GULF & SOUTH ATLANTIC REGIONAL PANEL
ON AQUATIC INVASIVE SPECIES
MINUTES
Wednesday, April 22, 2020 (Via GoToMeeting)

On Wednesday, April 22, 2020 **James Ballard** called the meeting to order at 9:00 a.m. The meeting began with introductions of the members and guests. The following were in attendance:

Members & Proxies
Kristina Alexander, MS-AL SGC, Oxford, MS
James Ballard, GSMFC, Ocean Springs, MS
Rob Bourgeois, LDWF, Baton Rouge, LA
Wesley Daniel, USGS, Gainesville, FL
Tom Jackson, NOAA, Miami, FL
Michael Kendrick, SC DNR, Charleston, SC
Peter Kingsley-Smith, SC DNR, Charleston, SC
Monica McGarrity, TPWD, Austin, TX
Robert McMahon, UT Arlington, Arlington, TX
Matt Neilson, U.S. Geological Survey, Gainesville, FL
Jim Page, GA DNR, Waycross, GA
Michael Pursley, MS DMR, Biloxi, MS
Matt Phillips, FWC, Tallahassee, FL
Steve Rider, AL DCNR, Montgomery, AL
Dennis Riecke, MDWFP, Jackson, MS
Craig van der Heiden, Miccosukee Tribe of Indians, Miami, FL

Kevin ?, USFS, ???

Discussion About the Model Bait Regulations Project

Kristina reported that she got a grant to develop a model regulation that could be applied by the states in the GSARP region. The idea is to harmonize the disparate state laws and regulations, with the idea that better laws would lead to reduced invasive species problems. She looked at all of the member states' laws and regulations, and wrote an abbreviated version of what she found, which was provided to the panel members. She asked the panel members to come up with ideas on what they would like to see the regulations do. Several topics were provided for discussion. The first was Transportation Restrictions. One aspect of this could be draining and drying boats before moving among lakes within the state, which could ideally also be expanded to out of state as well. Another aspect of transportation would be whether to limit the movement of the bait itself from one body of water to another, or not. These ideas would be under a transportation-focused state regulation. **Dennis** stated that Mississippi does not have a drain and dry regulation on boats, but there is a regulation on transporting live bait away from spillway areas. The bait must be put in a dry container or on ice. **Kristina** said that one idea would be a model regulation to include restrictions on transporting live bait. **Robert** said the problem with boat drain and dry in Texas is that there is little enforcement of it, and lots of unattended boat ramps. Unless there is enforcement at the ramps, not much can be done. **Monica** agreed, but said they do have a bait-related regulation, which is the restriction of transportation of live non-game fish from separate waterbodies where bighead carp have been found.

The next topic was Species Restrictions. **Kristina** asked the members their thoughts on having bait regulations that limit based on species. **Tom** suggested that in states where expenditures are being spent on removing exotic ornamental species that are not just from bait, but from trade, that there is a feedback policy in place to limit their sale if it is known that they are being released. **Dennis** said that his main concern is what species are going to show up in the future. He doesn't want to restrict the current sale of bait items, but stated that outside of what is currently in the trade, non-native species cannot be used if they are alive. **Kristina** asked **Dennis** how a list of current bait species would be developed. He stated that he calls bait dealers. He also called a state legislator who is a bait dealer and asked him what species he was raising and selling in Mississippi. For fish species, **Dennis** has a Mississippi River Basin Panel report on bait and bait pathway. They surveyed all the states, so **Dennis** knows what is being shipped from different states into Mississippi. He suggested that there be a regulation to prohibit buying any fish species from a pet store and using it for bait. **Kristina** suggested forming a committee. She said if a regulation is going to be established, it could refer to a list of non-native species that is being used as bait, assembled by an officially-formed committee. The committee would do background work to put together the list. What about a bait rule that includes testing for pathogens, viruses, or bacteria before the bait is allowed? **Dennis** said some states are already doing that. Several members would be in favor of that.

The next topic was Geographic Restrictions. **Kristina** asked the panel members if they thought that contaminated diseased bodies of water within states should be listed, and prohibit movement between those bodies of water. **Dennis** stated that what is needed is something that would allow the states to say that you cannot harvest bait in an area that contains specific non-natives. Mississippi and other states prohibit transporting fish out of state for use as bait. **Kristina** asked the panel members if that was useful for a bait restriction, and if they would like that restriction for their state. **Peter** said the question is, how much of that bait is already available? It may be limiting for some states that don't have information on every water body.

