GULF & SOUTH ATLANTIC REGIONAL PANEL
ON AQUATIC INVASIVE SPECIES
MINUTES
Wednesday, April 21, 2021 (Via GoTo Meeting)

On Wednesday, April 21, 2021, Chairman **Peter Kingsley-Smith** called the meeting to order at 8:30 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
Dave Armstrong, AL DWF, Tanner, AL
James Ballard, GSMFC, Ocean Springs, MS
Rob Bourgeois, LDWF, Baton Rouge, LA
Wesley Daniel, USGS, Gainesville, FL
Rob Emens, NC DEQ, Raleigh, NC
Pam Fuller, At-Large Member, High Springs, FL
Lisa Gonzalez, HARC, The Woodlands, TX
Nathaniel Hancock, NC DEQ DMF, Morehead City, NC
Leslie Hartman, TPWD, Palacios, TX
Chuck Jacoby, Indian River Lagoon NEP, Palatka, FL
Peter Kingsley-Smith, SC DNR, Charleston, SC
David Knott, At-Large Member, Charleston, SC
Monica McGarrity, TPWD, Austin, TX
Robert McMahon, UT Arlington, Arlington, TX
Matt Neilson, USGS, Gainesville, FL
Craig Newton, AL DCNR, Dauphin Island, AL
Chris Page, SC DNR, West Columbia, SC
Jim Page, GA DNR, Waycross, GA
Michael Pursley, MS DMR, Biloxi, MS
Matt Phillips, FWC, Tallahassee, FL
Dennis Riecke, MDWFP, Jackson, MS
Kristen Sommers, FWC, Tallahassee, FL
Cindy Williams, USFWS, Atlanta, GA

Staff
Ali Wilhelm, GSMFC, Ocean Springs, MS
Joe Ferrer, GSMFC, Ocean Springs, MS

Others
Larry Bowman, MRI, Charleston, SC
Amy Benson, USGS, Gainesville, FL
Ash Bullard, Auburn University, Auburn, AL
Daniel Farrae, SC DNR, Charleston, SC
Kirstine Grab
Julie Holling, SC DNR, West Columbus, SC
Jeanette Huber, SC DNR, Charleston, SC
Susan Jewell, USFWS, Falls Church, VA
Deah Lieurance, University of Florida, Gainesville, FL

Katie O'Donnell, USGS, Gainesville, FL
Katie O'Shaughnessy, APEM, Ltd. Environmental Consultancy, UK
Susan Pasko, USFWS, Falls Church, VA
Jeff Schaeffer, Tennessee Tech University, Cookeville, TN
Adam Sepulveda, USGS, Gainesville, FL

Public Comment

Chairman **Peter Kingsley-Smith** provided the opportunity for public comment. No public comments were received.

Adoption of Agenda

A motion to adopt the agenda was made, and passed unanimously.

Approval of Minutes

The minutes of the December 17, 2020 GoTo Meeting were presented for approval.

After minor changes, a motion was made to approve the minutes. The motion was seconded, and the motion passed.

Overview of the Gulf of Mexico Horizon Scan Project

Katie O'Shaughnessy gave a PowerPoint presentation entitled "Gulf of Mexico Invasive Species Forecasting". Forecasting/Horizon scanning in the context of invasive species prioritizes the threat posed by species that are absent or not yet widely spread in a risk assessment area, and is a vital part of invasive species management and an essential element of an early warning system. The major taxonomic groups are: ascidians; bivalves; bryozoans; corals and anemones; decapods; echinoderms; elasmobranch; fish; gastropods.

The research question: What species are likely to be introduced, establish, and cause ecological and/or socioeconomic harm to coastal and marine habitats in the risk assessment area over the next decade. The risk assessment area is the northern Gulf of Mexico (omitting Florida); estuarine, coastal and marine habitats out to the edge of the continental shelf; no "deep water" species.

The overall objectives of the project are to: develop methods to assess potentially invasive species in the northern Gulf of Mexico, which can be repeated every 10 years; produce a "watch list" of the highest risk potentially invasive species; publish results in academic journal. There are five phases of the project: 1) Initial species list; 2) Narrow down initial species list; 3) Formal risk assessment; 4) Review; 5) Group discussions. These phases will ultimately lead to a ranked list of species.

The CABI horizon scanning tool is being used to develop the initial species list. It uses CABI data to generate a list of species that are absent in the risk assessment area, but present in areas with similar climates. Also being used is the LEMIS (Law Enforcement Management Information System) list. It is provided by the U.S. Fish and Wildlife Office of Law Enforcement. The list of species was imported to the U.S. over the years 2015-2019. The list of species was cross-checked with the Nonindigenous Aquatic Species (NAS) Database and Gulf Base, which identifies species that are already established. Established species were removed. Remaining species were checked in FishBase or SeaLifeBase. These databases use AquaMaps to model matching habitat/climate. Other sources used to develop the initial species list are: the

Smithsonian database, NEMESIS database, Obis database, general internet searches, published literature, and aquarium shop visits.

Narrowing the initial species list includes: the likelihood of introduction; likelihood of establishment; likelihood of ecological or socio-economic harm; whether it is known to be invasive elsewhere; does suitable habitat occur in the RA area; does the organism have attributes that indicate it could be invasive.

The formal risk assessment is the Aquatic Species Invasiveness Screening Kit (AS-ISK V2.1). The previous, taxon-specific invasiveness tool kits have been replaced by a single risk identification (screening) tool, AS-ISK, which is applicable to all aquatic plants and animals from any type of aquatic system (marine, brackish, freshwater). The AS-ISK was created by integrating the generic screening module of the ENSARS into the architecture of FISK v2.03. There are 55 total questions. The Question Guidance details each question, and provides helpful resources. The review process is done by someone other than the original author.

So far, the major taxonomic groups of ascidians, bivalves, bryozoans, corals and anemones, decapods, echinoderms, elasmobranch, fish, and gastropods revealed 145 potentially invasive species (and counting).

Florida's Horizon Scan Project

Deah Lieurance gave a PowerPoint presentation entitled "Using Horizon Scanning, Rapid Risk Assessment, and Consensus Building to Identify Invasive Species Threats to the State of Florida". Current approaches employed to predict and regulate invasive species in the U.S. occur post-introduction. Over 30 points of entry (airports, domestic, and commercial ports) make Florida a gateway for introductions to the southeastern U.S. There is an urgent need to identify unknown or emerging invaders so preventative measures can be implemented.

The goals of the project are to provide a ranked list of invasive species threats (all taxa, excluding microorganisms; identify pathways for arrival; create a framework for other regions in the U.S. Working groups were put together based on their expert knowledge and breadth of what they do for a living. Then we put together our A preliminary list of species was put together, and were divided into teams. There was a marine team, a plant team, a vertebrate team, and an invertebrate team. Eventually those were split into a terrestrial and aquatic team.

The CABI Horizon Scanning tool was used. Information from CABI Compendia datasheets is used to generate a list, which includes species that are absent from the selected 'area of risk', but present in 'source areas'. The initial list contained 9,629 species, which were divided into taxonomic groups. Species already in Florida were removed. The species were ranked by number of global records.

The Horizon Scanning workshop was held on December 11-12, 2019 in Gainesville, Florida. There were presentations on the lists, pathways, rapid risk and assessment tool. Group discussions were held to refine the methods, and breakout sessions by the taxonomic group to work on lists. The lists were narrowed to between 100-250 species.

There are three pathways for invasive species: vector, movement of commodity, and dispersal. Dispersal is a release in nature, escape from confinement, or transport contaminant. Vector is a

transport stowaway, such as the bio fouling on the outside of a ship. Movement of commodity is via a corridor and unaided dispersal.

Three risk elements were scored; likelihood of arrival (1-5); likelihood of establishment (1-5); likelihood of causing impacts (1-5), with a maximum score of 125. Confidence was assigned for each of the likelihood scores, and an overall confidence estimate was done for the final score. These confidence estimates ranged from very low, low, moderate, and high. Preliminary risk designations were done: >64 = High Risk species; 27-63 = Moderate Risk species; <27 = Low Risk species.

When the risk assessments were done, the review phase was done. All assessments receiving a score of 20 points or more were peer reviewed. Each taxonomic team was given time to read over reviewer comments and flag species requiring more discussion. Within taxa consensus was reached via ZOOM. All High and Moderate risk species were compiled for final consensus.

Preliminary results identified two prominent pathways for invasive species: escape from confinement, and transport contaminant. Marine species identified included: alewife (release in nature and corridor); agar agar (escape from confinement); sea snot (transport stowaway and contaminant). Terrestrial invertebrates included: cabbage moth (transport contaminant); cotton bollworm (transport contaminant and unaided); nun moth (transport stowaway and contaminant). Aquatic invertebrates included: zebra mussels (transport contaminant); red swamp crayfish (escape from confinement and release in nature); virile crayfish (escape from confinement). Plant species included: common privet (escape from confinement); common bent (escape from confinement and release in nature; scotch broom (transport stowaway and contaminant). Vertebrate species included: crab-eating macaque (escape from confinement); Japanese fire belly newt (escape from confinement); redbelly tilapia (escape from confinement and release in nature).

The next steps will be to collaborate with USGS to complete habitat suitability models for high risk species. Staff are currently working on improving guidelines and validation of the rapid risk screening tool. Additional species will be screened and ranked in 2022. Lists will be revisited at regular intervals to add or subtract species as new information surfaces. The final consensus is scheduled for May 27, 2021.

Southeast Region Horizon Scan Project

Cindy Williams provided a map of the geographic boundaries used to define the target region for the FY21 Regional Transportation Horizon Scan for the Southeast. The geographic scope was used in determining climate similarity between donor locations and the southeast.

The USFWS is completing a series of regionally-focused Horizon Scans that will eventually be used to form a nationally coordinated early detection, rapid response program, which is one of the goals of their Strategic Plan.

The scope for each horizon scan is defined by their regional partners. It must focus on transportation pathways, and on aquatic freshwater or brackish water vertebrates, micro-invertebrates, or plants.

Work on the project began in December 2020. Invasive species experts from across the southeast were involved, and 15 agencies and organizations provided information into the project scope.

The group agreed that the focus would be on floating leaf plants and submergent aquatic plants that theoretically could be transported as hitchhikers in international commercial shipments or the nursery and water garden trades. The group also specified their geographic focal area, which is the map that **Cindy** provided.

The USFWS has a risk assessment team that generated a list of species found in countries with similar climate to the southeast in the area covered in the map that were also frequent exporters of nursery and water garden products into the southeast. There is now a subset list of these species that are being screened for invasiveness risk to the southeast, using the Rapid Risk Screening Tool. They anticipate completing the project in fall 2021. A written report on the project, and risk screening reports for individual species will be made publicly available. Additional scans will be done in the future to address additional pathways that were not prioritized in this specific horizon scan.

Generally, the Great Lakes is the area where most of the horizon scanning has been done. Prevention funding from the USFWS was awarded to the southeast and the pacific northwest regions to do this kind of exercise. Eventually, all of the U.S. will be covered, with the exception of Florida, which is already being done.

Overview of the Southeast Cooperative Fish Parasite & Disease Project

Ash Bullard gave a PowerPoint presentation about his Southeastern Cooperative Fish Parasite and Disease Project ("The Cooperative"). The Auburn University diagnostics laboratory is available to state agencies, federal agencies, private fish culturists, individuals, and citizens who pay an annual fee to be a member of the cooperative to have access to the laboratory. The university has cooperative contracts with many state agencies. There are also contracts with funding agencies in the regional and national level.

Most of the lab work in aquatic animal health and disease diagnostics is focused on taxonomy, parasitology, virology, and microbiology. Pathogens, parasites, microbes, and viruses are a large part of aquatic nuisance/invasive species biology. The lab is a full spectrum analytical disease diagnostics lab.

