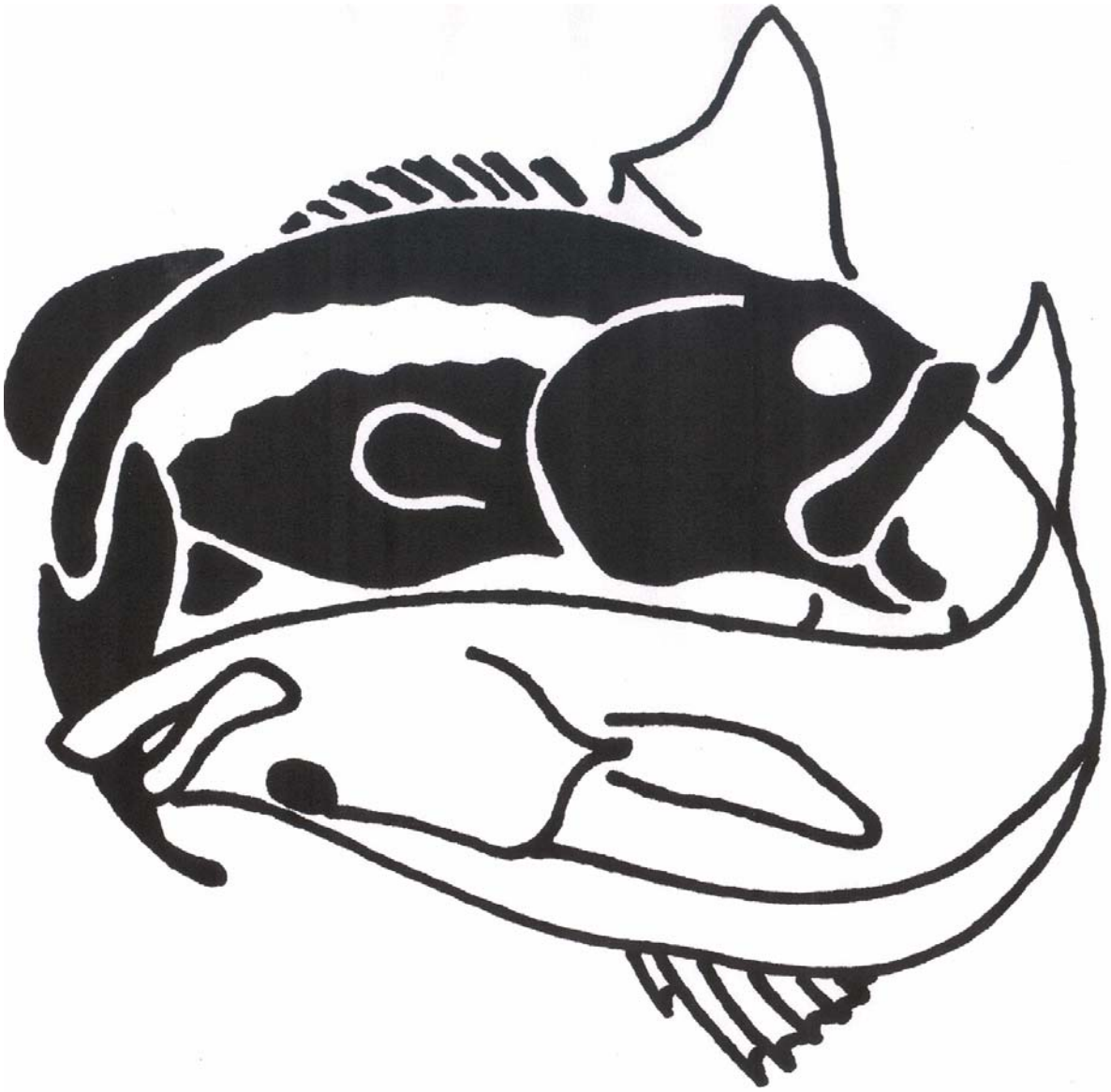

24th Annual Meeting

Florida Chapter American Fisheries Society

February 23-25, 2004

Annual Meeting
Florida Chapter American Fisheries Society
February 23-25, 2004

General Program

Monday, 23 February, 2004

Noon to 5pm – Registration

Noon - Lunch
1:00 to 5:20pm – Contributed Papers
5:30pm – Dinner
5:20 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) followed by the BONFIRE Social

Tuesday, 24 February, 2004

7:00 to 8:00am - Breakfast
7:30am to 5:00pm - Registration

8:00 to 2:20pm - *Symposium:* **Improving Recreational Fisheries with Bag Limits and Size Limits: Effective Fisheries Management in Florida?**

2:20 to 5:00pm – Contributed Papers
5:00pm – Dinner
6:00 to 7:00pm – Chapter Business Meeting
7:00pm UNTIL? - **RAFFLE and Bonfire SOCIAL**

Wednesday, 25 February, 2004

7:00 to 8:00am - Breakfast
7:30 to 9:00am - Registration
8:00am to Noon - Contributed Papers
Noon - Lunch
1:00pm – Awards presentation:
Best Papers- Student and Professional
Best Posters- Student and Professional
Rottman Scholarships

Agenda 24th Florida Chapter American Fisheries Society Meeting

Monday, 23 February, 2004 Moderator: Mike Allen
Contributed Papers Bold indicates student presentations

1:00- *Hanson, C. W., and J. P. Chanton. **The influence of diet on stable carbon isotope composition in otoliths of red drum (*Sciaenops ocellatus*).**

1:20- Deitche, S. M., and D. C. Hicks. Assessment of fish kill complaints in Pinellas County lakes and ponds.

1:40- Lowerre-Barbieri, S., N. Henderson, J. Llopiz, S. Walters, and J. Bickford. Reproductive parameters of spotted seatrout, *Cynoscion nebulosus*, in Tampa Bay, FL.

2:00- *Lundy, E.. **Habitat selection by largemouth bass, redear sunfish, and bluegill in two Central Florida Lakes.**

2:20- *Debicella, J., D. J. Murie, and D. C. Parkyn. **Non-lethal Fin-ray Ageing of Gag Grouper and its Potential Application for Ageing Threatened Groupers.**

2:40- Starzinger, K. J., G. R. Fitzhugh, R. J. Allman and R. A. Farsky. Precision of age estimation in red snapper (*Lutjanus campechanus*).

3:00- Break, 20 minutes Moderator: Steve Bortone

3:20- *Hill, J. E., C. E. Cichra, and L. G. Nico. **Ontogenetic dietary shifts and dietary overlap of a nonindigenous fish and an ecomorphologically similar native fish.**

3:40- *Berens, E. J., and D. J. Murie. **Gastric evacuation and digestion state indices for gag grouper consuming fish and crustacean prey.**

4:00- *Anderson, P., and W. A. Szelistowski. **The association between schooling mysids (Crustacea: Mysidacea) and territorial damselfishes (Pisces: Pomacentridae) on a coral reef.**

4:20- Patterson, H. M., R. S. McBride, and N. Julien. Population structure of red drum (*Sciaenops ocellatus*) as determined by otolith chemistry.

4:40- Patterson, H. M., R. G. Taylor, and R. S. McBride. Natal origin of common snook, *Centropomus undecimalis*, in Florida Bay.

5:00 - Satterwhite, M. Trophic relationships among coastal pelagic fishes in the northeast Gulf of Mexico: a preliminary study.
5:30- Dinner
5:20 to 7:00pm- Poster Set Up
7:00pm- Poster Session (Drinks and snack will be in the poster area, and the presenters will be available to answer questions) and Bonfire Social.

Tuesday, 24 February, 2004

7:00 to 8:00am- Breakfast
7:30 to 5:00pm- Registration

Symposium: **Improving Recreational Fisheries with Bag Limits and Size Limits: Effective Fisheries Management in Florida?**

8:00- Allen, M. Symposium Introduction.

8:20- Cailteux, R. L., D. A. Dobbins, and F. Cross. Evaluation of a 356-mm minimum size limit for redear at Merritt's Mill Pond, Florida.

8:40- Greenwood, M. Trends in young-of-the-year abundance of species subjected to Florida's saltwater fishing regulations.

9:00- Henry, K. R., M. S. Allen, and E. Nagid. Are voluntary release practices impeading the effectiveness of largemouth bass harvest restrictions?

9:20- Bortone, S. A. Re-Thinking Recreational Fisheries Management: Teaching a New Dog Old Tricks.

9:40- Break, 20 minutes

10:00- Holder, J. Evaluation of angler and fish population response to a 305-mm minimum length limit for black crappie on Lake Monroe, Florida.

10:20- Hood, P. Case history of red snapper management in the Gulf of Mexico Exclusive Economic Zone (EEZ).

10:40- Weeder, J. Case History of Yellowtail Snapper Management in the South Atlantic Exclusive Economic Zone (EEZ).

11:00- Furse, J. Preliminary evaluation of a 38-61 cm protective slot limit on largemouth bass at Lake Istokpoga.

11:20- Nagid, E. Largemouth bass cohort response to drawdown management at Rodman Reservoir.

11:40- Mahmoudi, B. The striped mullet fishery in Florida: fishery management and harvest restriction based on randomized climatological processes.

12:00-1:00- Lunch

1:00- de Silva, J. Harvest restrictions as a tool in the management of a fish population: an interstate example using weakfish *Cynoscion regalis* as an example.

1:20- Wattendorf, B. Big, bad bass: who wants them?

1:40- Porak, W. Managing largemouth bass fisheries with length limits in Florida.

2:00- Murphy, M. An overview of changes in data and techniques used to prepare stock assessments for Florida's marine resources.
Symposium Conclusion

Contributed Papers

2:20- Chandler, G. M., J. C. Holder, and R. S. McBride. The progression of spawning seasonality of American shad in the St. John's River, Florida.

2:40- *Eme, J. and W. A. Bennett. **Challenging van't Hoff's Rule: Paradoxical Q_{10} Responses of
Fishes from Hyperthermic Environments on Hoga Island, Sulawesi, Indonesia**

3:00- Break, 20 minutes Moderator: Debra Murie

3:20- Brusher, J. H., J. C. Taylor, G. R. Fitzhugh and D. A. DeVries. Recruitment indices for the shallow-water grouper complex.

3:40- Barnett, L., G. Fitzhugh, J. Brusher, and J. Taylor. Recruitment indices for the shallow-water grouper complex: effective or not?

4:00- Winner, B. L., B. Bradham, S. Fisk, R. H. McMichael, Jr., B. Robertson, J. Sanford, and E. Sherwood. Effect of size-at-release on short-term survival and coded-wire tag retention of hatchery-reared red drum.

4:20- *Rogers, M., M. S. Allen, and D. Jones. **Relationships Between River Surface Level and Fish Assemblage in the Ocklawaha River, Florida.**

4:40- Greenawalt, J. M., E. C. Milbrandt, and S. A. Bortone. Fish community composition in a seagrass-drift algae habitat: is niche partitioning driving the equation?

