the Shellcracker

FLORIDA CHAPTER OF THE AMERICAN FISHERIES SOCIETY

http://www.sdafs.org/flafs

October, 2009

President's Message:

"Gearing Up…Meetings and Habitat Conservation!"

Late summer has now turned to Fall in Florida, and hopefully for most of us this means that we need to start making plans to attend our next annual meeting in Camp Ocala! Mark your calendars for February 16-18, 2010….you will find a registration form in this newsletter and for sure try to send it in early to help with the planning. President-Elect and Program Chair, Linda Lombardi-Carlson, has planned a great symposium focusing on "Uncertainties in Fisheries Science." This will undoubtedly be an eye-opener and a great resource for many of us in the future. Linda will be organizing the program in the months to come and will be asking for volunteers to help with various activities that go along with our meeting, e.g., judging posters and papers. We are all too busy these days, but please consider stepping up and helping out when the call comes….since I organized the program last year, I am positive that Linda will greatly appreciate the help!

Our *Local Arrangements Committee* for the 2011 Southern Division AFS Meeting has also been busy negotiating for the time and place of the meeting. Many thanks to Eric Nagid (Chair), Kevin Johnson, Dave Kerstetter, Dennis Renfro and John Galvez, who have all worked hard over the summer debating the pros and cons of various conference venues and dates. We are pleased to tell you that we are in the final negotiations with the Grand Hyatt Tampa Bay Hotel with a 13-16 January 2011 date. Some perks that will directly benefit attendees staying at the hotel are free in-room internet service and a 15% discount at all hotel restaurants. Again, this meeting will depend heavily on all of the FL Chapter members lending a hand where and when possible. Committees for the various activities will be set up once the Southern Division election for their President-Elect is finished, as he will also be the Chair of the Oversight Committee for the 2011 meeting. We will also be having discussions at the 2010 FL Chapter meeting towards its organization. Keep an eye out for an email or a note in the January newsletter asking for the many volunteers needed to serve on a variety of committees….there is bound to be one that you're interested in!

I also wanted to bring it to everyone's attention that the **National Fish Habitat Conservation Act** has been re-introduced in the 111th Congress. AFS members have been working for several decades to reach this milestone. There is a "took kit" for this Act (i.e. supporting material for this legislation, talking points, legislation four sheet summary, sample letter to members of Congress, and a section-by-section summary of the Act), which can be found at the fish habitat web site:
http://fishhabitat.org/index.php?option=com_content&view=article&id=213:national-fish-habitat-conservation-act-toolkit&catid=36:news&Itemid=50
I would encourage everyone to take a look at this information….it is far-reaching for our aquatic resources…. and, where at all possible, provide support.

The next newsletter will be going out in January 2010 and so I wish everyone well and good health as the clock winds us into yet another year…..and as always, good fishing!

Cheers, Deb Murie
FL Chapter President

Getting in Touch

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Upcoming Events

October 8 – 9: Using Hydroacoustics for Fisheries Assessment, short course. Seattle, Washington. www.htisonar.com

October 15 – 16: Using Acoustic Tags to Track Fish, short course. Seattle, Washington. www.htisonar.com

October 19 – 24: Fish Culture Techniques & Recirculating Aquaculture Systems: Principles of Design and Operation, workshops. Harbor Branch, Ft. Pierce, Florida. www.aquaculture-online.org

November 1 – 5: Estuaries and Coasts in a Changing World. Portland, Oregon. www.sgmeet.com/cerf2009/

November 2 – 5: 2009 National Forum on Contaminants in Fish. Portland, Oregon. www.epa.gov/waterscience/fish/forum/2009/

Check out our Parent Society's calendar at http://www.fisheries.org/afs/calendar.html for other events not listed here!

New Titles

Standard Methods for Sampling North American Freshwater Fishes. Scott A. Bonar, Wayne A. Hubert, and David W. Willis, editors. 335 pages. Published by the American Fisheries Society. August 2009.

Challenges for Diadromous Fishes in a Dynamic Global Environment. Alex Haro, Katherine L. Smith, Roger A. Rulifson, Christine M. Moffitt, Ronald J. Klauda, Michael J. Dadswell, Richard A. Cunjak, John E. Cooper, Kenneth L. Beal, and Trevor S. Avery, editors. 943 pages, Symposium 69. Published by the American Fisheries Society. August 2009.

