on sandy substrates in the central portion of the reserve harbored honeycomb moray *(Gymnothorax saxicola*), and bandtail puffer (*Sphoeroides spengleri*). Sites sampled in the northeast region of the reserve, with habitat consisting of sandy substrates, fish burrows or rocky outcrops were dominated by honeycomb moray, bank sea bass (*Centropristis ocyurus*), red porgy, vermilion snapper *(Rhomboplites aurorubens*), scamp and red grouper (*Epinephelus morio*).

Kevin J. Dockendorf and Micheal S. Allen

Factors influencing black crappie Pomoxis nigromaculatus recruitment in three Florida lakes.

Dept. of Fisheries and Aquatic Sciences, University of Florida

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We investigated relations between larval and juvenile black crappie Pomoxis nigromaculatus abundance, size, and prey availability at three Florida lakes. Age-0 black crappie were collected at Lakes Wauberg, Lochloosa, and Tarpon using surface and bottom trawls during summer-fall 2000 and 2001. Zooplankton abundance was measured concurrent with trawl sampling. In both fall seasons, juvenile size was largest in Lake Tarpon and smallest in Lakes Lochloosa and Wauberg. However, abundance of age-0 black crappie and summer crustacean zooplankton abundances were higher in Lakes Lochloosa and Wauberg than Lake Tarpon in both years. The lack of a relationship between crustacean zooplankton density and black crappie size across lakes suggests that age-0 black crappie summer growth may not be related to food availability. However, abundance of age-0 black crappie may be the result of high zooplankton abundance during early life. Ontogenetic diet shifts, density dependence, and environmental variables may determine summer growth in age-0 black crappie.

David R. Douglas[1], Rue S. Hestand III[1], Boyd Z. Thompson[1], Bruce V. Jaggers[1], Lowell L Trent[1], and Craig T. Mallison[2]

Cooperative Revegetation Projects in Central Florida Lakes - Getting Everybody Wet And Muddy

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Many central Florida public lakes have experienced degradation of fish and wildlife habitat as a result of urbanization, agricultural impacts and water level stabilization. Many of these lakes currently support only limited submersed plant communities and/or littoral communities characterized by monotypic stands of exotic and undesirable plant species. In 1997 the Florida Fish and Wildlife Conservation Commission (FWC) Aquatic Plant Section began a cooperative program with local and state agencies as well as homeowners associations, environmental clubs and school groups to initiate revegetation projects on many of these public water bodies. Existing stands of undesirable plant species are controlled using herbicides allowing desirable native species to recolonize. If the native plant response is less than desired revegetation with desirable native species is initiated. A large effort is made to get as many individuals from various user groups out in the water assisting with these project so they have a "stake " in their lake. In some instances the scale of the project requires the use of a contractor to facilitate timely completion. As of fall 2001, cooperative revegetation projects have been conducted on 12 water bodies throughout central Florida with over 350,000 aquatic plants of 13 species being planted. An additional 6 water bodies in central Florida are scheduled for revegetation projects in 2001 - 2002. Other groups in the FWC Aquatic Plant Section are conducting similar revegetation projects in other areas of the state.

Nicole M. Dunham and Brent L. Winner.

Relative abundance and distribution of four species of batoids in Tampa Bay, Florida

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Tampa Bay has an abundant batoid population, with both pelagic and benthic species present. Our objective in this study was to describe the relative abundance and distribution of four common batoids in Tampa Bay: *Dasyatis sabina*, *Dasyatis say*, *Dasyatis americana*, and *Rhinoptera bonasus*. Samples were collected by Florida's Fisheries-Independent Monitoring Program using a stratified random multi-gear sampling design. From January 1989 to December 2000 11,975 individuals were collected: *D. sabina* (n=5,625), *D. say* (n=845), *D. americana* (n=60), and *R. bonasus* (n=5,467). Disc width (mm), sex, sample location, water quality, and other habitat parameters were recorded for all rays collected. Seasonal and annual trends in catch-per-unit-of-effort (CPUE, rays/haul) were examined for each species. Catch rates in haul and purse seines were highest for R. bonasus, followed by *D. sabina*, *D. say*, and *D. americana*. However, *D. sabina* and *D. say* were the species with the highest CPUE in the trawls. Preliminary analysis of sex ratios showed a disproportionate number of male rays for *D. sabina* (5:1), *D. say* (3:1), and *R. bonasus* (28:1). The sex ratio for *D. americana* was 1:1. A wide size range of rays was collected: *D. sabina* (65-400mm), *D. say* (95-1005mm), *D. americana* (85-975mm), and *R. bonasus* (135-975mm). Spatial and temporal distributions, habitat preferences,

and correlations between fish presence and various environmental factors (e.g., salinity, temperature) were observed.

Nann A. Fangue, B. Nicole Tiffany, and Wayne A. Bennett

Effects of Harmful Algal Blooms on Heat Tolerance of Atlantic Stingray in St. Josephs Bay, Florida

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From August 17th through October 22nd 1999 thousands of menhaden, *Brevoortia* sp., redfish, *Sciaenops ocellatus*, and pinfish, *Lagodon rhomboides*, in St. Joseph's Bay, Florida were killed by hypoxia and/or toxicity during a harmful algal bloom (HAB) of unprecedented duration and intensity. Atlantic stingrays, *Dasyatis sabina*, were present in the Bay during the HAB, though mortality in this group was low suggesting that stingrays may have been more tolerant than other fishes to HAB effects. At sublethal levels, toxins and hypoxia may act as a masking factor by perturbing regulated physiological systems thereby decreasing tolerance to other environmental entities. Heat tolerance expressed as the critical thermal maximum (CTMax), is a commonly used endpoint for quantifying masking effects. The CTMax of stingrays captured during the red tide was 41.7�C and was not significantly different from the August 2000 (no red tide) CTMax of 41.3�C (t-test, p=0.344). During the event, stingrays avoided the sandbars they typically occupy and congregated in large numbers in shallow near-shore areas of the Bay's mouth. Stingrays appeared lethargic but otherwise healthy. Movement of stingrays to shallow well-oxygenated water within the Bay coupled with low observed mortality and normal CTMax following transfer to laboratory water suggests that Atlantic stingrays may be more sensitive to hypoxia than red tide toxins.

Katie J. Fitchett, Jodie L. Rummer, Nann A. Fangue, Heidi L. Wallman, B. Nicole Tiffany, Christopher M. Pomory, and Wayne A. Bennett

Utilization of Shallow Rockpools by Reef Fishes in the Dry Tortugas National Park

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Rockpools on Loggerhead Key in the Dry Tortugas National Park experience cyclic tidal changes in water quality and physical dimension resulting in ichthyofaunal assemblages that differ markedly from the nearby coral reef. Over 20 reef species were observed on the adjacent beach rock formations; however, only six of these were also found inhabiting the shallow rockpools. Differing physiological adaptations among reef fishes probably dictated which species could successfully inhabit the rockpools. Five fishes were tested for high temperature tolerance, measured as Critical Thermal Maxima (�C), and low-oxygen tolerance, measured as Critical Oxygen Minima (mg/L). High temperature and low oxygen tolerance for schoolmaster, *Lutjanus apodus*, French grunt, *Haemulon flavolineatum*, slippery dick, *Halichoeres bivittatus*, cocoa damsel, *Pomacentrus variabilis*, and frillfin goby, *Bathygobius soporator* were 40.9, 36.2,

37.8, 37.6, 40.9&#65533;C and 0.56, 0.77, 0.49, 0.50, and 0.27mg/L respectively. All fishes in the pools were transient juveniles except for the notably tolerant frillfin goby, which occurred as adults and juveniles. Harsh thermal and oxic conditions may offer clear benefits for some Loggerhead Key reef fishes by providing refuge from predators, foraging grounds, and potential nursery areas.