5:00- Dinner
6:00-7:00- Chapter Business Meeting
7:00- Raffle and Bonfire Social

Wednesday, 25 February 2004

7:00 to 8:00am- Breakfast
7:30 to 9:00am- Registration

Contributed Papers Moderator: Jay Holder

8:00- Barnett, B. K., R. J. Allman, L. Barbieri, and J. Tunnell. Age and Growth of Yellowtail Snapper, *Ocyurus chrysurus*, off South Florida 1980-2002.

8:20- Poulakis, G. R., A. J. Adams, D. A. Blewett, and P. W. Stevens. Abundance, distribution, and seasonality of red drum, *Sciaenops ocellatus* (Osteichthyes: Sciaenidae), in Charlotte Harbor, Florida.

8:40- Tyler, M. Relationships between Harmful Algal Blooms and the Recruitment of Five Estuarine Species in Charlotte Harbor, Florida.

9:00- Trotter, A., J. Whittington, W. Mitchell, and J. Lewis. Movement patterns of common snook, *Centropomus undecimalis*, on the east coast of Florida.

9:20- Harter, S. Changes in fish populations within the deep-sea *Oculina* coral ecosystem off the east coast of Florida.

9:40- *Cooney, P., and M. S. Allen. **Effects of artificially introduced groundwater on fish assemblages in Central Florida Lakes.**

10:00- Break, 20 minutes Moderator: Brent Winner

10:20- Guindon-Tisdel, K., and C. Powell. An overview of the age, growth, and reproduction of Florida Pompano in the Tampa Bay area.

10:40- Lyon, H. M., L. A. Collins, G. R. Fitzhugh, L. Lombardi-Carlson, W. T. Walling, Jr., D. W. Oliver, and B. K. Barnett. What exactly are "Brown Bodies" and should their presence in gonads indicate sexual maturity in fishes?

11:00- Bickford, J., S. Lowerre-Barbieri, and S. Walters. Preliminary sonic tagging of spotted seatrout, *Cynoscion nebulosus,* in Tampa Bay, Florida.

11:20- Sanford, J., and T. Tsou. Recruitment, annual abundance, and habitat associations of young-of-the-year striped mullet, *Mugil cephalus*, in riverine systems of Tampa Bay, Florida, 1996 to 2002.

11:40- Stoecklin, G. W. Ontogeny of prey capture modulation in the common snook, *Centropomus undecimalis.*

Noon- Lunch
1:00- Awards presentation- Best papers & posters, Rottman Scholarships

Posters

*Reyier, E. A., and J. M. Shenker. **Spatiotemporal variation in ichthyoplankton communities of the northern Indian River Lagoon Complex with emphasis as to the importance of a no-take fisheries reserve.**

Reyier, E. A., R. H. Lowers, and D. M. Scheid. Wetlands Initiative at Merritt Island National Wildlife Refuge: V. Ichthyofaunal community structure under three differing water management strategies.

Walters, S., S. Lowerre-Barbieri, D. Mann, and J. Bickford. Mapping Tampa Bay *Cynoscion nebulosus* spawning habitat using passive acoustic surveys.

Heagey, R. F., M. F. D. Greenwood, K. Fischer, J. M. Fine. Surviving hypoxia: the return of Hillsborough Bay as a nursery area for fishes of Tampa Bay.

Powell, C., K. Guindon-Tisdel, and L. Barbieri. Preliminary results of a catch and release mortality study of tarpon in Boca Grande Pass, Florida.

*Sandberg, J., A. A. Wilkes, and W. A. Bennett. **Salinity mediated changes in metabolic rates, urea and trimethylamine oxide (TMAO) levels in Atlantic Stingray, *Dasyatis sabina*.**

Sauer, J., A. Sebastian, and R. Paperno. Recruitment, habitat use, and growth of juvenile pigfish (*Orthopristis chrysoptera*) in the Indian River Lagoon, Florida.

Flock, M., D. Hicks, R. McWilliams, M. Poirier, and C. Flegel. The species composition, seasonal variation, and habitat preferences of juvenile fish and selected invertebrates in Shell Key Preserve, Pinellas County, FL.

Casey, J. P., G. R. Poulakis, and P. W. Stevens. The distribution and seasonality of juvenile gag, *Mycteroperca microlepis*, in Charlotte Harbor, Florida.

*Hodgdon, M., A. Holcomb, B. Miller, M. Roche, and J. M. Grim. **Effects of Rapid Decompression on Striped Burrfish, *Chilomycterus schoepfi*.**

Krebs, J. M., A. B. Brame, and C. C. McIvor. Community structure and habitat use by fish assemblages in altered wetlands: An ecological comparison of mosquito ditches and natural tidal creeks tributary to Tampa Bay.

The influence of diet on stable carbon isotope composition in otoliths of red drum(*Sciaenops ocellatus*)

Chad W. Hanson and Jeffrey P. Chanton
Florida State University Department of Oceanography, Tallahassee, Florida 32301-4306

Incorporating a stable isotope approach to measure information permanently stored in fish otoliths has enabled an alternative means of examining life history and dynamics of fish species and populations. Carbon isotopes ($^{13}C/^{12}C$) in otoliths are derived through a mixture of dissolved inorganic carbon (DIC) in the surrounding seawater and metabolic effects such as somatic growth and consumption though there is not a consensus on which of these factors control overall otolith $\delta^{13}C$. To evaluate the influence of dietary carbon on fish otoliths, juvenile red drum (*Sciaenops ocellatus*) were raised in tanks with flow-through ambient seawater and fed diets differing by 2.12‰ ($p < 0.000$) in carbon isotope composition ($\delta^{13}C$). Muscle tissue from both treatment groups were enriched 1.51‰ in ^{13}C relative to the respective diets and differed significantly ($p < 0.000$). Red drum otoliths displayed similar isotopic distinction between the two groups ($p < 0.000$) and were enriched (~16-17‰) from their respective diets. Since both treatment groups were subjected to the same environmental conditions, it is postulated that sources of carbon through diet control overall otolith $\delta^{13}C$ in juvenile red drum. Results from this study indicate the potential of evaluating feeding behaviors and patterns associated with fish species and populations by analyzing carbon isotopic signatures recorded in otoliths.

Assesment of fish kill complaints in Pinellas County lakes and ponds

Scott M. Deitche and Donald C. Hicks
Pinellas County Department of Environmental Management, Water Resources Management, Clearwater, Florida

The Pinellas County Department of Environmental Management's Water Resources Management Section is charged with responding to citizen water quality complaints. From January of 1999 through December of 2002, County staff responded to 722 complaints. Of those, approximately 15% were fish kills. An overwhelming majority of the reported kills occurred in freshwater systems. The visible nature of fish kills requires an immediate response to both assess the situation and to provide the citizens of Pinellas county with timely service. Although the County does not usually clean up the dead fish, our information regarding causes has enabled many homeowners, associations, municipalities, and the County itself to modify lakes and ponds to minimize the likelihood of these events occurring again.

Water Resources staff developed an integrated Access database to catalog and analyze citizen complaint data, in response to the ever-increasing numbers of citizen water quality issues. The database has been an effective tool for analyzing complaint data. The parameters examined in this paper include temporal and spatial trends from 1999-2002.

In 2003, WRMS began entering historic complaint data (pre-1999) into the Access database. Initial data for the years 1987 – 1994 is already available and is being integrated into the master

database for analysis. The historic data provides an additional layer of information for temporal and spatial assessments of fish kill trends in Pinellas County.

Species breakdowns are an essential aspect of assessment. Initial assessment places tilapia as the most prevalent species represented in freshwater fish kills. Bass, bluegill, threadfin shad, gizzard shad, and grass carp are also represented.

The primary cause of fish kills in Pinellas County was low dissolved oxygen. Factors contributing to low dissolved oxygen were highly variable and included algae blooms, sedimentation, aeration system failure and groundwater pumping. Data will be examined for additional factors such as natural versus man-made waterbodies.

Reproductive parameters of spotted seatrout, *Cynoscion nebulosus*, in Tampa Bay, FL

Susan Lowerre-Barbieri, Nathan Henderson, Joel Llopiz, Sarah Walters and Joel Bickford
Florida Fish and Wildlife Conservation Commission, Florida Marine Research Institute, 100 8th Avenue SE, St. Petersburg, FL 33701

A total of 2,861 spotted seatrout, *Cynoscion nebulosus*, were collected in the lower Tampa Bay from March 2000 through January 2003. They ranged in size from 145 to 640 mm total length (TL), with an average size of 354 mm TL. Two different patterns of spawning activity were observed. Females in the lower estuary occurred throughout the day and year and active spawners were mixed with nonactive spawners. In contrast, at a spawning site located in a relatively deep channel between barrier islands, 97% of the females were active spawners, and fish were collected only at the time of spawning. Spotted seatrout matured at a young age and small size, with more than 50% of the females being mature at 260 mm TL. Their spawning season was protracted: from mid-March through mid-September. Batch fecundities (n=180) ranged from 28,826 eggs/female to 1,280,888 eggs/female and increased with fish size. The average spawning frequency, based on females collected in the morning with post ovulatory follicles, was once every 8.9 days, or 20.7 times over the season. Annual fecundity increased with age, ranging from 1,891,504 eggs for age-one females to 18,048,054 eggs for fish age five or older.

Habitat selection by largemouth bass, redear sunfish, and bluegill in two Central Florida lakes

Earl Lundy
Florida Fish and Wildlife Conservation Commission, St. Johns River Fisheries Office, 5450 U.S. Highway 17, DeLeon Springs, FL 32130

Patterns of habitat use by three centrarchid fishes, largemouth bass, redear sunfish, and bluegill, were analyzed in regards to seasonal and diurnal patterns, physiochemical parameters, and benthic features in Lake Joanna and Lake Gertrude in central Florida. Stepwise regression was used to examine patterns of habitat usage. Largemouth bass exhibited preference for emergent littoral vegetation, docks, and other features that formed breaks, transitions, or boundary effects in habitats, as opposed to gentle gradations. Numbers were greatest in shallow, littoral waters. Redear sunfish were most prevalent at night and in shallow, littoral zones. Emergent vegetation

and silted bottom were preferred, possibly for forage preference. Both largemouth bass and redear sunfish were most prevalent during spring and summer and preferred clearer, more oxygenated waters with more basic pH. Bluegill exhibited few habitat preferences and no seasonality. Physico-chemical parameters preferred by bluegill were opposite those preferred by largemouth bass and redear sunfish. Overall trends for bluegill populations indicated a preference for deeper waters.

