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North Carolina - Aquatic Invasive Species report to GSARP, April 2021

Department of Agriculture:
The State Noxious Weed Regulations, adopted under authority of the N. C. Plant Pest Law, were established to prevent the widespread establishment of harmful non-native plants that are placed on the Noxious Weed List. Any plant on the Noxious Weed List is prohibited entry into the state without a permit. Noxious Weeds already present in the state are contained by prohibiting movement of the plant outside of regulated areas. In addition to the plant itself, articles that could contain Noxious Weed propagules such as soil or hay, are also regulated. In addition, the sale of Noxious Weeds is prohibited unless exempted by provisions of the Noxious Weed Regulations. In addition to the State Noxious Weed Regulations, the General Assembly of North Carolina has adopted the Aquatic Weed Control Act providing the Department of Agriculture with the authority to regulate the importation, sale, use, and distribution of noxious aquatic weeds.

The NCDA&CS Plant Industry Division's Plant Protection Section monitors aquatic nurseries through annual inspections to ensure regulated plants are not being sold online or at retail locations and nurseries.

Yellow Floating Heart (*Nymphoides peltata*) – State of NC Class A Noxious Weed
Several new sites of yellow floating heart were identified in eastern, central and western North Carolina. These new sites were treated in 2020 and will be monitored in the future. In all, 10 locations were treated for yellow floating heart in 2020, of which 3 were new.

Giant Salvinia (*Salvinia molesta*) – Federal Noxious Weed
A major infestation of *Salvinia molesta* was discovered in Columbus County, very close to the SC border. NCDA&CS is providing assistance to NCDEQ's efforts to contract the removal of this plant.

Wooly Frogsmouth (*Philydrum lanuginosum*) First find in U.S.
Although not a regulated weed, NCDA&CS took regulatory action to prevent further spread. Initially found in August 2016, this Guam native served as a first find in the U.S. Initially treated in late 2016 and 2017, no treatment was done in 2018 because the plant could not be found. In 2019 wooly frogsmouth was observed in its original location and in a nearby pond. Treatments began again in 2019 and 2020. The 2020 survey revealed good control for visible plants, however, plants below the waterline were not effectively treated. The NCDA&CS is actively working with NC Wildlife Resources Commission in pursuing other treatment options in

addition to the current method of control. The gopher frog (*Rana capito*) uses borrow pits, like the one infested with wooly frogsmouth, as nesting sites and is considered an endangered species in NC. Careful consideration for the timing and type of treatment will continue.

Aquatic Weed Control Program:
2020 Summary

The program was staffed by 2 permanent FTEs. Additionally, we hired a full-time temporary technician in July and a part-time temporary technician in September. Temporary employees were retained until the end of the year. We clocked 1,737 man-hours of fieldwork (down from 2,015 in 2019…. an impact from COVID-19).

$449,800 was budgeted for the proposed aquatic weed management activities. Money spent from the Aquatic Weed Fund requires a 1:1 non-state dollar match.

The program website:
https://deq.nc.gov/about/divisions/water-resources/water-planning/water-supply-planning/aquatic-weed-control-program

Despite a relatively late and slow start, due to the pandemic, staff was able to travel to sites and conduct most of the proposed management activities (fieldwork).

A few specific projects are detailed below:

Lake Waccamaw *Hydrilla verticillata* removal project
Lake Waccamaw (~9,000 acres) is one of only a handful of natural lakes in North Carolina. A large-scale herbicide treatment was implemented for 7 consecutive years (2013-2019). The lake was treated with fluridone for all years. Hydrilla growth was fully suppressed by the treatments and there is no evidence that new tuber production had occurred since 2012. A technical advisory group has been steering this project. That group recommended no treatment for the 2020 weed season. A fairly robust monitoring program was implemented and efforts were focused on the area that was targeted with herbicide. The monitoring included snorkeling/wading in shallow water, running SONAR tracks, and rake-toss sampling. A lake-wide submersed vegetation survey was also conducted at the end of the growing season. No Hydrilla was detected.