J. Frouzova [1], W. F. Porak [2] and W. E. Johnson [2]

Feeding behavior of two size groups of na&#65533;ve (pellet-reared) and wild largemouth bass (Micropterus salmoides) in a laboratory experiment.

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Previous field studies indicated reduced feeding efficiency of pellet-reared largemouth bass during their transition from artificial feed to live prey, or a failure to transition, after being stocked into Florida lakes. We designed a laboratory experiment to compare the feeding efficiency of two size groups (mean = 300 mm and 100 mm total length) of na&#65533;ve (pellet-reared) and wild largemouth bass (*Micropterus salmoides*). Fish were fed small live prey, bluegill (*Lepomis macrochirus*) and Seminole killifish (*Fundulus seminolus*) in the case of bigger largemouth bass, and mosquito fish *(Gambusia affinis*) in the case of smaller fish. Laboratory feeding experiments were run for 48 hours with largemouth bass as a solitary predator for both size groups, and bigger pellet-reared largemouth bass were also tested as a group predator. Bigger pellet-reared fish were not able to catch live prey as a solitary predator, but they fed regularly in a group. Small pellet-reared fish fed on live prey significantly better than bigger pellet-reared fish but significantly lower than wild fish about the same size. Behavioral differences in predator-prey interactions were observed in tanks with na&#65533;ve largemouth bass compared to tanks with wild fish. Our results indicate that the ability of pellet-reared fish to learn to feed on live prey decreases with age and seem to be influenced by interaction with other fish in the tank.

Beacham Furse

Fishery Response to Aquatic Habitat Enhancement on Lake Istokpoga

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Lake Istokpoga (11,300 hectares) is Florida's fifth largest natural lake and is considered by many anglers as one of the top fishing lakes in the nation; however, tussock development and expansion has negatively impacted the lake's littoral habitat. In an effort to restore this habitat, the Lake Istokpoga Aquatic Habitat Enhancement Drawdown Project was conducted during spring 2001. The primary objective of the project was to restore littoral habitat for fish and

wildlife. An estimated 1,813,709 m3 of tussock and organic sediments were removed with earth-moving equipment to restore 530 hectares (34 km) of fish and wildlife littoral habitat. A sampling program has been developed to evaluate the response of fish populations to enhancement of previously degraded littoral habitat. Data, including species composition, relative abundance, and size structure of selected species, from enhanced areas will be used to determine aquatic habitat enhancement success and future habitat degradation. Sampling methodology included electrofishing (water depths between 0.5 m and 1.5 m) and Wegener rings (water depths <0.5 m). Preliminary data is indicative of quality littoral habitat (i.e., diverse vegetative community over sandy substrate) in enhanced areas. Twenty-eight species were collected during the initial fall sampling period. Bluegill (*Lepomis macrochirus*), redear sunfish (*L. microlophus*), and seminole killifish (*Fundulus seminolis*) were the most frequently-sampled species. Threadfin shad (*Dorosoma petenense*) were frequent, though highly variable in abundance, in electrofishing samples, while eastern mosquitofish (*Gambusia holbrooki*) were the second most abundant species during Wegener ring sampling. Although largemouth bass (*Micropertus salmoides*) were not collected during Wegener ring sampling, largemouth bass were observed in good numbers (0.43 + 0.28 fish/min) in electrofishing samples.

Kevin Grant and Christa Pierini

Spatial-Temporal Distribution, Abundance, and Species Composition of Fishes and Selected Macroinvertebrates in Alligator Harbor, Florida

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Monthly stratified-random sampling was conducted in the Apalachicola Bay region to investigate changes in the relative abundance of juvenile and adult fishes and selected macroinvertebrates. The objective of this study was to examine the species composition, distribution, and abundance of specimens collected from September 1998 to December 2000 in Alligator Harbor. Alligator Harbor, a shallow, neutral estuary located along the Florida Panhandle, was the easternmost part of the Apalachicola Bay region sampled. A total of 59 183-m haul seines and 12 21.3-m center bag seines were deployed, yielding 16,548 fishes and selected macroinvertebrates. A total of 42 families, 63 genera, and 83 species were collected. Brevoortia spp. and Lagodon rhomboides were the most common overall, composing 34% and 16%, respectively, of the total number of fish collected. *Mugil curema* and *Leiostomus xanthurus* were among the numerically dominant of the recreationally and commercially important species and composed 14.5% and 7% of the total catch, respectively. This information can be used by resource managers as a tool to develop effective management plans for Alligator Harbor.

Jeffrey M. Grim[1] and Brent L. Winner[2].

Relationship Between Weight and Growth of the Heart and Activity Level of Three Elasmobranch Fishes.

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Bertin (1958) suggested that the ratio of the weight of a fish's heart in relation to its total body weight is directly related to the fish's overall level of muscular development and physical activity: the more active the fish, the larger the heart. To test Bertin's hypothesis in elasmobranch fishes, we examined the relationship between the weight and growth of the heart, and activity level in a benthic batoid, *Dasyatis sabina* (n = 74); a pelagic batoid, *Rhinoptera bonasus* (n = 50); and a small coastal shark, *Sphyrna tiburo* (n = 49). Based upon our estimation of the level of activity of each of these species, we hypothesized that if Bertin's theory is correct, the relative weights of the hearts of the three species would be as follows: the smallest heart would belong to the benthic batoid, the intermediate to the pelagic batoid, and the largest to the coastal shark. Specimens were collected from June to August 2001 during routine Fisheries-Independent Monitoring sampling in Tampa Bay. Length (mm), total weight (g), and heart weight (g) were recorded for all specimens. We calculated a heart-weight index (HWI = (Heart wt./ Total weight) *100) for each specimen. These heart-weight indices (*R. bonasus* = 0.20, *D. sabina* = 0.18, *S. tiburo* = 0.16) were comparable to the HWIs previously reported for elasmobranchs. Heart weight exhibited a linear relationship with total weight of the fish for all species. Allometric growth patterns of the heart were observed and suggested a hypomegalistic pattern for two of the three species. Although the pelagic batoid had a significantly higher HWI than did the benthic batoid, the HWI of the small coastal shark was not significantly different from that of the benthic batoid. Assuming that we ranked the activity levels correctly for these three species, then Bertin's (1958) hypothesis must be rejected in this instance. The apparently simple relationship between activity level and heart size may be confounded by other factors, such as blood chemistry and cardiac morphology.