Non-lethal Fin-ray Ageing of Gag Grouper and its Potential Application for Ageing Threatened Groupers

Debicella, Jaclyn, Debra J. Murie, and Daryl C. Parkyn*
Department of Fisheries and Aquatic Sciences, University of Florida, 7922 NW 71st Street, Gainesville, FL 32653. Email: jackiedebo@hotmail.com, dmurie@ufl.edu, dparkyn@ufl.edu

Gag grouper (*Mycteroperca microlepis*) was used as a model species to develop a non-lethal, fin-ray method for ageing grouper species. Collection of gag samples throughout their size range (maximum of 1100 mm TL), and hence age range (maximum of 13 yrs), would allow biases associated with underestimating the ages of older individuals to be quantified. In addition, juvenile gag can be readily sampled and identification of the first annulus is therefore possible. To assess these ageing biases, paired samples of sagittal otoliths and fin rays were collected from 297 gag grouper. Sectioned otoliths (~0.5 mm) were compared to sectioned pectoral, pelvic, anal, and dorsal fin rays (~0.8 mm), with the latter providing the most readable sections. Spearman's ρ for corresponding ages from otoliths and dorsal fin rays was 0.8011. Agreement between structures was 67%, and ages were ± 1 yr of each other for 92% of the fish. Future analyses include measurement of the marginal increment to examine synchrony in the timing of the annulus deposition in the two structures. Paired ageing structures from Nassau grouper (*Epinephelus striatus*) are currently being examined to determine if fin rays provide an alternative, non-lethal ageing method for threatened grouper species.

Precision of age estimation in red snapper (Lutjanus campechanus)

Karl J. Starzinger, Gary R. Fitzhugh, Robert J. Allman and Robert A. Farsky
NOAA Fisheries, Panama City Laboratory, 3500 Delwood Beach Rd., Panama City, FL 32408

Validation of aging methods, an important step in estimating growth and longevity, has been accomplished for red snapper. However, routine age interpretation remains largely subjective. A reference collection of 300 red snapper otoliths was circulated among six aging laboratories in the Gulf region. Average Percent Error (APE; estimate of precision) ranged from 2.5 to 6.0 % for 5 facilities with no apparent bias in estimates as age increased. One initial estimate was notably higher at an APE of 12% and bias was evident. For moderately long-lived species such as red snapper, a precision benchmark of $\leq 5\%$ has been suggested. Beyond the need for initial training to recognize annulus patterns in decades-old fish, it was evident that common differences between readers were related to interpretation of the otolith edge type and interpretation of the first annulus. Careful measurement of annulus distances and identification of otolith edge patterns aided by light reflectivity measurements indicated that annual rates of transition from translucence to opaque were fairly consistent. However, annual differences in the seasonal timing of otolith zone transition occurred on the order of a few months (this study

compared to others). The degree of opacity varied in the first annulus and the mean distance from the core to the distal edge of the 1st annulus was 1.05 mm (sd=0.11). By recognizing possible variations in these factors and with use of a training set and reference collection, our expectation is that a 5% (APE) precision target can be readily achieved and improved upon.

Ontogenetic Dietary Shifts and Dietary Overlap of a Nonindigenous Fish and an Ecomorphologically Similar Native Fish

Jeffrey E. Hill[1], Charles E. Cichra[2], and Leo G. Nico[3]
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Given that trophic morphology is an indicator of a fish's ability to handle prey, morphologically similar species might be expected to exhibit similar ontogenetic dietary shifts and overlap considerably in diet. If prey are limiting, competition will occur between species with large dietary overlap. Peacock cichlids *Cichla ocellaris* (Cichlidae) were intentionally introduced into the native range of the ecomorphologically similar largemouth bass *Micropterus salmoides* (Centrarchidae) in southeast Florida in 1984. Observations suggested that both species used similar habitats within the canal system. We investigated the hypothesis that similar morphology results in similarity in dietary shifts and in dietary overlap regardless of phylogenetic relations. Collections of juvenile largemouth bass (N = 247) and peacock cichlids (N = 301) (i.e., ≤ 160 mm total length [TL]) were made in Cutler Drain and Snapper Creek canals in Miami-Dade County, Florida, in 1999 and 2001. The co-occurrence of juveniles of similar size and prey handling ability was confirmed by length frequencies and gape width measurements. Analysis of stomach contents (i.e., frequency of occurrence, numerical abundance, and volume) revealed a general similarity in patterns of prey use, but there were some important differences. Zooplankton dropped out of the largemouth bass diet after the 80 mm TL group but remained in the diet of peacock cichlids through the 100 mm TL group. Insects and decapod crustaceans were consumed to a greater extent by largemouth bass than by peacock cichlids. Additionally, peacock cichlids became fully piscivorous (i.e., ≥ 60% fish by frequency of occurrence) at shorter lengths (i.e., 100 mm TL group) than largemouth bass (i.e., 120 mm TL group). There also was considerable overlap in diet (i.e., Schoener's Index values > 0.60) between the two species on seven out of eight sampling dates. Our results suggest that morphological similarity of a nonindigenous species with a native fish is broadly predictive of similarity in prey use and dietary overlap, but also demonstrate the occurrence of potentially important species-specific differences. Although our results further suggest that the presence of peacock cichlids might be detrimental to largemouth bass populations via food competition, available data do not suggest a decline in largemouth bass abundance during the 20-year period following the peacock cichlid introduction.

Gastric evacuation and digestion state indices for gag grouper consuming fish and crustacean prey

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Gag grouper Mycteroperca microlepis comprise one of the most valuable fisheries in the Gulf of Mexico; with over 7.8 million pounds landed in 2001. Gag production measured through growth depends on the total amount of surplus energy available after losses due to metabolism and wastes. Gag consuming relatively energy poor prey, such as crabs, will therefore have less surplus energy available for growth unless consumption rates are increased. Estimating consumption rates of gag, which feed primarily on fish prey and secondarily on crustacean prey, requires prey-specific evacuation models. To develop these models, 40 wild gag ranging in size from 300-750 mm TL were acclimated in a recirculating, 28° C seawater system until they began voluntary feeding. Individual fish were then fed a meal at 1.5% of their body weight of either scaled sardines, Harengula jaguana, or swimmer crab, Portunus gibbesi. After a pre-determined elapsed time, each fish was sacrificed and the remaining meal weighed. The amount of meal remaining after an elapsed digestion time was modeled to calculate digestion rates and formulate a gag-specific evacuation model. Future work will include re-evaluating consumption rates of gag in the wild using a gag-specific consumption model.

The Association Between Schooling Mysids (Crustacea: Mysidacea) and Territorial Damselfishes (Pisces: Pomacentridae) on a Coral Reef

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[2]Department of Marine Science, Eckerd College, St. Petersburg, FL 33711

The association between schooling mysids and territorial damselfish was quantified through observations and experiments on Glover's Atoll, Belize. Surveys of association and analysis using a loglinear model revealed a significant positive association between mysids (primarily Mysidium integrum and M. columbiae) and adult damselfish (Stegastes diencaeus and S. planifrons), no association between mysids and juvenile S. diencaeus, and a significant negative association between mysids and juvenile S. planifrons. Predation experiments revealed that mysids located within adult damselfish territories suffered fewer attacks than mysids outside territories. We were unable to quantify any costs or benefits to damselfish in this association. We hypothesize that mysids co-occur with adult damselfish in a commensal relationship; mysids gain protection from predation as a result of adult damselfish territorial behavior.

Population structure of red drum (*Sciaenops ocellatus*) as determined by otolith chemistry

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Phone: *(+613) 8344 7986* Fax: *(+613) 8344 7909* Email: *mpatt@unimelb.edu.au*

In order to examine current genetic-based paradigms pertaining to the structure and possible philopatry of red drum populations, we used solution-based inductively coupled plasma-mass spectrometry (ICP-MS) to analyze the otolith chemistry of juvenile red drum (*Sciaenops ocellatus*) from eight different estuaries in the Gulf of Mexico (Gulf) and the North Atlantic Ocean. One estuary (Tampa Bay, FL) was sampled in three different years. Analyses of variance for five elemental ratios (Mg/Ca, Mn/Ca, Zn/Ca, Sr/Ca, Ba/Ca) were all significantly different between estuaries, as was a multi-element signature (MANOVA, Pillai's Trace $F_{50, 1020} = 19.41$, $p < 0.0001$). We also found that red drum from the Gulf could be distinguished from those taken from the Atlantic Ocean with 99.5% accuracy, likely due to differences in water chemistry between these water masses. A discriminant function developed using these elemental ratios was more than 80% accurate in assigning juvenile red drum to their natal estuary, or in the case of Tampa Bay, to the correct year of spawning. We also used laser ablation ICP-MS to examine the otolith core chemistry of adult red drum collected from spawning aggregations near Tampa Bay. Using a discriminant function analysis with a calibration data set derived from juvenile signatures, we found that 75% of the adult cores matched the juvenile signal established for Tampa Bay 1982. Although preliminary, the results presented here suggest that red drum may return to their natal estuary to spawn, which has been postulated from genetic data. A metapopulation model, rather than the single-stock model currently used, may have advantages for management of this species in the Gulf.

Natal origin of common snook, *Centropomus undecimalis*, in Florida Bay

Heather M. Patterson[1], Ronald G. Taylor[2], and Richard S. McBride[2]
[1]Department of Zoology, University of Melbourne, Victoria 3010, Australia
[2]Florida Fish and Wildlife Conservation Commission, Florida Marine Research Institute, 100 Eighth Avenue SE, St. Petersburg, Florida 33701-5095, USA

Adult snook support popular fisheries in the Florida Keys and adjoining Everglades National Park, but no eggs, larvae, or juvenile common snook have been found in past ichthyoplankton and juvenile fish surveys conducted in that area. Although adult snook occur in Florida Bay, the absence of larvae and the rarity of juveniles suggest that the major source of recruitment to the adult stock in this region originates elsewhere. Inductively coupled plasma-mass spectrometry (ICP-MS) was used to investigate the origin of common snook (Centropomus undecimalis) in Florida Bay, Florida. We examined juvenile snook otoliths from Florida's Atlantic and Gulf of Mexico (Gulf) populations and the cores of otoliths from adults collected in Florida Bay and determined that there were significant differences in several elemental ratios (Mn/Ca, Cu/Ca,

Sr/Ca, Ba/Ca) in the otoliths from the three locations (Atlantic, Gulf and Florida Bay). A discriminant function analysis (DFA) also indicated a significant multi-element difference (Pillai's Trace, $F_{12,106} = 18.172$, $p < 0.0001$). A jackknife cross-validation procedure determined that juvenile Gulf and Atlantic otoliths were never misclassified by coast, indicating a distinct difference in their otolith chemistry. Using only juvenile otoliths to derive a calibration function, which was then applied to the test data set of adults from Florida Bay, a separate DFA indicated that the adults from Florida Bay likely originated from both coasts of Florida in roughly equal proportions. These results concur with those of genetic studies that suggest that both east and west coast populations contribute to the snook found in Florida Bay.