Whirling disease in wild trout is a devastating disease. The pathogen that causes the disease is called *Myxobolus cerebralis*, which is an introduced species to North America that came in with infected rainbow trout or brown trout from Europe. The disease has been detected in the southeastern U.S., where it was considered not to range in that region. Whirling disease has been documented in wild trout populations in the southeastern U.S., and there is evidence of altered life cycle of *M. cerebralis*. Very little was known about *M. cerebralis* in the southeastern U.S. Early on, there was skepticism that it actually caused disease in wild trout populations. There was no documentation of this occurrence in the published literature. Upon further investigation by testing diseased trout submitted to the lab by cooperative member states, *M. cerebralis* was confirmed in trout. An extensive study was begun to test particular water basins in North Carolina. It was learned that the pathogen is not everywhere, but in certain streams, and established in certain trout populations, but not in all trout populations. The life cycle of the parasite is distinct in the southeastern U.S. Distribution, host specificity, life cycles, abiotic factors, etc. need attention. The findings of the study (Morphological and molecular confirmation of *Myxobolus cerebralis* myxospores infecting wild-caught and cultured trout in North Carolina (SE USA)) were published in peer review journals, which has led to significant additional research with other cooperative states.

In further studies of parasites in native trouts, another parasite species was found, completely distinct from *M. cerebralis*, although it looked very similar. The findings (A new species of *Myxobolus* (Myxozoa: Bivalvulida) infecting the medulla oblongata and nerve cord of brook trout *Salvelinus fontinalis* in southern Appalachia (New River, NC, USA)) were published in peer review journals.

In another case of diagnostics and parasite identification, a report was received from River Keeper groups in Georgia of a non-game species, a blacktail shiner, with large bumps on its body. After studies were done on the fish, it was discovered that a new parasite species was infecting the fish, which causes cysts on the skin of fish. The findings (A new species of the *Thelohanellus* kudo, 1933 (Myxozoa: Bivalvulida) infecting skeletal muscle of blacktail shiner, *Cyprinella venusta* Girard, 1856 (Cypriniformes: Cyprinidae) in the Chattahoochee River Basin, Georgia) were published in the *Journal of Parasitology*.

In yet another case of diagnostics and parasite identification, a cyst was found in a sicklefin redhorse. Once again, a new parasite species related to *M. cerebralis* was identified in the fish.

Gill lice are infecting trouts and white basses in the southeast U.S. These parasitic copepods infect the gill and mucal cavities of game fish in the southeast. There is a gill lice species on brook trout, and a different gill lice species on rainbow trout. The findings (Exotic "Gill Lice" species (Copepoda: Lernaeopodidae: *Salmincola* SPP.) Infect Rainbow Trout (*Oncorhynchus mykiss*) and Brook Trout (*Salvelinus fontinalis*) in the southeastern United States) were published in peer review journals. Ash said they are working with the states to figure out therapies and control measures, and also document geographically how wide-spread the parasites are so that bio-security input can be provided to the states.

Ash stated that they also go out into the field and assist state agency biologists with killing parasites. They have done field applications of salt, magnesium sulfate, organophosphate, formalin, and hydrogen peroxide treatments to kill parasitic copepods. If they have an application for a biosecurity measure that they want to develop, and there is not a therapy, Ash and his colleagues will assist them to develop it and implement it in the field. They recently assisted Georgia Department of Natural Resources with gill louse infections in white bass and striped bass, and to try and figure out how to kill the parasites. Because it is not known what other fishes this parasite can infect, it is important not to translocate it throughout the region. The fish needed to be treated in a hauling truck before being delivered to a hatchery in a different river basin. A trout hauling truck was acquired for different treatments and concentrations of the chemicals. As the fish were being exposed to the different treatments, copepods were removed to see if they were dead or not by using microscopes at the sites. A protocol was developed by researching different concentrations of chemicals, and coming up with a successful treatment that would kill the copepods.

Some River Keeper groups and citizen conservation groups are beginning to affect the day-to-day work of state and federal agency biologists. A recent incident of hundreds of dead fish in the Savannah River caused a local River Keeper group to post information about it on social media, and to confer with people who had no expertise in aquatic animal health. Several stories with incorrect information about the incident were posted. Ash and the Auburn University lab got involved to perform analyses on the dead fish. Fish specimens were sent to the Auburn University lab for tests, where it was determined that it was caused by something quite common, called red sore disease, caused by a co-occurrence of a ciliate, and a common bacterium,

Aeromonas hydrophila. There is a need for disease biologists to be involved in fish kills, which often times involve exotic invasive species. Ash and a colleague published a research article in the *Journal of Fish Diseases* entitled Morphology, phylogenetics and pathology of "red sore disease" (coinfection by *Epistylis cf. wuhanensis* and *Aeromonas hydrophila*) on sportfishes from reservoirs in the South-Eastern United States.

The University of Auburn lab has also worked with the Tennessee Aquarium related to parasite identification and species of concern on restocking endangered fishes into a river, but are concerned about pathogens.

Utah's eDNA Structured Decision Model

Adam Suplveda gave a PowerPoint presentation entitled "Environmental DNA Works, Now What?". Adam stated that eDNA is highly sensitive, only detects DNA, and often indicates species presence (but not always). There can be a mismatch between DNA presence and species presence, which causes outcome uncertainty. It's not always known when DNA is indicative of a species presence. Perhaps it had been deposited there from residue from a boat, etc. There is no guarantee that a specie's presence is going to result in colonization, establishment, spread, or impact. Given all this uncertainty, what rapid response actions should managers take after an early detection? The focus is on eDNA sampling. The hope is that this issue and question is generalizable across all methods, whether they are molecular or non-molecular.

Adam and other colleagues are focusing on a case of quagga/zebra mussels and eDNA in the Jordanelle Reservoir in Utah near Park City, a ski resort town. These mussel invasions are a costly problem that could have impacts that total in the hundreds of millions of dollars each year. There is a dam at Jordanelle Reservoir that produces hydroelectric power. It delivers water to Salt Lake City and many other suburban areas in that region. It is also a recreational hub for residents. Since the reservoir is so large, EDRR would be difficult and costly. The Utah Department of Wildlife Resources is starting an eDNA early detection program. A decision process template will be created so that issues can be dealt with proactively, and not reactively.

The decision model involves working with decision-makers and stakeholders to identify the problem, define the objectives, choose alternatives, evaluate the consequences, figure out the trade-offs, and then finally, to empower them to take action. They want to know what appropriate actions should be taken following >1 eDNA detections of QZ mussels at Jordanelle Reservoir, immediately and long-term.

Objectives were identified, such as to maintain recreational access by minimizing the number of closures (ramp days); protect the ecosystem by minimizing spatial extent and the likelihood of spread; protect water supply and infrastructure; maximize public support; and minimize cumulative costs of any type of management action.

Alternatives were identified, such as to do a containment by putting up watercraft inspection stations, or both contain with buoys and control with molluscicide.

For objective attributes, the likely outcome can be obtained by using empirical data, modeled data, or literature data. If that information is not available, expert opinion can be used.

For things done to reduce the likelihood of mussel spread to other lakes, there would be tradeoffs, such as closing ramps, which would impact recreation, and watercraft inspections,

which would upset some boaters. If the major importance to managers and stakeholders is to maximize public support, there is a high likelihood that no rapid response will be done. If the major importance is to prevent regional spread of the invasive species, it is likely that a decision will be made to initiate a rapid response. Another issue is that control costs are too high, and the effect too uncertain. Control costs would need to be reduced to become a viable option.

A general template is being created for managers and stakeholders by USGS for the decision process after eDNA detections. It is being refined to apply to different invasive species and different types of water bodies. A graphic user interface that managers can use will be designed by USGS so that they can enter their own parameters to evaluate their decisions after an early detection.

Adam told the panel members that if anyone is interested in working with USGS on a case study specific for their region, to contact him. This will take place in fall 2021. There will be meetings and training sessions.

What the "Lacey Act" is and isn't; Status of Injurious Wildlife Provisions

Susan Jewell gave a PowerPoint presentation entitled "What the 'Lacey Act' is and isn't and Status of Injurious Wildlife Provisions". In 1900, the Lacey Act was passed, the first major national conservation statute. Back in the 1800s, people were importing wild birds and mammals for various reasons, and intentionally releasing them into the wild without consideration of repercussions. There were two main purposes of the Lacey Act. The first was "to regulate the introduction of American or foreign birds or animals in localities where they have heretofore existed". This was primarily to stop the importation of wild animals and birds that were harming American agriculture and wildlife. The second purpose was "to prohibit the transportation by interstate commerce of game killed in violation of local laws". This was primarily to protect U.S. native wildlife. Two Titles in the Lacey Act are: Title 16, which is Conservation – Control of Illegally Taken Fish and Wildlife, and Title 18, which is Crimes and Criminal Procedure – "§42. Importation or shipment of injurious mammals, birds, fish (including mollusks and crustacea), amphibia, and reptiles; permits, specimens for museums; regulations".

The Act in the Fifty-sixth Congress in 1900 had no title. It was listed as Chapter 553. The name Lacey was not anywhere on the act, nor did it appear for almost 100 years. The purpose was "To enlarge the powers of the Department of Agriculture, prohibit the transportation by interstate commerce of game killed in violation of local laws, and for other purposes", "…and also to regulate the introduction of American or foreign birds or animals in localities where they have not heretofore existed", "That it shall be unlawful for any person or persons to deliver to any common carrier, or for any common carrier to transport from one State or Territory to another State or Territory…any foreign animals or birds the importation of which is prohibited…or killed in violation of the laws of the State…".

In 1960, amendments were made to Injurious Wildlife. Congress amended the Lacey Act by adding: fishes, mollusks, crustaceans, reptiles, and amphibians to the species that could be designated as injurious; more categories of interests that could be affected as justification for designating species (injury to human beings, forestry, or to wildlife or wildlife resources of the United States); exceptions under permit; and the shipment clause rewording.

What is covered now: Title 18 (Injurious) – wild mammals, wild birds, fishes, mollusks, crustaceans, reptiles, and amphibians, or the offspring or eggs. Title 16 (Trafficking) – Any fish

or wildlife, whether dead or alive, including without limitation any wild mammal, bird, reptile, amphibian, fish, mollusk, crustacean, arthropod, coelenterate, or other invertebrate, whether or not bred, hatched, or born in captivity, and includes any part, product, egg, or offspring thereof. Any wild member of the plant kingdom, including roots, seeds, and other parts thereof… which is indigenous to any state and either CITES-listed, listed pursuant to any state law for conservation.

Prohibitions: Title 18 (Injurious) – Importation and transport between shipping clause jurisdictions (of injurious wildlife). Title 16 (Trafficking) – Unlawful to import, export, sell, acquire, or purchase fish, wildlife or plants that are taken, possessed, transported, or sold in violation of any law, treaty, or regulation of the U.S. or in violation of any Indian tribal law; or in interstate or foreign commerce involving any fish, wildlife, or plants taken, possessed, or sold in violation of state or foreign law.

Penalties: Title 18 (Injurious Wildlife) – Misdemeanor: strict liability for violations; up to $5,000/$10,000 fine or up to 6 months jail or both. Title 16 (Trafficking) - Class A misdemeanor: "knowingly" for violations; up to $10,000/$200,000 fine or 1 year in jail or both; other civil, criminal, and forfeiture penalties.

Amendments adding taxa of organisms: Title 18 (Injurious) – 1960: added fishes, reptiles, amphibians, mollusks, and crustaceans. Title 16 (Trafficking) – 1969: added amphibians, reptiles, mollusks, and crustaceans NATIVE; 1981: added endangered native plants, fishes; 2008: added trees and plant parts.

