GULF & SOUTH ATLANTIC REGIONAL PANEL
ON AQUATIC INVASIVE SPECIES
MINUTES

Wednesday, December 1, 2021 – Thursday, December 2, 2021 (Via GoTo Meeting)

On Wednesday, December 1, 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
Jon Lane, USACE, Jacksonville, FL
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
Susan Pasko, USFWS, Falls Church, VA
Cal Johnson, AL Department of Environmental Mgmt., Decatur, AL
Ceci Weibert, Great Lakes Commission, Ann Arbor, MI
Chelsea Bohaty, USACE, Jacksonville, FL
Janelle Johnson, NC Division of Marine Fisheries, Elizabeth City, NC
Jeff Good, SC DNR, Charleston, SC
Jeff Hill, University of Florida, Ruskin, FL

Hannah Hoff, University of Montana
Jeff Schaeffer, TN Tech University, Cookeville, TN
Jonathan Freedman, USGS, Gainesville, FL
Michael Kendrick, SC DNR, Charleston, SC
Susan Wilde, University of Georgia, Athens, GA
Timothy Ellis, NC DNR, Raleigh, NC
Jim Williams, Florida Museum of Natural History, Gainesville, FL
Kurt Kowalski, USGS, Ann Arbor, MI
Michael Hoff, Bloomington, MN
Kelly Gestring, FWC, Davie, FL

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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. The motion was seconded, and the motion passed.

Approval of Minutes
The minutes of the April 21, 2021 GoTo Meeting were presented for approval.

A motion to adopt the minutes was made. The motion was seconded, and the motion passed.

Invasive Species Passage Through the Tennessee-Tombigbee Waterway
Jim Williams gave a PowerPoint presentation entitled "Tennessee-Tombigbee Waterway: Invasive Species Gateway to the Gulf". There are a total of 864 native fish species across all drainages of the Tennessee-Tombigbee Waterway. Aquatic diversity in the Mobile Basin (Alabama, Georgia, Mississippi, and Tennessee) and the Tennessee Basin (Alabama) include fishes, mussels, snails, and aquatic turtles. The Tennessee-Tombigbee Waterway was built and promoted as a shortcut from the Tennessee and Cumberland Rivers to the Gulf of Mexico. This would be a shorter route than coming down the Mississippi River. It was opened in 1985, and is 234 miles long, 300 feet wide, and 9-12 feet deep. There are 10 locks, with a total lift of 340 feet. The locks are 600 feet long, and 110 feet wide. The waterway has cutoffs and tributaries, and most streams in this reach flow into and out of the waterway with no structures.

A 5-year summary of traffic on the Tennessee-Tombigbee Waterway was done that covered January 2015 – December 2019. There were approximately 1,973 total lockages done per year. Approximately 777 of the lockages were for recreational vessels. There were a total of 3,886 recreational vessels. Recreational traffic equaled 39.4% of all lockages. Total lockages were 9,863.

Foreign, nonindigenous fishes currently found in the Tennessee-Tombigbee Waterway include Silver Carp, Bighead Carp, Black Carp, Round Goby, and Northern Snakehead. Other foreign nonindigenous fishes include Goldfish; Grass Carp, and Common Carp.

The EPA and Ecosystem Division in Athens, GA conducted a water quality study on invasive plants in the Tennessee-Tombigbee Waterway. Water Hyacinth and Bulrush are becoming increasingly problematic. Navigation of vessels has been impeded due to their proliferation. The

U.S. Army Corp of Engineers has utilized aerial and boat spraying of herbicides to control the plant growth.

There are also native aquatic species that have the potential to be invasive due to movement across the Tennessee and Tombigbee River divide, via the waterway. This can negatively impact native species and/or their environments. These two basins are inhabited by very distinct evolutionarily aquatic communities that have been isolated for millions of years. Possible outcomes include hybridization and ecological interactions (competitive displacement and predator-prey relationships). While threats from this group crossing the divide may appear subtle on the surface, they have the potential to significantly impact biodiversity on both sides of the divide. Some of the species of concern if "mixed" are Paddlefishes, Minnows and Carps, Black Basses, Walleyes, and aquatic turtles. There are already signs of some species populations crossing the divide and hybridizing. The spread of zebra mussels is also a concern.

Jim sent a letter with recommended actions to reduce the risk of invasion via the Tennessee-Tombigbee Waterway to the Army Corps of Engineers.

1. The Corps of Engineers, in concert with the U.S. Coast Guard, consider issuing a navigation bulletin closing Bay Springs Lock to all non-commercial traffic. Traffic data for Bay Springs Lock (both directions) for five years revealed that recreational vessels make up approximately 40% of the total traffic on the Tennessee-Tombigbee Waterway. Taking this action could result in a 40% reduction in the risk of aquatics moving across the divide.

2. Station electrofishing boats and crews shock the area between Bay Springs Lock and Sonny Montgomery Lock, as well as the waterway below Sonny Montgomery Lock, for a distance of five miles following each lockage at Bay Springs and Sonny Montgomery Locks. Taking this action would provide an opportunity to capture any invasive fishes that had entered the lock chamber during upstream or downstream lockages.

3. The Army Corps of Engineers request to Congress for authorization to reprogram existing funds to begin work on the deployment of a fish passage barrier system in the canal section between Bay Springs Reservoir and above the Yellow Creek impoundment. This action would provide a critical step in preventing invasion by Asian Carps and other nonindigenous aquatics. The urgency of the situation begs immediate deployment of one or more of the existing technologies for containment of Silver Carp.

4. Disinfect lock chambers using carbon dioxide. Review research conducted at the Kaukauna Lock 2 on Fox River in Wisconsin in 2019 examining the economic and engineering feasibility of installation and operation of a large-scale CO2 infusion system.

Jim stated that there are several fish and wildlife research needs, such as establishing an online clearinghouse for published and unpublished reports on biology and ecology of the Tennessee-Tombigbee Waterway; beginning a check of museum records for specimens cataloged in collections from the lower Tennessee River drainage from the Kentucky Dam, upstream to Wilson Dam; conducting a biological survey of aquatic organisms in Yellow Creek embayment drainage, as well as the upper Tombigbee River drainage above Columbus Lock and Dam; collecting tissue samples and specimens for a DNA barcode project for fishes, mussels, turtles,

crayfishes, and other aquatic organisms in the two river systems. This will provide the foundation for future researchers to evaluate genetic changes that occur over time.

Jim found Congressional Energy and Water Development Appropriations Bill 2022 that addresses Carp barriers in the Mississippi River Basin and the Tennessee-Tombigbee Waterway. It reads: "Invasive Species Mitigation – The Committee recognizes that the Corps is engaged in a multipronged effort to combat invasive species in our country's waterways and protect the Mississippi River Basin, which is one of the most valued ecosystems in the world. The Committee recommends $500,000 for the Corps, in partnership with other federal partners, to begin planning, design, initial engineering and project management for construction of carp barriers in the Mississippi River Basin and the Tennessee-Tombigbee Waterway."

Jon Lane stated that he sent an email to Army Corps of Engineers headquarters during this meeting, and they responded that they are familiar with the situation, and are just recognizing the problem. Jon stated that the Corps needs to get involved quickly, and that he will reach out to both the research side and the operational side at the Corps to see what can be done about the matter. Jon asked Jim to email him the letter with the recommended actions he sent to the Corps.

Risk of Injurious Fish Species to the GSARP States

Jeff Hill gave a PowerPoint presentation entitled "Risk of Injurious Fish Species to the GSARP States". The Lacey Act prohibits 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". Lacey Act 2015 and 2017 court decisions do not prohibit interstate movement within the continental United States. The 2015 decision - there is "significant harm" from tropical snakes outside of Florida and Texas.

Jeff said their state recommendations to states are to adopt risk assessment tools to aid decision making; assess risks of current injurious species if not already prohibited; assess risks of future injurious species rather than automatically harmonize; foster current and create new partnerships, especially for cross-boundary issues.

The problem is that injurious wildlife listings are national-level risk assessments, which can be viewed as a one-size-fits-all. The USA is one of the largest risk assessment areas, and the most complex area. The risk of invasive species is regional, and the scale of risk assessment is critical. Do Gulf and South Atlantic Regional Panel (GSARP) states need to list current injurious fishes?

The goal was to provide information useful to evaluate risks of freshwater fishes listed as injurious to the GSARP region and its individual constituent states. The specific objectives were to: 1) determine how the climate match of 16 federally listed, injurious fish species varies within the GSARP region, a mostly homogenous Köppen-Geiger climate Region, using CLIMATCH; 2) determine if variation in climate match within the GSARP region influences the scores and risk estimation of a common risk screening tool; 3) synthesize information to provide recommendations on variation in climate at a regional and intrastate spatial scale and its influence on invasiveness risk screening.

The Gulf and South Atlantic region has a nearly uniform climate zone. Despite this, there is considerable variation in climate. In North-South, it is warmer in Florida, south Texas, and the

coastal Gulf of Mexico. In East-West, west Texas is more arid, and colder in west and north Texas and North Carolina. CLIMATCH for risk assessment does not use source data from the risk assessment area. It changes distribution of data, tautology, and overestimates potential spread in many cases. Care must be exercised in using risk assessments from different areas, even with similar climate zone. Differing climate match can affect FISK scores and risk estimates. Less for widespread, temperate zone species, and more for tropical zone species. GSARP states varied in their risk levels from injurious fish species.

Policy/Management implications are that states are not necessarily threatened by Ecological Risk Screening Summary (ERSS0 high-risk species, or current and future injurious wildlife species lists). Risk assessments at the most appropriate spatial scale will produce more effective decision-support tools. Even climate zones may not define the appropriate scale.

Determining the Risk of Consuming Fish and Waterfowl Harvested in Reservoirs Infested by Hydrilla Producing a Novel Cyanotoxin

Susan Wilde gave a PowerPoint presentation entitled "Determining the risk of consuming fish and waterfowl harvested in reservoirs infested by *Hydrilla* producing a novel cyanotoxin". In 1994-95 in DeGray Lake in Arkansas, 29 bald eagle mortalities occurred. In 1996-97 in DeGray, Ouachita, and Hamilton Lakes in Arkansas, there were 26 more eagle mortalities, and also American coot mortalities. It was determined that the mortalities were caused by avian vacuolar myelinopathy (AVM). This disease is the most significant unknown cause of eagle mortality in the history of the U.S.

When birds are inflicted with AVM, they suffer from neurological impairment, such as drooping wings, wobbly flight, and stumbling on land. Coots may dive and then not right themselves, and eagles may overshoot perches or fly into objects.

Studies were done at the National Wildlife Health Center in a Southeastern Cooperative Wildlife Disease Study. Unique brain legions were observed in samples of bald eagles and American coots. Open spaces in white matter of the central nervous system, specifically an intramyelinic edema, were observed. After full diagnostic examinations were done, no consistent gross abnormalities were observed, no infectious disease agents or known toxins were found (including those known to produce intramyelinic edema). Brain lesions were the only consistent finding. Eagle biologists and pathologists from Georgia, South Carolina, and North Carolina assisted in the investigation. On returning home, they noticed that the coots in their lakes were also showing the same symptoms. Testing in 2000 on coots revealed the same brain lesions were occurring in birds from North Carolina to Texas as well. USGS Sentinel trials discovered that AVM is site-specific, has a rapid onset of five days, and has a seasonal occurrence from late fall to winter.