Trophic relationships among coastal pelagic fishes in the northeast Gulf of Mexico: A preliminary study

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Potential for interspecific feeding competition was investigated among two species of shark (Atlantic sharpnose shark, Rhizoprionodon terraenovae, and blacknose shark, Carcharhinus acronotus) and three species of teleosts (Spanish mackerel, Scomberomorous maculatus, ladyfish, Elops saurus, and bluefish, Pomatomus saltatrix) by examining stomach contents. A total of 492 specimens (R. terraenovae = 312, C. acronotus = 35, S. maculatus = 81, E. saurus = 61, P. saltatrix = 3) were collected using gillnets from May to August 2002, in nearshore waters from Panama City to Apalachicola, Florida, in the northeast Gulf of Mexico. Diet was quantified using the index of relative importance (IRI) of prey items: IRI = % occurrence (% weight + % number). P. saltatrix was not included in analysis due to low sample size. Unidentifiable fish comprised the majority of the diets (71.35% - 96.95%) of all four predator species. Excluding unidentifiable fish, R. terraenovae and E. saurus diets were dominated by decapod crustaceans (0.72% and 5.50% IRI, respectively), C. acronotus diet was dominated by Brevoortia sp. (5.77% IRI), and S. maculatus diet was dominated by Anchoa mitchilli (10.19% IRI). Pair-wise comparisons made between species using the Pianka, Schoener, simplified Morisita, and Horn's indices showed that every species pair except ladyfish/Spanish mackerel demonstrates broad dietary overlap. However, upon exclusion of the unidentifiable fish category, percent composition of other prey categories showed some well-defined differences among predator species. These results indicate that, while dietary overlap is evident between all of the predators, other factors such as temporal or spatial variations in food supply or selection may contribute to the partitioning of food resources.

Evaluation of a 356 mm minimum size limit for redear sunfish at Merritts Mill Pond, Florida

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Virtually all legal redear sunfish Lepomis microlophus harvest was eliminated in Merritts Mill Pond from 1998 through 2002, with the implementation of a 356 mm TL minimum size limit.

Total angler effort decreased substantially from 1991-94 to 1998-2002, most of which was species directed effort for redear sunfish. Sunfish composition changed dramatically from a population that was dominated by bluegill L. macrochirus (84%) prior to extreme drawdown (1990), to one that was comprised mostly of spotted sunfish L. punctatus (74%) following an extreme 18 month dewatering (1996) and finally to one in which redear sunfish comprised the majority (54%) by the end of this study. Relative weights of redear sunfish have declined significantly ($P<0.05$) since implementation of the regulation, probably due to extraneous causes unrelated to the regulation. Mean length at age of redear sunfish indicated slower growth than previously determined and probably was one of the reasons very few fish ever reached the 356 mm TL minimum size limit. It was recommended to lower the minimum size limit to a more obtainable goal (254 mm) that would allow harvest of quality redear sunfish.

Trends in young-of-the-year abundance of species subject to Florida's saltwater fishing regulations

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Florida's saltwater fishing regulations include harvest quantity limits, size and gear restrictions, and closed seasons. Trends in young-of-the year (YOY) recruitment of important fishery species were studied using 21.3-m seine data collected from 1989 to 2002 in Tampa Bay, Charlotte Harbor, and the Northern Indian River Lagoon. Indices of YOY abundance were calculated for red drum (Sciaenops ocellatus), spotted seatrout (Cynoscion nebulosus), striped mullet (Mugil cephalus), sheepshead (Archosargus probatocephalus), blue crab (Callinectes sapidus), and pink shrimp (Farfantepenaeus duorarum). The only significant linear trends found were increasing numbers of striped mullet in Charlotte Harbor and decreasing numbers of blue crab in the Northern Indian River Lagoon. The majority of the species showed indications of compensatory mechanisms that regulated numbers of recruits. Interannual variation in abundance tended to be lower in species with relatively restricted nursery areas, e.g. spotted seatrout. Correlations in indices of abundance of striped mullet, pink shrimp, and red drum between Tampa Bay and Charlotte Harbor suggest that the conditions favoring recruitment into these geographically proximate estuaries were similar or that the juveniles of these species came from common areas.

Are voluntary release practices impeading the effectiveness of Largemouth bass harvest restrictions?

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Over the past 20-years there has been an increase in voluntary release angling practices among largemouth bass (Micropterus salmoides) anglers. We evaluated the potential for harvest restrictions to increase the number and catch rate of harvestable (≥ 254-mm TL) and memorable (> 510-mm TL) sized fish for a largemouth bass population subject to a high rate of voluntary release. Population-specific estimates of total annual mortality (49%), total catch (42%), harvest (11%), natural mortality (38%), length-at-age, and number-at-age were used in an age-structured model to simulate the response of the fishery to various harvest restrictions. Significant increases in the number of harvestable-sized and memorable-sized fish and angler catch rates of these fish were not apparent until length-specific exploitation rates were used in the model. Length-specific exploitation for the population was found to increase with increasing fish size. Simulations conducted using length-specific exploitation rates showed a catch and release regulation to be most effective at increasing total catch of harvestable-sized and memorable-sized fish; however a 610-mm minimum length limit was only slightly less effective and allowed for harvest of memorable-sized fish. Overall the results indicated that, despite a high rate of voluntary release (31%), the largemouth bass population could be effectively managed with harvest restrictions.

Re-Thinking Recreational Fisheries Management: Teaching a New Dog Old Tricks

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Recreational fishing may not be as old as commercial (read: subsistence) fishing but its history is long and rich (see: The Complete Angler [Izaac Walton, 1653] for a later day version of what passed as relaxation lo all those many years!). The hypothesis that 'modern recreational fisheries management has been able to provide a sustainable resource' can generally be rejected. This rejection is apparent and based on currently available data. While not all recreational fisheries are declining, a preponderance of evidence indicates that a majority of currently targeted fisheries are "not what they used to be". Part of the problem lies in the frame work upon which much of 'modern' fisheries science has been built. Managing recreational fisheries at the current scope and scale is a relatively new endeavor, probably not more than a few centuries old. Moreover, modern recreational fisheries management was developed largely at institutions steeped in the experience of terrestrial game management. Concepts such as bag and size limits

were staples in the aged tool box (get it? staples – tool box) of wildlife managers. Admittedly, approaching recreational freshwater fisheries management from a wildlife perspective gave limited vantage. However, fisheries management as it is currently applied, is derived from freshwater management practices developed mostly for closed systems (and based conceptually from a terrestrial wildlife perspective) and seems to have little hope of being effective in the estuarine and marine milieu. A new, fresh approach to recreational fisheries management is desperately needed. The problems we face should be looked upon anew and based upon the reality of human behavior coupled with the requirements necessary to sustain fisheries within the context of their ecosystem. This is really an old idea that must be belatedly learned by a relatively new group of practitioners.

Evaluation of Angler and Fish Population Response to a 305 mm Minimum Length Limit for Black Crappie on Lake Monroe, Florida

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Abstract: A 305 mm TL (12") minimum size limit was imposed for black crappie on Lake Monroe on 1 July 1998 with the intention of creating a "quality" crappie fishery, thereby increasing angler effort. Previous studies on Lake Monroe indicated fast growth and high catch success for the species. Concurrently, the statewide bag limit was reduced from 50 to 25 crappie per day. Creel surveys were conducted to measure changes in angling pressure. Angler effort was expected to decrease initially but rebound as numbers of quality fish were recruited to a legally harvestable size. Angler success rates, expected to increase as fish below the limit were protected from harvest, fluctuated during the five-year evaluation period, but did not show an increasing trend. Angler effort estimates remained much lower than pre-regulation estimates. Fish population variables were measured with samples collected by electrofishing. Although length-frequency distributions showed an increase in modal size during the initial years of the rule change and catch-per-unit-effort displayed an upward trend, the percentage of fish ≥ 305 mm did not increase. Anglers did not experience an increase in overall catch rates or in the proportion of quality size black crappie that could be legally harvested. Annual total mortality estimates decreased after the rule was implemented. However, due to only one year of pre-regulation data, the variability of crappie recruitment, and no angler exploitation data, changes in the estimates' significance were considered inconclusive.

Case History of Red Snapper Management in the Gulf of Mexico Exclusive Economic Zone (EEZ)

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The red snapper fishery in the Gulf of Mexico EEZ is one of the most heavily managed Gulf fisheries. The red snapper fishery, which has been in existence for over 100 years, was recognized as overfished as early as 1979 and prompted the Gulf of Mexico Fishery Management Council (Gulf Council) to take management action in the Reef Fish Fishery

Management Plan (FMP) implemented in 1984. Within this plan, the first of a series of gear limitations, bag limits, and size limits were introduced. Additional management measures that have been established include quotas, trip limits, fishing seasons, permit requirements, and a license limitation system. However, these actions alone cannot rebuild the red snapper stock. High levels of bycatch of juvenile red snapper that occur in the shrimp fishery have slowed the recovery of this stock. Therefore, red snapper are not only managed within the Reef Fish FMP, but have caused management actions to be promulgated through the Shrimp FMP to reduce bycatch levels. Besides being used to help rebuild red snapper, bag and size limits have been used to extend the recreational season.

Current management actions being considered for this stock are the development of an individual fishing quota, bycatch reporting requirements in the reef fish fishery, and the development of a rebuilding plan consistent with current fishery management standards. New information on release mortality rates of regulatory discards in the red snapper fishery may indicate that size and bag limits have limited usefulness in managing this stock. The future of these measures will be examined in an upcoming stock assessment.

Case History of Yellowtail Snapper Management in the South Atlantic Exclusive Economic Zone (EEZ)

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The yellowtail snapper fishery has existed in southern Florida for more than 100 years. Landings increased from 1000 mt to 1650 mt from 1981 to 1993, then decreased to 802 mt by 2001, and recreational and commercial effort followed a similar trend. Size, bag and gear limits were imposed by various state and federal agencies beginning in 1983. A 12-inch minimum size was adopted by the South Atlantic Fishery Management Council (South Atlantic Council) in 1983 because growth overfishing was occurring. The size limit was predicted to increase yield by 34%. The Florida Marine Fisheries Commission and Gulf of Mexico Fishery Management Council (Gulf Council) adopted this size limit for similar reasons by 1990, which is approximately when landings and effort began to decrease. Compliance with the size and bag limits has been high. A SEDAR stock assessment, completed in 2003, concluded that the fishery has persisted partly due to early maturation and larger minimum sizes. The 2003 report to Congress on the status of U.S. Fisheries during 2002, classified yellowtail snapper as overfished and undergoing overfishing. However, the 2003 SEDAR assessment indicated that the stock is no longer overfished or undergoing overfishing.

Preliminary Evaluation of a 38-cm to 61-cm Protective Slot Limit for Largemouth Bass on Lake Istokpoga

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Lake Istokpoga (11,300 hectares; Highlands County) has historically supported a strong recreational fishery for largemouth bass (Micropertus salmoides). With the designation of Lake Istokpoga as a Fish Management Area in 1997 and angler concern over a decline in future angling quality, the Florida Fish and Wildlife Conservation Commission's Division of Freshwater Fisheries was asked to determine the potential for management of a "high-quality" largemouth bass fishery in Lake Istokpoga. After consideration of biological and angler opinion data, a 38.1 cm (15") to 60.9 cm (24") protective slot limit with a three-fish bag limit, of which one fish may be 61.0 cm or longer, was implemented for largemouth bass on 1 July 2000. The goal of the regulation is management for a high-quality largemouth bass fishery, while allowing harvest of more abundant, smaller bass which most anglers prefer to harvest and "catch of a lifetime" trophy bass. Evaluation criteria include electrofishing catch rates, angler effort for bass, angler success for bass, angler catch and harvest composition, and tournament angler catch composition. Data through three years of regulation indicate both the bass population and recreational fishery have responded positively to slot-limit regulation in conjunction with other management strategies implemented on Lake Istokpoga.

