Gulf and South Atlantic Regional Panel on Invasive Species:
South Carolina Update for October 2011 Meeting.

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1) Infection of the invasive swim bladder parasite *Anguillicoloides crassus* in South Carolina populations of American eel *Anguilla rostrata*.

American eel (*Anguilla rostrata*) populations in South Carolina estuaries have shown a decline since at least 2001. The invasive nematode swimbladder parasite, *Anguillicoloides* (*Anguillicola*) *crassus*, is considered one potential reason for this decline. *A. crassus* originated in East Asia where it is widespread in its native host, the Japanese eel, *Anguilla japonica*. It was first documented in *A. rostrata* in North America in 1995 (Fries *et al.*, 1996). Since contaminants are known to negatively affect the ability of eels to resist infection by this parasite, College of Charleston graduate student Jen Hein, working with Dr. Isaure de Buron-Connors, hypothesized that *A. rostrata* from the ACE Basin NERR (Ashepoo-Combahee-Edisto) would be less infected than *A. rostrata* from heavily polluted habitats (Winyah Bay and Cooper River). Preliminary results from 66 eels showed a 53% prevalence of infection overall (Winyah Bay = 56%, n = 34, Cooper River = 54%, n = 26 and the ACE Basin NERR = 33%, n = 6). Results also indicate that the percent infection is highest in the summer (72%, n = 25), followed by spring (55%, n = 29) and winter (43%, n = 23). The incidence of infections even in juvenile eels (elvers) was also found to be high and preliminary findings suggest that this parasite may be capable of reducing the health of the eel. This work will continue through this fall and winter through funding from SeaGrant / NERR and Slocum-Lunz Foundation.

During the summer, Jen Hein and Dr. de Buron-Connors were also assisted by two students from Hampton University, VA enrolled in the NSF-funded Minorities in Marine and Environmental Sciences (MIMES) Summer Research Experience for Undergraduates Program (Aneese Williams & Joyah Waktins). Age, size and nematode infection were measured for American eels (*Anguilla rostrata)* collected from four South Carolina tributaries covering a wide range of salinities: Lower Pee Dee River (0 ppt); Winyah Bay (~5 ppt); Cooper River (~5 ppt); Baruch (>20 ppt). Eels examined from the Pee Dee River, Winyah Bay, Baruch and Cooper River sites had a 48.9% prevalence of adult stage of *A. crassus* and 53.4% prevalence of any stage of the parasite. There was no significant relationship between either eel age and/or total length and the likelihood of being infected by *A. crassus*. Prevalence of infection by the adult stage of *A. crassus* showed no significant difference between sites; however prevalence of infection by any stage of *A. crassus* (larval stages included) was highest at Baruch (highest salinity site) and lowest at Pee Dee River (freshwater site) indicating a strong role in salinity in determining infection prevalence.

2) Invasive monogeneans parasite of the American eel, *Anguilla rostrata*.

Monogeneans are very small (usually < 2 mm) parasitic flatworms within the Phylum Platyhelminthes that are largely ectoparasitic attaching to the skin or gills of fish using specialized hooks. Two species of invasive monogeneans are under investigation in the American eel, *Anguilla rostrata*, namely *Pseudodactylogyrus bini* and *P. anguillae*. It was recently postulated by Jordan Shealy and Dr. Isaure de Buron-Connors that these monogeneans should be present in all South Carolina estuaries due either to their initial invasion or to continual invasion. Both species *Pseudogyrodactylus* spp. were putatively identified (based on histology and morphology) by these investigators in eels collected from the Ashley River, while *P. anguillae* was also identified in eels collected from the Cooper and Edisto Rivers. Although neither species of *Pseudogyrodactylus* were reported from eels collected from the Combahee River, since this river is associated with the ACE Basin, which includes the Edisto River from which infected eels were collected, further investigation, particularly of larger sample sizes of eels, is warranted before their absence from this river can be confirmed. In addition, due to the difficulty of differentiating between species of *Pseudogyrodactylus* on morphology alone, future studies should incorporate DNA sequencing to confirm species identifications.

3) Understanding the impacts of the Asian seaweed, *Gracilaria vermiculophylla* on estuarine community dynamics.