In 2001, Susan was employed by South Carolina Department of Natural Resources and USC at the Marine Resources Research Institute as a research scientist. A suggestion of algae being the cause of AVM was introduced. Could the AVM sites be harboring toxic cyanobacteria since they are notorious for producing toxins in freshwater systems? Usually they are found in nutrient-rich systems, and the AVM sites were not. The 10 sites surveyed were manmade ponds and reservoirs, had low to moderate nutrients, had no harmful algal blooms in the water, and had dense nonnative aquatic plants. Susan wanted to find out what all of the systems had in common. She discovered spots on the underside of the leaves of invasive *Hydrilla* growing at all of the AVM sites. This cyanobacteria (or blue-green algae) was a previously undescribed

cyanobacterial species. They are a photosynthetic bacterial species that can produce liver and nerve toxins. They grow as an epiphyte on *Hydrilla* and other invasive exotic aquatic plants in all AVM sites. The food chain transfer hypothesis developed is that there are potentially toxic cyanobacterial colonies on *Hydrilla* and other aquatic plants in the AVM sites. Aquatic plants and epiphytic algae are primary food sources for coots. The sick waterfowl are consumed by bald eagles.

In another study, coot tissue affected with AVM was fed to non-releasable red-tailed hawks to test the hypothesis that the birds of prey were being infected with AVM by consuming herbivorous waterfowl. The hawks developed the same brain lesions as the birds on the field had.

In another herbivorous waterfowl trial, mallard ducks were fed *Hydrilla* with novel cyanobacteria from an AVM site, or *Hydrilla* without novel cyanobacteria from a control lake. AVM lesions were observed in the ducks that consumed the *Hydrilla* with novel cyanobacteria, but no lesions were observed in the ducks that consumed the Hydrilla without cyanobacteria from the control lake.

Many species of birds of prey have become affected with AVM, such as eagles, Great horned owls, Canada geese, coots, mallards, ring-necked ducks, buffleheads, killdeer, and American wigeon. There is a concern for people who hunt waterfowl in affected locations and then consume them.

This new species of harmful cyanobacteria, *Aetokthonos hydrillicola* (eagle-killer living on *Hydrilla*) is an epiphytic cyanobacteria associated with invasive aquatic plants, and implicated in bird deaths from AVM. It is a new genus and species because it is so different genetically and morphologically from anything that had previously been characterized.

The causative agent of AVM does not only live on *Hydrilla*, but that was the primary substrate. In situations where it was found growing on native vegetation, it is co-occurring with nonnative aquatic plants. The latest AVM infestation was confirmed in Phillpott Reservoir in Virginia. Other substrates positive for AVM are Eurasian watermilfoil and Brazilian waterweed, found in lakes and ponds in Arkansas, South Carolina, and Georgia. Susan is attempting to obtain plant samples from throughout the U.S. She has found *A. hydrillicola* also growing within tubers, which could be buried in the sediment, or passed through the gut of waterfowl. It has a number of ways of moving around. In food chain trial experiments, it was confirmed that fish become impaired with the same brain lesions, along with salamanders, frogs, tadpoles, turtles, birds, and snakes. Trials are needed on mammals to see if they can become infected.

In Florida, *A. hydrillicola* was found in invasive apple snails, which consume *Hydrilla* and other aquatic vegetation. Apple snails have taken over the native snails, which are consumed by Florida snail Kites. Kites are now forced to switch to invasive apple snails, which are over 99% of their diet. Snail kites are endangered in Florida.

In another study, AVM-positive *Hydrilla* material was fed to apple snails. The apple snails were then fed to chickens. Also, AVM-negative *Hydrilla* was fed to apple snails. The apple snails were then fed to chickens. Brain lesions were discovered in the chickens. The VM toxin can be transferred through an invertebrate. *A. hydrillicola* growing on *Hydrilla* leaflets produces biotoxin. Apple snails feed on *Hydrilla*, and accumulate the biotoxin. Snail kites feed on apple snails and ingest the biotoxin.

Bioassay studies for investigating VM toxin were done using *Hydrilla* from numerous lakes and a reservoir. Vertebrate avian bioassay, tissue culture cell line bioassay, invertebrate *C. dubia* bioassay, and vertebrate larval zebrafish bioassay were all used. The powerful zebrafish bioassay was the best for identifying positive or negative VM findings.

Aetokthonotoxin exposure leads to VM. It is neurotoxic, lipophilic, and not water soluble. Most cyanotoxins are water soluble. There is a concern about bioaccumulation of toxin in tissues. In studies of tissue in wild coots with VM, it was discovered that aetokthonotoxin was highest in breast and thigh tissue, and lower in liver tissue. In wild game fish tissue from bluegill, shiners, redear, largemouth bass, and warmouth, it was discovered that aetokthonotoxin was highest in the GI tract and muscle.

Aquatic invasive plant management solutions include biological control, such as using triploid sterile Grass Carp at locations where aetokthonotoxin occurs, and chemical control. In field and lab trials, 10-12" triploid sterile grass carp were an effective control of submerged aquatic plants. They did develop vacuolar lesions, but survived. It did not induce lesions in birds.

Toxin-induced vacuolar myelinopathy (VM) eluded scientists for over 25 years. It is induced by a pentabrominated biindole alkaloid, aetokthonotoxin (AETX), and produced by an epiphytic cyanobacterium *Aetokthonos hydrillicola*. Biosynthesis of AETX depends on bromide availability, and physical stressors (temperature, agitation) enhance production.

Susan stated that continued research is needed regarding several factors. AETX is lipid soluble, and trophic transfer has been demonstrated. There is the potential for bioaccumulation. Multiple taxa are susceptible to AETX, such as birds, fish, amphibians, reptiles, and invertebrates. Expanded monitoring of AETX in aquatic environments and animal tissues is needed to determine environmental risks. Public awareness should be increased. People can help detect invasive species, harmful cyanobacteria, and protect water resources. There is a critical need for research on mammalian susceptibility and human health risks from consumption of fish and water birds from VM reservoirs. There is a need to understand the complex environmental factors that affect the distribution and toxicity of *A. hydrillicola*. Further investigation is also needed on bioavailability of bromide from natural geologic origin and anthropogenic sources, such as coal-fired power plants, water treatment, flame retardants, fungicides, gasoline additives, and herbicides, and how they influence AETX production.

The Great Lakes Phragmites Collaborative

Kurt Kowalski gave a PowerPoint presentation entitled "The Great Lakes Phragmites Collaborative: Regional Coordination, Adaptive Management, and New Treatments for an Invasive Grass". Phragmites (*Phragmites australis* subsp. *australis*) is an aggressive invasive grass that impacts people and ecosystems. It crowds out native plant species, reduces biodiversity, alters nutrient dynamics, and alters hydrology. It impedes recreation for people by creating dense masses of grass. It is also a fire hazard. It is actually not just a Great Lakes issue, but a national issue.

The Great Lakes Phragmites Collaborative is a partnership between USGS, Great Lakes Restoration, and the Great Lakes Commission to connect people with information, and create resources to help facilitate discussions and communications among stakeholders within the region about biology, research, etc. It was based on the idea of collective impact – "the commitment of a group of important actors from different sectors to a common agenda for

solving a specific social problem". (Kania & Kramer, 2011). A website (www.greatlakesphragmites.net) is available that contains a large number of available resources. There is also a Twitter page and Facebook page.

Current management approaches include herbicides, mechanical control, prescribed burns, and managed hydrology. These have viable effectiveness, depending on site-specific conditions, implementation technique, and resource intensive. There is also expert disagreement, and minimal knowledge sharing. Because of these factors, the *Phragmites* Adaptive Management Framework (PAMF) was developed, which establishes effective and efficient *Phragmites* management throughout the Great Lakes. The process is to assess the problem; design; implement; monitor; evaluate; adjust. PAMF is implemented through a two-fold approach. The first approach is Collective Learning. PAMF is designed to help consolidate the management and learning that goes on by individual actions on the landscape and providing the information for future management decisions.

PAMF is a combination of participatory science and adaptive management. To facilitate the regional learning process, a team from the Great Lakes Phragmites Collaborative is developing a framework to use adaptive management. The *Phragmites* Adaptive Management Framework (PAMF) will reduce uncertainty by providing treatment guidance specific to each *Phragmites* stand. The PAMF set-up team will focus on three activities. First, they will build a database to record patch size, treatment history, and outcome for each *Phragmites* patch included in PAMF. They will also develop unbiased models that adapt to treatment results. These models ensure that management guidance is based on the observed effectiveness from each round of treatment. Finally, they will establish a standardized monitoring approach, which will allow managers across the basin to compare treatment effectiveness. Land managers who participate in PAMF have three responsibilities: Consider the treatment option recommended by the models; implement the standardized monitoring approach; and upload information to the database. These land manager activities will occur on a regular cycle, starting with considering which treatment to use. After application, land managers will monitor for treatment effect, and this cycle ends with the land manager uploading information on which treatment they chose, and how well it worked to the PAMF database. As this cycle repeats, the set-up team will use each round of information to update the models and improve the treatment guidance, allowing for adjustments to best management practices that are specific to each site. PAMF will create site-specific best management practices that help make sure land managers get the best bang for the buck. This approach can be a regional one, and can be a process where every single treatment in the Great Lakes basin goes toward improving all future *Phragmites* management.

An animation of *Phragmites australis* (Common Reed) was created that provides information on the invasiveness of Phragmites and its impacts. It can be viewed on the Great Lakes Phragmites website.

In 2020/2021, there were 124 active management units, 37 active managers, and 34 organizations. There has been participation all over the basin. During 2020-2021, active management units were in seven states and one province, and 34 counties, municipalities, and districts. Current outreach consists of remote training webinars; monitoring assistance in the field; online resources such as self-guided online participant training; "How-to" instructional videos, instructive guides on all phases of the PAMF cycle; regular updates via blog posts, emails, and social media. Future endeavors of PAMF will include building participant involvement, refining components of PAMF, and evaluate the model overall.

Besides herbicides, mechanical, prescribed burns, and hydrology management, new innovative control strategies are being considered, such as microbiome and gene silencing. Microbes help plants by shielding them from a wide variety of threats. They impact biomass production, stem density, rhizome growth, seed output, growth rate, drought, temperature, and salt tolerance. Can microbes be disturbed to control *Phragmites*? A few years ago, Kurt and the USGS formed a nationwide group to create the Phragmites Symbiosis Collaborative. Meetings were held to collectively address microbiome research gaps and novel microbe-based management. To date, 15 papers have been published on microbial inventories and functional assessments. Research is focused on microbe-based control. They are working with Rutgers University and the USGS on a patent for application for bioherbicide. Microbial control next steps will be to pinpoint mechanisms, and scale up for field trials in summer 2022. Non-toxic treatments have been effective. Microbes are an understudied aspect of plant invasions. Microbial disruption is an effective, novel control, which could translate to other invasives. It provides new tools for managers.

The gene silencing idea is based on why *Phragmites* is so dominant. It has dense stems, vigorous roots and rhizomes, and has high seed output. Its traits have a genetic basis. Can these be "switched off"? Genetic biocontrol is focused on a natural plant process called RNA interference. The genetic biocontrol is not focused on DNA, and does not alter DNA, but blocks expression (RNA interference), so there is nothing to replicate generation to generation. It is transient, so by applying the treatment, it would get introduced to the plant for one generation. When the plant dies off, there is nothing to pass off onto the next generation. Since it is RNA-based, it just changes the expression, not the genome of the actual code. They are working to identify and target genes involved in photosynthesis, flower development, and root development, and to test for reduction in competitive dominance of *Phragmites*. If it cannot be killed off, maybe it can be made to be less competitive with native plants.

