SOUTH CAROLINA REPORT TO THE GSARP

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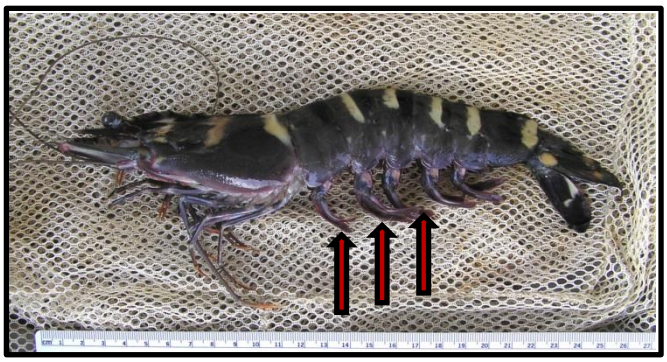
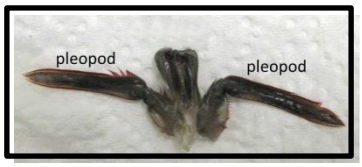
1— Dr. Amy Fowler was hired recently by SCDNR to head up the Crustacean Research Section of the Marine Resources Research Institute. Amy has a Bachelor's degree from U. New Hampshire, and a PhD from the U. of Aukland, where she worked on invasive species of the swimming crab*, Charybdis* (a species of this Indo-Pacific genus that is different from the one that's become established along the Atlantic coasts of North and South America and in the Gulf of Mexico in the past couple of decades). Since she graduated in 2011, Dr. Fowler has held several postdoctoral research positions, including stints at Villanova U. and at the Marine Invasions Research Lab at the Smithsonian Environmental Research Center, where she studied the infection of a small mud crab by the invasive castrating barnacle *Loxothylacus panopaei*. This parasite was introduced to the US Atlantic coast from the Gulf of Mexico, most likely in the 1960s as part of the oyster aquaculture trade in the Chesapeake Bay. Amy also headed up a group that assessed a pathway management scheme involving the treatment of packaging algae as a way of preventing the spread of AIS hitchhikers in shipments of live bait worms. In January of this year, after a short time at Purdue U., Amy came to SCDNR, where she promises to be a valuable addition to the professional staff as a crustacean scientist with a strong interest in issues and research related to marine and coastal AIS.

Along those lines, Amy and Peter Kingsley-Smith recently collaborated on the submission of a preliminary funding proposal under the State and Interstate ANS Management Plan Program. The work will be directed primarily towards improving our understanding of the recent invasion of the South Atlantic Bight and Gulf of Mexico by the Asian tiger shrimp, *Penaeus monodon*. The focus will be on the collection of tiger shrimp across a range of habitats, from the shallow coastal juvenile nursery habitats in estuaries and tidal creeks to the sandy or muddy-sand offshore habitats of mature adults. Some of the potential effects of the establishment of this large predatory penaeid on native shrimp, crab, and bivalve populations will be examined

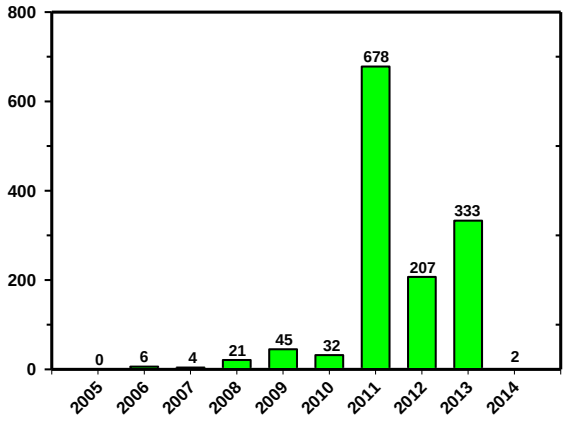
through an investigation that will look for ontogenetic shifts in feeding preferences using stable isotope analyses. Results should address concerns that the introduced species may compete for food resources with native species and may even consume some of them.

2— The preservation and archiving of pleopod tissue samples for genetic analyses commenced in 2008, and it continues as fresh tissue becomes available. These samples are being held in a tissue repository maintained in Beaufort, NC by the NOAA National Centers for Coastal Ocean Science Laboratory. The need for obtaining additional samples from across the introduced range of the species, as well as from its native range and other regions of introduction and establishment, continue to be a priority. Using this tissue, USGS researchers will try to identify the geographic origins of *P. monodon* living along the Gulf and Atlantic coasts of the US, in the hope of answering questions regarding the status of their establishment, the number of releases, and the population structure of this shrimp in its introduced range.