Largemouth Bass Cohort Response to Drawdown Management on Rodman Reservoir

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We examined the effects of reservoir drawdowns on largemouth bass age-1 abundance and year class strength at Rodman Reservoir from 2000 to 2003. We found a significant difference between age-1 catch per minute (CPM) among years, but no consistent trends were found between age-1 abundance produced during drawdown years and non-drawdown years. Catch curve residuals corresponding to cohorts produced during drawdown years were consistently positive, indicative of strong year classes, with the exception of the 2002 year class. Current drawdown magnitude, timing, and duration generally have a positive effect on the largemouth bass population, and is an inexpensive tool for largemouth bass management on the Rodman Reservoir.

The striped mullet fishery in Florida: fishery management and harvest restriction based on randomized climatological processes

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Striped mullet, Mugil cephalus, is an important forage species, that supports valuable commercial and recreational fisheries in Florida. With development of a valuable export roe market in the late 1970, fishing pressure on female spawning stocks significantly increased in Florida. Concerns regarding overfishing prompted state and regional management agencies to place strict regulations on the fishery. Assessing and managing the mullet fishery has been challenging, especially because of socio-economic and legal issues, complex biological considerations, and the 1995 constitutional "net ban" amendment. In this presentation, the effects of various management regulations on the striped mullet fishery and stock conditions during the pre- and post-net ban periods are discussed. To reduce commercial catch during the spawning season, the weekend closure was adopted as one of the key management regulations, because it is based upon the apparent association between cold front events and mullet schooling and offshore migration. The following steps were taken to evaluate the effects of weekend closures under randomized climatological processes: 1) tested for the statistical significance of the effects of cold fronts upon commercial mullet daily catch rates; 2) estimated percent changes in the catchability rates as the result of cold front events; and 3) constructed a fishery simulation model that included frequency of cold front events, seasonal trends in population availability, gear selectivity, seasonal trends in fishing effort and shifting of effort from weekends to weekdays. Model estimates of fishery yields for various weekend-closure options were compared to the observed yield from the 1993 and 1994 fishing seasons.

Harvest Restrictions as a tool in the management of a fish population: an interstate perspective using weakfish *Cynoscion regalis* as an example

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Since the early 1800s, weakfish have been an economically important species on the Atlantic coast of the United States. The fishery primarily occurs between Rhode Island and the east coast of Florida, which is at the southern range of the species. Weakfish are managed through the Atlantic States Marine Fisheries Commission. The first coast-wide management plan was developed in 1985 to address concerns about declining landings, bycatch in other fisheries, the lack of adequate data for management, and the need to address user conflicts through interstate management. This plan resulted in a set of voluntary measures that the Atlantic coastal states were to implement. However, the abundance of weakfish continued to decline, partly because several states were not implementing the plan recommendations. This led to a series of amendments that required states with directed fisheries to reduce fishing mortality rates via quotas, size limits, and reductions in bycatch. The adoption of these management measures resulted in the recovery of the stock. The most recent amendment, adopted in 2002, takes into

account the improved state of the stock and includes revised biological reference points that will maintain low fishing mortality rates, expand the age structure of the stock, and ensure adequate spawning-stock biomass.

"Big Bad Bass--Who Wants Them?": The Human Side of Bass Management

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Black bass have been a mainstay of Florida freshwater fishing since the days of Native Americans and territorialism. The question then for a conservation agency is not whether or not anglers want bass—but whether they want lots of small bass, intermediate sized bass or that big bad bass that may make them a world-famous record holder? "Florida Trend" magazine in November 2003 ran an article entitled "Tipping the Scales." The article came with the teaser "Bass fishing is a multimillion-dollar business in Florida, the nation's bass capital. So why will the next world record fish likely come from Texas or California?" They implied that management should focus on creating the next world record. The Florida Fish and Wildlife Conservation Commission, on the other hand, seeks to consider the wishes of the majority of users for a particular resource and use our best science to meet angler expectations consistent with a philosophy of sustainable use. This presentation discusses our approach and rationale.

Managing largemouth bass fisheries with harvest restrictions in Florida

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Florida Fish & Wildlife Conservation Commission biologists have experimented with largemouth bass harvest restrictions on selected water bodies since the early 1980s. It was not practical to implement individual regulations on the nearly 10,000 freshwater resources in Florida, so regulations were implemented statewide in 1992 for all indigenous species of black bass, including largemouth bass, Suwannee bass, shoal bass and spotted bass. A new daily bag limit of five black bass per day was adopted statewide. Different minimum size limits were implemented in north Florida (305 mm) and central Florida (356 mm) because of differences in black bass growth rates in these two regions. A 356-mm maximum size limit, which allows one bass over the maximum size per day, was implemented in south Florida. This south Florida regulation was chosen partially because of low fishing mortality and high natural mortality on largemouth bass populations in the Everglades during periods of low water, and partially because of very high mercury concentrations in larger bass in the Everglades. High minimum size limits (e.g., 457-mm), protective slot length limits (e.g., 356 to 508 mm), no harvest rules and reduced daily bag limits (e.g., 3 fish per day) are used on selected water bodies throughout Florida in an attempt to improve the quality of bass fisheries in terms of increased sizes of bass caught by anglers.

An overview of changes in data and techniques used to prepare stock assessments for Florida's marine resources

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The earliest stock assessments for Florida's marine animals generally relied solely on information on the biology and life history of the animal. Simple studies of the size at first reproduction appear to have been the basis for the earliest data-based assessments, which usually resulted in the adoption of minimum size limits designed to allow fish to spawn at least once before being harvested. Life history studies grew in importance as a source of data for stock assessments during the late 1970s and early 1980s. These data were generally used in equilibrium assessments of yield per recruit. During the same time frame, when concern was voiced about the potential for fishing to reduce the production of new recruits, yield per recruit analysis was expanded to spawning-stock-biomass per recruit analysis. During the early development of assessments in Florida, equilibrium biomass-dynamic models were used sparingly when the adequate life history information was inadequate. However, the necessary catch, and especially effort, information for these models was sparse or not always accurate. An advantage of many assessments made during this early period was that all necessary information for each assessment could be collected by special short-term studies of life histories. The major disadvantage was that it required making unrealistic assumptions regarding equilibrium conditions. During the 1990s data collection programs and assessment tools and techniques rapidly improved. As time series for commercial catch and effort, recreational catch and effort, and relative abundance and age structure became longer, stock assessments that employed all these data were developed-- mostly relying on age-structured analyses. Increasing computer speed and the availability of software packages like ADAPT and ICA facilitated this shift. By the late 1990s, most assessment reports from Florida's state researchers included a variety of analyses, including age-structured analyses and non-equilibrium surplus-production analyses and modified Delury methods. Recently, there has been an ever-increasing pace to changes in assessment techniques resulting from increases in computing power and the development of programming languages and spreadsheet capabilities that are suited for developing specialized stock-assessment applications. Assessments that explicitly incorporate environmental data are now being used to model Florida's marine renewable resources. The application of Bayesian statistical techniques and spatially explicit analyses appears to be on the near-term horizon for assessments of Florida marine resources.

The progression of spawning seasonality of American shad in the Saint Johns River, Florida

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American shad, *Alosa sapidissima*, was the most important commercial fishery in the state of Florida during the late 1800s. Still popular among recreational fishermen, American shad are caught during their spawning run in Florida's Saint Johns River. This presentation reviews data from the 2002-2003 spawning season regarding timing of the spawning run, sex ratio, length-weight comparisons, and general condition. These data were collected via a roving creel survey between lakes Monroe and Harney and by electrofishing between lakes George and Poinsett. Sampling began in December 2002 and was continual until May 2003. American shad (n=499) were collected from January 7 through April 16. The percentage of females caught increased significantly, from 15% to 50% (χ^2=8.9, df=3, p=0.03), during the spawning season. Male and female body weight and fork lengths were significantly related. Female American shad were on average 32% heavier and 11% longer than males. Approximately 30% of all fish caught showed signs of ulceration, bloody tissue, scale loss, or other signs of stress or disease. Examination of ulcerated American shad by aquatic health experts at FMRI has determined that this species became vulnerable to a fungus, *Aphanomyces invadans*, toward the end of their spawning run.

Challenging van't Hoff's Rule: Paradoxical Q_{10} Responses of Fishes from Hyperthermic Environments on Hoga Island, Sulawesi, Indonesia

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Water temperature of environments adjacent to coral reefs (marginal habitats) can fluctuate markedly and limit fish distributions and activity during hyperthermic low tide events. Temperatures of marginal habitats surrounding Hoga Island, Sulawesi, Indonesia can fluctuate daily by as much as 15ºC during the region's mixed diurnal tides. Common goby (*Bathygobius fuscus*) and a sandflat goby species (*Bathygobius* sp.) remain in hyperthermic rockpools of variable depth and structure at low tide, when the temperature can reach 42.0 °C. Diamond-scale mullet (*Liza vaigiensis*), white-tailed humbug (*Dascyllus aruanus*) and nine-banded cardinalfish (*Apogon novemfasciatus*) are found along patch reef and seagrass formations where temperatures fluctuate less. These five species adhere to specific temporal and spatial life histories within marginal habitat subtypes of Hoga Island. Diamond-scale mullet, white-tail humbug and nine-banded cardinalfish demonstrate significant changes ($p < 0.001$) in their weight-specific metabolic rate when transferred between 26.0 and 32.0°C, each exhibiting a normal Q_{10} response of ~2.0. In contrast, common and sandflat goby demonstrate no significant change in metabolic rate ($p \geq 0.235$) and a retarded Q_{10} response of ~1.0. These data suggest that fishes bound to intertidal hyperthermic habitats are likely to show depressed Q_{10} responses. This adaptation may

be necessary for fishes to exploit variable hyperthermic areas and help explain distribution of fishes throughout tropical intertidal regions.

Recruitment Indices for the Shallow-Water Grouper Complex

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The ultimate objective of this study is to develop an age-based annual recruitment index of gag, scamp, and red grouper in the eastern Gulf of Mexico. The pilot phase of this study, still underway, is to evaluate the feasibility and effectiveness of using a chevron fish trap in a fishery-independent survey to capture young (ages 0-3) shallow water groupers on the west Florida shelf. Specific objectives in the pilot phase were to compare catches from estuarine and nearshore shelf waters, test bait preferences, examine the effect of adjusting trap throat size on the species and size composition, and examine behavioral responses of the target species. During the pilot phase, traps with different bait types (squid, Boston mackerel or Gulf menhaden) were fished in the NMFS Panama City lab boat basin for preference trials. Offshore trap sets were rotated between 6 natural bottom locations in the Panama City area. Each site was fished with two traps set during daylight hours, no closer than 200 m apart for approximately 1.5 hr. Three trap throat sizes were evaluated: 100%, 50% and 33% of the standard MARMAP configuration. In order to observe behavioral interactions within the trap and gauge proximity to reef and external species composition relative to catch, video cameras were placed into 40% of the offshore trap sets. Most fishes captured were counted and released alive, but target species (groupers, gray triggerfish and red snapper) were additionally measured. Groupers were also sampled for age and maturity status. To get some idea of trap selectivity and effectiveness, species composition based on visual surveys using SCUBA was compared to species composition based on trap catches. To take advantage of summer-to-fall movements by young gag, the work was largely conducted from August through early December.