Kurt said they and other partners recently sequenced the *Phragmites* genome (road map) and developed numerous gene targets. Many silencing vectors were tested in model species and in *Phragmites*. A cutting-edge delivery system for *Phragmites* is being developed. The next steps will be to optimize a delivery system, explore new targets, scale up to field trials, and continue outreach and regulatory groundwork. Genetic biocontrol could improve outcomes and species-specificity of *Phragmites* control.

Overview of the ECOSTAR Rating System

Mike Hoff gave a PowerPoint Presentation entitled "Invasive Species are Neither for nor Against Humans. However, Ecosystems are Very Unforgiving of Mismanagement of Invasive Species Risk". Mike stated that, historically, eyes have been wide shut on risk assessment and risk management. Mike and other collaborators/partners developed the ECOSTAR™ Rating System for Nonnative Species. Over 3.2 billion live animals were imported into the United States during 2000-2014, along with untold numbers of live plants. Pathogens hitchhike on imported species, goods, conveyances, and humans. Nonnative plants and animals are also domestically cultured and sold live within the U.S. No rating system has been available to supply chains of the risk of live nonnative organisms to natural resources in the U.S. Rating systems advising industries are advising sustainable seafood buyers, native plant landscapers, sustainable land developers, iPhone app users (via app store rating system), and appliance and electrical product buyers and other products. Mike stated that he would like to see labels on all nonnative species to aid, empower, and inform consumers to make wise decisions. There is a need to communicate effectively and efficiently with live organism supply chains about the risk of nonnative species.

ECOSTAR™ is a rating system for live, nonnative plants and animals that can communicate complex ecological risk information. ECOSTAR™ rating labels are based ecological risk information of nonnative species into simple, plain-language information that can be understood within one minute. The project goal is to protect the environment by providing information to all in the supply chain about the risk of harm of a nonnative species in jurisdictions and regions within the U.S. The project objective is to complete one ECOSTAR™ Label for each of 10 nonnative species to demonstrate products tested in the project. Labels were based on Ecological Risk Screening Summaries (ERSS), or other science-based risk assessments. The most important component of the labels is a map with each state colored red, yellow, or green. The colors are based on the Risk Assessment Mapping Program (RAMP). RAMP can map and score a climate niche for any species, using scientific native and established range data under present and future projected climates. Three prototype, simplified labels were developed for review by invited experts. The three labels were for Water Hyacinth, Rio Grande Cichlid, and Freshwater Angelfish. Simplified Labels show the name of the species, the Risk Summary, a photo of the species, a map of the U.S. with red, yellow and green risk, and how to take action. Experts were asked to review the three prototype labels, then answer 10 questions on the interview form. Enhanced Labels were drafted for use when a partner wishes to provide access (URLs) to more detailed risk assessment information than in Simplified Labels. State-Specific Labels use modifications of the Simplified and/or Enhanced Label. These have the climate match color shown for the subject state.

Experts concurred with DRAFT, Simplified Labels, so 10 additional Simplified Labels were produced. The labels show the name of the species, Risk Summary, photograph of the species, U.S. colored map of risk status, and actions to take. The new labels are Parrot Feather, European Frogbit, Chinese Mystery Snail, Stinging Catfish, Convict Cichlid, Mayan Cichlid, Blue Tilapia, Mozambique Tilapia, Red Piranha, and African Jewelfish. The Enhanced Labels produced show the name of the species, Risk Summary, photograph of the species, U.S. colored map of risk status, actions to take, and also links to care sheets, data sheets, species profiles, ecological risk screen summaries, etc. The Enhanced Labels are Water Hyacinth, Freshwater Angelfish, Rio Grande Cichlid. The State-Specific Labels produced show the name of the species, Risk Summary, photograph of the species, U.S. colored map of risk status, actions to take, and also links to care sheets, data sheets, species profiles, ecological risk screen summaries, etc. The State-Specific Labels are Carolina Fanwort (Minnesota) and Nile Tilapia (Mississippi). **Dennis Riecke** assisted with the development of the State-Specific Label for Mississippi for Nile Tilapia.

Experts concurred that great amounts of scientific risk assessment analytical results can be summarized and synthesized into Labels for use in informing the entire supply chain for non-regulatory risk management. The implication is that the climate niche match map is the key information in each label. ECOSTAR™ label development protocol requires RAMP or similar climate niche mapping and scoring. Mike said they hope to move to Phase 2 of the project, which will be to operationalize. Several state representatives have expressed interest in having discussions. The first discussion will occur next week. To operationalize, a 4-step plan for a supply chain will be created to identify nonnative species being sold or traded by a company; search for ECOSTAR™ label in the database; educate an industry/company internally; and share information by including labels in sale/trade of nonnative species.

Possible future actions include seeking funding to operationalize ECOSTAR™ production, with the objective to ultimately produce thousands of labels. They hope to develop this in partnership with states, regional consortiums of states, NGOs, and/or others.

The Ecological Risk Screening Summaries can be found at: https://www.fws.gov/fisheries/ans/erss_high_risk.html. Mike will email the ECOSTAR™ Project Final Report to James for distribution.

Thursday, December 2, 2021

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

Update on USGS ANS Projects
Wes Daniel gave a PowerPoint presentation entitled "U.S. Horizon Scan of Organisms in Trade". The U.S. Horizon Scan of Organisms in Trade (OIT) project is a USGS and USFWS collaborative funded project focusing on what species has the potential to be the next invader coming from the organisms in the trade pathway. This project is only looking at vertebrates, and only considering species that are not already established in the U.S.

The goal of the project is to conduct a global horizon scan to help identify alien vertebrate species within the Organisms of Trade Pathway at greatest risk of entering the country, establishing populations, and becoming invasive in the U.S.

The foci of the project are: 1) to develop an approach to review a large number (>21,000) of Organisms in Trade; 2) to identify species that have a high risk of invasiveness nationally and regionally; 3) evaluate species with unknown natural histories based on phylogenetic and expert knowledge; 4) create a repeatable tool for early detection and rapid response efforts; and 5) be complementary to other horizon-scanning projects being conducted on a national, regional, and state/territorial/tribal level.

A modified version of Helen Roy's (2014) rapid assessment screening tool is being used. Each taxon is scored based on three risk categories: Establishment; Spread and Invasion History; Negative Impacts. Scoring is based on a 5-point likelihood scale from 1 (very low) to 5 (very high). Experts score each species based on available information. The overall risk score obtained through this rapid screening tool is calculated as the product of the individual scores for three risk categories (described above). The maximum score possible is 125 (5 x 5 x 5).

Data sources of Organisms in Trade came from the U.S. Fish and Wildlife Service – Law Enforcement Management Information System (LEMIS) and the Industry List from the Pet Industry Joint Advisory Council (PIJAC).

Species were considered High Risk if they received a score over 64. A Medium Risk score was over 27. A Low Risk score was less than 27. These data are preliminary. In total, there were 759 species represented, with 28 falling into the High Risk category, and 168 in Medium Risk. The Southern ecoregions have higher numbers of High and Medium risk species compared to Northern ecoregions.

The next steps are to finalize the watch lists of species (national and regional), which will be provided to the USFWS for consideration for ERSS review. The USGS NAS Database will host watch lists and create species profiles for high-risk aquatic species. A national paper and multiple taxa-specific papers are being worked on along with Climatch R code. A validation step of the Horizon Scan is being conducted. Wes is working on a new hotspot analysis project with Michigan State University. Results from all the Horizon scans, along with landscape factors, and model areas at high risk of invasion from potential aquatic invaders are being developed.

Wes gave a PowerPoint presentation entitled "Conducting a Gap Analysis for Invasive Species Pathways to Determine Where Prevention Measures May Be Lacking". Thirteen federal agencies enact efforts to prevent introductions. Despite efforts, new introductions of AIS occur each year. This indicates that some pathways lack effective prevention measures. The goal is to determine where prevention is lacking by conducting a formal gap analysis of current state vs. ideal state, and to identify non-existent or ineffective measures, or lack of authority. This includes a systematic review of the USGS NAS database. Ideally, policy recommendations on how to fill the "gaps" will be developed, current prevention tools for assessing pathway risks will be reviewed, and a set of metrics will be created. USGS is identifying case studies for the gap analysis. They hope to find out where gaps in authority exist that allow for new AIS to be introduced. The NAS and NEMESIS databases are being used to select case studies. The focus is on pathways identified by the NAS database, such as aquarium release, bait release, aquaculture, stocking, shipping (ballast, etc.), canals, pet escape, and hitchhikers.

The plan for improving current preventative measures is to do a systematic review of the USGS NAS database. The case studies will help to build the gap analysis. To fill the gaps, determining where other prevention measures or policies are possible is needed, with a focus on primary introductions and review of secondary spread in the U.S. Current national and regional prevention tools for assessing pathways risk will be evaluated and metrics produced.

Update on New Introductions

Wes Daniel gave a PowerPoint presentation entitled "USGS NAS Update: New Species Occurrences". Since April 1st 2021 there were 20 NAS alerts and 18 new species introductions across our region. Ten were fishes, five were plants, and three were mollusks. Seven species were in Florida, seven in Texas, three in Louisiana, and three in Georgia.

An established population of the Rio Cauca Caecilian (Rubber Eel) was discovered in Tamiami Canal in Miami-Dade County in FL. A reptile shop in Gainesville is selling these eels.

A single, Red-toothed Triggerfish was observed in West Palm Beach, FL. It was collected live, and is now on display at the Phillip and Patricia Frost Museum of Science in Miami. This was obviously an aquarium release.

Waterpoppy was discovered in Blunn Creek at Stacy Park in Travis County, Texas. This species is an aquatic ornamental plant, and was likely an aquarium dump. Its impacts are not currently known as there has been no research done on this species.

A new occurrence of Mosquito Fern was observed in Pine Log Creek at Crooked River in Franklin County, FL. This was most likely the result of an aquarium dump. Impacts from this plant include blocking water pipes, causing infrastructure issues, altering habitat that causes the

removal of oxygen from the water by shading out sunlight which then causes fish kills, and forming dense mats that interfere with boating.

A Zebra Mussel was discovered attached to a native mussel in the San Saba River in San Saba County, TX.

USGS has been working to add eDNA as a new source of data to the database, and this is near completion. They are currently working through the federal registry for the form's requirement for data screening since this is a new source of information for that. Manuscripts and communication plans are currently being developed and data sets are currently being tested.

Wes spoke on the Impact Tables project. These tables are an aggregate of all known impacts of non-indigenous species. The Impact Table headers can be sorted, and individual impact entries can be chosen to reveal details about the impact claim. The impacts are broken down by Ecological and Economic. The NAS point maps can be queried through a drop-down map that displays occurrences of species that have the impact type. Impacts are associated with species, not specimens. There are approximately 154 species listed that have information about them. More species are being added every year. The tables can be found on the USGS website.

A new project called AquaDePTH, an aquatic disease and pathogen database, is under way to develop a national repository to support aquatic animal diseases and pathogen biosurveillance. Spatially-referenced freshwater and marine aquatic pathogen and disease information will be curated. USGS will host the data, and cooperators will be invited to share their information. They plan to work with existing data systems and numerous state, federal, and tribal partners. The ability to overlay information from other platforms such as the USFWS National Wild Fish Health Survey will be developed. USGS is already partnering with USFWS and USDA APHIS. This project will be a 3-4- year developmental process. The plan for FY22 will be to build a community of practice to inform database development for the duration of the project. In FY23 the plan will be to develop required elements, including a public landing page and dashboard. In FY24 the plan will be to finalize the database and the public launch. USGS are looking for stakeholders to have in-depth conversations about their use of the database. Those interested in participating can contact Wes Daniel or Matt Neilson.

