

Newsletter of the SFRC-Fisheries and Aquatic Sciences Program

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STATE OF ... THE FISHERIES AND AQUATIC SCIENCES PROGRAM

By Mike Allen, PhD, Associate Director, Fisheries and Aquatic Sciences Program, msal@ufl.edu



Mike Allen

The Fisheries and Aquatic Sciences (FAS) program has had a number of exciting things happening over the past six months.

Our Marine Sciences major is off and running, with about 30 undergraduates currently enrolled. We expect the major to grow rapidly in the coming years. Thanks go to Shirley Baker and Bill Lindberg for their work in developing this inter-college major that will benefit students interested in marine sciences at UF.



Angelfish

Craig Watson at the [Tropical Aquaculture Laboratory](#) and Leslie Sturmer with [Shellfish Extension](#) are leading a legislative budget request (LBR) aimed to improve the overall aquaculture programs in IFAS. This LBR would add faculty and staff in critical areas needed to improve aquaculture research, teaching, and outreach programs in Florida. We are hopeful that this LBR will have support in the legislature this year.

Our online Master of Fisheries and Aquatic Sciences is up and running, along with the ability for anyone to have access to our online courses. Interested students, agency cooperators, or members of the public can now take nearly all of our courses online via the "off-book" program, no matter where they are located. They can pursue the MFAS degree plan, or they can just take a course or two of interest for continuing education.

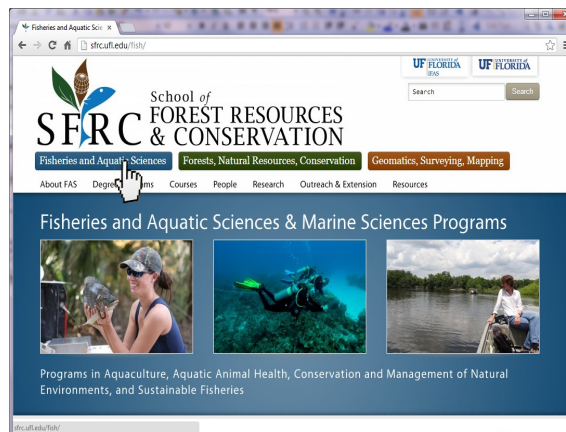
I've gotten great feedback about the online courses from fisheries biologists wanting to improve skills in quantitative methods and basic fish biology.

The new system for our online Master's keeps costs down such that students pay in-state rates, even if they are located out-of-state. Deb Murie and Rhiannon Pollard deserve thanks for getting these systems up and running.

Finally, be sure to check out the new web site (www.sfrc.ufl.edu), which does a great job of highlighting our FAS program and all the programs in the SFRC. Thanks goes to Rhiannon Pollard for her work on developing the redesigned site.

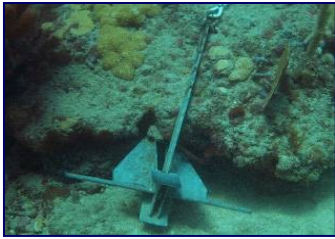
WaterWorks is a semi-annual publication of the [Fisheries and Aquatic Sciences Program](#) in the School of Forest Resources and Conservation at the University of Florida/IFAS. The purpose of the newsletter is to provide information to prospective students, alumni, stakeholders, and partners.

This issue was edited by Nancy Montes, Bob Swett, and Roy Yanong. To contribute an article or information for a future issue, contact Mike Allen (msal@ufl.edu).



MANAGING THE USE OF FLORIDA'S CORAL REEFS: ARE MOORING BUOYS WORTH THEIR SALT?

By Don Behringer, PhD, Assistant Professor in Marine Ecology and Diseases, Fisheries and Aquatic Sciences, behringer@ufl.edu



Boat anchor lodged on a coral reef in southeast Florida

Anchoring can be a major source of damage to coral reefs adjacent to heavily populated areas, resulting in dislodged or broken hard corals, sea whips, and sponges. The effects of many sources of reef degradation such as ocean warming, eutrophication, ocean acidification, and over-fishing are

controversial and even when addressed will take years, decades, or longer to reverse. However, anchor damage to coral reefs is immediate but manageable. With an appropriate management program, education, and awareness, anchor damage can be greatly reduced or eliminated.