Interstate Transport: 1900 – Prohibits interstate transport of injurious wildlife. 1960 – (18 U.S.C. § 42 (a)(1)) states: "The importation into the United States, any territory of the United States, the District of Columbia, the Commonwealth of Puerto Rico, or any possession of the United States, or any shipment between the continental United States, the District of Columbia, Hawaii, the Commonwealth of Puerto Rico, or any possession of the United States…is hereby prohibited." The latter clause is known as the "shipment clause".

In 2017, a lawsuit was filed by the United States Association of Reptile Keepers against USFWS over the meaning of the shipment clause's terms for interstate shipping. The Circuit Court's decision was "We therefore decline to conclude that Congress, by implication, altered the meaning of the shipment clause's terms so as to criminalize the interstate shipment of every Lacey Act species. Rather, the clause continues to mean what it has meant since its enactment: it prohibits the shipment of injurious species between the listed jurisdictions, including to and from the continental United States, but it does not speak to shipments between the 49 continental states."

In March 2021, a new bill was introduced to amend Title 18, United States Code 42, to enhance protections against the importation, and transport between states, of injurious species, and for other purposes. It also includes language for emergency listing and prohibition of importation and interstate transportation for species not native to the United States unless already imported in more than minimal quantities or Secretary determines it does not pose a risk. This Act would be called the "Invasive Fish and Wildlife Prevention Act of 2018". This Act is separate from the Lacey Act. Prohibitions in Section 7 of the Interstate Transport in HR 6362 states "it is unlawful for any person subject to the jurisdiction of the United States to import into the United States or transport between states any wildlife designated as an injurious wildlife taxon or taxa". There are

736 injurious species listed in the Wildlife Regulations section. At listing, 288 species were not established, and 94% were listed preemptively. None of those species has established since listing.

Final Results of the Model Bait Regulations Project

Kristina Alexander gave a PowerPoint presentation on the Model Bait Regulation for Limiting Invasive Species project she has been working on. The Mississippi-Alabama Sea Grant Legal Program (MASGLP) received funding from the U.S. Fish and Wildlife Service and the Gulf States Marine Fisheries Commission to develop model regulatory language for use by Gulf and South Atlantic states to limit the spread of invasive species through the live bait pathway. MASGLP researched the laws and regulations of the Gulf and South Atlantic states, considering any rule addressing invasive plants and animals, as well as laws addressing bait. **Kristina** provided links in her PowerPoint to Significant Laws and Regulations Addressing Invasive Species and Bait for the five gulf states, plus North Carolina, Puerto Rico, Georgia, and South Carolina.

Additional research was conducted by reviewing bait laws in other states, and a draft Model Bait Regulation was produced from the combined research. The draft shared with state fish and wildlife experts, including lawyers, requesting comments. The comments were incorporated into the final version. **Kristina** provided a link in her PowerPoint presentation to the final version.

This rule is designed to limit the spread of invasive species from the use of bait. It limits species that may be used as bait, and also addresses how invasives can be unintentionally introduced via bait containers. It considers pathogens as invasives that can be regulated. Invasive species laws and regulations in most states do not address bait users. In some cases, the rule that bans the release of nonnative species exempts bait.

The rule will change the way live bait is used. Bait cannot be carried from one waterbody to another without replacing the water at the time of leaving the waterbody. If invasive species are present in a body of water, fishermen are not allowed to remove anything other than game fish. They will be required to keep a receipt for bait purchased while they still have the bait in their possession. It proposes a $2 fee increase for fishing licenses to be used for invasive species education and eradication. Informational pamphlets would be given to everyone who purchases a fishing license. Overall, it is believed that this will benefit recreational fishers by improving fishing spots.

The rule will change some practices of state resource officials. It should make some aspects easier for natural resource officials by allowing lists of invasive species, including those allowed to be used as bait, to be maintained without undergoing regulatory or statutory review. It does add to the role of natural resource officials by requiring public notice of contaminated waterbodies. States will need to maintain a list of waterbodies containing invasives (or recently treated), and that list, and a map of those waterbodies, needs to be available online, and regularly updated.

The rule authorizes agencies to check species used as bait, even when native, to see whether they carry an invasive pathogen. Additionally, the rule indirectly affects imports by stopping states from exporting bait without a permit.

Update on New Introductions

Wes Daniel gave a PowerPoint presentation entitled "Update on New Introductions from the NAS Database". For the period of 10/01/2020 – 4/19/2021, there have been 25 NSA alerts. The top states are Georgia (6); Florida (5); South Carolina (4); Texas (4). Data sources include: literature (6); NAS sighting report (9); personal communication (10). Taxonomic groups include: plants (7); fishes (7); Australian spotted jellyfish alerts (5).

New species to the U.S. were recently discovered. In February, a tigerfish was found by a Dauphin Island Sea Lab staff member in an overflow creek in a tidal pool in Dauphin Island, Alabama. The specimen was collected and is now on display for educational purposes. This is most likely an aquarium release. An Asian river prawn was also discovered. It potentially traveled over in ballast water. It has the potential to be high impact on the native fauna because it has a high degree of environmental adaptability by being able to migrate from fresh to brackish water. It potentially traveled over in ballast water, but could also be an aquarium dump.

The Australian water clover is now established in Alabama, Georgia, North Carolina, Texas, and Washington. Its means of introduction was potentially via aquarium releases. The Australian spotted jellyfish is established in the northern Gulf of Mexico, and off the coast of the Carolinas. Its means of introduction was via the polyp stage hitchhiking with ships or other seagoing infrastructure.

In the spring, seven webinars on eDNA in the NAS database were held. There were 164 participants. Three steps were discussed: experimental standards, stakeholder backing, and integration into NAS. Three products are being developed: community standards; communication plan; displaying eDNA on the NAS database. **Wes** said right now they are still working on what it will actually look like as they go forward to put the data onto the database.

An infestation of zebra mussels in aquarium moss balls in pet stores all over the U.S. is being investigated. At this time, 41 states have verified that they had moth balls infested with zebra mussels. US Fish and Wildlife and the USDA responded very quickly, with help from border patrol. Importation of the moss balls has been restricted to only two airports – LAX and JFK. The USDA will do the first review of any new imported moss balls to look for any pests or pathogens, followed by US Fish and Wildlife. These moss balls come in large crates of hundreds of thousands. Most balls are imported from the Ukraine. There are investigations being managed by the Office of Law Enforcement on a national scale. Numerous states are also investigating and taking their own legal actions.

The USGS and US Fish and Wildlife are collaborating on a project called the National Horizon Scan of Organisms in Trade. The project will be completed in phases. The goal of this project is to identify regional hotspots at the highest risk of invasion from watch list of freshwater species. This information will be provided to stakeholders through online interactive maps housed on the NAS database. The project will address the arrival, establishment, spread, and impact of invasive vertebrate species within the organisms in trade pathway. The proposed approach will review tens of thousands of organisms in trade (OIT) to identify species that have a high risk of invasiveness in the U.S. The project team will reduce the OIT to a manageable number of higher risk species. The project team will also evaluate a species invasion history and known impacts based on expert knowledge. Watch lists will then be developed, which can be utilized in many ways.

The project will be completed in October 2021. The proposed products from the project include: A global list of the highest-risk traded species that have the potential to become invasive in the U.S.; a regional watchlist of OIT species of high risk; a public interface on the NAS web page providing easy access to the watch lists, and species profiles highlighting the high-risk species; creation of ArcGIS Server web service layers of any maps for use by stakeholders; publish any automation tools developed on code.usgs.gov; publication of the results of the project. The state invasive species lists will help to prioritize species for NAS Tools, including the Flood and Storm Tracker (FaST), and provide information to congressional members when opportunities arise.

Discussion on Southeast AIS Grants

Cindy Williams reported that the Notice of Funding Opportunity for state plans has come out, and if it has not yet been submitted, states should do so. The due date is April 30, 2021, and there will not be an extension. The deadlines that their internal accounting systems have require that requests for funding are received by September 30th because there is a two-step process.

USFWS has begun discussions for the invasive carp grants. There has been new guidance for what legislation will be using for the invasive carp grants for this year. Everyone will be getting a new grant this year for both the invasive carp grants and for state plans. There is no 25% match or limit on indirects for the invasive carp grants like there are with state grants. There are no final numbers yet.

As for the GSARP small grants process, USFWS will be amending that grant this year to add some additional funds. It is not yet known how much it will be. A Notice of Funding Opportunity will need to be sent out as soon as possible so that they can get the funding from last year identified, and then any new grants that they would award this year would be part of that. The number of grants awarded will be based on how much funding is received.

Dennis asked when the Notice of Funding Opportunities will come out, and when the grants might be awarded. **James** stated that final funding from USFWS has not yet been awarded, so it will most likely be this summer. The funding from last year will be combined with this years.

State Reports/ Members Forum

Alabama

Saltwater report:

Craig Newton reported that several invasive species have been documented in Alabama coastal waters. The bocourt swimming crab, tessellated blenny, Australian spotted jellyfish, Asian green mussel, Asian tiger shrimp, and red lionfish have been documented, although non-validated or undocumented reports of additional invasive species likely exist. The current status of the Australian spotted jellyfish and the bocourt swimming crab does not indicate that these two invasive species pose an imminent concern. The 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, however, and red lionfish continue to be invasives of heightened concern, and their broadened distribution, increased abundance, and/or documented negative effects on native species warrants concern.

The latest nonnative observed in the marine waters of Alabama was a single crescent grunter. The specimen was collected on February 28, 2020, but was not reported to the appropriate officials until March 29, 2021. The specimen was collected at the Dauphin Island Airport, and was maintained in an aquarium at Five Rivers Delta Resource Center. The ADCNR/MRD was notified once the Five Rivers staff realized the fish was not native to Alabama. The fish is currently in quarantine at the Dauphin Island Estuarium, and will be displayed for outreach purposes to educate the public on the problems associated with invasive species.

The Amazon red tail catfish was observed in Alabama's marine waters in July 2016. The specimen was collected in a recreational crab trap at a private dock on the Bon Secour River. A single bocourt swimming crab was collected in a commercial crab trap during a November 2016 ADCNR/MRD onboard fisheries observation trip. The exact location is unknown, but the general location of capture is south of Lillian Bridge and north of Ross Point in Perdido Bay. No observations have been made since the first observation in 2007 until the 2016 observation.

The Asian tiger shrimp has been a species of concern since 2006 when it was first observed in Alabama's inshore waters. After the first individual was documented, captures have increased. From 2006 to 2009, the distribution was primarily restricted to Alabama's southern inshore waters, but its distribution extended the northern Mobile Bay and into Perdido and Wolf Bays in 2011. The 43 confirmed reports during 2011 indicate the Asian tiger shrimp occurs within all of Alabama's primary estuary basins; however, the concern for tiger shrimp has decreased within the commercial shrimping community, which has resulted in fewer validated reports. Despite the reduction in validated reports, AMRD personnel communications with commercial shrimpers indicate a significant abundance of tiger shrimp occur within Alabama waters.

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. In December 2012, AMRD received a grant from Gulf States Marine Fisheries Commission (GSMFC) 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. Additional funding was secured from GSMFC to continue the monitoring in 2014, and continue and continue increasing public awareness. Fishery-independent monitoring of reefs offshore of Alabama report a pattern in the lionfish invasion. Remotely Operated Vehicle (ROV) surveys within the Alabama Offshore General Permit Reef Zone from 2011 through 2015 indicate a widespread distribution of lionfish between 10 nm and 50 nm offshore of Alabama. From 2016 to 2019, spearfishing tournaments were held to specifically target red lionfish. 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 the 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. A concern exists due to the COVID-19 pandemic that outreach activities to increase awareness of invasive species were limited, and spearfishing tournaments that include red lionfish as categories were cancelled due to the pandemic. This limited the control of population increase and distribution of lionfish. On the other hand, Alabama resource managers made a significant stride in covering regulatory gaps observed in the Lacy Act.