Eno River *Hydrilla verticillata* abatement project
Flowing across the north side of Durham, the Eno is part of the Neuse River Basin (https://deq.nc.gov/about/divisions/water-resources/planning/basin-planning). A large section of the river (~16 miles) was treated with fluridone in 2015 and 2016 to control Hydrilla. The treatment was expanded to ~22 miles in 2017 and a repeat of that treatment occurred in 2018. The project was initially slated as a two-year pilot project with the objective being to demonstrate the effectiveness of an herbicide treatment (fluridone) as a method of controlling Hydrilla in a riverine system. Two injector units were deployed along the river. The units

metered herbicide into the water and were operated remotely. The treatment resulted with significant reduction of Hydrilla while minimal to no impact to non-target plant and animal species were realized. In 2019 the herbicide treatment was reduced, targeting only the upper-most section of the river (a portion of what was targeted in 2017-2018). A single injector unit was used in 2019. No herbicide treatment was implemented in 2020. A late summer survey (visual reconnaissance via kayak) of the ~22 mile stretch detected Hydrilla at 4 points. The objective of the survey was to determine presence/absence, not necessary measure acreage of Hydrilla in the river; however; anecdotally, we observed less than ½ acre.

The project is managed by the Eno River Hydrilla Management Task Force (ERHMTF), a partnership of local, state, and federal government agencies, academia and non-profit organizations.

A central location for information regarding this project is housed on the NC Invasive Plant Council website, see http://nc-ipc.weebly.com/eno-river-hydrilla-project.html

Gapway Swamp Giant Salvinia eradication project (Columbus County)
This site is a rural setting, near the NC/SC State line. This infestation of Giant Salvinia was brought to our attention during the summer of 2020. To our knowledge this is an isolated event and the only site in NC. According to locals, Giant Salvinia has been present in this system for several years. Spread/movement of Giant Salvinia within this site has been limited due to the site being heavily vegetated (extensive floating tussocks and stands of hardwoods) and experiences low flows (initial estimate of 5 CFS). The infested area is ~250 acres.

Gapway Swamp is impounded. The impoundment is called Richardson Pond and it is surrounded by private property. Just upstream of Richardson Pond is Buffkin Pond, a failed impoundment, also surrounded by private property. Columbus County Cooperative Extension has assisted us by connecting with the land owners and is essentially acting as a liaison (between DEQ and property owners).

The objective of this project will be to eradicate Giant Salvinia. We are still in the planning phase but anticipate some level of management activities to begin this year.

Division of Marine Fisheries:
Tiger Shrimp *Penaeus monodon*:
It appears tiger shrimp are abundant again this year in North Carolina. Despite reduced sampling efforts due to COVID-19, a Tiger shrimp was still captured during the 2020 Pamlico Sound Survey.

In 2012, tiger shrimp was added as a code in our state trip ticket program. Since then annual landings have ranged between 5 to 25lbs, valuing between $20 to $145. There is limited commercial fishermen participation in landings.

Catfish:

Blue Catfish *Ictalurus furcatus* ranges in North Carolina has been expanding over the years and the commercial landings have been increasing. Blue catfish have been caught across all of Albemarle Sound and its tributaries, and are expanding into the northern Pamlico Sound region. Commercial fishermen have been actively harvesting large numbers of blue catfish throughout Albemarle Sound and all tributaries. In recent years the number of fishermen using trotlines to catch blue catfish has increased as well. The NC Division of Marine Fisheries has partnered with SeaGrant and NC Wildlife Resource Commission in monitoring blue catfish in the state.

Flathead Catfish appear to be moving upstream in several watersheds in the Tar River and Neuse River basins and are the likely cause for the decline of the Carolina Madtom. Recent analysis shows that the Carolina Madtom is below detectability levels in areas with known Flathead Catfish populations. Intensive surveys and management actions, including Flathead Catfish removal, may be needed in the very near future to prevent Carolina Madtoms from going extinct. The US Fish and Wildlife Service Sport Fish Restoration Grant has funded a non-native catfish project in the Cape Fear which will begin in 2017. This study will look at habitat and prey selection of flathead catfish.