Aquatic Nuisance Species Task Force Update

Susan Pasko gave a PowerPoint presentation entitled "Aquatic Nuisance Species Task Force: Overview and Strategic Plan". The Aquatic Nuisance Species Task Force is the only Federally-mandated intergovernmental organization solely dedicated to preventing and controlling aquatic invasive species. It was established by Congress in 1990 and reauthorized in 1996. Its mission is to develop and implement a program for waters of the United States to prevent the introduction and dispersal of ANS; to monitor, control, and study such species; and to disseminate related information. The Task Force is composed of 13 Federal agency representatives, 13 ex-officio members, six Regional Panels, and several Sub-committees. The Regional Panels are the Great Lakes Regional Panel, the Western Regional Panel, the Mississippi River Basin Panel, the Northeast Regional Panel, the Mid-Atlantic Regional Panel, and the Gulf and South Atlantic Regional Panel. The USFWS continues to support the Regional panels in their operations, and each panel is currently receiving the fully authorized amount of $50,000 per panel. The Standing Committees are the Prevention Committee, the Early Detection/Rapid Response Committee, the Control and Restoration Committee, the Research Committee, and the Education and Outreach Committee.

Another primary role of the Task Force is to provide technical support to states for the development of state or interstate management plans. Since its establishment, the Task Force has approved 45 Plans – 42 State Plans, and three Interstate Plans. The Plan for Alabama was approved two weeks ago. Once a Plan is approved by the Task Force, the state is eligible to apply for funding through the USFWS Grant Program. In 2021, The Task Force received $4M to help fund the Grant Program. The money is divided evenly among any states that apply for funding.

The Task Force held a meeting in November. Agenda items included updates about the USGS NAS database, ballast water management, the National Invasive Species Council Management Plan, the ECOSTAR Rating System, Gap Analysis for Invasive Species Pathways, Aquatic Plant Pathway Discussion, Champlain Canal Barrier Feasibility Study, EDRR National Horizon Scan for Organisms in Trade, an Invasive Carp Plan update, Moss balls, and AIS Message Frames and Metaphors. The Subcommittees also presented their proposed work plans for 2022. The Task Force approved the Alabama Aquatic Nuisance Species Management Plan, the Aquatic Nuisance Species Task Force Bylaws, the Watercraft Inspection Best Management Practices (pending incorporation of suggested edits), the National AIS Research Priorities List, and the Summary of Gaps in Control and Restoration Measures (pending incorporation of suggested edits and removal of appendix). Action Items included: 1) The Executive Secretary will coordinate with the EDRR Subcommittee and the Regional Panels to evaluate the ANS Experts Database, and will develop a recommendation for its modification and /or continuation; 2) The Executive Secretary will coordinate with the Prevention Subcommittee to develop an introduction to describe the background and intent of the Watercraft Inspection Best Management Practices; 3) The Prevention and Outreach Subcommittee will work together to develop and implement a communications and engagement strategy with eCommerce platforms to limit sale and distribution of AIS by online retailers; 4) The Control Subcommittee will coordinate with the ANSTF Co-Chairs to refine a structure consistent with the bylaws for workgroups tasked to update or develop species management plans; 5) Subcommittees will refine their work plans and resubmit them to the ANS Task Force by December 17th 2021. ANS Task Force members and panels will provide comments on the work plans to the Executive Secretary by January 14th 2022.

The ANS Task Force Strategic Plan consists of the following Goals: Coordination (Coordinate a national ANS program for waters of the U.S.; Control & Restoration (Contain and control established ANS and restore native species and ecosystems); Prevention (Prevent the establishment and spread of existing ANS); Research (Facilitate research on ANS threats, impacts, and controls); Early Detection & Rapid Response (Identify and respond to new species detections in a timely manner to prevent their establishment and spread); Outreach & Education (Conduct outreach and education to increase awareness concerning the threats of ANS).

The Coordination Goal and Work Plan for 2022 has as its Goal Objectives to strengthen ANS Task Force operations to provide effective communication, information sharing, and decision making by holding two ANS Task Force and at least one Regional Panel Principal meetings per year, updating the ANS Task Force website, and working with NISC, USDA NISIC to develop a clearinghouse of ANSTF and other key documents; to strengthen the capacity for ANS management at state and regional levels by continuing to provide technical assistance for state and interstate ANS Management Plan development; construct a national assessment of the ANS Program for waters of the United States by annually assessing ANS Task Force accomplishment

reports and report on the progress and gaps to the ANS Task Force Strategic Plan, and to prepare the next ANS Task Force Report to Congress.

The Prevention Goal Work Plan for 2022 has as its Goal Objectives to evaluate and refine risk analysis procedures to assess potential ANS and pathways for introduction by evaluating and refining the pathway risk assessment process and complete guidelines for the use and interpretation of these tools; to identify priority pathways and species of concern by working with federal agencies and responsible industry sectors to make organisms in trade importation data electronically available and searchable, and assess new ANS introductions to determine where prevention measures may have been lacking or ineffective or resulted from gaps in authority; to encourage the implementation of measures to manage high priority pathways and species by evaluating seaplanes as a potential pathway for ANS, and identifying mitigation measures, and establishing an ad-hoc subcommittee to evaluate and implement the roles and responsibilities of the ANSTF under the Vessel Incidental Discharge Act.

The EDRR Goal Work Plan for 2022 has as its Goal Objectives to facilitate monitoring efforts to detect and report new sightings of ANS by developing a plan for capacity-building in NAS to meet stakeholder needs, and develop ANS watch lists; to develop processes to rapidly assess new species detections and determine appropriate management actions by developing a report describing available tools for interpretation of eDNA detection patterns and recommendations regarding current best practices and future research needs; to facilitate the development of capacities to respond rapidly to new invasions by developing a report describing where emergency response funds are currently in use to address ANS, providing a model to establish and administer an emergency rapid response fund, and revise ISC training tailored to ANS Response.

The Control and Restoration Goal Work Plan for 2022 has as its Goal Objectives to coordinate the development and implementation of ANS Management and Control Plans by determining a Plan Liaison, if needed, for each ANS Management and Control Plan to monitor and report plan progress and implementation needs, assist Plan Liaisons in finding Plan Managers, and developing a formal process to approve development of additional ANS Management and Control Plans; to identify and communicate effective control and restoration techniques by communicating management perspectives on the development, risk characterization, and possible utilization of genetic-based tools for ANS control; and identifying gaps in available control and restoration measures and encourage innovation by communicating the gap and measures that are needed to address gaps in control measures.

The Research Goal Work Plan for 2022 has as its Goal Objectives to establish ANS Task Force research priorities and identify prospective partners by promoting the annual priority research list and surveying ANS Task Force members and regional panels for a list of funded/planned AIS research; facilitate activities that support priority ANS research needs by developing a communication plan to promote the ANS Research Priorities List; track and disseminate study results to incorporate into ANS management decisions and activities by developing a process to update the National AIS Priority Research List.

The Education and Outreach Goal Work Plan for 2022 has as its Goal Objectives to evaluate ANS communication, education, and outreach efforts to ensure they are consistent and effective by conducting an assessment of national campaigns that target outdoor recreational users; to develop processes to share information and consistently implement ANS outreach strategies by

populating the Stop Aquatic Hitchhikers portal to serve as a national clearinghouse for education, outreach, and marketing materials, and establishing an ANS Outreach Community of Practice; to raise the profile and communicate priorities of the ANS Task Force by maintaining one-page fact sheet about the ANS Task Force and regional panels, and develop templates for ANS Task Force messaging and briefings to ensure consistency.

Region 4 USFWS/Small Grants Program

Cindy Williams reported that in 2020 USFWS did not award funds to any projects under its regional small grants program. In 2021, additional funds were added, from $25,000 to $50,000 per project. One of the projects funded was to compare the old fish assembly data that was done approximately 20 years ago in the lower Mississippi River with more current data, now that invasive carp have invaded. In order to fund more projects from small grants, the project was pulled, and the USFW funded it directly to avoid some of the overhead costs. With additional USFWS funds left over, funding was also provided to the Phillip and Patricia Frost Museum of Science in Miami for a trailer.

Cindy advised that due to increased costs, anyone who planned on submitting proposals in the future should make sure that their budgets are as up to date and as inclusive as possible.

James Ballard reported that over the last seven years, 43 projects were funded, totaling over $1M. In 2021, the program received 23 proposals totaling $1,094,399. Following the review and ranking of all proposals by the panel's Review Committee, four projects were selected for funding, totaling $177,693. The four projects selected were: Leveraging Habitat Suitability Modeling to Inform Management of Nonnative Fishes in a Changing Climate (US Geological Survey); A Horizon Scan to Collaboratively Identify Invasive Species Threats to the Islands of Puerto Rico and the U.S. Virgin Islands (University of Florida); Invasive Armored Catfish and Midas Cichlid in Puerto Rico Rivers: Evaluations of Invasion Extent and Efficacy of a Physical Control Method (University of Tennessee and North Carolina State University); Integrating Chemical and Biological controls for the Aquatic Weed *Alternanthera philoxeroides* (Alligator Weed).

State Reports/ Members Forum

Alabama

Saltwater report:

Craig Newton reported that several invasive species have been documented in Alabama waters. The most commonly reported invasive species along coastal Alabama are Australian Spotted Jellyfish, Asian Tiger Shrimp, and Red Lionfish, but other invasive species also occur in Alabama waters. Interactions between native species and invasive species typically results in negative impacts to the native species. Prey of Australian Spotted Jellyfish include early life history stages of many commercially and recreationally important finfish. The temporal/spatial distribution of Australian Spotted Jellyfish could drastically increase finfish larvae/egg mortality rates if spawning events coincide with swarm activities. Similarly, the Bocourt Swimming Crab could compete for resources of the native Blue Crab. The current status of the Australian Spotted Jellyfish and the Bocourt Swimming Crab does not indicate that they pose an immanent concern. On the other hand, Asian Tiger Shrimp 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 non-native species observed in the marine waters of Alabama was a single Crescent Grunter. The specimen was collected in February 2020, but was not reported to the appropriate officials until March 2021. The specimen was collected at the Dauphin Island Airport, and was maintained in an aquarium at the 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 is on display for outreach purposes to educate the public on the problems associated with invasive species.

The Asian Tiger Shrimp has been a species of concern since 2006 when it was first observed in Alabama's inshore waters in the Mississippi Sound. Captures of them appear to have incrementally increased. In 2011, its distribution extended to northern Mobile Bay and into Perdido and Wolf Bays, and they are now in all of Alabama's primary estuary basins. Despite the reduction in validated reports from the commercial shrimping community, evidence suggests that the Asian Tiger Shrimp has become established in Alabama's waters. Communications between AMRD and commercial shrimpers indicate that a significant abundance of Asian Tiger Shrimp occur within Alabama waters.

Red Lionfish have successfully colonized the Gulf of Mexico waters offshore of Alabama. The first confirmed report of Red Lionfish was documented in 2011 by a spear fisherman who collected an individual from an oil/gas platform approximately 43 miles south of Dauphin Island. Numerous unconfirmed reports of lionfish have been made that indicate lionfish were abundant in 2011 on Trysler Grounds, a natural hard-bottom area 20 nautical miles south-southeast of Orange Beach. Unconfirmed reports from SCUBA divers from 2012-2013 indicate lionfish abundance on Trysler Grounds had increased from previous levels. Unconfirmed reports by divers indicated 60-100 lionfish within the Trysler Grounds reef complex.