Robert F. Heagey, Tien-Shui Tsou, Sven Kupschus

Size-specific salinity preferences of several ecologically and economically important species in Tampa Bay

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Increasing demands on freshwater resources have led to increases in freshwater withdrawal from rivers in Florida. The potential effects of these withdrawals on estuarine ecosystems include the alteration of salinity regimes, of productivity levels, and of the associated biotic communities. In this preliminary study of Tampa Bay fishes, we used multivariate analysis techniques to investigate the community structures of both juvenile and small adult fish in five salinity categories ranging from freshwater to saltwater. A clear transition from fresh water communities to saltwater communities was observed. Size-specific salinity preferences of several ecologically and economically important species were also investigated. The juveniles and small adults of stripped mullet, red drum, and common snook showed a preference for low salinities (0-10 ppt). These results highlight the importance of riverine and low-salinity habitats within Tampa Bay to the survival of a number of important fisheries species.

Kristin R. Henry [1], Micheal S. Allen [1], and Eric Nagid [2]

Evaluation of largemouth bass exploitation and potential harvest restrictions at Rodman Reservoir, Florida.

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Rodman Reservoir is considered a premier largemouth bass fishery in Florida, but the trophy-fish potential of the reservoir could potentially be enhanced with a harvest restriction. We conducted a variable reward tagging study to estimate exploitation of largemouth bass at Rodman Reservoir. A total of 1,380 largemouth bass ≥ 345-mm were tagged in 2000-2001 using Hallprint® dart-style tags, the monetary reward for tag returns ranged from $5 - $55. Total mortality of largemouth bass was estimated from a catch curve and growth rates were determined from annuli on sagittal otoliths. An age-structured model was used to simulate the response of the fishery to various harvest restrictions. During the first year of the study, tag returns showed that 40% of the largemouth bass at Rodman Reservoir were caught during 2000-2001, 11% of the population was harvested, whereas 29% of the population was caught and released. Total mortality was estimated at 44%. Simulations showed that the average weight in the creel, the number of memorable-size fish in the creel, and the total number of fish caught and released were greatest under a 457-mm minimum length limit. The results suggest that a high length limit would maximize angler catch rates and provide trophy catches.

Jeffrey E. Hill

Adverse Effects of Introduced Fishes in South Florida: What Do the Data Show?

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South Florida has been described as a "biological cesspool" of introduced organisms. Indeed, Florida is now home to more exotic fish species than any other state. Ecological harm is a common assumption when studying introduced fishes and there are well-documented examples of such harm in the United States and elsewhere. However, the existence of widespread documentation of large adverse effects caused by introduced fishes in the south Florida canal and Everglades systems is a common misconception of many citizens, politicians, resource managers, and biologists. An examination of the literature revealed that there are few or no data regarding adverse effects for most introduced fishes in south Florida. For many species, the best information available is that due to high numbers they must cause harm. Herein I briefly review the data for peacock cichlid *Cichla ocellaris*, walking catfish *Clarias batrachus*, pike killifish *Belonesox belizanus*, and Orinoco sailfin pleco *Pterygoplichthys multiradiatus*. The purpose of this review is not to assert that introduced fishes cause no harm, it is, however, to bring about

awareness of the lack of data in this unique system, spur research to address this need, and remind us that we must carefully evaluate the data and clearly delineate speculation.

Peter Hood

Marine Protected Areas (MPAs) in Florida: An Introduction

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In May 2000, President Clinton signed an executive order on marine protected areas (MPAs). The purpose was to assist in the protection of significant natural and cultural resources within the marine environment for the benefit of present and future generations by strengthening and expanding the Nation's system of MPAs. In the executive order, MPAs are defined as "any area of the marine environment that has been reserved by Federal, State, territorial, tribal, or local laws or regulations to provide lasting protection for part or all of the natural and cultural resources therein." If and how MPAs are used in fishery management in Florida will be a challenge to fisheries managers. Given the definition of MPAs , there are a variety of MPAs already in existence for Florida's oceanic and estuarine waters. These areas include marine sanctuaries, habitat areas of particular concern, fishing gear exclusion zones, and security buffer zones. In determining whether MPAs are appropriate management tools, it is important to understand the benefits and limitations of this tool, as well as understand the viewpoints of the various user groups of the marine environment. The purpose of this symposium will be to educate members of the Florida Chapter of AFS about the complex issues that are associated with MPAs.

A.K. Horntvedt, S.H. Denison & W.A. Szelistowski.

Genetic differences in Western Atlantic and Eastern Pacific populations of the leatherjacket, Oligoplites saurus.

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Oligoplites saurus is one of few coastal marine bony fishes distributed both in the Western Atlantic and Eastern Pacific Regions. The population genetic structure of this species is therefore particularly interesting. We are currently using RFLP analysis and DNA sequencing of the 16s gene in order to examine differentiation of leatherjackets from one Pacific and several Atlantic sites. Preliminary results suggest that Florida and Caribbean specimens are similar genetically but that differences between Atlantic and Pacific fishes are considerably greater. The biogeographical and taxonomic implications are considered.

Mike H. Hulon

Florida Fish and Wildlife Conservation Commission's Aquatic Resources Enhancement Section - What is it?

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The Florida Fish and Wildlife Conservation Commission (FWC) Division of

Freshwater Fisheries has a Section dedicated to Florida's Aquatic Resources. The Aquatic Resource Enhancement Section strives to improve aquatic habitat in water bodies throughout Florida. A dedicated funding source ($1.5 million) was established in 1989 through an additional $5.00 increase to each fishing license sale. Since 1989 numerous habitat enhancement projects have taken place, with the 1996 Lake Kissimmee Project being the most visible. Through continued success and hands on visible work being done around the state, during the 2000 Legislative Session state lawmakers saw fit to provide an additional $5.7 million dollars to FWC's Aquatic Resource Enhancement Section. The additional funding became available on July 1, 2001 and FWC's plans are to start aggressive work improving aquatic habitat on numerous water bodies in the near future.