Freshwater report:

Dave Armstrong reported that Steve Rider and other ADWFF staff have been updating portions of the Alabama ANS statewide plan since Fall 2020. A final draft copy should be ready for submission to the National Aquatic Species Task Force for a re-review in Spring 2021.

ADWFF staff implemented staff field collections, reconnaissance and assistance to cooperators targeting Asian carp during CY 2020 (using gillnets and electrofishing) to determine abundance and distribution using standard methods in Alabama water of the Tennessee River. Collections and surveys were made in four reservoir pools. Silver carp were captured during two Fall collections at two tributaries, only within Pickwick Reservoir. Plans for 2021 include expansion of sampling program and staff.

The infestation and control of apple snails in Threemile Creek in Mobile are being led by the Mobile Bay National Estuary Program (MBNEP). A contractor was recently selected to implement control measures within Langan Municipal Lake as soon as possible.

Zebra mussels were documented in Holt Reservoir within the Black Warrior River watershed. ADWFF malacologists have discussed reconnaissance surveys in Holt pool and adjoining areas downstream.

Japanese mystery snails have recently been documented in the Black Warrior River watershed. These snails were previously documented in Mobile County at Pierce Creek in 2003.

ADCNR hired its first ANS coordinator to work within the ADWFF office in Tanner during November 2020. This is a state-wide appointment, though focus will be on Asian carp monitoring and control-eradication in the Tennessee River valley.

Florida

Matt Phillips told the members that he put a link for FWC's annual report in the Chat section of the meeting.

Mechanical projects have increased in the invasive plant program. Lake Okeechobee is under maintenance control for floating plants. FWC is in good shape maintenance wise for most of their invasive species.

FWC is looking into a potential hybrid eel grass species in south Florida lake systems. A paper will be published shortly on this.

Monitoring on fish health issues continues in response to numerous social media posts that give mis-impression about fish increasingly being seen with sores on their skin. This is being researched, but FWC sees no anomalies that are different from what they have been seeing over the last 20-30 years.

FWC has successfully eradicated a salvinia population from the Rainbow River area of central Florida. At one time, there were approximately a dozen sites with Salvinia, but there are now about four that still have active populations. Eradication efforts continue.

Kristen Sommers reported that the 2021 Lionfish Awareness and Removal Days (LRAD) is scheduled for May 15-16, 2021 in Destin, FL. Visitors will get to taste lionfish, watch fillet demonstrations, participate in family-friendly games, and much more. This event is held in conjunction with the state's largest lionfish removal tournament, the Emerald Coast Open Lionfish Darby on May 14-16, 2021. Participating restaurants create and sell lionfish dishes.

The Florida Fish and Wildlife Conservation Commission (FWC) is planning to hold the 2021 Lionfish Challenge. The goal of the Challenge is to encourage and reward recreational and commercial divers for removing lionfish from Florida waters. The Lionfish Challenge will be May 21st through September 6th, 2021. At the end of the Challenge, the recreational diver with the most lionfish, and the commercial diver with the most weight of lionfish, will be crowned Lionfish King or Queen for their category. Participants can also win bi-weekly raffles.

In October 2020, the FWC's Nonnative Fish and Wildlife Program (NFWP) received a report of green mussels in Little Lake Worth in Palm County. Photographs of mussels removed from a private dock and ladder were confirmed by FWC as nonnative green mussels. This nonnative species was first discovered in Tampa Bay in the late 1990s, rapidly increased in abundance, and soon spread south all along east and west Florida, and into the Keys. The FWC and other partners are currently undertaking major restoration projects in the Lake Worth Lagoon, including creating nesting islands surrounded by rip rap intended for native oyster habitat. Green mussels are a bio-fouling organism, and there are concerns that they could displace native oysters, and cause substantial economic fouling issues for ships and structures such as floating docks, channel markers, pilings, and intake pipes. The initial survey of Little Lake Worth discovered green mussels at four locations with floating docks. Little Lake Worth is directly connected to the main Lake Worth Lagoon. Concern that green mussel larvae could spread into Lake Worth Lagoon, and settle on critical restoration habitats and submerged infrastructure initiated additional surveys for the presence of this species. Between October 2020 and March 2021, 25 sites were sampled in the area. All but one of the sites sampled in Lake Worth Lagoon were free of green mussels, but they were present in three of the five sites in Little Lake Worth Lagoon. Additionally, FWC staff have confirmed green mussels at several locations further north in the Intracoastal Waterway, including the Ft. Pierce and Sebastian inlets. Green mussels have been reported from these areas in the past, but they were assumed eradicated due to cold water temperatures. The FWC is working closely with partners to monitor the presence of this species in Lake Worth Lagoon, and assess the threats it may pose to the natural environment and ongoing restoration efforts. A flyer is being developed to aid in outreach for the public that provides information on the identification and reporting of green mussels to the FWC using the IveGot1 app or www.IveGot1.org. FWC staff will review the reports to monitor the presence of green mussels in Lake Worth Lagoon and surrounding areas.

The FWC recently contracted researchers with the University of Florida (UF) to conduct bio-profiles and Aquatic Species Invasiveness Screening Kit (AS-ISK) risk screen on 10 nonnative fish and wildlife species, including African clawed frog, western clawed frog, blue-ringed octopus, clown knifefish, four species of loricariid catfish (*Pterygoplichthys anisitsi*), cane toad, and spectacled caiman. The university completed bio-profiles and risk screens for four species of loricariid catfishes with native ranges in the Orinoco and Amazon river basins, or rivers in Paraguay. These species are large-bodied, heavily armored fish commonly referred to as sailfin catfish due to an elongated dorsal fin. Aquarists use them to clean algae from their tanks and eat surplus food. Due in part to their popularity, they are one of the most widely-introduced fishes, with established populations in many tropical and subtropical regions of the world. They cause a

variety of negative ecological impacts, including competition for food, spawning burrows, and habitat alteration such as burrowing activities, alteration of nutrient cycling, or destruction of aquatic macrophytes. The AS-ISK analyses yielded scores for the four *Pterygoplichthys* species similar to other high-risk species that represent a hazard to Florida. The 10 bio-profiles and AS-ISK risk screenings for species covered in the contract will be completed by June 2021. The FWC will use the information provided in the risk screen to guide future management actions.

During this report period, the FWC received on report of tiger prawn from Biscayne Bay in Miami-Dade County.

Despite COVID-19 travel restrictions, a "virtual" Fish Slam was held the week of March 15, 2021. Forty fish biologists from 10 organizations sampled 33 sites from Jacksonville to Homestead, Florida. Participants were able to take day trips to sample local areas near their home base. Eighteen species of nonnative fishes were collected or observed. No new nonnative species were collected, but the FWC and partners collected some unusual species, including Chanchita, Jack Dempsey, and Midas Cichlid from a new location in Broward County.

Bullseye snakehead are present in many canals in southwest Palm Beach County, but have only recently moved into the Lake Ida-Osborne chain-of-lakes system in southeastern Palm Beach County. These lakes are part of a large, interconnected canal system, and bullseye snakehead likely entered Lake Ida via one or more of these canals. These lakes, although highly modified from their natural state, represent aquatic habitats different than what is found in the manmade canals in the area. An FWC multi-divisional grant proposal was funded to examine how bullseye snakehead, largemouth bass, and butterfly peacock use the "natural" habitats, and to compare stomach contents to these three species collected in manmade urban canals. Stomach content collection of the three species began in July 2020, and will continue for at least a full year to examine seasonal differences in diet and diet overlap between species. Baseline fish community data in the major canals and lakes in the study area were collected in December 2020 by conducting 61, 10-minute electrofishing transects in which all fish were collected, weighed, and measured. An additional 75 bullseye snakehead presence/absence transects were conducted in lateral canals in the study area. Staff will repeat these transects to detect potential changes in the fish communities, and to monitor the distribution and abundance of bullseye snakehead. In March 2021, staff surgically implanted radio transmitters into 25 of each of the three target species. Fish movements will be monitored by three shore-based remote receivers stationed at the mouth of canals leading out of the lake to determine if fish move out of the lakes, and by handheld receivers on boats to document movement and habitat use by individual fish. The fish were also tagged with reward tags to encourage anglers who catch these fish to report it to the FWC. Anglers provide catch information, and return the radio transmitter to claim their reward, but may keep the harvested fish.

The goal of the FWC's standardized electrofishing program is to monitor native and nonnative fish populations in southeast Florida urban canals. The FWC's Wildlife Impact Management Section coordinated with FWC's Division of Freshwater Fish Management staff to develop a modified sampling protocol based on their long-term monitoring program. The new protocol keeps three fixed-starting point transects that the FWC's NFWP has used since 1997. Additionally, three to five randomly chosen daytime transects were added to this protocol to increase the probability of detecting a new nonnative fish species. In October 2020, the FWC's NFWP sampled six core canals, using these modified protocols. The canals have fish communities representative of those found in the metropolitan Miami-West Palm Beach area.

These canals have been sampled using standardized methods since 2000. The addition of new transects increased the mean number of nonnative fish species collected in the six historically-sampled canals by 33%, and the number of native species collected increased by 35%. No new nonnative species were collected, but staff documented a range extension for clown knifefish. A total of 3,662 fish were collected from six urban canals. Native fish (27 species) comprised 56% of the total catch, and nonnative fish (18 species) comprised the remainder. One additional nonnative, and five native fish species were collected from the supplemental transects, but combined, represent <1% of the total number of native fish collected in these samples.

In March 2021, the FWC was notified of the presence of zebra mussels and their microscopic larvae in moss balls being sold in some pet shops throughout the U.S., including Florida. A rapid, multi-divisional response within FWC resulted in contact with distributors of the moss balls within the state and their customers to encourage pet shops to remove moss balls from their shelves and properly dispose of them. The FWC updated the zebra mussel species profile website with decontamination protocols for pet shops and home aquarists, to prevent zebra mussels from being released into waterways. The FWC also issued a news release to inform home aquarists of the potentially serious environmental impacts of zebra mussels, how to safely dispose of moss balls, and how to decontaminate aquarium water that might have contained zebra mussels. The FWC continues to work with state and federal partners to address this national issue.

The FWC has received a small number of singleton reports of arapaima through social media posts, anglers, and concerned citizens. Arapaima are one of the largest freshwater fish, and can reach lengths of 10 feet and weigh 400 pounds. They are listed as a Conditional species in Florida, which limits their possession to individuals or institutions conducting research, commercial import or export business, and for public exhibition. Arapaima cannot be kept as pets by home aquarists. Permitted aquaculture facilities can raise and sell them only as a food fish. The FWC Law Enforcement Division is investigating these reports to discover the source(s) of the released arapaima. The FWC and U.S. Geological Service are working collaboratively with the U.S. Fish and Wildlife Service to develop a proposal to fund an Early Detection/Rapid Response project to prevent the establishment of this potentially detrimental fish species in the U.S. Outreach materials will be developed to inform the public on the potential environmental consequences of releasing arapaima, and to encourage the public and anglers to report observations or catches to FWC's Exotic Species Hotline.

The Snakehead Round-up has been postponed until September or October 2021. The FWC will act as the weigh-master, and provide outreach materials to participants and spectators. These tournaments provide valuable data on effort and harvest of bullseye snakehead, and catch rates of co-occurring largemouth bass.