Interested in contributing something to the Shellcracker? Email Kevin Johnson at *kevin.johnson@myfwc.com* with any articles or information that you would like to be included in the next issue. The deadline for the next issue is December 31st, 2009, so start fishing...

Feature Article

Researchers Work to Understand and Recover the Endangered Smalltooth Sawfish

By: Dana M. Bethea[1] & Joana Fernandez de Carvalho[2]

Research

Like most other elasmobranchs, sawfish are characterized by a long life span, slow growth rate, late maturation, and low fecundity. Once common in the Gulf of Mexico and off the southeast coast of the United States (Bigelow and Schroeder, 1953), decades of commercial and recreational fishing pressure and habitat loss during the second half of the twentieth century have caused sawfish populations to decline by up to 95% (Simpfendorfer, 2002). Additionally, sawfish are easily entangled in fishing gear, making this animal extremely vulnerable to overfishing and slow to recover from population depletion.

Today, sawfish exist mostly in southern Florida (Poulakis and Seitz, 2004; Simpfendorfer and Wiley, 2005). In 2003, the smalltooth sawfish (*Pristis pectinata*) was listed as Endangered under the Endangered Species Act, making it the first US marine fish and first elasmobranch to receive this designation. Smalltooth sawfish is just one of the six sawfish species that occur worldwide in tropical and sub-tropical rivers, lakes, and coastal areas.

In early 2007, the Smalltooth Sawfish Implementation Team (a multiagency team from NOAA, state agencies, universities and non-governmental organizations) completed the Smalltooth Sawfish Recovery Plan, bringing about a new phase of research and management for US populations. One of the high priority research areas indentified in the plan is monitoring of the number of juvenile sawfish in various regions throughout Florida to provide a baseline and time series of abundance. One of the more important regions identified for this species is the section of Florida coast from Marco Island to Florida Bay. This region encompasses the Ten Thousand Islands National Wildlife Refuge and Everglades National Park.

Working with sawfish in southwest Florida is demanding: extreme tidal exchange, oyster bars and mud flats, wind, thunderstorms, alligators, sharks, and mosquitoes. However numerous the challenges, dedicated scientists seek to understand and recover populations of this unique and poorly-understood elasmobranch. They are currently deploying a variety of sampling gear aimed at tagging and studying this species in its natural habitat.

Smalltooth sawfish are highly site specific. They return not only to the same natal estuarine system, but to the same specific mangrove habitat where they grew up. Through collaboration with university geneticists at SUNY Stony Brook, mitochondrial DNA identification of recaptured individuals reveals sawfish siblings may occupy the same mudflat. Moreover, a single adult female may give birth on that same mudflat year after year. Researchers at the University of Florida and the Florida State University are also using state of the art pop-off archival satellite tags, smart position and temperature (SPOT) tags, and passive telemetry techniques to keep track of movements and habitat use both inshore and offshore.

Domestic and cooperative international research, coupled with policy decisions, such as the 2007 prohibition on international trade of smalltooth sawfish via the Convention on the International Trade in Endangered Species (CITES), will help to bring this species back from the edge of extinction.

Sawfish Encounters

Remember, it is illegal to harm or harass a smalltooth sawfish in any way except with a permit or in a permitted fishery; however, accidental captures do occur while fishing for other species. Caution should be used with a hooked or netted sawfish as they are large, powerful animals that can cause serious injury. *Never* remove the saw! Keep the gills and spiracles of the sawfish in the water at all times. Untangle and remove as much of the line or net as possible. Remove any hooks using a long-handled de-hooker for safety. Release the animal quickly and report the encounter to the National Sawfish Encounter Database (NSED).

The NSED was established as a sawfish reporting database to assist in sawfish research and conservation efforts. Encounter reports (accidental captures and sightings) are very important tools for monitoring the sawfish population. They assist in the evaluation of species abundance and habitat range, helping scientists estimate the population size and identify habitat preferences. Since sawfish populations are low, any information about the species is invaluable, so these reports play a vital role in monitoring the health of the population. The NSED is curated by the Florida Program for Shark Research at the Florida Museum of Natural History in the University of Florida. The NSED currently contains information on over 3500 encounters dating back to 1782.

Your report can greatly help conservation efforts by providing the following information:
* Your name, phone number, and e-mail address.
* Date, time, and location of encounter.
* Number, size, and behavior of the sawfish.
* Your activity at time of encounter or sighting.
* Information on any tags, scars, or distinguishing marks.