Chuck Idelberger

Fish assemblages in the tidal portions of the Myakka and Peace Rivers

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The Fisheries-Independent Monitoring program (Fish and Wildlife Conservation Commission's Florida Marine Research Institute) has been conducting intensive fisheries sampling in Charlotte Harbor since 1989. Fish assemblages in the tidal portions of two Charlotte Harbor tributaries, the Myakka and Peace Rivers, are of particular interest in light of past-- and the possibility of future-- environmental impacts caused by increases in development, phosphate mining, and water withdrawal in these areas. Data collected during 47 months of stratified-random sampling with 21.3m seines and 6.1m otter trawls (February 1996-December 1999) were used to 1) describe the fish fauna and 2) examine the variations in fish assemblage composition between rivers, habitats (nearshore vs. offshore), seasons, and river locations (upstream vs. downstream). More than 550,000 fish (representing 99 taxa and 41 families, in 846 samples) were collected. *Anchoa mitchilli* (bay anchovy) was by far the most numerous species taken, followed by *Menidia* spp. (silversides), *Cynoscion arenarius* (sand seatrout), *Lucania parva* (rainwater killifish), *Eucinostomus harengulus* (tidewater mojarra), and *Gambusia holbrooki* (eastern mosquitofish). The species composition of fish assemblages in the tidal portions of the Myakka and Peace Rivers was similar. Fish assemblage composition was most influenced by habitat (nearshore vs. offshore) and season, and then by river location (downstream vs. upstream). Fish were more abundant and diverse in nearshore habitats than in offshore habitats. Seasonal differences in fish assemblages were due to differences in the life cycles of the various species; these seasonal differences are particularly pronounced for the more polyhaline fishes, whose young utilize the study area as a nursery. The tidal portions of the Myakka and Peace Rivers support substantial, diverse, dynamic fish communities in addition to serving as nursery areas for important sport and commercial species.

Doug Kelly

MPAs -- Is The Pain Worth The Gain?

Supporters of MPAs in the U.S. commonly exaggerate their benefits and make equivocal comparisons to existing MPAs in foreign settings. While it's recognized that many of those pushing hardest for MPAs stand to gain financially or must do so at the behest of their employer (i.e. --NOAA), recreational anglers in particular are unhappy about favoritism being shown to certain user groups. This fairness issue, coupled with broad questions about the objectivity of MPA-related studies and their interpretations by proponents, gives rise to the question as to whether the benefits of MPAs are worth the enormous derision that this issue continues to cause -- even after seven years of the Oculina Bank MPA and more than 10 years of debate and discussion. In addition, given the current U.S. budgetary cuts due to a shifting of resources into fighting global terrorism and other worthy projects, MPAs and the bureaucratic costs associated with them will be vulnerable unless saltwater recreational anglers (11,000,000 in the U.S.) are truly onboard. An objective model for siting MPAs will be presented that just might achieve such acceptance.

Phil Light and Fred Vose

Fish assemblage structure on artificial and natural reefs in Palm Beach County

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Despite a growing interest in the use of artificial reefs to enhance populations of reef fish, relatively few studies have documented the extent to which these structures increase local abundances of recreationally valuable fish or what effect the construction material used to build the reef has upon the structure of fish assemblages. Furthermore, few studies have compared fish assemblages on artificial reefs with those on adjacent natural reefs. Our study was conducted by the Palm Beach County Department of Environmental Resources Management, under a grant from the Florida Fish and Wildlife Conservation Commission. Fish populations on artificial reefs in Palm Beach County were monitored for 28 months, and those on nearby natural reefs were monitored for the final 12 months of this period. At the artificial reefs, the ten most abundant species included four species of the snapper-grouper complex, and snappers were over ten times more abundant than on natural reefs. There were also pronounced differences between the size and life-stage distributions of the fish on natural and artificial reefs. Natural reefs had size distributions that were strongly skewed towards smaller size classes, and juveniles were nearly 1.5 times as abundant as adults. On the other hand, fish on artificial reefs were considerably larger, and juveniles were less than one quarter as abundant as adults. This study provides a framework for evaluating the usefulness of artificial reefs and indicates that in order to provide habitat for fish in various taxa and life stages it may be necessary to deploy reefs that contains shelter in a range of sizes and of different structural complexity. Additional studies focusing on specific construction materials and using replicated fish counts to address questions regarding recruitment, predation, and movement patterns may help to clarify some of the controversies surrounding the use of artificial reefs.

Linda A. Lombardi-Carlson

Latitudinal variation in life history traits of the bonnethead shark, *Sphyrna tiburo*, from three areas in the Gulf of Mexico

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Life history traits were analyzed to test for latitudinal differences in populations of the bonnethead shark, *Sphyrna tiburo*, by comparing data collected between March 1998 and November 1999 from three areas in the Gulf of Mexico. The areas chosen represent a north to south gradient across five degrees of latitude (northwest Florida, Tampa Bay, and Florida Bay). Latitudinal variation in a population reflects differences in a species covering a large geographical range. In terms of size, the smaller-sized individuals are found in the warmer parts of the range, whereas the larger individuals are found in the cooler parts of the range. The von Bertalanffy growth model was fitted to age-length data separately by sex in each area. Male and female *S. tiburo* from northwest Florida had the largest predicted asymptotic sizes (1007-mm and 1398-mm, respectively). Male and female *S. tiburo* from northwest Florida grew faster at each growth interval compared to males and females in Tampa Bay and Florida Bay, respectively, providing evidence for countergradient variation. Males and females from northwest Florida were larger and older at maturity than males and females from Tampa Bay and Florida Bay. These results further support the concept of latitudinal variation in life history traits occurring in *S. tiburo* populations from the Gulf of Mexico.

S. Lowerre-Barbieri., Frederic E. Vose and James A. Whittington.

Sex, lines, and videotape: does catch-and-release of the common snook, *Centropomus undecimalis*, affect reproductive output?

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This study was undertaken to characterize a spawning aggregation of common snook, use biotelemetry to determine if released fish left the spawning aggregation, and determine if the stress of being caught and released affected the fish's reproductive output. A spawning aggregation of common snook was studied in Lake Worth Inlet, FL, during the summers of 1998 and 1999. The aggregation was made up of large, mature fish that were actively spawning, indicated by females with hydrated oocytes or postovulatory follicles and males with flowing milt. Individual courtship behaviors of a few fish were observed by divers, but no spawning events were observed. Biotelemetry indicated that the stress of being captured and released did not cause fish to immediately leave the aggregation. However, individual fish moved to and from the aggregation during the spawning season. Fish implanted with either live or dummy ultrasonic tags continued to spawn. Behavioral and histological evidence suggested that the stress of being caught on hook-and-line and then released did not cause females either to interrupt or terminate spawning. Released females were consistently recaptured from the aggregation, and levels of ovarian atresia and spawning activity were similar for both recaptured and control fish.

Kevin Madley

Developing a Florida Estuarine and Marine Ecosystem and Habitat Classification System

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A standard, benthic habitat classification system for Florida does not exist. Over fourteen different classification systems have been used with Florida mapping projects to date. This is problematic for efforts to compile statewide habitat estimates, produce habitat maps for the entire state, or compare habitats across regions. Consensus for a standardized classification system will be a large step toward more reliable characterization of Florida seafloor habitats.

FMRI has gathered the classification systems used throughout Florida and the tropics and subtropics. In addition, we have researched national classification systems and successful efforts in terrestrial habitat characterization. We have attempted to combine components of a variety of systems to form a hierarchical classification system to propose as a strawman for further testing in Florida.

The Gulf of Mexico program has interest in eventually expanding the Florida classification system to encompass habitats for all of the Gulf states. The goal would then be to coordinate adoption of this classification system to be used by all mapping agencies involved with Gulf of Mexico habitat classification. This would enhance fishery habitat comparisons among Gulf states.