UF Fisheries and Aquatic Sciences (FAS) researchers Dr. Don Behringer, Dr. Bob Swett, and Dr. Tom Frazer recently completed a study of the coral reefs in southeast Florida with the goal of understanding how these coral reefs are used, the spatial patterns of use, and the resulting impacts of use. Southeast Florida has a large human population, and not surprisingly, the coral reefs adjacent to this area receive considerable anchoring pressure - particularly in Miami-Dade County. The FAS research team used a series of GIS-guided aerial surveys to determine where vessels are anchoring, which types of vessels are anchoring, and how the reefs are being used.

They found that Miami-Dade County reefs received nearly twice the proportion of anchoring than either Broward or Palm Beach County (Fig. 1), and greater than 90% of that anchoring was by small diving or fishing boats. It is also of particular interest to note the high proportion of moored vessels in Broward County. The coral reefs in Broward

County are similar in structure and environmental conditions to Miami-Dade County reefs, so it is reasonable to assume they should receive similar anchoring pressure. However, until recently, Broward was the only county in southeast Florida to have an extensive mooring buoy program (www.broward.org) aimed at managing human use. Although there could be other factors involved, assuming boaters would anchor if a mooring buoy were not available, the difference in anchoring between Miami-Dade and Broward could largely be explained by the use of mooring buoys in Broward. The difference between Miami-Dade and Palm Beach is more likely a function of deeper reefs with strong and unpredictable currents in Palm Beach that make anchoring impractical. Martin County has a high proportion of vessels anchored, but the overall number of vessels using those reefs is much smaller.

The intensity of anchoring in Miami-Dade County is not only disturbing to observe, but appears to correspond with greater reef damage. In this part of the study, the FAS team set up survey sites on coral reefs throughout southeast Florida to track the magnitude and frequency of damage to the reefs over three years. They found that Miami-Dade had greater than twice the percentage of hard coral damage (e.g., dislodged, broken branches, or buried organisms) and approximately a third more sea whip damage than either Broward or Palm Beach County.

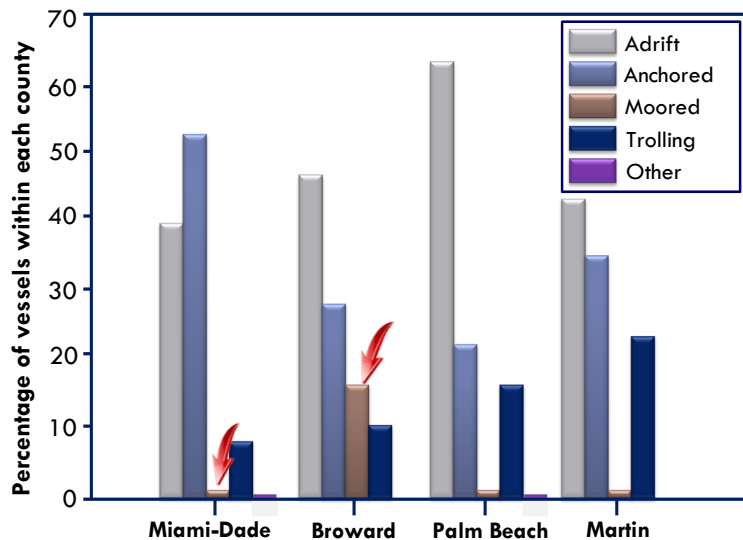
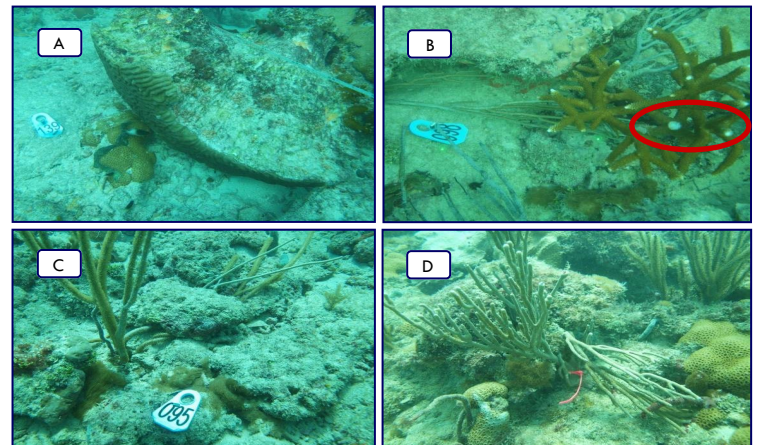


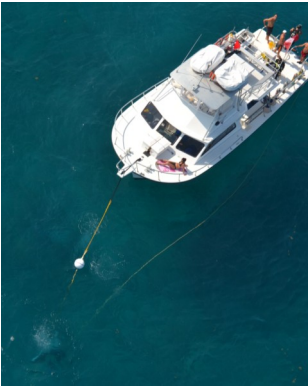
Fig 1. Status of vessels observed during a vessel use study in southeast Florida (2008-2009) as a percentage of the vessels in each county.