3— In addition to the lines of research mentioned above, credible reports of tiger shrimp captures continue to be recorded and reported to the USGS as they are received from points of contact in the coastal states of the GSARP region. Data in the USGS database and in one maintained by SCDNR provided information used in preparation of a manuscript by several GSARP members and others that documents the first seven years (2006-2012) of this incipient invasion (Fuller, Knott, Kingsley-Smith, Morris, Buckel, Hunter and Hartman. 2014. Invasion of Asian tiger shrimp, *Penaeus monodon* Fabricius 1798, in the western north Atlantic and Gulf of Mexico. Aquatic Invasions 9: 59-70. doi:http://dx.doi.org/10.3391/ai.2014.9.1.05). The paper acknowledges the difficulty of obtaining meaningfully quantitative data, due to inconsistent and often waning interest in reporting by commercial fishermen; however, after dropping off in 2012, the number of



reports rebounded in 2013. It's likely that the graph here does not include unknown numbers of reports in 2013 from some of the Gulf states.

4— Referred to in our prior reports as *Anguillicoloides*, the nematode *A. crassus* is a native parasite in the Japanese eel, but it has become widespread as an invasive parasite in swim bladders of American and European eels, as well. Recent molecular analyses by European and American researchers resulted in the replacement of the species into the genus *Angillicola*. Because of 1) historically declining stocks of American eels, 2) data deficiencies and priorities identified by the ASMFC, 3) a 2010 petition for listing this fish as threatened under the Endangered Species Act, and 4) the known deleterious effects on eel health caused by *A. crassus*, that parasite is the subject of ongoing research by SCDNR's Inshore Fisheries Research Section. Their recent study found that at least 58% of American eels at larval and adult stages that were sampled in SC estuaries are infected. Infection prevalence at the glass eel stage becomes high within months of recruitment to freshwater habitats. Funding has been requested by SCDNR to develop and test the use of qPCR to detect and quantify the presence of the parasite in planktonic and benthic fauna, which include a known intermediate host of *A. crassus*, near a confirmed site of glass eel recruitment.

5— Faunal identification of invertebrates scraped from settlement blocks deployed for ~3 months at various locations throughout the ACE Basin NERR is nearing completion. Preliminary results from examination of 12 of the 15 recruitment samples present a faunal list of 60 invertebrate taxa (24 identified to species level, 4 to genus, 14 to family, and 18 to various higher level taxa). Four of those species are known to be invasive (*Amphibalanus amphitrite* [barnacle], *Paradella dianae* and *Synidotea laevidorsalis* [isopod crustaceans] and *Petrolisthes armatus* [anomuran crustacean]). An additional species, the South American mussel *Mytella charruana*, was collected from outside of the targeted sampling surface of one block, and it is likely that the ubiquitous nonindigenous barnacle *Balanus trigonus* had settled on blocks that were lost from tethers on pilings that were located in high salinity waters near ocean inlets at three sites.

6— In previous reports we have described the investigations of Dr. Erik Sotka (College of Charleston) and colleagues on the impacts of a nonindigenous seaweed, *Gracilaria vermiculophylla*, on mudflats in SC and GA. Much of their initial work has been published:

Byers, J.E., Gribben, P.E., Yeager, C. and Sotka, E.E. 2012. Impacts of an abundant introduced ecosystem engineer within mudflats of the southeastern US coast. Biological Invasions 14(12): 2587-2600.

Likely the result of worldwide transport of Japanese oysters, the seaweed can now be found along the Pacific North American coast from Canada to Mexico, on the Atlantic seaboard from Maine to Georgia, and in the eastern North Atlantic from Morocco to the Baltic Sea, according to Sotka. Along with colleagues and a new NSF grant, he will conduct laboratory experiments and use genetic tools on seaweed samples from Japan, Korea, both coasts of the US, Portugal, France and Germany in order to reconstruct the evolutionary history of *G. vermiculophylla* and to search for an explanation of its pervasiveness across so much of the world. "We think that part of the reason this seaweed is so successful is that in parts of Asia seaweed was farmed for certain qualities. The people farming it probably selected traits that they wanted and bred for those traits – in this case, *G. vermiculophylla* was likely bred for resistance to environmental stressors, bacteria and being eaten. And then it escaped from the farm," Sotka said. The grant will facilitate an examination of the evolutionary changes that contributed to this adaptive species' development and its rapid worldwide dispersion.