Clare M. Mangum[1] and G. Walter Ingram, Jr.[2]

A Preliminary Investigation of the Age Structures of Gray Triggerfish (*Balistes capriscus*) in the Gulf of Mexico.

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Over the past several years the gray triggerfish (*Balistes capriscus*) has increased in popularity in both the recreational and commercial sectors. Due to the increase in the number of recreational samples, a more complete determination of the growth rates and reproduction of gray triggerfish can be examined. This presentation will delve into the methods and materials involved in age and growth analysis, and will discuss some of the problems associated with analyzing data gathered at a time when there was minimal harvest of the gray triggerfish (due to the popularity of other reef fish). A comparison of ages, lengths, and weights of the recreational samples gathered from 1980-1993, from the Gulf of Mexico (including Florida, Alabama, Texas, and Louisiana), will provide information that will not only be useful in allopatric population analysis, but will provide some insight into the effects of increased harvest, in terms of the status of the gray triggerfish stocks in the Gulf of Mexico. Because triggerfish seem to exhibit extreme site fidelity, compared

to other reef fishes, there arises a concern that local or regional depletions might occur (due to fishing) and therefore may be apparent in a geographic comparison of demographic traits such as size and age.

Richard S. McBride and Michael D. Murphy

Current and Potential Yield per Recruit for Hogfish, *Lachnolaimus maximus*, in Florida

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Hogfish (*Lachnolaimus maximus*) is a valuable fishery species that lives on reefs of the Gulf of Mexico, Caribbean Sea, and Atlantic Ocean north to the Carolinas. In Florida, hogfish landings have been declining in recent years. Moreover, maximum fish size in south Florida, where landings are greatest, is only half the maximum fish size for the eastern Gulf of Mexico. These trends in landings and fish sizes suggest continuing problems for the fishery. In this paper we explore some costs and benefits of increasing the minimum legal fish size to increase the yield per recruit of hogfish. We also comment on the potential additional benefit, in terms of increased recruitment, that could result from this management option.

Richard S. McBride, Fredrik J. Stengard, and Behzad Mahmoudi

Maturation and diel reproductive periodicity of round scad (Carangidae: *Decapterus punctatus*).

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The diel reproductive periodicity of Carangidae is poorly known but appears to be highly variable between species. Some species spawn during the day, others are believed to spawn at night, and it is demonstrated here that round scad, *Decapterus punctatus*, spawn at dusk. We collected *D. punctatus* in the eastern Gulf of Mexico during three April cruises (1995, 1996, and 1997). Based on histological criteria, size at 50% maturity was 113 mm fork length (FL) for males and 128 mm FL for females. The gonad-somatic index (GSI) of mature males was significantly different between hours and appeared to show diel periodicity. Diel periodicity was also observed in changes in female GSIs, whole oocyte diameters, and ovarian histology. The average GSI of mature females fluctuated two-fold between day and night, and the size distribution of whole oocytes in some fish was bimodal (at 0.3-0.4 and 0.7-0.8 mm diameter) at dusk rather than unimodal during most of the diel cycle. Histological preparations revealed that these rapid changes in ovarian GSIs and oocyte size distributions were the result of final oocyte maturation. Germinal vesicle migration was observed from 9 am to 2 pm eastern standard time (EST), germinal vesicle breakdown was evident as early as 11 am EST, and ovulation occurred as early as 6 pm EST. Spawning frequency (approximately every five days) was similar whether calculated from the proportion of females with hydrated oocytes during the afternoon or from the proportion of females with post-ovulatory follicles during the morning. Batch fecundity correlated with fish size and ranged from 5,500 to 34,700 hydrated eggs per individual. These

findings do not support published hypotheses that young-of-the-year *D. punctatus* reproduce before their first winter or that *D. punctatus* reproductive output is bimodal within a year.

Charlie Mesing and Rich Cailteux

Preliminary Evaluation of Stocking Advanced -Fingerling Largemouth Bass to Supplement Non-drawdown Year Classes in Lake Talquin, Florida

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Largemouth bass *Micropterus salmoides*, raised on zooplankton in hatchery ponds, were stocked into Lake Talquin (3,561 ha) to evaluate relative year class contribution and growth of hatchery fish at 28/ha (100,000) and 40/ ha (141,000) in 2000 and 2001, respectively. Mean total lengths of stocked fish in both years ranged from 65 to 88 mm. Prior to stocking, approximately 8,000 (8%) in 2000 and 25,000 (19%) in 2001 were marked with coded wire tags (CWT). Mean survival of stocked fish was greater than 90% in aquaria for 72 hours for both years. Yoy bass collected with CWT represented 6 % (N = 24) of 405 young-of-year (yoy) bass in October 2000 and 8% (N = 31) of 391 yoy bass in October 2001 electrofishing samples. Conservatively, stocked bass comprised an estimated 30 - 40% of the 2000 and 2001 yoy electrofishing samples based on CWT returns, otolith analysis and length frequency comparisons between historic natural populations and stocked fish. Otolith analysis of yoy bass indicated that 98% of the yoy bass > 190 mm in total length (N=42) were hatchery fish. Stocked yoy and age-1 bass grew rapidly and were considerably larger by October (150-258 mm TL) and April (160-290 mm TL) than natural bass collected since 1982. Mean October yoy CPUE electrofishing values at historic standardized stations (N = 20) in 2000 (0.50; SE 0.06) and 2001(0.42; SE 0.06) were significantly lower ($P > 0.05$) than drawdown year classes (1.2-3.8 yoy bass/min) and similar to poor year classes before and after drawdowns. Chi-square analysis revealed a significant difference ($P < 0.05$) in the frequency of shad *Dorosoma* spp. found in hatchery bass (23%) stomachs compared to natural yoy bass (5%) analyzed. By October 2001, shad were identified in 37% of the stomachs of yoy stocked bass and 0% in natural bass.

Christopher Metcalf

Stream Restoration Using Natural Channel Design Techniques

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Stream disturbances in the past have been restored with a multitude of methodologies and single purpose objectives. These objectives include conducting stream bank erosion control, increasing instream fish habitat, providing energy dissipation, or containing flood flows. Traditional approaches to planning and designing stream restoration has been associated with bioengineering techniques (vegetation revetment), instream habitat structures and rigid, one-dimensional channel hydraulics. These methods initially meet project objectives for an improved fish habitat or reduce stream bank erosion, however, many typically lead to continued stream instability and

emerging problems. The persistent tendency of stream disturbances occurs because natural self-maintaining channels are more complex with many interrelated relationships that are not taken into consideration during project planning and designing. The important features to stream restoration include stream width, depth, sinuosity, meander geometry, and slope. These factors are essential components to any stream restoration project and designing in accordance with the natural tendencies of rivers identifies the cause of instability and the potential or geomorphological character for a stable stream.