Examples of damaged organisms including: (A) a dislodged and inverted coral head, (B) broken endangered staghorn coral branches, (C) rubble flipped onto a sea whip and, (D) a broken sea whip.

Coincidentally, in late 2009, Miami-Dade began installation of mooring buoys in earnest. Drs. Behringer and Swett are currently working on a project funded by the Florida Fish and Wildlife Conservation Commission State Wildlife Grant's program (FWC-SWG) which is aimed at determining if the mooring buoys installed in Miami-Dade change boater use patterns, reduce anchoring pressure, and ultimately protect coral reefs from anchor damage.

(Continued on page 3)



Are Mooring Buoys Worth their Salt? from page 2

This information will be critical as we try to manage the use of our imperiled coral reefs, including the federally endangered staghorn coral (*Acropora cervicornis*) found throughout the region. The Florida Department of Environmental Protection partially funded, in conjunction with FWC-SWG and Mote Marine Laboratory, the initial aerial survey and reef impact studies and they are currently using this information as they develop a management plan for coral reefs in this region. The Miami-Dade County Department of Environmental Resource Management installed the buoys being studied in the current project so are very interested in knowing if their efforts are helping to protect the resource. Finally, divers, fishermen, boaters, and tourists from around the country will benefit through conservation of the only barrier reef in the continental U.S.

NON-LETHAL HEALTH ASSESSMENT OF RED DRUM (*SCIAENOPS OCELLATUS*) IN NASA'S KENNEDY SPACE CENTER RESERVE

By Carla Garreau, MS, Fisheries and Aquatic Sciences (Ruth Francis-Floyd, Advisor)

Despite the significant Florida red drum fishery, sex and stress hormone data are unavailable. Current non-lethal health assessment programs do not collect this information. My thesis was the first study to assess sex and stress hormones for adult red drum in Florida, with the goal of developing protocols defining "health" and providing baseline data. The study will fill a gap of knowledge for the species. These data will help enable researchers and agencies interested in the well-being of fish for management a better understanding of the fish's overall health using non-lethal practices.



Fig 1. NASA's Kennedy Space Center Reserve (in yellow).

The sampled population was collected within NASA's Kennedy Space Center Reserve, a *de facto* marine fisheries reserve. My project incorporated the Florida Fish and Wildlife Conservation Commission Stock Enhancement Research Facility's (SERF's) external health index augmented with blood chemistry analysis of glucose, cortisol, 11-ketotestosterone (11-KT) and 17 β -estradiol (E2). Red drum (n=126) were collected from NASA's Kennedy Space Center

waters (Fig. 1), the oldest fully protected no-take fisheries reserve in the United States, during three different reproductive periods to evaluate the seasonal variation and effect of reproductive activity on the stress response. The fish were hooked and brought to the boat in an average time of two minutes. A blood sample was taken from the branchial vessels (Fig. 2) in non-anesthetized fish in less than 5 minutes from initial hook-up and the entire assessment was done in less than 10 minutes; fish were then released back to the lagoon.



Carla (on right) and Dr. Ruth Francis-Floyd, her advisor (on left) holding an adult red drum

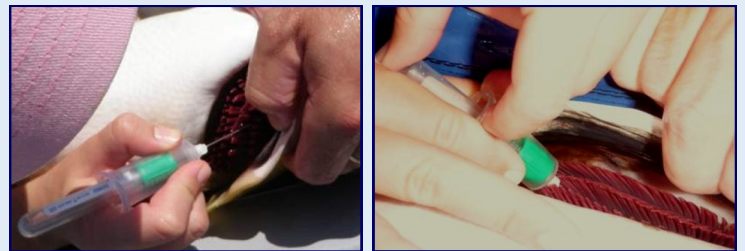


Fig 2. Collecting a blood sample from the branchial vessels in the gill arch of red drum.