AL Marine Resources Division received a grant from Gulf States Marine Fisheries Commission in December 2012 to monitor reef communities in the Gulf of Mexico, increase public awareness of the lionfish invasion, dispatch Red Lionfish when encountered during SCUBA surveys, and streamline the general coordination between state agencies, federal agencies, and the public. Eighteen dive surveys were completed by AMRD personnel. SCUBA divers who were active in submitting reports, samples, and increasing public awareness received t-shirts. Additional funding was received from GSMFC to continue monitoring and increasing public awareness. AMRD personnel conducted SCUBA surveys at 18 reef sites in 2014, and created an Adopt-a-Reef program that emphasized the reporting and capturing of Lionfish. It featured a web-based application that allowed for the submission and viewing of reports collected by Adopt-a-Reef participants. Unfortunately, the developer of the website removed the site from public access, which effectively ended the Adopt-a-Reef program. Beginning in 2016, spearfishing tournaments were held to specifically target Red Lionfish. Lionfish tournaments were held in 2016, 2018, and two in 2019. During the 2019 tournaments, over 3,000 pounds of Lionfish were harvested.

During the first several years the Lionfish invasion, population growth of Red Lionfish increased substantially from year to year, but the rate of population during the previous few years has reduced such that it seems the population has plateaued to a stable state. The spatial distribution has not changed after becoming established. There is a concern that due to COVID, there has been limited outreach activities to increase awareness of invasive species. Spearfishing tournaments that include Red Lionfish as categories were also cancelled due to the pandemic, which limited the control of population increase and distribution of Lionfish.

Florida

Kristen Sommers reported that the Lionfish Removal and Awareness Day was held on May 15-16, 2021 in Destin, FL. Over 6,000 people attended the event. The event coincides with the Emerald Coast Open, the world's largest lionfish tournament. This event brought in 10,250 lionfish. The Lionfish Challenge 2021 began on May 21, 2021 and ended on September 6, 2021. The goal of the Lionfish Challenge is to encourage and reward recreational and commercial divers to remove lionfish from Florida waters. This year, 471 people registered for the Lionfish Challenge, and 185 divers submitted lionfish – the highest number of divers who submitted lionfish since the inception of the Lionfish Challenge in 2016. Divers in the Recreational Division submitted 16,457 lionfish, and 4,599 pounds of lionfish were submitted in the Commercial Division. A total of 21,146 lionfish were removed from waters around Florida. The FWC has also developed additional harvest programs for recreational and commercial divers. The objectives are to incentivize dive chapters to conduct lionfish-specific recreational harvesting trips, and to provide additional incentive to commercial divers to maximize commercial harvest effort to increase the number of lionfish removed from Florida waters. This summer, the recreational program had 10 registered dive charters that brought in 1,530 lionfish. Commercial divers were reimbursed for 2,766 pounds of lionfish. The FWC also sponsored six lionfish tournaments around the state. Tournament divers brought in over 9,500 lionfish.

Two reports of Asian Tiger Shrimp were received during April-September 2021. One report was received in August from Escambia County, and one report was received in September from Volusia County.

Six reports of Green Mussels were received. Three reports were received through EDDMaps, and three reports were received through iNaturalist. All reports were from areas with known populations of Green Mussels in Florida.

Freshwater report:

Bullseye Snakehead have recently expanded their range into Lake Ida. Biologists from the FWC and NOAA are collaborating on a multi-pronged project to compare movement, diet overlap, and habitat utilization of Bullseye Snakehead, Butterfly Peacock Bass, and Largemouth Bass. Collection of stomach content data by gastric lavage from the three species began in July 2020, and to date 291 Bullseye Snakehead stomach samples with 63% containing food, 689 Butterfly Peacock Bass with 54% containing food, and 931 Largemouth Bass with 67% containing food have been collected and examined. An additional 12 months of sampling are planned. The diets of the three predatory fish appear very similar, with fish, crayfish, and grass shrimp the top three prey items by frequency, number, and weight. Bullseye Snakehead show the highest diversity of prey items, including cane toad tadpoles, turtles, lizard, and water snakes. Preliminary telemetry data indicate individual Bullseye Snakehead, Butterfly Peacock Bass, and Largemouth Bass have traveled more than seven miles north of the original tagging location to Lake Osborne, and Butterfly Peacock and Largemouth Bass have traveled a similar distance south to the Delray Canal. However, most of the fish have remained in Lake Ida. Some have moved only ¼ mile from the tagging site. All the radio tagged fish (25 of each species) were also marked with a reward tag to gather information on angler effort and harvest. Twenty-three tags were returned in the first month, but no additional tags have been submitted since that time. The FWC will continue to track these species over the next year.

As part of the Bullseye Snakehead study of Lake Ida, FWC biologists conducted Bullseye Snakehead presence/absence surveys in 2019 to document their range and abundance in the Lake

Ida-Osborne chain-of-lakes system and associated canals. In 2019, Bullseye Snakehead were found from Lake Ida north to the southern lobe of Lake Osborne. Bullseye Snakehead quickly expanded their range. The FWC will continue to monitor the spread of Bullseye Snakehead in this area, particularly in canals that are north of and connected to the West Palm Beach Canal.

In June 2020, a USGS biologist confirmed an angler's report of Bullseye Snakehead in one of a series of retention ponds in Bradenton, FL south of Tampa. This disjunct population is 150 miles northwest of their known range in Broward and Palm Beach counties. The proximity of this population to natural areas and the pond's connectivity to these areas during high rain events made it a high priority to attempt to eradicate this population of Bullseye Snakehead. Follow-up electrofishing sampling and backpack electroshocking by FWC biologists indicated that Bullseye Snakehead were only present in one pond approximately five acres in size. In May 2021, a rotenone renovation was conducted by backpack sprayer while environmental conditions were favorable to contain the chemical to the isolated pond with Bullseye Snakehead. Fish were collected for four days. A total of 48 Bullseye Snakehead were collected, along with seven other nonnative fish species. Over 600 pounds of fish were collected, with approximately 40% being nonnative species. Throughout the treatment period, the adjacent retention ponds were visually inspected at night, and no Bullseye Snakehead were observed. The FWC will periodically conduct electrofishing in the pond to ensure that this population of Bullseye Snakehead was successfully eradicated.

Last summer, the FWC received reports of angler-caught Arapaima from several west coast of Florida locations. In February 2021, the FWC recovered a dead Arapaima from the Caloosahatchee River near Cape Coral. This fish contained a Passive Integrated Transponder (PIT) tag that triggered an FWC Law Enforcement investigation. The fish was traced back to a permitted aquaculture facility that had an unfenced Arapaima breeding pond. It appeared that the Instagram reports received were from anglers who trespassed onto the aquaculture facility property at night who caught the Arapaima, took pictures, then released the fish back into the pond. The photos were altered to make the location more difficult to identify. This discovery lessened FWC's concern over the possibility of Arapaima being in several waterbodies, as it appears that most of the reports came from the same location. The dead Arapaima found in the Caloosahatchee River was reportedly removed from the same facility by a disgruntled employee, and was likely dead before it went into the water. No citations were issued during this investigation. The FWC conducted follow-up electrofishing in February, May, and June 2021 in waterbodies where Arapaima were reported. No additional Arapaima were observed or collected.

The U.S. Fish and Wildlife Service, USGS, and FWC collaborated on a grant proposal titled "Prevent the Establishment of Arapaima in North America". The project goals are to characterize risk posed by four species of Arapaima to North America, and raise public awareness of Arapaima and conduct a multi-day 'bioblitz' focused on areas where Arapaima have been reported and in waterbodies near permitted aquaculture facilities. Funded activities include completing or updating ecological risk screening summaries for four Arapaima species; conducting a risk assessment for the four Arapaima species using Freshwater Fish Injurious Assessment Model; conducting a multi-day bioblitz in selected southwest Florida waterbodies to look for Arapaima; and purchasing specialized collection gear in the event an Arapaima is sighted so that local staff can collect and eradicate the fish.

In July 2021, FWC biologists responded to an angler report of a Clown Knifefish caught in Lake Okeechobee. This report was the first of Clown Knifefish from the lake. Electrofishing was

conducted in a small, deep portion of the lake called the 2nd Dynamite Hole, and in the Rim Canal (where Clown Knifefish may have entered the lake). Three adult male Clown Knifefish were collected from the 2nd Dynamite Hole. No other specimens were collected or observed in the lake areas sampled or in two canals downstream. Additional electrofishing and gillnetting did not yield any additional Clown Knifefish. Local bait and tackle shops were notified and encouraged to report any future catches of Clown Knifefish to FWC biologists. It is speculated that the Clown Knifefish were illegally released, but is possible that they entered the lake through a series of interconnected canals leading from the C-51 Canal, an area with a large population of this species.

The FWC contracted with UF to generate bioprofiles and complete AS-ASK risk screens for African Clawed Frog, Western Clawed Frog, Blue-ringed Octopus, Clown Knifefish, four species of Sailfin Catfish, Cane Toad, and Spectacled Caiman. The results of the AS-ISK risk screening placed the four species of Sailfin Catfish, the African Clawed Frogs, and Cane Toads in the High-Risk category. Clownfish and Spectacled Caiman were placed in the Medium-Risk category. The Blue-ringed Octopus was placed in the Low-Risk to Florida category, but due to the fact that they have a high climate match for Florida, and the species has a venomous bite fatal to humans, their potential hazard status would be elevated and lead to increased scrutiny as a risk.

At its February 2021 meeting, the FWC Commissioners approved staff recommendations to create new rules to address the importation, breeding, and possession of high-risk invasive reptiles. The approved rule changes to Chapter 68-5 specifically address Burmese Pythons, Argentine Black and White Tegus, Green Iguanas, and 13 other high-risk nonnative snakes and lizards that pose a threat to Florida's ecology, economy, and human health and safety. The new rules move these 16 high-risk nonnative reptiles to Florida's Prohibited List, and include reporting requirements for permittees, biosecurity requirements to limit escape of these high-risk species, and additional language to clarify limited exceptions for some entities currently in possession of Green Iguanas and Tegus for commercial use or as pets. The rule will allow for current Tegu and Green Iguana pet owners to keep their pets with a no-cost permit. The new rules went into effect on April 29, 2021. Pet owners and other entities were given a 90-day grace period ending in July 2021 to come into compliance by applying for a no-cost permit, upgrading indoor caging, and having any qualifying animals PIT tagged. The Commissioners added an additional 180-day grace period ending October 26, 2021 to the rule package to give impacted entities more time to come into compliance with the increased biosecurity requirements for outdoor caging. Persons or businesses in possession of the newly listed Prohibited constrictors and Nile Monitor for commercial sale had until June 28, 2021 to liquidate their inventory in Florida. These species may not be possessed for commercial sale purposes in Florida after the grace period ended. Breeding of Green Iguanas and Tegus must end by June 30, 2024.

Commissioners approved the staff recommendation to create a Nonnative Fish and Wildlife Technical Assistance Group (TAG), which will include representatives from the pet industry, aquaculture, environmental groups, and other stakeholders to share information, obtain input, and understand perspectives surrounding Florida's nonnative fish and wildlife regulatory infrastructure. The first TAG meeting was November 17, 2021 in Daytona Beach, FL.