Being successful at stream restoration is principally based on applied fluvial geomorphology and natural channel design techniques. This incorporates quantitative data collections along a stream section describing the change in features laterally, longitudinally and vertically. The steps to restoring a stream that is self-maintaining and provides the best fish habitats incorporate the following: 1) accessing the watershed to determine the stream condition and evolutionary change; 2) identifying an appropriate stream type for restoration base on a stream classification system associated with complex river channel form; 3) produce a reproduction of a reference reach that represents a stable river section for design criteria similar to its channel form, channel materials, discharge, and fish habitat (i.e., riffle, run and pool); and 4) transposed the new channel design over the existing conditions and construct the project. Basically, the approach is to create a new stream channel from a natural stable stream condition and replicate its physical and biological function.

These principles and techniques are being implemented in Florida and it is encouraging that interdisciplinary resource managers are understanding the benefit of applied practices in stream restoration.

Christopher Metcalf

"The Gulf Sturgeon"

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The Gulf sturgeon (*Acipenser oxyrinchus desotoi*), a subspecies of the Atlantic sturgeon (*Acipenser oxyrinchus*), is a anadromous fish that inhabits the coastal rivers from Louisiana to Florida during the warmer months and overwintering in the estuaries, bays and Gulf of Mexico. Gulf sturgeon provided a very lucrative commercial fishery throughout its range in the early 1900s. However, over fishing, lose of habitat and habitat degradation, and water pollution have contributed to the population decline which prompted its listing in 1991 as threatened under the Endangered Species Act of 1973. A presentation video on the Gulf sturgeon describes its life history and recovery efforts underway to restore the species to a level that would ultimately result in delisting.

Length: 17:30 minutes

The video was produced in cooperation with:

U.S. Fish & Wildlife Service

U.S. Army Corps of Engineers

Joseph Mikulas, Gary Fitzhugh, Doug DeVries, Chris Palmer, Nancy Evou, Linda Lombardi-Carlson, Robert Allman, K.J. Starzinger, Natalie Amesbury, Chris Gardner, Clare Mangum, William Fable

Developing a Production Aging Program for Reef Fish and Mackerel Supporting Gulf of Mexico Stock Assessments

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With new requirements for national standards in the federal fishery management process, and increased independent review, stock assessments are requiring higher resolution information on age structure, growth and year-class strength. Often, size-at-age variation and difficulty obtaining accurate estimates of year-class strength creates problems for assessments. This is particularly true for reef fish and sub-tropical species. As a result there is increased demand for direct age sampling of the catch. We present our approach to increasing efficiency and productivity while attempting to balance quality in the aging process. For Gulf of Mexico stock assessments focusing on species targeted for federal management, three main sampling programs provide hard-part samples (otoliths and spines) from the catch; the Trip Interview Program, (TIP), the Beaufort NMFS Headboat Survey, and the Marine Recreational Fisheries Statistical Survey (MRFSS). Because of cost limitations and the large number of species of interest, we do not attempt to develop annual databases of individual fish ages. Rather, we strive to maintain accurate logs of collections, manage an archive of hard parts and subsequently build data bases specifically needed for scheduled stock assessments. We feel that collection logs allow more timely tracking and reporting on sampling levels and geographic coverage. With more attention on aging priorities, and more timely feedback to samplers, we have seen a steady increase in sampling effort during the last four years. We review our current processing levels, costs, error estimates in aging, and discuss how these factors can lead to improved sampling designs.

Craig W. Osenberg, and Colette M. St. Mary

Marine reserves: a tentative and cautionary evaluation of a powerful tool

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Marine protected areas provide a powerful management tool for protecting valuable marine resources. There's little doubt that MPAs can have significant and positive results on marine populations and ecosystems. However, the stakes are potentially high. Considerable political capital can be spent creating MPAs. If they don't measure-up to expectations, future designation of MPAs can be jeopardized. Thus, it's important that scientists provide a complete case, including uncertainty about benefits as well as possible negative outcomes. In this talk, we

briefly review the status of MPAs and then raise a variety of issues that we feel have not been adequately assessed in empirical and theoretical investigations of MPAs. In particular, we discuss and critique 1) empirical assessments of the effects of MPAs; and 2) theoretical studies (especially the absence of models that consider some important aspects arising from the dynamics of age- and spatially-structured populations). We also discuss the difficulties inherent to evaluating multi-variate biological responses without appropriate economic models that put diverse biological responses into a common currency. Our goal (having been invited to play devil's advocate) is not to detract from the expeditious establishment of marine reserves, but rather to suggest several ways in which their establishment can be facilitated using sound science (in addition to effective advocacy).

Heather T. Porter, Marc D. Julian, Ann B. Forstchen, Ruth O. Reese

Parasite presence in cultured, stocked, and wild red drum Sciaenops ocellatus in the Alafia River, Florida

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Project Tampa Bay is a multi-disciplinary, five-year stock enhancement assessment program, currently in its second year. To date, over one million red drum Sciaenops ocellatus have been released into the Alafia River in Hillsborough County. The major concerns of any stock enhancement program are the impact that released fish may have upon wild stocks, the potential for parasite transfer, the difference in susceptibility of stocked fish to disease, and the ability of stocked fish to survive after release. As part of Project Tampa Bay, the Aquatic Health Group at the Florida Marine Research Institute monitors the health of cultured, stocked, and wild fish in the Alafia River. Wild and stocked red drum collected in the Alafia and cultured red drum sampled from the Stock Enhancement Research Facility ponds are diagnosed for the presence of seven target ectoparasites: *Amyloodinium ocellatum*, *Ambiphrya* sp., *Ergasilus* sp., *Trichodina* sp., and *Trichodinella epizootica* and endoparasites: *Ceratomyxa* sp. and *Scolex polymorphus*. Preliminary results indicate that there are significant differences in parasite presence among cultured, stocked, and wild red drum. Wild red drum tend to have a higher proportion of parasitized individuals as well as higher parasite loads. Cultured red drum have very few parasites. Stocked red drum, that are as disease and parasite free as possible on release into the wild, appear to accumulate the "wild-type" parasite load over time, suggesting that their habitat and diet after release become the same as that of wild fish.

Chris Powell, Kathy Guindon-Tisdel, and Luiz Barbieri

A preliminary assessment of the life history of the Florida pompano (*Trachinotus carolinus*) in the Tampa Bay area

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We collected 498 Florida pompano (*Trachinotus carolinus*) from Tampa Bay and the adjacent Gulf waters from December 2000 to December 2001 to assess their age, size structure, growth, and reproduction. The population was sampled monthly primarily by using 200-300m trammel nets, but supplemental gillnet and hook-and-line catches were also made. Young-of-the-year were targeted by using 23m and 200m beach seines along the surf zone nursery habitat. Trammel nets captured 257 pompano with a size range of 262-522mm TL and a modal length of 370mm TL. Ages of these fish ranged from 0 to 6 years; 6 years is a new maximum age for Gulf coast pompano. Preliminary size-at-age comparisons showed that the oldest pompano (ages 5 and 6) were males, whereas the largest in length and weight were females. The sex ratio of male to female fish was 104:153. Weights of the fish ranged from 243.3g to 2,091.0 g, with a mean of 686.4g; no difference in the length/weight relationship was observed between sexes. Gonadal maturity stages and the fact that no gravid females were collected inshore indicated that pompano develop but do not spawn there. Young-of-the-year recruitment to the surf zone was seen from May through November, with peaks in June and July. Sampling in potential spawning grounds nearshore will continue in 2002 to further investigate their reproductive biology.