No record is too old. Old pictures, newspapers, magazines, books or historic reports are welcome.

Sawfish encounter information can be reported in four different ways:
* Online at: www.flmnh.ufl.edu/fish/sharks/sawfish/form.html
* By phone: (352) 392-2360 or (352) 871-8230
* By e-mail: sawfish@flmnh.ufl.edu
* By mail: National Sawfish Encounter Database Florida Program for Shark Research, Florida Museum of Natural History, Dickinson Hall Museum Road, PO Box 117800, Gainesville FL 32611-7800

To learn more about smalltooth sawfish research, see:
http://sero.nmfs.noaa.gov/pr/SmalltoothSawfish.htm
http://www.pclab.noaa.gov/content/80_Sharks/20_Research_Areas/90_Sawfish/Sawfish.php
http://www.flmnh.ufl.edu/fish/Sharks/sawfish/

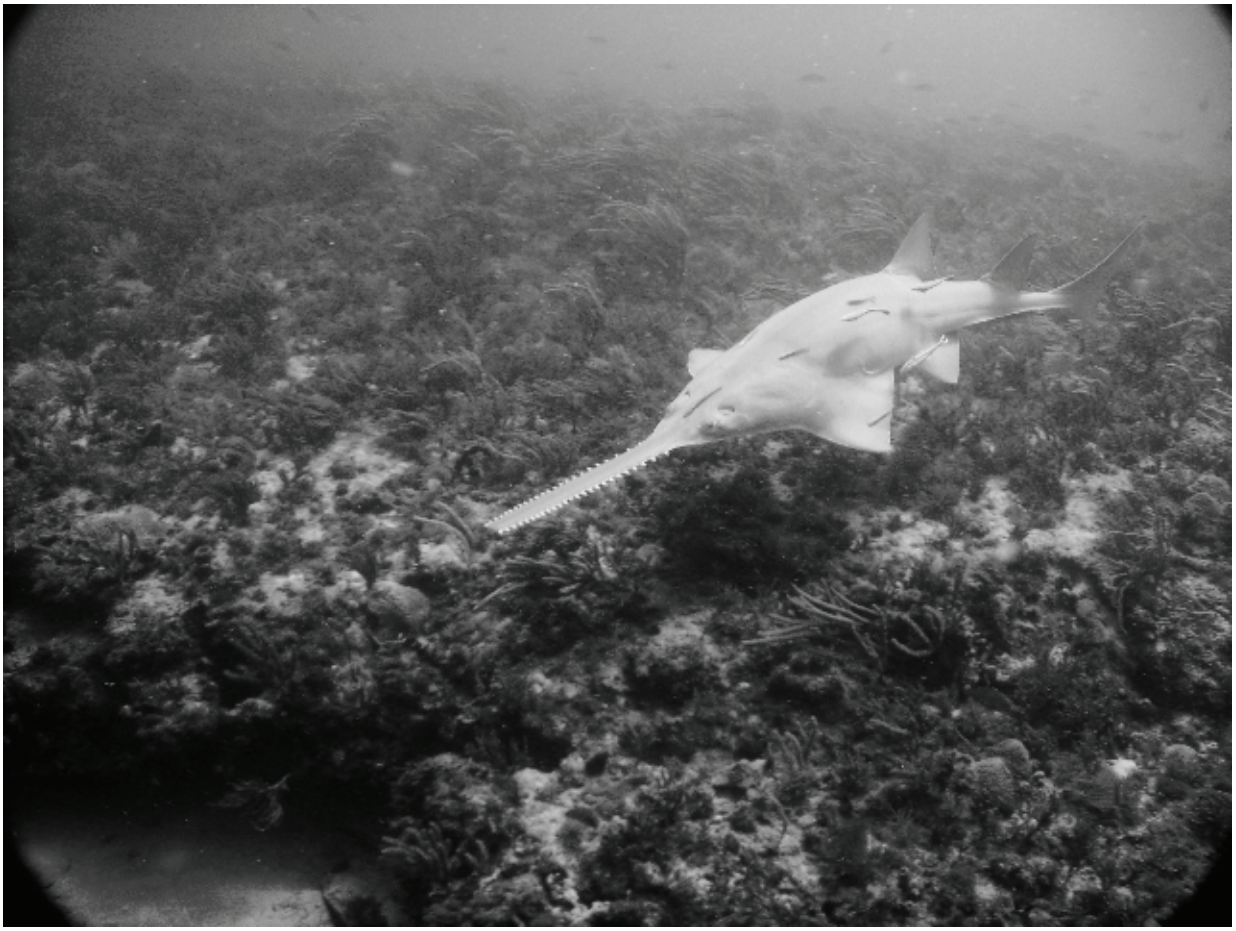
For more information, contact the Team Lead for the Smalltooth Sawfish Implementation Team: Dr. John Carlson, NOAA Fisheries Southeast Fisheries Science Center Panama City Laboratory Panama City, FL. John.Carlson@noaa.gov