Georgia

Jim Page reported that COVID-19 continued to have impacts on many of their invasive species efforts during the reporting period.

Efforts to remove flathead catfish from the Satilla River are scheduled to resume in late spring 2021, and will continue these efforts through early/mid fall.

Georgia DNR staff continue to remove blue catfish from the Satilla River. Removal of this second nonnative species occurs simultaneously during flathead catfish removals. Removal efforts for 2021 are scheduled to resume in late spring.

During this reporting period, island apple snails were discovered by GA DNR staff in Pipe Maker Canal in the Savannah River in Chatham County. Dozens of specimens were observed, along with egg castings everywhere. No treatment was done – species are already present in that watershed.

In early March, GA officials, along with all other U.S. states, were notified of contaminated moss balls being shipped to PetCo and other pet stores that had been found to contain zebra mussels. GA DNR staff visited several pet stores, and confirmed the presence of zebra mussels in moss ball containers in PetCo and PetSmart stores. Following a national recall of products, GA DNR staff visited stores in person to collect contaminated specimens for destruction; issued a press release to inform the public of the issue; developed and shared a multitude of educational materials to inform aquarium owners as to how they could clean their aquariums and prevent the release of zebra mussels; and conducted multiple interviews with TV and radio outlets to help spread the word. Information pertaining to the contaminated moss ball issue was put on the GA DNR ANS website for the public to have easy access to. Additionally, GA DNR staff developed tracking tools in ArcGIS to track visited or contacted pet stores.

Commercial fishermen continue to periodically report catches of Asian tiger shrimp in GA waters, though such incidences remain low. Reports continue to be provided through the new reporting tool on the GA DNR-WRD website. One report in March 2021 indicated 10 tiger shrimp were captured during 14 days of shrimp trawls occurring off the GA coast. GA DNR will continue to monitor these occurrences. During fishery-independent standardized sampling conducted monthly at over 36 sites coastwide to assess Penaeid shrimp and blue crab populations, GA DNR staff may potentially intercept tiger shrimp. No tiger shrimp were captured in these surveys during the reporting period.

An Indo-pacific swimming crab was caught by a commercial shrimp trawler in September 2020 off St. Simons Island in Glynn County, and given to the University of Georgia Marine Extension Service. The crab was euthanized.

Staff have continued to make additional updates to the GA DNR Aquatic Nuisance Species web page.

Staff developed and printed a 12-page Aquatic Nuisance Species (ANS) educational workbook designed for students in grades 3rd – 7th. These workbooks were designed to provide some good foundational knowledge of ANS, examples of it, problems associated with it, and how they as students can help prevent introductions of new ANS in the future. There are several activities in the book to engage them in better displaying what they've learned. Copies of the workbook have been distributed to several schools around the state, and additional copies are available at any GA DNR fisheries office.

During this reporting period, GA DNR staff spoke to over 1,090 students and adults across five schools/civic groups about aquatic nuisance species. Due to COVID-19, the events were held outside.

Louisiana

Rob Bourgeois reported that during the week of February 12-19, 2021, a late season cold event occurred that appeared to have an impact on the aquatic nuisance species (ANS) of the state. The freeze occurred late in the winter, and also rising water temperatures may have helped mitigate the impact to the more tropical invasive species.

COVID-19 has reduced the number of public events where LDWF distributes ANS outreach to the public. LDWF published social media posts during the year on apple snails and invasive vegetation. The reduction in COVID restrictions has allowed sampling efforts to resume, and increased public requests to hold outreach events.

A project was initiated where observations from members of the public are filtered on iNaturalist to produce a list of all invasive species reported. iNaturalist is an online community that allows people to share observations to discuss, identify, and create research-quality citizen science data for science and conservation. This list of species and locations will be screened by the LDWF ANS coordinator to look for new invasive species, as well as any range extensions observed. Any observations of interest may generate a site visit to determine if the report is accurate.

Public reports of apple snails have slowed to a few dozen since January 2021. Reports have recently increased, but are not as prevalent as in years past. Most reports were from known locations. The northern reaches of the established apple snail range will be monitored for potential freeze impacts. An isolated private pond in Sorento was visited by the ANS coordinator, who found apple snails actively laying eggs, and were visible at dusk on the margins of the pond.

Preliminary work has begun on two projects that are funded through USFWS's Lower Mississippi River Asian Carp Partnership and the Atchafalaya, Red and White Rivers Asian Carp Partnership. These two projects should assist LDWF in locating breeding areas and identifying potential locations for carp barriers. Four projects will be developed that will help develop markets for Asian carp, investigate obstacles inhibiting commercial fishermen from harvesting Asian carp, as well as studying the impacts of Asian carp on native commercially important fish.

Asian swamp eels were found in Bayou St. John in New Orleans in June 2019. A local college professor continues to monitor and sample the population. No eels have been found since September 2020. It is unlikely they would have suffered any effects of the freeze. Small eels were found in September 2020. LDWF plans to monitor the area and sample in the spring and summer of 2021.

LDWF's planned sampling during the reporting period was canceled due to COVID-19 restrictions on research cruises. LDWF received an extension on this grant, and hopes to resume the sampling program this summer.

Blue tilapia were found during routine sampling by LDWF in October 2019 in University Lake in Baton Rouge. Repeated sampling in 2020 has shown a reproducing population. A reduced population was expected due to the February 2021 freeze. A member of the public sent a photograph of a decomposing tilapia, which was attributed to the freeze. In late February, sampling efforts did not find any tilapia in areas where a small number of tilapia was found in prior years. In March 2021, the LDWF ANS coordinator inland fisheries staff electrofished the area of the lake where tilapia were found in previous years. No tilapia were found. After the

February freeze, a member of the public reported 8-10 large dead fish, and described them as similar to the shape of bluegill, but with bigger fins. This further suggests that the tilapia did suffer a freeze kill. LDWF will continue to sample and remove tilapia. Any impacts to native fish from a thriving tilapia population will be tracked.

The February 2021 freeze appears to have helped with aquatic plant control. The lakes in north Louisiana were not showing any active vegetative growth by the end of March, indicating that a substantial giant salvinia die-off has occurred. Other more heavily invested lakes such as Caddo Lake, Lake Bistineau, Black Lake, and Saline Lake have begun to exhibit vegetative growth. In south Louisiana, minimal amounts of Salvinia have been found, and are actively growing as temperature increase. Water hyacinth, the biggest aquatic plant problem in south LA, have started actively growing again. Statewide spray crews are concentrating their efforts in areas with chronic giant salvinia problems.

Mississippi

Freshwater report:

Dennis Riecke reported that giant salvinia management in Ross Barnett Reservoir included containment with floating booms within Pelahatchie Bay; boat and on-foot surveys conducted for giant salvinia; new colonies identified and treated with glyphosate, flumioxazin, and fluridone from airboat and helicopter; recreational access opened from main lake into Pelahatchie Bay and closed area reduced to inside containment booms; drawdown to 296.0' elevation to expose any remaining plants to cold temperatures over winter.

ANS funds were used to purchase herbicides and floating containment booms.

Special permits were issued for the harvest of Asian carp at Moon Lake for the 2020-2021 season.

Efforts to enlist commercial fishermen as contract workers to harvest Asian carp in the Mississippi River and Yazoo River basin were abandoned due to only one person submitting the necessary forms to do so.

An effort to provide an Incentivized Asian Carp Fishing Contract was initiated with Asian carp processors. Two processing firms signed contracts to participate. MDWFP will reimburse them 18 cents per pound of Asian carp if they pay fishermen at least 25 cents per pound.

Ongoing coordination activities include: Coordinating and administering and ANS grant for research on "Development of management strategy for surveillance and containment of invading Asian carp in waters connected to the Tennessee River", which was initiated in September 2019; coordinating and administering a federal ANS grant to implement activities specified in the *Mississippi State Management Plan for Aquatic Invasive Specie*s, and participating in the Mississippi Aquatic Species Council to guide implementation of the activities; coordinating and administering an ANS grant for the "Moon Lake Asian Carp Tracking Research Project", which was initiated in October 2020; coordinating and administering with USFWS, Tennessee, and Kentucky an ANS grant for an Asian carp incentivized harvest program in the Mississippi River and Yazoo River Basin; and participating in Tennessee River/Cumberland River Asian Carp Control, Barrier Placement Structured Decision Making calls and webinars.

The ANSTF Annual Report to Congress and Bylaws have been reviewed and edited.

Ongoing information and education activities include: Continuing distribution of "Stop Aquatic Hitchhikers" cards along with all initial boat registrations and boat renewal registration cards that are mailed out; continue printing the "Stop Aquatic Hitchhikers" logo and bullet list in the annual regulation guides and the *Digest of Mississippi Freshwater Commercial Fishing Laws and Regulations*.

Monitoring and reporting activities include: monitoring giant salvinia populations at the Ross Barnett Reservoir, Pickwick, and the Tennessee-Tombigbee Waterway; continuing the Asian Carp Telemetry Project on the Pickwick and Tennessee-Tombigbee Waterway; continuing sampling for Asian carp in Pickwick, the Divide Cut, and Bay Springs; coordinating and implementing Asian carp tagging on Pickwick in December; continuing to monitor water hyacinth at Horseshoe Lake, Little Round Lake, and Belzoni Cutoff; notified online sellers (Amazon, eBay, Craigs List, Etsy) that sales and shipment of water hyacinths, alligator weed, and *Trapa natans* are illegal under federal law; submitted annual performance report for federal ANS grant to implement activities specified in the *Mississippi State Management Plan for Aquatic Invasive Species*; submitted annual performance report for MSU "Development of management strategy for surveillance and containment of invading Asian carp in waters to the Tennessee River project to USFWS.

Two FY21 Asia carp funding proposals submitted by Mississippi State University were recently reviewed. Work plan documents were submitted to USFWS.

The Mississippi State University research project "Development of Management Strategy for Surveillance and Containment of Invading Asian Carp in Waters to the Tennessee River" project, which was initiated in September 2019, is ongoing. Project activities performed by MSU personnel and students from October-December 2020 include: Sampling in Bay Springs and Yellow Creek in December. No Asian carp were captured; sampling in Bay Springs was done six times, and Yellow Creek four times. By-catch was very minimal, and consisted of blue catfish, flathead catfish, and common carp; continuing investigation of the potential effects of bighead carps on native fish assemblages in reservoirs of the lower Tennessee River.

The Mississippi State University research project "Moon Lake Asian Carp Tracking Research Project" was initiated in October 2020. Project activities performed by MSU personnel and students from October-March 2021 include: Several trips to Moon Lake, with key contacts; hiring a graduate student who successfully completed and defended a research proposal; collecting existing hydrography data from various gauges available near the study area, which will be used to model water levels in Moon Lake and Yazoo Pass, and predict when connections are made; purchasing various pieces of equipment needed to complete the project; collecting movements of silver carp via acoustic tags inside with functioning passive acoustic array; manual tracking of fish within Moon Lake; setting up wildlife cameras to relate direction of flow to movement of silver carp; crating a relational database to hold, manipulate, and relate collected data.

Twenty-five live Asian swamp eels identified as *Monopterus cuchia* were confiscated from a Chinese food market in Jackson in March 2021. Specimens were vouchered and frozen.

Peter stated that he was not aware that there was a second species of Asian swamp eel. He was aware of *Monopterus albus*, but not *Monopterus cuchia*. He asked **Dennis** how easily the two species are differentiated, and if the two species were being tracked separately, or if they were being collectively being tracked as Asian swamp eels. **Dennis** stated that one of their museum biologists identified the swamp eel, but if someone wants to request specimens to verify that identification, they are welcome to. He is not sure if the two species are being tracked separately. **Matt Neilson** stated that USGS is tracking them as separate taxa. **Monica** stated that some Asian swamp eels they found in a pond in Texas were also identified as *Monopterus cuchia*.