The next topic was Stronger Punishment. **Kristina** stated in some states, it is illegal to introduce non-native species into a body of water unless it accidently happens when a boat is moved from one body of water to another. She said one way to stiffen protections would be to end the innocent boater exception. **Dennis** said that Mississippi has a similar law that basically states that no aquatic species can be released into any public water bodies without a permit. A risk assessment must also be done before a permit is granted. Enforcement hinges on the ability of the conservation officer to know what a species is that is being released into the water. **Kristina** said that a lot of states focus on commercial bait, and that might be based on the ability to control the process. Is that where the focus should stay? **Dennis** stated that he could foresee that people selling bait on a retail level would be required to get their bait from someone in the bait industry, and not from bait harvested in the wild. **Mike** pointed out that on the Mississippi coast, bait shrimp is harvested from the wild in the immediate region. **Robert** said that as far as harvesting bait fish or bait shrimp from the wild, there is also a problem with moving invasive organisms, such as zebra mussel larvae, from one water body to another. **Monica** stated that their regulation regarding non-game fish collection allows them to put in restrictions for anything that might have an impact on the ecosystem, so they put restrictions on nongame fish permits that disallow transfer of live nongame fish from water bodies that have zebra mussels. With broader regulatory terms, such as allowing restrictions on permits for anything that might have ecological impacts on the spread of aquatic invasive species, it does not restrict them geographically to a specific list of lakes or to any specific species. In their regulations pertaining to introduction of fish, shell fish, and aquatic plants, and in the statute, there is an exception for different species to be

introduced while fishing, and that specifies native shrimp. **Kristina** asked about the idea of including a surcharge on fishing licenses that would be used to cover remediation costs of invasive species. Would it help people to become more aware of the problem and expense of invasive species? **Dennis** said he didn't think a fee would be feasible, but a bond with fish producers in the aquaculture industry would be a good idea. If their fish get released, and an agency tries to eradicate it, the fish producer would have to bear the cost of the eradication. **Tom** stated that he likes the idea, but one of the problems with charging a fee is that there might be application problems, and also a lack of sales. **Dennis** said that he didn't think you could achieve standardization on fees for punishment. The best that could be hoped for is to encourage states to make the release of nonnatives their highest penalty. In Mississippi, it is a Class 1 violation, and is a $2,000-5,000 fine and 30 days in jail, which is sometimes waived. **Tom** said more education for the public about the impact of invasive species is needed. **Dennis** suggested that the state agencies create a nonnative species section on their website, or on a separate website, to discuss responsible usage of bait, and the acquisition of bait.

Discussion About Emerging AIS Issues

Wes reported that the Prevention Committee is brainstorming on the best way to move forward on improving the US Fish and Wildlife Service's LEMIS (Law Enforcement Management Information System) import aquatic species list, and making it more accessible and searchable. They want to link as many aquatic species as possible to ITIS (International Taxonomic Information System). At this time, the list is only available through a Freedom of Information Act request, which can be intimidating. They want to have digital images of aquatic species available to inspectors, so when a shipment is received, the inspectors can match the species that is in the shipment with their digital image.

James said the main goal is to work on getting a new system developed that would incorporate all importation data to be used overseas, whereby importers in the pet trade industry would enter their shipment information into the system on each species they are importing into the US, which would generate their implication documents. This would be in a digital format so that when the shipment arrives in a US port, the inspectors would scan the container, which would show a list of species inside the container, along with the scientific name and images of the species. If one of the aquatic species is flagged as a new invasive species, it can be dealt with immediately. A list of main aquatic species imports by importers is being developed. More updates will be provided at a future GSARP meeting. **Tom** suggested using RFID (Radio Frequency Identification) tags for shipments, which is the wireless, non-contact use of radio frequency waves to transfer data.

Wes stated that they recently had an eDNA webinar that covered all of the regional panels. The recording of the webinar and other materials are available, and can be obtained by contacting **Wes**.

State Reports/ Members Forum

Alabama

Saltwater:

Asian tiger shrimp have been a species of concern since 2006, when it was first observed in Alabama's inshore waters. After the first individual was documented, captures of Asian tiger

shrimp have increased. A confirmed report of a single specimen occurred in 2008 near Mobile Bay Light. In 2009, there were five confirmed reports. From 2006-2009, the distribution of Asian tiger shrimp was primarily restricted to Alabama's southern inshore waters. Its distribution extended to northern Mobile Bay and into Perdido and Wolf Bay in 2011. The 43 confirmed reports during 2011 indicate the Asian tiger shrimp occurs within all of Alabama's primary estuary basins; however, concern surrounding Asian tiger shrimp has decreased within the commercial shrimping community, which has resulted in fewer validated reports. Communications between AL MRD personnel and commercial shrimpers indicate that a significant abundance of Asian tiger shrimp occur within Alabama waters, despite the reduction in validated reports. Evidence suggests that Asian tiger shrimp have become established in Alabama's waters.

Several invasive species have been documented in Alabama coastal waters – tessellated blenny, Bocourt swimming crab, Australian spotted jellyfish, Asian green mussel, Asian tiger shrimp, and red lionfish. Unfortunately, the ecological effects of these invasive species are poorly understood in Alabama's estuaries and Gulf of Mexico waters. Prey of Australian spotted jellyfish include early life history stages of many commercially and recreationally important finfish, and the temporal/spatial distribution of Australian spotted jellyfish could drastically increase finfish larvae/egg mortality rates if spawning events coincide with swarm activities. The Bocourt swimming crab could compete for resources with the native blue crab. The current status of the Australian spotted jellyfish and the Bocourt swimming crab, however, does not indicate that these two invasive species pose an imminent concern. Tessellated blenny and Asian green mussel do not appear to pose an immediate threat, but their distribution and abundance should be monitored to ensure early detection of proliferation. The Asian tiger shrimp and red lionfish continue to be invasive species of heightened concern, and their broadened distribution, increased abundance, and/or documented negative effects on native species warrants concern.