[1]NOAA Fisheries Service SEFSC Panama City Laboratory 3500 Delwood Beach Road Panama City, FL 32408
[2]Florida Program for Shark Research, Florida Museum of Natural History, Dickinson Hall Museum Road, PO Box 117800, Gainesville FL 32611-7800

Photo Captions:

Sawfish_1:
NOAA Fisheries Panama City Laboratory interns, Kelcee Smith and Alyssa Napier, and contract staff, Alicia La-Porte, removing a smalltooth sawfish from the sampling gear in Faka Union Bay, FL. Photo credit: Dana M. Bethea

Sawfish_2:
Smalltooth sawfish being measured and scanned for internal PIT tag. Photo credit: Dana M. Bethea



Sawfish_3:
Smalltooth sawfish observed by diver in 2009 reported to the NSED. Photo credit: Scott Cameron

Literature cited

Bigelow HB and Schroeder WC (1953) Sawfished, guitarfishes, skates and rays. In Fishes of the Western North Atlantic, pp.1-514. Sears Foundation for Marine Research. Yale University, New Haven, Connecticut.

Poulakis GR and Seitz JC (2004) Recent Occurrence of the Smalltooth Sawfish, *Pristis pectinata* (Elasmobranchiomorphi: Pristidae), in Florida Bay and the Florida Keys, with Comments on Sawfish Ecology. Florida Scientist 67:27-35.

Simpfendorfer CA (2002) Smalltooth Sawfish: The USA's First Endangered Elasmobranch? Endangered Species Update 19:53-57.

Simpfendorfer CA and Wiley TR (2005) Determination of the distribution of Florida's remnant sawfish population and identification of areas critical to their conservation. Final report to the Florida Fish & Wildlife Conservation Commission, Tallahassee, FL.

Florida Chapter of the American Fisheries Society
4H Camp Ocala, Florida
Annual Meeting Registration: February 16-18, 2010

Official Use Only:
Postmarked:_____
Entered: _____
Deposited: _____

First: _____ **Last:** _____ ☐ **Student (please check)**

Affiliation:_____
This address will be used in our mailing list and should be the one where you want to receive newsletters and other materials.

Street Address:_____

City:_____ **State:**_____ **Zip Code:**_____

Work Phone:_____ **Ext:**_____ **Email:**_____

T-Shirt Size: (Select One) Small Medium Large X-Large XX-Large XXX-Large

Arrival Time: (Select One) Tue Noon Tue PM Wed AM Wed Noon Wed PM Thur AM

Please check the appropriate boxes below.

PRE-REGISTRATION: registration form postmarked by Friday, January 8, 2010
☐$ 30.00 One-day Registration ☐$ 40.00 Full Registration

LATE-REGISTRATION: registration form postmarked after Friday, January 8, 2010
☐$ 35.00 One-day Registration ☐$ 47.00 Full Registration

Meals and Lodging

Tuesday, February 16, 2010
- ☐ $7.00 Lunch
- ☐ $14.50 Dinner
- ☐ $26.00 Lodging

Wednesday, February 17, 2010
- ☐ $6.50 Breakfast
- ☐ $7.00 Lunch
- ☐ $14.50 Dinner
- ☐ $26.00 Lodging

Thursday, February 18, 2010
- ☐ $6.50 Breakfast
- ☐ $7.00 Lunch

Dietary Needs:
- ○ Vegetarian
- ○ Low Fat
- ○ Other: _____

Full Meals and Lodging ☐ **$115.00**
Linens (please bring own, limited supply) ☐ $ 6.00

Florida Chapter dues (calendar year 2010) ☐ **$10.00** ☐ FL Chapter dues paid via AFS annual membership.