The FWC is contracting with UF to use Eastern Mosquitofish as a biocontrol agent for invasive Western Clawed Frogs that currently exist in 11 breeding ponds in the Riverview area east of Tampa. Yearly recruitment during the rainy season (June – October) is critical in maintaining or

expanding the population. Habitat occupancy modeling of this population indicated that the presence of native fish, particularly Eastern Mosquitofish, dramatically influences if a pond is suitable for Western Clawed Frog breeding. The aggressive Eastern Mosquitofish kills even the largest tadpoles by nipping the tail and body. If the Eastern Mosquitofish escape the ponds, they will only augment existing populations. The key will be to apply continued biocontrol pressure on the breeding ponds. Based on risk screenings, Western Clawed Frogs pose a high risk to much of Florida. This project may provide the means to eradicate a potentially detrimental nonnative species.

The Fish Slam is tentatively scheduled for March 2022. The focus of the event will be on waterbodies on the west coast to look for Arapaima and other nonnative fish species.

Georgia

Jim Page reported that the COVID-19 pandemic continued to have impacts on many of their invasive species efforts during April, 2021 – October, 2021; however, they tried to remain as available as possible to respond to invasive species issues, and did accomplish numerous invasive species efforts.

GA DNR staff initiated the 2021 removal efforts of Flathead Catfish from the Satilla River in May. Early on removal efforts were consistent and effective; however, the persistent rains in July, August, and September resulted in high river levels, thus minimizing the effectiveness of the gear, and negatively impacting removal efforts. Nonetheless, staff removed 3,261 Flathead Catfish via shocking.

In addition to removing Flathead Catfish in the Satilla River, GA DNR staff continue to remove Blue Catfish from the River, which occurs simultaneously during Flathead Catfish removals. During the 2021 removal season, 80 Blue Catfish were removed from the Satilla River.

GA DNR staff continue to receive reports of ANS species being captured in Georgia. Via reports from multiple private citizens, Island Apple Snails were captured in a pond in Ben Hill County, a pond in Bulloch County, Lake Worth in Dougherty County, and a canal in Chatham County.

A Midas Cichlid hybrid was captured in Flathead Creek in Muscogee County. Reports were provided by a private citizen; however, the fish was released. The fish was positively identified by FL FWCC/GA DNR staff.

Via reports from a UGA Fisheries Professor, an Oriental Weatherloach was captured in Indian Creek in Jackson County. Positive ID was verified by UGA/GA DNR staff, and several individuals were captured during fish sampling, and retained.

In April, GA DNR staff were notified by a vessel owner who was suspicious of several unidentified mussels attached to the stern of his vessel. The owner indicated that he had brought the boat from Tennessee, and was preparing the boat to be launched into the water. A GA DNR mussel biologist inspected the boat, and confirmed the presence of several dozen zebra mussels attached to the stern. The larger mussels were removed, and the boat was thoroughly scraped, cleaned, and decontaminated.

A report was received of Water Hyacinth in Little Catfish Creek in Camden County. Another report was received in October of a large volume of Water Hyacinth in Lake Oconee. Georgia Power will treat it.

Commercial fishermen continue to periodically report catches of Asian Tiger Shrimp in Georgia waters, though reporting levels remain low. Reports continue to be provided through the new reporting tool on the GA DNR-WRD website. Two reports of a single Tiger Shrimp captured in bait trawls in September 2021 and October 2021 were provided to GA DNR staff, with both instances occurring in Maiden Creek (St. Andrews estuary). Staff will continue to monitor Tiger Shrimp occurrence. GA DNR staff may potentially intercept Tiger Shrimp during fishery-independent standardized sampling conducted monthly at over 36 sites coastwide. No Tiger Shrimp were captured during the reporting period. These surveys suggest that the abundance of Tiger Shrimp in Georgia's sampled waters is low.

Via a private citizen report, a Green Porcelain Crab was captured at the Belleville boat ramp in McIntosh County. It was positively identified by SC DNR Senior Marine Scientist Peter Kingsley-Smith.

Visits to schools and other educational outlets continue to be of utmost priority. Due to COVID-19, events are only held outside. Staff spoke to over 1,000 students and adults. The Traveling Trunk continues to be a valuable tool provided by the Gulf and South Atlantic Regional Panel on Aquatic Invasive Species (GSARP).

Louisiana

Rob Bourgeois reported that in May 2021, the LDWF ANS coordinator received a report from the public of a Pacu capture in University Lake in Baton Rouge. Upon receiving the fish, it was determined to be a Red Piranha. LDWF has sampled the lakes monthly and has not recovered any more Piranha. LDWF will continue to sample in the area, since it is located near a long-term sampling location. A sampling event in October did not produce any more Piranha.

Public reports of Apple Snails slowed to a few dozen from December 2020 – mid-March 2021. Reports increased to a comparable level of previous years. Most reports were from known locations, with some expansion within water bodies or drainages with existing populations. Populations in the western part of the state have showed some expansion.

In March, the LDWF ANS coordinator visited an isolated private pond in Sorento, LA where Apple Snails were actively laying eggs, and visible at dusk on the margins of the pond. Obviously, the freeze did not have an effect on that population. Floods in May, and Hurricane Ida floods have increased the amount of Apple Snail reports, with most of those reports being nuisance reports in yards and other areas that typically do not get reported.

In FY2020, LDWF began two projects funded through USFWS's Lower Mississippi River Invasive Carp Partnership, and the Atchafalaya, Red and White Rivers Invasive Carp Partnership. These two projects should assist LDWF in locating breeding areas, and identifying potential locations for carp barriers. During plankton tows for one project, LDWF biologists captured one- to two-inch Silver Carp in June. Approximately 55 invasive carp have been tagged to help understand the movement of the carp in South Louisiana. A Grass Carp tagged in Iowa was detected in the lower Atchafalaya River through this project. Both of these projects will conclude in December 2022.

In FY2021, LDWF began four partnership-funded projects that will investigate the development 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. These projects will hopefully help increase market demand, as well as help understand impacts to native fish. For FY 2022, LDWF has proposed additional studies, which will continue to develop commercial markets for carp, help define the exact breeding periods of the carp, further study impacts to native fisheries, and investigate the effectiveness of commercial gill nets in off-channel habitats.

Asian Swamp Eels were found in Bayou St. John in New Orleans in June 2019. LDWF and a local college professor continue to monitor and sample the population. In September 2020, small eels were found in samples collected. No eels were found from September 2020 to August 2021. The population remains small and localized. LDWF plans to monitor the area, and sample in the spring and summer of 2022.

Due to COVID-19 restrictions on research cruises, LDWF's planned Lionfish sampling during December 2020 to October 2021 was canceled. LDWF received an extension on this grant, and the sampling program was resumed this summer, with limited success. Recent impacts of Hurricane Ida may further delay this work from occurring, due to the marine research laboratory being damaged. All research has shut down until repairs can be made, and people are allowed back onto Grand Isle.

Blue Tilapia were found during routine sampling in October 2019 by LDWF in University Lake located in Baton Rouge. Repeated sampling in 2020 has shown a reproducing population. The February 2021 freeze kept the Baton Rouge area under 40 degrees for 137 hours, and below freezing for 94 hours. In February, sampling efforts did not find any Tilapia in areas where a small number of them were found in prior years. A member of the public reported 8 to 10 large dead fish in the days after the freeze, and described the dead fish as similar to the shape of Bluegill, with bigger fins. This further suggests that the Tilapia did suffer a freeze kill. No Tilapia have been seen in samplings in March, June, July, and October. No live Tilapia have been found or reported since fall 2019.

The freeze in February 2021 appears to have helped with aquatic plant control. The lakes in north LA 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 began to exhibit vegetative growth by the end of March. In south LA, minimal amounts of *Salvinia* have been found, but pockets of *Salvinia* have started actively growing with increased temperatures. Water Hyacinth will continue to be the biggest aquatic plant problem in south LA, as the surviving plants began actively growing immediately after the freeze. Statewide spray crews are concentrating their efforts in areas with chronic Giant Salvinia problems.

LDWF continued with control of invasive vegetation species, using a variety of techniques. Aquatic plant control plans were developed for 74 different waterbodies during December 2020 to October 2021. Giant Salvinia continues to be the most problematic invasive plant in LA. Since 2010, LDWF has treated approximately 21,400 acres of Giant Salvinia per year with herbicides. LDWF uses an integrated approach to control aquatic plants, consisting of chemical, physical, and biological methods in an effort to achieve a greater combined benefit. LDWF has an annual

Aquatic Plant Control Program budget of $3,200,000 of which over 50% is spent on Giant Salvinia alone for monitoring, treatment, and research.

Due to COVID-19, public events have been reduced where LDWF distributes ANS outreach to the public. The reduction in COVID restrictions have allowed LDWF to conduct sampling efforts, 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. This list of species and locations will be screened by the LDWF ANS coordinator to look for new invasive species and any range extensions observed. Any observations of interest may generate a site visit to determine if the report is accurate.

Mississippi

Freshwater report:

Dennis Riecke reported that MDWFP fisheries biologists chemically treated Water Hyacinth, Alligator Weed, Cuban Bulrush, and Hydrilla at Ross Barnett Reservoir. Initial results have been positive. These populations will be monitored for long-term control.

Giant Salvinia management during December 2020 – October 2021 in the Ross Barnett Reservoir included monthly boat surveys, floating containment booms within Pelahatchie Bay, closed recreational access inside the containment booms, and a drawdown that remained in effect through March 2021. No Giant Salvinia was found during that time period.

In July 2021, biologists sprayed 300 gallons of chemical herbicide on five acres of Smartweed in English Lake at Holmes County State Park, and 300 gallons of chemical herbicide on five acres of Alligator Weed at Simpson County Lake.

In August 2021, biologists sprayed 700 gallons of chemical herbicide on <1 acre of Giant Salvinia and Torpedo Grass at Mike Connor State Lake. Over 80% of the shoreline was also treated as a precaution to eliminate individual plants that may have scattered throughout the lake. Floating containment boom was deployed around the main infestation.

MDWFP fisheries biologists chemically treated Water Hyacinth, Alligator Weed, Cuban Bulrush, Giant Cutgrass, and Common Salvinia at Lake Tangipahoa in Percy Quin State Park. Alligator Weed flea beetles were also added as biocontrol in May 2021.

MDWFP biologists chemically treated Water Hyacinth at Lake Bogue Homa in Laurel, MS, and Water Hyacinth and Alligator Weed at Lake Mary Crawford in Monticello, MS.

MDWFP fisheries biologists surveyed oxbow lakes, creeks, and streams connected to Leaf River in an attempt to identify the source of Giant Salvinia in the Pascagoula River.

Giant Salvinia management in Lake Mike Connor included containment with floating booms, boat and on-foot surveys, and new colonies identified and treated with herbicides.

Parrotfeather management in Wall Doxy State Park Lake (Spring Lake) included surveying and photographing Parrotfeather biomass from March to September 2021, treating critical areas around piers and boat ramps with herbicide and monitoring the results, treating 30 acres of the

main lake with herbicide and monitoring the results, and performing a winter drawdown November 20, 2020 – March 2nd, 2021

Efforts to recruit commercial fishermen as contract workers to harvest invasive Carp in the Mississippi River, Yazoo River Basin, and Pickwick Lake were abandoned due to lack of interest among the fishermen. Contracts were advertised to processors to reimburse them 28¢/lb. if they paid at least 25¢/lb. to fishermen for invasive carp harvested from the Mississippi River and Yazoo River Basin. Two in-state carp processors signed contracts in March 2021. One firm purchased invasive carp from April – August. Total pounds of invasive Carp equaled 80,584, for a total of $14,505.00 reimbursed. Contracts were once again issued to two firms in October 2021. There were no bids from Mississippi carp processing firms. Carp processing firms in Tennessee will now be contacted.