During the last decade, the Asian seaweed *Gracilaria vermiculophylla* has rapidly proliferated along high-salinity mudflats in several South Carolina and Georgia estuaries. This seaweed invasion is particularly noteworthy because the mudflats in these estuaries were historically devoid of macrophyte-based primary production and structure. *Gracilaria vermiculophylla* therefore has few native analogues in these mudflat environments, and thus represents an important opportunity to examine the ecosystem consequences of an invasion within an historically-unexploited niche. This past summer, a MIMES Program undergraduate student (Wilmelie Cruz Marrero, University of Puerto Rico-Humaçao), working with Dr. Erik Sotka (co-PI with Dr. Jeb Byers on an NSF-funded *G. vermiculophylla* grant project) investigated the interactions between the polychaete *Diopatra cuprea* (Family Onuphidae) and the two algal species *G. vermiculophylla* (invasive) and *Ulva lactuca* (native). This student also investigated the effect of tidal height on the relative growth rate of *G. vermiculophylla*.

Based on field transects, within the intertidal zone, tidal elevation did not significantly affect relative growth rate (RGR, i.e., change in length) of *G. vermiculophylla*; however, depth within the subtidal zone did significantly affect RGR, and RGR was significantly higher at subtidal compared to intertidal elevations. Laboratory experiments were also conducted to determine algal species preferences of *D. cuprea* both for decorating its tube and for direct consumption in both choice and no choice experiments. In choice experiments, *D. cuprea* attached significantly more *Ulva lactuca* than *G. vermiculophylla* to its tubes. In no choice experiments, there was no significant difference in the amount of each algal species attached by *D. cuprea*. In choice experiments, *D. cuprea* consumed significantly more *U. lactuca* than *G. vermiculophylla*, but in no choice experiments, consumption rates did not different between algal species. At the Fort Johnson field site, 90-95% of *D. cuprea* tubes were observed to be dominated by *G. vermiculophylla*, as *U. lactuca* is scarce at this site and therefore not as available to *D. cuprea*.

4) Collection of live adult specimens of Island apple snails, *Pomacea insularum* and hatching of juveniles under laboratory conditions.

At the last meeting, the collection of a live Island apple snail, *Pomacea insularum* and several egg masses was reported from the same location in Mt. Pleasant, near Charleston, SC where its existence had previously been reported, based on empty shells and egg masses. A return visit to these sites on August 16th 2011 by David Knott and interested staff from the SC Aquarium yielded no evidence of fresh egg masses, although there were scarce remnants of egg masses on the inside of two culverts (although it cannot be determined definitively whether these egg masses were laid earlier in 2011 or in the 2010 breeding season). In recent visits no live snails were reported, however 17 empty shells were observed at the pond's edges in shallow water. Fifteen of these empty shells were collected and measured (shell height: mean = 70.9mm; S.D. = 6.2 mm; shell width: mean = 65.2 mm; S.D. = 7.4 mm). Based on the literature, August represents a time when egg-laying by *P. insularum* would be occurring and therefore the lack of fresh egg masses suggests a lack of live and/or reproductively mature *P. insularum* at this location. This may be attributable to consecutive cold winters reducing the extent of this localized population. In general, however, there has not been a thorough inspection of the connected waterways in this area for the presence of *P. insularum* and to the best of our knowledge there have been no eradication treatments of the apple snails in this area.

5) Increasing Asian tiger shrimp, *Penaeus monodon* catches from the southeast region.

Ongoing annual monitoring of the Asian tiger shrimp, *Penaeus monodon*, native to the Indo-Pacific, has revealed a remarkable number of animals being collected along the U.S. east coast this year (n = 117+), ranging from NC to LA. In addition to confirmed reports, anecdotal reports from commercial trawlers support this recent trend of increasing numbers and spatial extent. Several *P. monodon* have been collected from estuarine habitats this year, unlike in previous years when reports from these habitats were rare. Among the more than 117 specimens that have been reported and confirmed was the second juvenile shrimp on record (110 mm TL, 8.2 g), heightening concerns that there may be a reproductive population in the southeast U.S. Much speculation surrounds the source(s) of *P. monodon* within the southeastern United States, but it is hoped that coordinated regional collecting and reporting efforts will help to address this. In South Carolina, efforts have recently been instigated that incorporate the use of standardized data collection cards that should facilitate the efficient collection of information from commercial fishermen and aid in the incorporation of these data in the USGS database. Tissues samples are also being collected, which, along with samples archived in previous years, will be used for genetic analyses to better understand the possible sources of these introductions and to determine whether or not this invasive species has indeed become established along the U.S. coastline.