Total Amount: _____

Total Enclosed: _____ ○Cash ○Check
(Minimum $10)

Balance Due: _____ ○Cash ○Check ○Credit

Please Make Checks Payable to Florida Chapter, AFS and mail to:

Travis Tuten
FWC
7922 NW 71st Street
Gainesville, FL 32653

Phone: (352) 955-3220 ext. 113
Fax: (352) 955-3210
Email: travis.tuten@myfwc.com

*Checks not payable to 'Florida Chapter, AFS' will be returned to sender.

Registration Forms may be sent via fax (attention: Travis) or via email: (subject: 2010 AFS FL).
A minimum amount of $10 must be mailed to validate your registration.

Note: This is a cafeteria-style service and food must be ordered a week in advance.
Since meals are pre-paid, **please** submit your registration form *by Monday, February 8th, 2010.*
Registrations will still be accepted at the meeting.
We can only accept **non-FWC VISA** or **MASTERCARD** on the meeting date**.**
Credit card charges are submitted by our parent organization, AFS, after the meeting.
If you would like to pay your meeting fees with a credit card, then please send a $10 check for your deposit.

Annual Meeting and Symposium Announcement – 1st Call for Papers
30th Annual Meeting of the Florida Chapter of the American Fisheries Society

Uncertainties in Fisheries Science

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

Well Florida Fishheads, it's that time of year again—time to begin thinking about what you might present at the annual Florida AFS Meeting, or at least how you can sneak away from work for a few days to enjoy the company of friends and colleagues at the chapter meeting. The 2010 meeting is still a few months away, but it is never too early to plan to attend. The meeting format will consist of both invited and contributed oral presentations and posters. The symposium on Wednesday will be 'Uncertainties in Fisheries Science.'

There are a variety of uncertainties in fisheries science from errors associated with measuring fish, processing age structures, the interpretation of age structures, in the collection of landings data (commercial and recreational), in creel surveys, experimental designs, and in the confounded affect of these errors in population dynamic models. As either marine or freshwater fisheries biologists, we need the ability to explain the uncertainties in our data to better understand trends in datasets. This symposium will review these areas of uncertainty in fisheries science and methods to correct for these uncertainties.

Topics will include:

1. Research Limitations
2. Observation & Reporting Uncertainties
3. Theoretical Uncertainties
4. Other forms of uncertainty – noise, unexpected events, novel conditions, ecological uncertainty (modified from, Bocking, S. 2004. Science and Natural Resources Management. pp. 75 – 105. Nature's Experts: Science, Politics, and the Environment. Rutgers University Press. New Brunswick, N.J.)

All abstracts are due ***Friday, January 8, 2010***, for full consideration in the symposium or contributed sessions. Please send your abstract (<300 words) and associated information (following the format given below, pg. 9) to **linda.lombardi@noaa.gov**; in the subject line of your email, please list the author(s) as they will appear in the program (e.g., SchaubMooreMajikowski.doc). Platform presentations will be 20 minutes (15 minutes for presentation and 5 minutes for questions or discussion). We will have PowerPoint 2003 **(please save your presentation as PowerPoint 2003)** loaded on a laptop capable of accepting your presentation on a CD, DVD or flashdrive. All posters will be formally presented on Tuesday evening, February 16, and can be left up for the entire meeting. Posters should be no larger than 150 X 100 cm (60" X 40"), but they can be set up either as portrait or landscape format on an easel. If you require other options for projection or poster formats, please contact the annual meeting's Program Chair, Linda Lombardi, at linda.lombardi@noaa.gov.

The 2010 meeting will be held at the Ocala 4-H Camp, on beautiful Sellers Lake in the Ocala National Forest. This venue is located east of Ocala, south of SR 40, just off SR19. Maps and directions will be available in the next issue of the Shellcracker and are currently on the Chapter's website at http://www.sdafs.org/flafs/doc/ocala4h.html.

The meeting's schedule will be similar to recent past meeting. We will begin at noon on February 16th. Lunch will be served and then followed by the presentation of contributed papers. The 'Uncertainties in Fisheries Science' Symposium will be on Wednesday. The business meeting and raffle will follow dinner on Wednesday night. We will hear more contributed papers on Thursday morning, followed by lunch and the presentation of awards immediately following lunch.