All reproductive periods scored near or above the "healthy" level for the SERF health index. The lower SERF index scores were attributed to wild fish having more parasites than cultured fish at SERF. Condition factor indices ranked on average all fish as excellent-exceptional. Glucose, cortisol, and E2 levels were significantly different among reproductive periods. Cortisol values ranged between 0.93 – 1.25ng/ml, well below the typical 10 ng/ml found in many other teleosts. 11-KT was significantly elevated during the spawning period for both sexes. Quick blood collection time may have minimized the glucose and cortisol response associated with handling.

Results from this study illustrate the utility and potential uses of this data for future comparisons of red drum near the study area and in the state of Florida. An important concept to move forward is implementation of more non-lethal methods for red drum health assessments, which would be a win-win for fisheries management and recreational anglers. All of the above research was conducted under the stipulations of NASA IACUC protocol #GRD-11-077, Merritt Island National Wildlife Refuge special use permit # 014, and the state of FL permit SAL-09-0512-SR.

If you have any questions or comments please feel free to contact me at: Carla.M.Garreau@NASA.Gov.



Bryan holding a large-mouth bass

INTERACTIONS BETWEEN FISH AND ANGLERS: A SPATIAL ANALYSIS OF FISH VULNERABILITY TO ANGLING

By Bryan Matthias, MS, PhD Student (FAS), Janice Kerns, PhD Student (FAS), Mike Allen, PhD, Professor (FAS), Rob Ahrens, PhD, Associate Professor (FAS), and Doug Beard, Chief, USGS National Climate Change and Wildlife Science Center.

For recreational fisheries where fishing effort is not typically controlled with regulations, assessing fish stocks is vital to management to prevent stocks from being overharvested. Aside from size selectivity, most fisheries assessment models assume that fish populations are comprised of fish that are equally vulnerable to angling. However, it is unknown how anglers target fish in relation to fish habitat preference. We assessed whether habitat selection by fish or anglers could cause a portion of a fish population to be invulnerable to angling. We then used data from angler tag returns to empirically test if there was a portion of a population that was invulnerable to angling. This study was conducted on a 2,450 hectare lake in North Central Florida. This lake has a thin band of emergent vegetation around the perimeter and very little vegetation in the open water areas.



Bryan tracking tagged largemouth bass using radio telemetry.

The locations of anglers were sampled to evaluate the spatial distribution of fishing effort from November 2010 through October 2011. The spatial distribution of largemouth bass *Micropterus salmoides* was also measured using radio telemetry. Eighty-one largemouth bass were captured using electrofishing and angling in the fall of 2010. The fish were also tagged

with an external reward tag (\$200) to obtain angler catch data on the tagged fish. Fish were tracked on the same days that anglers were surveyed.

Largemouth bass and bass anglers did not completely overlap spatially. Three-hundred thirteen anglers were categorized as targeting largemouth bass out of 832 anglers surveyed. Ninety-one percent of the largemouth bass anglers were targeting the onshore littoral zones of the lake. Fish were divided into three habitat preference groups based on how often they were located onshore; with 39 onshore fish that selected littoral habitats, 19 offshore fish that selected open water habitats, and 23 generalist fish that extensively used both types of habitats. Assuming the distribution of tagged fish was representative of the largemouth bass population as a whole, about a third of the fish appeared to be invulnerable to angling based on their location at any one time. Results from the tag returns indicated that 58% of all radio tagged fish were caught at least once by anglers. Forty-seven percent of the offshore fish were caught, 65% of the generalist fish were caught, and 59% of the onshore fish were caught. Results from the Chi-square test indicated there was not a significant difference between the portions of fish caught based on the habitat preference of the fish (Chi-square = 1.39, $P = 0.45$), indicating all fish had similar vulnerabilities to angling regardless of the fish's habitat preference.