The latest invasive species observed in Alabama's marine waters was an Amazon red tail catfish in July 2016. It was collected in a recreational crab trap at a private dock on the Bon Secour River. A Bocourt swimming crab was collected in a commercial trap during an AL DCNR/MRD onboard fisheries observation trip in November 2016. The location of the capture is south of Lillian Bridge and north of Ross Point in Perdido Bay. No other observations of the Bocourt swimming crab have been made since the 2016 observation.

Red lionfish have successfully colonized the Gulf of Mexico waters offshore of Alabama. The first confirmed report was documented in June 2011 by a spear fisherman who collected an individual from an oil/gas platform approximately 43 miles south of Dauphin Island. During the 2012 diving season, a recreational diver reported observing approximately 60 lionfish during a dive at Trysler Grounds. In June 2012, a diver reported observing up to 100 lionfish at an artificial pyramid reef. The diver would not disclose the exact location. After a lionfish rodeo in June and July 2012, 26 lionfish were donated to AMRD. No collection information was obtained by the rodeo coordinator.

In December 2012, AL MRD received a grant from Gulf States Marine Fisheries Commission to monitor reef communities in the Gulf of Mexico, dispatch red lionfish when encountered during SCUBA surveys, increase public awareness of the lionfish invasion, and streamline the general coordination between state agencies, federal agencies, and the public. Eighteen dive surveys were completed by AMRD personnel during 2013. T-shirts were distributed to members of the SCUBA community who were active in submitting reports, samples, and increasing public

awareness. Additional funding was received from Gulf States Marine Fisheries Commission in 2014 to continue the monitoring and continue increasing public awareness. In 2014, AMRD personnel conducted SCUBA surveys at 18 reef sites, and created an Adopt-a-Reef program that emphasizes the reporting and capturing of lionfish. The Adopt-a-Reef program features a web-based application that allows for the submission and viewing of reports collected by Adopt-a-Reef participants. To date, 50 members of the public are enrolled in the Adopt-a-Reef program, and 57 reports have been submitted by the program's members.

Fishery-independent monitoring of reefs offshore of Alabama report a similar pattern in the lionfish invasion. Remotely Operated Vehicles (ROV) surveys within the Alabama Offshore General Permit Reef Zone from 2011 through 2015 indicate a widespread distribution of lionfish between 10 nautical miles and 50 nautical miles offshore of Alabama. No red lionfish were observed during 2011 ROV surveys, but frequency of occurrences was 100% during 2015 ROV surveys. In 2016, spearfishing tournaments began to specifically target red lionfish. A weekend-long "Lions on the Line" tournament was held at FloraBama during 2016, and 1,662 lionfish were harvested. The Alabama Lionfish Challenge tournament was held from May 26, 2018 through September 3, 2018. The recreational division harvested 540 lionfish, and the commercial division harvested 278 lbs. of lionfish. Tournaments were also held in April 2019, when 2,140 lbs. of lionfish were harvested, and September 2019, when 1,296 lbs. of lionfish was harvested during the tournaments.

The spatial distribution of red lionfish has not changed after becoming established; however, the rate of population growth has changed over time. During the first several years of invasion, population growth increased substantially from year to year. However, the rate of population growth during the previous few years has reduced such that it seems the population has plateaued to a stable state.

Freshwater:

Steve reported that they have received Asian carp funding, and hopefully an ANS coordinator will be hired in the future.

Their ANS Plan has been submitted, and they are hoping for approval in the near future.

Florida

Although the 2020 Lionfish Removal and Awareness Day event was cancelled due to COVID-19, the Florida Fish and Wildlife Conservation Commission (FWC) is planning to hold the 2020 Lionfish Challenge. The Lionfish Challenge is scheduled to begin May 22nd, and run through October 11th. The Challenge is a state-wide event open to recreational and commercial divers. Checkpoints will be set up around the state for recreational divers to submit their catch, and recreational divers will provide copies of trip tickets to document the weight of lionfish they harvested. The recreational diver with the most lionfish, and the commercial diver with the most weight of lionfish will be crowned the Lionfish King or Queen for their category.

Research continues on sun coral, a nonnative species that has colonized artificial habitats in the western Atlantic Ocean, the Gulf of Mexico, the southeast coast of Florida, and the Florida Keys. There have been no confirmed observations of the species on natural coral reef habitat within the Florida Reef Tract. Local interest in their commercial collection has resulted in a series of ongoing observational and experimental studies by FWC Fish and Wildlife Research Institute

(FWRI) to determine whether the removal of sun corals effectively reduces prevalence or conversely, results in the colonization of new areas. To test the capacity of sun corals to invade natural reefs, the effects of light, colony orientation, and live rock with algae on coral growth was examined in a controlled aquarium experiment. Results did not indicate any effect of algae, and coral growth was highly variable. FWC will continue to evaluate the invasive potential of sun corals.