Numerous Coordination, Information, Education, Monitoring, Reporting, and Research activities were completed during the reporting period of December 2020 – October 2021. Some highlights include:

- An ANS grant for research on "Development of Management Strategy for Surveillance and Containment of Invading Invasive Carp in Waters Connected to the Tennessee River" was coordinated and administered in September 2019, and completed in September 2021.
- A federal ANS grant to implement activities specified in the *Mississippi State Management Plan for Aquatic Invasive Species* was coordinated and administered.
- MDWF assisted the MS Department of Environmental Quality in applying for FY21 federal funds for state ANS plans.
- ANS brochures were distributed at the Outdoor Exposition Trade Show in Jackson, MS.
- MDWF participated in the MS River Basin Panel Microsatellite Chemistry of water collection process.
- The "Stop Aquatic Hitchhikers" cards continue to be distributed along with all initial boat registrations and boat renewal registration cards that are mailed out.
- Links to the MS River Basin Panel on Aquatic Nuisance Species, Gulf and South Atlantic Regional Panel on Aquatic Invasive Species, Stop Aquatic Hitchhikers, and Habitattitude websites are on the department website.
- Data were collected on Silver Carp captured during electrofishing in the Tunica Cutoff.
- Invasive carp Telemetry Project continued on Pickwick and Tennessee-Tombigbee Waterway, and Tennessee River.
- MDWF assisted various federal and state agencies with tagging invasive carp in Pickwick Lake.
- Budgets, preproposals, and project narratives were solicited for three FY21 invasive carp research projects submitted by MS State University.
- All grant application documents and forms were prepared, submitted, and edited as required in Grant Solutions to obtain USFWS Invasive Carp Project funding starting October 1, 2021.

Ongoing activities for the Mississippi State University research project on "Development of Management Strategy for Surveillance and Containment of Invading Invasive Carp in Waters Connected to the Tennessee River" include working with TVA's long-term gillnetting data set to search for signs of shifts in fish assemblages that can be linked to the invasive carp invasion; obtaining data on movement of approximately 300 Bighead Carp in the TN River system, which will be used to test whether Bighead Carp movements differ among seasons; continuing to

investigate the potential effects of Bighead Carps on native fish assemblages in reservoirs of the lower TN River relying on TVA's long-term dataset. Three Silver Carp have been collected at Bay Springs. No invasive carp have been collected at Yellow Creek.

Ongoing activities for the Mississippi State University research project "FY 2020 Lower Mississippi River – Moon Lake Invasive Carp Tracking Research" initiated in October 2020 include manual tracking of fish within Moon Lake; setting up wildlife cameras to relate direction of flow to movement of Silver Carp; creating a regional database to hold, manipulate, and relate collected data. Over 50% of tagged fish have been detected on the passive receivers. Nineteen observed fish have moved out of the immediate study range of the transceivers downstream into the Old Coldwater River. Once fish were originally translocated, they seemed to settle down or moved out of the study site area. Most fish that were left in Moon Lake have stayed in Moon Lake.

Giant Salvinia was detected in Lake Mike Connor in Collins, MS in August 2021. This is a new location. Invasive Swamp Eels were found in a live invasive food market in Jackson, MS in March 2021. The owners were charged, and the eels were seized. Northern Snakehead were detected in April and May 2021 in two new locations – Lane Bayou in Bolivar County, and Lake Whittington.

Future activities include:

- Continued surveying of state lakes for aquatic invasive plants
- Continued chemical treatments of Giant Salvinia at Ross Barnett Reservoir, and survey reservoir for occurrences.
- Purchase additional aquatic herbicides, and hire contractors to treat public and private waters infested by invasive plants.
- Purchase additional floating containment booms for emergency response to new detections of Giant Salvinia on public water in Mississippi.
- Seek approval of legislation required to initiate licensing of retail bait outlets selling live freshwater fishing bait.
- Adopt 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 list of approved, restricted, and prohibited species as specified in the public notice that regulates aquaculture activities in Mississippi.
- Establish an Early Detection Rapid Response (EDRR) monitoring program comprised of state and federal personnel who sample aquatic species in Mississippi public waterways on a routine basis.
- Work on revisions to the *Mississippi State Management Plan for Aquatic Invasive Species*.

Saltwater report:
Mike Pursley reported on early detection/rapid response activities. The Giant Apple Snail infestation in the Pascagoula River expanded downriver. There were several river flooding events this summer that may have facilitated their spread. Crews continue to record their control efforts and survey tracks using the ArcGIS Quickcapture app. Approximately 45,000 egg masses have been destroyed, and over 4,200 live snails have been removed from the river since this infestation was first detected in 2014.

Two aerial photo surveys totaling 265 miles were conducted for early detection of AIS in difficult to access areas, and to monitor treatment efforts.

A program of integrated pest management and spot herbicide application was used to control populations of Common Salvinia, Giant Salvinia, Alligator Weed, Torpedo Grass, Eurasian Watermilfoil, and Water Hyacinth in accordance with all regulations.

One report of an invasive Tiger Shrimp was received and reported to the NAS database. There have been anecdotal reports that shrimp boat crews are keeping these shrimp for personal consumption without reporting them.

A new state record Lionfish was certified by the Mississippi Department of Marine Resources. The 2 lb. 12.98 oz. Red Lionfish was speared by a resident of Biloxi.

A mobile phone invasive species reporting tool has been maintained and promoted on MDMR's website social media outlets.

North Carolina

Rob Emens reported that during the 2021 season, 10 sites infested with Yellow Floating Heart were treated. One of the sites was a new site, but several sites did not grow back this season. These sites will continue to be monitored in 2022 for any regrowth. If there is no presence after three years of monitoring, it will be declared as eradicated from the site.

A major infestation of Giant Salvinia was discovered in Columbus County, very close to the South Carolina border. Removal efforts will begin soon.

The North Carolina Department of Agriculture and Consumer Services took regulatory action to prevent further spread of Wooly Frogsmouth in August 2016. This nonnative plant species was a first-find in the U.S., and was initially treated in 2016 and 2017. No 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 very good control for the plants above the waterline, but the plants below the waterline were not effectively treated. In 2021, a portion of the water was pumped out during the only month to treat the weed, due to the occurrence of the rare Gopher Frog. This reduced the water level by two feet, and allowed greater access to the weed for treatment. Efforts will continue in 2022.

The Gapway Swamp Giant Salvinia Project deals with Gapway Swamp, a rural setting near the NC/SC state line. The infestation was discovered during the summer of 2020. This is an isolated event, and is the only site in North Carolina. The infested area is approximately 250 acres. Gapway Swamp is currently impounded. The impoundment is called Richardson Pond, and it is surrounded by private property. Herbicide treatments began in 2021. The primary target area was approximately 50 acres in the lower end of Richardson Pond. The objective of the project will be to eradicate Giant Salvinia from the pond. The entire infested area will be under management beginning in 2022.

Data collection for Lionfish from the Trip Ticket Program began in 2013. Preliminary data indicate landings for 2021 will be higher than 2020. Additionally, 2021 landings are projected to be the third highest historically.

Blue Catfish presence in North Carolina has been expanding over the years, and commercial landings are also 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 of Blue Catfish throughout Albemarle Sound and all tributaries. The NC Division of Marine Fisheries has partnered with Sea Grant and NC Wildlife Resource Commission in monitoring Blue Catfish in the state. Preliminary Blue Catfish trip ticket information indicate that landings will be considerably higher in 2021, compared to 2020, but this data should be viewed cautiously, as it is unknown how often Blue Catfish are included in a "mixed catfish" category.

The River Goby is established in the Morehead City area. Although native to south Florida, it is not native to NC. Given the proximity to the port, the vector seems likely to be ballast water.

Juvenile Koi/Amur Carp were collected from the Dan River in 2021. This is thought to be a first reported occurrence for the Dan River.

Oriental Weatherfish have again been caught in South Buffalo Creek in 2021. The last known capture of this species in this area was from 2009.

There are greater numbers of Green Porcelain Crabs around the Morehead City area than previously thought. They have now been collected at Fort Macon, Radio Island, and Beaufort. No previous records north of Wilmington were found.

In 2012, Tiger Shrimp were added to the Trip Ticket Program. Preliminary data do not suggest landings will be higher in 2021 compared to 2020. No Tiger Shrimp were captured during a Pamlico Sound Survey in 2021.

Specimens of the East Asian River Prawn have now been collected in North Carolina each year since 2014. Little is known about how the East Asian River Prawn was introduced to North Carolina, although it is hypothesized that it may have been introduced via ballast water. Genetic analysis is now complete, and a research paper is underway.

Marine fisheries staff have reported locally abundant *Agarophyton vermiculophyllum* (formerly *Gracilaria vermiculophylla*), an invasive red alga that appears to be spreading and having seasonal negative impacts on fishing gear. It may also contribute to shoreline destabilization.

A first reported occurrence for Water Lettuce occurred in Little River in Pasquotank County in September 2021. The fishermen who initially made the report were informed that it was invasive, and attempted to remove all specimens they could find themselves. A trip to the area in October yielded only two small, wilted specimens in the direct and surrounding areas.

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

Efforts continue with SC FPDL to explore spatial distribution and life history characteristics of Gill Lice. Additional research with SC FPDL will continue.

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 that initial collection, 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 North Carolina. 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 a national pet store in Seattle, WA. Soon it was discovered that these moss balls were also found at stores in Georgia, Virginia, and numerous other states. In March, a Wildlife Commission fisheries biologist purchased moss balls from a pet store in Burlington, NC that appeared to contain 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 their moss balls 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 initiated a public relations campaign to inform aquarium owners of the risk of being infested with Zebra Mussels, and how to safely dispose of the moss balls and decontaminate their fish tanks.

NC Wildlife Resources Commission staff worked with NC State to minimize impacts of *Lyngbya* treatments in Lake Gaston on native mussels. *Lyngbya*, or black mat algae, can shade out native vegetation, and form dense mats around boat ramps and docks. Mussel surveys were conducted to determine mussel abundance to identify areas to avoid when treating with algaecides.

NC Wildlife Resources Commission staff conducted crayfish surveys in Grassy Creek, which flows into Kerr Lake in the Roanoke Basin, to determine impacts on native crayfish species. Grassy Creek has several crayfish species, including an isolated population of the Chowanoke Crayfish, a species of concern in NC. The nonnative Virile Crayfish was detected in 2014 in the lake and is considered established, but it is not known if the species would expand its range into Grassy Creek and what impacts it may have on native crayfish. Surveys were conducted, and only one Virile Crayfish was found in Grassy Creek. Healthy populations of native species, including the Chowanoke Crayfish, were found throughout the creek, which indicates that the Virile Crayfish have had no detectable impacts on native species thus far. Grassy Creek will continue to be monitored.

Recent crayfish surveys in eastern NC 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 to initiate a study to determine if the Red Swamp Crayfish is the cause of the decline in the native crayfish.

In fall of 2018, the NC Wildlife Resources Commission began surveys to evaluate catfish populations in the Pee Dee River. These surveys focused on invasive Flathead Catfish, Blue

Catfish, and nonnative Channel Catfish. Electrofishing surveys were conducted in fall 2018, springs 2019, fall 2019, and spring 2020. No native catfish were observed – only Blue, Flathead, and Channel Catfish were collected. Both Flathead Catfish and Blue 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, suggesting restrictive harvest regulations may not be warranted.