(Continued on page 9)

15 YEARS OF 4-H CONGRESS...

By Charles Cichra, PhD, Professor, Fisheries and Aquatic Sciences Program, cecichra@ufl.edu

On August 2, 2012, for the 15th consecutive year, Fisheries & Aquatic Sciences hosted an environmental workshop for the 4-H Congress held annually at the University of Florida. Titled "Exploring Florida's Aquatic Resources," the 6-hour workshop gave participants a hands-on overview of Florida's water resources, fish, aquatic insects and plants. Faculty, staff and graduate students have annually hosted up to 30 youth, transported from campus to the ponds at the FAS Millhopper site, guiding them through various activities. Activities included fish sampling techniques (electro-fishing and seining), and fish handling techniques (weighing, measuring, tagging, and aging fish) conducted by Dr. Chuck Cichra and graduate students Erika Thompson and Kimberly Orren; an introduction to the biology and reproduction of the sturgeon from Eliza Livengood (graduate student of Dr. Frank Chapman); spiny lobster and



peppermint shrimp

research from Mike Dickson, (graduate student of Dr. Don Behringer); aquatic invertebrate collection, identification, and ecology with Sharon Fitz-Coy, senior biologist; and an overview of aquatic plants/weeds. Dr. Denise Petty, UF veterinarian who specializes in fish diseases used power point presentations, video, microscopes, and dissections of sick fish to fascinate participants with the world of fish parasites and disease organisms. The day's activities ended with the opportunity to go fishing for bass, bluegill, and catfish in the ponds, before being transported back to campus.

Marine Sciences Major Starts Off Swimmingly

The new Marine Sciences Interdisciplinary Studies major began Summer B, 2012. Since then, over 30 incoming freshmen, transfer students, and current UF students have declared Marine Sciences as their major. As more students become aware of the major, we expect it to gain even more momentum.

The nine Marine Sciences core courses, and the wide selection of electives, draw on the expertise of faculty in the School of Forest Resources and Conservation to provide students a strong foundation in all marine organisms (fish, invertebrates, algae), quantitative skills in statistics and sampling, and economics and policy. The major is sufficiently flexible to allow students, in consultation with an advisor, to tailor electives to

their specific interests and needs. For example, several Marine Sciences students are also completing the pre-professional requirements for admission to The College of Veterinary Medicine.

One of the Marine Sciences major core courses, GLY3083 Introduction to Marine Science, is currently under development and will be offered for the first time Spring 2013. This course will be truly interdisciplinary and integrative, with modules conducted by faculty from across colleges. Dr. Bill Lindberg, SFRC Fisheries and Aquatic Sciences Program, will teach the culminating module on marine conservation and management.

Students and faculty alike are excited that the University of Florida now has a Marine Sciences major !

For further information contact Shirley Baker, sbaker25@ufl.edu, and to keep up with new developments in the major and in marine sciences in general, please "like" us on Facebook www.facebook.com/UfMarineSciencesMajor.



Notes & News

Students United in the Research of Fisheries (SURF) ...

partnered with 21st Century Community Learning Centers, a federally funded program to increase STEM-education in Alachua County schools, and invited four schools and 120+ students to learn about freshwater ecology, fish and macroinvertebrate diversity, and held fishing activities to teach fisheries science. SURF also partnered with the Florida Museum of Natural History and the Forestry and Wildlife graduate students to hold a myriad of fish and aquatic science demonstrations at the museum to showcase their work/interests to 1800+ museum guests.

Thanks to a generous contribution from the Leiden Foundation, the Mystic Aquarium, a division of Sea Research Foundation, based in Mystic, CT, is in a position to bring on board two tenure track Research Scientists. FAS graduate **Dr. Paul Anderson** is fortunate to be one of those people. The Research and Veterinary Services Department of Mystic Aquarium pursues research in the fields of neuroimmunology, animal nutrition, veterinary science and infectious disease; with a historical emphasis on marine mammals. Paul looks forward to rounding out this profile by bringing his specialties in fish and elasmobranch behavior, physiology, and bioacoustics to the table, and advancing the State of the Art of animal husbandry and aquaculture. To learn more about Research at The Mystic Aquarium, go to: <http://www.mysticaquarium.org/research>

Kyle Wilson, SURF President ...

was an honorable mention for the 2012 National Science Foundation Graduate Research Fellowship, a recipient of the UF SFRC 2012 Wayne Smith Student Leadership Award, and the recipient of the 2012 William L. Maier Jr. Scholarship from the Florida Aquatic Plant Management Society.