River Goby (*Awaous banana*)

The River Goby seems to have established itself in the Morehead City area. Although native to south Florida, it is not a NC native. From 2016 to date ~20 specimens have been colected, including YOY, from a retention pond and adjoining creek next to the DMF HQ. Given the proximity to the port, the vector seems likely to be ballast water. Vouchers were sent to Gabriela Hogue at the NC museum, and the Smithsonian Environmental Research Center.

Green Porcelain Crabs (*Petrolisthes armatus*)

A number of Green Porcelain Crabs have been collected by at Carteret Community College in Morehead City, NC. This may represent the most northern record of the species as no previous records north of Wilmington were found.

East Asian River Prawn (*Macrobrachium nipponense*)

Specimens of *Macrobrachium nipponense* have now been collected in North Carolina each year since 2014. Little is known about how *Macrobrachium nipponense* was introduced to North Carolina although it is hypothesized that it may have been introduced via ballast water. Specimens are common from the Beaufort, Morehead City, and Wilmington areas. Researchers are currently awaiting sequencing results to finish an ongoing paper.

Gracilaria vermiculophylla

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

Wildlife Resources Commission:

Myxobolus cerebralis

Efforts continue with the Southeastern Cooperative Fish Parasite and Disease Laboratory at Auburn University (SCFPDL; Dr. Ash Bullard; School of Fisheries, Aquaculture, and Aquatic Sciences) on a multi-year effort to increase our understanding of *Myxobolus cerebralis* (*Mc*; the causative agent of whirling disease) distribution and ecology in NC. This investigation has been informative and will continue in 2021.

Gill Lice

As with *Mc*, efforts continue with SCFPDL to explore spatial distribution and life history characteristics of gill lice (*Salmincola californiensis* and *S. edwardsii*). Additional research with SCFPDL will continue.

Didymo

In 2018, Tennessee Tech University (TTU; Dr. Justin Murdock; Department of Biology) initiated a regional-scale assessment to define the current distribution of Didymo (*Didymosphenia geminata*) 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 (additional information about this community science effort can be found at this link). Ultimately, this multi-year effort will establish a baseline for Didymo distribution.

Zebra Mussels *Dreissena polymorpha*

On March 3, 2021 the NC Wildlife Resources Commission received notice that moss balls contaminated with Zebra Mussels were being sold at national pet store in Seattle WA. Soon word came in that these were also found at stores in Georgia, Virginia, and numerous other states. On March 5, a Wildlife Commission fisheries biologist purchased moss balls from a pet store in Burlington, NC that appeared to contain Zebra Mussels. These moss balls were taken to the NC Museum of Natural Sciences where Curator of Mollusks, Art Bogan, confirmed that they were indeed 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 item were inspected to determine if their moss balls were contaminated. In all, over 280 stores were visited. Moss balls contaminated with Zebra Mussels were found in all 9 Wildlife Commission Districts. The NC Wildlife Resources Commission has also 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. The Wildlife Commission is also coordinating with state and Federal agencies including the US Fish and Wildlife Service, NC Department of Agriculture, and the NC Department of Environmental Quality. The NC Wildlife Resources Commission will continue its public information efforts. The Wildlife Commission is in the process of determining areas most susceptible to zebra mussel infestation, developing a

monitoring plan and determining the feasibility of a response plan should Zebra Mussels be found in North Carolina waters.

Red Swamp Crayfish

Recent crayfish surveys in eastern North Carolina by biologists with the NC Museum of Natural Sciences, NC Wildlife Resources Commission, and SC Department of Natural Resources have indicated a decline in several native crayfish species including the Sandhills Crayfish (*Procambarus pearsei*) and the Waccamaw Crayfish (*Procambarus braswelli*). Coincident with this decline is a rapid increase in the abundance of the invasive Red Swamp Crayfish (*Procambarus clarkii*) throughout much of eastern North Carolina. The NC Wildlife Resources Commission is partnering with researchers at Appalachian State University and will initiate a study in 2021 to try to determine if the Red Swamp Crayfish is the cause of the decline in the native crayfish.