Zebra mussels in moss balls in two pet stores were reported to the USGS NAS database. *M. cuchia* is distinguishable from *M. albus*, based upon the pharyngeal air sacs. One species has two air sacs that expand laterally, and the other species has two air sacs that expand ventrally. The size of the spots on the body can also be used for identification. FWC has a fact sheet on both species, and how to tell them apart.

Future activities include: Developing management and control fact sheets on invasive aquatic plants; purchasing aquatic herbicides and hiring contractors to treat public and private waters infested by invasive plants; purchasing floating containment booms for emergency response to new detections of invasive plants in public waters in Mississippi; composing freshwater fishing bait regulations to specify what live bait can be legally sold, possessed, transported, and used in Mississippi; seeking approval of legislation required to initiate licensing of retail bait outlets selling live freshwater fishing bait; adopting a list of approved, restricted, and prohibited species under the authority specified in MS Code 49-7-80, and as specified in the *Mississippi State Management Plan for Aquatic Invasive Species*, and amend the list of approved, restricted, and prohibited species as specified in the agency rule that regulates aquaculture activities in Mississippi; establishing an EDRR monitoring program comprised of state and federal personnel who sample aquatic species in Mississippi public waterways on a routine basis; working on revisions to the *Mississippi State Management Plan for Aquatic Invasive Species*.

Saltwater report:

Mike Pursley reported that a program of integrated pest management and spot herbicide application was used to control populations of common salvinia, giant salvinia, alligator weed, torpedo grass, beach vitex, and water hyacinth.

An aerial photo survey of 185 miles was conducted for early detection of AIS, and to monitor existing infestations. Experimental UAV flights were also conducted to investigate the potential for giant salvinia detection using different imaging systems.

An amphibious marsh buggy equipped with an herbicide sprayer has been rented to find and treat giant salvinia in marsh areas of the Pascagoula that are difficult to assess. Limitations so far are that the machine can get stuck in muddy areas when water levels are low, and that the travel speed in open water is slow.

No new sightings of Asian tiger shrimp or giant applesnail were received during this reporting period. Since the infestation was first detected in 2014, 30,368 egg masses have been destroyed, and 1,132 live snails have been removed from the river.

A customize4d ArcGIS Quick Capture mobile application was configured to better document giant applesnail locations, and record control efforts. With this tool, MDMR staff and contractors can easily document their survey paths, and record and photograph egg masses destroyed and live snail collection, with just the push of a button. This technology will also soon be configured to document invasive plant sightings and treatments. Data gathered by each mobile user is automatically uploaded to MDMR's server to be viewed and analyzed.

MDMR invasive species staff visited with local pet retailers to inform them about the potential contamination of zebra mussels in aquarium moss balls, and to provide them with literature about the situation. No moss balls checked during these visits had visible zebra mussels. All stores voluntarily quarantined the moss balls as a precaution.

A mobile phone invasive species reporting tool has been made available to the public and promoted on MDMR's website and social media outlets. The mobile application allows citizens to quickly take and upload a geotagged picture in the field of a suspected invasive species through a web browser or a free downloadable application. MDMR invasive species staff review and validate each report, and determine the appropriate response.

North Carolina

Nathaniel Hancock reported that several new sites of yellow floating heart were identified in eastern, central, and western North Carolina. These new sites were treated in 2020, and will be monitored in the future. Ten locations were treated in 2020, of which three were new.

A major infestation of *Salvinia molesta* was discovered in Columbus County, very close to the South Carolina border.

Although not a regulated weed, NCDA&CS took regulatory action to prevent further spread of wooly frogsmouth, which was initially found in August 2016. Initially treated in late 2016 and 2017, not treatment was done in 2018 because the plant could not be found. In 2019, it was observed in its original location, and in a nearby pond. Treatments began again in 2019 and 2020. The 2020 survey revealed good control for visible plants, but plants below the waterline were not effectively treated. Other treatment options, in addition to the current method of control, are being pursued. Since gopher frogs, an endangered species in NC, use borrow pits like the one infested with wooly frogsmouth as nesting sites, careful consideration for the timing and type of treatment will continue.

The State Noxious Weed Regulations were established to prevent the widespread establishment of harmful nonnative plants that are placed on the Noxious Weed List. Any plant on the Noxious Weed List is prohibited entry into the state without a permit. The sale of noxious weeds is also prohibited unless exempted by provisions of the Noxious Wedd Regulations. The General Assembly of North Carolina has also adopted the Aquatic Weed Control Act, providing the Department of Agriculture with the authority to regulate the importation, sale, use, and distribution of noxious aquatic weeds. The NCDA&CS Plant Industry Division's Plant Protection Section monitors aquatic nurseries through annual inspections to ensure regulated plants are not being sold online or at retail locations and nurseries.

The Aquatic Weed Control Program hired two temporary technicians in 2020, who were retained until the end of the year. COVID-19 caused a reduction in man-hours of fieldwork from 2,015 in 2019 to 1,737 in 2020.

Nathaniel reported on the Lake Waccamaw *Hydrilla verticillata* Removal Project. A large-scale herbicide treatment was implemented for seven consecutive years from 2013-2019. The lake was treated with fluridone for all years. Hydrilla was fully suppressed by the treatments, and there is no evidence that new tubar production had occurred since 2012. A technical advisory group has been steering the project, and recommended no treatment for 2020. A robust monitoring program was implemented, and efforts were focused on the area that was targeted with herbicide. A lake-wide submersed vegetation survey was also conducted. No hydrilla was detected.

For the Eno River *Hydrilla verticillata* Abatement Project, a large section of the river, approximately 16 miles, was treated with fluridone in 2015 and 2016 to control hydrilla. The treatment was expanded to approximately 22 miles in 2017, and a repeat of that treatment occurred in 2018. The project was initially slated as a two-year pilot project, with the objective being to demonstrate the effectiveness of fluridone as a method of controlling hydrilla in a riverine system. Two injector units were deployed along the river, and were remotely operated. The treatment resulted with significant reduction of hydrilla, while minimal to no impact to non-target plant and animal species were realized. In 2019, the treatment was reduced, targeting only the upper-most section of the river. One injector unit was used in 2019. No treatments were done in 2020. A late summer survey via kayak visual reconnaissance of the approximately 22-mile stretch detected hydrilla at four points. The objective of the survey was to determine the presence or absence of hydrilla in the river.

The objective of the Gapway Swamp Giant Salvinia Eradication Project, which is still in the planning phase, will be to eradicate giant salvinia from Gapway Swamp. The site is a rural setting near the North Carolina/South Carolina state line. It is impounded, and surrounded by private property. The DEQ is working with the Columbus County Cooperative Extension, who is connecting with the land owners, and acting as a liaison. The infestation was brought to the attention of the NCDEQ Division of Marine Fisheries in 2020. It is believed to be an isolated event, and the only site in NC. The infested area is approximately 250 acres. It is anticipated that some level of management activities will begin this year.

Tiger shrimp appear to be abundant again this year in North Carolina. Despite reduced sampling efforts due to COVID-19, a tiger shrimp was still captured during the 2020 Pamlico Sound Survey. In 2012, tiger shrimp was added as a code in the state trip ticket program. Since then, annual landings have ranged between 5-25 lbs. There is limited commercial fishermen participation in landings.

Blue catfish ranges in NC has been expanding over the years, and the commercial landings have been increasing. Blue catfish have been caught across all of Albemarle Sound and its tributaries, and are expanding into the northern Pamlico Sound region. Commercial fishermen have been actively harvesting large numbers throughout Albemarle Sound and all tributaries. Trotline usage to catch blue catfish has increased as well. The NC Division of Marine Fisheries has partnered with Sea Grant and NC Wildlife Resource Commission in monitoring blue catfish in the state.

Flathead catfish appear to be moving upstream in several watersheds in the Tar River and Neuse Rivers basins, and are the likely cause for the decline of the Carolina Madtom. Recent analysis shows that the Carolina madtom is below detectability levels in areas with known flathead catfish populations. Intensive surveys and management actions, including flathead catfish removal, may be needed in the near future to prevent Carolina madtoms from going extinct. The

US Fish and Wildlife Service Sport Fish Restoration Grant funded a nonnative catfish project in Cape Fear that will look at habitat and prey selection of flathead catfish.

The river goby has established itself in the Morehead City area. Although native to south Florida, it is not a NC native. From 2016 to date, approximately 20 specimens have been collected, including young-of-year, from a retention pond and adjoining creek next to the DMF headquarters. The vector seems likely to be ballast water.

Several green porcelain crabs have been collected in Morehead City, NC. This may represent the most northern record of the species. No previous records north of Wilmington were found.

Since 2014, specimens of *Macrobrachium nipponese* have been collected yearly in NC. Little is known about how they were introduced to NC, although it is believed that it was via ballast water. Specimens are common from the Beaufort, Morehead City, and Wilmington areas. Researchers are currently awaiting sequencing results to finish an ongoing paper.

Marine fisheries staff have reported locally abundant *Gracilaria vermiculophylla* algae that appear to have seasonal negative impacts on fishing gear. It can also contribute to shoreline destabilization.

Efforts continue with the Southeastern Cooperative Fish Parasite and Disease Laboratory (SCFPDL) at Auburn University on a multi-year effort to increase understanding of *Myxobolus cerebralis*, the causative agent of whirling disease distribution and ecology in North Carolina.

Efforts also continue with SCFPDL to explore spatial distribution and life history characteristics of gill lice.
In 2018, Tennessee Tech University (TTU) initiated a regional-scale assessment to define the current distribution of didymo in western North Carolina. TTU identified didymo cells within Tuckaseegee River in 2015, and since then, little information has been obtained on the diatom in the state. Sample kits were provided to anglers in 2019 to facilitate additional samples across western NC. Ultimately, this multi-year effort will establish a baseline for didymo distribution.

In March 2021, the North Carolina Wildlife Resources Commission received notice that moss balls contaminated with zebra mussels were being sold at stores in Georgia, Virginia, and numerous other states. On March 5th, a Wildlife Commission fisheries biologist purchased moss balls from a pet store in Burlington, NC that appeared to contain zebra mussels. The moss balls were taken to the NC Museum of Natural Sciences where the Curator of Mollusks confirmed they were zebra mussels. The Wildlife Commission sent Wildlife Enforcement officers to every pet store in the state to inform them of the contaminated moss balls. Most stores voluntarily agreed to destroy their inventory of moss balls or turn them over to Wildlife Commission staff for decontamination. Stores that did not volunteer to remove the moss balls were inspected to determine if they were contaminated. Over 280 stores were visited. Moss balls contaminated with zebra mussels were found in all nine Wildlife Commission districts. The NC Wildlife Resources Commission has also initiated a public relations campaign to inform aquarium owners of the risk of moss balls being infested with zebra mussels and how to safely dispose of them, and decontaminate their fish tanks. The Wildlife Commission is also coordinating with state and federal agencies. Public information efforts will continue. The Wildlife Commission is determining areas most susceptible to zebra mussel infestation, developing a monitoring plan,

and determining the feasibility of a response plan should zebra mussels be found in North Carolina waters.

Recent crayfish surveys in eastern North Carolina by biologists have indicated a decline in several native crayfish species, including the sandhills crayfish and the Waccamaw crayfish. Coincident with this decline is a rapid increase in the abundance of the invasive red swamp crayfish throughout much of eastern NC. The NC Wildlife Resources Commission is partnering with researchers at Appalachian State University, and will initiate a study in 2021 to attempt to determine if the red swamp crayfish is the cause of the decline in the native crayfish.