Congratulations to the FAS 2011-2012 Award Winners:



PhD Student of the Year:

Matthew DiMaggio
(Advisor: Cortney Ohs)



MS Student of the Year:

Larry Lawson
(Advisor: Jeff Hill)



SURF Faculty of the Year:

Dr. Charles Cichra

Upcoming Events

The Fifth Annual UF Marine Biology Symposium

The symposium will be held at the Whitney Lab in Marineland, Florida on **January 17th and 18th, 2013**. We are excited that



Dr. Steve Gaines from UC Santa Barbara will be the keynote speaker (gaineslab.msi.ucsb.edu). Dr. Gaines (on left) will address the "Status of the World's Unassessed Fisheries: Solutions for the Looming Food Security Challenges."

COSEE Florida again will sponsor a poster session on the first evening, while the second evening will be marked by a barbecue dinner. The symposium continues a tradition of giving researchers, educators, students, staff and their collaborators a great opportunity to share their research in a casual atmosphere.

The Florida Sea Grant College Program, UF/IFAS SFRC, COSEE Florida, and Seahorse Key Marine Lab are sponsoring the fifth annual symposium. If you participated last year, then you know what a smashing success it was. Please join us by registering at: <http://conferences.dce.ufl.edu/SSP/section.aspx?s=1400037140>.

We hope to see you in January!

The 16th Annual Fisheries and Aquatics Sciences Graduate Student Symposium

The 16th annual Fisheries and Aquatics Sciences Graduate Student Symposium will be held on **April 5th, 2013** at the Straughn IFAS Extension Professional Development Center in Gainesville.

This event provides the opportunity for graduate students to share their research interests and projects with their peers, faculty and staff in the Fisheries and Aquatic Sciences Program.



Fall Graduates

The UF IFAS School of Forest Resources and Conservation is pleased to present its December 2012 degree candidates with a major in Fisheries and Aquatic Sciences:

Doctor of Philosophy

Dana L. Bigham, Analyses of Temporal Changes in Trophic State Variables in Florida Lakes. Chair: Daniel Canfield; Co-Chair: Carlos Duarte.



Master of Science



Chelsey Crandall nee Campbell, Regional Stock Structure of Greater Amberjack in the Southeastern United States Using Otolith Shape Analysis. Chair: Daryl Parkyn.

Morgan Audrey Edwards, Age, Growth and Diets of Lionfish (*Pterios* spp.) from Little Cayman Island, B.W.I. Chair: Tom Frazer.



Patrick G. Gardner, Reproductive Biology of Invasive Lionfish (*Pterois volitans/miles* Complex) from Little Cayman Island. Chair: Tom Frazer.

Carla M. Garreau, Development of Methods for Non-lethal Health Assessment of the Red Drum (*Sciaenops ocellatus*) inside NASA's Kennedy Space Center No-take Fisheries Reserve. Chair: Ruth Francis-Floyd; Co-Chair: Louis Guillette



Stacey Sandrey, Spatial and Temporal Differences in Nutrient Concentrations at the Devil's Eye Spring and Devil's Cave System, Florida. Chair: Daniel Canfield

Preeyanan Sriwanayos, Selected Pathogens of Ornamental Fishes. Chair: Ruth Francis-Floyd; Co-Chair: Denise Petty.



Natalie K. Steckler, Effects of Pond Aeration Methods and Post-Harvest Holding Treatments on Zebra Danio Growth and Survival. Chair: Roy Yanong