Registration forms will also be available on the Chapter's website:
http://www.sdafs.org/flafs/meetings.html

Please note the savings available if you register on or before January 8, 2010. This helps in many ways: reduces everyone's registration time, gives us a head's up on the count for meals, saves money, gets you the correct size of the meeting t-shirt, and you don't miss any talks. Therefore, please print the **pre-registration form** and send in your deposit to the Chapter's Secretary-Treasurer, Travis Tuten (see registration form for Travis' contact information), by **January 8, 2010**. Last, you should plan to bring your own linens or sleeping bag if you are planning to sleep at the camp. Linens will only be available in limited supplies and for a small fee.

Students: Several student travel awards will be available. The application form is available on the Chapter's website at http://www.sdafs.org/flafs/awards.html. Master's and doctoral students are also eligible for the Roger Rottmann Memorial Scholarship, for which the recipient(s) will be announced at the Annual Meeting. More information and the application materials are available at http://www.sdafs.org/flafs/awards.html.

We're looking forward to our 2010 annual meeting, and hope to see you there!

Linda Lombardi
FL AFS President-Elect

Abstract Format:
Limit abstracts to ≤ 300 words and follow this format (2003 MS WORD is preferred):

Presenter: Schaub, M.; Email: MattShaub@HoustanTexans;
Author(s): Schaub, M.[1], S. Moore[2], and D. Majikowski[3]. Affiliation. Address.

Title: The Sometimes Rocky Road of a University of Virginia Quarterback

Abstract: You know how this works: <300 words (MS Word will count it for you!)

Student Presentation: no (versus yes, work reported was completed while a student).

Presentation type: oral (versus poster)

Symposium consideration: Indicate topic
Topic – 1. Research Uncertainties, 2. Observational & Reporting Uncertainties,
3. Theoretical Uncertainties and 4. Other Forms of Uncertainties

Are you willing to be a moderator? Yes or No If yes, Oral or Poster

NEW AWARDS!!!

The Awards Committee is seeking nominations for the Florida Chapter's newly established Outstanding Achievement and Rich Cailteux Awards. Send nominations (letter outlining the accomplishments of the individual that meet the criteria of each award) to Eric Nagid (eric.nagid@myfwc.com) by **January 8th, 2010**. Applications should be limited to one page, but descriptive enough to convey why the individual is deserving of the award.

Outstanding Achievement Award

The purpose of the Outstanding Achievement Award is to recognize individuals for singular accomplishments and contributions to fisheries, aquatic sciences, and the Florida Chapter. The award aims to honor individuals for distinct contributions to the fisheries profession and enhancing the visibility of the Chapter. The Outstanding Achievement Award is the highest honor Florida AFS may bestow upon an individual member or collaborating group.

Candidates will be evaluated according to the following criteria:

- Original techniques or research methodology
- Original ideas, viewpoints, or data which contributed to fisheries management or our understanding of aquatic resources
- Important ecological discoveries
- An original fishery research or management program of statewide importance
- Activities in public education and outreach that have statewide impacts

Rich Cailteux Award

The purpose of the Rich Cailteux Award is to recognize individuals who have maintained a long-term commitment to research, management, and/or conservation of Florida fisheries and aquatic resources. This award aims to honor individuals for their career contributions to the fisheries profession and enhancing the visibility of the Florida Chapter.

Candidates will be evaluated according to the following criteria:

- A minimum of 20 years spent in a fisheries related field in Florida
- Substantial career contributions to Florida aquatic resources and the fisheries profession
- An imaginative and successful program in fisheries and aquatic sciences education
- A history of mentoring young fisheries professionals, and involvement and leadership with the Florida Chapter of the American Fisheries Society

Student Section

Student Research Highlight

Linking Habitat to Movement and Performance of Gag Grouper

Zy Biesinger
PhD Candidate
Program of Fisheries and Aquatic Sciences
University of Florida, Gainesville, FL

In the southeastern United States, gag grouper (Mycteroperca microlepis) is among the most valuable finfishes and populations are depleted and overfished. The most effective conservation efforts for harvested species, like gag, are effective management practices. There is a growing need to improve our understanding of how conspecific density and the spatial arrangement of habitat affect behavior and fitness, as management tools, like marine protected areas and artificial reef programs, become increasingly spatial in nature.