A risk screening study is ongoing of the invasiveness risk to Florida of 11 marine ornamental fishes of the family *Pomacentridae* using AS-ISK Phase 2. FWC continues to support this research in its second and final year of the project. The objective of the second year of this study is to use the information gathered for the biological profiles of 11 pomacentrid species to complete the AS-ISK risk screens, as well as additional information on risks and management.

A three-day Fish Chat and Slam event was held in South Florida in November 2019. Fifty fish biologists from 15 organizations participated in the event. The Fish Chat provided an opportunity for participants from different agencies and institutions to engage in a discussion/dialogue about ongoing and future projects. The Fish Slam event took place in Palm Beach, Broward, and Miami-Dade counties, where 32 freshwater sites were sampled for nonnative fishes. Twenty-five species of nonnative fishes were collected or observed. Nonnative fishes were tissue-sampled for DNA collections, and then preserved for future research. Some specimens were frozen and later processed for skeletal collections.

Bullseye snakehead have moved into the Lake Ida-Osborne chain-of-lakes system in southeastern Palm Beach County. FWRI, Freshwater Fish Management (FFM), and Nonnative Fish and Wildlife Program (NFWP) staff have submitted a Conservative Wildlife Tag grant proposal to examine how bullseye snakehead use of these 'natural' habitats compare to those individuals found in manmade urban canals. Bullseye snakehead were collected in associated canals north and south of Lake Ida, but were not found in Lake Osborne further north.

The goal of the FWC's standardized electrofishing program is to monitor native and nonnative fish populations in southeast and Florida urban canals. The FWC's Wildlife Impact Management Section coordinated with FWC FFM staff to develop a modified sampling protocol based on their long-term monitoring program. The new protocol keeps three fixed-starting point transects. Additionally, three to five randomly chosen daytime transects were added to the protocol. In October 2019, six core canals were sampled using the modified protocols. The addition of new transects increased the mean number of nonnative fish species collected in six historically sampled canals by 21%, and the number of native species collected increased by 59%. A total of 3,564 fish were collected from the canals. Native fish comprised 57% of the total catch, and nonnative comprised the remainder. Spotted tilapia, butterfly peacock, Mayan cichlid, and African jewelfish were the principle nonnative fish species collected, making up 65% of the nonnative fish collected.

The final Bullseye Snakehead Roundup of 2019 was held October 5th. Twenty-six anglers competed. The anglers brought in 199 bullseye snakehead. These additional fish bring the 2020 total number of bullseye snakehead caught in three tournaments to 451 fish.

Researchers have continued to capture and mark clawed frogs to determine population estimates for ponds and movement patterns between occupied water bodies. qCR performed at UF determined that the clawed frog population in the Riverview region of Hillsborough County was

not the African clawed frog as previously thought, but rather, the closely related western clawed frog. Via trapping, the updated number of occupied water bodies with clawed frogs is 22 within the Riverview area. Researchers are also developing a species distribution model to determine potential spread throughout the state of Florida. The project will be completed in summer 2020.

At the University of Central Florida, researchers are continuing to conduct pathogen screening and evaluation of eDNA detection in the surrounding area to understand whether and how disease may be facilitating or hindering the invasion front. They are also analyzing clawed frog invasion genomics to identify genomic correlates of invasion success. The project will be completed in summer 2020.

Cane toad traps were used to attempt capture of cane toads last year using a series of acoustic lures. Researchers also radio tracked several individuals to determine movement patterns, habitat use, and potential impacts to native wildlife. The project was completed in spring 2020, and results will be peer-reviewed and published in the near future.

In October 2019, a singleton caecilian tentatively identified as *Typhlonectes natans* was collected by electrofishing from a canal in Miami-Dade County. This is the first time that an aquatic caecilian has been captured from the wild in Florida. No additional specimens were observed or collected in follow-up sampling. The specimen will be transferred to the Florida Museum of Natural History in Gainesville, FL and kept as a voucher specimen.

Matt reported that last year, they controlled approximately 63,795 acres of invasive and obnoxious weeds statewide, at a cost of approximately $15M.

Georgia

Jim reported that during the 2019 sampling season, 6,315 flathead catfish were removed from the Satilla River. Since 2007, over 78,000 flathead catfish have been removed. Suppression of the flathead catfish population in the Satilla River has been demonstrated through measured changes in biomass, size, and age-structure. However, higher recruitment and earlier maturation is being witnessed.

In addition to removing flathead catfish in the Satilla River, GA Department of Natural Resources staff continue to remove blue catfish from the river. In 2019, 663 blue catfish were removed. Continued monitoring and removal of this species will continue.