Fisheries and Aquatic Sciences Publications in 2012

- Ahrens, R.N.M.**, Walters, C. J., and Christensen, V. 2012 . Foraging arena theory. *Fish and Fisheries*. 13(1): 41-59.
- Allen, M. S., R. M. Ahrens**, M. J. Hansen, and R. Arlinghaus. 2012. Utility of minimum-length limits to prevent recruitment overfishing while considering dynamic angling effort patterns. *Fisheries Management and Ecology* (In Press).
- Austin JD**, Johnson A[‡], Matthews M, Tringali M, Porak WF, **Allen MS**. 2012. An assessment of hatchery effects on Florida bass (*Micropterus salmoides floridanus*) microsatellite genetic diversity and sibship reconstruction. *Aquaculture Research*. 43: 628-638. DOI:10.1111/j.1365-2109.2011.02873.x.
- Bachmann RW, Bigham DL, Hoyer MV, Canfield DE Jr**. 2012. Factors determining the distributions of total phosphorus, total nitrogen, and chlorophyll a in Florida lakes. *Lake and Reservoir Management* 28:10–26. **Best Paper of the Year Award for the international journal of the North American Lake Management Society.**
- Bachmann RW, Bigham DL, Hoyer MV, Canfield DE Jr**. 2012. Phosphorus, nitrogen, and the designated uses of Florida lakes. *Lake and Reservoir Management* 28:46–58. **Best Paper of the Year Award for the international journal of the North American Lake Management Society.**
- Bachmann RW, Bigham DL, Hoyer MV, Canfield DE Jr**. 2012. A strategy for establishing numeric nutrient criteria for Florida lakes. *Lake and Reservoir Management* 28:84–91. **Best Paper of the Year Award for the international journal of the North American Lake Management Society.**
- Baeza, J.A., Anderson, J.R., Spadaro, A.J., and **D.C. Behringer**. 2012. Sexual dimorphism, allometry, and size at first maturity of the Caribbean King Crab, *Mithrax spinosissimus*, in the Florida Keys. *Journal of Shellfish Research* 31.
- Barbour, A.B., Adams, A.J., Yess, T., **Behringer, D.C.**, and R.K. Wolfe. 2012. Comparison and cost-benefit analysis of PIT tag antennae resighting and seine-net recapture techniques for survival analysis of an estuarine-dependent fish. *Fisheries Research* 121-122: 153-160.
- Behringer, D.C.** 2012. Diseases of wild and cultured juvenile crustaceans: insights from below the minimum landing size. *Journal of Invertebrate Pathology* 110: 225-233.
- Behringer, D.C.**, Butler, M.J. IV, Shields, J.D., and J. Moss. 2012. PaV1 infection in the Florida Spiny Lobster Fishery and its Effects on Trap Function and Disease Transmission. *Canadian Journal of Fisheries and Aquatic Sciences* 69: 136-144.
- Behringer, D.C.**, Butler IV, M.J., and J.D. Shields. 2012. Juvenile Caribbean spiny lobsters are plagued by the lethal viral pathogen PaV1. Pages 387-388 in Kruczynski, W.L. and P.J. Fletcher (eds), *Tropical Connections: South Florida's Marine Environment*. IAN Press, University of Maryland Center for Environmental Science, Cambridge, Maryland.
- Behringer DC**, Butler MJ IV, Stentiford GD. 2012. Disease effects on lobster fisheries, ecology, and culture: overview of DAO Special 6. *Diseases of Aquatic Organisms* 100: 89-93.
- Camp, E.V., D.C. Gwinn, W.E. Pine and **T.K. Frazer**. 2012. Changes in submersed aquatic vegetation affect predation risks of common prey fish *Lucania parva* (Cyprinodontiformes: Fundulidae) in a spring-fed coastal river. *Fisheries Management and Ecology*. 19:245-251.
- Coffin, A.W., **Swett, R.A.**, and Cole, Z.D., 2012, A spatial analysis of cultural ecosystem service valuation by regional stakeholders in Florida—A coastal application of the social values for ecosystem service (SolVES) tool: U.S. Geological Survey Fact Sheet 2012–3125, 4 p.
- Crosby, T.C., **J. E. Hill**, K. H. Hartman and **R. P. E. Yanong**. 2012. Effects of Metomidate Hydrochloride Sedation on Blood Glucose and Marketability of Transported Threespot Gourami *Trichogaster trichopterus*. *Journal of Aquatic Animal Health* 24(2):73-80.
- Edwards C. T. T., Hillary R. M., Levontin P., Blanchard J. & **Lorenzen K.** (2012) Fisheries assessment and management: a synthesis of common approaches with special reference to deepwater and data-poor stocks. *Reviews in Fisheries Science* 20: 126-153.
- Foss, A. J., **E. J. Philips**, M. T. Aubel and N.J. Szabo. 2012. Investigation of extraction and analysis techniques for *Lyngbya wollei* derived paralytic shellfish toxins. *Toxicon* 60:1148-1158.
- Foss, A. J., **E. J. Philips**, M. Yilmaz and A. Chapman. 2012. Characterization of paralytic shellfish toxins from *Lyngbya wollei* dominated mats collected from two Florida springs. *Harmful Algae* 16:98-107.
- Frazer, T.K.**, C.A. Jacoby, M.A. Edwards, S.C. Barry and **C.M. Manfrino**. 2012. Coping with the lionfish invasion: can targeted removals yield beneficial effects? *Reviews in Fisheries Science* 20(4): 185-191.
- Frost, J., C.A. Jacoby, **T.K. Frazer** and A. Zimmerman. 2012. Bacterial decomposition of *Chrysaora quinquecirrha* (Desor 1848) supplies carbon, nitrogen and phosphorous. *Hydrobiologia* 690:247-256.
- Haley, N. V., R. A. Wright, D. R. DeVries, and **M. S. Allen**. 2012. Privately owned small impoundments in central Alabama: a survey and evaluation of management techniques for largemouth bass and bluegill. *North American Journal of Fisheries Management* 32:1180–1190.
- Hardin S, **Hill JE**. 2012. Risk analysis of barramundi perch *Lates calcarifer* aquaculture in Florida. *North American Journal of Fisheries Management* 32:577-585.
- Hargrove, J.S., **D.C. Parkyn, D.J. Murie**, and **J.D. Austin**. 2012. Augmentation of French grunt diet description using combined visual and DNA-based analyses. *Marine and Freshwater Research* 63(8): 740-750 DOI: 10.1071/MF12099.
- Havens, K.** 2012. Effects of climate change on the eutrophication of lakes and estuaries. *EDIS SGEF-189*, 3 pp.