Recruitment indices for the shallow-water grouper complex: effective or not?

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There are several challenges associated with the statistical analysis of catch per unit of effort (CPUE) data. The distribution of CPUE data collected in our pilot survey of juvenile grouper abundance in the northeastern Gulf of Mexico is highly skewed and clumped, with a large proportion of zero catches and infrequent, but large, dominating catches. Generalized linear models, based on the negative binomial and delta distributions, were used to standardize CPUE estimates of gag grouper. Monte-Carlo simulation was used to calculate the sample size required to achieve the precision necessary to create a recruitment index for forecasting purposes. We found that 117 trap sets inshore would produce an abundance estimate for age-0 gag with +/-25% precision. Offshore, 428 trap sets would be needed to obtain +/-27% precision in the relative abundance of older year classes. Despite relatively low predicted levels of precision, continued research is warranted. Annual recruitment in gag is extremely variable, with dominant year-

classes routinely composing between 10% and 40% of the harvested age structure. Therefore, recruitment of dominant cohorts would be detected, whereas minor changes in juvenile abundance might not.

Effect of size-at-release on short-term survival and coded-wire tag retention of hatchery-reared red drum

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In March 2000, the Florida Marine Research Institute, in collaboration with Mote Marine Laboratory, initiated a series of release experiments to evaluate stocking strategies for hatchery-reared red drum in Tampa Bay. Since then, 25 independent release events have been conducted in which a total of more than 1.1 million red drum have been released. Three standard length size classes (phases) of fish were released (phase I ≅ 35mm; phase II ≅ 75mm; phase III ≅ 150 mm). Each phase was released in-season with the natural population. For each of the release events we conducted a short-term (24-hr) survival and tag retention (phase II & III only) experiment. A random sub-sample of each release group was selected and held near the release location in a floating net pen. Survival rates ranged from 58.1 to 100%, with phase II fish having the highest mean survival rate, 97.4%. Tag-retention rates ranged from 88.4 to 99.5%, with phase III fish having the highest mean tag retention rate, 98.4%. The effects of size-at-release, release location, water temperature, salinity, dissolved oxygen, and other factors on survival and tag-retention rates will be statistically compared and reviewed. These data will provide a better understanding of how the stressors of harvest, transport, and release affect hatchery-reared red drum and will allow us to subsequently adapt our protocols to optimize fish survival and tag retention.

Relationships Between River Surface Level and Fish Assemblage in the Ocklawaha River, Florida

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Increasing water needs in Florida have led to legislation mandating the establishment of minimum flows for Florida rivers. We reviewed a long-term Florida Fish and Wildlife Conservation Commission electrofishing data set from the Ocklawaha River, Florida collected during 1983-1994 to evaluate trends in fish community metrics relative to historical river levels. Electrofishing data were used to estimate catch per effort and biomass per effort of selected

species, fish diversity, richness and evenness. Catch rates and community variables were compared between years and significant differences were related to historical water levels using multiple regression models. Results indicated that differences in fish metrics were more common at the site with increased river level variability. Multiple regression models indicated that fish abundance and species richness were negatively related to river levels and species diversity was negatively related to variability in river level during the two years prior to sampling. Spotted sunfish *Lepomis punctatus* exhibited the most species-specific variability among years and abundance was positively related to flows. Low river levels negatively influenced fish abundance and fish communities, and minimum flow levels in Florida should manage for the periodicity of low flow events to prevent sequential years of adverse effects on fish populations.

Fish Community Composition in a Seagrass-Drift Algae Habitat: Is Niche Partitioning Driving the Equation?

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Seagrass habitat provides protection for many commercially and recreationally important species. Some fish species use the habitat for their entire life history while many are only present during critical life history stages, resulting in a dynamic community composition. The objective of this study was to determine the key factors influencing the structure of a southwest Florida seagrass fish community. A relatively pristine seagrass bed was sampled monthly for one year using an otter trawl. Multi dimensional scaling was used to analyze the community composition throughout the year. Principle components analysis (PCA) was used to analyze affects on community composition due to temperature, salinity and drift algae abundance. PCA analyses showed that these factors were not influential and the dominant factors structuring the community composition were the presence/absence and abundance of two dominant species; *Lagadon rhomboides* and *Eucinostomus* spp. Length frequency distributions of these two species showed temporal separation in recruitment suggesting niche partitioning.

Age and Growth of Yellowtail Snapper, *Ocyurus chrysurus*, off South Florida 1980-2002

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Yellowtail snapper, *Ocyurus chrysurus*, were sampled from the commercial and recreational fishery and by fishery independent survey off South Florida during 1980-2002. Sagittal otoliths were collected along with corresponding meristic data. Sizes ranged from 115 to 605 mm FL with a mean length of 312 mm FL. Yellowtail snapper were aged with a high degree of precision (average percent error <1%). Ages ranged from 1-17 years with a mean age of 3.96 years for the commercial fishery, 3.33 years for the recreational fishery and 3.0 years for the fishery

independent survey. Yellowtail snapper entered the commercial and recreational fishery by age 2. The commercial and recreational fisheries were dominated by 2 and 3 year olds. The commercial fishery indicated the influence of a strong 1994 year class. Weight-length relationships were not significantly different between the sexes but were different between northern and southern sampling areas (ANCOVA; $p<0.001$). The von Bertalanffy growth curve parameters for all areas and fishing modes combined were similar to previously published estimates for yellowtail snapper. Atlantic yellowtail snapper from the southern sampling area (south of 26^{o} latitude) were significantly larger and older than those from the northern sampling area (north of 26^{o} latitude). However, size-at-age and the von Bertalanffy growth coefficient were greater in the northern sampling area. Further site specific sampling is needed to elucidate these demographic differences.

Abundance, distribution, and seasonality of red drum, *Sciaenops ocellatus* (Osteichthyes: Sciaenidae), in Charlotte Harbor, Florida

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The red drum, *Sciaenops ocellatus*, is a popular species for both sport and food from the Gulf of Maine to the Gulf of Mexico. Red drum biology has been studied extensively throughout this range, although no studies have examined habitat use by this estuarine-dependent species in Charlotte Harbor—one of the largest estuaries in Florida. Red drum were sampled with small and large seines (21.3-m with 3.1-mm mesh; 183-m with 37.5-mm mesh) monthly from January 1996 to December 2002. A total of 5,014 red drum (99% <125 mm SL) were collected in 3,032 small-seine hauls, and a total of 762 individuals were collected in 1,356 large-seine hauls. Post-settlement juveniles (≤20 mm SL) recruited to the interior estuary (e.g., Turtle Bay, northern Matlacha Pass, Myakka and Peace rivers) between October and January, with a major peak in October. Larger juveniles (21–125 mm SL) were found in the same locations as post-settlement recruits, but were most abundant in the Myakka and Peace rivers from October to March. Red drum between 80 and 125 mm SL were found almost exclusively in riverine habitats along the shoreline. Individuals 100–299 mm SL were found in the same interior parts of the estuary where recruitment occurred. Red drum ≥300 mm SL (≥age-1) were collected year-round along shorelines throughout the estuary. Additional analyses will examine the relative importance of a variety of seagrass and shoreline habitats to the survival of red drum in Charlotte Harbor.

Relationships between Harmful Algal Blooms and the Recruitment of Five Estuarine Species in Charlotte Harbor, Florida

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Harmful algal blooms (HAB) have killed billions of fish over the years. Fish mortalities associated with *Karenia brevis* events are common, widespread, and affect hundreds of species

in various life stages. To evaluate the impacts of HAB on fishery resources, we examined the relationship between HAB events and juvenile abundances of five estuarine species (*Sciaenops ocellatus, Cynoscion arenarius, Cynoscion nebulosus, Bairdiella chrysoura, and Callinectes sapidus*) in Charlotte Harbor, Florida. Juveniles were collected using a 21.3-m seine and 6.1-m otter trawl during spring (Mar. – Apr.) and fall (Oct.- Nov.) from 1989 to 1994; and HAB events were defined by the maximum cell counts of *Karenia brevis* from 1988 to 1994. We found that the abundances of *C. sapidus* and *C. arenarius* rose during years in which there were no strong HAB events during the fall recruitment season. Also, abundances of *C. nebulosus* and *B. chrysoura* fell in the spring when strong HAB events had occurred the previous fall and winter. There were no defined relationships between HAB events and *S. ocellatus*. More detailed studies are needed to understand mechanisms behind the observed relationships.

Movement patterns of common snook, *Centropomus undecimalis*, on the east coast of Florida.

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A total of 19,410 common snook, *Centropomus undecimalis*, were tagged between 1983 and 1997 along the southeast coast of Florida. Through October of 2001, 4,464 of these tagged fish were recaptured and reported with enough information to determine seasonal movement patterns. These patterns were determined by mapping tag and recapture locations in ArcPlot software, and then calculating both distance and direction traveled along the most direct inshore path. Typically, adult snook were reported in major inlets and along adjacent beaches during their spawning season from late April through early October. From November through March, snook were reported inland in lower-salinity estuaries and freshwater habitats where they over-winter. During these months, movement was generally north into the St. Lucie River and Indian River Lagoon systems. Tag returns during April and May show snook returning south towards their spawning locations. For all years combined, spatial data indicated that 38% of tagged snook were recaptured at or near their tagging location, 25% moved between 1 and 20 miles regardless of direction, and 37% were recaptured more than 20 miles from the tagging site. Returns of tagged subadult snook indicate that immature fish move from their primary juvenile habitats, similar to the adult over-wintering areas, towards the southern inlets as they grow to be sexually mature individuals. This mark and recapture study provides evidence that the east coast snook stock is composed of one intermixing, divergent population.