Cheyenna M. Reber and Wayne A. Bennett

Thermal Acclimation Rates of Pinfish, *Lagodon rhomboides,* Exposed to Abrupt Temperature Decrease

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Fish in Florida estuaries are often subject to rapid, large-scale temperature decreases sometimes resulting in massive fish kills. Several factors have been shown to affect the overall tolerance of estuarine species to extreme cold events, including thermal history, acclimation rate, and magnitude of the change in temperature. While some of these factors have been researched, little is known about the ability of fish to acclimate to sudden cold temperatures or the rate at which acclimation takes place. Acclimation rates were determined for pinfish, Lagodon rhomboides, using time series changes in critical thermal minima (CTMin). Fish were transferred from 23, 19, and 15°C to 19, 15, and 12°C, respectively. Critical thermal minima were determined for each group at 0,1,2,4,7,14 and 26 d post-transfer. Cold tolerance gain was characterized by initially rapid decreases in CTMin that leveled off as fish approached full acclimation to the new temperature. Intrinsic acclimation rates of each temperature transfer group were calculated by plotting CTMinima on log-transformed time (days+1). Acclimation rates and thermal tolerance profiles may be useful management tools for modeling effects of severe cold events on estuarine fish mortality.

Kip Runyon

Stormwater Treatment as a Resource Enhancement Technique in Montgomery Lake, FL

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The Florida Fish and Wildlife Conservation Commission's (FWC) Aquatic Resources Enhancement Section uses a variety of tools to enhance fish and wildlife habitat in Florida waters. One method employed is stormwater treatment. FWC recently contracted a stormwater retrofit project on 36-acre Montgomery Lake in Lake City, Florida (Columbia County). Montgomery Lake is located in a highly developed area of Lake City with state roadways, commercial, industrial, and residential areas prevalent. Due to the largely impervious nature of the watershed, even modest rainfalls rapidly produce large volumes of degraded stormwater flowing directly into the lake with little treatment. This has resulted in the build-up of a large silt delta where the stormwater enters the lake, aquatic vegetation problems, a layer of organic sediments covering the lake bottom, and aesthetic problems from incoming trash. A three-stage treatment system was installed to mitigate pollution impacts on Montgomery Lake. The system consists of an influent box for water control and removal of debris and some large sediment, a grit sump for large sediment settling, and a wetland treatment pond for finer sediment and nutrient removal. Water quality samples were collected during rain events pre- and post-construction to elucidate the project's impact on stormwater quality entering Montgomery Lake.

Philip Wesley Stevens [1,2], Clifford Kip Bennett [1],and James Joseph Berg [1,3]

A flyingfish spawning aggregation (*Parexocoetus brachypterus*) observed in the northeastern Gulf of Mexico

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A spawning aggregation of *Paraexocoetus brachypterus* was observed in the northeastern Gulf of Mexico over the outer continental shelf, 100 km south of Mobile, Alabama. The spawn occurred during 9 May 2001 just after moonrise two days post full moon. The weather conditions during the spawn were calm, surface current was moving easterly along the outer continental shelf, and a pycnocline was present at a depth of 10 - 15 m. The numerical density of spawning flyingfish at the surface, determined from video analysis, was 25 ± 2 fish m-2. More than one million flyingfish were estimated to have participated in the spawn. Male and female flyingfish collected by dip net were running ripe. Male flyingfish were three times more abundant than females, which would be consistent with observations of three to four flyingfish grouped together before and after the spawning aggregation, if several males were simultaneously pursuring a single female. Although egg attachment to flotsam is the only reproductive mode that has been described for flyingfishes with demersal eggs, the P. brachypterus spawn occurred in the absence of flotsam. Other possible egg development modes include egg suspension upon current, mid-water suspension above pycnocline or upon topographically induced turbulence, or benthic.

Ron Taylor

Laboratory calibration of postovulatory follicles from natural spawning common snook.

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The spawning frequency of wild caught female fish can be estimated from the incidence of postovulatory follicles (POF) if the rate of resorption is known. By inducing spawning of captive fishes and then observing them in the laboratory, researchers can determine qualitative and quantitative measures with which to calibrate the degeneration of POF and to validate field results. We conducted laboratory studies to document the precise resorption rate of POF in common snook. Three females were sacrificed at 6-hour intervals during the 96 hours immediately after ovulation and their gonads excised and fixed for histology. T0 (hours post spawn)- Perimeter (P) =1.32mm. Structure ovoid with large lumen that opens to the ovarian cavity. Thecal cells elongate and aligned end to end. Basement membrane complete. Granulosa cells columnar with large, centrally located, spherical nuclei. Capillaries within theca externa. T6- P=0.74mm. Lumen reduced. Margins smooth. Theca externa cells squamous with amoeboid nuclei. Granulosa nuclei central, condensed, sub-spherical. Onset of apoptosis and karyorrhexis. T12- P=0.59mm. Morphology rectangular/triangular but without folds. Apoptosis rampant. Basement membrane broken. Karyorrhexis in granulosa. Nuclei apoptotic. T18- P= 0.44 mm. Two cell layers lost. Lumen with amorphous debris. Basement membrane fragmentary. T24- P=0.37mm. Lumen minimal. Pyramidal. Epithelial cells reduced to normal size. FOM in F8. T36- P=0.244 mm. No lumen. Only fragments of basement membrane. Granulosa cells vacuolated. T48 and older - extremely difficult to recognize.

Paul E. Thurman and Richard S. McBride

Age and growth of roughtongue bass (Serranidae: *Holanthias martinicensis*) in the Northeastern Gulf of Mexico.

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Roughtongue bass, *Holanthias martinicensis,* is a small protogynous hermaphrodite common on the deep-water reefs of the western Atlantic Ocean and Gulf of Mexico. Recent diet studies showed that *H. martinicensis* is an important link between zooplankton and the larger commercially important species such as red snapper, *Lutjanus campechanus*, and greater amberjack, *Seriola dumerili*; however, no demographic information about the long-term stability of these forage populations is available. Ages of 182 *H. martinicensis* were estimated by examining the ring structure on whole sagittal otoliths. Although we cannot validate the periodicity of ring formation until year-round samples have been examined, most of the fish collected during May had a ring that was either newly formed or on the margin. *Holanthias martinicensis* reached an average size of 71 mm during their first year, and then growth slowed significantly. The largest fish examined so far was 131 mm SL and is similar to the maximum

size reported in the literature. The modal age of the fish examined was 3 years and the oldest fish was 8 years. These preliminary estimates of ages were higher than we anticipated and suggests a fairly stable age-structure for this species.