Fisheries and Aquatic Sciences Publications in 2012

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- Havens, K.** and **Frazer, T.** 2012. Rethinking the role of nitrogen and phosphorus in the eutrophication of aquatic ecosystems. EDIS SGEF-190, 3 pp.
- Havens, K.**, Lytton, G. and Seaman, W. 2012. A Practical Guide to Estuary Friendly Living. Florida Sea Grant SGE6-64, 21 pp.
- Hoyer, M. V.**, **D. E. Canfield, Jr.**, M. D. Netherland and D. A. Leeper. 2012. Lack of augmentation effects on aquatic macrophyte abundance and distribution in West-Central Florida lakes, USA. *Hydrobiologia*: 686:29-40.
- Hoyer MV**, N Wellendorf, R Frydenborg, D Bartlett, and **DE Canfield, Jr.** 2012. A comparison between professionally (Florida Department of Environmental Protection) and volunteer (Florida LAKEWATCH) collected trophic state chemistry data in Florida. *Lake Reservoir Management*. 28: 277-281.
- Hazlerigg, C.R.E., **Lorenzen, K.**, Thorbek, P., Wheeler, J.R. & Tyler, C.R. (2012) Density-dependent processes in the life history of fishes: evidence from laboratory populations of zebrafish *Danio rerio*. *PLOS One* 7(5): e37550.
- Jett, J., T. Brijesh, **R. Swett**. 2012. Boater speed compliance in manatee zones: examining a proposed predictive model. *Society & Natural Resources*, doi:10.1080/08941920.2012.711434.
- Ley, J., and **M. S. Allen**. 2012. Modeling marine protected area value in a catch-and-release dominated estuarine fishery. *Fisheries Research* (In press).
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Interactions Between Fish and Anglers from page 4

Differences in the distributions of largemouth bass anglers and largemouth bass lend support to Martin (1958) and Cox and Walters (2002) hypothesis that fish populations are often comprised of fish that are either vulnerable to angling or invulnerable to angling. However, data from the tag returns indicated that even though a subset of fish spent most of the time in areas invulnerable to angling, ultimately they were captured at similar rates to onshore fish.

Therefore, the movement of largemouth bass between areas that were targeted and those that were not targeted by largemouth bass anglers could have been sufficiently high such that all fish did not remain invulnerable to angling or there were other factors such as learning and hook avoidance or angler behavior that influenced their vulnerability.

With recreational anglers being a major component in many of today's fisheries, it is important to understand the dynamics of angler behavior. The spatial distribution of effort can significantly impact both the fish population and the

vulnerability of individual fish. Not only is it possible for recreational anglers to overfish populations, but with selective, non-random targeting of individuals within a population it might also be possible to alter the genetic structure of the population by targeting individuals with certain life history traits. Additionally, the non-random distribution of fishing effort can essentially create protected areas for fish in systems where the distribution of anglers is not the same as the distribution of the targeted species. This can happen when the majority of a population congregates in certain areas or when fish are distributed throughout a large area and anglers are limited by the number of access points and distance (such as in many coastal fisheries). Incorporating these differences in vulnerability to angling into stock assessment models can allow for more accurate predictions of stock status. Spatial differences in vulnerability to angling may offer unique alternatives to the use of protected areas as management tools, and thus, should be considered when assessing fish stocks.