In 2020, the University of North Carolina at Wilmington, in partnership with the NC Wildlife Resources Commission, completed the first phase of a study looking at the trophic ecology of nonnative catfishes in the Lower Cape Fear River ecosystem. The first phase was a 23-year study in the Cape Fear, Northeast Cape Fear, and Black Rivers. Diet analysis indicated that Flathead Catfish consumed large amounts of fish, crayfish, freshwater prawns, and aquatic insects, with fish becoming more prominent as fish age. Blue Catfish mostly consumed *Corbicula spp*., along with a mix of fish and aquatic insects, with fish becoming more prominent in the diet as the fish ages. Primary fishes consumed by both Flathead and Blue Catfish were in the families *Centrarchidae* (sunfishes and black basses) and *Ictaluridae* (catfishes). A second phase of the study is evaluating the effects of hurricane-induced fish kills, especially pre-and post-hurricane analysis of potential impacts on the invasive catfish biomass. The study will be completed in 2022.

The NC Wildlife Resources Commission is conducting a survey of invasive, nonnative catfish species on Lake Gaston. The goal of this study is to describe the Blue Catfish population in Lake Gaston, estimating their baseline relative abundance, size structure, condition, growth, mortality, and diet composition. Fish were primarily collected using gill nets at several sites during the winter of 2017 through 2021. Data is currently being evaluated.

USFWS Mattamuskeet National Wildlife Refuge, in partnership with NCWRC, was awarded a $1M grant awarded by the USFWS Large Invasive Species grant program to remove invasive Common Carp from Lake Mattamuskeet. It will go into effect in FY2023.

Initial efforts to retrofit water control structures with carp barriers in 2021 has proved successful, with observations of Common Carp unable to enter the lake from nearby tributaries.

After an almost two-year break, caused in part by the pandemic, a team of scientific divers from the NC Aquarium on Roanoke Island was able to resume Lionfish Mitigations off Cape Hatteras, NC. The team collected 221 lionfish from four shipwreck locations. The collection consisted of 46% adult females, 36% adult males, and 18% juveniles.

The North Carolina Aquatic Nuisance Species Management Plan (NCANSMP) was drafted in 2014-2015, and is a working document that provides a framework for implementing state-level collaboration on North Carolina's aquatic nuisance species challenges. In 2016, the Governor's office was not interested in submitting the plan to the national ANS Task Force (ANSTF) for review/approval. With a new administration in place, the idea of submitting the plan has been reignited. The group that authored the plan (steering committee) reconvened in July 2018, and has met numerous times to review and edit the document. The group intends to gain renewed support from the state agencies, and ultimately request that the Governor's office submit it to the ANSTF.

South Carolina

Michael Kendrick reported that White Spot Syndrome Virus (WSSV), which infects many crustacean species, is highly pathogenic, and was recently associated with both wild and farmed Red Swamp Crayfish in Louisiana. Since Louisiana exports a considerable number of live Red Swamp Crayfish 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 Red Swamp Crayfish is a vector for WSSV, this species was tested using molecular qPCR assays recently modified and optimized from Blaylock *et al*. (2019) by colleagues in the SCDNR Population Genetics Research Section. These qPCR methods were used to screen samples of several tissue types obtained from *P. clarkii*, including gill, muscle, and pleopods. The results for this study are in presence/absence form for all individuals that are screened. Since WSSV can have significant impacts on estuarine crustaceans, sampling locations focus on brackish water habitats and habitats near brackish water where *P. setiferus* and *C. sapidus* have a higher likelihood of exposure if WSSV is present. This year, 75 *P. clarkii* and 30 *P. troglodytes* store-bought samples have been screened using the optimized qPCR assay along with positive control samples, negative control samples, and no DNA template controls. All 30 *P. troglodytes* samples tested negative for WSSV, while nearly half of the *P. clarkii* samples tested positive. 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. To further assess the potential for WSSV to impact wild crustaceans in the estuarine environment, 50 wild-caught specimens of each white shrimp, brown shrimp, and blue crab were also analyzed for the presence of WSSV. None of these wild-caught estuarine specimens tested positive for the virus.

Researchers at the SCDNR 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* (invasive to SC), 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 SC, 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* (formerly *Orconectes*), with little data currently available for hybridization within the genus *Procambarus*.

A subset of sites sampled to investigate the presence of WSSV are being 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. Of the 17 loci that consistently amplify in *P. clarkii*, six also amplify and bin reliably in *P. troglodytes*. Re-runs of failed amplifications are complete, and final scoring of genotypes are under way. Final analysis for assessing the potential of

hybridization between these two species will begin soon, and will include the six microsatellite loci that work for both species.

The Redeye Bass in the Savannah River Basin is one of the three priority species included in the National Fish and Wildlife Foundation's Native Black Bass Initiative, and is a species of highest concern in SCDNR's State Wildlife Action Plan (SWAP). This listing is primarily due to the effects of hybridization with the Alabama Bass, which was intentionally 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 SCDNR have developed a microsatellite-based genetic tool to investigate hybridization in Black Bass populations in the Savannah River basin. Their variability make microsatellites an effective tool to investigate genetic structure and hybridization among populations. In addition to 10 polymorphic microsatellites developed for Redeye Bass, microsatellites originally developed for Largemouth Bass have been used for other Black Bass species to assess hybridization impacting endemic Shoal Bass in the Chipola River. Hierarchical STRUCTURE analysis suggests that Black Bass genotyped at 17 loci with sets of reference samples of 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, as "near pure" species if 90-98% genetic ancestry occurs from a single species, and as "hybrid" if less than 90% genetic ancestry occurred from a single species. Project results to date include evidence of widespread invasion by Alabama Bass and active hybridization throughout the Redeye Bass range.

Texas

Monica McGarrity reported that aquatic invasive plant management continues to be a priority in Texas, with Giant Salvinia and Water Hyacinth remaining the most problematic species. A high degree of control has been achieved, and no water bodies are currently considered impaired for recreational access. The February 2021 freeze resulted in a significant reduction in Giant and Common Salvinias, Water Hyacinth, and Water Lettuce; however, Water Hyacinth has quickly rebounded from seed. Giant Salvinia integrated pest management includes Salvinia Weevil introductions. Fortunately, the weevils were able to survive the severe weather on some reservoirs. Crested Floating Heart has become a significant problem on Caddo Lake, where efforts to treat with ProcellaCOR are meeting with limited success. Additional treatment efforts will be needed in 2021-2022.

Watershed-scale riparian plant management in key Native Fish Conservation Areas continues to be a priority. Efforts are ongoing to manage Saltcedar across the Upper Brazos River watershed in critical habitat for Smalleye and Sharpnose shiners to improve habitat, with nearly 140 private landowners participating, and 18,591 acres treated to date. The Healthy Creeks Initiative has partnered with approximately 330 private landowners and the Nueces River Authority to treat Arundo infestations along river streams and rivers in the Pedernales, Blanco, Guadalupe, Medina, and Nueces River watersheds of the Texas Hill Country in Central Texas, and recently expanded to include the Llano River and San Felipe Creek.

Brazilian Peppertree is invading important coastal prairie along the Texas gulf coast, reducing habitat for native plants and animals, including migratory birds and shoreline marine life, as well as reducing the resiliency of the coast in the face of storms. To help counter this threat, the Texas Gulf Region Cooperative Weed Management Area (CWMA) was formed in 2014 with several state, county, city, and local partners. It covers the coastal barrier islands from Packery Channel

north to Port O'Connor, TX. The CWMA's focus has been on removal of Brazilian Peppertree from public lands and natural areas on Mustang Island in and around Port Aransas. The Coastal Bend Bays and Estuary Program implemented a project funded by Texas Parks and Wildlife Department to provide native trees for homeowners and to assist them in BPT removal from their property. The overall goal of this project was to continue Brazilian Peppertree control within the Texas Gulf Region-Coastal Weed Management Area on public and private lands. Funding from TPWD was used to conduct a marketing campaign to increase awareness of the CWMA Brazilian Peppertree Replacement Program, assist Port Aransas homeowners in removing BPT on their property and replacing them with native trees, and continue to restore public lands by planting native species and to remove Brazilian Peppertree and other invasive plant species from the Port Aransas Nature Preserve and other public properties in and around Port Aransas. Native trees were planted on private properties, and one acre of Brazilian Peppertree was treated across private properties and public lands within Port Aransas Nature Preserve.

Invasive Silver and Bighead Carp have been detected in the waters of the Red River Basin, but information regarding this species was limited primarily to isolated angler reports. An invasive carp population assessment was conducted, and baseline native fish assemblage data was collected. The project is reaching the end of the first year, with a second year already funded. An additional year will be proposed for the project to collect data and conduct acoustic telemetry. Invasive Carp have been detected in Texas tributaries of the Red River, and TPWD will be seeking to implement changes to regulations to prevent the transfer of invasive Carp to include these waters in 2022.

Public outreach on aquatic invasive species is a key component of Texas' ANS management strategy. The 2021 Protect the Lakes You Love public awareness campaign made nearly 138M impressions through a variety of paid media. Outreach this year also expanded to include focus on the Never Dump Your Tank campaign, and direct targeted angler outreach to prevent the spread of invasive Carp.

Texas recently completed a request for proposals, and will be funding four new AIS research projects in fiscal years 2022-2023. Two projects focus on Zebra Mussels – assessment of drivers of population differences between two Texas lakes, and evaluation of rapid, automated veliger detection technology. One project investigates key aspects of the ecology of Suckermouth Armored Catfish, with a focus on enhancing ongoing removal efforts in critical habitat for Fountain Darter and Texas Wild Rice. The final project uses remote sensing methods to survey Native Fish Conservation Areas around the state for presence of significant *Arundo donax* infestations, with an increasing trend to aid in guiding future management efforts.

Sea Grant

Kristina Alexander stated that if any members had questions they would like to include for her MDEQ/FWS-funded survey, they can email them to her. She previously sent out emails for ideas. She is designing questions to find out what people know about invasive species, where they learned from, and what states are willing to do to stop the spread of invasive species.

Election of Officers

James Ballard stated that due to the pandemic and the need for virtual meetings instead of in-person meetings, the Commission has been keeping the current officers for numerous committees, instead of electing new ones. This will change once in-person meetings begin again in the future. This could also be an option for the GSARP, if a Motion is made to do so. Both

Dennis Riecke and **Peter Kingsley-Smith** stated that they would be willing to extend their positions. **Kristin Alexander** made a Motion that **Peter Kingsley-Smith** continue as Chairman, and **Dennis Riecke** continue as Vice Chairman of the GSARP for a 2-year term. The Motion was seconded.

Chairman: Peter Kingsley-Smith
Vice Chairman: Dennis Riecke

Other Business

Wes stated that he is interested in the opinions of the GSARP members concerning the Experts Database. The EDRR Subcommittee is interested in reviewing whether the Experts Database should be maintained. Wes said he would like to know the panel members thoughts on whether it should be enhanced, maintained, or discontinued. **James Ballard** will send the database link to the panel members. **Pam Fuller** stated that the Expert Database was developed by the USGS years ago because the GSARP states independently decided that they needed to develop an Experts Database for their region. She said that it was meant to be much more than it has ever become. **Wes Daniel** suggested expanding it with other taxonomy experts to make it broader, and not just AIS-focused. **Pam** stated that was always the intent. **Dennis** suggested putting the Experts Database link on each panel's website. **Peter** pointed out that it would be important to clarify who the audience is intended to be. Is it for citizens who encounter species that are difficult to identify? **Monica** said that due to the turnaround of ANS Coordinators, the lists need to be continually updated. **James** suggested putting the issue on the next GSARP meeting agenda.

Next Meeting, Time and Place

The location of the next meeting will be in Gulf Shores, Alabama.
The date will be decided at a later date – probably the first week in April.
The meeting could possibly be virtual due to the pandemic.

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 12:35 p.m.