Since the 1960s, invasive and nonnative catfish have spread through North Carolina, and have had major impacts on native aquatic species in riverine and reservoir systems. Despite this, a fishery has developed in many locations, including the Pee Dee River, NC. In 2019, following overexploitation concerns from anglers, a regulation measure was put in place to limit the daily harvest of catfish in the Pee Dee River below Blewett Falls Dam, to the South Carolina border, to five fish, in aggregate. In 2018, the NC Wildlife Resources Commission began surveys to evaluate catfish populations in the Pee Dee River. The surveys focused on invasive flathead catfish and blue catfish, and nonnative channel catfish. Electrofishing surveys were conducted in fall 2018, spring and fall 2019, and spring 2020. No native catfish were observed. Blue catfish, flathead catfish, and channel catfish were collected. Otoliths were removed from a subsample of blue and flathead catfish, and aging was completed. Blue catfish ranged from 3-25 years old. Flathead catfish ranged from 0-15 years old. Both blue catfish and flathead catfish were highly abundant, and along with the smallmouth buffalo (also a nonnative species) made up most of the biomass of the fish community. Results indicate an abundance of large, invasive catfish in the Pee Dee River, which suggests that restrictive harvest regulations may not be warranted.

In 2020, the University of North Carolina at Wilmington, in partnership with the North Carolina Wildlife Resources Commission, completed a study to look at the trophic ecology of nonnative catfishes in the Lower Cape Fear River ecosystem. This was a two-year study in the Cape Fear, Northeast Cape Fear, and Black rivers. Diet analysis indicated that flathead catfish consumed large amounts of fish, crayfish, aquatic insects, and freshwater prawns, with fish becoming more prominent as the fish ages. Blue catfish consumed mostly *Corbicula* spp., along with a mix of fish and aquatic insects, with fish becoming more prominent as the fish ages. Primary fishes consumed by both flathead and blue catfish were sunfishes, black basses, and catfishes. Flathead catfish also consumed anadromous species. The North Carolina Wildlife Resources Commission is conducting a survey of invasive, nonnative catfish species on Lake Gaston. The goal of the study is to describe the blue catfish population in Lake Gaston, estimating their baseline relative abundance, size structure, condition, growth, mortality, and diet composition. This study will provide critical information on this popular fishery, and can be used to evaluate regulations, along with indications of intraspecific and interspecific competition. Data is currently being evaluated.

The North Carolina Aquatic Nuisance Species Management Plan is being reviewed and edited by the steering committee that authored the plan. No major changes are anticipated, but the committee believes the updated plan will be much improved. The group intends to gain renewed support from state agencies, and ultimately have the Governor submit the plan to the Aquatic Nuisance Species Task Force. The current version of the plan provides the existing framework for implementing state-level collaboration on NC's ANS challenges.

Rob Emens reported that a major infestation of giant salvinia was recently discovered in ponds on 250 acres in a rural area in Columbus County, within a mile of the South Carolina state line. This salvinia infestation has probably been there for several years. The last time there was a giant salvinia infestation being managed was about 10 years ago. The NC DEQ partnered with the county, and the Army Corps of Engineers is interested in partnering with them and helping with control work.

South Carolina

Peter Kingsley-Smith reported that researchers at the SC DNR MRRI are developing molecular tools to test whether hybridization is occurring within wild populations of the *Scapulicambarus* subgenus of crayfish. The red swamp crayfish, *Procambarus clarkii*, is nested within the subgenus *Scapulicambarus*, which it shares with only four other species. Within this subgenus, the eastern red swamp crayfish, *Procambarus troglodytes*, was shown by Busack (1989) to be the species most closely related to *P. clarkii*. The eastern red swamp crayfish is the most abundant native crayfish species in South Carolina, where much of its range overlaps with known locations of invasive *P. clarkii*. Hybridization is common among crayfish species; however, the majority of the research to assess hybridization of nonnative crayfish with native species has focused on the genus *Faxonius*, with little data currently available for hybridization within the genus *Procambarus*.

A subset of sites sampled to investigate the presence of white spot syndrome virus (WSSV) are used to also assess hybridization. Baited minnow traps and dip netting were the primary techniques used to locate *P. clarkii* and *P. troglodytes*. Microsatellite markers will be used to genotype both *P. clarkii*, *P. troglodytes*, and any potential hybrids collected in the field. The resulting genotypes will be subjected to the model-based Bayesian clustering methods implemented in STRUCTURE in order to estimate and visualize potential shared ancestry that would be expected if hybridization is occurring between these two species. So far, 17 microsatellite markers have been optimized for amplification in *P. clarkii*, and the optimization of the multiplex panel is complete. The first attempt at genotyping both *P. clarkii* and *P. troglodytes* for this project is complete, and **Peter** said they are currently screening for reliable amplification in both species. Allele binning analyses are under way, and once complete, all data will be scored before re-running amplifications that failed. Markers that amplify in both species will be used for the final hybridization analyses.

To better understand the distribution of the invasive red swamp crayfish *Procambarus clarkii* and to predict its potential impacts on native species, SC DNR biologists surveyed stream and wetland habitats across the Savannah River and Pee Dee River basins. *Procambarus clarkii* was collected at only one sampling location in the Savanah River basin. The 15 locations sampled in the Pee Dee River basin were previously known to have populations of *P. clarkii*, with new efforts resulting in an additional 1,142 *P. clarkii* specimens from these locations.

White spot syndrome virus (WSSV) infects many crustacean species, is highly pathogenic, and was recently associated with both wild and farmed red swamp crayfish, *Procambarus 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 SC, such as the commercially-and recreationally-important white shrimp and blue crab that are known to be susceptible to the effects of WSSV.

To determine if *P. clarkii* is a vector for the WSSV, this species was tested using molecular qPCR assays recently modified and optimized from Blaylock *et al*. (2019) by collegues in the SC DNR Population Genetics Research Section. These qPCR methods were used to screen samples of several tissue types, including gill, muscle, and pleopods obtained from *P. clarkii*. The results for this study are in presence/absence form for all individuals that are screened. Since WSSV can have significant impacts o estuarine crustaceans, sampling locations will focus on brackish water habitats and habitats near brackish water where *P. setiferus* and *C. sapidus* would have a higher likelihood of being exposed if the virus is present. To date, 208 *P. clarkii*, and 158 *P. troglodytes* have been screened using the optimized qPCR assay along with positive control samples, negative control samples, and no DNA template controls. Despite positive WSSV results for store-bought crayfish, sampling of 14 locations in the Charleston area has so far resulted in no records of wild-caught crayfish testing positive for WSSV.

The redeye 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 is a species of highest concern in SC DNR's State Wildlife Action Plan (SWAP). 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 in the reservoirs has been documented in the field, and confirmed by genetic analysis.

Researchers at the SC DNR have developed a microsatellite-based genetic tool to investigate hybridization in black bass populations in the Savannah River basin. Their variability makes 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 regional congeneric species can be assigned to clusters with high confidence. 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 occurs from a single species.

Project results to date include: 1) evidence of widespread invasion by Alabama bass and active hybridization throughout the redeye bass range; 2) documentation of 25 tributary sites where pure/near-pure redeye bass are located without incident of hybridization; and 3) documentation for the first time of hybridization occurring on nests in running waters (nearly 60% of sampled streams contained hybrids). The SC DNR Population Genetics Research Section 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.

The bullseye snakehead has been documented to occur in southern Florida, where it is known to compete with a variety of bass species, and to consume native reptiles, amphibians, and smaller fishes. Northern snakehead are more prevalent across the Atlantic coast than bullseye snakehead, posing a more probable threat to native species. Freshwater ecosystems on the Atlantic coast are extremely rich in biodiversity, and have a high number of native species that would be at risk to an invasion of snakehead species. Although not currently documented in SC, both bullseye snakehead and Northern snakehead are found – to varying degrees – in Florida, Georgia, and North Carolina. Typically, when first documented in a new area, however, invasive snakehead have already established a persistent population. Since northern snakehead are found in states

and watersheds closely surrounding SC, it is important to be able to rapidly assess waters once a detection of any snakehead species occurs.

The SC DNR Population Genetics Research Section has begun the development of a panel of species-specific markers for snakehead species. An optimized and functional panel will support the rapid evaluation of the distributional extent of an invasion once detected. This research team is using existing genetic sequence data and published eDNA tools to design and optimize a suite of eDNA tools for detection of both *C. marulius* and *C. argus*. Previous provided data sources will be used to optimize an efficient suite of eDNA tools. Benchtop tests will be conducted with all identified tools with DNA from *C. marulius* and *C. argus*, from its sister family Osphronemidae (Gouramis), and from a diversity of freshwater fishes available in the SC DNR Genetics Tissue Collection. An understanding of distribution is extremely beneficial in identifying potential pathways of movement for snakehead into freshwater ecosystems. Once potential pathways are identified, biologists can make more informed management decisions on how to maximize containment of a snakehead invasion, and design possible eradication strategies. Providing timely and accurate data is the most effective way to inform management to reduce the risk of invasive snakehead species across the region.

On March 1, 2021, U.S. Geological Survey scientists were alerted that zebra mussels had been found attached and inside aquarium moss balls. Within three days of this first report, similarly contaminated products were found in aquarium supply stores in over 25 states across the U.S. In a rapid, coordinated effort in SC, the SC DNR Freshwater Fisheries Section staff visited pet stores and aquarium supply stores across the state to both inform store owners as to the issue, and inspect a number of different moss ball products, if still present in the store. Information was also provided on appropriate steps for decontamination and disposal. Information was also distributed through SC DNR's social media platforms. Crustacean Research and Monitoring Section staff collected moss balls from three pet stores in Charleston County on March 4, 2021, and observed zebra mussels on four of eight specimens examined. The invasive mussels were observed on at least some of the moss balls examined from all three stores visited. All site visit information conducted by the SC DNR (both presence and absence of invasive zebra mussels) was gathered using the ArcGIS Survey 123 platform, and an export of all these data is being shared with USGS.

Researchers with the SC DNR MRRI's Shellfish Research Section remain interested in understanding the invasion of the South Atlantic Bight and Gulf of Mexico by the Asian tiger shrimp. The total number of tiger shrimp reported to SC is currently 476, with a size range of 58 to 330 mm total length. Although reports have declined in recent years, it is likely that a high proportion of the tiger shrimp collected are being kept for consumption instead. Researchers at the MRRI have initiated a collaboration with researchers at Auburn University to explore the viral diseases present in tiger shrimp, initially making use of archived specimens housed at the MRRI.

Chris Page reported that Cuban bulrush is a problem, and has taken over several impoundments. Treatment will be done in the next few months.

The salvinia infestation still exists in the Santee Cooper Lakes in Lake Marion, the upper lake area of Lake Marion, and Lake Moultrie. They have all been treated with herbicide.

The state aquatic plant management plan was passed by the council.

Toxic algae blooms in SC freshwater lakes have not been a problem over the years, but they have gradually been getting worse, and more numerous across the state. There have also been toxic algae blooms in some drinking water lakes, which has expanded over the past three years. Spartanburg, which is not a prime area for toxic algae blooms, has put in a multi-million-dollar system to monitor and to treat the toxic algae blooms, due to issues with water taste and odor.

Texas

Monica McGarrity reported that since the beginning of state fiscal year 2016, the Texas legislature has increased state funding allocations to Texas Parks and Wildlife Department (TPWD) for aquatic invasive species management. The TPWD recently prepared a report on enhanced efforts over the past five years.

Since their initial introduction into the state in 2009, zebra mussels have invaded 31 lakes across six watersheds in Texas. TPWD and their partners continue to monitor 43 lakes for early detection - 21 for population monitoring, and one post-treatment.