Changes in fish populations within the deep-sea *Oculina* coral ecosystem off the east coast of Florida

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Approximately 20-30 miles off the east coast of Florida at depths of 60-120 m lie high relief structures composed of the largest concentration of ivory tree coral, *Oculina varicosa*, in the world. This unique deep-water ecosystem provides habitat for a wide array of invertebrate and fish including economically important groupers. In order to protect this fragile, yet extremely valuable habitat, the *Oculina* Habitat Area of Particular Concern (OHAPC) was established in 1984, prohibiting the use of trawls, dredges, traps, and long lines. Subsequent closure to all bottom fishing, including hook and line, in 1994 allowed the creation of an experimental area to examine the use of a marine reserve for recovering overfished reef fish populations. The OHAPC was expanded in 2000 to cover over 300 nm² due to extensive damage to coral habitat and drastic declines in the grouper populations. In 1995, 2001, and 2003, a combination of manned submersible and remotely operated vehicle (ROV) transects were made to examine fish populations of the *Oculina* Banks. Comparisons of fish counts from these transects and earlier research done in 1980 displayed a drastic change in species composition. Whereas several species of economically important grouper and snapper were the most abundant species in 1980, fish counts from 1995-2003 transects were dominated by smaller, economically unimportant species such as small sea basses, butterflyfish, and damselfish. However, research conducted in 2001 and 2003 show signs of recovering grouper populations. Grouper species appear to display slight increases in numbers and the appearance of juvenile speckled hind and snowy grouper suggest the OHAPC may function as a nursery habitat.

Effects of Artificially Introduced Groundwater on Fish Assemblages in Central Florida Lakes

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Water levels in central Florida lakes have declined as a result of drought conditions, diverted rainwater runoff, and increased groundwater withdrawals since the 1960's. In an effort to maintain water levels in lakes near Tampa, the Southwest Florida Water Management District (SWFWMD) has issued permits to allow landowners to pump water from underground limestone aquifers into lakes. Consequently, lake augmentation may alter the water chemistry and other lake parameters. We assessed effects of groundwater augmentation on fish assemblages and water quality in seven Florida lakes. Fish were collected by electrofishing, and the length and weight of all captured fish was recorded. Catch per unit effort, species richness, diversity, and evenness were compared to information from a 60-lake database of non-augmented lakes in Florida (Hoyer and Canfield 1992). Although the well water being pumped into all seven lakes had higher phosphorus levels than the lake water, the augmented lakes had water chemistry values within 95% confidence interval values relative to the lake database. There were also no

diverging trends found for the fish assemblages of augmented lakes compared to the unaugmented lake database.

An overview of the age, growth, and reproduction of Florida Pompano in the Tampa Bay area

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We collected Florida pompano (*Trachinotus carolinus*) from Tampa Bay and adjacent Gulf waters during 2001-2002 to assess their age, size structure, growth, and reproduction. Sampling schedule was based on the lunar calendar and gear used was predominantly 200-300m trammel nets, with gillnets and hook and line used supplementally. We collected data from 1,704 pompano: 750 males, 861 females, and 93 of unknown sex or immature. The fork lengths of these fish ranged from 79mm to 481mm FL, with a modal length of 290mm. 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. No difference in the length/weight relationship was observed between sexes. We collected females with advanced yolked oocytes in every month of the year except November; however, most of these fish were collected between February and July. Pompano ovaries from fish collected in early stages of hydration (n=2) and others in final oocyte maturation were collected during April, May, July, and September and at various times of day, ranging from 08:00 to 16:00. Evidence suggests that spawning may take place year-round and that spawning habitat may be more inshore than previously suggested.

What exactly are "Brown Bodies" and should their presence in gonads indicate sexual maturity in fishes?

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We investigated the usefulness of brown bodies (late-stage atresia and/or melano-macrophage centres that naturally occur in gonad tissue) to separate immature and mature scamp (Serranidae*: Mycteroperca phenax*) sampled from the Gulf of Mexico during 1991-2002. Most scamp were sampled from commercial and recreational fishing ports along the west coast of Florida. Brown bodies were quantified as none, few (1 to 5), and many (> 5) in 1499 scamp using standard histological slides. The large size (>0.20 mm in diameter) of many brown bodies led us to believe that they were not late atretic oocytes but were melano-macrophage centres. Some brown bodies appeared to be aggregating, some seemed to be engulfing old oocytes or other structures, and a few were encapsulated. We found brown bodies to be present year round with the highest percentages during the spawning months of February through June. Therefore, the

presence of brown bodies indicates maturity in scamp. Further research is needed to resolve the problem of distinguishing late-stage atresia from brown bodies.

Preliminary Sonic Tagging of Spotted Seatrout, *Cynoscion nebulosus*, in Tampa Bay, Florida

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Trials were conducted to evaluate the feasibility of using acoustic telemetry for monitoring residence times of spotted seatrout, *Cynoscion nebulosus*, at a known spawning site. Individual spotted seatrout (n=6) were caught at Bunces Pass in Tampa Bay and implanted with Vemco V8sc-2L ultrasonic tags. After recovering from surgery, fish were placed into a net pen located close to shore, where actively spawning fish have been previously caught. Two Vemco VR2 receivers were moored 1.5m off the bottom in the adjacent channel, one at the mouth of the pass and the other approximately 500m inside the pass. Six separate trials were conducted, and trial duration ranged from a day and a half to seven days. Although V8sc-2L tags have an expected range of 200 to 300m, the reception from the inside receiver, which was 170m from the net pen, was highly variable. Reception varied day-to-day as well as hour-to-hour. Gaps in reception when no tag was detected ranged from one to eleven hours. Only during two nonconsecutive days did tag reception occur continuously throughout the entire day. Reception from the receiver placed at the mouth (330m from the pen) was even less reliable than that from the inside reciever. Tag reception apparently is most affected by distance, current speed, and tidal stage.

Recruitment, annual abundance, and habitat associations of young-of-the-year striped mullet, *Mugil cephalus*, in riverine systems of Tampa Bay, Florida, 1996 to 2002

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Variations in recruitment, annual abundance, and habitat associations of young-of-the-year (YOY; 20 – 55-mm SL) striped mullet, *Mugil cephalus*, were examined in three rivers from 1996 to 2002. In all years, YOY mullet recruited into the rivers from January through April, with peak abundances occurring in February. Indices of abundance (arithmetic and least-squares-adjusted mean catch-per-unit-effort) of YOY mullet were compared in three rivers by year. Environmental and physical variables associated with striped mullet abundance were examined in each river. Striped mullet abundance in the Alafia River was significantly higher than that in the Little Manatee River, but not different from that in the Manatee River. When striped mullet abundance data from all rivers were combined, abundance in 1998 was higher than all other years except 2001. Annual indices of abundance did not show any increasing or decreasing trend over the seven-year period. Mullet were found more abundantly along riverine shorelines than in open waters of the bay. Abundance was higher along marsh and exposed shorelines than along mangrove shorelines in the Alafia, and along exposed shorelines than along marsh, mangrove, or structured shorelines in the Little Manatee. These findings provide fisheries managers with

information on the abundance and habitat usage of young-of-the-year striped mullet in the years following Florida's 1995 restriction on entangling nets, and may help to establish a relationship between juvenile recruitment and adult abundance.

Ontogeny of prey capture modulation in the common snook, *Centropomus undecimalis*

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The present study is the first to address the role of ontogeny in the feeding behavior of common snook under various prey types. Using high-speed video, feeding events were recorded and analyzed for integral linear and timing kinematic variables (11 total) in order to investigate the effects of body size on prey capture. The 13 snook used in this study ranged in size from 40 to 220mm SL. Untethered live and dead mosquitofish and shrimp, representing two extremes of elusiveness, were used to analyze feeding events. Maximum gape and premaxillary protrusion scaled isometrically with size for all prey types. Most timing variables (i.e. time to reach maximum gape) demonstrated a scaling coefficient near zero. The amount of maximum cranial rotation was observed to scale with slight negative allometry indicating a decrease in cranial rotation with increasing size. Comparing across prey types within a given size class ANOVA revealed that prey capture modulation occurs throughout the ontogenetic size series tested here but was seen to markedly decrease with increasing size. This study highlights the importance of taking the potentially confounding effect of size and prey type into account when making both inter-and intraspecific comparisons of feeding kinematics in fish.

Spatiotemporal variation in ichthyoplankton communities of the northern Indian River Lagoon Complex with emphasis as to the importance of a no-take fisheries reserve

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One of the anticipated benefits of no-take fisheries reserves is a local increase in the production of fish eggs and larvae, a condition that may benefit adjacent habitat through planktonic export. The shallow estuarine waters surrounding Kennedy Space Center are microtidal and certain management areas, which differ in their degree of public access, are largely divided by earthen causeways, offering a unique opportunity to quantify ichthyoplankton production across a reserve boundary. Collections for this ongoing 24-month study consist of eight samples taken bi-weekly with a neuston net from each of four semi-enclosed sub-basins of the Banana River Lagoon (BRL) and Mosquito Lagoon (ML), whose management ranges from no-entry to unrestricted. From August 2002 to January 2004, approximately 486,000 larvae have been taken in 1228 individual samples. Larval anchovies of the genus Anchoa predominated collections (76%) followed by those of the family Gobiidae (15%). The family Sciaenidae (3%) was the most diverse with nine taxa recorded. Results demonstrate that during summer and fall 2002 and 2003, significantly lower larval densities of most taxa, including several of economic

importance, were consistently found in the BRL no-take reserve. The factors behind this are not yet clear but several possibilities will be discussed.

Wetlands Initiative at Merritt Island National Wildlife Refuge: V. Ichthyofaunal community structure under three differing water management strategies

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Impounded salt marshes at Merritt Island National Wildlife Refuge (MINWR), Florida are managed to meet many specific objectives. As a consequence, impoundments here are held under three distinctive hydrological protocols; Wildlife Aquatic Management (WAM), Rotational Impoundment Management (RIM) and Open, which differ in their degree of connectivity to the adjacent Indian River Lagoon. The purpose of this study was to compare fish assemblages between these three strategies and to assess the value of local marshes as a nursery area for juvenile fishes. Results of twenty-eight months of collections utilizing cast nets, culvert traps and throw traps demonstrate that transient (migratory) species were present under all three hydrologic protocols, but catch-per-unit-effort was significantly higher in Open and RIM impoundments that had a more direct connection to the adjacent Indian River. The most common transient fishes were juvenile striped mullet, menhaden, spot and ladyfish. The high capture rates of transients in perimeter ditches suggest that MINWR salt marshes do play an important regional nursery role, despite the great distance (over 50 km) from the nearest ocean inlet. Conversely, resident taxa reached significantly higher density and biomass under WAM management, likely benefiting from increased cover of SAV and the exclusion of piscine predators.

Mapping Tampa Bay Cynoscion nebulosus Spawning Habitat Using Passive Acoustic Surveys

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A preliminary hydrophone sampling survey was conducted in Tampa Bay, Florida, from July through September of 2003, targeting the calls of male spotted seatrout. Hydrophones, a type of underwater microphone, can be used to detect and record spawning sounds of soniferous fishes. During their spawning season in Tampa Bay, which is between March and September, mature male spotted seatrout, Cynoscion nebulosus, generate sounds in the crepuscular and evening periods by vibrating sonic muscles against the swim bladder. Calls serve to attract other males and hydrated females to specific spawning locations. Active spawning sites can be located using hydrophones to find these calling males. We conducted hydrophone sampling at 388 randomly assigned locations throughout the bay and detected and recorded spawning aggregations at 34 sites. Spawning aggregation sounds were detected in both the upper and lower Tampa Bay but none were detected in the middle bay. Preliminary mapping of the calls shows spawning aggregation sounds occur in a wide range of habitats, including channels, sea grass, sand bottom,

and beach areas. Although these sounds were detected in a range of habitats, the majority of aggregation sounds were located at sites categorized by edges of sea grass flats or in channels.