Pee Dee River Catfish Sampling

Since the 1960s invasive and non-native catfish have spread through North Carolina and have had major impacts on native aquatic species in both riverine and reservoir systems. While these catfish can have a negative effect on the ecosystem, a fishery has developed in many locations, including the Pee Dee River, North Carolina. In 2019, following overexploitation concerns from anglers, a regulation measure was put in place to limit the daily harvest of catfish in the Pee Dee River, below Blewett Falls Dam to the South Carolina border, to 5 fish, in aggregate. In fall of 2018, the North Carolina Wildlife Resources Commission began surveys to evaluate catfish populations in the Pee Dee River. These surveys focused on invasive Flathead Catfish (*Pylodictis olivaris*) and Blue Catfish (*Ictalurus furcatus*), as well as non-native Channel Catfish (*Ictalurus punctatus*). Electrofishing surveys were conducted fall 2018, spring 2019, fall 2019, and spring 2020. All catfish were targeted, however no native catfish were observed. Blue catfish (n=251), Flathead Catfish (n=178), and Channel Catfish (n=254) were collected. Mean catch-per-unit-effort for Blues, Flatheads, and Channels was 10.0, 7.1, and 10.1 fish/hour, respectively. Otoliths were removed from a subsample of Blue (n=154) and Flathead Catfish (n=38) and aging was completed. Blue Catfish ranged from 3 to 25 years old, with a mean age of 10.23 years old. Flathead Catfish ranged from 0 to 15 years old, with a mean age of 4.47 years old. Relative weights (Wr) were calculated for all fish collected and very few had a Wr below 80, indicating most fish were in good condition. Both Flathead Catfish and Blue Catfish were highly abundant and along with the Smallmouth Buffalo (also a non-native 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.

Cape Fear River Catfish Study

In 2020, the University of North Carolina at Wilmington, in partnership with the NC Wildlife Resources Commission, completed a study looking at the trophic ecology of non-native catfishes in the Lower Cape Fear River ecosystem. This was a 2-year study in the Cape Fear, Northeast Cape Fear, and Black rivers. Diet analysis indicated that Flathead Catfish (*Pylodictis olivaris*) consumed large amounts of fish, crayfish, freshwater prawns, and aquatic insects with fish becoming more important as fish age. Blue Catfish (*Ictalurus furcatus*) consumed mostly

Corbicula spp. along with a mix of fish and aquatic insects with fish becoming more prominent as the fish ages. Primary fishes consumed by both Flathead and Blue Catfish were in the families Centrarchidae (sunfishes and black basses) and Ictaluridae (catfishes). Flathead Catfish also consumed anadromous species.

Lake Gaston Catfish

The North Carolina Wildlife Resources Commission is conducting a survey of invasive, non-native catfish species on Lake Gaston. The goal of this study is to describe the Blue Catfish (*Ictalurus furcatus*) population in Lake Gaston, estimating their baseline relative abundance, size structure, condition, growth, mortality, and diet composition. This study will provide critical information on this popular fishery and can be used to evaluate regulations along with indications of intraspecific and interspecific competition. Fish were primarily collected using gill nets at several sites in Lake Gaston during the winter of 2017 through 2021. Data is currently being evaluated.

State ANS Plan:

The North Carolina Aquatic Nuisance Species Management Plan was drafted in 2014-2015. The Plan was signed by NC Department of Environmental Quality, NC Wildlife Resources Commission, and NC Department of Agriculture and Consumer Services in February of 2016. At the time, the Governor's Office did not submit the plan to the national ANS Task Force for review/approval. With a new administration, conversation has been renewed on the status of the state's ANS Plan. The group that authored the plan (steering committee) reconvened in July 2018 and has met several times to review and edit the document. No major changes to the outline or spirit of the document are anticipated, but the committee believes the updated plan will be much improved. The group intends to gain renewed support from state agencies and ultimately have the Governor submit it to the ANSTF. Rob Emens and Timothy Ellis continue to facilitate the revision and re-adoption process for the NCANSMP, with an expectation of making much more progress in 2021 than what was achievable in 2020. The current version of the NCANSMP (adopted by the relevant state regulatory agencies in late 2015) provides the existing framework for implementing state-level collaboration on NC's ANS challenges. We continue to look for all opportunities to align the state's interest and capacity with the expectations of the federal ANS Task Force as we continue to both update and implement the NCANSMP.