Commercial fishermen continue to periodically report catches of Asian tiger shrimp in Georgia waters, though the incidences remain low. Managers will continue to monitor the occurrence of tiger shrimp. GA DNR staff have initiated a new reporting tool on the GA DNR website to allow people to report tiger shrimp online. GA DNR staff may potentially intercept tiger shrimp during fishery-independent standardized sampling conducted monthly at 36+ sites coastwide, using a 40-foot trawl net towed by a research vessel. A single tiger shrimp was captured in the net in December 2019 in Sapelo estuary. Results of the surveys suggest that abundance of tiger shrimp in Georgia's sampled waters are low.

Staff have updated the GA DNR Aquatic Nuisance Species web page on the website.

The Traveling Trunk continues to be utilized at many Georgia schools.

Louisiana

Rob reported that a breeding population of blue tilapia in a lake in Baton Rouge was found last year in routine sampling. A total of 26 fish were collected from several samplings. None were found in future samplings until field staff recently sampled the lake and found three blue tilapia, with one female with eggs in her mouth. Samplings will continue.

Mississippi

Freshwater report:

Dennis reported that they had a Mississippi River Basin Panel meeting in March.

Treatment continues on salvinia in the Ross Barnett Reservoir. It appears that it is under control at this time. Booms have been deployed, and surveys continue.

A new plant species, water clover, was recently discovered in the Ross Barnett Reservoir. This is the third appearance in Mississippi.

A research project to track Asian carp in the Tennessee-Tombigbee Waterway is under way with Mississippi State University.

Dennis is working with a local chef to organize commercial fishermen to utilize funding for contract fishing in the Tennessee-Tombigbee Waterway and lower Mississippi River.

Saltwater report:

Mike reported that one aerial survey of 200 miles, and 62 waterway missions were conducted for early detection of aquatic invasive vegetation, and monitoring of existing infestations.

A program of integrated pest management and spot herbicide application was used to control populations of common salvinia, alligator weed, torpedo grass, beach vitex, and water hyacinth.

A new spray boat equipped with a 100-gallon, dual-power gas/electric spot sprayer, boom arms, and an air-cooled mud motor was added to the MS Department of Marine Resources aquatic invasive species control fleet.

During weekly control missions, 557 giant applesnail egg masses were destroyed, and five live snails were removed from the Pascagoula River. Gulf Corps, a youth conservation organization, continued to assist staff with control. Giant applesnail populations are now established in areas that became connected with the original infestation during recent periods of river flooding. This has greatly expanded the area occupied by the snails.

An article entitled “Protecting Mississippi Waterways from Aquatic Invasive Species” was written for and published in Water Log, a quarterly publication of the Mississippi-Alabama Sea Grant Legal Program.

South Carolina

Peter reported that recent research conducted at the SC Department of Natural Resources (DNR) Marine Resources Research Institute (MRRI) to investigate the salinity tolerance of newly hatched island apple snails, *Pomacea maculata*, produced by adults collected from the wild

South Carolina populations, demonstrated their ability to tolerate salinities as high as 8 psu, representative of upstream estuarine habitats in South Carolina. Furthermore, there is a well-established population of *P. maculata* in a suburban neighborhood in West Ashley, located less than 3 km from the Ashley River. In order to determine the distribution and potential spread of P. maculate within this neighborhood, SC DNR biologists surveyed all ponds within the neighborhood, and one seasonally-flooded, forested wetland area nearby, during fall 2018 and summer 2019. The neighborhood ponds and nearby wetland area were resurveyed in fall 2019 when no *P. maculata* were observed in additional retention ponds or in the wetland area. In November 2019, however, *P. maculata* was observed in one pond located in an adjacent neighborhood, and also at several points along a canal in a wooded area between the two neighborhoods. These results suggest that *P. maculata* has additional dispersal capabilities within this area. Additional surveys will be conducted in July 2020 to assess this same population, as well as potential spread to surrounding neighborhoods and wetland areas.

SC DNR biologists are in the process of surveying stream and wetlands habitats in the Southern and Middle Atlantic Coastal Plains and Southeastern Plains ecoregions in order to better understand the distribution of invasive red swamp crayfish, *Procambarus clarkii*, and predict potential impacts to native species. SC DNR biologists surveyed for *P. clarkii* in the PeeDee watershed in January, April, and May 2019. A total of 17 locations were sampled, and at least six different species of crayfish were collected. Red swamp crayfish was found at 12 of the 17 sampled sites, and 73% of the collected specimens were identified as *P. clarkii* based on morphological traits. Other crayfish species collected included two conservation priority species, Carolina sandhills crayfish, and Waccamaw crayfish.