Nicole Tiffany, Linda L. Martin, and Wayne A. Bennett

Effects of Acute Hypoxia on High Temperature Tolerance of Bluegill Sunfish, *Lepomis macrochirus*

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Bluegill sunfish, *Lepomis macrochirus*, frequent shallow, warm waters that may experience highly variable thermal and oxic conditions. Previous studies have established bluegill tolerance limits for either high temperature or low oxygen independently; however, it is not known what effect hypoxia has on temperature tolerance. We used critical thermal methodology to quantify critical thermal maxima (CTM) of bluegill acclimated at 5, 14, 22 or 30 C and exposed to normoxic (6.12-8.40 mg/L), moderately hypoxic (3.28-3.61 mg/L) and markedly hypoxic (1.09-2.00 mg/L) conditions. Critical thermal maxima of bluegill at all acclimation temperatures were unaffected by moderate hypoxia but decreased between 7.0 and 1.9 C under markedly hypoxic conditions. These data suggest that heat tolerance limits that are typically measured under normoxic conditions in the lab may not accurately reflect ecological responses of bluegill in naturally hypoxic environments.

Nicole Tiffany, Nann A. Fangue, and Wayne A. Bennett

Probable Extirpation of a Unique Endemic Octopus Species from St. Joseph's Bay, Florida

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Harmful algal blooms (HAB) have been a well-documented event along the west coast of Florida since the 1800's. From August 17th-October 22nd, 1999 St. Joseph's Bay, Florida experienced a severe and prolonged HAB with cell counts ranging from 10,000 to 1,000,000 cells/L, causing discolored water, shell bed closure, and notable invertebrate mortality. Prior to the HAB of 1999 an endemic and possibly undescribed species of octopus (probably *Octopus mercatoris*, but often misidentified as *Octopus joubini*) inhabited grass beds at densities as high as 1 per 30m2. The proclivity of *O. mercatoris* for shallow sea grass habitats and sedentary lifestyle made the mollusk especially vulnerable to the 1999 HAB. Extensive and repeated sampling since 1999 has failed to turn up any *O. mercatoris* in St. Joseph's bay. It may be difficult for *O. mercatoris* populations from other locations to re-colonize St. Joseph's Bay due to the relatively small number of benthic hatchlings produced. Even assuming a high emigration rate, plans for extensive development of St. Joseph's Bay and the associated loss of critical habitat may further interfere or prevent re-colonization of this unique endemic species.

Derek M. Tremain, Christopher W. Harnden, and Douglas H. Adams

Fish movements in relation to an estuarine no-take zone and the concept of fisheries replenishment: through adult spillover - fact or fiction?

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We examined the movement patterns of fish that were tagged in the northern Indian River Lagoon between 1990 and 1999 to assess the degree of fish exchange between an estuarine no-take zone (NTZ) and the surrounding waters. Approximately 93% of the 5,951 fish tagged were in one of the following five sportfish species: red drum, *Sciaenops ocellatus*; black drum, *Pogonias cromis*; sheepshead, *Archosargus probatocephalus*; common snook, *Centropomus undecimalis*; or spotted seatrout, *Cynoscion nebulosus*. A total of 432 tagged fish were recaptured during the study period, including 65 individuals that emigrated out of the NTZ and 16 individuals that immigrated into the NTZ from surrounding waters of the lagoon. However, assessments of recapture rates relative to fishing pressure suggested that movements of sportfish into protected habitats could be even more substantial than movements out of these areas. Migration distances between the original tagging location and reported recapture sites for emigrating fish were between 0 and 150 km and appeared to be influenced by the proximity of the NTZ to habitats that are important to specific life-history stages of the individual species. Migration distances for fish that immigrated into the NTZ ranged from approximately 10-75 km. These data demonstrated that while estuarine no-take reserves can protect species from harvest, they may also serve to extract exploitable individuals from surrounding fisheries. Supplemental replenishment of nearby fisheries through adult spillover may be less important than are mechanisms such as increased egg production and larval export.

Troy D. Tuckey and Mark DeHaven

Comparison of fish assemblages in tidal creeks and seagrass habitats in the Suwannee River estuary

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Fish assemblages were investigated in tidal creek and seagrass habitats in the Suwannee River estuary, Florida. A total of 91,571 fish representing 43 families were collected in monthly seine samples from January 1997 to December 1999. Tidal creeks supported greater numbers of fish (3.9 fish m-2; 83% of total) than seagrass habitats did (0.9 fish m -2), but the number of species was the same (80 in each habitat). Forty-five of the 80 species were common to both habitats. Fish assemblages were examined through routines in PRIMER and four fish assemblages were identified: seagrass-winter, seagrass-spring, seagrass-summer and fall, and tidal creeks-all seasons. Seasonal assemblages within tidal creeks were 59% similar, whereas seasonal assemblages within seagrass habitats were 40% similar. The average dissimilarity between the two habitats (75%) was due to the unequal distributions of the species common to both habitats. Important recreational and commercial species such as spot (*Leiostomus xanthurus*), striped mullet (*Mugil cephalus*), red drum (*Sciaenops ocellatus*), and sand seatrout (*Cynoscion*

arenarius) were found primarily in tidal creeks and were among the top 14 taxa contributing to the dissimilarity. We found tidal creek and seagrass habitats in the Suwannee River estuary supported diverse assemblages of fishes and demonstrated seasonal differences associated with recruitment of early life stages.

Brent L. Winner, David Blewett, and Robert H. McMichael, Jr.

Abundance and distribution of common snook, Centropomus undecimalis, along shoreline habitats of three Florida estuaries.

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The common snook, Centropomus undecimalis, is one of the most sought-after gamefish in the inshore waters of southern Florida, and is commonly found in coastal, estuarine, and riverine waters from Cape Canaveral on the Atlantic coast to Tampa Bay on the Gulf coast. Relative abundance, spatial distribution, and habitat preference of snook along shoreline habitats in three Florida estuaries were investigated. Monthly stratified-random sampling was conducted with a 183-m (38-mm stretch mesh) haul seine from January 1997 through December 2000 in Tampa Bay, Charlotte Harbor, and the northern and southern Indian River Lagoon (IRL). A total of 12,674 snook, ranging in size from 121 to 993 mm standard length, were collected in 3,136 haul seines. Snook catch per unit effort (CPUE) was highest in the southern Indian River Lagoon (7.69 fish/haul), followed by Tampa Bay (4.56 fish/haul), Charlotte Harbor (2.92 fish/haul), and the northern IRL (0.65 fish/haul). Length-frequency distributions of snook differed in the four estuaries. Mean standard length was highest in Charlotte Harbor (461 mm), similar for the northern IRL (445 mm) and Tampa Bay (442 mm), and lowest in the southern IRL (392 mm). Variability of snook CPUE was examined in relation to month, physical parameters (temperature, salinity, etc.), and habitat parameters (shore vegetation, bottom vegetation, etc.) by using general linear models and post hoc tests. Seasonal effects on CPUE were most evident in Tampa Bay and the northern IRL, where catches were lower during the colder winter months. We collected large juvenile and adult snook along a variety of areas and shoreline habitats, including mangrove forests, sandy beaches, seawalls, and salt marshes. Highest snook CPUEs were associated with areas having high salinities, overhanging shoreline vegetation, and abundance of prey species.