Surviving Hypoxia: The Return of Hillsborough Bay as a Nursery Area for Fishes of Tampa Bay

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According to many national sources, Hillsborough Bay was and still is known as a polluted hypoxic area of Tampa Bay. Fish kills were common from the late 1950s through the 1970s. Studies from that period suggested that juvenile fish abundance in Hillsborough Bay was lower than in other areas of Tampa Bay, presumably due to pollution-induced hypoxia. Comprehensive management has since addressed the major nutrient loading from chemical, fertilizer, and sewage treatment point sources: this has resulted in improved water quality. Data from long-term fisheries-independent monitoring, begun in 1989, suggest that juveniles of several fish species of ecological and economic importance recruit to Hillsborough Bay in greater numbers than they do to other areas of Tampa Bay. Therefore, Hillsborough Bay no longer appears to be an unproductive hypoxic area.

Preliminary Results of a Catch and Release Mortality Study of Tarpon in Boca Grande Pass, Florida

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Tarpon (Megalops atlanticus) are among the most sought-after inshore gamefish in Florida waters, where state regulations require anglers to purchase a $50.00 tag to harvest or possess a tarpon. Because the tarpon fishery is largely catch and release, data gathered from tags have traditionally been inadequate for estimating total annual fishing effort or mortality and for providing any demonstrable recommendations to manage tarpon stocks. The objective of this ongoing study is to estimate catch-and-release mortality of tarpon caught on hook and line by using traditional live bait and breakaway jig in Boca Grande Pass. We tagged and tracked 28 tarpon using ultrasonic tags and telemetry and recorded many variables, including fight time and condition of the fish at the time of release. Fourteen of the 28 were caught on live bait and fourteen on breakaway jigs. Two mortalities were confirmed and four more fish were suspected to have died, based upon movement patterns. Preliminary results suggest catch-and-release mortality rates are similar for the two types of bait used in the study and that the condition of the fish at the time of release may play a role in their post-release survival.

Salinity mediated changes in metabolic rates, urea and trimethylamine oxide (TMAO) levels in Atlantic Stingray, *Dasyatis sabina*

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Atlantic stingrays, Dasyatis sabina, commonly inhabit shallow Gulf of Mexico waters where salinities may range from nearly freshwater to 70‰ seawater. Like most elasmobranches, Atlantic stingrays mitigate osmotic stress associated with changing salinity by accumulating urea and trimethylamine oxide (TMAO) solutes in their tissues and body fluids. Elasmobranch solute levels have been extensively studied for fish in normal saltwater; however, little research has been done on TMAO and urea levels at extreme salinities. Furthermore, altering and maintaining this solute concentration is an expensive process which contributes to additional metabolic costs. We will use sealed-jar respirometry to quantify osmotic metabolic costs in Atlantic stingray exposed to specific salinities they encounter in nature. Additionally, we will spectrophotometrically quantify TMAO and urea levels in Atlantic stingrays exposed to hypo- and hypersaline conditions. Our data will improve the overall understanding of osmotic function and metabolic costs in Atlantic stingrays and could provide a model for discerning osmoregulation in elasmobranchs.

Recruitment, habitat use, and growth of juvenile pigfish (Orthopristis chrysoptera) in the Indian River Lagoon, Florida

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Pigfish (Orthopristis chrysoptera) are commonly found throughout the estuarine waters of Florida. During the summer, pigfish are the primary live baitfish for commercial fisheries targeting spotted seatrout (Cynoscion nebulosus). Data from stratified-random sampling conducted during 1998—2002 in the Indian River Lagoon (IRL), Florida were used to determine the timing of recruitment, the seasonal changes in abundance and selected habitat use, and the growth of juvenile pigfish (<60 mm SL). Although the timing of annual recruitment events from January through April was consistent between years, the magnitude of events was found to be significantly less during 1998 – 2000 than during 2001 or 2002. The general trend seen during sampling for pigfish was that juvenile fish were not collected during fall and early winter and few adults were collected during late winter and early spring. Spatial patterns in abundance (catch per unit effort) of juveniles indicate that deeper seagrass beds with a higher percent coverage (>50% cover) are important nursery grounds for juvenile pigfish. In the IRL, juvenile growth rates varied between years, with the instantaneous growth coefficient (G) ranging from 0.31 to 0.57.

The Species Composition, Seasonal Variation, and Habitat Preferences of Juvenile Fish and Selected Invertebrates in Shell Key Preserve, Pinellas County, FL

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The Shell Key Preserve is located at the mouth of Tampa Bay in Pinellas County. The preserve is managed by the Pinellas County Department of Environmental Management's (PCDEM) Division of Environmental Lands. The Division's management plan includes a resource management component that calls for a detailed inventory and assessment of the area's natural resources. The state's fisheries monitoring program typically collects only 1 to 2 samples per month in the preserve. PCDEM staff proposed a monitoring program to provide a detailed inventory of the assemblage of juvenile fish and selected invertebrates, their seasonal variation, and habitat preferences. This presentation summarizes the initial analysis of samples collected in the first year. PCDEM staff collected 137 samples from September 2002 to August 2003, using a 21-m, 3-mm mesh center bag seine. Samples were collected bi-monthly at sites randomly selected within nine habitat types. Over 157,900 specimens belonging to 89 taxa were collected. The dominant taxa, in order of abundance, were Lucania parva, Leiostomus xanthurus, Eucinostomus spp., Menidia spp., Floridichthys carpio, Cyprinodon variegatus, and Lagodon rhomboides, accounting for over 90% of the total catch. Variation in species assemblage among seasons and habitats will be described as well as the role of the preserve as habitat for recreationally and commercially important species.

The distribution and seasonality of juvenile gag, Mycteroperca microlepis, in Charlotte Harbor, Florida

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Estuaries play a key role in the juvenile stage of gag (Mycteroperca microlepis). This economically important species has been documented to use temperate and subtropical estuaries from North Carolina to the northeastern Gulf of Mexico. Juveniles (<300 mm SL) have been collected from seagrass beds within Charlotte Harbor during ichthyofaunal surveys, but their distribution, seasonality, habitat use, and relative abundance have not been examined. Gag were collected by the Fisheries – Independent Monitoring program, staff of the Florida Fish & Wildlife Conservation Commission's –Florida Marine Research Institute, from January 1996 to December 2002. Sampling using a 21.3-m seine, a 183-m haul seine, and a 183-m purse seine was conducted monthly and a total of 738 individuals ranging in size from 30 to 489 mm SL were captured. Most (96%) gag collected were 30 to 288 mm SL (less than one year old). The first recruits (<100 mm SL) were collected during April and May in polyhaline seagrass beds in Gasparilla Sound and Pine Island Sound. Juveniles (<250 mm SL) remained in high–salinity areas of the estuary until fall, when they egress to nearshore habitats in the Gulf of Mexico, probably cueing on the passage of cold fronts in November. Because the estuary is subtropical, gag may be able to reside longer in Charlotte Harbor than they typically do in temperate estuaries

– where most have moved to offshore habitats by October. Larger gag (>250 mm SL) were also caught at similar locations primarily from May to December. Interannual variability was high; with 58% of the total gag catch being captured during two years. Most individuals were caught over seagrass beds, although other habitats where they were caught included fringing mangroves and oyster bars. Additional analyses of habitat data will allow us to examine alternative habitats within the estuary.

Effects of Rapid Decompression on Striped Burrfish, *Chilomycterus schoepfi*

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Catastrophic Decompression Syndrome (CDS) in fish is caused by a rapid decrease in pressure resulting in the swimbladder expansion, with concomitant loss of internal anatomical integrity. Striped burrfish, (family Tetraodontidae), have evolved the ability and unique supporting anatomy necessary to naturally increase their body volume by up to three times. The ability to inflate is a primary means of defense in these fishes, but this ability may also have other advantages as well. For example, burrfish are known to inhabit depths from 0 to 30 m and a flexible body compartment may prove useful when coping with extreme changes in pressure and potential CDS effects. Burrfish in our experiments were exposed to pressure treatments of 1, 4, and 7 atm, which mimic depths in the fish's natural environment. Necropsies of treated burrfish did not reveal haematoma, volvulus, eversion or prolapse of the major organs or organ systems, all classic injuries associated with CDS in typical teleosts. Resistance to CDS injuries in burrfish may result from the unique anatomical features associated with their inflation including an extensive peritoneal cavity, absence of pleural ribs and pectoral girdle, and a complexly folded and thick-walled extensible stomach. Negative effects of pressure change resulting in CDS are devastating to other fish species, whereas the novel adaptations of striped burrfish may allow them to move between depths with impunity.

Community structure and habitat use by fish assemblages in altered wetlands: An ecological comparison of mosquito ditches and natural tidal creeks tributary to Tampa Bay

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Salt marsh and mangrove wetlands serve as critical habitat for numerous fish species of ecological and economic importance. Habitat modification through mosquito control ditching has undoubtedly altered the hydrological and geomorphological characteristics of these systems. Linearly-ditched channels with their steep, spoil-lined banks create submerged habitats atypical of natural wetlands and may render portions of the marsh surface inaccessible to fishes. We will assess potential habitat differences between natural and altered wetlands in Tampa Bay and the effects of these differences on fish communities.

In order to determine the magnitude of functional equivalency between natural wetland habitats and those altered by ditches, fixed sites will be sampled during the next 3 years within the Tampa Bay estuary. Sample sites in creeks, ditches and ponds will be characterized by documenting habitat characteristics: channel morphology, hydrology, substrate type and shoreline/bottom vegetation. Faunal community structure will be described by identifying and enumerating fish and invertebrate species collected in replicate seine samples. Differences in species abundance, composition, and diversity, as well as size structure and overall biomass will be used to define community structure within habitat types. Finally, habitat characteristics influencing fish community structure will be delineated using multivariate statistics. In addition to enhancing our knowledge of habitat function for fish communities, study results will be applied to guide restoration within county preserves and to assist with a model of ecosystem processes in the estuary.

During the initial months of the study, 55 species of fishes, shrimps and crabs, consisting of 18,306 individuals, were collected using bag seines at 81 sites in Mobbly Bayou in northern Tampa Bay and Terra Ceia in the lower southeastern Bay. The most abundant species were bay anchovy, *Anchoa mitchilli* (n=3,033) mosquitofish, *Gambusia holbrooki* (n=2,894); and mojarra, *Eucinostomus* spp. (n=2,670). Economically-valuable species comprised 16% overall and included, among others, juveniles of red drum, *S. ocellatus* (n=886); blue crab, *C. sapidus* (n=753); mullet, *Mugil* spp. (n=719); pink shrimp, *F. duorarum* (n=114); snook, *C. undecimalis* (n=40); sheepshead, *A. probatocephalus* (n=20); grey snapper, *L. griseus* (n=11); and spotted seatrout, *C. nebulosus* (n=10).