Michael reported that also of concern in South Carolina are the rusty crayfish and the virile crayfish, two nonnative crayfish species. The rusty crayfish is currently is currently established in the Broad River watershed of North Carolina, only a few miles from the North Carolina/South Carolina border. The virile crayfish was collected by SC DNR biologists in July 2018 from the Catawba River at the Catawba Indian Reservation. SC DNR biologists have surveyed mainstream and tributary locations of the Broad and Catawba Rivers in South Carolina for rusty crayfish and virile crayfish in October 2018, and August, September, and October 2019. So far, no specimens of rusty crayfish have been collected in South Carolina; however, in August 2019, virile crayfish was collected by SC DNR biologists from Lansford Canal State Park, a site 17 km downstream from the previous known location of Catawba Indian Reservation.

The eastern red swamp crayfish, *Procambarus troglodytes*, is the most abundant native crayfish species in South Carolina, where much of its range overlaps with known locations of invasive red swamp crayfish, *P. clarkii*. Hybridization is common among crayfish species; however, the majority of research to assess the role of nonnative crayfish hybridizing with native species has focused on the genus Faxonius, with little evidence currently available for wild hybridization within the genus Procambarus.

Researchers at the SC DNR MRRI are nearing completion of the development of microsatellite-based tools that will allow for effective testing of the hypothesis that hybridization is occurring within wild populations of the Scapulicambarus subgenus of crayfish. This will be accomplished using polymorphisms in genetic microsatellites from *P. clarkii* and *P. troglodytes* specimens collected in and around the Charleston, SC area. To test this hypothesis, collection locations for *Procambarus spp.* will include: 1) A location where *P. troglodytes*, but not *P. clarkii*, is known

to occur; 2) a location where *P. clarkii* occurs without reports of *P. troglodytes*; and 3) a location where both *P. clarkii* and *P. troglodytes* are known to occur.

SC DNR biologists sampled 112 aquatic habitats in the Charleston area during the current reporting period. Sampling focused on regions west of Charleston Harbor, including James Island, Johns Island, Wadmalaw Island, and West Asley, but more recent sampling efforts have also included locations in Mount Pleasant, SC. Baited minnow traps and dip netting were the primary techniques used to locate *P. clarkii* and *P. troglodytes*. During this time, 874 *P. troglodytes* and 1,635 *P. clarkii* specimens were collected. As a result of these sampling efforts, the first record of *P. clarkii* was established on Wadmalaw Island. To date, no *P. clarkii* have been recorded from Mount Pleasant, SC.

The white spot syndrome virus (WSSV) infects many crustacean species, is highly pathogenic, and was recently associated with both wild and farmed red swamp crayfish, *P. clarkii*, in Louisiana. Since Louisiana exports a considerable number of live P. clarkii to South Carolina, the potential presence of WSSV in these specimens raises concerns that this virus could infect native crustacean species in South Carolina. These native species of concern include commercially-and recreationally-important white shrimp and blue crab that inhabit brackish waters, and that are known to be susceptible to the effects of WSSV. To determine if *P. clarkii* is a vector for the WSSV, *P. clarkii* will be tested using molecular qPCR assays recently modified and optimized from Blaylock et al. (2019) by colleagues in the SC DNR Population Genetics Research Section. Researchers at the MRRI developed WSSV-positive tissues in January 2020 to verify the assay by inoculating *P. clarkii* and *P. setiferus* with WSSV. In addition, to date, 22 *P. clarkii* collected from the coastal plain of South Carolina have been screened for WSSV, none of which tested positive. Crayfish collections from Charleston County, SC, including on James, Johns, and Wadmalaw Islands, are ongoing. These qPCR methods will be used to screen samples of several tissue types, including gill, muscle, and pleopods obtained from *P. clarkii*. The results for this study will be in presence/absence form for all individuals that are screened. Since WSSV can also have significant impacts on estuarine crustaceans, sampling locations will focus on brackish water habitats where *P. setiferus* and *C. sapidus* would have a higher likelihood of being exposed if the virus is present.

The redeye bass (Bartram's bass) in the Savannah River Basin is one of three priority species included in the National Fish and Wildlife Foundation's Native Black Bass Initiative, and a species of highest concern in SC DNR's State Wildlife Action Plan. This listing is primarily due to the effects of hybridization with the Alabama bass, which was introduced into the reservoir systems in the Savannah River Basin in the 1980s. Since then, hybridization between the two species has been documented in the field, and confirmed by genetic analysis. SC DNR have recently captured Alabama bass and hybrid individuals in riverine habitats upstream of the reservoirs, while pure Bartram's bass individuals are increasingly confined to smaller rivers. While previous work by the SC DNR has documented that Bartram's bass populations are diminishing due to introgression with Alabama bass, key questions remain regarding the extent of this process in tributary streams. Preliminary assessments of Bartram's bass individuals and egg samples have been conducted to confirm species identity and the extent of hybridization of Bartram's bass with closely related shoal bass species throughout the range in the upper Savannah River Basin using probe-based quantitative PCR (qPCR). This approach using probes specific to Bartram's bass, or "all other" (currently largemouth, smallmouth, and Alabama bass), suggests that while it is feasible to distinguish pure Bartram's bass from hybrids with a degree of confidence, researchers may not be able to distinguish among other possible closely related