One factor contributing to the depleted state of gag populations is that, historically, fisheries management efforts have treated growth, fecundity, and mortality as constant across large spatial scales; but awareness is growing that spatial variation in these density- and habitat-dependent processes is important to population dynamics. The importance of accounting for spatial processes is especially true for species like gag, that have spatially structured life histories.

In the Gulf of Mexico gag spend their early life stages in nearshore nursery grounds (Bullock and Smith 1991) before moving out across Florida's shallow continental shelf (Koenig and Coleman 1998) where they spend 2 to 6 years as pre-reproductive juveniles (Collins et al. 1998). Finally, individuals join spawning aggregations in deep waters far offshore (Collins et al. 1998). For gag, it appears that a population bottleneck exists during the juvenile life stage (Lindberg et al. 2006) where future fecundity depends on density- and habitat-dependent growth and survival. During their time on the shallow shelf, juvenile gag aggregate at infrequent rocky ledges or outcroppings which serve as shelter from predators. As gag forage across the surrounding landscape, they necessarily choose between habitats, e.g. sand- and live-bottom.

To understand the effects of this choice, my project studies gag movement relative to habitat types, using internal acoustic transmitters and a hydrophone array to record two- and three-dimensional fish positions. I relate gag movement directly to landscape features using categorical habitat maps created from high-resolution sonar imagery. To connect behavior and landscape to gag performance, I measure indicators of gag reproductive potential. Because juvenile gag are always pre-reproductive females, not yet investing in egg production, growth and relative weight (collectively called performance) are proxies for future fecundity.

The research objectives of my project are as follows. 1. To understand how landscape composition affects space-use, I test whether more live-bottom cover leads to a greater space-use, i.e. a larger home range, and 2. To understand how the habitat-behavior interaction affects gag performance, I test whether more live-bottom cover leads to greater growth and relative weight.

Research Methods

Juvenile gag have naturally established residency on existing experimental reefs. These reefs are placed in natural landscapes ranging from high sand-bottom to high live-bottom cover. To quantify habitat qualities and features of the surrounding landscape, I create high-resolution habitat maps from sonar imagery obtained from towing a sidescan sonar "tow-fish" along many adjacent parallel paths to produce a single mosaic of the wider reef area. The landscape surrounding each reef is quantified by its percent of live-bottom cover and specific landscape features are identified. To monitor fish movement relative to habitat qualities and features I record the movement of gag on reefs of high and low live-bottom cover. I tag 8 fish in each of 3 replicates of these 2 treatments. The 5-hydrophone array derives 2-D or 3-D (depending on the tag type) fish position estimates to about every 6 seconds over 2 weeks.

To tag and track fish, divers deploy coated wire fish traps adjacent to a reef, and within 48hrs, slowly raise the caged fish to the surface. Once onboard the research vessel, the tagging procedure moves fish from a seawater holding tank, to an immobilization tank, to a weighing and measuring station, to a tagging station, and finally to an overboard holding cage. After a recovery and observation period, the fish are released at depth to the reef by divers.

Together, the movement telemetry data and habitat maps will allow me to observe gag movement relative to specific landscape characteristics such as shelter, seafloor topography, and habitat patch boundaries. At the end of the season, fish then at the experimental reefs will be collected by divers for length, weight, and otolith measurement to determine performance.

Using traditional statistical and movement analysis methods, as well as more sophisticated spatial modelling techniques, I will evaluate differences in space-use and gag performance relative to habitat type.

References

Bullock, L.B. and G.B. Smith. 1991. Seabasses (Pisces: Serranidae). Memoirs of the Hourglass Cruises 8(2). Florida Marine Research Institute, St. Petersburg, Florida, USA. 243 pp.

Collins, L.A., A.G. Johnson, C.C. Koenig, and M.S. Baker Jr. 1998. Reproductive patterns, sex ratio, and fecundity in gag Mycteroperca microlepis (Serranidae), a protogynous grouper from the northeastern Gulf of Mexico. Fishery Bulletin 96: 415-427.

Koenig, C.C. and F.C. Coleman. 1998. Absolute abundance and survival of juvenile gag in sea grass beds of the northeastern Gulf of Mexico. Transactions of the American Fisheries Society 127: 44-55.

Lindberg, W.J. T.K. Frazer, K.P. Portier, F. Vose, J. Loftin, D. Murie, D.M. Mason, B. Nagy, and M.K. Hart. 2006. Density-dependent habitat selection and performance by a large mobile reef fish. Ecological Applications 16(2): 731-746.