In March 2021, zebra mussels were found on "marimo moss balls" for aquaria in states around the U.S. and in some Canadian provinces, triggering a wide-scale rapid response effort. The TPWD Law Enforcement investigated numerous stores in Texas, and found an empty zebra mussel shell on moss balls being sold at one store in Austin. One major chain had already pulled these from shelves before store visits were conducted. A member of the public also provided a report, with photographs, of potentially live zebra mussels on moss balls sold at another major chain in Temple. TPWD Law Enforcement worked with Petco and PetSmart corporate, as well as distributors, to address the issue. TPWD issued a press release to increase public awareness.

In January 2021, TPWD announced the successful eradication of zebra mussels from Lake Waco in Central Texas. This eradication was made possible only by very early detection, timing of detection prior to peak spawning, and a multi-agency rapid response effort. In September 2014, City of Waco employees found zebra mussels at a single boat ramp on Lake Waco, which were later confirmed by TPWD. Additional surveys in the area found approximately 75 more adult mussels, as well as a few zebra mussel larvae, but all were in a localized area around the ramp and adjacent marina. An infested barge believed to be the source of the invasive mussels was identified in the adjacent marina, and removed from the lake two days after the mussels were detected. At that time, the lake was designated as 'positive' for zebra mussels, but the invasion had not reached fully established, 'infested' levels. In October 2014, partner agencies worked together on a rapid response effort to install nearly an acre of benthic barriers (plastic sheeting) over the shoreline and lake bottom in the affected area, and weighted it down with sandbags. This method was used in an attempt to kill the mussels by blocking oxygen, impede dispersal of larvae prior to spawning, and prevent them from becoming established in the lake. This was a very substantial undertaking that required many people, heavy equipment, boats, and commercial divers. The benthic barrier was removed in March 2015. One potentially live mussel was found and eliminated after the plastic was removed, which indicated the effort was successful in creating extremely low oxygen conditions not conducive to zebra mussel survival over much of the area. Since 2015, TPWD and the city of Waco have continued to monitor the lake intensively, and no zebra mussel larvae, settled adults, of their DNA have been detected in the lake. Lake Waco has been downgraded to 'undetected/negative' status. The TPWD and partners will continue to monitor the lake foe reintroduction.

In December 2020, TPWD designated Lake Buchanan in the Colorado River Basin as fully infested with zebra mussels. This represents an upstream introduction of zebra mussels, and is not the result of downstream dispersal as was previously seen with many of the lakes in this river basin. Downstream Inks Lake is now at risk of invasion via downstream dispersal. Lower Colorado River Authority (LCRA) scientists discovered zebra mussel larvae in plankton samples taken from three sites around the lake in October. The TPWD then confirmed the identity through microscopic and genetic analysis. The LCRA scientists analyzed samples collected in November, and again found zebra mussels at two of the three sites. In December, crews working on a floodgate project at Buchanan Dam discovered several settled zebra mussels. It is evident that a reproducing population is present in the lake.

Zebra mussels were detected in Medina Lake in February 2021, which marks the first introduction of invasive zebra mussels in the San Antonio River Basin – the sixth river basin in Texas to be invaded. On February 11th, a member of the public submitted a report and photo to TPWD of a zebra mussel located at a boat ramp near the mouth of Haby's Cove. TPWD staff conducted searches at the site, and located two zebra mussels attached to rocks along the shoreline near the site where the first mussel was discovered. Bandera County River Authority & Groundwater District (BCRAGD) staff conducted a search on February 24th, and located a single zebra mussel attached to a settlement sampler at a dock approximately three miles upstream from the first location where zebra mussels were detected. The BCRAGD later conducted additional surveys of numerous locations, boat hulls, and boat engines around the lake, but no additional zebra mussels were found. The lake has been designated as 'positive' for zebra mussels, and additional monitoring will be conducted.

Lake Placid, located in the Guadalupe River Basin, was previously designated as 'positive' for zebra mussels, but was upgraded to fully infested status in March 2021. In May 2019, zebra mussel larvae and a single adult were documented at Lake Placid, but biologists had not yet found evidence of an established, reproducing population in the lake, until February 2021 during some routine maintenance activities at the Lake Placid Dam. Guadalupe-Blanco River Authority employees discovered a population of adult zebra mussels in the hydroelectric turbine near the bottom of the dam. Numerous mussels of different size classes were found, indication the presence of an established, reproducing population.

Numerous aquatic invasive plants are highly problematic in Texas, including giant and common salvinias, water hyacinth, hydrilla, and crested and yellow floating hearts. In 2016, the Texas Legislature allocated approximately $3.2M annually to TPWD for aquatic invasive species management. Aquatic plant control efforts have increased approximately five-fold. Infestations are currently being managed on over 50 water bodies around the state, primarily in east Texas. Efforts to rapidly respond to new infestations with containment and control strategies have also increased.

Since the last GSARP meeting in December 2020, there have been no new invasions of giant salvinia or other problematic aquatic invasive plants documented. Winter storms caused some salvinia mortality, but the snow cover may have insulated it against the impacts from the freeze, and die-off was lower than expected.

Riparian invasive plant management continues to be a focus, prioritizing treatment of giant reed and saltcedar. Partnership efforts begun in late 2015 have accomplished treatment of these species on over 425 private properties and several public properties in key Native Fish

Conservation Areas where conservation efforts can have maximal benefit. Treatment efforts for giant reed will expand this summer to include a new project on San Felipe Creek.

The TPWD aquatic invasive species outreach campaign continues to be a focus. Methods include billboards, gas station advertising, boat ramp signage, digital radio ads, pre-roll videos, other digital advertising, print ads and mailings, and in-house social media. The 2021 campaign launch will begin in May.

Four research projects are currently being funded by TPWD and partners, focusing on effects of water chemistry on zebra mussel reproduction and early development, population dynamics and impacts of zebra mussels on native unionids, native plant competition methods for enhancing hydrilla control, and the bait fish pathway for introduction of gulf killifish and sheepshead minnows outside their native range within the state and hybridization impacts. Research projects will be completed by end of fiscal year 2021. The TPWD has also recently issued a request for proposals for new research projects for state fiscal years 2022-2023.

For fiscal years 2016 to 2020, aquatic invasive plant management resulted in over 50 water bodies being actively managed; intensive early detection and rapid response; over 60,000 acres of giant Salvinia treated; almost 1.5 million giant Salvinia weevils introduced as biological controls; over 6,000 acres of water hyacinth treated; and almost 1,000 acres of other species treated. Increasing public awareness to slow the spread of aquatic invasive species included billboards and gas station advertising on key routes; an annual aquatic invasive species outreach campaign from Memorial Day through Labor Day; prominent signage at over 275 boat ramps; digital and social advertisements; communication with over 575K registered boaters; and almost 800 million "impressions" generated. Ninety-one percent of boaters surveyed have heard of seen "Clean, Drain and Dry" message. Restoring Texas streamlines resulted in watershed-scale control of river and Creekside invasive plants at no cost to landowners; over 325 landowners participating in Arundo control across five Hill Country river basins; over 15,000 acres of saltcedar treated on over 100 properties on the Brazos River; and elephant ear control on over 50 miles of the Llano River. Invasive mussel early detection resulted in a coalition of 15 partner entities working together to monitor over 40 lakes for early detection of invasive mussels' DNA, larvae, or settled adults; partners monitored existed populations in over 20 water bodies; zebra mussels successfully eradicated from Lake Waco as a result of very early detection and coordinated, interagency rapid response.

University/Research

Robert McMahon reported that during September 2020, he and his colleague, Dr. Jason Locklin of Temple Community College completed a year-long comparative study of the population dynamics of zebra mussels in two closely adjacent reservoirs, Belton Lake and Stillhouse Hollow Lake, whose outlets are 12.23 km apart on separate arms of the Little River Drainage system in central Texas. The study was conducted at marinas located near the outlets of both water bodies. Zebra mussels were discovered in Belton Lake in 2013, and Stillhouse Hollow Lake in 2016. PVC settlement monitors were horizontally suspended from marina infrastructure on nylon ropes at varying depths, and sampled monthly to determine mussel settlement density. Veliger larvae densities were determined monthly with vertical plankton net tows. Data loggers were used to determine water temperature and dissolved oxygen concentrations hourly at each sampling depth over the course of the experiment, and ph was recorded monthly at 1 m depth intervals. Sampling started in September 2019, and ended in September 2020. The results indicated that annual temperature and pH ranges were similar in both lakes, falling well within that tolerated by zebra

mussels. Percent of full air oxygen saturation values also fell within the range tolerated by zebra mussels.

During 2020, there were distinct spring and fall mussel reproductive periods recorded at Belton Lake. In contrast, there was a single extended reproductive period in Stillhouse Hollow Lake beginning in May 2020, and declining by November 2020. In both lakes, mussel densities peaked on settlement plates during June 2020. These results indicated that in two relatively similar Texas water bodies, zebra mussels in the more newly invaded Stillhouse Hollow Lake developed higher settlement densities than occurred in Belton Lake, which had been infested in 2013. Previous studies indicated that early after invasion, zebra mussel settlement densities in Belton Lake were similar to those recorded in Stillhouse Hollow Lake in 2020, suggesting that zebra mussel populations may decline relatively rapidly after initial infestations of Texas water bodies.

Robert and Dr. Locklin are presently investigating the change in mussel physiological condition measured as dry tissue weight relative to shell length in monthly mussel samples taken from both lakes from May 2021 to May 2022 to determine if greater loss of tissue condition during warm summer months in older mussel populations is responsible for the density declines with time observed in Texas zebra mussel populations.

Aquatic Nuisance Species Task Force Update

Susan Pasko reported that the next Task Force meeting will be a virtual meeting held June 28-30, 2021. A draft agenda is being circulated with the co-chairs.

There are five active sub-committees that meet on a regular basis. They are working on an annual work plan. Key items are: the Prevention group has recently published a Notice of Funding Opportunity on grants.gov. It closes on June 4, 2021, and Susan said they hope to make a funding selection within the month after it closes.

The Control Subcommittee has been working on restructuring the Control Plan guidance document, and is evaluating the existing Species Control Plan.

The Outreach Subcommittee recently closed a funding opportunity that has been proposed to do an assessment of outreach campaigns that focus on recreational outdoor users. Four proposals were received, and are currently being reviewed. The proposal selected for funding will be announced in a few weeks.

The Research Subcommittee is developing a national AIS Research Priority list. Last year, a survey had previously been sent out to collect suggestions of what species should be on the list. There was a great response, and the progress of the list, and their recommendations will be presented at the June Task Force meeting.

The zebra mussels being found in aquarium moss balls, and the rapid response effort, have been a priority for USFWS. There will be an update on the situation, as well as discussions on the overall rapid response, at the June Task Force meeting.

Other Business

Panel Recommendations
There were no panel recommendations.

Next Meeting, Time and Place

The dates of the next meeting will be decided at a later date. A doodle poll will be sent out in a few months to decide if the panel members want to have an in-person meeting; a hybrid meeting that some members can attend in person, while others attend virtually via GotoMeeting; or a totally virtual meeting. If the meeting will be an in-person meeting, the location will be in Alabama. The city will be decided on in the doodle poll.

Peter brought up that the Mid-Atlantic Panel on Aquatic Invasive Species (MAPAIS) has expressed interest in holding a joint meeting with the Gulf and South Atlantic Regional Panel. North Carolina would be a good venue for this possible future joint meeting.

Public Comment

The Chairman provided the opportunity for public comment. There was none.

A Motion was made to adjourn the meeting, and the Motion was approved. There being no further business, the meeting adjourned at 3:25 p.m.

Action Items

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James will send a doodle poll to the panel members in a few months to decide if they want to hold an in-person fall meeting, or hold it virtually.