introduced black bass species hybridizing with Bartram's bass. In response, researchers at the SC DNR have developed a microsatellite-based genetic tool to investigate hybridization in black bass populations (specifically Bartram's bass) in the Savannah River Basin. Microsatellites are short sequences of DNA that contain variable repeating units of base pairs that can be thought of as "genetic fingerprints" of individuals. This variability, combined with a high mutation rate, make microsatellites an effective tool to investigate genetic structure and hybridization among populations. In addition to 10 polymorphic microsatellites developed for redeye bass, microsatellites originally developed for largemouth bass have been used for other black bass species to assess hybridization impacting endemic shoal bass in the Chipola River. Hierarchical STRUCTURE analysis suggests that black bass genotyped at 17 loci with sets of reference samples of congeneric species that occur in that part of the country (shoal bass, northern spotted bass, Choctaw bass, Alabama bass, Suwanee bass, and smallmouth bass) can be assigned to clusters with high confidence.

To date, researchers have completed the optimization of the marker suite, and have genotyped a total of 1,235 samples with the new microsatellite marker suite. Genotyping efforts funded by this project have included the completion of the black bass samples for the reference collection and an additional 200 field samples. The binning analysis was also completed for the new marker panel for the increased scoring efficiency and accuracy.

The development of an analysis protocol using STRUCTURE to identify genetic ancestry and hybridization in unknown field samples has been completed by the team. The STRUCTURE protocol analyzed genotype data from 266 reference species samples from eight confirmed species or hybrids (shoal bass, smallmouth bass, Florida bass, Florida bass X largemouth bass hybrids, Alabama bass, largemouth bass, spotted bass, and Bartram's bass), and all unknown field samples genotyped at 10 or more loci. A representative output was selected to extract and visualize results. Individuals are assigned as "pure" species if over 98% genetic ancestry results from a single species, "near pure" species if 90-98% genetic ancestry occurs from a single species, and "hybrid" if less than 90% genetic ancestry occurred from a single species. The SC DNR Population Genetics Team is continuing to process unknown field samples to increase sample sizes for informative analyses of gene flow patterns within species, as well as hybridization rate patterns across the landscape.

There have been no reports of Asian tiger shrimp to the USGS database during 2020. Researchers at the SC DNR Marine Resources Research Institute (MRRI) remain interested in understanding the invasion of the South Atlantic Bight and Gulf of Mexico by the Asian tiger shrimp, Penaeus monodon. The total number of tiger shrimp reported in SC is currently 468, with a size range of 58-330mm total length. Although reports have declined in recent years, it is likely that a portion of tiger shrimp collected may be kept for consumption instead.

Texas

Monica reported that they are continuing to focus on giant salvinia, Toledo Bend, and Caddo Lake. With the Corona virus, their contractors are still working every day to treat water bodies. The inhouse boats and aquatic habitat enhancement teams have not been treating due to the Corona virus, but might resume soon.

Giant salvinia is repeatedly being found in several water bodies. It has been extricated from Brandy Branch Reservoir, Lake Fork Reservoir, Martin Creek Reservoir, and Lake Athens using booms and herbicides. These have been effective at containing it.

Crested floating heart and yellow floating heart are infesting several lakes in the state, but crested floating heart has been successfully extricated from Lake Athens.

Zebra mussels are now in 30 water bodies in the state. A new infestation has been found in O.H. Ivie Lake, which is a few hundred miles upstream from some other water bodies that are infested on the Colorado River. The status is not fully known yet. Zebra mussels were found in a water tank that draws water from the reservoir. Also found was a zebra mussel veliger at a distant location, and zebra mussel eDNA at another location. The lake is classed as 'positive'. It is being monitored.

Zebra mussels have been found in Marble Falls, which is another downstream spread in the Colorado River. They have also been found in Granger Lake and Lake Walter E. Long, which pulls water off the Colorado River.

Zebra mussel monitoring in the spring was uncertain due to Covid-19, but it will move forward with sampling.

Monica said they have been working on a comprehensive rule change package over the last several years for exotic species regulations. They are expecting it to be proposed to the commission in August of this year. The rules could be enacted by early next year. **James** asked what the regulations cover. **Monica** stated that they will be adding some of the Lacey Act list of species that could have moderate potential for survival in the state. They are also going to propose having some oversight over private water bodies where tilapia are being stocked. There are continued reports of tilapia showing up in rivers around the state, and concerns from conservation partners. People can have Mozambique tilapia stocked in private ponds, with zero oversight from the state. Heavy rains can cause pre-compoundments to overflow. **Monica** did a spatial conservation assessment to look at potential fish species of greatest conservation need in the state that might be expected to be impacted by tilapia, based on documented impact to their congeners. She looked at habitat degradation and preexistence of tilapia as a degradation factor. She identified a conservation zone and a stocking zone. The potential number of tilapia pond stocking customers was also looked at by using data from permitted tilapia sellers who were selling to individuals other than food markets. In the stocking zone, it would not be required to get approval from the department. In the conservation zone, an assessment would be required of each site prior to approving tilapia to be sold for that location for stocking, with the goal that if it is a pre-compoundment that overflows, then tilapia stocking would not be allowed to be introduced there.

Monica stated that when the rules were first put into place, and the last revisions done, there were no zebra mussels in the state. There are now issues with water supply facilities, private hydro-electric facilities, etc. due to them not having a way of disposing the zebra mussels. They can only be scraped off back into the water bodies. Transport and disposal measures are being looked at, which includes bagging the mussels before transport. The measures need to be effective in terms of biosecurity and also consistent with operations in each instance.

Citizens are required to have a permit to possess aquatic plants such as giant salvinia. Some citizens are pulling up salvinia from around their boat docks and placing it onto their property, and technically should have a permit. **Monica** said they are discontinuing this requirement for

the purpose of disposal and transport, and preferably if the salvinia is allowed to dry completely. Bagging rules still apply.

James asked if they are able to access water bodies on private property for aquatic plant control. **Monica** stated that they are not allowed to do that. Citizens are required to possess an exotic species permit. Occasionally, people will contact them about giant salvinia in their ponds. If it is determined that it is a risk for introduction into a water body, or counterproductive to their treatment effects, then a treatment will be done. They have received feedback from the Texas Aquaculture Association, who were supportive and interested in protecting native plant species.

Monica reported that they are working on four research projects. One of the projects is to study the potential impacts of zebra mussels on native mussels, and to establish baseline monitoring sites for that. A second project is to study calcium effects on zebra mussels, specifically looking at earlier life stages. A third project is to study whether planting native plant species might help to out-compete invasive hydrilla in water bodies in San Antonio that are a critical habitat for fountain darters. Endangered Texas wild rice will also be planted in the areas to study interactions between different species, and how it might contribute to the success of restoration efforts. A fourth project is to do population assessments and surveys of the bait industry due to issues in the state where coastal species such as sheepshead, minnow, and gulf killifish have been introduced into inland waters and some lakes. One issue in regards to bait reports is that a lot of species are "lumped" together. Assessments will be done to determine if the species are prevalent, and if there is a future risk of additional re-introductions. Hybridization and predation are also issues.

University/Research

Robert reported that he and a colleague have a paper accepted for publication in aquatic invasions on the life history and population dynamics of zebra mussels in Lake Belton in central Texas. This is the most southern of any zebra mussel population reports.

Robert said a graduate student of his is defending her dissertation on the population dynamics of three populations of zebra mussels, encompassing three to five years of studies, in three different lakes. When it is posted by the university, he will send **James** the URL.

MS/AL Sea Grant

Kristina reported that they put together an informational flyer about not flushing aquarium fish. They will be distributed to veterinarian offices, schools, and pet stores.

NOAA

Tom reported that they are going to put out a publication on a herbivorous crab that is a mangrove predator. They are black, with red claws. They live in trees, and only come out of the trees to mate. They are moving into Florida, and are now moving farther into north Florida. **Tom** said they saw hundreds of them in Coral Gables waterways last January.

NOAA has 10 Habitat Focus Areas (HAFs) around the nation that are targeted places where NOAA is partnering to improve habitat conditions for fisheries, protected resources, and coastal communities. Biscayne Bay is listed as one of the focus areas. **Tom** is using invasive species lists from Biscayne National Park and other entities in the area. Most of the lists are out of date, and there are no staff to do updates. **Tom** has collated the lists into a baseline list for Biscayne

National Park and that area. He told the panel members that he might contact them for any additional information that can be added. He will complete the list by spring 2021.

Tribal

Craig reported that before COVID-19, they were actively performing surveys. Several patches of salvinia were removed. They also finished their canal clean-up, where rotenone was used. He said 95% of the fish they removed were exotics, such as spotted tilapia, sailfin catfish, and walking catfish. They also electro-fished largemouth bass and gar before the rotenone treatment was done. After the treatment, there were hardly any juvenile species, which indicates that the exotics are out-competing them at nesting sites and eating their eggs. Through a partnership with the USFWS, they re-introduced bass and gar, along with bait fish such are bluegill and shiners.

Through a partnership with FL FWS, they are removing exotic species from three islands. The project is on hold due to the Everglades being too dry, and crews cannot get out to the islands.

Craig said they have been actively working with the Miccosukee school to teach the children about exotic species and removing cane toads and Cuban tree frogs from around houses and the reservation.

US Forest Service

Kevin said that they are currently updating their aquatic invasive species list. It should be completed in the next few months.

Other Business

James reported that funding for the Gulf and South Atlantic Reginal Panel on Aquatic Invasive Species has been increased to $50,000.

Next Meeting Time and Place

Due to COVID-19, the dates and location of the next meeting will be decided at a later date.

Public Comment

James provided the opportunity for public comment. There was none. The meeting adjourned at 12:00pm.

Action Items

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When it is posted by the university, **Robert** will send **James** the URL on a dissertation by one of his graduate students on the population dynamics of three populations of zebra mussels, encompassing three to five years of studies, in three different lakes.